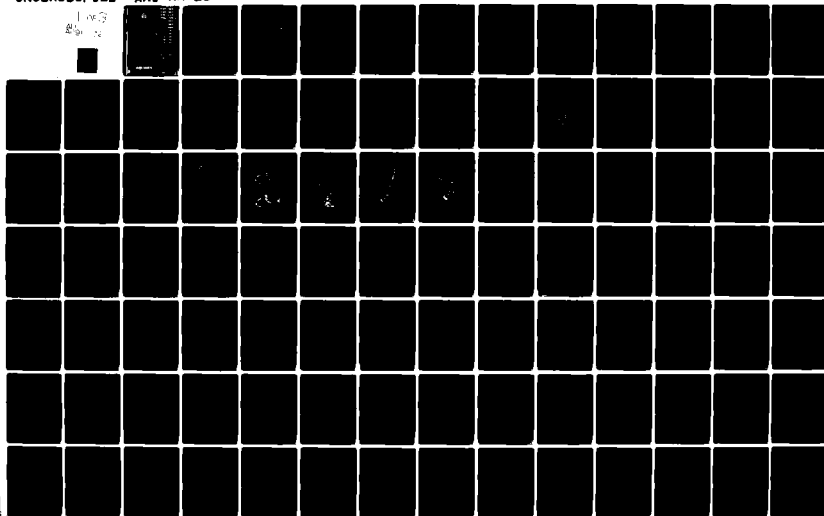


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ADDITION OF A 5 cm^{-1} SPECTRAL RESOLUTION
BAND MODEL OPTION TO LOWTRANS

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This report presents a modified version of the atmospheric transmission and radiation code LOWTRAN5, which includes: (1) an increase in the spectral resolution from 20 to 5/cm ⁻¹ , (2) the addition of temperature dependent molecular absorption coefficients, and (3) the use of a multi-parameter, Doppler-Lorentz band model for calculation of molecular transmittance. A set of 5/cm ⁻¹ band model parameters have been developed using the molecular data in the Air Force Geophysics Lab HITRAN line compilation for the major atmospheric absorbers (CO ₂ , H ₂ O, O ₃ , CH ₄ , O ₂ , H ₂ , N ₂ , NO, CO, HCl, HF, HCN, HNC, H ₂ CO, H ₂ O ₂ , H ₂ SO ₄ , H ₂ PO ₄ , H ₂ SiO ₄ , H ₂ GeO ₄ , H ₂ SnO ₄ , H ₂ TiO ₄ , H ₂ ZrO ₄ , H ₂ MoO ₄ , H ₂ WO ₄ , H ₂ CrO ₄ , H ₂ SeO ₄ , H ₂ TeO ₄ , H ₂ AsO ₄ , H ₂ SbO ₄ , H ₂ BiO ₄ , H ₂ PbO ₄ , H ₂ SnO ₃ , H ₂ GeO ₃ , H ₂ TiO ₃ , H ₂ ZrO ₃ , H ₂ MoO ₃ , H ₂ WO ₃ , H ₂ CrO ₃ , H ₂ SeO ₃ , H ₂ TeO ₃ , H ₂ AsO ₃ , H ₂ SbO ₃ , H ₂ BiO ₃ , H ₂ PbO ₃ , H ₂ SnO ₂ , H ₂ GeO ₂ , H ₂ TiO ₂ , H ₂ ZrO ₂ , H ₂ MoO ₂ , H ₂ WO ₂ , H ₂ CrO ₂ , H ₂ SeO ₂ , H ₂ TeO ₂ , H ₂ AsO ₂ , H ₂ SbO ₂ , H ₂ BiO ₂ , H ₂ PbO ₂ , H ₂ SnO ₁ , H ₂ GeO ₁ , H ₂ TiO ₁ , H ₂ ZrO ₁ , H ₂ MoO ₁ , H ₂ WO ₁ , H ₂ CrO ₁ , H ₂ SeO ₁ , H ₂ TeO ₁ , H ₂ AsO ₁ , H ₂ SbO ₁ , H ₂ BiO ₁ , H ₂ PbO ₁ , H ₂ SnO ₀ , H ₂ GeO ₀ , H ₂ TiO ₀ , H ₂ ZrO ₀ , H ₂ MoO ₀ , H ₂ WO ₀ , H ₂ CrO 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20. Contd.

The absorption coefficient, S/d , and line density, $1/d$, band model parameters were determined at $5/\text{cm}^{-1}$ resolution from $400\text{--}10,000/\text{cm}^{-1}$ ($1\text{--}25\ \mu\text{m}$) and at 200, 225, 250, 275, and 300K. Examples of these parameters for H_2O and the uniformly mixed gases are presented. In addition to the S/d and $1/d$ band model parameters, the need for and determination of the molecular continuum absorption due to the tails of lines originating outside a given spectral interval are presented.

Comparisons of LOWTRAN5 transmittance and radiance calculations with the modified version, LOWTRAN5(BMOD), are shown and discussed. Comparison of predictions using both versions of LOWTRAN5 with transmittance and radiance measurements are included.

A detailed set of appendices are included which cover instructions for the required modifications to LOWTRAN5, implementation directions, program listings, and test cases.

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William Cornette

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1. INTRODUCTION

The LOWTRAN5 computer code⁽¹⁾ and its predecessors, LOWTRAN2, 3, 3B and 4^(2,3,4,5), developed by the Air Force Geophysics Laboratory (AFGL), are widely used to calculate atmospheric transmittance and radiation in the 0.25-28 μm spectral region at a resolution of 20 cm^{-1} . These codes include the effects of scattering and absorption by atmospheric molecules and aerosols. LOWTRAN5 is easily used and allows the user considerable flexibility in selecting model atmospheres, aerosol type and distribution, local radiosonde data and atmospheric paths. The spectral resolution is determined by the model used for molecular line absorption and emission, since the other components, molecular continuum absorption and aerosol extinction, exhibit a slowly varying spectral structure. For calculational efficiency LOWTRAN5 utilizes temperature-independent molecular absorption coefficients and approximates molecular line absorption by a one-parameter band model which has a spectral resolution of 20 cm^{-1} . This paper discusses a modified version of LOWTRAN5 which includes, (1) an increase in the spectral resolution from 20 to 5 cm^{-1} , (2) the addition of the temperature dependence of the molecular absorption coefficients, and (3) the use of a multi-parameter, Doppler-Lorentz band model for calculation of molecular transmittance. All other LOWTRAN5 features such as aerosol models, molecular and aerosol scattering, continuum components and refractive effects remain unchanged.

The use of band model approximations in atmospheric transmittance calculations has been thoroughly reviewed by Anding⁽⁶⁾ (1967) and more recently by LaRocca and Turner⁽⁷⁾ (1975). The most recent contributions to this area, which are not covered in the reviews, includes work by Aoki,⁽⁸⁾ Greunzel,⁽⁹⁾ and Pierluissi et al.⁽¹⁰⁾ The main contribution of this effort is a synthesis of previous theoretical formulations into an entirely theoretical, unique model incorporated into an operational version of LOWTRAN5. The primary features of the model include:

1. Temperature dependent absorption coefficients and line density parameters;
2. Explicit evaluation of the exact expression for the equivalent width of a Voigt line in a finite spectral interval,
3. Inclusion of the molecular continuum absorption due to the tails of lines originating outside a given spectral interval,
4. Relatively high spectral resolution (5 cm^{-1}) for a band model,
5. Temperature and frequency dependent collision broadened line-widths, and,
6. Power law approximation to the transmittance of a finite number of lines.

The 5 cm^{-1} band model parameters have been developed using the molecular data in the AFGL HITRAN⁽¹¹⁾ line atlas for the major atmospheric absorbers (CO_2 , N_2O , CO , CH_4 , O_3 , O_2 , H_2O). The absorption coefficient, S/d , and line density, $1/d$, band model parameters were determined at 5 cm^{-1} resolution from $400\text{--}10,000 \text{ cm}^{-1}$ ($1\text{--}25 \text{ }\mu\text{m}$) and at 200, 225, 250, 275, and 300K.

A combined Doppler-Lorentz band model is used to approximate the change in molecular transmittance due to the altitude dependence of the lineshape. The Curtis-Godson^(12, 13) approximation is used for multilayered transmittance calculations.

The philosophy for incorporating the 5 cm^{-1} band model option, hereafter referred to as BMOD, has been to minimize all coding changes to LOWTRAN5. While developing BMOD, and interfacing it with LOWTRAN5, it was found that some minor changes to the code would increase its overall utility. As a result, the code modifications presented in this report are divided into two categories: those required to implement the BMOD option and optional changes which increase the code's general usefulness or its compatibility with different machines. The required and optional changes are indicated in the listing (Appendix D) with an asterisk and a colon respectively as part of the sequence number.

The BMOD option requires the addition of six subroutines and the use of an external disc or tape file which contains the band model parameters. The BMOD option is activated by an additional input parameter (JBMOD) which has been added to Card 1 and by allowing access to a binary file with the band model parameters. Otherwise, the usual LOWTRAN four-card sequence of data cards is unchanged, unless the Print/Plot Package described below is used.

Optional changes to the program include a Print/Plot Package, generalization of some statements, and inclusion of a blackbody source term. As part of the Print/Plot Package the results calculated at 5 cm^{-1} resolution can be degraded through a user-specified slit function; the results are printed in tabular form. The user can request transmittance and/or radiance plots as a function of either wavenumber or wavelength. Several LOWTRAN5 statements have been generalized to a more standard FORTRAN format which should increase the ease of implementation. A background blackbody source, which previously was restricted to reside at sea level, can now be located at any altitude.

This report provides description and documentation for implementing the 5 cm^{-1} capability into LOWTRAN5. This report is intended as a supplement to the LOWTRAN5 Users' Manual.⁽¹⁾ The molecular transmittance model and the band model parameters used in BMOD are presented in Section 2. The modifications to the LOWTRAN5 code are described in Section 3. Input instructions are given in Section 4. The appendices consist of a detailed description of the Print/Plot Package, flowcharts for the additional subroutines, a list of variables, a complete program listing, sample cases with input and output, and a narrative description for implementing the BMOD option to LOWTRAN5.

Comparison of the execution time for cases run with and without the BMOD option are presented in Table 1. Our experience on the Aerodyne PRIME 400 computing system is that the 5 cm^{-1} capability is roughly a factor of two to four slower than the regular LOWTRAN5.

TABLE 1 - ILLUSTRATIVE RUN TIMES ON PRIME 400 COMPUTER

PATH	GROUND TO SPACE (33 LAYERS)		GROUND TO SPACE (33 LAYERS)	
	TRANSMITTANCE		TRANSMITTANCE AND RADIANCE	
WAVENUMBERS.	400 - 9995 cm^{-1} (5 cm^{-1} STEPS)		1900 - 2500 cm^{-1} (5 cm^{-1} STEPS)	
TIME	CPU	I/O*	CPU	I/O*
LOWTRAN5	51 sec	19 sec	25 sec	4 sec
BMOD OPTION	220 sec	21 sec	86 sec	8 sec

*JP = 0, Full LOWTRAN5 printout.

2. MOLECULAR TRANSMITTANCE MODEL

2.1 Single Line Equivalent Width

The expression used in the modified LOWTRAN5 code to calculate molecular transmittance is based on a statistical model^(14,15,16) for a finite number of lines in a finite spectral interval, and is given by

$$\tau = [1 - (\bar{W}_{sl}/nd)]^n \quad (1)$$

where τ is transmittance, $\bar{W}_{sl}$ is the average of the single line equivalent width over the line strength distribution in the spectral interval, n is the effective number of lines, and d is the mean line spacing. The number of lines is related to the spacing by

$$n = \Delta\omega/d \quad (2)$$

where $\Delta\omega$ is the width of the interval. For large values of n , generally $n > 10$, Eq. (1) simplifies to a more recognizable exponential form given by

$$\lim_{n \rightarrow \infty} \tau = \exp(-\bar{W}_{sl}/d) \quad (3)$$

For the molecular species and relatively low temperatures encountered in the Earth's atmosphere, the spectral line density is sufficiently small (generally $n < 10$ for $\Delta\omega = 5 \text{ cm}^{-1}$), so that the power law transmittance approximation in Eq. (1) is preferred.

There are many approximations available⁽¹⁷⁾ for calculating the equivalent width; the different approximations are valid for different regimes, Doppler or collision broadening, weak line or strong line, etc. However, no single approximation is adequate for the range of pressures and optical pathlengths encountered in atmospheric transmission calculations. Rather than incorporate different approximations, we directly evaluate the exact expression for the equivalent width of a single line with a Voigt lineshape; W_{sl} is given by

$$W_{sl} = (2\gamma_D/(\ln 2))^{1/2} \int_0^{x_m} \left(1 - \exp \left\{ -(Su/\gamma_D)(\ln 2/\pi)^{1/2} F(x,y) \right\} \right) dx \quad (4a)$$

$$F(x,y) = \frac{y}{\pi} \int_{-\infty}^{\infty} \frac{\exp(-t^2)}{y^2 + (x-t)^2} dt \quad (4b)$$

$$x = (\ln 2)^{1/2} (\omega - \omega_0)/\gamma_D \quad (4c)$$

$$y = (\ln 2)^{1/2} \gamma_C/\gamma_D$$

where γ_D is the Doppler linewidth, γ_C is the collision broadened linewidth, S is line strength, u is optical pathlength, ω is frequency, x is dimensionless frequency, y is dimensionless linewidth, and $F(x,y)$ is the Voigt lineshape function. Numerical integration of Eq. (4a) from 0 to x_m is extremely time consuming; however, it is not necessary to numerically integrate over the entire interval. There is always a value of x , say x_p , beyond which the asymptotic expression for $F(x,y)$ is quite accurate and is given by

$$\lim_{x \rightarrow \infty} F(x, y) = \frac{y}{\sqrt{\pi} x^2} \quad (5)$$

Thus, Eq. (4a) can be numerically integrated up to x_l , and from x_l to x_m the integration is given directly by

$$\int_{x_l}^{x_m} \exp(-\beta^2/x^2) dx = \beta \left[\frac{e^{-z_m^2}}{z_m} - \frac{e^{-z_l^2}}{z_l} + \sqrt{\pi} \left\{ \operatorname{erf}(z_m) - \operatorname{erf}(z_l) \right\} \right]$$

$$\beta = \sqrt{(Su/\gamma_D) (\ln 2/\pi)^{1/2} (y/\sqrt{\pi})} \quad (6)$$

$$z = \beta/x$$

where the error function, $\operatorname{erf}(z)$, is evaluated by a rational approximation.⁽¹⁸⁾ For evaluation of $F(x, y)$ in the numerical integration, an algorithm developed by Humlicek⁽¹⁹⁾ is used. At lower altitudes, where collision broadening predominates, x_l is of order 10^2 and at higher altitudes, where Doppler and collision broadening are comparable, an x_l of 3 or less is usually sufficient. A typical value of x_m , for $\Delta\omega/2 = 2.5 \text{ cm}^{-1}$, is $x_m \approx 10^3$.

At altitudes where Doppler broadening predominates ($y < 10^{-3}$) the equivalent width integral is approximated as the sum of a pure Doppler ($y = 0$) equivalent width and the asymptotic contribution with $x_l \approx 3$, where the Doppler equivalent⁽¹⁷⁾ width is given by

$$\lim_{y \rightarrow 0} W_{sl,D} \approx (2/\ln 2)^{1/2} \gamma_D \sqrt{\ln \left\{ 1 + (\ln 2/2) (Su/\gamma_D)^2 \right\}} \quad (7)$$

2.2 Curtis-Godson Approximation

Paths through a real atmosphere usually pass through regions of changing pressure, temperature and/or concentration. The Curtis-Godson^(12,13) approximation replaces an inhomogeneous path with a homogeneous one by using average values for the equivalent width and transmittance parameters. The Curtis-Godson approximation is very good for paths where the temperature or species gradient is not particularly steep. This is certainly the case for atmospheric paths where the temperature variations for arbitrary paths fall within the range of 200 to 300K. The total optical depth is a sum over contributions from the individual layers and is given by

$$(S/d)_u = \sum_i (S/d)_i \Delta u_i \quad (8)$$

where Δu_i is the incremental optical path and $(S/d)_i$ is the average molecular absorption coefficient for the i 'th layer. This quantity is used as the weighting function in calculating the mean value of γ/d , which is given by

$$\overline{(\gamma/d)} = \sum_i (\gamma/d)_i (S/d)_i \Delta u_i / (S/d)_u \quad (9)$$

where γ stands for either γ_C or γ_D . The average values of the line density, $1/d$, and total number of lines, n , are analogously defined. The equivalent width is calculated with

$$\frac{Su}{\gamma_D} = (S/d)_u / \overline{(\gamma_D/d)} \quad (10)$$

and the transmittance is computed with

$$\bar{n} = \Delta\omega \overline{(1/d)} \quad (11)$$

2.3 Line Wing Absorption

The transmittance, as approximated by Eq. (1), takes into account only lines which originate within the spectral interval, and, for these lines, only the fraction of the line profile which falls within the interval is included in the computation of the equivalent width by Eq. (4a). This approximation is reasonable in the strongly absorbing region of a band; however, because the absorptivity is expressed in terms of the local line strength distribution, it becomes a poor approximation in regions where the lines are weak or nonexistent. This typically occurs in the center and far wings of a band (i.e., past the band head), and also in spectral intervals containing no lines which are in the vicinity of isolated strong lines. For these situations, the local absorption is dominated by the accumulated tails of the stronger lines originating outside the interval. The effect of line wing absorption is included in the transmittance by

$$\tau = \left[1 - (\bar{W}_{sl}/nd) \right]^n \exp(-C_m u) \quad (12)$$

where C_m is the molecular line wing continuum absorption coefficient. The determination of C_m is discussed in a later section.

2.4 S/d and 1/d Parameters

The S/d and 1/d band model parameters were generated from the AFGL HITRAN line atlas by ^(7,11)

$$S/d(\omega, T) = \left[\sum_i S_i(T) \right] / \Delta\omega \quad (13)$$

$$1/d(\omega, T) = \left[\sum_i \sqrt{S_i(T)} \right]^2 / \left[\Delta\omega^2 S/d(\omega, T) \right]$$

where $S_i(T)$ is the integrated line strength of the i 'th transition at temperature, T , and $\Delta\omega$ is the spectral resolution. The sums in Eq. (13) are subject to the constraint that the line center, ω_i , of each transition included fall within the spectral interval, $\omega - \Delta\omega/2 \leq \omega_i \leq \omega + \Delta\omega/2$. The line strength at an arbitrary temperature, can be scaled from the HITRAN line strength at a reference temperature, T_0 , by

$$S_i(T) = \frac{Q_v(T_0)Q_r(T_0)}{Q_v(T)Q_r(T)} \exp \left[-E_i(T_0 - T)/(kT_0T) \right] \times \left\{ \left(1 - \exp \left[-hc\omega_i/(kT) \right] \right) / \left(1 - \exp \left[-hc\omega_i/(kT_0) \right] \right) \right\} S_i(T_0) \quad (14)$$

where Q_v and Q_r are the vibrational and rotational partition functions, and E_i is the energy of the lower transition state.

The S/d and $1/d$ parameters were computed at 5 cm^{-1} resolution from 400 to $10,000 \text{ cm}^{-1}$ ($1\text{--}25 \text{ }\mu\text{m}$) and at 200, 225, 250, 275, and 300K. Following the LOWTRAN format, the band model parameters of the uniformly mixed gases (CO_2 , N_2O , CO , CH_4 , O_2) were combined according to atmospheric mixing ratio, χ_m , by

$$S/d_{\text{unmix}} = \left[\sum_m \chi_m \sum_i S_{im} \right] / \Delta\omega \quad (15)$$

$$1/d_{\text{unmix}} = \left[\sum_m \sqrt{\chi_m} \sum_i \sqrt{S_{im}} \right]^2 / \left[\Delta\omega^2 S/d_{\text{unmix}} \right]$$

Band model parameters for the nonuniformly mixed gases, H_2O and O_3 , were calculated individually according to Eq. (13). For the uniformly mixed species an average molecular weight $\bar{M}_{\text{unmix}}$, and line broadening parameter,

$\bar{\alpha}_{\text{umix}}$, were also determined, as they are required in the evaluation of the Doppler-Lorentz curve-of-growth. These quantities were calculated as line strength weighted averages by

$$\bar{M}_{\text{umix}} = \left[\sum_m M_m \chi_m \sum_i S_{im} \right] / \left[\sum_m \chi_m \sum_i S_{im} \right] \quad (16)$$

where an analogous expression was used for $\bar{\alpha}_{\text{umix}}$.

2.5 Line Wing Continuum Absorption Coefficients

The approximate contribution of the line tail absorption in the k 'th spectral interval is given by

$$C_m(T, P, \omega_k) = \frac{P}{P_0} \sqrt{\frac{T_0}{T}} \frac{\Delta\omega}{\pi} \sum_{i \neq k} \frac{s/d(\omega_i, T) \gamma_i^0}{(\omega_i - \omega_k)^2} \chi(\omega_i - \omega_k) \quad (17)$$

where $\chi(\omega_i - \omega_k)$ is a form factor expressing deviation from Lorentzian behavior, and the sum is over all spectral intervals, i , excluding $i = k$. We have calculated $C_m(T, P, \omega_k)$ for all the bands of H_2O and CO_2 on the same wavenumber and temperature grid as the S/d and l/d parameters. For the CO_2 bands the Burch^(20,21,22) form factor was used, while for the H_2O bands 250 cm^{-1} Lorentz tails were assumed.

2.6 Examples of Band Model Parameters

Examples of the S/d (molecular absorption coefficient) and l/d (line density) band model parameters and the continuum absorption coefficients for the uniformly mixed gases and H_2O are shown in Figs. 1 through 5. The temperature variation of the S/d parameter for the uniformly mixed gases in the

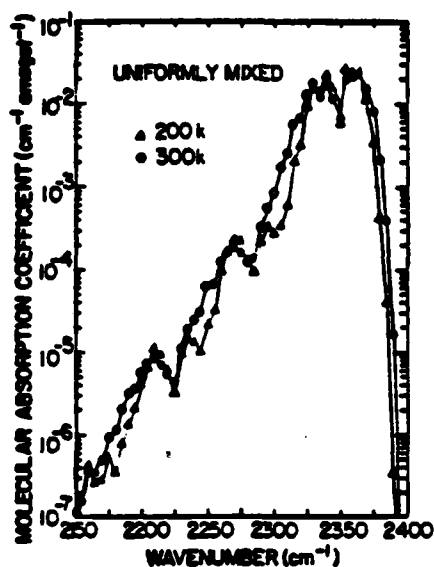


Figure 1. Temperature Dependence of the Uniformly Mixed Gas Molecular Absorption Coefficient.

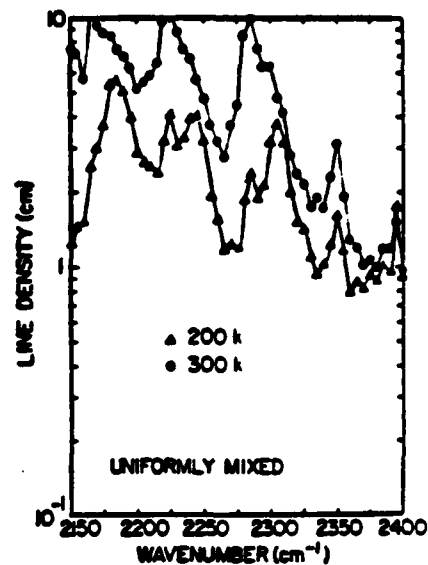


Figure 2. Temperature Dependence of the Uniformly Mixed Gas Line Density Parameter.

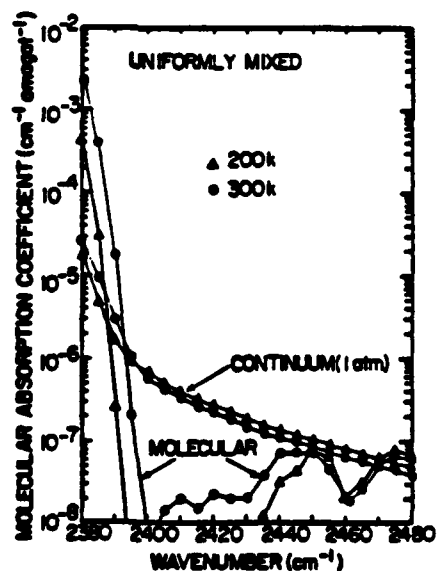


Figure 3. Temperature Dependence of the Uniformly Mixed Gas Molecular and Continuum Absorption Coefficients in the Band Head Region of the $4.3 \mu\text{m}$ CO_2 Band.

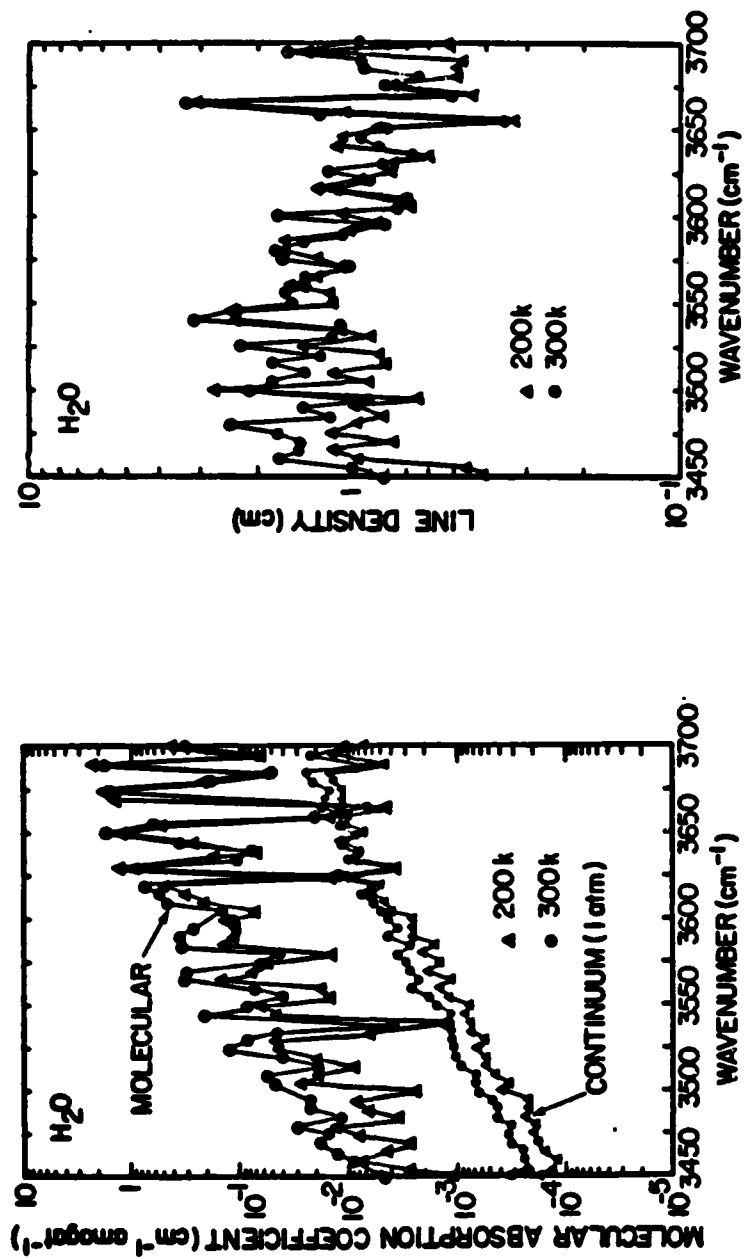


Figure 4. Temperature Dependence of the H_2O Molecular and Continuum Absorption Coefficients.

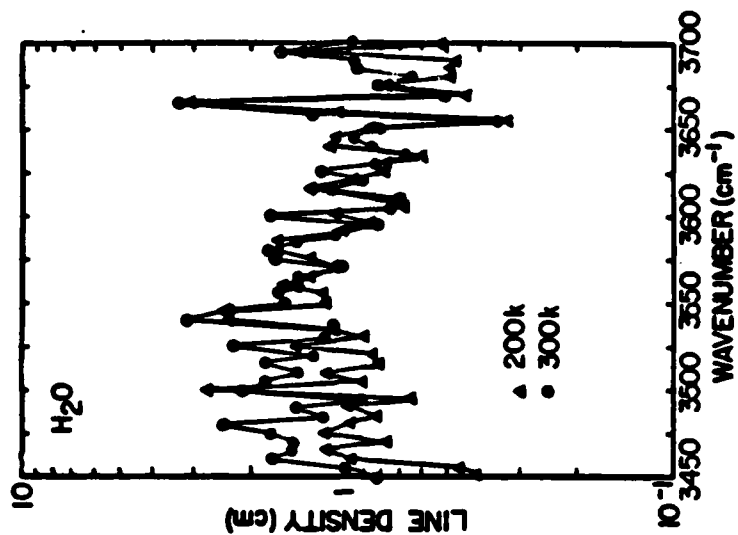


Figure 5. Temperature Dependence of the H_2O Line Density Parameter.

spectral region of the $4.3 \mu\text{m}$ CO_2 absorption is found in Fig. 1. A significant temperature variation is seen to occur throughout this region for the range of atmospheric temperatures typically encountered below 100 km altitude. In atmospheric transmission calculations, the band model parameters at intermediate temperatures are determined by linear extrapolation from the tabulated values at 200, 225, 250, 275, and 300K. The temperature dependence of the line density, $1/d$, parameter in the $4.3 \mu\text{m}$ region is displayed in Fig. 2. The spectral region about the band head of the CO_2 $4.3 \mu\text{m}$ band has been previously studied because of its potential use for satellite sounding of atmospheric temperature and density.^(23,24) The relative contribution of the molecular and continuum absorption coefficients in this spectral region are shown in Fig. 3. There is a strong temperature dependence of the molecular absorption coefficients from $2380\text{--}2400 \text{ cm}^{-1}$, about an order of magnitude variation from 200 to 300K. A much weaker temperature dependence is calculated for the continuum absorption. The continuum component below 2380 cm^{-1} is typically two or more orders of magnitude smaller than the molecular absorption coefficient. The molecular and continuum absorption coefficients for the low wavenumber portion of the $2.7 \mu\text{m}$ H_2O band are shown in Fig. 4. In several of the pronounced micro-window regions, such as 3535 , 3625 , and 3665 cm^{-1} , the continuum absorption is comparable to the molecular absorption. The line density parameter for the $2.7 \mu\text{m}$ H_2O band is found in Fig. 5.

2.7 Comparisons of LOWTRAN5 and LOWTRAN5(BMOD)

Examples of transmittance and radiation calculations with the LOWTRAN5 and LOWTRAN(BMOD) options are displayed in Figs. 6 through 15. These comparisons highlight the similarities and differences between the two options for a variety of atmospheric paths. It is apparent that if the 5 cm^{-1} BMOD calculations were degraded to the 20 cm^{-1} LOWTRAN5 calculations, the overall agreement would be quite good. However, at 5 cm^{-1} resolution, large deviations from the lower resolution calculations occur. The horizontal path transmittances in Figs. 6 through 9 demonstrate the altitude dependence of the two

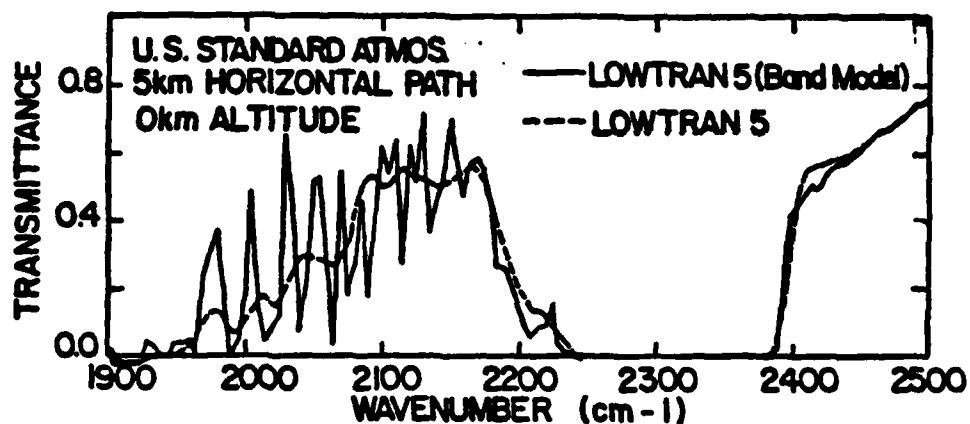


Figure 6. Comparison of LOWTRAN5 (Band Model) and LOWTRAN5 Atmospheric Transmission Predictions for a 5 km Horizontal Path at 0 km Altitude.

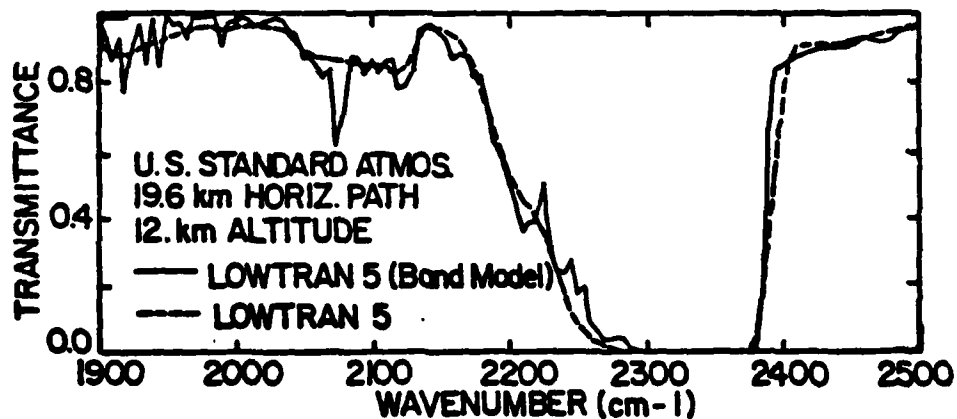


Figure 7. Comparison of LOWTRAN5 (Band Model) and LOWTRAN5 Atmospheric Transmission Predictions for a 19.6 km Horizontal Path at 12.0 km Altitude.

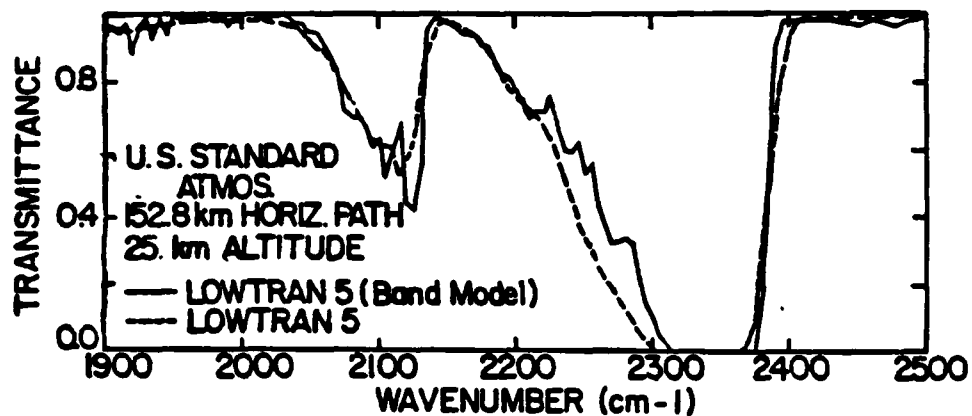


Figure 8. Comparison of LOWTRAN5 (Band Model) and LOWTRAN5 Atmospheric Transmission Predictions for a 152.8 km Horizontal Path at 25.0 km Altitude.

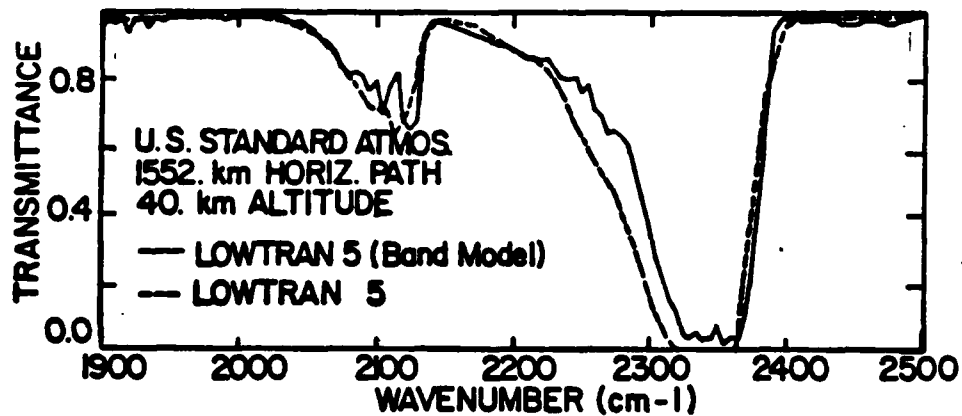


Figure 9. Comparison of LOWTRAN5 (Band Model) and LOWTRAN5 Atmospheric Transmission Predictions for a 1552. km Horizontal Path at 40.0 km Altitude.

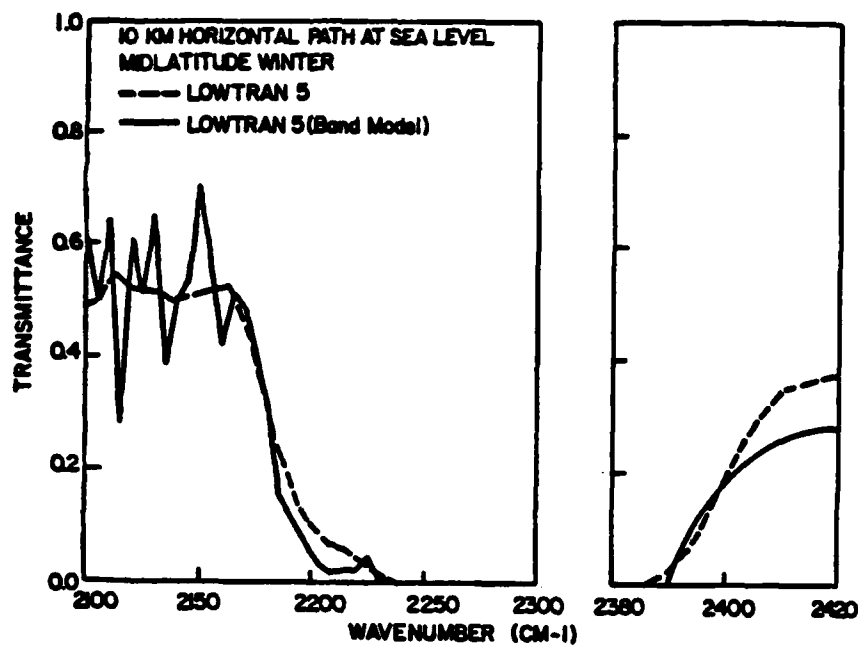


Figure 10. Comparison of LOWTRAN5 (Band Model) and LOWTRAN5 Atmospheric Transmission Predictions for the Wings of the $4.3 \mu\text{m}$ CO_2 Band.

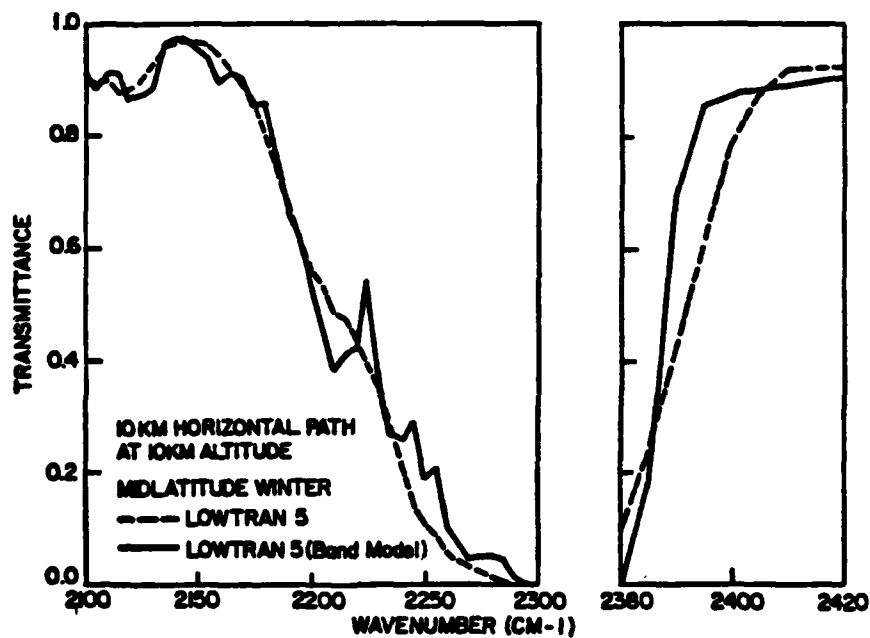


Figure 11. Comparison of LOWTRAN5 (Band Model) and LOWTRAN5 Atmospheric Transmission Predictions for the Wings of the $4.3 \mu\text{m}$ CO_2 Band.

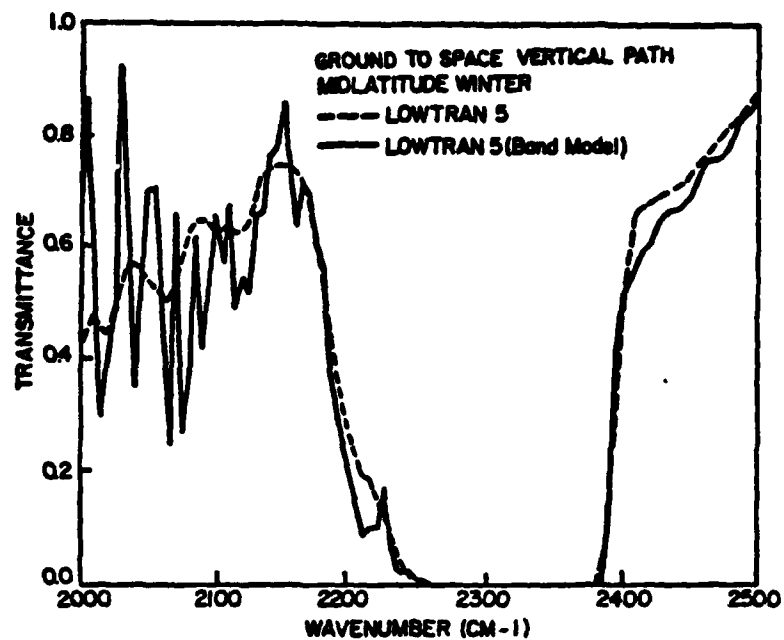


Figure 12. Comparison to LOWTRAN5 (Band Model) and LOWTRAN5 Atmospheric Transmission Predictions for a Ground to Space Vertical Path.

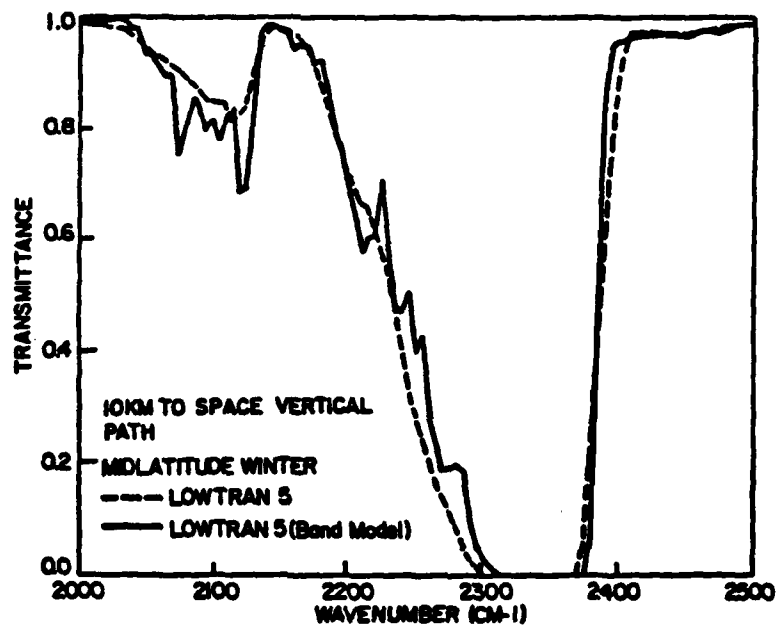


Figure 13. Comparison of LOWTRAN5 (Band Model) and LOWTRAN5 Atmospheric Transmission Predictions for a 10 km to Space Vertical Path.

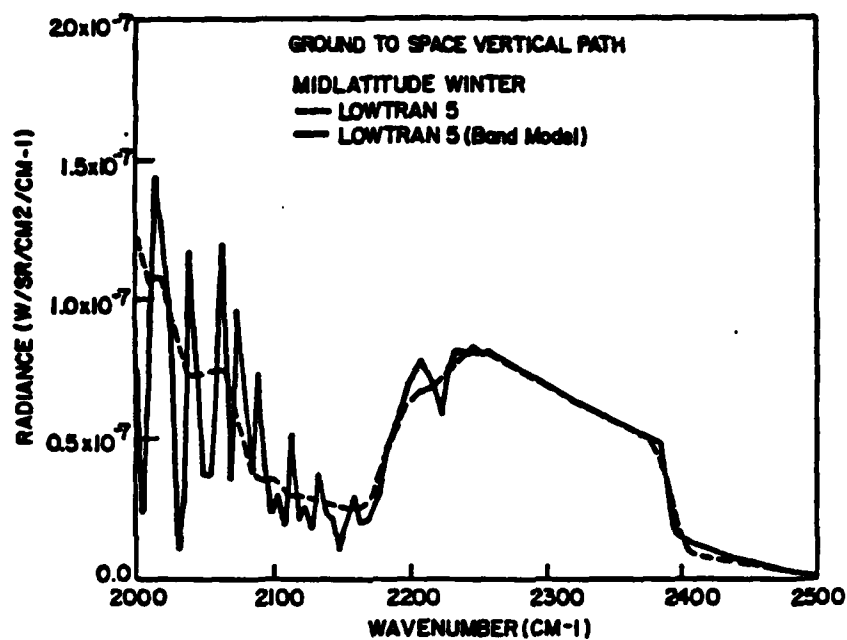


Figure 14. Comparison of LOWTRAN5 (Band Model) to LOWTRAN5 Background Radiance Predictions for a Ground to Space Vertical Path.

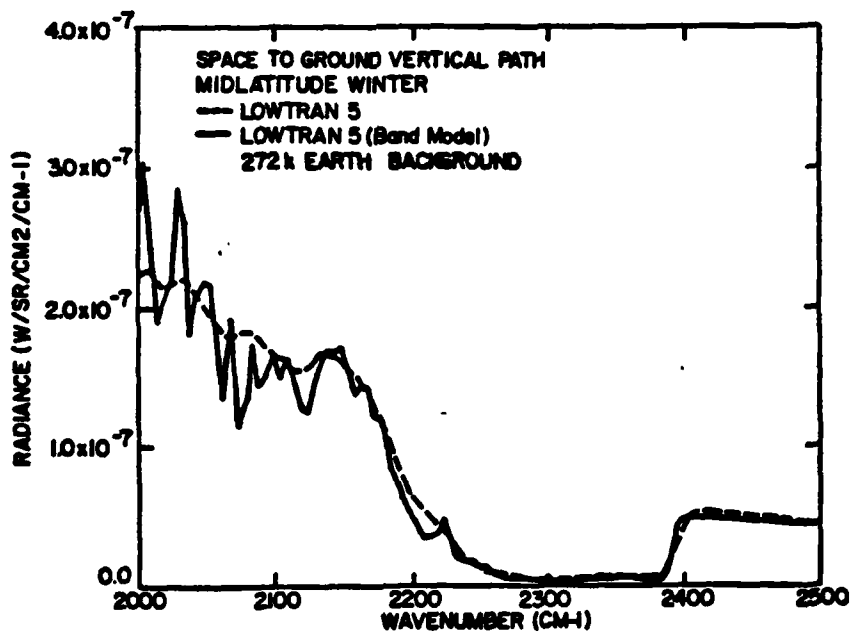


Figure 15. Comparison of LOWTRAN5 (Band Model) to LOWTRAN5 Background Radiance Predictions for a Space to Ground Vertical Path.

options. The path lengths at each altitude were chosen to give an identical molecular column density for the uniformly mixed gases. The increased transmittance with increased altitude is chiefly due to curve-of-growth effects. That is, as altitude increases, the molecular linewidth decreases, and the centers of lines become more opaque while the wings become more transparent. The differences between the two models reflect different curve-of-growth formulations. In LOWTRAN5, the one parameter curve-of-growth, reduces to the familiar weak and strong line limits, for small and large absorber amounts respectively, which is essentially a collisional broadening transmittance model. In LOWTRAN5(BMOD), the equivalent width calculation includes both collisional and Doppler broadening effects.

2.8 Comparison of LOWTRAN5 Models to Measurements

Comparison of LOWTRAN5 predictions for both the 20 cm^{-1} and 5 cm^{-1} options with transmittance and background radiance measurements are shown in Figs. 16 through 21. In Figs. 16 and 17 the LOWTRAN5 predictions are compared to transmission data obtained by AFGL (Sandford, et al.)⁽²⁵⁾ in the vicinity of Johnston Island. It is seen that the LOWTRAN5(BMOD) results closely follow the 4 cm^{-1} interferometric data. In Fig. 18, the LOWTRAN5(BMOD) predictions generally follow the 2 cm^{-1} General Dynamics (Blay et al.)⁽²⁶⁾ transmission data, although, there is a significant discrepancy around $2.3\text{ }\mu\text{m}$. Similar calculations with LOWTRAN5 have compared better with the data in this region, which suggests that some H_2O lines may be missing from the HITRAN compilation in this region. Background radiance predictions are compared to measurements^(27,28,29) in Figs. 19 through 21, where the LOWTRAN5(BMOD) calculations closely parallel the data in all cases.

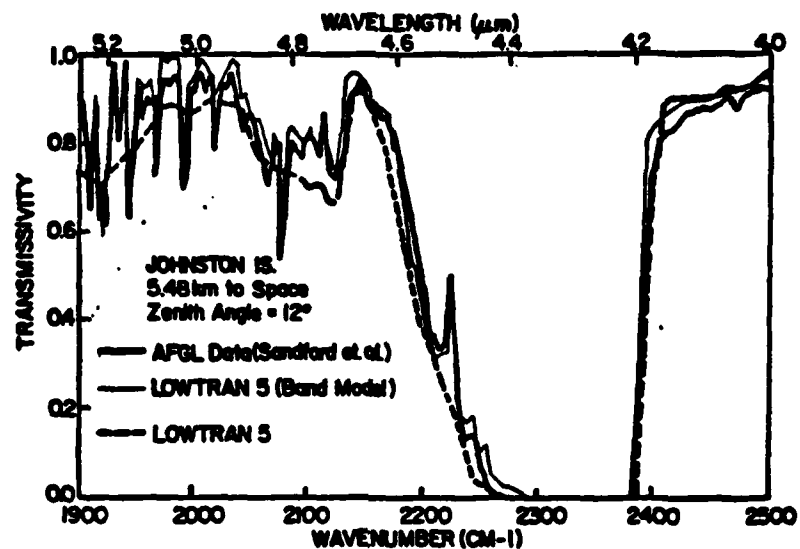


Figure 16. Comparison of LOWTRAN5 (Band Model) and LOWTRAN5 Predictions to AFGL Transmission Measurements⁽²⁵⁾ for a 5.48 km to Space Path with a 12° Zenith Angle.

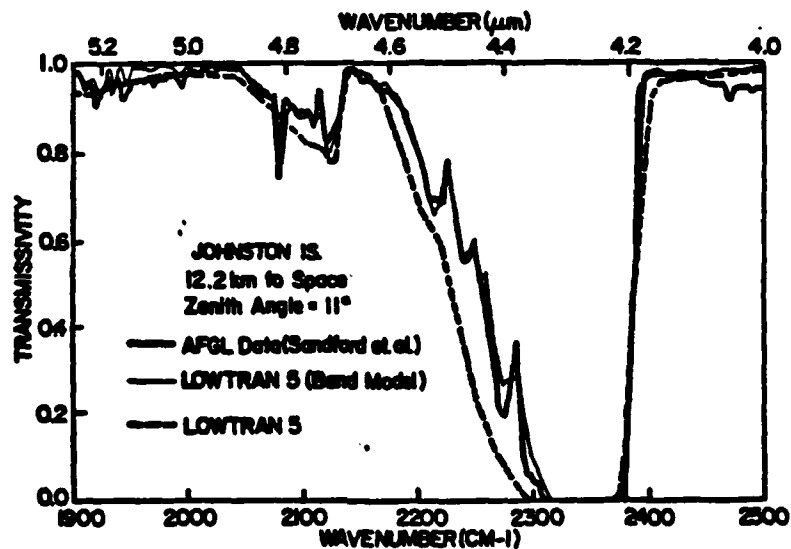


Figure 17. Comparison of LOWTRAN5 (Band Model) and LOWTRAN5 Predictions to AFGL Transmission Measurements⁽²⁵⁾ for a 12.2 km to Space Path with a 11° Zenith Angle.

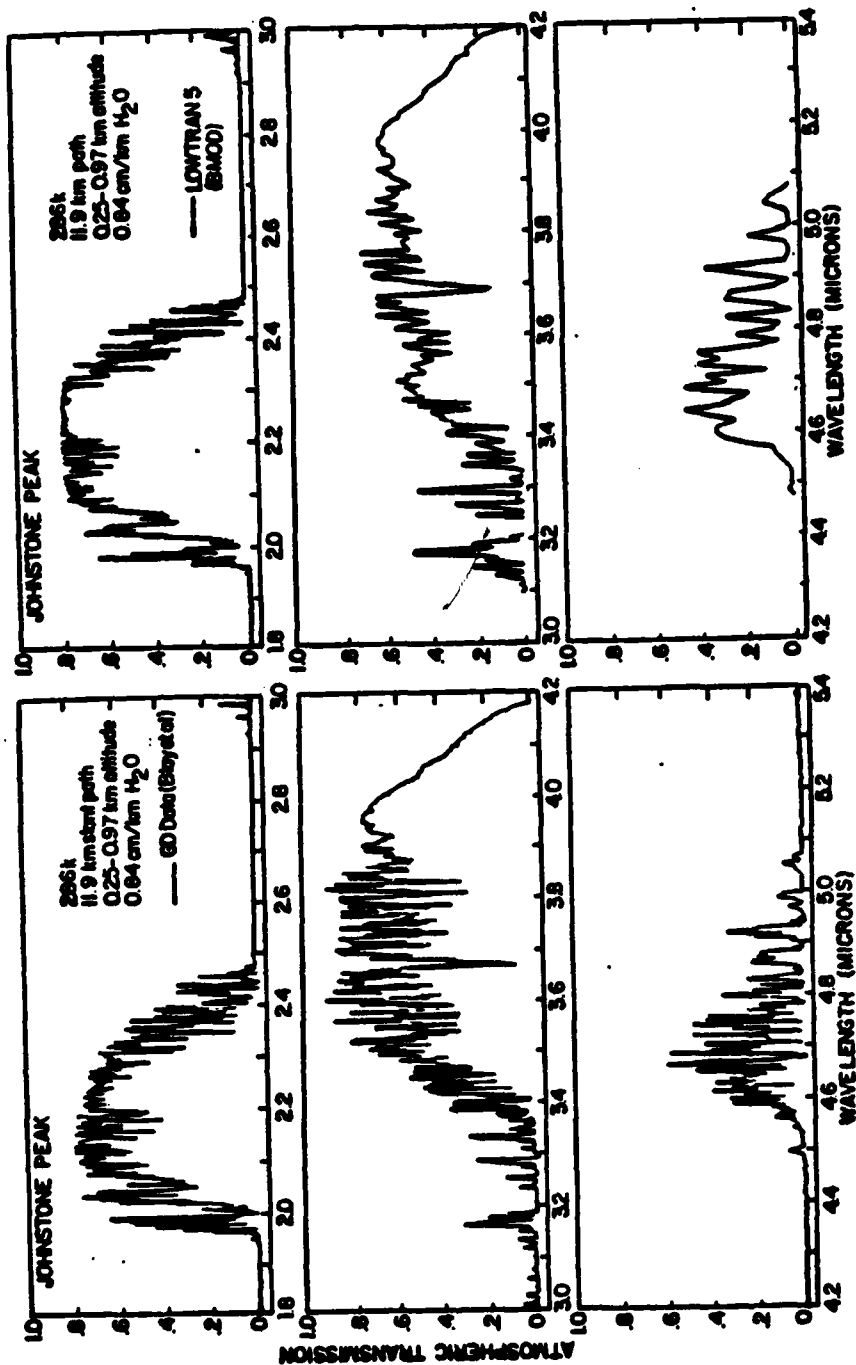


Figure 18. Comparison of LOWTRAN5 (Band Model) Predictions to General Dynamics Transmittance Measurements (26) for a Low Altitude 11.9 km Slant Path.

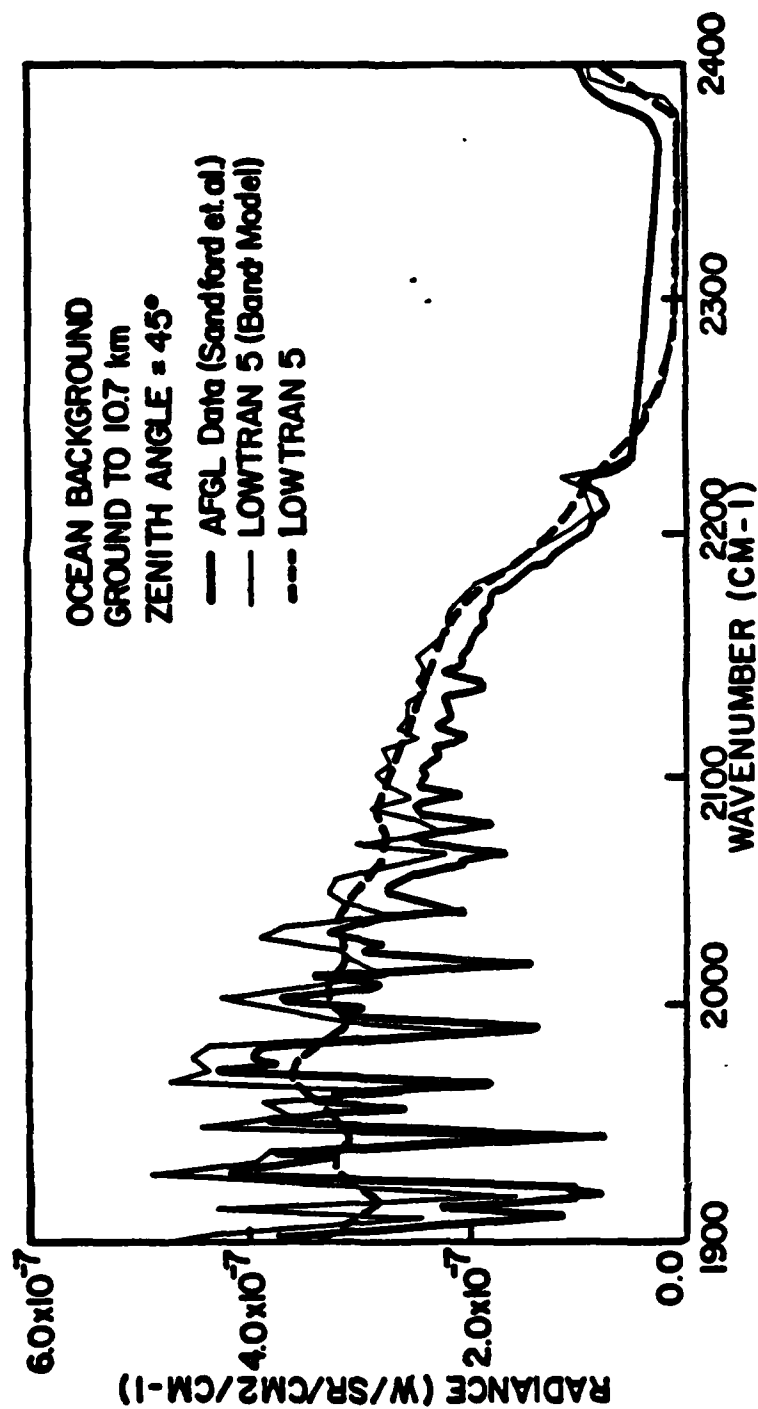


Figure 19. Comparison of LOWTRAN5 (Band Model) and LOWTRAN5 Predictions to AFGL Ocean Background Radiance Measurements.

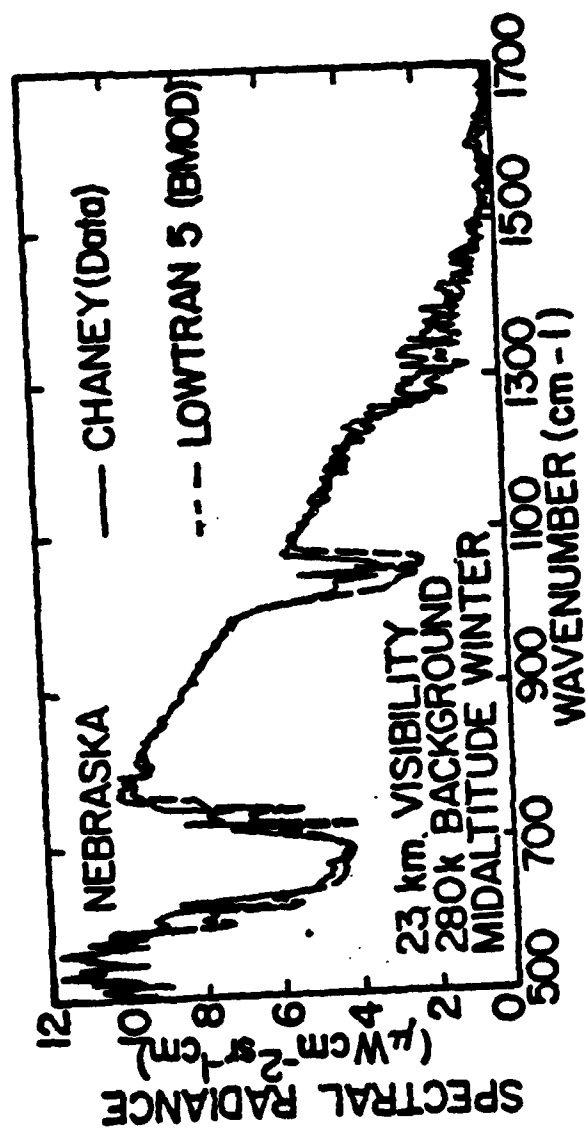


Figure 20. Comparison of LOWTRAN5 (Band Model) Predictions to University of Michigan Balloon Measurements of Background Radiance over Northern Nebraska.

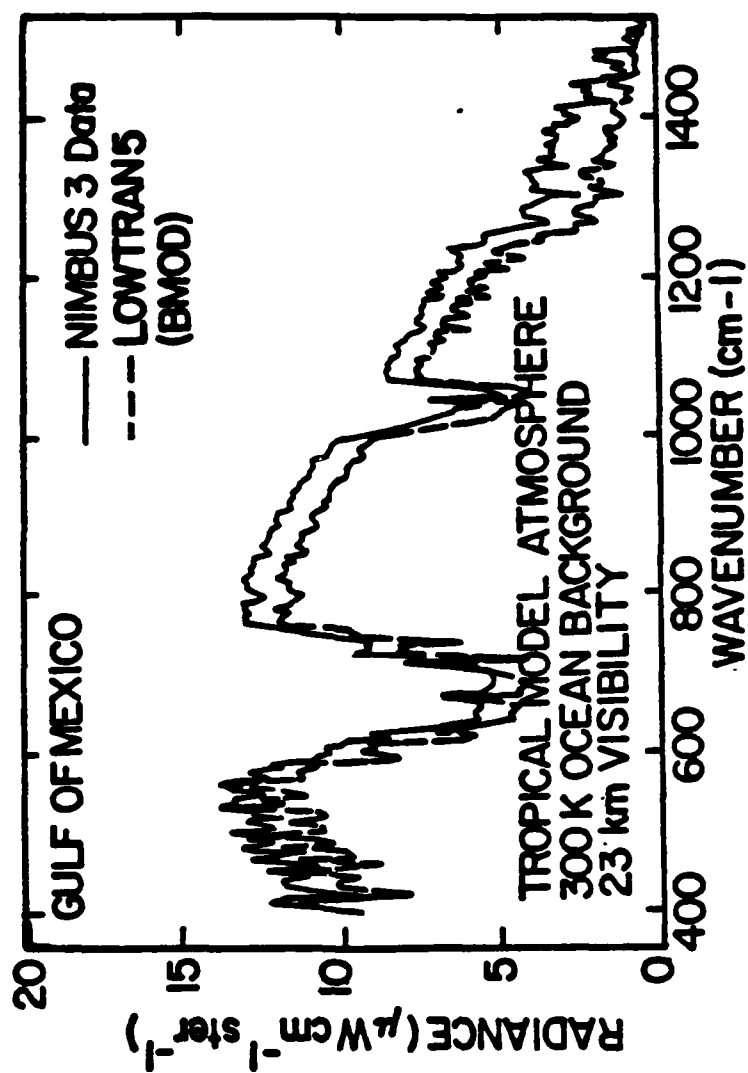


Figure 21. Comparison of LOWTRAN5 (Band Model) Prediction
NIMBUS 3 Satellite Measurements of Background
Radiance Over the Gulf of Mexico.

3. MODIFICATIONS TO LOWTRAN5

The coding modifications to LOWTRAN5 fall into two general categories. The first category, which is discussed in subsection 3.1 and 3.2, covers changes required to implement the BMOD option (5 cm^{-1} spectral resolution). The second category is optional changes which, although not required for the BMOD option, do serve to increase the code's overall capabilities. The optional changes discussed in subsection 3.3 include:

- The Print/Plot Package for plots and use of a slit function
- A blackbody source term at any H2 for radiation calculations
- Formatted READ and WRITE statements for general machine compatibility
- I/O device numbers in common blocks to facilitate device assignments
- LOWTRAN5 data in a BLKDATA subroutine for general machine compatibility
- LOWTRAN5 File 7 commented out because of the Print/Plot Package.

The required changes are indicated in the program listing by an asterisk before the sequence number; the optional changes are indicated by a colon. The required and non-required changes are guided by the philosophy that the impact on the LOWTRAN5 coding be minimized.

3.1 Implementation of the 5 cm^{-1} Capability

A new control parameter (JEMOD) on Card 1 selects a spectral resolution of 5 or 20 cm^{-1} . When using the BMOD option, an external tape or disc file containing the band model parameters in binary format is required for program execution.

Several changes have been made to the LOWTRAN5 common blocks. The new input parameter JEMOD has been added to common /CARD1/, because it is one of the input parameters on Card 1. Additionally, a new common block, /CARD4/, has been added to the main program LOWEM and to subroutines BMDATA and LIB. These subroutines need to know whether an additional LOWTRAN case is being calculated. The common block, /BMDCOM/, is shared by BMDATA and BMOD. It contains variables used in the band model calculations. Additionally, the pressure, PRES(68), has been added to blank common.

Several modifications were necessary in the calculation of the absorber amounts for H_2O , the UMLX gases and O_3 . In LOWTRAN, the equivalent horizontal path parameters (EH), which are defined as the equivalent absorber density for a 1 km horizontal path at each altitude, are defined as the product of the actual absorber densities and an empirical scaling law which approximates the effects of altitude on the curve-of-growth. Since BMOD uses the unscaled absorber density for these species, they are calculated in subroutine HPROF and stored in the EH array in place of the scaled absorber densities. In a regular LOWTRAN5 calculation, the array WPATH(i) calculated in subroutine PATH stores the equivalent absorber density for the total path from the observer through the i'th layer. Since BMOD uses the Curtis-Godson approximation to calculate an equivalent optical depth, the incremental absorber density for the path through each layer is needed and is stored in WPATH. Additionally, the mean pressure for each layer is calculated in subroutine PATH and stored in blank common as PRES. It should be noted that the mean pressure and temperature of the layer in which H_1 (or H_2) fall is used by BMOD and not the mean pressure between H_1 (or H_2) and the layer boundary. This can lead to a small interpolation error in the band model coefficients but has little impact on the calculated transmittances.

The interface between the regular LOWTRAN5 and the BMOD option is made through subroutine calls made in subroutine TRANS. The one call to BMDATA reads the binary file header, skips over the wavenumber blocks to the first wavenumber of the calculation and calculates wavenumber-independent quantities. The calls to subroutine BMOD are made once for each wavenumber and then additionally in the loop

over atmospheric layers that calculates the molecular transmittance. On the first call, BMOD checks for the next read and sets up the calculation for the subsequent loop over layers; the atmospheric transmittance is calculated at 5 cm^{-1} spectral resolution in the second call. The approximately forty lines in TRANS, which calculate the H_2O , UMIX , and O_3 transmittance at 20 cm^{-1} resolution are skipped.

3.1.1 Subroutine BMDATA

Subroutine BMDATA is called once each calculation from line TRA *313 in TRANS. This subroutine makes the initial binary file read and calculates wavenumber-independent quantities for subsequent use by subroutine BMOD.

After reading the file header BMDATA checks the wavenumber range requested by the user to see if it falls within the range in the file. If the requested interval is totally outside of the band model parameter range, the program stops with an error message. However, if the requested wavenumber interval is only partially outside of the allowed range, the program readjusts the upper and/or lower wavenumbers to the file's values and proceeds with the calculation. The next read skips over wavenumber blocks in the file until it reaches the wavenumber block containing V_1 , the initial wavenumber.

If the option $IXY = 1$ is used, the next calculation has the same atmospheric and path parameters but a new wavenumber range. In this case, the call to BMDATA only rewinds the file and performs the initial reads. The common block /CARD4/ was added to pass the value of IXY to BMDATA.

When using the BMOD option, the array WPATH contains the incremental optical depths for each layer. However, WPATH is not calculated by subroutine PATH when the path lies completely within one atmospheric layer, so it must be specified in subroutine BMDATA for use by subroutine BMOD. Next, the absorber densities (WPATH) are converted to the units of cm-amagats to be consistent with the units of the band model parameters. The absorber density conversion factors from the regular LOWTRAN5 units to those used in LOWTRAN5 (BMOD) are:

<u>SPECIES</u>	<u>LOWTRAN5</u>		<u>LOWTRAN5 (BMOD)</u>
H ₂ O	1 gm/cm ²	=	1.25 x 10 ³ cm amagat
Umix Gases	1 km	=	1.0 x 10 ⁵ cm amagat
O ₃	1 cm amagat	=	1 cm amagat

where 1 amagat = 1 atm at STP. Finally, several wavenumber independent quantities for each layer are calculated in BMDATA and stored in the appropriate arrays for later use by BMOD. These are, $\sqrt{T}$, the pressure normalized to one atmosphere (P/P_0), and the temperature indices for interpolation of the band model parameters.

3.1.2 Subroutine BMOD

Subroutine BMOD calculates the transmittance using the statistical band model described in subsection 2.1. Its initial call is made once every wavenumber from TRANS (line TRA*1283), and subsequent calls are made for each layer to calculate the transmittance from line TRA*1394. On the first call BMOD checks to see if the next block of band model parameters needs to be read (IW is the counting variable) and then zeros out quantities for the transmittance calculations. On the subsequent call(s), BMOD calculates the total optical depth and transmittance for each species. The continuum contribution due to tails of H₂O and CO₂ lines originating outside the 5 cm⁻¹ interval are included in the calculation. BMOD returns the transmittance for each species and required path to TRANS. The transmittances are stored in the regular LOWTRAN5 transmittance array (TX).

The call(s) made by TRANS to BMOD for calculating the transmittance is imbedded in a loop over atmospheric layers. When only transmittance is calculated, this DO-loop in TRANS consists of one pass. When atmospheric radiation is calculated, the TRANS loop is over all layers, because the radiation depends on the incremental change in transmittance for each layer. The Curtis-Godson approximation for the statistical band model also requires

the contribution from each layer for transmittance calculations. In keeping with the philosophy of minimizing changes to the basic LOWTRAN5 program, this layer loop is done in BMOD for transmittance-only calculations and in TRANS for radiation calculations. Thus, the layer loop in BMOD consists of just one pass when TRANS is looping over all layers and vice-versa. Subroutine BMOD determines whether the loop in TRANS is over one layer or all layers and then adjusts its own loop variable accordingly (line BMO 570).

The curve-of-growth used in the statistical model is based on the equivalent width of a single average line in an interval. The equivalent width is calculated by subroutine EWIDTH using a Voigt lineshape to combine the Doppler and Lorentz lineshapes. The Curtis-Godson approximation is used to calculate the Lorentz halfwidth (S1), Doppler halfwidth (S2) and line density (S3) for the equivalent homogeneous path (see Eqs. (8) and (9)). The effective number of lines is calculated from Eq. (11).

In addition to the molecular contributions from lines within each 5 cm^{-1} spectral interval, contributions from tails of H_2O and CO_2 lines external to that interval are also included. Since these tails have a smooth spectral structure, they form a continuum component, and Eq. (12) is used to calculate the transmittance. Only the CO_2 tails are considered in the UMX gases. The tail contributions and the molecular components are combined (multiplied together) and stored in the matrix TX. These values for the transmittance are then used by subroutine TRANS in its calculation of the total atmospheric transmittance and radiation.

3.1.3 Subroutine CALC

CALC is called by subroutine BMOD (line BMO 720) to determine the band model parameters for arbitrary temperatures. The tabulated band model parameters are linearly interpolated over temperature for each layer. If the atmospheric temperature is outside of the temperature range of the tabulated parameters, the entry for either the lowest or highest temperature is returned.

3.1.4 Subroutine EWIDTH

EWIDTH is called by subroutine BMOD (line BMO 980) to calculate the equivalent width of a single average line for the 5 cm^{-1} interval. As discussed in subsection 2.1, the Voigt lineshape is numerically integrated over the full interval using Eqs. (4) to (7). When the optical depth at the line center is less than X_{MIN}/π Beer's law is used. Otherwise EWIDTH compares the relative values of the Doppler and Lorentz halfwidths and selects the proper formula for the numerical integration.

Several numerical approximations are used in calculating the equivalent width. Equation (4b) is the real part of the complex error function⁽¹⁸⁾ and is calculated in subroutine CPF12. The region out to three halfwidths is calculated by using a linear approximation for Eq. (4) in the integration interval. From a study of various combinations for the number of integration intervals for each halfwidth (ISTEP) and the number of halfwidths from the line center (NALF), integrating out to three halfwidths in six steps was found to represent a reasonable trade-off between numerical accuracy and execution time. The region beyond three halfwidths of the line center is calculated using Eq. (6).

3.1.5 Subroutine ERFU

ERFU is used by EWIDTH (line EWI 760) to calculate the error function as part of the evaluation of Eq. (6). A polynomial approximation which is accurate to better than 2.5×10^{-5} is used.⁽¹⁸⁾

3.1.6 Subroutine CPF12

CPF12 is called by EWIDTH (line EWI 560) to calculate the complex error function⁽¹⁸⁾ and its first derivative. The real part is identical to Eq. (4b), and the first derivative is used to approximate its frequency dependence when performing the integration of Eq. (4a). The complex error function subroutine,

which was developed by J. Humlicek,⁽¹⁹⁾ is based on a 12'th order Hermite polynomial approximation. We investigated using only an 8'th order approximation, but the results were not sufficiently accurate.

3.2 Data Tape for the Band Model Parameters

The tabulated band model parameters are stored in an external file. The file has approximately 23,000 entries. It contains the S/d and l/d parameters for five temperatures plus the average linewidth and molecular weight for each species at 5 cm⁻¹ increments. The four species stored in the file are H₂O, the UMIX gases, O₃, and the H₂O and CO₂ line wings. The data for the four species are blocked in 100 cm⁻¹ increments (20 wavenumber points) for the wavenumber range from 400 cm⁻¹ to 9990 cm⁻¹. The tape is delivered with the data written in formatted form (120 characters/line). However, a binary file is expected by LOWTRAN5 because of the significant difference in the execution speed. Conversion of the formatted file to binary format on the user's system is discussed further in Appendix F, and a sample program listing is in Appendix G.

3.3 Optional Changes

The optional changes to the coding are modifications which either increase the code's usefulness or make it more compatible with other computers (e.g., CDC, UNIVAC, DEC, IBM, Honeywell, etc.). These changes are indicated by a colon and can easily be ignored by the user. If the user wishes to just implement the BMOD option on his already operational version of LOWTRAN5, only the BMDATA, BMOD, CALC, EWIDTH, ERFU, and CPF2 subroutines need to be added (though this procedure is not recommended). Making the changes indicated by asterisks in the program and preparing the binary tape will complete the implementation. The optional changes in this version of LOWTRAN5 and their motivation are described below.

3.3.1 Slit Function and Plotting Package

The Print/Plot Package was developed at Aerodyne Research, Inc. for use with the LOWTRAN5 computer code on its PRIME 400 system. A detailed description is given in Appendix A; the input parameters are described in Section 4.

The slit function allows the user to degrade the 5 cm^{-1} calculations to a lower spectral resolution. The slit function is defined by specifying the weighting factors for up to eight wavenumber points. The routine is self-normalizing so the user can specify arbitrary values for the weights and wavenumber increments. The results are presented in tabular form with each transmittance or radiation value being printed twice. The first tabulation has two significant figures for a quick scan of the results, and the second one contains five significant figures.*

The plot package allows the user to plot results as part of the calculation. As a minimum the user only needs to specify the title and the dimensions of the plots. However, he can specify other parameters such as the wavenumber interval and the interval at which the transmittance or radiation are presented. Usually the print/plot package will make its own selection. The MODEL = 10 option can be used to obtain multiple plots from the same calculation. For example, when using a slit function the degraded results can be calculated and plotted after the undegraded results are plotted.

3.3.2 Blackbody Source Term at H2

A blackbody radiation source at H2 is always included in LOWTRAN5 for look-down paths when H2 falls within the first layer. The optional change allows a blackbody source term to be included for arbitrary H2. Radiation calculations with no source term are obtained by specifying IEMISS = 1 (for the radiation calculation) and zero or a negative temperature for TBOUND (to remove the source term).

* This does not imply that the calculated results have this accuracy.

3.3.3 Generalized READ and WRITE Statements

The READ and PRINT statements were generalized to provide a version that can be easily implemented on the largest number of FORTRAN compilers. The unformatted PRINT statements were changed to WRITE statements with the addition of the logical unit associated with input. The READ statements that did not reference FORTRAN logical units were modified to include the unit number. Unit numbers are indicated by integer variables so that their assignments may easily be changed.

3.3.4 FORTRAN Logical Unit and File Assignments

Integer variables are used throughout this version of LOWTRAN5 for the FORTRAN logical units (FLUs) in all program I/O. This aids in implementing the code in facilities that have different FLUs default values for particular devices. Table 2 displays the variable names for the FLUs, where the variable names are assigned their values, and the value and file type associated with each variable. Changing the indicated line in the program is all that is necessary to change the FLU assignment. The COMMON blocks DEVNUM and PLTDEV are used to communicate the FLUs from program module to program module.

NIN, NOUT and NSTOR (FLUs 5, 6 and 7, respectively) have their same meaning as in the original version of LOWTRAN5. All other FLUs have been added to this version. NPLT contains the same transmittance and radiance values that are written to NSTOR, but in binary. The file associated with NPLT is used as input to the Print/Plot Package. NTBL is associated with the input binary file that contains the band model parameters. This file is read by subroutines EMOD and BMDATA. NSCR is associated with a scratch file used by the Print/Plot Package to store and retrieve degraded spectra. NPLT is the FLU associated with the CALCOMP-type plotting device (if any) on the computer system.

TABLE 2 - FORTRAN LOGICAL UNIT (FLU) ASSIGNMENTS

VARIABLE NAME	ASSIGNED IN	DESCRIPTION	FLU ASSIGNMENT	FILE TYPE
NIN	LOW:1237	INPUT FILE	5	READ ONLY
NOUT	LOW:1238	PRINTED OUTPUT FILE	6	WRITE ONLY
NSTOR*	LOW:1239	SECONDARY OUTPUT FILE	7	WRITE ONLY
NPLT	LOW:123A	INFO FOR PRINT/PLOT PACKAGE	9	TEMPORARY READ/WRITE
NTBL	BMD 350	BINARY-BAND MODEL PARAMETERS	12	READ ONLY
NSCR	LIB 320	SCRATCH PAD FOR PLOTTING	11	TEMPORARY READ/WRITE
NPLTR	LIB 460	CALCOMP-TYPE PLOT DEVICE	4	WRITE ONLY

*References to NSTOR have been commented out.

3.3.5 BLOCK DATA Restructure

The original version of LOWTRAN5 contained several named BLOCK DATA subprograms. Some of the DATA statements in the BLOCK DATA modules contain non-standard ANSI FORTRAN syntax. In an attempt to make this version of LOWTRAN5 more universal, the BLOCK DATA structure was changed.

All the named BLOCK DATA subprograms were concentrated into one un-named BLOCK DATA routine. The commons for storing the C1, C2 and C3 data were removed as these data are only used in one subroutine, C1DTA, C2DTA, C3DTA, respectively.

Any DATA statements with "implied-do loop" syntax were changed into a standard syntax. In order to keep the number of continuation cards to less than twenty, some arrays were added and placed in EQUIVALENCE with the larger LOWTRAN5 arrays in the DATA statements.

4. INPUT INSTRUCTIONS

The first four data cards are identical to those for LOWTRAN5 with the exception of the addition of JBMOD to Card 1. The second group of cards specifies the parameters for the optional Print/Plot Package. The input parameters are given in Table 3. For completeness, the regular LOWTRAN5 input cards are summarized in subsection 4.1. More detailed information can be found in the LOWTRAN5 User's Manual.⁽¹⁾ Instructions for specifying the Print/Plot parameters are given in subsection 4.2.

TABLE 3 - LOWTRAN5 INPUT DATA

CARD NUMBER	PARAMETERS	FORMAT
1	MODEL, IHAZE, ITYPE, LEN, JP, IM, M1, M2, M3, ML, IEMISS, RO, TBOUND, ISEASN, IVULCN, VIS, JBMOD	11I3, 2F10.3, 2I3, F11.3, I2
1A	(IF MODEL = 7 AND IM = 1) Z, P, T, DP, RH, WH, WO, AHAZE, VIS1, IHA1, ISEAL, IVUL1	3F10.3, 2F5.1, 3E10.3, F7.3, 3I1
2	H1, H2, ANGLE, RANGE, BETA	7F10.3
2'	(REPLACES CARD 2 WHEN MODEL = 0) H1, P, T, DP, RH, WH, WO, RANGE	3F10.3, 2F5.1, 2E10.3, F10.3
3	V1, V2, DV	7F10.3
4	IXY	I3
5	TITLE	20A4
6	MSLT, MPRT, MPLT, NS, WIDTH, SHIFT	4I2, 2X, 2F10.0
7A 7B	(SLIT FUNCTION PARAMETERS) XSS(I), I = 1, NS SS(I), I = 1, NS	8F10.5 8F10.5
8A 8B	(PLOTING PARAMETERS) XAXIS, XINT, XEND, DXT, NMINK YAXIS, YINT, YEND, DYT, NMINY	4E10.4, I10 4E10.4, I10

4.1 LOWTRAN5 Input Parameters

The instructions and user options given here are the same as the regular LOWTRAN5 code excepting some changes to Card 1. The changes are the MODEL = 10 option, use of a blackbody source for arbitrary H2, and the JEMOD option. The user is directed to the LOWTRAN5 User's Manual⁽¹⁾ for further explanation, especially for the aerosol models.

CARD 1: MODEL, IHAZE, ITYPE, LEN, JP, IM, M1, M2, M3, ML, IEMISS, RO,
TBOUND, ISEASN, IVULCN, VIS, JEMOD
(Format 11I3, 2F10.3, 2I3, F11.3, I2)

- | | | | |
|-------|---|----|--|
| MODEL | = | 0 | Meteorological data for a horizontal path
(Card 2' follows) |
| | = | 1 | Tropical atmosphere |
| | = | 2 | Midlatitude summer |
| | = | 3 | Midlatitude winter |
| | = | 4 | Subarctic summer |
| | = | 5 | Subarctic winter |
| | = | 6 | 1962 U.S. Standard |
| | = | 7 | User specified atmospheric profile |
| | = | 10 | Skip to plot package (Card 4 follows). |
-
- | | | | |
|-------|---|---|---|
| IHAZE | = | 0 | No aerosol attenuation |
| | = | 1 | Rural model, 23 km visibility |
| | = | 2 | Rural model, 5 km visibility |
| | = | 3 | Maritime model, 23 km visibility |
| | = | 4 | Maritime model, 5 km visibility |
| | = | 5 | Urban model, 5 km visibility |
| | = | 6 | Tropospheric model, 50 km visibility |
| | = | 7 | User-defined extinction model |
| | = | 8 | FOG1 (advection fog), 0.2 km visibility |
| | = | 9 | FOG2 (radiation fog), 0.5 km visibility |

ITYPE = 1 Horizontal (constant-pressure) path
 = 2 Slant path from H2 (source) to H1 (observer)
 = 3 Slant path from space (source) to H1 (observer)

LEN = 0 Normal operation
 = 1 Selects the long downward path when $0 < HMIN < H2$

JP = 0 Normal operation
 = 1 Suppress printed output

IM = 0 Subsequent calculations to be run with MODEL = 7
 = 1 Radiosonde data to be read in initially

M1 = 0 Normal operation
 = 1-6 Selects temperature and pressure altitude profile
 from the appropriate model atmosphere

M2 = 0 Normal operation
 = 1-6 Selects corresponding water vapor model profile

M3 = 0 Normal operation
 = 1-6 Selects corresponding ozone model profile

ML = 0 Normal operation
 ≠ 0 Number of user-specified levels (when IM = 1)

IEMISS = 0 Transmittance only
 = 1 Transmittance and radiation calculated

RO = 0 Earth radius appropriate to model atmosphere
 (If MODEL = 0 or 7, the midlatitude value of
 6371.23 km is used)
 ≠ 0 User-specified value

TBOUND > 0 Blackbody temperature of source at H2
 ≤ 0 No blackbody source at H2 (only atmospheric radiance
 is calculated)

ISEASN = 0 Season determined from value of MODEL
 Spring-Summer for MODEL = 0,1,2,4,6,7
 Fall-Winter for MODEL = 3,5
 = 1 Spring-Summer
 = 2 Fall-Winter

IVULCN = 0,1 Background stratospheric profile and extinction
 = 2 Moderate volcanic profile and aged volcanic
 extinction
 = 3 High volcanic profile and fresh volcanic
 extinction
 = 4 High volcanic profile and aged volcanic extinction
 = 5 Moderate volcanic profile and fresh volcanic
 extinction

VIS ≠ 0 Visibility range (km)
 = 0 Default value set by IHAZE

JBMOD = 0 Regular LOWTRAN5
 = 1 5 cm⁻¹ BMOD option

CARD(S) 1A: (Insert when MODEL = 7)
 Z, P, T, DP, RH, WH, WO, AHAZE, VIS1, IHA1, ISEA1, IVUL1
 (Format 3F10.3, 2F5.1, 3E10.1, F7.3, 3I1)

Z = Altitude (km)

P = Pressure (mb)

T = Ambient temperature (°C)

DP - Dew-point temperature ($^{\circ}\text{C}$)
 RH - Relative humidity (%)
 WH - Water vapor density (gm m^{-3})
 WO - Ozone density (gm m^{-3})
 AHAZE - Aerosol number density (normalized by the user to
 the required meteorological range using the
 LOWTRAN extinction coefficients)
 VIS1 - Meteorological range (km) for the altitude, Z
 IHA1 - Aerosol extinction and meteorological range control
 for the altitude, Z
 ISEAL : - Aerosol season control for the altitude, Z
 IVUL1 - Aerosol profile and extinction control for the
 altitude, Z

CARD 2: H1, H2, ANGLE, RANGE, BETA
 (Format 7F10.3)

H1 - Altitude of observer
 H2 - Altitude of path start (source altitude in
 radiation calculations)
 ANGLE - Initial zenith angle measured from H1 (degrees)
 RANGE - Path length (km)
 BETA - Earth center angle subtended by H1 and H2

CARD 2': (Replaces Card 2 when MODEL = 0)
H1, P, T, DP, RH, WH, WO, RANGE
(Format 3F10.3, 2F5.1, 2E10.3, F10.3)

HI = Altitude of horizontal, constant-pressure path

P,T,DP,RH, Defined under Card(s) 1A
WH,W0

RANGE = Path length (km)

CARD 3: V1, V2, DV
(Format 7F10.3)

V1 = Initial wavenumber (cm^{-1})

V2 = Final wavenumber (cm^{-1})

DV = Wavenumber increment (cm^{-1})
 (must be 5 cm^{-1} when JBMOD = 1)

CARD 4: IXY (Format I3)

IXY = 0 End of calculation
 = 1 Only select new Cards 3 and 4-8
 = 2 Select new data sequence
 = 3 Only select new Cards 2 and 4-8
 = 4 Only select new Cards 1 and 4-8

The new data cards specified by IXY are read after the Print/Plot control cards (Cards 5-8).

4.2 Print/Plot Parameters

The second group of input cards determines the options for the Print/Plot Package. The LOWTRAN transmittance and radiation calculations are written to an external file (NPLT) which is rewound and read by this output section. Multiple calls which allow specification of different output formats for the same calculation are obtained by repeating the calculation (IXY = 2 or 4) and then setting MODEL = 10 on Card 1. In this case, the transmittance calculations are skipped, and the previous results can be printed and/or plotted in a different format (e.g., vs wavenumber and then vs wavelength). The general sequence for the output control cards is as follows:

Card 5	TITLE
Card 6	Print/Plot Control Parameters
Cards 7A,B	Slit Function Parameters
Cards 8A,B	Plotting Parameters

The output subroutines are executed in one call to subroutine LIB, which is made just after reading Card 4 of the regular LOWTRAN5 input data sequence.

CARD 5: TITLE
(Format 20A4)
This title is printed on the plots and tabulated output.

CARD 6: MSLT, MPRT, MPLT, WIDTH, SHIFT
(Format 4I2, 2X, 2F10.0)

MSLT = 0 Repeat the previous case with no change in parameters; (cannot have MSLT = 0 on the first case)

= 1 Use the calculated results directly

= 2 Degrade using the slit function

MPRT = 0 Do not print any results

= 1 Print transmittance only

= 2 Print radiation only

= 3 Print transmittance and radiation

MPLT = 0 Skip plots

= (1,-1) Plot transmittance vs (cm^{-1} , μm)

= (2,-2) Plot radiance vs (cm^{-1} , μm)

= (3,-3) Plot transmittance and radiance vs (cm^{-1} , μm)

NS = Number of (XSS, SS) points to define the slit function (max. 8)

WIDTH = Total width of the slit function base in cm^{-1}

SHIFT = Shift (cm^{-1}) in the midpoint of the slit function for the next calculational point in degrading the spectrum

If MSLT = 0, the Print/Plot parameters are used from the previous case; then the other parameters on Card 6 are zero, and Cards 7 and 8 are skipped. If no slit function is desired (MSLT = 1) or if the previously specified slit function is repeated (MSLT = 0), Cards 7A and 7B are omitted. MPLT is the control variable which governs the number and type of plots.

CARD 7A: XSS(I), (I = 1, NS) (Format 8F10.5)

CARD 7B: SS(I), (I = 1, NS) (Format 8F10.5)

XSS = Wavenumber coordinates of slit function points

SS = Values of the weighting function at the XSS points

An example of a generalized slit function is given in Fig. 22 for an arbitrary set of XSS and SS values. The results which have been calculated at the resolution specified by DV (5 cm^{-1} for the BMOD option!) are degraded by integrating over the slit function. Interpolation between the user-specified points is linear. High order polynomial interpolations can be used by changing the value of the parameter NDEG in Subroutine GEN. The slit function is self normalizing, so arbitrary values of SS and XSS can be used. That is, the span of the slit coordinate points, $|XSS_{\max} - XSS_{\min}|$, is normalized to WIDTH, and the area of the weighting function points over XSS is normalized to unity. For example, a triangular slit function, which has a spectral resolution of 40 cm^{-1} (FWHM) and, whose spectrum is calculated in increments of 10 cm^{-1} , is given by:

NS	=	3	XSS	=	-1.0, 0.0, 1.0
WIDTH	=	80.	SS	=	0.0, 1.0, 0.0
SHIFT	=	10.			

CARD 8A: XAXIS, XINIT, XEND, DXT, NMINK (Format 4E10.4, I10)

CARD 8B: YAXIS, YINIT, YEND, DYT, NMINY (Format 4E10.4, I10)

(XAXIS, YAXIS) = Length of (x-axis, y-axis) in inches

(XINIT, YINIT) = Value of (x,y) at the origin (optional)

(XEND, YEND) = Upper limits of (x,y) (optional)

XSS	SS
-1.0	0.
0.0	1.
+1.0	0.

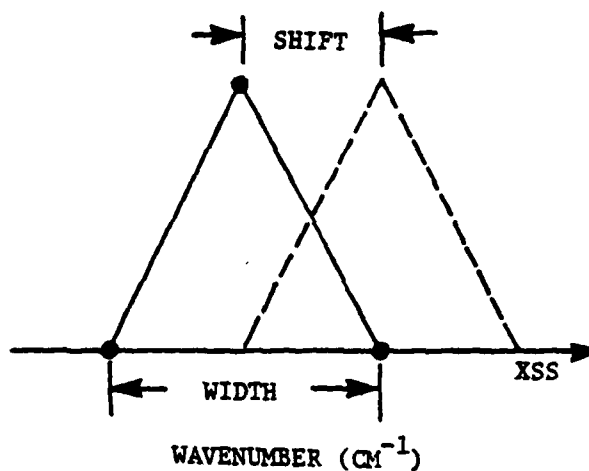


Figure 22. Example of the Generalized Slit Function for a Simple Triangular Slit. The Values of XSS and SS are Tabulated.

(DXT, DYT) = (x,y) units between major tic marks (optional)

(NMINX, NMINY) = Number of minor tic marks between the major ones (optional)

Except for XAXIS and YAXIS, which determine the physical dimensions of the graph, the plotting variables need not be specified. The default values are determined internally. For example, the default values of XINIT and XEND are V1 and V2.

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APPENDIX A

LOWTRANS PRINT/PLOT PACKAGE

- A.1 INTRODUCTION**
- A.2 PLOTTER SUBROUTINES**

A.1 INTRODUCTION

In addition to the 5 cm^{-1} option, a Print/Plot Package is included with this version of LOWTRAN5. Since its only interface with the main program is through one call statement in the main program and four writes to FLU NPLT by subroutine TRANS, the user has the option whether or not to use this additional capability with no impact on the rest of the program.

The Print/Plot Package expands the output capabilities of the code to allow the user to:

- Spectrally degrade the results using a user-specified slit function; and
- Tabulate the calculated transmittance and/or radiation as a function of wavenumber or wavelength; and
- Generate plots on the user's plotter.

By using the MODEL = 10 option, multiple calls to the Print/Plot Package through subroutine LIB can be made so that the results from a single calculation can be presented in different formats (undegraded and degraded spectra, plots vs. wavenumber and vs. wavelength, etc.).

The Print/Plot Package consists of the subroutines listed in Table A.1. The first six subroutines are part of the LOWTRAN5 program, and the second eight are calls to the plotter. The second group (or a suitable modification thereof) must be furnished by the user's facility as part of its plotting library. The plotter subroutines which the Print/Plot Package expects the user to provide are described in Section A.2.

TABLE A.1 - PRINT/PLOT SUBROUTINES

NAME	ARGUMENTS	FUNCTION
LOWTRANS SUBROUTINES (PRINT/PLOT PACKAGE)		
LIB	MSLTO, LPLT	CALLS SLIT FUNCTION SETS UP OUTPUT AND PLOTS
ALL	---	PRINTS/PLOTS UNDEGRADED SPECTRUM
GEN	WIDTH,SHIFT,XSS,SS,NS	CALCULATES SLIT FUNCTION
PROUT	---	PRINTS OUTPUT AND PLOTS CURVES
WRTDAT	N,X,Y	SETS UP DATA FOR PROUT
TERP	XC,X,Y,NDEG,NPTS,IER	PERFORMS NEWTON'S INTERPOLATION FOR DISCRETE DATA POINTS
PLOTTER SUBROUTINES (USER'S INSTALLATION)		
PLOT	X,Y,IPEN	PLOTS A VECTOR/MOVES PEN
SYMBOL	X,Y,HITE,ARRAY,THETA,NCHARS	PLOTS VECTORED SYMBOLS
NUMBER	X,Y,HITE,RNUM,THETA,NDEC	PLOTS REAL NUMBER
LINE	XARRAY,YARRAY,NPTS,INC,LINCTL, ISYM	PLOTS LINE FROM SCALED ARRAYS
AXIS	X,Y,TITLE,NCHARS,AXLEN,THETA, RLEAST,DELTAV,DELTAT,NMIN	PLOTS A LABELED AXIS
INITP\$	IPDEV,IEDEV	INITIALIZES PLOT PACKAGE
ENDPLT	---	TERMINATES PLOTTING
WHERE	X,Y,FAC	GIVES PEN COORDINATES

TABLE A.2 - LOCATION OF CALLS TO EXTERNAL PLOTTER

SUBROUTINE NAME	CALLING LOCATION	FUNCTION
INITP\$	LIB 910	INITIAL CALL TO THE PLOTTER
PLOT	LIB 920	MOVES PEN TO THE ORIGIN
PLOT	LIB 1280	RESETS ORIGIN FOR NEXT PLOT
ENDPLT	LIB 1340	CLOSE PLOTTING FILES BEFORE STOPPING
AXIS	PRO 730	DRAW X-AXIS
AXIS	PRO 740	DRAW SCALE ON TOP AND PRINT TITLE
AXIS	PRO 750	DRAW Y-AXIS
AXIS	PRO 760	DRAW SCALE ON RIGHT-HAND SIDE
SYMBOL	PRO 780	PRINTS NORMALIZATION LABEL (IF PLOT IS RENORMALIZED)
WHERE	PRO 790	LOCATE PEN
NUMBER	PRO 810	WRITE EXPONENT OF RENORMALIZATION
WHERE	PRO 820	LOCATE PEN
SYMBOL	PRO 830	PRINT LABEL
LINE	PRO 1140	PLOT LINE

A.2 PLOTTER SUBROUTINES

The plotter library used at Aerodyne Research, Inc. is a modification of DIPILOT. Prime DIPILOT (Device Independent PLOT Package) is designed to allow the user to direct his plotter output to the plotter, using the industry accepted Calcomp calling sequences.

SUBROUTINE CALLING SEQUENCES

The FORTRAN subroutines used in the Print/Plot Package for LOWTRAN5 are described below. All linear arguments are in inches.

Subroutine PLOT - Basic Pen Movement Control

The PLOT subroutine allows the user to draw a vector or move the pen from one point to another. Optionally, the origin may be reset to the given X and Y coordinates, depending on the value of the pen control variable (IPEN).

Calling Sequence:

CALL PLOT (x,y,ipen)

x,y	The coordinates to which the pen is to be moved, relative to the current origin
ipen	The pen control variable, set as follows:

<u>Value</u>	<u>Meaning</u>
2	lower pen and move
3	raise pen and move
-2	lower pen, move, and reset origin to given x,y
-3	raise pen, move, and reset origin to given x,y

Subroutine SYMBOL - Plots Vektored Symbols

This subroutine will plot an ASCII character string as vectored symbols. The full ascii character set is supported, including the 26 lower case characters. Also, it is possible to plot one of the 10 centered symbols by setting ARRAY to the appropriate number (0-9) and setting NCHARS to -1 or -2.

Calling Sequence:

CALL SYMBOL (x,y,hite,array,theta,nchars)

x,y	The coordinates of the lower left-hand corner of the first character to be plotted, or the coordinates of the centered symbol if NCHARS is -1 or -2.
hite	Height of the characters to be plotted
array	ASCII array or special symbol code
theta	The angle of rotation
nchars	The number of characters to be plotted or, if a special symbol is to be plotted:

<u>Value</u>	<u>Meaning</u>
-1	raise pen before moving
-2	lower pen before moving, thus drawing a part of the line or curve

Subroutine NUMBER - Plots a Real Number

This routine will plot any real number to a user-specified number of decimal places. Leading zeroes and spaces are suppressed.

Calling Sequence:

CALL NUMBER (x,y,hite,rnum, theta,ndec)

x,y	Coordinates of the lower left-hand corner of the first digit to be plotted
hite	Height of the output string
rnum	The real number to be plotted
theta	The angle of rotation of the string
ndec	Number of decimal places to be plotted as follows:

<u>Value</u>	<u>Meaning</u>
>0	plot number to 'ndec' decimal places
0	plot no decimal places, but do plot a decimal point (.)
-1	plot integer part only

Subroutine LINE - Plots a Line from Two Arrays

This subroutine will plot a line from 2 scaled X and Y arrays. Optionally, the plotted line may consist of a line only, a line with centered symbols at user-specified intervals, or centered symbols only, depending on the line control variable (LINCTL). Note that this line has been scaled by subroutine PROUT, and the two extra elements are added to the end of the data array being plotted. The first element represents the first value for the plot range, and the second element represents the change in units per inch.

Calling Sequence:

CALL LINE (xarray,yarray,npts,inc,linctl,isym)

xarray,yarray	The two arrays used to plot the line; these may be scaled by SCALE before use by LINE								
npts	Number of data points to be plotted								
inc	The increment of the subscript for consecutive elements within the array								
linctl	Line plotting control variable, set as follows: <table><thead><tr><th><u>Value</u></th><th><u>Meaning</u></th></tr></thead><tbody><tr><td>0</td><td>line is drawn connecting points</td></tr><tr><td><0</td><td>symbol is drawn at each IABS(linctl) 'th point; no line is drawn</td></tr><tr><td>>0</td><td>symbol is drawn at each (linctl)i'th point; a line is drawn connecting the points</td></tr></tbody></table>	<u>Value</u>	<u>Meaning</u>	0	line is drawn connecting points	<0	symbol is drawn at each IABS(linctl) 'th point; no line is drawn	>0	symbol is drawn at each (linctl)i'th point; a line is drawn connecting the points
<u>Value</u>	<u>Meaning</u>								
0	line is drawn connecting points								
<0	symbol is drawn at each IABS(linctl) 'th point; no line is drawn								
>0	symbol is drawn at each (linctl)i'th point; a line is drawn connecting the points								
isym	The number of the special symbol to be drawn, if any								

Subroutine AXIS - Plots a Labeled Axis

This routine will plot a labeled axis with user-specified tic mark variations, labels, and length.

Calling Sequence:

CALL AXIS (x,y,title,nchars,axlen,theta,rleast,deltav,deltat,rmin)

x,y	The coordinates of the left-hand end of the axis
title	ASCII title of the axis

nchars	Number of characters in the title - if >0, tic marks, calibration, and title will appear on the counter-clockwise side of the axis; if <0, they will appear on the clockwise side of the axis; nchars should be <0 for X axis, >0 for Y axis
axlen	Length of axis
theta	Angle of rotation of axis, calibration, and title
rleast	The minimum value in the array - this may be name of the first extra element of the array returned by SCALE
deltav	The change in value of the array for each inch to be plotted - this may be the name of the second extra element of the array returned by SCALE
deltat	The change in value of the array between plotted tic marks
nmin	The number of minor (uncalibrated) tic marks between major ones

Subroutine WHERE - Returns Current Pen Position

The WHERE subroutine returns the current pen position in the two given variables, thus locating a "lost" pen. This is useful in determining pen position after a call to subroutine SYMBOL.

Calling Sequence:

CALL WHERE (x,y,fac)

x,y	The current scaled pen position relative to the origin
fac	Current factor

Subroutine INITPS - Plot Initialization

This routine allows the program to specify the plot and error devices. The dimensions of the plotter bed are assumed to be internal so they are not specified in the call.

Calling Sequence:

CALL INITPS (ipdev, iedev)

ipdev Plot device number

iedev Error device number

NOTE: This is not a standard Calcomp call. The appropriate initialization routine at the user's facility should replace this.

Subroutine ENDPLT - Plot Termination

This subroutine will dump any points in the buffer and close any plot or error files.

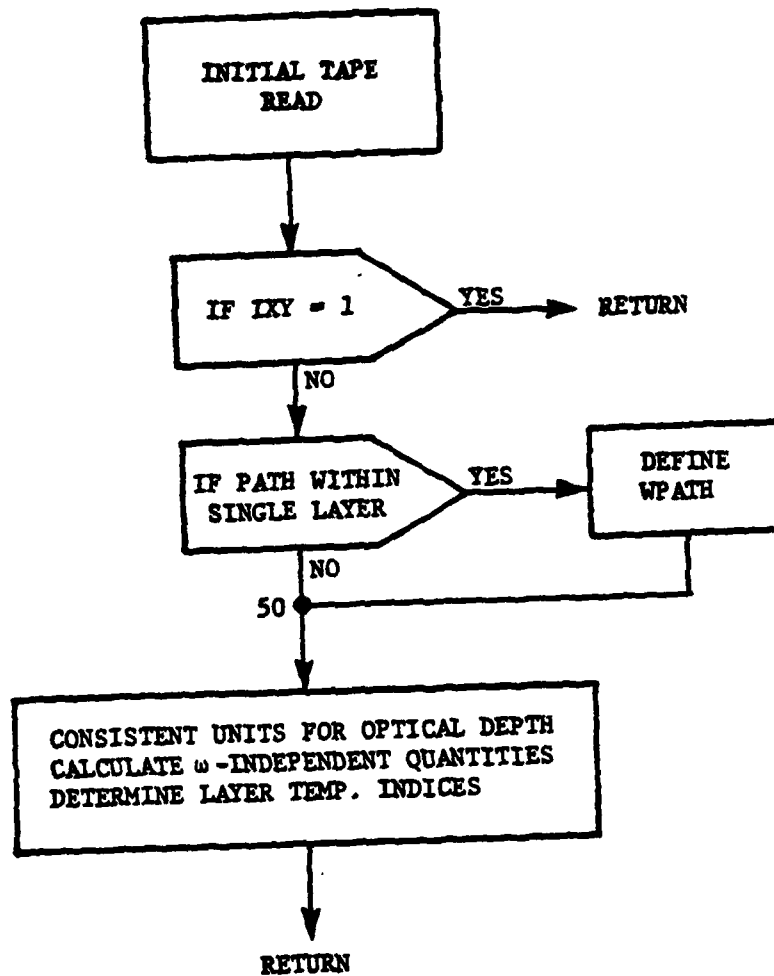
Calling Sequence:

CALL ENDPLT

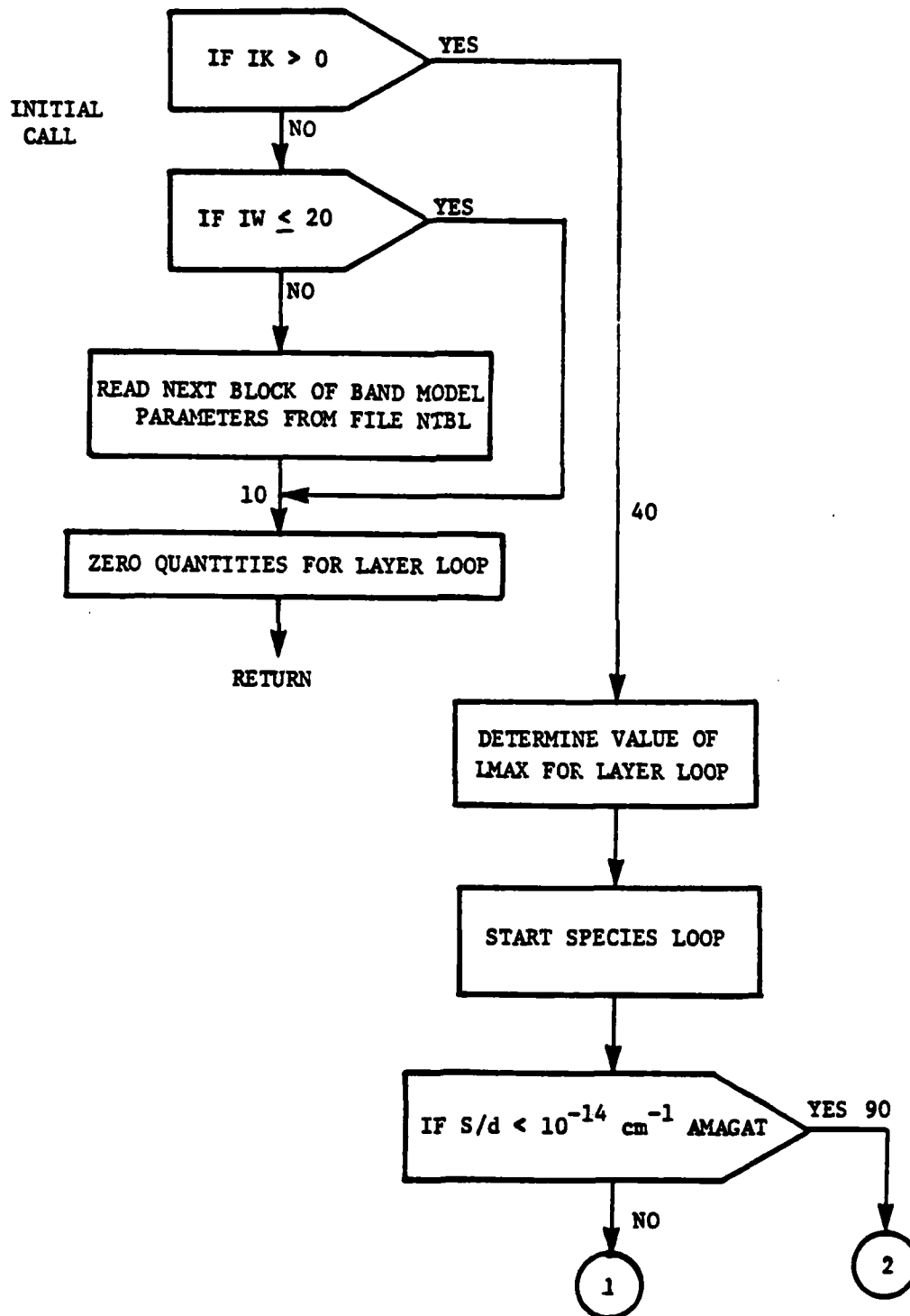
APPENDIX B

FLOWCHARTS

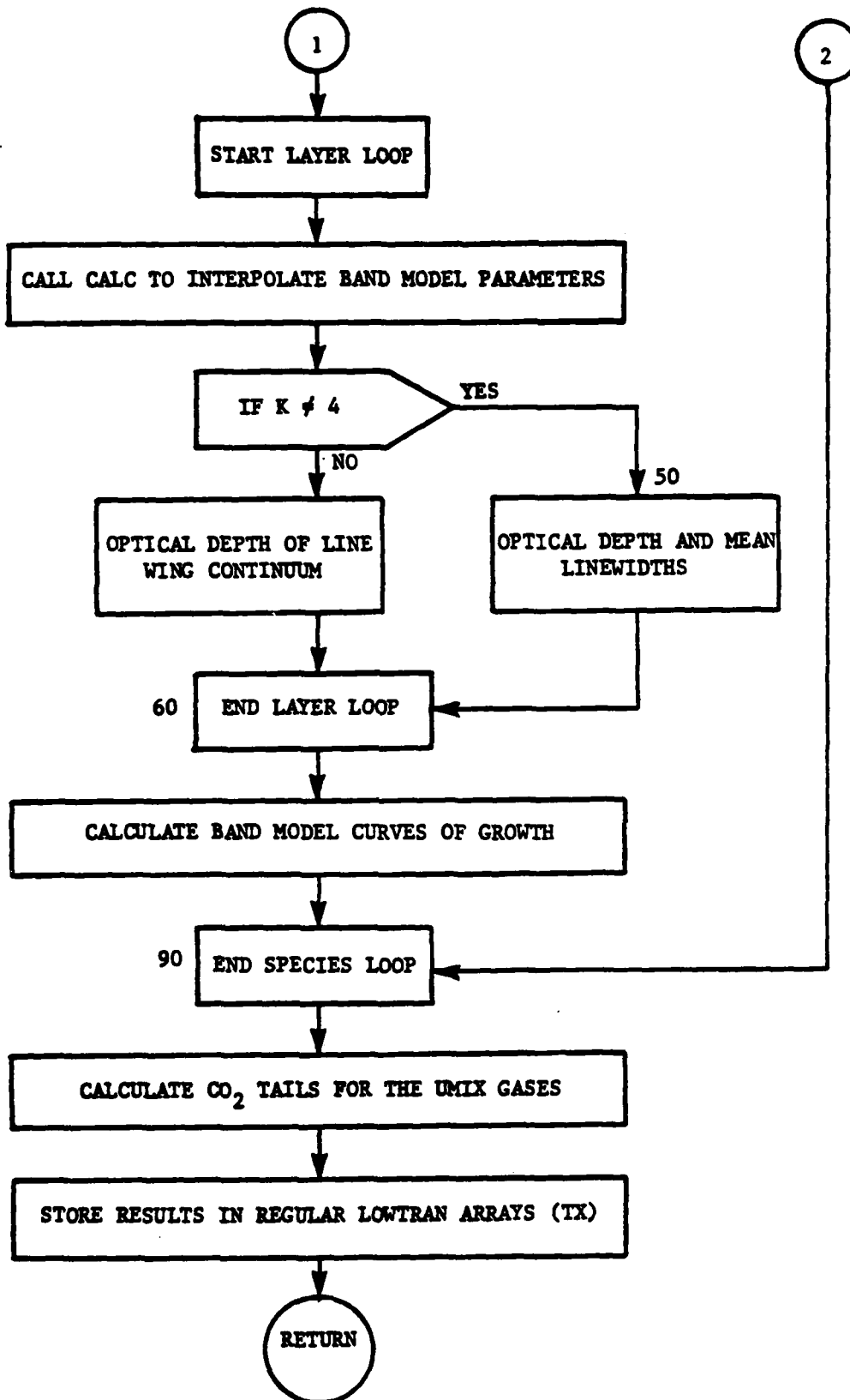
SUBROUTINE BMDATA



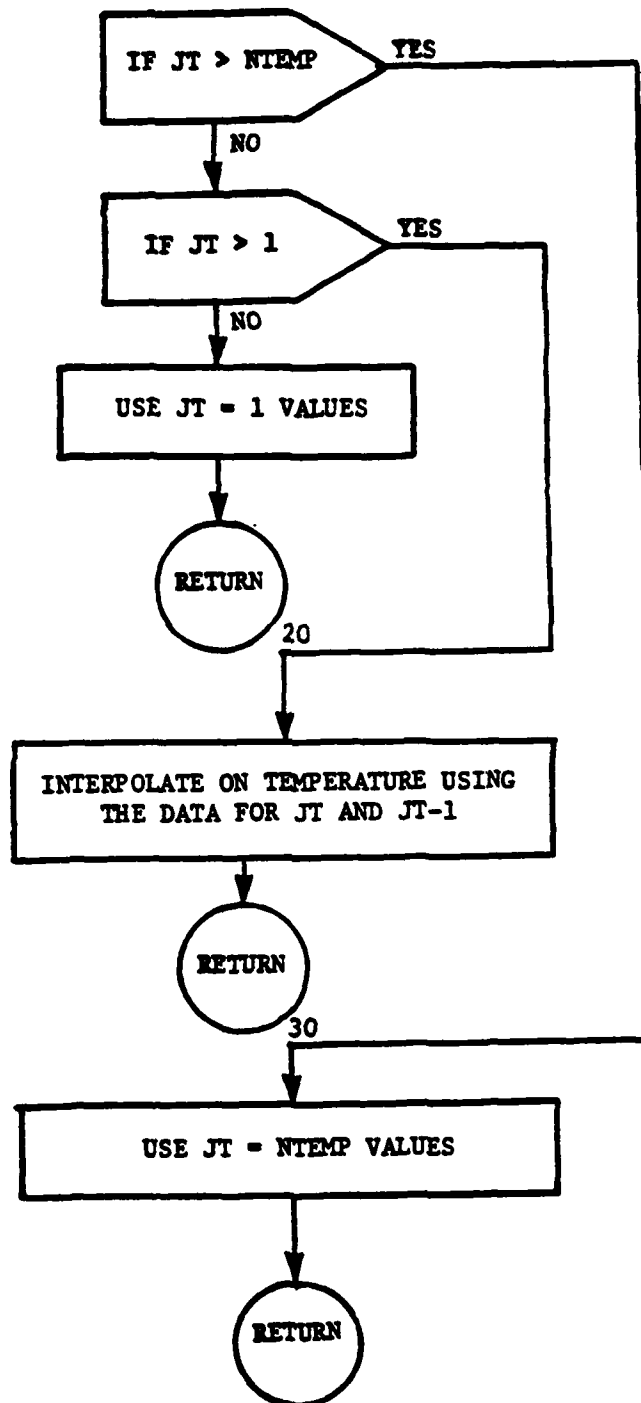
SUBROUTINE BMOD



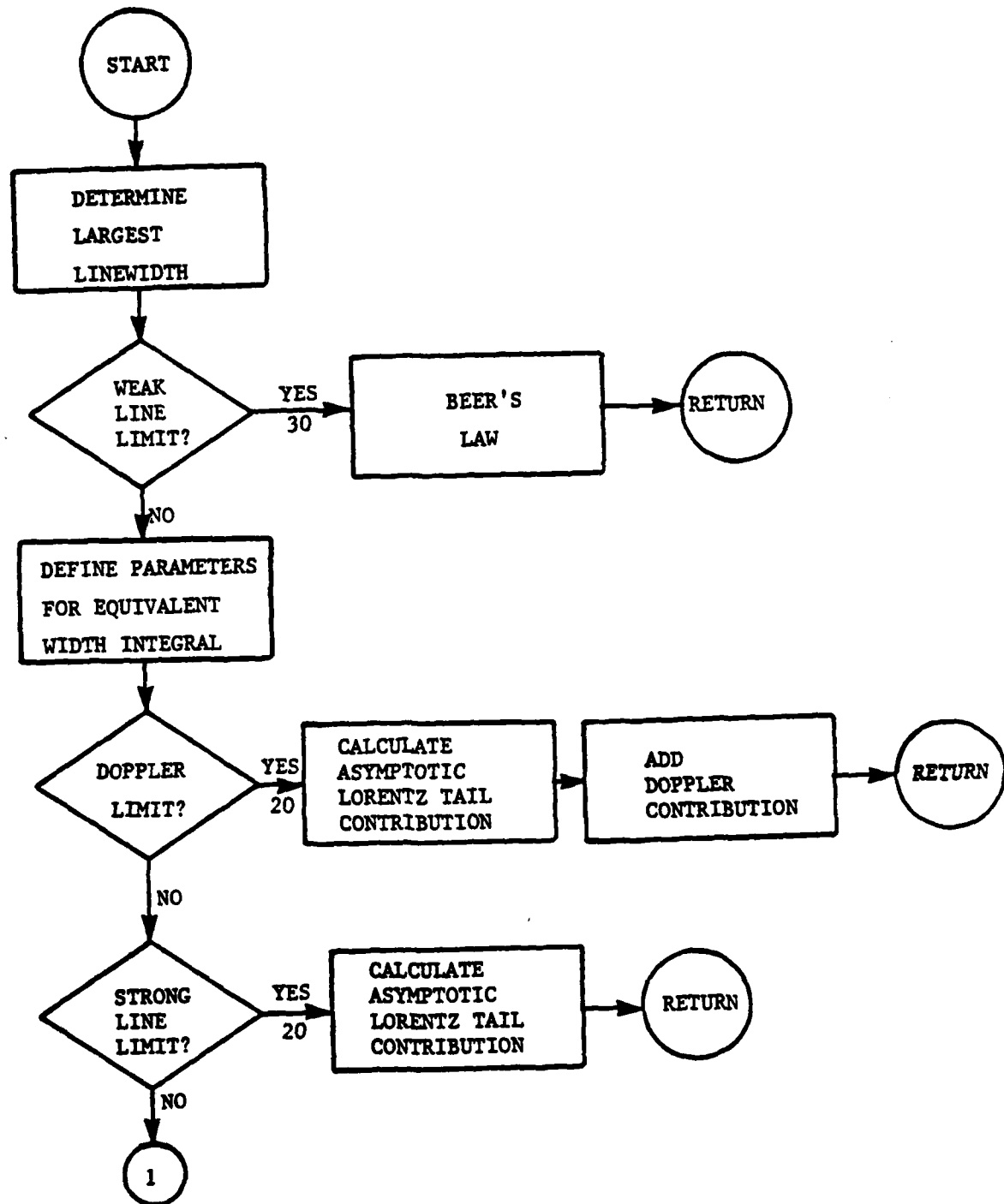
SUBROUTINE EMOD (Cont.)



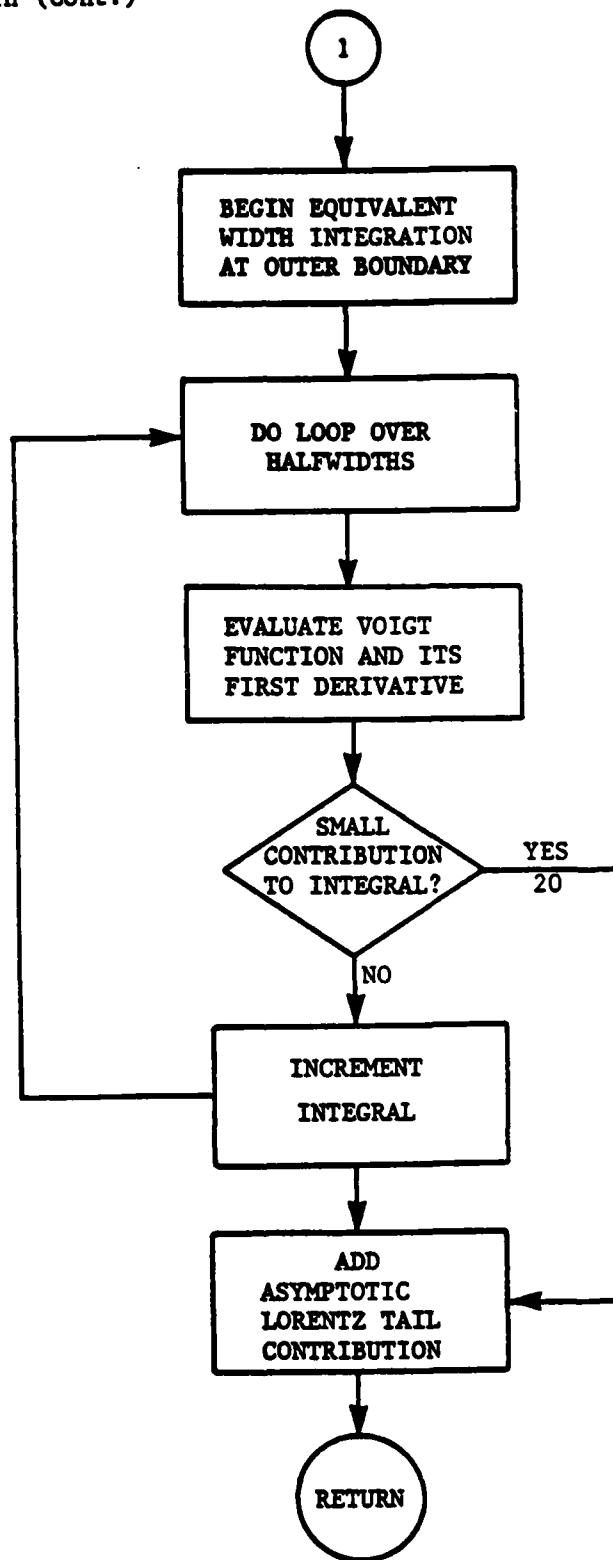
SUBROUTINE CALC



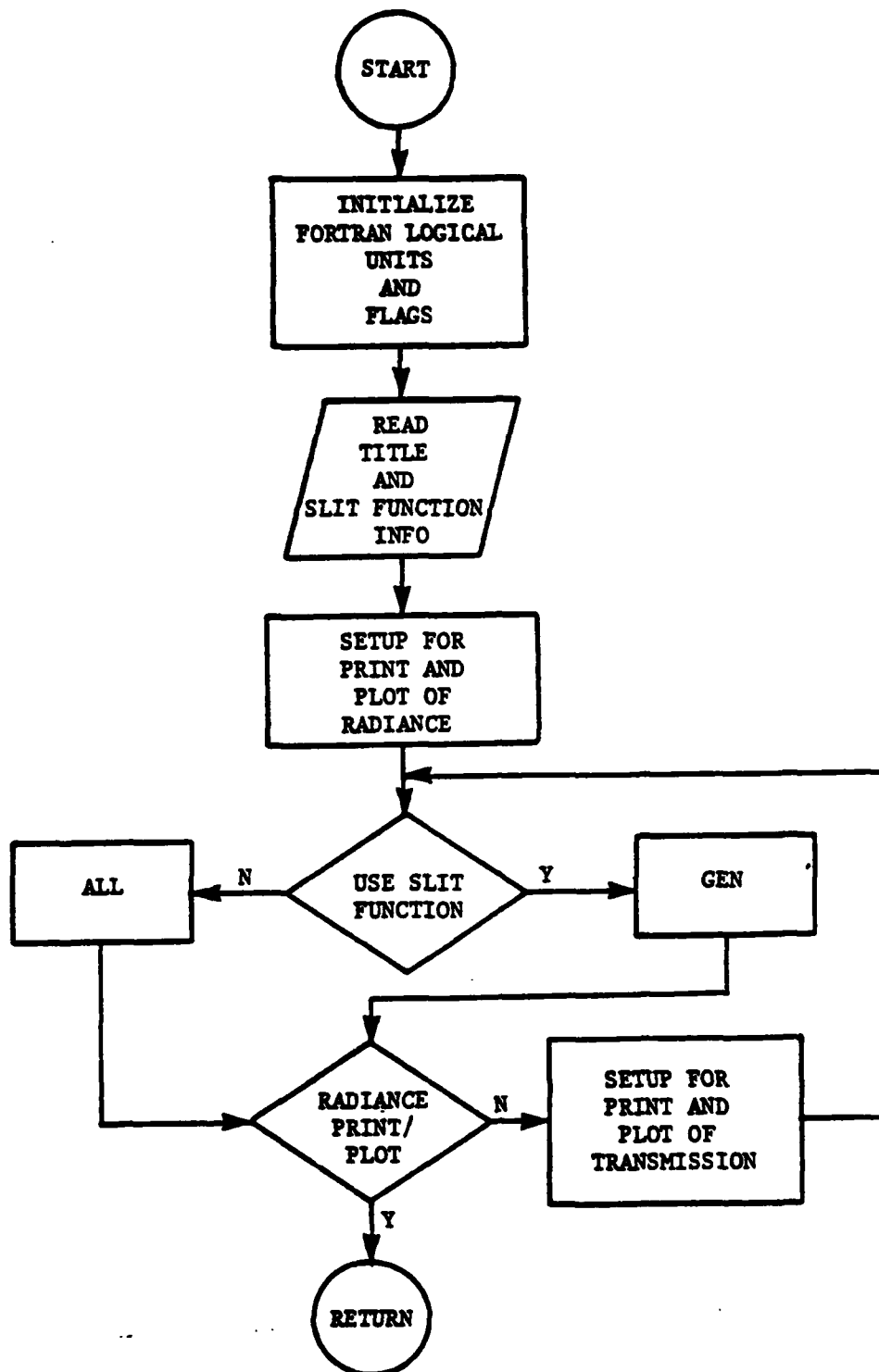
SUBROUTINE EWIDTH



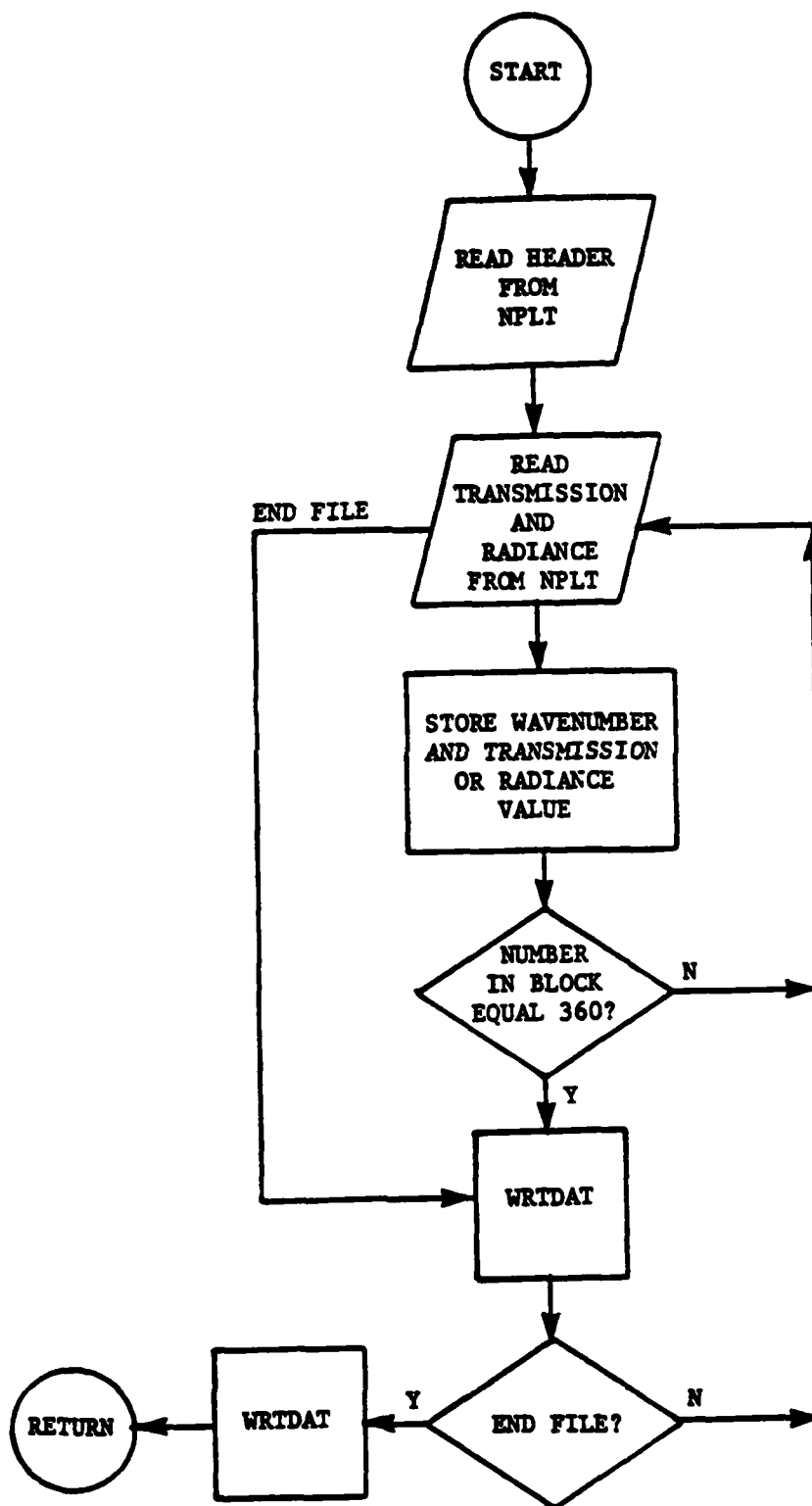
SUBROUTINE EWIDTH (Cont.)



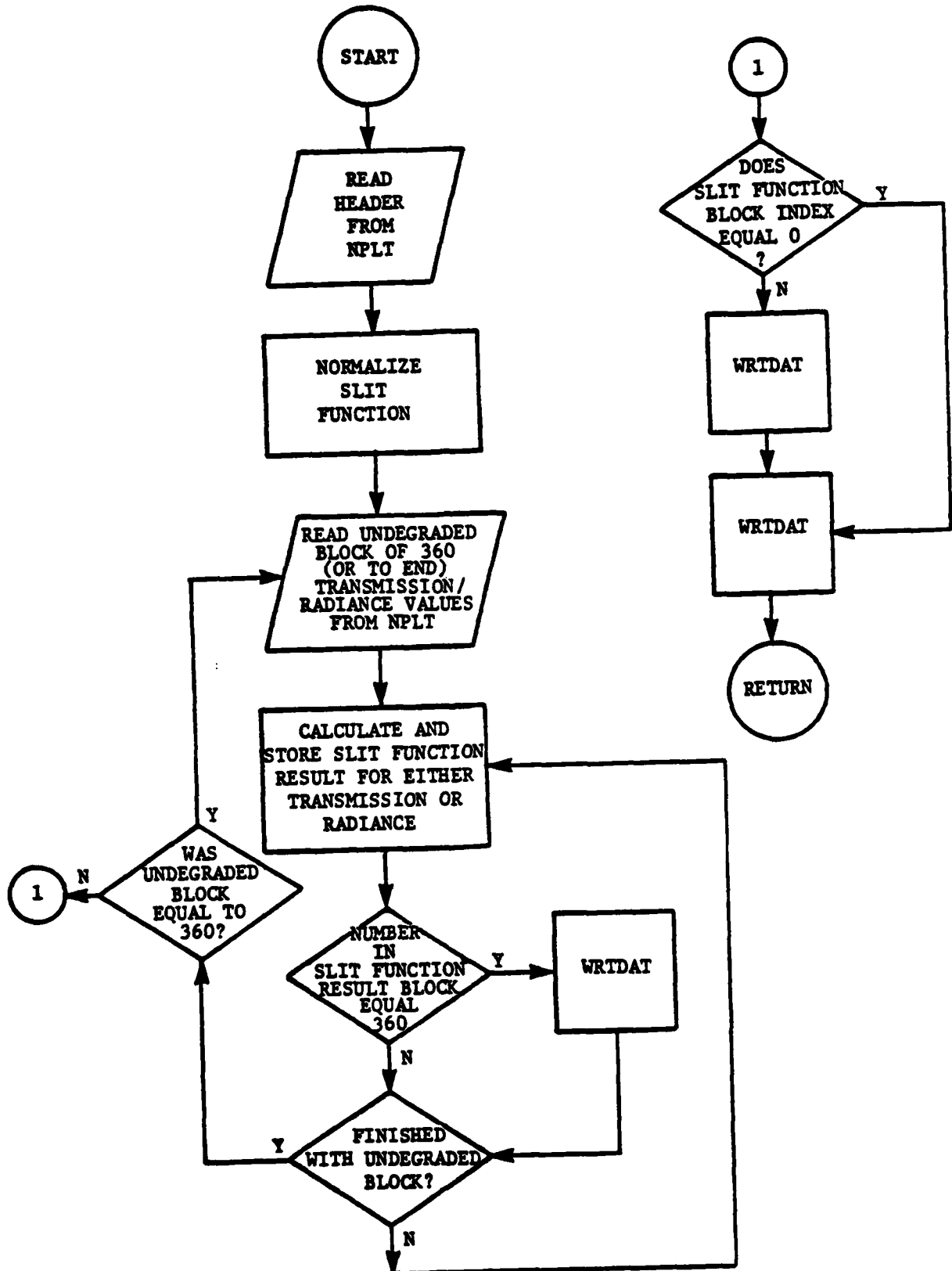
SUBROUTINE LIB



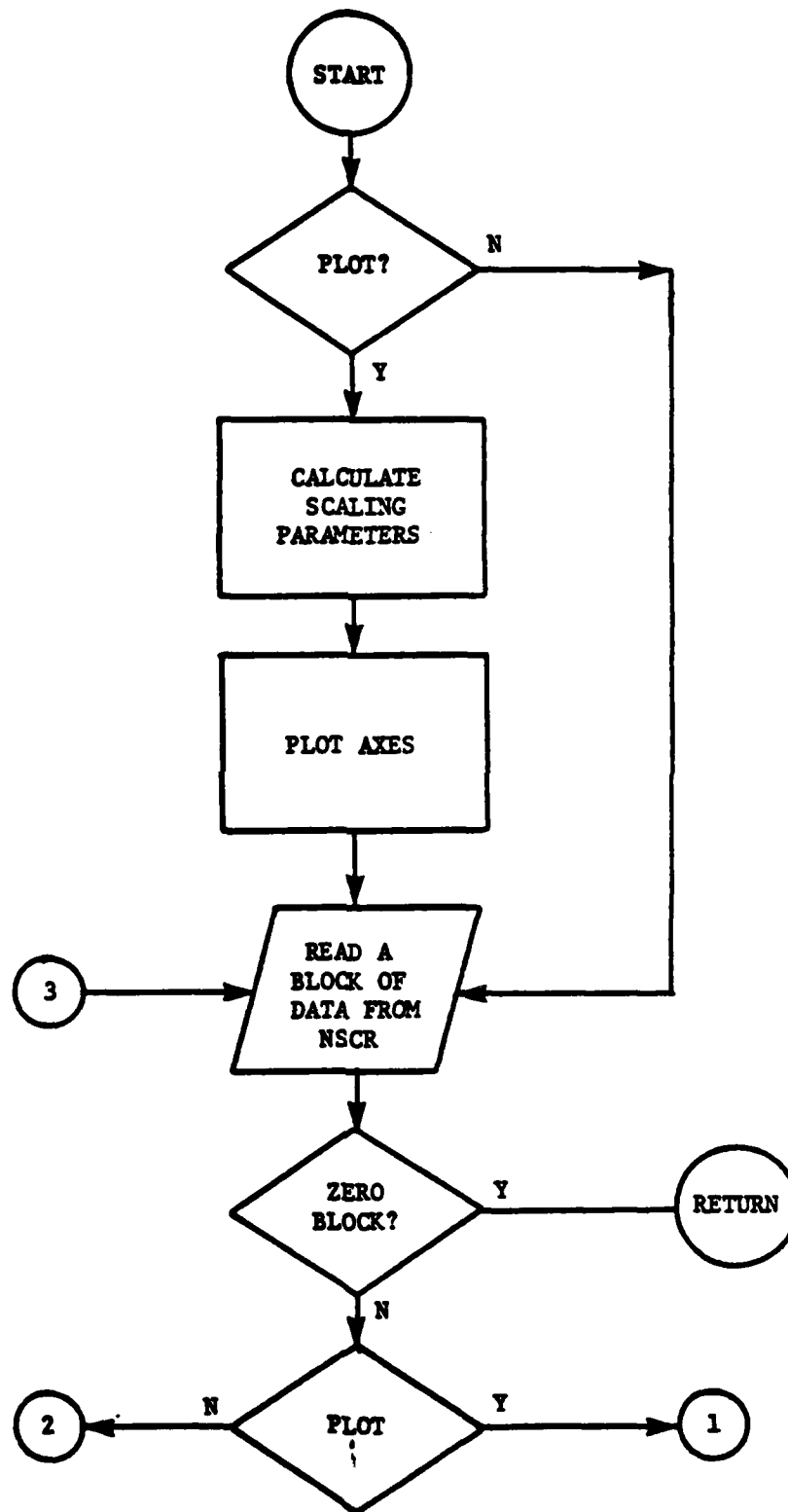
SUBROUTINE ALL

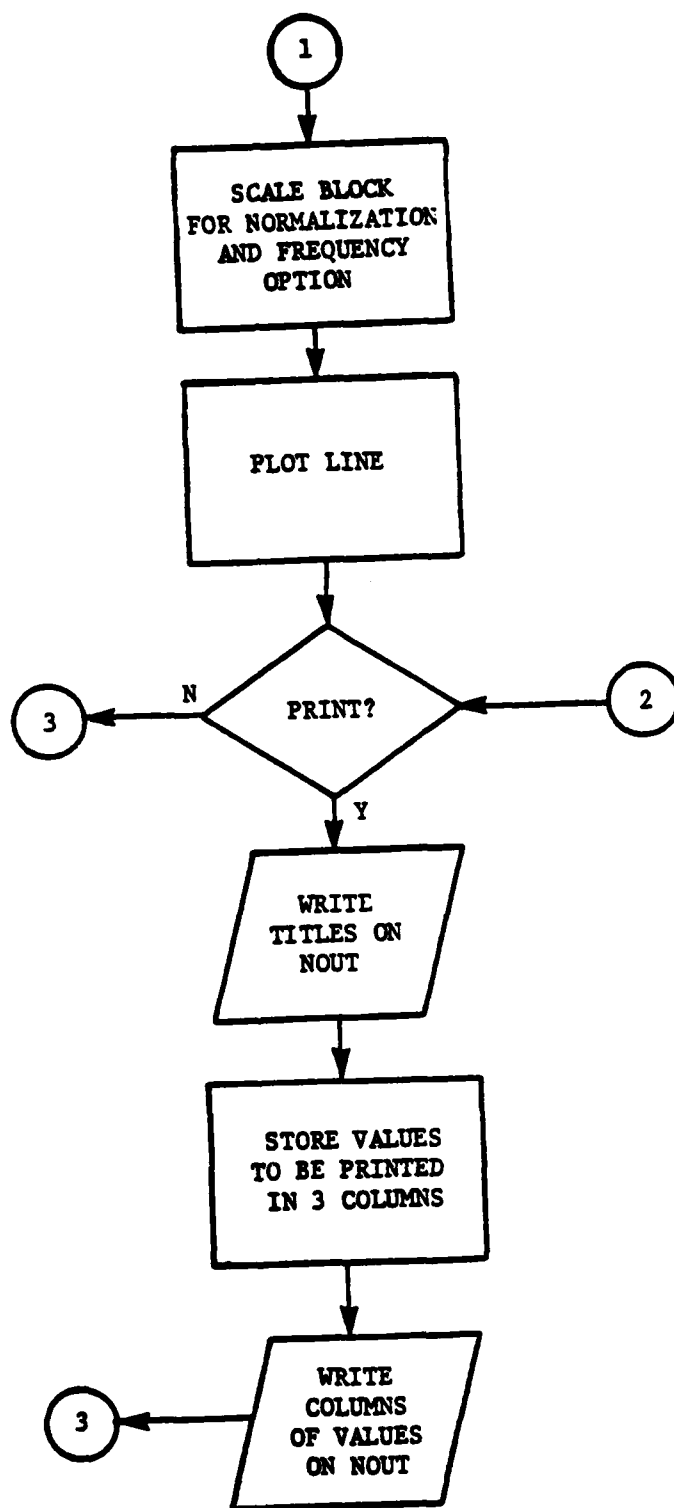


SUBROUTINE GEN

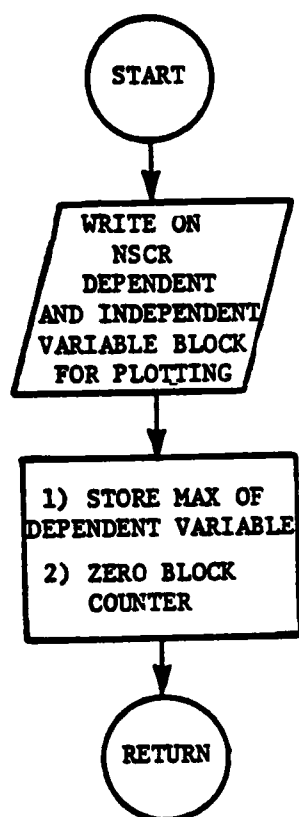


SUBROUTINE PROUT

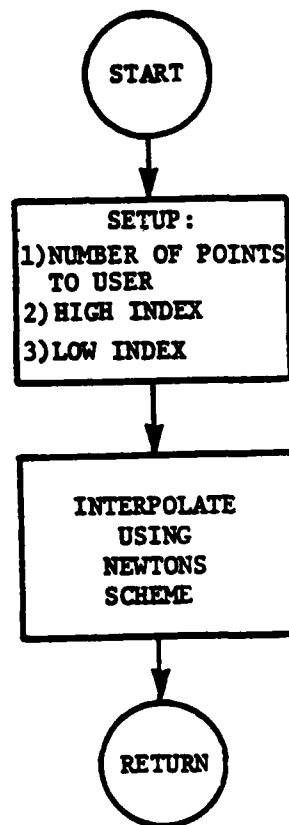




SUBROUTINE WRTDAT



SUBROUTINE TERP



APPENDIX C
LIST OF VARIABLES

- C.1 NEW SUBROUTINES
- C.2 COMMON BLOCKS

C.1 NEW SUBROUTINES

- SUBROUTINE BMDATA -

IDV	Frequency Increment
IK	Loop Counting Variable for Layers
IT	Loop Counting Variable for Temperature
J	Loop Counting Variable
JBLOCK	Number of Data Blocks for the Initial Read
JV	Loop Counting Variable for Reading the Tape
K	Loop Counting Variable for Species
KSPEC	Number of Species on Data Tape
N	Loop Counting Variable for Temperature
NV	Number of Wavenumber Entries on the Tape
TT	Temperature
UNITS	Conversion Factors to Units of cm amagat
VA	Lowest Frequency on Data Tape
VB	Highest Frequency on Data Tape

- SUBROUTINE BMOD -

ABSM	Value of S/d Returned by CALC
ACBAR	Mean Lorentz Halfwidth Times Line Density
ADBAR	Mean Doppler Halfwidth Times Line Density
ANLINE	Number of Equivalent Lines in an Interval
DINV	Line Density Parameter (1/d)
FAC1	Incremental Optical Depth
FAC2	Constant for Doppler Lineshape
FAC3	Constant for Collision Curve of Growth Calculation
JT	Index for Temperature Interpolation of Band Model Parameters
JV	Loop Counting Variable for Reading the Data Tape
K	Species Loop Counting Variable
KSPEC	Number of Species on Data Tape
L	Loop Counting Variable for Layers
LMAX	Upper Limit of Layer Loop
LMIN	Lower Limit of Layer Loop
N	Loop Counting Variable
ODBAR	Mean Value of the Line Density (1/d)
S1	Summing Variable for ACBAR
S2	Summing Variable for ADBAR
S3	Summing Variable for ODBAR
TRANS	Transmittance
TT	Temperature
WSL	Equivalent Width of a Single Line
XS	Optical Depth

- SUBROUTINE EWIDTH -

ACBAR	Path Average Collision Linewidth Times Line Density
ADBAR	Path Average Doppler Linewidth Times Line Density
ALFC	Path Average Collision Linewidth
ALFD	Path Average Doppler Linewidth
ALFMAX	Larger of ALFC or ALFD
ASYMP	Asymptotic Lorentz Tail Contribution to Equivalent Width
C1	$\sqrt{\ln 2}$
C2	$\sqrt{\ln 2 / \pi}$
C3	$(S_u / \gamma_D) C1$
C4	$C1 / ALFD$
CDRAT	Lower Limit of RAT for Switching to Doppler Limit
DELW	Integration Step Size
DELX	Nondimensional Integration Step Size
DV	Spectral Resolution of Calculation
EXP0	Voigt Contribution to Equivalent Width Integral
EXP1	First Derivative Voigt Contribution to Equivalent Width Integral
FAC	Intermediate Calculation Factor
HALFDV	$DV / 2$
ISTEP	Determines Integration Step Size
NALF	Number of Halfwidths to Outer Integration Boundary
NMAX	Number of Integration Points from Outer Boundary to Line Center
ODBAR	Path Average Line Density
RAT	$ALFC / ALFD$
RT2	$\sqrt{2}$
RTPI	$\sqrt{\pi}$
SUM	Current Value of Equivalent Width Integral
TTRANS	Beer's Law Transmittance
U1	Variable used in Calculation of Asymptotic Tail Contribution to Equivalent Width
U2	Same as for U1

SUBROUTINE EWIDTH (Cont.)

WI	Imaginary Part of Complex Error Function
WR	Real Part of Complex Error Function (Voigt Function)
WR1	First Derivative of WR
WSL	Equivalent Width
X	Nondimensional Frequency
XMIN	Outer Boundary for Numerical Integration of Equivalent Width Integral
XS	Used for Weak and Strong Line Limit Checks
XSMAX	Lower Limit for Switching to Strong Line Limit
XSMIN	Upper Limit for Switching to Weak Line Limit
XSTAR	Weak Line Optical Depth
Y	$\sqrt{\ln 2} \gamma_C / \gamma_D$

- SUBROUTINE LIB -

BLANK	4 Spaces (Hollerith)
DY	Change in Y Axis Value Per Plotted Major Tic Mark
I	Do Loop Variable
ITY	<0 For Transmission, >0 For Radiance
IX	Axis Annotation Index
IXT	Vector of Number of Characters Per Annotation of X Axis
IYT	Vector of Number of Characters Per Annotation of Y Axis
JSLOT	Stores Current MSLT
LPLT	Plot Initial Reaction Flag
MPLT	Plot Type
MPLTN	Value Input as Plot Type
MPRT	Print Type
MPRTN	Value Input as Print Type
MSLT	Value Input as Slit Function Type
MSLTO	Last Slit Function Type
NS	Number of Entries Input in Slit Function
NSN	Value Input for NS
PLTR	Flag for Reading Plot Input
PRTR	Flag for Reading Print Input
SHIFT	Slit Function Shift
SHIFTN	Value Input for SHIFT
SS	Weighting Values for Slit Function
WIDTH	Total Width of Slit Function in cm ⁻¹
WIDTHN	Value Input for WIDTH
XEND	Upper Limit for X Axis
XORG	Plot Origin on Plotter Bed (X Coordinate)

SUBROUTINE LIB (Cont.)

XSS	Wavenumber Coordinate for Slit Function
XTIT	Array of X Axis Titles
YEND	Upper Limit for Y Axis
YINI	Input Value for YINIT of Common/YBLOCK/
YORG	Plot Origin in Plotter Bed (Y Coordinate)
YTIT	Array of Y Axis Titles

- SUBROUTINE ALL -

DV	Wavenumber Interval for Data Stored on NPLT
DVM	Double Precision Version of DV
N	Number of Data Points Passed to WRTDAT
V	Vector That Stores Transmission and Radiance Values
XFF	Wavenumber Counter

- SUBROUTINE GEN -

AREA	Area Calculated Under the Slit Function
DV	Wavenumber Interval for Data Stored on NPLT
DVM	Double Precision Version of DV
FAC	Wavenumber Factor for Slit Function Points
FIRST	Logical Variable to Indicate the Number of Passes Through The Routine
I	Do Loop Variable
IER	Argument of TERP
IS	Slit Function Index
IX	Wavenumber Counter
IXX	First Wavenumber Index in Group
J	Do Loop Variable
N	Number of Degraded Data Points Passed to WRTDAT
NDEG	Order of Interpolation Performed on TERP
NF	Number of Undegraded Wavenumber Points in Block
NS	Number of Slit Function Points
S	Scaled Weighting Values for the Slit Function
SHIFT	The Slit Function Shift for the Next Calculation of the Degraded Spectrum
SS	Weighting Values for the Slit Function
SUM	Integrated Slit Function Value
TERPV	Interpolated Value
V	Vector that Stores Transmission and Radiance Values
WIDTH	Width of Slit Function in Wavenumbers
XC	Centered Slit Function
XF	Wavenumber of Block Beginning
XFF	Wavenumber Counter
XMID	Wavenumber Center of Slit
XS	Wavenumber Coordinates of Slit Function
XSS	Unscaled Wavenumber Coordinates of Slit Function
XX	Wavenumber Counter in Block

- SUBROUTINE PROUT -

DUMFAC	Dummy Returned Scale Factor From WHERE
FIRST	Logical Flag Which Indicates the First Time Through the Routine
I	Do Loop Index
II	Data Index for Print Out
DEXP	Normal Ratio Exponent for Plotting
II	Line Number for Print Out
J	Do Loop Index
K	Implied Do Loop Index
N	Number of Points in the Data Block
N1	Number of Points in the Plotting Block of Data
NCOL	Column Number for Print Out
NI	Number of Lines to Print
NN	End Index of Print Page
NN3	Number of Lines on Print Page
OUT	Print Our Array
TEXP	Temporary Exponent Storage for Plot Normalization
TNORM1	Characters Used for Normalization Title
TNORM2	TNORM1 Part 2
VSX	Wavenumber Temporary Storage
XEND	End of X Axis Plot
XNORM	X Coordinate for Normalization Title
XPT	X Coordinate for Plotted Point
YCHECK	YMAX Check for Normalization
YNORM	Y Coordinate for Normalization Title
YPT	Y Coordinate for Plotted Point

- SUBROUTINE WRTDAT -

FLAG	Logical Flag for Wavenumber to Frequency Conversion
I	Do Loop Index
N	Number of Data Points in X and Y
X	Vector of Independent Variables (Wavenumber or Frequency)
Y	Vector of Dependent Variables (Transmission or Radiance)
YI	Temporary Storage of Y(I)

- SUBROUTINE TERP -

CON	Temporary Storage of Interpolation Function
HI	High Index for Interpolation of X Vector
I	Do Loop Index
IA	Temporary Index for Interpolation Calculation
IER	Interpolation, Extrapolation Flag
IL	Lower Limit for Interpolation
IM	Low Index -1
IR	Range Index
IS	Temporary Index for Interpolation Calculation
K	Do Loop Index
LOW	Low Index for Interpolation of X Vector
N	Number of Points Used in the Interpolation
NDEG	Degree of Interpolating Polynomial
NFIT	NDEG + 1
NPTS	Number of Entries in X and Y
VAL	Temporary Interpolation Value
X	Vector of Independent Variables
XC	Value of Independent Variable at Which the Interpolated Value For the Dependent Variable is Desired
Y	Vector of Dependent Variables
YI	Temporary Storage Vector for Intermediate Results

C.2 COMMON BLOCKS

- COMMON /BMDCOM/ SD, OD, ZMWT, ALFØ, WT, JJ, IW, NTEMP, TBAND -

ALFØ	Molecular Linedwidth at STP
IW	Counting Variable for Frequencies Within a Tape Data Block
JJ	Indices for Temperature Interpolation of BM Parameters
NTEMP	Number of Temperatures for Tabulated BM Parameters
OD	Mean Line Density (1/d)
SD	Band Model Absorption Parameter (S/d)
TBAND	Temperatures for Tabulated BM Parameters
WT	Square Root of Temperature
ZMWT	Mean Molecular Weight

- COMMON /BMDCOM/ SD, OD, ZMWT, ALFØ, WT, JJ, IW, NTEMP, TBAND -

ITYPE	Print/Plot Type -1 Transmission, -2 Radiance
ISLOT	Plot Flag - >0 Plot, <0 No Plot
NEWT	Units Flag - >0 cm ⁻¹ , <0 µm
IPRT	Print Flag - >0 Print, <0 No Print

- COMMON /SETUP/ ITYPE, ISLOT, NEWT, IPRT

F A Storage Vector of 360 in Length

- COMMON /BLOCK2/Y,X [OR YY,XX IN PROUT] -

Y A Storage Vector of Dependent Variables for Print/Plot of
 363 in Length

X A Storage Vector of Independent Variables for Print/Plot of
 363 in Length

- COMMON /BLOCK3/ARRAY [OR Y IN PROUT] -

ARRAY A Storage Vector of 363 in Length

- COMMON /VS/ VS1, VS2 -

VS1 Lower Bound for Spectral Information in Current Block

VS2 Upper Bound for Spectral Information in Current Block

- COMMON /MAXY/YMAX -

YMAX Largest Value Written on NSCR Used for Plot Scaling

- COMMON /PLTDEV/NSCR, NPLTR -

NSCR FORTRAN Logical Unit for the Temporary Storage of Degraded Spectra

NPLTR FORTRAN Logical Unit for the CALCOMP-Type Plotter

- COMMON /XBLOCK/XTITLE, XAXIS, XINIT, YSCALE, DXT, NMINX -
 /YBLOCK/YTITLE, YAXIS, YINIT, YSCALE, DYT, NMINY

XTITLE Vectors of 20 in Length Which Store the Axes Titles

YTITLE

XAXIS Axis Length in Inches

YAXIS

XINIT Starting Value for the Respective Axis

YINIT

XSCALE Change in Axis Value Per Inch for the X-Axis and Y-Axis

YSCALE Respectively

DXT Change in Axis Value Per Plotted Major Tic Mark

DYT

NMINX Number of Minor Tic Marks (Between Major Tics) for Each

NMINY Axis

- COMMON /PBLOCK/TITLE, ICHAR, JCHAR, KCHAR -

TITLE A Vector of 20 In Length That Stores the Print/Plot Title

ICHAR Number of Characters in X-Axis Annotation (XTITLE)

JCHAR Number of Characters in Y-Axis Annotation (YTITLE)

KCHAR Number of Characters in TITLE

APPENDIX D

LISTING OF MODIFIED LOWTRANS

Changes required to implement the BMOD option are indicated by an asterisk before the line number. The optional changes are indicated by a colon.

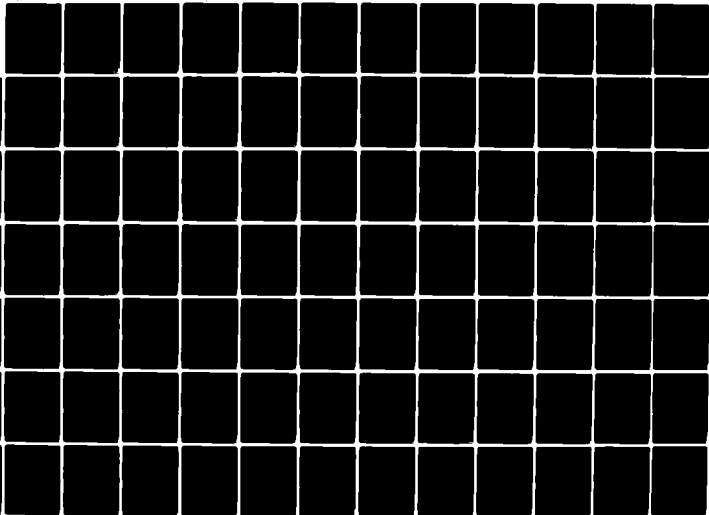
C	PROGRAM LOWEM(INPUT=128,OUTPUT=128,TAPE6=OUTPUT,	TAPE9,	LOW	*10
C	* TAPE11,TAPE12,TAPE5=INPUT)		LOW	*11
C			LOW	*12
C	MODIFIED FOR 5 CM-1 BAND MODEL — OCTOBER 1980		LOW	*13
C	INCLUDES AERODYNE PLOT PACKAGE		LOW	:14
C			LOW	*15
C	*****		LOW	20
C	LOWTRAN 1 NOV 79		LOW	30
C			LOW	40
C	AUTHORS		LOW	50
C	F.X.KNEIZYS		LOW	60
C	E. P. SHETTLE		LOW	70
C	L. W. ABREU		LOW	80
C	J. H. CHETWYND JR.		LOW	90
C	J.E.A. SELBY		LOW	100
C	W. O. GALLERY		LOW	110
C	R. W. FENN		LOW	120
C	R. A. MCCLATCHEY		LOW	130
C			LOW	140
C	PROGRAM LOWTRAN CALCULATES THE TRANSMITTANCE AND/OR RADIANCE		LOW	150
C	OF THE ATMOSPHERE		LOW	160
C	FROM 350 CM-1 TO 40000 CM-1 (0.25 TO 28.57 MICRONS) AT 20 CM-1		LOW	170
C	SPECTRAL RESOLUTION ON A LINEAR WAVENUMBER SCALE.		LOW	180
C	REFRACTION AND EARTH CURVATURE EFFECTS ARE INCLUDED. ATMOSPHERE		LOW	190
C	IS LAYERED IN ONE KM. INTERVALS BETWEEN 0 AND 25 KM., 5 KM. INTER-		LOW	200
C	VALS TO 50 KM., A TWENTY KM. INTERVAL TO 70 KM., AND A THIRTY KM.		LOW	210
C	INTERVAL TO 100 KM.		LOW	220
C	*****		LOW	230
C			LOW	240
C	THE FOLLOWING CARDS SHOULD BE KEYPUNCHED BY THE USER		LOW	250
C	AND MAILED TO: F.X.KNEIZYS,AFGL/OPI,HANSCOM AFB,MASS 01731		LOW	260
C	THE CARDS WILL BE USED TO UPDATE THE AFGL MALING LIST		LOW	270
C	AND FOR NOTIFICATION TO THE USER OF ERRORS IN THE CODE		LOW	280
C			LOW	290
C			LOW	300
C	(USE COLUMNS 21 TO 72)		LOW	310
C	LOWT5 NAME		LOW	320
C	LOWT5 COMPANY		LOW	330
C	LOWT5 ADDRESS		LOW	340
C			LOW	350
C			LOW	360
C	*****		LOW	370
C			LOW	*371
C	THIS VERSION OF LOWTRAN5 HAS BEEN MODIFIED BY AERODYNE RESEARCH,		LOW	*372
C	TO PERFORM THE CALCULATIONS AT A SPECTRAL RESOLUTION OF 5 CM-1.		LOW	*373
C	THIS WORK WAS SUPPORTED BY THE NAVY OPTICAL SIGNATURES PROGRAM,		LOW	*374
C	CHINA LAKE, CALIFORNIA		LOW	*375
C	AUTHORS		LOW	*376
C	L. S. BERNSTEIN		LOW	*377
C	D. C. ROBERTSON		LOW	*378
C	R. HAIMES		LOW	*379
C			LOW	*37A
C	FOR CALCULATIONS AT 5 CM-1, THE USER MUST USE AN EXTERNAL FILE		LOW	*37B

AD-A091 972

AERODYNE RESEARCH INC BEDFORD MA CENTER FOR ELECTRO---ETC F/G 4/1
ADDITION OF A 5/CM SPECTRAL RESOLUTION BAND MODEL OPTION TO LOW---ETC(U)
OCT 80 D C ROBERTSON, L S BERNSTEIN, R HAIMES N60530-80-C-0067
ARI-RR-232 NL

UNCLASSIFIED

100
25



C	(FILE NO. NTBL) WHICH HAS THE BAND MODEL PARAMETERS. THE 5 CM-1	LOW	*37C
C	BAND MODEL PARAMETERS HAVE BEEN GENERATED FROM THE AFGL HITRAN	LOW	*37D
C	LINE ATLAS FOR THESE SEVEN ATMOSPHERIC MOLECULES:	LOW	*37E
C	H2O, CO2, O3, CH4, NO, CO AND O2.	LOW	*37F
C	FOLLOWING THE LOWTRAN FORMAT, H2O & O3 ARE CALCULATED SEPARATELY,	LOW	*37C
C	WHILE THE OTHERS ARE LUMPED INTO THE UNIFORMLY MIXED GASES (CO2+)	LOW	*37H
C		LOW	*37I
C	*****	LOW	*37J
C		LOW	*37K
C	PROGRAM ACTIVATED BY SUBMISSION OF FOUR CARD SEQUENCE AS FOLLOWS	LOW	380
C		LOW	390
C	CARD 1 MODEL, IHAZE, ITYPE, LEN, JP, IM, M1, M2, M3, ML, IEMISS, RO, TBOUND,	LOW	400
C	IISEASN, IVULCN, VIS, JBMOD	LOW	*410
C		LOW	*420
C	CARD 2 H1, H2, ANGLE, RANGE, BETA	LOW	430
C	CARD 3 V1, V2, DV	LOW	440
C	CARD 4 IX	LOW	450
C	***** ADDITIONAL INPUT CARDS FOR THE PRINT/PLOT PACKAGE *****	LOW	:451
C	CARD 5 TITLE	LOW	:452
C	CARD 6 MSLT, MPRT, MPLT, NS, WIDTH, SHIFT	LOW	:453
C	CARD 7A XSS	LOW	:454
C	CARD 7B SS	LOW	:455
C	CARD 8A XAXIS, XINIT, XEND, DXT, NMIX	LOW	:456
C	CARD 8B YAXIS, YINIT, YEND, DYT, NMIX	LOW	:457
C		LOW	460
C	MODEL=1,2,3,4,5 OR 6 SELECTS ONE OF THE FOLLOWING MODEL ATMOSPHERE	LOW	470
C	TROPICAL, MIDLATITUDE SUMMER, MIDLATITUDE WINTER, SUBARCTIC SUMMER,	LOW	480
C	SUBARCTIC WINTER, OR THE 1962 U.S. STANDARD RESPECTIVELY	LOW	490
C	MODEL=10 SKIPS DIRECTLY TO PLOTTING PACKAGE USING OLD NPLT FILE	LOW	:491
C	MODEL=0 FOR HORIZ. PATH WHEN METEOROL. DATA USED\INSTEAD OF CARD 2	LOW	500
C	READ H1, P(MB), T(DEG C), DEW PT. TEMP(DEG C), REL HUMIDITY, H2O DENSITY	LOW	510
C	(GM.M-3), O3 DENSITY(GM.M-3), RANGE(KM) WITH FORMAT 429.	LOW	520
C	MODEL=7 WHEN NEW MODEL ATMOSPHERE(E.G. RADIOSONDE DATA) USED.	LOW	530
C	DATA CARDS ARE READ IN BETWEEN CARDS 1 AND 2, AND SHOULD CONTAIN\	LOW	540
C	ALTITUDE(KM.), PRESSURE, TEMP, DEW PT. TEMP, REL. HUMIDITY, H2O DENSITY,	LOW	550
C	O3 DENSITY, AEROSOL NO. DENSITY, VIS1, IHA1, ISEA1, IVUL1	LOW	560
C	435 SEE NSMDL FOR DETAILS.	LOW	570
C	NOTE THAT EITHER DEW PT. TEMP. OR REL. HUMIDITY CAN BE USED.	LOW	580
C		LOW	590
C	M1, M2, M3, ARE USED TO CHANGE TEMP, H2O, AND O3 ALTITUDE PROFILES.	LOW	600
C	IEMISS=0=TRANSMISSION MODE / IEMISS=1=EMISSION MODE	LOW	610
C	TBOUND=TEMPERATURE OF EARTH IN DEGREES KELVIN	LOW	620
C	IF TBOUND = ZERO, ASSUMES AIR TEMPERATURE OF MODEL ATMOS.	LOW	630
C		LOW	640
C	IF IHAZE=0 NO AEROSOL EXTINCTION IS COMPUTED	LOW	650
CCC	VIS PARAMETER ON CARD 1 OVERRIDES DEFAULT IHAZE VALUE	LOW	660
CCC	NOTE EXPANSION OF IHAZE PARAMETER	LOW	670
C	IHAZE=1 RURAL-23KM	LOW	680
C	IHAZE=2 RURAL-5KM	LOW	690
C	IHAZE=3 MARITIME-23KM	LOW	700
C	IHAZE=4 MARITIME-5KM	LOW	710
C	IHAZE=5 URBAN-5KM	LOW	720
C	IHAZE=6 TROPOSPHERIC-50KM	LOW	730

C	IHAZE=7 USER DEFINED	LOW 740
C	IHAZE=8 FOG1 - DEFAULT VISIBILITY =0.2KM	LOW 750
C	IHAZE=9 FOG2 - DEFAULT VISIBILITY =0.5KM	LOW 760
C	VISIBILITY PROFILES (NEW PARAMETER-ISEASN)	LOW 770
C	ISEASN=0 DEFAULTS TO SEASON OF MODEL	LOW 780
C	ISEASN=1 SPRING-SUMMER	LOW 790
C	ISEASN=2 FALL-WINTER	LOW 800
C	NEW PARAMETER - IVULCN	LOW 810
C	10-30KM AEROSOL TYPE/VIS PROFILE	LOW 820
C	IVULCN=0 DEFAULT TO STRATOSPHERIC BACKGROUND	LOW 830
C	IVULCN=1 STRATOSPHERIC BACKGROUND	LOW 840
C	IVULCN=2 AGED VOLCANIC TYPE/MODERATE VOLCANIC PROFILE	LOW 850
C	IVULCN=3 FRESH VOLCANIC TYPE/HIGH VOLCANIC PROFILE	LOW 860
C	IVULCN=4 AGED VOLCANIC TYPE/HIGH VOLCANIC PROFILE	LOW 870
C	IVULCN=5 FRESH VOLCANIC TYPE/MODERATE VOLCANIC PROFILE	LOW 880
C		LOW 890
C	ITYPE=1,2 OR 3 INDICATES THE TYPE OF ATMOSPHERIC PATH	LOW 900
C	ITYPE=3, VERTICAL OR SLANT PATH TO SPACE	LOW 910
C	ITYPE=2, VERTICAL OR SLANT PATH BETWEEN TWO ALTITUDES	LOW 920
C	ITYPE=1, CORRESPONDS TO A HORIZONTAL (CONSTANT PRESSURE) PATH	LOW 930
C		LOW 940
C	JBMOD = 0 DEFAULTS TO LOWTRANS	LOW *941
C	= 1 SELECTS THE 5 CM-1 BAND MODEL OPTION	LOW *942
C		LOW *943
C	H1=OBSERVER ALTITUDE (KM)	LOW 950
C	H2=SOURCE ALTITUDE (KM)	LOW 960
C	ANGLE= ZENITH ANGLE AT H1 (DEGREES)	LOW 970
C	RANGE=PATH LENGTH (KM)	LOW 980
C	BETA=EARTH CENTRE ANGLE	LOW 990
C	VIS = VISUAL RANGE AT SEA LEVEL (KM)	LOW 1000
C	(IF ITYPE=1 READ H1 AND RANGE; IF ITYPE=3 READ H1 AND ANGLE.	LOW 1010
C	IF ITYPE=2 READ H1 AND TWO OTHER PARAMETERS E.G. H2 AND ANGLE)	LOW 1020
C		LOW 1030
C	V1=INITIAL FREQUENCY (WAVENUMBER CM-1) INTEGER VALUE	LOW 1040
C	V2=FINAL FREQUENCY(WAVENUMBER CM-1) INTEGER VALUE	LOW 1050
C	DV= FREQUENCY INTERVALS AT WHICH TRANSMITTANCE IS PRINTED	LOW 1060
C	NOTE DV MUST BE A MULTIPLE OF 5 CM-1. WHEN JBMOD=1, DV MUST	LOW *1070
C	BE 5CM-1. USE THE SLIT FUNCTION TO DEGRADE THE RESULTS.	LOW *1071
C		LOW 1080
C	IXY=0 TO END DATA , -1 FOR NEW V1,V2,DV ONLY , -2 TO CONTINUE DATA	LOW 1090
C	IXY=3 FOR NEW CARD 2 ONLY, -4 FOR NEW CARD 1 ONLY.	LOW 1100
C	MSLT=0 REPEAT PREVIOUS CASE (SKIP CARDS 6 TO 8), -1 NO SLIT FUNCT	LOW:1101
C	(SKIP CARDS 6A,6B), -2 DEGRADE USING THE SLIT FUNCTION	LOW:1102
C	MPRT=0 DON'T PRINT, -1 PRINT TRANS. ONLY, -2 PRINT RADIANCE ONLY,	LOW:1103
C	-3 PRINT TRANS. AND RADIANCE	LOW:1104
C	MPLT=0 SKIP PLOTS, -1 PLOT TRANS. VS CM-1, -2 PLOT RADIANCE,	LOW:1105
C	-3 PLOT TRANS. AND RADIANCE, -1,-2,-3 SAME BUT PLOT VS MICRON	LOW:1106
C	NS=NUMBER OF DEFINING POINTS (XSS,SS) FOR SLIT FUNCTION	LOW:1107
C	WIDTH=WIDTH OF BASE(CM-1); SHIFT=INCREMENT TO NEXT SLIT FCN.	LOW:1108
C	XAXIS=LENGTH OF AXIS(INCHES); (XINIT,XEND)=(FIRST, LAST) X POINTS	LOW:1109
C	DXT=MAJOR TIC MARK INCREMENT	LOW:110A
C	NMINX=NO. OF MINOR TICS BETWEEN MAJOR ONES	LOW:110B
C	YAXIS,YINIT,YEND,DYT,NMINY=DITTO FOR THE Y AXIS.	LOW:110C

C	*****LOW 1110	
C		LOW:1111
C	***** IMPLEMENTATION NOTE *****	LOW:1112
C	LITERAL ASSIGNMENTS WILL HAVE TO BE CHANGED FOR MACHINES THAT	LOW:1113
C	STORE MORE THAN 4 CHARACTERS PER SINGLE PRECISION WORD (UNIVAC	LOW:1114
C	AND CDC). THE DOUBLE PRECISION VARIABLES AFFECTED ARE:	LOW:1115
C	HZ,SEASN,VULCN,AHOL,AHOL1,AHOL2,AHOL3	LOW:1116
C	ADDITIONALLY, SOME LITERALS FOR THE PLOT PACKAGE ARE DESCRIBED	LOW:1117
C	AT THE TOP OF SUBROUTINE LIB.	LOW:1118
C		LOW:1119
	DOUBLE PRECISION HZ,SEASN,VULCN	LOW:111A
	COMMON /CARD1/ MODEL,IHAZE,ITYPE,LEN,JP,IM,M1,M2,M3,ML,IEMISS,RO	LOW 1120
	1 ,TBOUND,ISEASN,IVULCN,VIS,JBMOD	LOW*1130
	COMMON /CARD2/ H1,H2,ANGLE,RANGE,BETA,HMIN,RE	LOW 1140
	COMMON /CARD3/ V1,V2,DV,AVW,CO,CW,W(15),E(15),CA,PI	LOW 1150
	COMMON /CARD4/ IXI	LOW*1151
	COMMON /CNTRL/ LENST,KMAX,M,IJ,J1,J2,JMIN,JEXTRA,IL,IKMAX,NLL,NP1	LOW 1160
	1,IFIND,NL,IKLO	LOW 1170
	COMMON /MDATA/ Z(34),P(7,34),T(7,34),WH(7,34),WO(7,34)	LOW 1180
	* ,SEASN(2),VULCN(5),VSB(9),HZ(15),HMX(34)	LOW 1190
	COMMON /DEVNUM/ NIN,NOUT,NSTOR,NPLT,NTBL	LOW:1191
	COMMON RELHUM(34),HSTOR(34),EH(15,34),ICH(4),VH(15),TX(15)	LOW 1200
	COMMON WLAY(34,15),WPATH(68,15),TBBY(68),PRES(68)	LOW*1210
	COMMON ABSC(4,40),EXTC(4,40),VX2(40)	LOW 1220
		LOW:1221
C	SPECIFY PLOT CONTROL PARAMETERS	LOW:1222
C	MSLTO = 0	LOW:1223
	LPLT = 0	LOW:1223
C		LOW:1224
	IXY=0	LOW 1230
C	SET UP FILE NUMBERS FOR I/O PROCEDURES	LOW:1231
C	NTBL (USED BY BMDATA & BMOD) IS DECLARED IN BMDATA.	LOW:1232
C	NSCR (PLOTTER SCRATCH FILE) IS DECLARED IN LIB	LOW:1233
C	NPLTR (PLOTTER FILE NO.) IS DECLARED IN LIB	LOW:1234
C	TO USE THE NSTOR OUTPUT FILE, REMOVE THE C FROM THESE LINES:	LOW:1235
C	LOW 1239,2280-2310,2380 AND TRA 2330,2420	LOW:1236
	NIN = 5	LOW:1237
	NOUT = 6	LOW:1238
C	NSTOR = 7	LOW:1239
	NPLT = 9	LOW:123A
C	CALL MDTA	LOW:1240
	KMAX=15	LOW 1250
	PI=2.0*ASIN(1.0)	LOW 1260
	CA=PI/180.	LOW 1270
	10 CONTINUE	LOW 1280
	RE=6371.23	LOW 1290
	IFIND=0	LOW 1300
C	JP NE 0 SUPPRESS PRINT	LOW 1310
	READ (NIN,105) MODEL,IHAZE,ITYPE,LEN,JP,IM,M1,M2,M3,ML,IEMISS,RO,	LOW:1320
	1TBOUND,ISEASN,IVULCN,VIS,JBMOD	LOW*1330
C	IEMISS=0=TRANSMISSION MODE / IEMISS=1=EMISSION MODE	LOW 1340
	IF (IEMISS.EQ.1) WRITE (NOUT,110)	LOW:1350
	IF (IEMISS.EQ.0) WRITE (NOUT,115)	LOW:1360

	IF (JBMOD.EQ.1) WRITE(NOUT,118)	LOW*1361
	LENST=LEN	LOW 1370
	WRITE(NOUT,105) MODEL, IHAZE, ITYPE, LEN, JP, IM, M1, M2, M3, ML, IEMISS, RO	LOW:1380
	1, TBOUND, ISEASN, IVULCN, VIS, JBMOD	LOW*1390
C	SKIP TO PLOT PACKAGE WHEN MODEL=10	LOW:1391
	IF (MODEL.EQ.10) GO TO 77	LOW:1392
15	M=MODEL	LOW 1400
	IF((M.EQ.3.OR.M.EQ.5).AND.ISEASN.EQ.0) ISEASN=2	LOW 1410
	IF (VIS.LE.0.0.AND.IHAZE.GT.0) VIS=VSB(IHAZE)	LOW 1420
	ICH(1)=IHAZE	LOW 1430
	ICH(2)=6	LOW 1440
	ICH(3)=9+IVULCN	LOW 1450
	ICH(4)=15	LOW 1460
	IF (ICH(1).LE.0) ICH(1)=1	LOW 1470
	IF (ICH(3).LE.9) ICH(3)=10	LOW 1480
	IF (MODEL.EQ.1) RE=6378.39	LOW 1490
	IF (MODEL.EQ.4) RE=6356.91	LOW 1500
	IF (MODEL.EQ.5) RE=6356.91	LOW 1510
	IF (IHAZE.NE.7) GO TO 20	LOW 1520
	READ (NIN,200) (DUMMY,EXTC(1,I),ABSC(1,I),I=1,40)	LOW:1530
20	IF (RO.GT.0.0) RE=RO	LOW 1540
	IF (MODEL.EQ.7.AND.IM.NE.0) GO TO 35	LOW 1550
	IF (IXY.GT.3) GO TO 65	LOW 1560
	IF (MODEL.EQ.0) GO TO 35	LOW 1570
25	READ (NIN,120) H1,H2,ANGLE,RANGE,BETA	LOW:1580
	WRITE (NOUT,185) H1,H2,ANGLE,RANGE,BETA	LOW:1590
	X1=RE+H1	LOW 1600
	IF (ITYPE.EQ.3) GO TO 40	LOW 1610
	IF (ITYPE.EQ.1) GO TO 65	LOW 1620
	X2=RE+H2	LOW 1630
	IF (RANGE.EQ.0.) GO TO 50	LOW 1640
	WRITE (NOUT,195) H1,H2,ANGLE,RANGE,BETA	LOW:1650
	IF (H2.EQ.0.0.AND.ANGLE.NE.0.0) GO TO 30	LOW 1660
	ANGLE=ACOS(0.5*((H2-H1)*(1.+X2/X1)/RANGE-RANGE/X1))/CA	LOW 1670
	GO TO 60	LOW 1680
30	X2=SQRT((X1/RANGE+RANGE/X1+2.0*COS(ANGLE*CA))*X1*RANGE)	LOW 1690
	H2=X2-RE	LOW 1700
	GO TO 60	LOW 1710
35	CONTINUE	LOW 1720
	IF (ML.LE.0) ML=1	LOW 1730
	CALL NSMDL	LOW 1740
	IM=0	LOW 1750
	IF (MODEL.EQ.0) GO TO 65	LOW 1760
	NL=ML	LOW 1770
C	NOTE THAT Z(1) MAY NOT CORRESPOND TO THE VALUES GIVEN FOR STANDARD	LOW 1780
C	MODEL ATMOSPHERES	LOW 1790
	IF (IXY.GT.3) GO TO 65	LOW 1800
	GO TO 25	LOW 1810
40	IF (RANGE.GT.0.0) GO TO 45	LOW 1820
	IF (H2.GT.0.0.AND.H2.LT.H1) IFIND=1	LOW 1830
	GO TO 65	LOW 1840
45	ITYPE=2	LOW 1850
	BETA=ACOS(0.5*(RANGE*RANGE/(X1*X2)-X2/X1-X1/X2))/CA	LOW 1860

50	IF (BETA.EQ.0.) GO TO 55	LOW 1870
	IFIND=1	LOW 1880
	BET=CA*BETA	LOW 1890
	X2=RE+H2	LOW 1900
	ANGLE=ATAN(X2*SIN(BET)/(X2*COS(BET)-X1))/CA	LOW 1910
	RANGE=X2*SIN(BET)/SIN(ANGLE*CA)	LOW 1920
	BET=BETA	LOW 1930
	GO TO 65	LOW 1940
55	RANGE=(X2/X1)**2-(SIN(ANGLE*CA))**2	LOW 1950
	IF (RANGE.GE.0.0) RANGE=X1*(SQRT(RANGE)-ABS(COS(ANGLE*CA)))	LOW 1960
60	IF (ANGLE.NE.0..OR.ANGLE.NE.180.) BET=ASIN(RANGE*SIN(ANGLE*CA)/X2)	LOW 1970
	IF(ANGLE.LT.0.) ANGLE=ANGLE+180.	LOW 1980
	IF (RANGE.LT.0.0) RANGE=-RANGE	LOW 1990
	BET=BET/CA	LOW 2000
	WRITE (NOUT,195) H1,H2,ANGLE,RANGE,BET	LOW 2010
65	CONTINUE	LOW 2020
	IF (IXY.LE.2) READ (NIN,120) V1,V2,DV	LOW 2030
	IF (IXY.LE.2) WRITE (NOUT,120) V1,V2,DV	LOW 2040
	IF (ITYPE.EQ.1) WRITE (NOUT,125) H1,RANGE	LOW 2050
	IF (ITYPE.EQ.2) WRITE (NOUT,130) H1,H2,ANGLE	LOW 2060
	IF (ITYPE.EQ.3) WRITE (NOUT,135) H1,ANGLE	LOW 2070
	IF (MODEL.EQ.0) M=7	LOW 2080
	IF (VIS.GT.0.0) WRITE (NOUT,175) VIS	LOW 2090
	IF (M.EQ.1) WRITE (NOUT,140) MODEL	LOW 2100
	IF (M.EQ.2) WRITE (NOUT,145) MODEL	LOW 2110
	IF (M.EQ.3) WRITE (NOUT,150) MODEL	LOW 2120
	IF (M.EQ.4) WRITE (NOUT,155) MODEL	LOW 2130
	IF (M.EQ.5) WRITE (NOUT,165) MODEL	LOW 2140
	IF (M.EQ.6) WRITE (NOUT,160) MODEL	LOW 2150
	IF (IHAZE.EQ.0) WRITE (NOUT,190)	LOW 2160
	IF (IHAZE.NE.0) WRITE (NOUT,170) IHAZE,HZ(IHAZE),VIS	LOW 2170
	IF (ISEASN.EQ.0) WRITE (NOUT,205) SEASN(1)	LOW 2180
	IF (ISEASN.NE.0) WRITE (NOUT,205) SEASN(ISEASN)	LOW 2190
	IF (IVULCN.EQ.0) WRITE (NOUT,210) VULCN(1)	LOW 2200
	IF (IVULCN.NE.0) WRITE (NOUT,210) VULCN(IVULCN)	LOW 2210
	AVW=10000./V1	LOW 2220
	ALAM=10000./V2	LOW 2230
	WRITE (NOUT,180) V1,V2,DV,ALAM,AVW	LOW 2240
	CALL HPROF	LOW 2250
	CALL GEO	LOW 2260
	CALL EXABIN	LOW 2270
70	CONTINUE	LOW*2271
C	CHECK THAT DV = 5 CM-1 WHEN JBMOD = 1	LOW*2272
	IF ((JBMOD.EQ.0) .OR. (DV.EQ.5.0)) GO TO 72	LOW*2272
	WRITE (NOUT,225)DV	LOW*2274
	STOP	LOW*2275
72	CONTINUE	LOW*2276
C	WRITE(NSTOR,105)MODEL,IHAZE,ITYPE,LEN,JP,IM,M1,M2,M3,ML,IEMISS,RO,	LOW:2280
C	1 TBOUND,ISEASN,IVULCN,VIS,JBMOD	LOW*2290
C	WRITE(NSTOR,120) H1,H2,ANGLE,RANGE,BETA	LOW:2300
C	WRITE(NSTOR,120)V1,V2,DV	LOW:2310
	IF ((IEMISS.EQ.0) .AND. (JBMOD.EQ.0)) GO TO 75	LOW*2320
	CALL PATH	LOW 2330

	IF (IEMISS.EQ.0) GO TO 75	LOW*2331
	WRITE (NOUT,215)	LOW:2340
	WRITE (NOUT,220)	LOW:2350
75	CALL TRANS	LOW 2360
77	READ (NIN,105) IXY	LOW:2370
C	CALL PLOT SUBROUTINES	LOW:2371
	CALL LIB(MSLTO,LPLT)	LOW:2372
C	END FILE NSTOR	LOW:2380
	JEXTRA=0	LOW 2390
	IFIND=0	LOW 2400
	WRITE (NOUT,105) IXY	LOW:2410
	IF (IXY.EQ.0) GO TO 95	LOW 2420
	GO TO (80,10,85,10,95), IXY	LOW 2430
80	READ (NIN,120) V1,V2,DV	LOW:2440
	AVW=10000./V1	LOW 2450
	ALAM=10000./V2	LOW 2460
	WRITE (NOUT,180) V1,V2,DV,ALAM,AVW	LOW:2470
	GO TO 70	LOW 2480
85	IF (IEMISS.EQ.1) WRITE (NOUT,110)	LOW:2490
	IF (IEMISS.EQ.0) WRITE (NOUT,115)	LOW:2500
	IF (MODEL.EQ.0) GO TO 35	LOW 2510
	GO TO 25	LOW 2520
95	STOP	LOW 2530
C		LOW 2540
100	FORMAT (3I3,6F11.4)	LOW 2550
105	FORMAT (11I3,2F10.3,2I3,F11.3,I2)	LOW*2560
110	FORMAT (47H1 PROGRAM WILL BE EXECUTED IN THE EMISSION MODE)	LOW 2570
115	FORMAT (51H1 PROGRAM WILL BE EXECUTED IN THE TRANSMISSION MODE)	LOW 2580
118	FORMAT (41H THE 5CM-1 BAND MODEL OPTION WILL BE USED)	LOW*2581
120	FORMAT (7F10.3)	LOW 2590
125	FORMAT (//10X,28H HORIZONTAL PATH, ALTITUDE =,F7.3,11H KM,RANGE =,LOW 2600	
	1F7.3,3H KM)	LOW 2610
130	FORMAT (//10X,50H SLANT PATH BETWEEN ALTITUDES H1 AND H2 WHERE H1	LOW 2620
	1=,F7.3,8H KM H2 =,F7.3,18H KM,ZENITH ANGLE =,F7.3,8H DEGREES)	LOW 2630
135	FORMAT (//10X,39H SLANT PATH TO SPACE FROM ALTITUDE H1 =,F7.3,19H	LOW 2640
	1KM, ZENITH ANGLE =,F7.3,8H DEGREES)	LOW 2650
140	FORMAT (/20X,18H MODEL ATMOSPHERE ,I1,11H = TROPICAL)	LOW 2660
145	FORMAT (/20X,18H MODEL ATMOSPHERE ,I1,21H = MIDLATITUDE SUMMER)	LOW 2670
150	FORMAT (/20X,18H MODEL ATMOSPHERE ,I1,21H = MIDLATITUDE WINTER)	LOW 2680
155	FORMAT (/20X,18H MODEL ATMOSPHERE ,I1,21H = SUB-ARCTIC SUMMER)	LOW 2690
160	FORMAT (/20X,18H MODEL ATMOSPHERE ,I1,21H = 1962 US STANDARD)	LOW 2700
165	FORMAT (/20X,18H MODEL ATMOSPHERE ,I1,21H = SUB-ARCTIC WINTER)	LOW 2710
170	FORMAT (/20X,15H HAZE MODEL ,I1,3H = ,A10,8H VIS=,F5.1,2HKM)LOW 2720	
175	FORMAT (/25X,13HHAZE MODEL =,F5.1,29H KM VISUAL RANGE AT SEA LEVELLOW 2730	
	1L)	LOW 2740
180	FORMAT (/10X,21H FREQUENCY RANGE V1= ,F7.1,13H CM-1 TO V2= ,F7.1,1LOW 2750	
	14H CM-1 FOR DV =,F6.1,9H CM-1 (,F6.2,3H - ,F5.2,10H MICRONS))	LOW 2760
185	FORMAT (10X,7F10.3)	LOW 2770
190	FORMAT (/20X,39HAEROSOL SCATTERING NOT COMPUTED, IHAZE=0)	LOW 2780
195	FORMAT (10X,4H H1=,F7.3,6HKM,H2=,F7.3,9HKM,ANGLE=,F8.4,13HGEOM. RALOW 2790	
	1NGE =,F7.2,8HKM,BETA=,F8.5)	LOW 2800
200	FORMAT (4(F6.2,2F7.5))	LOW 2810
205	FORMAT (/20X,10H SEASON = ,A13)	LOW 2820

210	FORMAT (/20X,34H VERTICAL PROFILE AEROSOL MODEL = ,A16)	LOW 2830
215	FORMAT (1H1,50X,28HRADIANCE(WATTS/CM2-STER-XXX))	LOW 2840
220	FORMAT (30X,47HFR(CM-1) WVL(MICRON) PER CM-1 PER MICRON,26HLOW	2850
1	INTEGRAL TRANS)	LOW 2860
225	FORMAT (20X,10(1H*),2X,38HWHEN USING BAND MODEL OPTION (JBMOD=1)	LOW*2861
1	20H, DV MUST BE 5.0!! ,10(1H*)//20X,6HDV = ,F6.1,	LOW*2862
2	27H---THEREFORE PROGRAM STOPS!)	LOW*2863
	END	LOW 2870

	SUBROUTINE NSMDL	NSM	10
C		NSM	20
C	USED FOR USER DEFINED ATMOSPHERIC MODELS (MODEL=0 OR 7)	NSM	30
C	DEFINES ALTITUDE DEPENDENT VARIABLES Z,P,T,WH,WO AND HAZE	NSM	40
C	LOADS HAZE INTO APPROPRIATE EH LOCATION	NSM	50
C		NSM	60
	DOUBLE PRECISION HZ,SEASN,VULCN,AHOL,AHOL1,AHOL2,AHOL3	NSM	:61
	COMMON /CARD1/ MODEL,IHAZE,ITYPE,LEN,JP,IM,M1,M2,M3,ML,IEMISS,RO	NSM	70
1	,TBOUND,ISEASN,IVULCN,VIS,JBMOD	NSM	*80
	COMMON /CARD2/ H1,H2,ANGLE,RANGE,BETA,HMIN,RE	NSM	90
	COMMON /CARD3/ V1,V2,DV,AVW,CO,CW,W(15),E(15),CA,PI	NSM	100
	COMMON /CNTRL/ LENST,KMAX,M,IJ,J1,J2,JMIN,JEXTRA,IL,IKMAX,NLL,NP1	NSM	110
1	,IFIND,NL,IKLO	NSM	120
	COMMON /MDATA/ Z(34),P(7,34),T(7,34),WH(7,34),WO(7,34)	NSM	130
1	,SEASN(2),VULCN(5),VSB(9),HZ(15),HMX(34)	NSM	140
	COMMON /DEVNUM/ NIN,NOUT,NSTOR,NPLT,NTBL	NSM	:141
	COMMON RELHUM(34),HSTOR(34),EH(15,34),ICH(4),VH(15),TX(15)	NSM	150
	COMMON WLAY(34,15),WPATH(68,15),TBBY(68),PRES(68)	NSM	*160
	COMMON ABSC(4,40),EXTC(4,40),VX2(40)	NSM	170
	F(A)=EXP(18.9766-14.9595*A-2.43882*A*A)*A	NSM	180
	RV=4.6150E-3	NSM	190
	T0=273.15	NSM	200
	IC1=1	NSM	210
	N=7	NSM	220
	IF(IVULCN.LE.0) IVULCN=1	NSM	230
	IF(ISEASN.LE.0) ISEASN=1	NSM	240
C	FOR MODEL EQ ZERO	NSM	250
	IHA1=0	NSM	260
	ISEA1=0	NSM	270
	IVUL1=0	NSM	280
	VIS1=0.	NSM	290
	AHAZE=0.	NSM	300
C	END OF MODEL ZERO DEFAULT	NSM	310
	IF (M.NE.0) WRITE (NOUT,100)	NSM	:320
	DO 65 K=1,ML	NSM	330
	AHOL= 8H	NSM	:340
	AHOL1= 8H	NSM	:350
	AHOL2= 8H	NSM	:360
	AHOL3= 8H	NSM	:370
	IF(M.EQ.0) READ(NIN,85) H1,P(7,1),TMP,DP,RH,WH(7,K),WO(7,K),RANGE	NSM	:380
	IF(M.EQ.0)WRITE(NOUT,90) H1,P(7,1),TMP,DP,RH,WH(7,K),WO(7,K),RANGENS	NSM	:390
	IF (M.GT.0) READ (NIN,80) Z(K),P(7,K),TMP,DP,RH,WH(7,K),WO(7,K),	NSM	:400
1	VIS1,IHA1,ISEA1,IVUL1	NSM	:410
	IF (M.EQ.0) Z(K)=H1	NSM	:420
	WRITE (NOUT,95) Z(K),P(7,K),TMP,DP,RH,WH(7,K),WO(7,K),AHAZE,VIS1,	NSM	:430
1	IHA1,ISEA1,IVUL1	NSM	:440
C	IHA1 IS IHAZE FOR THIS LAYER	NSM	450
C	ISEA1 IS ISEASN FOR THIS LAYER	NSM	460
C	IVUL1 IS IVULCN FOR THE LAYER	NSM	470
	IF(ISEA1.EQ.0) ISEA1=ISEASN	NSM	480
	IF(IHA1.GT.0.OR.IVUL1.GT.0) GO TO 10	NSM	490
	ITYAER=IHAZE	NSM	500
	IF (Z(K).GT.2.0) ITYAER=6	NSM	510

	IF (Z(K).GT.9.0) ITYAER=IVULCN+9	NSM 520
	IF (Z(K).GT.30.) ITYAER=15	NSM 530
	IHA1=HAZE	NSM 540
	IVUL1=IVULCN	NSM 550
	GO TO 15	NSM 560
10	IF(IVUL1.GT.0)ITYAER=IVUL1+9	NSM 570
	IF(IHA1.GT.0) ITYAER=IHA1	NSM 580
	IF(ITYAER.GT.15) ITYAER=15	NSM 590
	IF(IHA1.LE.0) IHA1=HAZE	NSM 600
	IF(IVUL1.LE.0) IVUL1=IVULCN	NSM 610
15	IF (K.EQ.1) GO TO 20	NSM 620
	IF(N.EQ.7.AND.ITYAER.EQ.6.AND.Z(K).GT.2.0) GO TO 17	NSM 630
	IF (ITYAER.EQ.ICH(IC1)) GO TO 20	NSM 640
17	IC1=IC1+1	NSM 650
	N=IC1+10	NSM 660
	IF (IC1.LE.4) GO TO 20	NSM 670
	IC1=4	NSM 680
	N=14	NSM 690
	ITYAER=ICH(IC1)	NSM 700
20	ICH(IC1)=ITYAER	NSM 710
	J=IFIX(Z(K)+1.0E-6)+1	NSM 720
	IF (Z(K).GE.25.0) J=(Z(K)-25.0)/5.0+26.	NSM 730
	IF (Z(K).GE.50.0) J=(Z(K)-50.0)/20.0+31.	NSM 740
	IF (Z(K).GE.70.0) J=(Z(K)-70.0)/30.0+32.	NSM 750
	IF (J.GT.33) J=33	NSM 760
	FAC=Z(K)-FLOAT(J-1)	NSM 770
	IF (J.LT.26) GO TO 25	NSM 780
	FAC=(Z(K)-5.0*FLOAT(J-26)-25.)/5.	NSM 790
	IF (J.GE.31) FAC=(Z(K)-50.0)/20.	NSM 800
	IF (J.GE.32) FAC=(Z(K)-70.0)/30.	NSM 810
	IF (FAC.GT.1.0) FAC=1.0	NSM 820
25	L=J+1	NSM 830
	T(7,K)=TMP+T0	NSM 840
	IF (M1.GT.0) P(7,K)=P(M1,J)*(P(M1,L)/P(M1,J))**FAC	NSM 850
	IF (M1.GT.0) T(7,K)=T(M1,J)*(T(M1,L)/T(M1,J))**FAC	NSM 860
	IF (M2.GT.0) WH(7,K)=WH(M2,J)*(WH(M2,L)/WH(M2,J))**FAC	NSM 870
	IF (WH(7,K).GT.0.0) GO TO 35	NSM 880
	IF (RH.GT.0.0) GO TO 30	NSM 890
	DPK=T0+DP	NSM 900
	TT=T0/DPK	NSM 910
	WH(7,K)=DPK*F(TT)/T(7,K)	NSM 920
	GO TO 35	NSM 930
30	TA=T0/T(7,K)	NSM 940
	RHSAT=F(TA)	NSM 950
	RHD=.01*RH	NSM 960
	DN=(1.0-(1.0-RHD)*RHSAT*RV*T(7,K)/P(7,K))	NSM 970
	WH(7,K)=RHSAT*RHD/DN	NSM 980
35	CONTINUE	NSM 990
	IF (M3.GT.0) WO(7,K)=WO(M3,J)*(WO(M3,L)/WO(M3,J))**FAC	NSM 1000
	HSTOR(K)=0.	NSM 1010
	IF (HMX(J).LE.0.) GO TO 40	NSM 1020
	IF (HMX(L).LE.0.) GO TO 40	NSM 1030
	HSTOR(K)=HMX(J)*(HMX(L)/HMX(J))**FAC	NSM 1040

40	CONTINUE	NSM 1050
	EH(7,F)=0.	NSM 1060
	EH(12,K)=0.	NSM 1070
	EH(13,K)=0.	NSM 1080
	EH(14,K)=0.	NSM 1090
	EH(15,F)=0.	NSM 1100
	IF(IHAZE.EQ.0) GO TO 60	NSM 1110
	IF (VIS1.LE.0.0) VIS1=VIS	NSM 1120
	IF (AHAZE.EQ.0.0) GO TO 45	NSM 1130
	EH(N,K)=AHAZE	NSM 1140
C	AHAZE IS IN LOWTRAN NUMBER DENSITY UNITS	NSM 1150
	GO TO 55	NSM 1160
45	CALL AERPRF (J,VIS1,HAZ1,IHA1,ISEA1,IVUL1,NN)	NSM 1170
	CALL AERPRF (L,VIS1,HAZ2,IHA1,ISEA1,IVUL1,NN)	NSM 1180
	HAZE=0.	NSM 1190
	IF ((HAZ1.LE.0.0).OR.(HAZ2.LE.0.0)) GO TO 50	NSM 1200
	HAZE=HAZ1*(HAZ2/HAZ1)**FAC	NSM 1210
50	EH(N,K)=HAZE	NSM 1220
55	AHOL=HZ(ITYAER)	NSM 1230
	IF (AHAZE.NE.0.) GO TO 60	NSM 1240
	IF (Z(K).LE.2.0) AHOL1=HZ(IHA1)	NSM 1250
	IF ((Z(K).GT.2.0).AND.(Z(K).LE.30.)) AHOL2=SEASN(ISEA1)	NSM 1260
	IF (Z(K).GT.9.0) AHOL3=VULCN(IVUL1)	NSM 1270
60	WRITE (NOUT,95) Z(K),P(7,K),T(7,K),DP,RH,WH(7,K),WO(7,K),EH(N,K),	NSM 1280
1	VIS1,IHA1,ISEA1,IVUL1,ITYAER,AHOL1,AHOL2,AHOL3,AHOL	NSM 1290
65	CONTINUE	NSM 1300
	IF (IC1.LT.4) GO TO 75	NSM 1310
	IC2=IC1+1	NSM 1320
	DO 70 K=IC2,4	NSM 1330
70	ICH(K)=ICH(K-1)	NSM 1340
75	CONTINUE	NSM 1350
	RETURN	NSM 1360
C		NSM 1370
80	FORMAT (3F10.3,2F5.1,2E10.3,E10.3,F7.3,3I1)	NSM 1380
85	FORMAT (3F10.3,2F5.1,2E10.3,2F10.3)	NSM 1390
90	FORMAT (10X,26HINPUT METEOROLOGICAL DATA\10X,2HZ=,F7.2,7I1 KM, P=,NSM 1400	
	1F7.2,6H MB,T=,F5.1,15H C, DEW PT.TEMP,F5.1,17H C, REL HUMIDITY=,F5NSM 1410	
	2.1,16H Z, H2O DENSITY=,1PE9.2,7H GM M-3/10X,15H OZONE DENSITY=,F9.NSM 1420	
	32,16H GM M-3, PANGE=,OPF10.3,4H KM)	NSM 1430
95	FORMAT (3F10.3,2F5.1,3E10.3,F10.3,4I3,4(1X,A10))	NSM 1440
100	FORMAT (24H MODEL ATMOSPHERE NO. 7,/4X,6HZ (KM),3X,6HP (MB),4X,49NSM 1450	
	1HT (C) DEW PT ZRH H2O(GM.M-3) O3(GM.M-3) NO. DEN.,30X,15HAEPOSOL NSM 1460	
	2PROFILE,6X,10HEXTINCTION)	NSM 1470
	END	NSM 1480

	SUBROUTINE HPROF	HPR	10
C	MODIFIED FOR 5 CM-1 BAND MODEL OPTION --- OCTOBER 1980	HPR	*11
C	REVISED 12 DEC 1979	HPR	20
C	DEFINES THE ATMOSPHERIC DENSITY PROFILE OF THE MOLECULAR AND	HPR	30
C	AEROSOL AMOUNTS FOR THE MODEL SELECTED	HPR	40
C		HPR	50
	DOUBLE PRECISION HZ,SEASN,VULCN	HPR	:51
	COMMON /CARD1/ MODEL, IHAZE, ITYPE, LEN, JP, IM, M1, M2, M3, ML, IEMISS, RO	HPR	60
	1, TBOUND, ISEASN, IVULCN, VIS, JBMOD	HPR	*70
	COMMON /CARD2/ H1, H2, ANGLE, RANGE, BETA, HMIN, RE	HPR	80
	COMMON /CARD3/ V1, V2, DV, AVW, CO, CW, W(15), E(15), CA, PI	HPR	90
	COMMON /CNTRL/ LENST, KMAX, M, IJ, J1, J2, JMIN, JEXTRA, IL, IKMAX, NLL, NP1	HPR	100
	1, IFIND, NL, IKLO	HPR	110
	COMMON /MDATA/ Z(34), P(7,34), T(7,34), WH(7,34), WO(7,34)	HPR	120
	1, SEASN(2), VULCN(5), VSB(9), HZ(15), HMIX(34)	HPR	130
	COMMON /DEVNUM/ NIN, NOUT, NSTOR, NPLT, NTBL	HPR	:131
	COMMON RELHUM(34), HISTOR(34), EH(15,34), ICH(4), VH(15), TX(15)	HPR	140
	COMMON WLAY(34,15), WPATH(68,15), TBBY(68), PRES(68)	HPR	*150
	COMMON ABSC(4,40), EXTC(4,40), VX2(40)	HPR	160
	F(A)=EXP(18.9766-14.9595*A-2.43882*A*A)*A	HPR	170
	DO 5 I=1,34	HPR	180
	DO 5 J=1, KMAX	HPR	190
	5 WLAY(I,J)=0.	HPR	200
C	RV = H2O GAS CONSTANT	HPR	210
	AVW=0.5E-4*(V1+V2)	HPR	220
	AVW=AVW*AVW	HPR	230
	CO=77.46+.459*AVW	HPR	240
	CW=43.487-0.3473*AVW	HPR	250
C	CHANGE FOR BLACKBODY SOURCE AT ANY H2 (SEE TRANS--LINE TRA:2181)	HPR	:251
C	IF(TBOUND.LE.0.AND.(M1.LE.0.OR.M.EQ.7))TBOUND=T(M,1)	HPR	:260
C	IF(TBOUND.LE.0.AND.M1.GT.0.AND.M.LT.7) TBOUND=T(M1,1)	HPR	:270
	IF (JP.EQ.0) WRITE (NOUT,45)	HPR	:280
	IF (JP.EQ.0) WRITE (NOUT,50)	HPR	:290
	IF (M.LT.7) ML=NL	HPR	300
	RV=4.6150E-3	HPR	310
	DO 25 I=1,ML	HPR	320
	PS=P(M,I)/1013.0	HPR	330
	TS=273.15/T(M,I)	HPR	340
	WTEMP=WH(M,I)	HPR	350
	IF(M1.GT.0.AND.M.LT.7)PS=P(M1,I)/1013.	HPR	360
	IF(M1.GT.0.AND.M.LT.7) TS=273.15/T(M1,I)	HPR	370
	IF(M2.GT.0.AND.M.LT.7) WTEMP=WH(M2,I)	HPR	380
	RELHUM(I)=0.	HPR	390
	IF (Z(I).GT.2.0) GO TO 10	HPR	400
	RHOSTR=(PS*1013.0)*(TS/273.15)/RV	HPR	410
	RELHUM(I)=100.0*(WTEMP/F(TS))*((RHOSTR-F(TS))/(RHOSTR-WTEMP))	HPR	420
10	D=0.1*WTEMP	HPR	430
	X=PS*TS	HPR	440
	PT=PS*SQR(TS)	HPR	450
	EH(1,I)=D*PT**0.9	HPR	460
	EH(2,I)=X*PT**0.75	HPR	470
	EH(4,I)=0.8*PT*X	HPR	480
	PPW=4.56E-5*D*273.15/TS	HPR	490
	TS1=(296.0/273.15)*TS	HPR	500

	EH(5,I)=D*PPW*EXP(6.08*(TS1-1.0))+0.002*D*(PS-PPW)	HPR 510
	EH(10,I)=D*(PPW+0.12*(PS-PPW))*EXP(4.56*(TS1-1.0))	HPR 520
	EH(6,I)=X	HPR 530
C	SUBROUTINE AERPRF COMPUTES EH(7,I)	HPR 540
C	EH(7,I)=AERSOL FOR 0-2KM	HPR 550
C	EH(12,I)=AERSOL FOR 2-9KM	HPR 560
C	EH(13,I)=AERSOL FOR 9-30KM	HPR 570
C	EH(14,I)=AERSOL FOR 30-100KM	HPR 580
	IF (M.NE.7) CALL AERPRF (I,VIS,HAZE,IRAZE,ISEASN,IVULCN,N)	HPR 590
	IF (M.EQ.7) GO TO 15	HPR 600
	EH(7,I)=0.	HPR 610
	EH(12,I)=0.	HPR 620
	EH(13,I)=0.	HPR 630
	EH(14,I)=0.	HPR 640
	EH(15,I)=0.	HPR 650
	EH(N,I)=HAZE	HPR 660
15	CONTINUE	HPR 670
	EH(15,I)=RELHUM(I)*EH(7,I)	HPR 680
	IF(ICH(1).GT.7)EH(15,I)=RELHUM(1)*EH(12,I)	HPR 690
	EH(8,I)=46.6667*WO(M,I)	HPR 700
	IF (M3.GT.0.AND.M.LT.7) EH(8,I)=46.667*WO(M3,I)	HPR 710
	EH(3,I)=EH(8,I)*PT**0.4	HPR 720
C	EH(11,I)=HNO3 ABSORBER AMOUNT (ATM-CM)/KM	HPR 730
	EH(11,I)=PS*TS*HMIX(I)*1.0E-04	HPR 740
C		HPR *741
C	SWITCH FOR 5CM-1 BAND MODEL OPTION	HPR *742
	IF (JBMOD.EQ.0) GO TO 18	HPR *743
	EH(1,I) = D	HPR *744
	EH(2,I) = X	HPR *745
	EH(3,I) = EH(8,I)	HPR *746
18	CONTINUE	HPR *747
C		HPR *748
	IF (M.EQ.7) EH(11,I)=PS*TS*HSTOR(I)*1.0E-04	HPR 750
	EH(9,I)=1.0	HPR 760
	REF=1.0E-6*(CO*X*1013.0/273.15-PPW*CW)	HPR 770
	IF (I.EQ.ML) GO TO 20	HPR 780
	P2=P(M,I+1)	HPR 790
	T2=T(M,I+1)	HPR 800
	W2=WH(M,I+1)	HPR 810
	IF(M1.GT.0.AND.M.LT.7) P2=P(M1,I+1)	HPR 820
	IF (M1.GT.0.AND.M.LT.7) T2=T(M1,I+1)	HPR 830
	IF (M2.GT.0.AND.M.LT.7) W2=WH(M2,I+1)	HPR 840
	PPW=4.56E-6*W2*T2	HPR 850
	EH(9,I)=0.5*(REF+1.0E-6*(CO*P2/T2-PPW*CW))	HPR 860
20	IF (I.EQ.ML) EH(9,I)=0.	HPR 870
	IF (JP.NE.0) GO TO 25	HPR 880
	P1=P(M,I)	HPR 890
	T1=T(M,I)	HPR 900
	IF(M1.GT.0.AND.M.LT.7) P1=P(M1,I)	HPR 910
	IF(M1.GT.0.AND.M.LT.7) T1=T(M1,I)	HPR 920
	WRITE (NOUT,40) I,Z(I),P1,T1,(EH(K,I),K=1,6),EH(9,I),EH(8,I)	HPR :930
25	CONTINUE	HPR 940

IF(JP.EQ.0) WRITE (NOUT,55)	HPR :950
DO 35 I=1,ML	HPR 960
IF (JP.NE.0) GO TO 30	HPR 970
P1=P(M,I)	HPR 980
T1=T(M,I)	HPR 990
IF(M1.GT.0.AND.M.LT.7) P1=P(M1,I)	HPR 1000
IF(M1.GT.0.AND.M.LT.7) T1=T(M1,I)	HPR 1010
WRITE (NOUT,40) I,Z(I),P1,T1,(EH(K,I),K=10,11),EH(7,I),(EH(K,I),	HPR:1020
1 K=12,15),RELHUM(I)	HPR:1030
30 EH(9,I)=EH(9,I)+1.	HPR 1040
35 CONTINUE	HPR 1050
RETURN	HPR 1060
C	HPR 1070
40 FORMAT (I4,OPF9.2,F9.3,F9.3,1X,1P8E10.3)	HPR 1080
45 FORMAT (1H1,///10X,20H HORIZONTAL PROFILES/)	HPR 1090
50 FORMAT (4H ID,5X,3HALT,6X,1HP,8X,1HT,8X,3HH2O,6X,4HCO2+,8X,2HO3,8HPR	HPR 1100
1X,2HN2,5X,8HH2O(10M),4X,4HMOLS,5X,5H(N-1),4X,6HO3(UV))	HPR 1110
55 FORMAT (1H1,///10X,20H HORIZONTAL PROFILES/,4H ID,5X,3HALT,6X,1HPHPR	HPR 1120
1,8X,1HT,6X,7HH2O(4M),5X,4HHNO3,6X,4HAER1,6X,4HAER2,6X,4HAER3,6X,4HHPR	HPR 1130
2AER4,3X,9H(AER1*RH),5X,2HRH)	HPR 1140
END	HPR 1150

	SUBROUTINE AERPRF (I,VIS,HAZE,IHAZE,ISEASN,IVULCN,N)	AER	10
C	WILL COMPUTE HORIZONTAL PROFILES FOR AEROSOLS	AEP	20
	COMMON/PRFDTA/ZHT(34),HZ2K(34,5),FAWI50(34),FAWI23(34),SPSU50(34),AEP	30	
	1SPSU23(34),BASTFW(34),VUMOFW(34),HIVUFW(34),EXVUFW(34),BASTSS(34),AEP	40	
	2VUMOSS(34),HIVUSS(34),EXVUSS(34),UPNATH(34),VUTONO(34),	AER	50
	3VUTOEX(34),EXUPAT(34)	AER	60
	DIMENSION VS(5)	AER	70
	DATA VS/50.,23.,10.,5.,2./	AER	:80
	HAZE=0.	AER	90
C	CALL PRFDTA	AER	:100
	N=7	AER	110
	IF (IHAZE.EQ.0) RETURN	AER	120
	IF (ZHT(I).GT.2.0) GO TO 15	AER	130
	DO 5 J=2,5	AEP	140
	IF (VIS.GE.VS(J)) GO TO 10	AER	150
	5 CONTINUE	AEP	160
	J=5	AEP	170
10	CONST=1./(1./VS(J)-1./VS(J-1))	AER	180
	HAZE=CONST*((HZ2K(I,J)-HZ2K(I,J-1))/VIS+HZ2K(I,J-1)/VS(J)-HZ2K(I,J-1)/VS(J-1))	JAEP	190
	RETURN	AEP	210
15	IF (ZHT(I).GT.9.0) GO TO 35	AER	220
	N=12	AEP	230
	CONST=1./(1./23.-1./50.)	AEP	240
	IF (ISEASN.GT.1) GO TO 25	AER	250
	IF (VIS.LE.23.) HAZE=SPSU23(I)	AEP	260
	IF (VIS.LE.23.) RETURN	AEP	270
	IF (ZHT(I).GT.4.0) GO TO 20	AER	280
	HAZE=CONST*((SPSU23(I)-SPSU50(I))/VIS+SPSU50(I)/23.-SPSU23(I)/50.)	AER	290
	RETURN	AEP	300
20	HAZE=SPSU50(I)	AER	310
	RETURN	AER	320
25	IF (VIS.LE.23.) HAZE=FAWI23(I)	AER	330
	IF (VIS.LE.23.) RETURN	AER	340
	IF (ZHT(I).GT.4.0) GO TO 30	AEP	350
	HAZE=CONST*((FAWI23(I)-FAWI50(I))/VIS+FAWI50(I)/23.-FAWI23(I)/50.)	AEP	360
	RETURN	AER	370
30	HAZE=FAWI50(I)	AEP	380
	RETURN	AEP	390
35	IF (ZHT(I).GT.30.0) GO TO 75	AER	400
	N=13	AER	410
	HAZE=BASTSS(I)	AER	420
	IF (ISEASN.GT.1) GO TO 55	AER	430
	IF (IVULCN.EQ.0) HAZE=BASTSS(I)	AER	440
	IF (IVULCN.EQ.0) RETURN	AER	450
	GO TO (40,45,50,50,45), IVULCN	AEP	460
40	HAZE=BASTSS(I)	AER	470
	RETURN	AER	480
45	HAZE=VUMOSS(I)	AER	490
	RETURN	AER	500
50	HAZE=HIVUSS(I)	AEP	510
	RETURN	AER	520
55	IF (IVULCN.EQ.0) HAZE=BASTFW(I)	AER	530
	IF (IVULCN.EQ.0) RETURN	AEP	540

GO TO (60,65,70,70,65), IVULCN	AER 550
60 HAZE=BASTFW(I)	AER 560
RETURN	AER 570
65 HAZE=VUMOFW(I)	AER 580
RETURN	AER 590
70 HAZE=HIVUFW(I)	AER 600
RETURN	AER 610
75 N=14	AER 620
IF (IVULCN.GT.1) GO TO 80	AER 630
HAZE=UPNATM(I)	AER 640
RETURN	AER 650
80 HAZE=VUTONO(I)	AER 660
RETURN	AER 670
END	AER 680

	SUBROUTINE GEO	GEO 10
C		GEO 20
C	SPHERICAL GEOMETRY WITH REFRACTION	GEO 30
C	DEFINES ABSORBER AMOUNTS FOR THE ATMOSPHERIC SLANT PATH	GEO 40
C	USED TO SET UP VERTICAL PROFILE ARRAY VH AND DEFINES MATRIX	GEO 50
C	WLAY, FOR USE IN SUBROUTINE PATH	GEO 60
C		GEO 70
	DOUBLE PRECISION HZ,SEASN,VULCN	GEO :71
	COMMON /CARD1/ MODEL, IHAZE, ITYPE, LEN, JP, IM, M1, M2, M3, ML, IEMISS, RO	GEO 80
	1 , TBOUND, ISEASN, IVULCN, VIS, JBMOD	GEO *90
	COMMON /CARD2/ H1, H2, ANGLE, RANGE, BETA, HMIN, RE	GEO 100
	COMMON /CARD3/ V1, V2, DV, AVW, CO, CW, W(15), E(15), CA, PI	GEO 110
	COMMON /CNTRL/ LENST, KMAX, M, IJ, J1, J2, JMIN, JEXTRA, IL, IKMAX, NLL, NP1	GEO 120
	1, IFIND, NL, IKLO	GEO 130
	COMMON /MDATA/ Z(34), P(7, 34), T(7, 34), WH(7, 34), WO(7, 34)	GEO 140
	1 , SEASN(2), VULCN(5), VSB(9), HZ(15), HMI(34)	GEO 150
	COMMON /DEVNUM/ NIN, NOUT, NSTOR, NPLT, NTBL	GEO :151
	COMMON RELHUM(34), HSTOR(34), EH(15, 34), ICH(4), VH(15), TX(15)	GEO 160
	COMMON WLAY(34, 15), WPATH(68, 15), TBBY(68), PRES(68)	GEO *170
	COMMON ABSC(4, 40), EXTC(4, 40), VX2(40)	GEO 180
	JSTOR=0	GEO 190
	JEXTRA=0	GEO 200
	IF (IFIND.EQ.1) CALL ANGL (H1, H2, ANGLE, BETA, LENST, M, NL, RE, PI, ML)	GEO 210
	IFIND=0	GEO 220
	LEN=LENST	GEO 230
	IF (ITYPE.EQ.1) GO TO 20	GEO 240
	DO 5 K=1, KMAX	GEO 250
	VH(K)=0.0	GEO 260
5	CONTINUE	GEO 270
	BETA=0.0	GEO 280
	SR=0.0	GEO 290
	IP=0	GEO 300
C	NOW DEFINE CONSTANT PRESSURE PATH QUANTITIES EH(1-8)	GEO 310
	Y=CA*ANGLE	GEO 320
	SPHI=SIN(Y)	GEO 330
	R1=(RE+H1)*SPHI	GEO 340
	IF (H1.GT.Z(NL)) GO TO 10	GEO 350
	GO TO 20	GEO 360
10	X=(RE+Z(NL))/(RE+H1)	GEO 370
	IF (SPHI.GT.X) GO TO 15	GEO 380
	H1=Z(NL)	GEO 390
	J1=NL	GEO 400
	SPHI=SPHI/X	GEO 410
	ANGLE=180.0-ASIN(SPHI)/CA	GEO 420
	R1=(RE+H1)*SPHI	GEO 430
	GO TO 20	GEO 440
15	HMIN=R1-RE	GEO 450
	WRITE (NOUT, 235) HMIN	GEO :460
	GO TO 210	GEO 470
20	CONTINUE	GEO 480
	IP=1	GEO 490
	X1=H1	GEO 500
	CALL POINT (H1, YN, N, NP1, IP)	GEO 510

J1=N	GEO 520
TX1=TX(9)	GEO 530
DO 25 K=1,KMAX	GEO 540
25 E(K)=TX(K)	GEO 550
IF (ITYPE.EQ.1) GO TO 80	GEO 560
IF (ITYPE.EQ.3) H2=Z(NL)	GEO 570
IF (ANGLE.GT.90.0) GO TO 90	GEO 580
30 IF (ANGLE.GT.90.0.AND.NP1.GT.0) J1=J1+1	GEO 590
J2=NL	GEO 600
IF (ITYPE.EQ.3) GO TO 35	GEO 610
CALL POINT (H2,YN,N,NP,IP)	GEO 620
J2=N	GEO 630
IF (NP.GT.0) J2=J2-1	GEO 640
35 DO 40 K=1,KMAX	GEO 650
IF (K.EQ.9) GO TO 40	GEO 660
EH(K,J1)=E(K)	GEO 670
IF (ITYPE.EQ.3) GO TO 40	GEO 680
EH(K,J2+1)=TX(K)	GEO 690
40 CONTINUE	GEO 700
IF (J1.EQ.J2) TX1=TX1+YN-EH(9,J1)	GEO 710
C**** NOW DEFINE VERTICAL PATH QUANTITIES VH	GEO 720
IF (JP.EQ.0) WRITE (NOUT,225)	GEO :730
DO 45 K=1,KMAX	GEO 740
45 W(K)=0.	GEO 750
DO 75 I=J1,J2	GEO 760
X1=Z(I)	GEO 770
IF (I.LT.J2) X2=Z(I+1)	GEO :780
IF (I.EQ.J1) X1=H1	GEO 790
IF (I.EQ.J2) X2=H2	GEO 800
DZ=X2-X1	GEO 810
IF (I.EQ.NL) DZ=Z(I)-Z(I-1)	GEO 820
DS=DZ	GEO 830
C UPWARD TRAJECTORY	GEO 840
RX=(RE+X1)/(RE+X2)	GEO 850
THETA=ASIN(SPFI)/CA	GEO 860
PHI=ASIN(SPFI*RX)/CA	GEO 870
BET=THETA-PHI	GEO 880
SALP=RX*SPFI	GEO 890
IF (SPFI.GT.1.E-10) DS=(RE+X2)*SIN(BET*CA)/SPFI	GEO 900
BETA=BETA+BET	GEO 910
PSI=BETA+PHI-ANGLE	GEO 920
PHI=180.-PHI	GEO 930
SR=SR+DS	GEO 940
JEXTRA=0	GEO 950
DO 70 K=1,KMAX	GEO 960
EV=DS*EH(K,I)	GEO 970
IF (I.EQ.NL) GO TO 50	GEO 980
IF (EH(K,I).EQ.0.0.OR.EH(K,I+1).EQ.0.0) GO TO 55	GEO 990
IF (ABS((EH(K,I)/EH(K,I+1))-1.0).LT.1.0E-6) GO TO 60	GEO 1000
EV=DS*(EH(K,I)-EH(K,I+1))/ALOG(EH(K,I)/EH(K,I+1))	GEO 1010
GO TO 60	GEO 1020
50 IF (EH(K,I).EQ.0.0) GO TO 55	GEO 1030
IF (EH(K,I-1).EQ.0.0) GO TO 55	GEO 1040

IF (ABS((EH(K,I-1)/EH(K,I))-1.0).LT.1.0E-6) GO TO 60	GEO 1050
EV=EV/ALOG(EH(K,I-1)/EH(K,I))	GEO 1060
GO TO 60	GEO 1070
55 EV=0.	GEO 1080
60 VH(K)=VH(K)+EV	GEO 1090
IF (I.EQ.JSTOR) GO TO 65	GEO 1100
WLAY(I,K)=EV+W(K)	GEO 1110
W(K)=0.	GEO 1120
GO TO 70	GEO 1130
65 W(K)=EV	GEO 1140
IF (J1.NE.J2) GO TO 70	GEO 1150
WLAY(J2+1,K)=W(K)	GEO 1160
W(K)=0.	GEO 1170
JEXTRA=1	GEO 1180
70 CONTINUE	GEO 1190
IF (JP.EQ.0) WRITE(NOUT,245) I,X1,(VH(L),L=1,8),PSI,PHI,BETA,	GEO:1200
1 THETA,SR	GEO:1201
IF (JP.EQ.0) WRITE (NOUT,240) X2,(VH(L),L=10,14),DS	GEO:1210
IF (I.GE.NL) GO TO 75	GEO 1220
IF (I+1.EQ.J2) EH(9,I+1)=YN	GEO 1230
IF (I.EQ.J1) EH(9,I)=TX1	GEO 1240
RN=EH(9,I+1)/EH(9,I)	GEO 1250
SPHI=SPHI*RX/RN	GEO 1260
IF (SALP.GE.RN) SPHI=SALP	GEO 1270
75 CONTINUE	GEO 1280
GO TO 190	GEO 1290
C HORIZONTAL PATH	GEO 1300
80 DO 85 K=1,KMAX	GEO 1310
W(K)=RANGE*EH(K,1)	GEO 1320
IF (M.GT.0) W(K)=RANGE*TX(K)	GEO 1330
VH(K)=W(K)	GEO 1340
85 CONTINUE	GEO 1350
GO TO 200	GEO 1360
90 CONTINUE	GEO 1370
C DOWNWARD TRAJECTORY	GEO 1380
K2=0	GEO 1390
IF (NP1.EQ.1) J1=J1-1	GEO 1400
J2=J1+1	GEO 1410
J=J1+1	GEO 1420
YN1=YN	GEO 1430
IF (H2.GT.Z(J1+1).OR.H1.EQ.H2) GO TO 100	GEO 1440
IF (NP1.EQ.1.AND.H2.GE.Z(J1+1)) GO TO 100	GEO 1450
CALL POINT (H2,YN,N,NP2,IP)	GEO 1460
DO 95 K=1,KMAX	GEO 1470
95 W(K)=TX(K)	GEO 1480
TX2=TX(9)	GEO 1490
YN2=YN	GEO 1500
IF (H2.LT.H1) H=H2	GEO 1510
J2=N	GEO 1520
IF (J1.EQ.J2) TX2=TX1+YN2-EH(9,N)	GEO 1530
IF (H2.GT.H1) TX1=TX2	GEO 1540
IF (J1.EQ.J2.AND.H2.LT.H1) YN1=TX2	GEO 1550
100 AO=(RE+H1)*SPHI*YN1	GEO 1560

IF (H2.GE.H1) YN2=YN1	GEO 1570
DO 105 I=1,J1	GEO 1580
HMIN=A0/EH(9,I)-RE	GEO 1590
IF (I.EQ.J1) HMIN=A0/YN1-RE	GEO 1600
JMIN=I	GEO 1610
IF (HMIN.LE.Z(I+1)) GO TO 110	GEO 1620
105 CONTINUE	GEO 1630
110 X=HMIN	GEO 1640
IF (HMIN.LE.0.0) GO TO 120	GEO 1650
CALL POINT (X,YN,N,NP,IP)	GEO 1660
JMIN=N	GEO 1670
TX3=TX(9)	GEO 1680
IF (J2.EQ.N.OR.J1.EQ.N) TX3=YN2+TX(9)-EH(9,N)	GEO 1690
IF (TX3.LT.0.0) TX3=TX(9)	GEO 1700
IF (J1.EQ.N.AND.H2.GE.H1) GO TO 115	GEO 1710
HMIN=A0/TX3-RE	GEO 1720
IF (ABS(X-HMIN).GT.0.0001) GO TO 110	GEO 1730
115 IF (J1.EQ.N.AND.H2.GE.H1) YN1=TX3	GEO 1740
IF (J2.EQ.N.AND.J1.NE.J2) YN2=TX3	GEO 1750
IF (H2.GE.H1) TX2=TX3	GEO 1760
IF (H2.GE.H1) J2=N	GEO 1770
IF (H2.GE.H1.OR.H2.LT.HMIN) H=HMIN	GEO 1780
WRITE (NOUT,250) HMIN	GEO 1790
IF (H2.LT.HMIN) J2=N	GEO 1800
IF (H2.LT.HMIN) WRITE (NOUT,270) HMIN	GEO 1810
GO TO 125	GEO 1820
120 WRITE (NOUT,250) HMIN	GEO 1830
IF (H2.LT.H1) GO TO 125	GEO 1840
IF (ITYPE.EQ.3.OR.H2.GE.H1) WRITE (NOUT,255)	GEO 1850
ITYPE=2	GEO 1860
TX2=EH(9,1)	GEO 1870
JMIN=0	GEO 1880
J2=1	GEO 1890
H2=0.0	GEO 1900
H=0.0	GEO 1910
C**** NOW DEFINE VERTICAL PATH QUANTITIES VH	GEO 1920
125 IF (JP.EQ.0) WRITE (NOUT,225)	GEO 1930
JSTOR=J-1	GEO 1940
DO 155 I=1,NL	GEO 1950
J=J-1	GEO 1960
REF=EH(9,J)	GEO 1970
IF (I.EQ.1) REF=YN1	GEO 1980
IF (I.EQ.1.AND.K2.EQ.1) REF=YN2	GEO 1990
IF (J.EQ.J2.AND.K2.EQ.0) REF=TX2	GEO 2000
IF (I.NE.1) X1=Z(J+1)	GEO 2010
X2=Z(J)	GEO 2020
IF (J.EQ.J2.AND.K2.EQ.0) X2=H	GEO 2030
IF (J.EQ.JMIN.AND.K2.EQ.1) X2=HMIN	GEO 2040
HM=(RE+X1)*SPHI-RE	GEO 2050
IF (HM.GT.Z(J).AND.HM.GT.X2) X2=HM	GEO 2060
RX=(RE+X1)/(RE+X2)	GEO 2070
DS=X1-X2	GEO 2080
ALP=90.0	GEO 2090

THET=ASIN(SPHI)/CA	GEO 2100
SALP=RX*SPHI	GEO 2110
IF (ABS(X2-HM).GT.1.0E-5) ALP=ASIN(SALP)/CA	GEO 2120
BET=ALP-THET	GEO 2130
IF (SPHI.GT.1.0E-10) DS=(RE+X2)*SIN(BET*CA)/SPHI	GEO 2140
THETA=180.0-THET	GEO 2150
BETA=BETA+BET	GEO 2160
PSI=BETA-ALP-ANGLE+180.0	GEO 2170
SR=SR+DS	GEO 2180
DO 150 K=1,KMAX	GEO 2190
AJ=EH(K,J)	GEO 2200
BJ=EH(K,J+1)	GEO 2210
IF (J.EQ.J1) BJ=E(K)	GEO 2220
IF (J.EQ.J2.AND.H2.LT.H1.AND.H2.GT.0.0) AJ=W(K)	GEO 2230
IF (J.EQ.JMIN.AND.H2.GE.H1) AJ=TX(K)	GEO 2240
IF (J.EQ.JMIN.AND.ABS(H2-HM).LT.1.0E-5) AJ=TX(K)	GEO 2250
IF (K2.EQ.0) GO TO 130	GEO 2260
IF (J.EQ.J2) BJ=W(K)	GEO 2270
IF (J.EQ.JMIN) AJ=TX(K)	GEO 2280
130 IF (AJ.EQ.0.0.OR.BJ.EQ.0.0) GO TO 140	GEO 2290
IF (ABS((AJ/BJ)-1.0).LE.1.0E-6) GO TO 135	GEO 2300
EV=DS*(AJ-BJ)/ALOG(AJ/BJ)	GEO 2310
GO TO 145	GEO 2320
135 EV=DS*AJ	GEO 2330
GO TO 145	GEO 2340
140 EV=0.0	GEO 2350
145 VH(K)=VH(K)+EV	GEO 2360
150 WLAY(J,K)=EV	GEO 2370
IF (JP.EQ.0) WRITE(NOUT,245) J,X1,(VH(L),L=1,8),PSI,ALP,BETA,	GEO:2380
1 THETA,SR	GEO:2381
IF (JP.EQ.0) WRITE (NOUT,240) X2,(VH(L),L=10,14),DS	GEO:2390
IF (J.EQ.J2.AND.H2.GE.H1) GO TO 180	GEO 2400
IF (J.EQ.JMIN.AND.K2.EQ.1) GO TO 170	GEO 2410
IF (J.NE.1) RN=REF/EH(9,J-1)	GEO 2420
IF (J.EQ.J2+1) RN=REF/TX2	GEO 2430
IF (J.EQ.J2.AND.K2.EQ.0) RN=REF/YN2	GEO 2440
IF (J.EQ.(JMIN+1).AND.K2.EQ.1) RN=REF/TX3	GEO 2450
IF (SALP.GE.RN) RN=1.0	GEO 2460
SPHI=SALP*RN	GEO 2470
IF (J.EQ.J2.AND.K2.EQ.0) GO TO 160	GEO 2480
155 CONTINUE	GEO 2490
160 IF (HMIN.LE.0.0) GO TO 190	GEO 2500
IF (LEN.EQ.0) WRITE (NOUT,260)	GEO:2510
IF (LEN.EQ.0) GO TO 190	GEO 2520
IF (LEN.EQ.1) WRITE (NOUT,265)	GEO:2530
K2=1	GEO 2540
X1=X2	GEO 2550
IF (ABS(X1-HMIN).LE.0.001) GO TO 190	GEO 2560
H=HMIN	GEO 2570
J=J2+1	GEO 2580
IF (NP2.EQ.1) J=J-1	GEO 2590
B=BETA	GEO 2600
PH=180.0-ASIN(SPHI)/CA	GEO 2610

TS=SR	GEO 2620
PS=PSI	GEO 2630
DO 165 K=1,KMAX	GEO 2640
165 E(K)=VH(K)	GEO 2650
GO TO 125	GEO 2660
170 BETA=2.*BETA-B	GEO 2670
PSI=2.*PSI-PS	GEO 2680
SR=2.*SR-TS	GEO 2690
C LONG PATH TAKEN	GEO 2700
PHI=PH	GEO 2710
DO 175 K=1,KMAX	GEO 2720
175 VH(K)=2.*VH(K)-E(K)	GEO 2730
GO TO 190	GEO 2740
180 DO 185 K=1,KMAX	GEO 2750
185 VH(K)=2.0*VH(K)	GEO 2760
BETA=2.0*BETA	GEO 2770
SR=2.0*SR	GEO 2780
IF (H2.EQ.H1) GO TO 190	GEO 2790
RN=TX1/YN1	GEO 2800
SPHI=SIN(ANGLE*CA)	GEO 2810
IF (SPHI.LT.RN) SPHI=SPHI/RN	GEO 2820
GO TO 30	GEO 2830
190 CONTINUE	GEO 2840
IF (ANGLE.GT.90.0) WRITE (NOUT,215) HM	GEO:2850
DO 195 K=1,KMAX	GEO 2860
W(K)=VH(K)	GEO 2870
195 CONTINUE	GEO 2880
200 WRITE (NOUT,220)	GEO:2890
WRITE (NOUT,280)	GEO:2900
WRITE (NOUT,230) (W(I),I=1,8),W(10),W(11)	GEO:2910
IF(W(7).GT.0.0.AND.ICH(1).LE.7) W(15)=W(15)/W(7)	GEO 2920
IF(W(12).GT.0.0.AND.ICH(1).GT.7) W(15)=W(15)/W(12)	GEO 2930
205 WRITE (NOUT,275) (W(I),I=12,15)	GEO:2940
I=1	GEO 2950
210 RETURN	GEO 2960
C	GEO 2970
215 FORMAT (7F10.3)	GEO 2980
220 FORMAT (/10X,38H EQUIVALENT SEA LEVEL ABSORBER AMOUNTS//21X,112H W	GEO 2990
LATER VAPOUR CO2 ETC. OZONE NITROGEN (CONT) H2O (CONG	GEO 3000
2T) MOL SCAT AER1 OZONE(U-V)/24X,7HGM CM-2,10X,2HK	GEO 3010
3M,10X,6HATM CM,10X,2HKM,9X,7HGM CM-2,10X,2HKM,11X,5X,10X,6HATM CM)	GEO 3020
225 FORMAT (1H1,/10X,20H VERTICAL PROFILES,//,1X,2HID,3X,3HALT,6X,3H	GEO 3030
1H2O,7X,4HCO2+,6X,2HO3,9X,2HN2,6X,8HH2O(10M),4X,4HMOLS,6X,4HAER1,5X	GEO 3040
2,6HO3(UV),5X,3HPSI,6X,3HPHI,6X,4HBETA,4X,5HTHETA,4X,5HRANGE,/,14X,	GEO 3050
35H ,4X,7HH2O(4M),5X,4HHNO3,6X,4HAER2,6X,4HAER3,6X,4HAER4,3X,5	GEO:3060
48X,6HDRANGE//)	GEO 3070
230 FORMAT (/10X,8H W(1-8)=8(E14.3)/74X,E14.3,28X,E14.3/)	GEO 3080
235 FORMAT (69H TRAJECTORY MISSES EARTHS ATMOSPHERE. CLOSEST DISTANCE	GEO 3090
1OF APPROACH IS,F10.2,1X,/,1X,18HEND OF CALCULATION)	GEO 3100
240 FORMAT (3X,F8.3,9X,1P5E10.3,55X,OPF7.2,/)	GEO:3110
245 FORMAT (14,F8.3,1P8E10.3,OP4F8.3,F7.1)	GEO:3120
250 FORMAT (8H HMIN = ,F10.3)	GEO 3130
255 FORMAT (64H PATH INTERSECTS EARTH - PATH CHANGED TO TYPE 2 WITH H2	GEO 3140

1 = 0.0 KM)	GEO 3150
260 FORMAT (84H CHOICE OF TWO PATHS FOR THIS CASE -SHORTEST PATH TAKEN	GEO 3160
1. FOR LONGER PATH SET LEN=1.)	GEO 3170
265 FORMAT (85H CHOICE OF TWO PATHS FOR THIS CASE -LONGEST PATH TAKEN.	GEO 3180
1 FOR SHORT PATH SET LEN = 0)	GEO 3190
270 FORMAT (74H H2 WAS SET LESS THAN HMIN AND HAS BEEN RESET EQUAL TO	GEO 3200
1 HMIN I.E. H2 = ,F10.3)	GEO 3210
275 FORMAT (/30X,4HAER2,10X,4HAER3,10X,4HAER4,5X,9HR.H. MEAN,/10X,10H	GEO 3220
1W(12-15)=,4(1PE14.3)/)	GEO 3230
280 FORMAT (118X,11HNITRIC ACID)	GEO 3240
END	GEO 3250

	SUBROUTINE ANGL (H1,H2,ANGLE,B1,LEN,M,NL,RE,PI,ML)	ANG	10
	DOUBLE PRECISION HZ,SEASN,VULCN	ANG	:11
	COMMON /MDATA/ Z(34),P(7,34),T(7,34),WH(7,34),WO(7,34)	ANG	20
	1 ,SEASN(2),VULCN(5),VSB(9),HZ(15),HMX(34)	ANG	30
	COMMON /DEVNUM/ NIN,NOUT,NSTOR,NPLT,NTBL	ANG	:31
	COMMON RELHUM(34),HSTOR(34),EH(15,34),ICH(4),VH(15),TX(15)	ANG	40
	COMMON WLAY(34,15),WPATH(68,15),TBBY(68),PRES(68)	ANG	*50
	COMMON ABSC(4,40),EXTC(4,40),VX2(40)	ANG	60
C	*****	ANG	70
C		ANG	80
C	THIS SUBROUTINE CALCULATES THE INITIAL ZENITH ANGLE (ANGLE)	ANG	90
C	TAKING INTO ACCOUNT REFRACTION EFFECTS GIVEN H1,H2, AND BETA	ANG	100
C	(WHERE BETA IS THE EARTH CENTRE ANGLE SUBTENDED BY H1 AND H2),	ANG	110
C	ASSUMING THE REFRACTIVE INDEX TO BE CONSTANT IN A GIVEN LAYER.	ANG	120
C	FOR GREATER ACCURACY INCREASE THE NUMBER OF LEVELS IN THE MODEL	ANG	130
C	ATMOSPHERE.	ANG	140
C		ANG	150
C	THIS SUBROUTINE CAN BE REMOVED FROM THE PROGRAM IF NOT REQUIRED.	ANG	160
C	*****	ANG	170
	IP=99	ANG	180
	CA=PI/180.	ANG	190
	X1=RE+H1	ANG	200
	X2=RE+H2	ANG	210
	LEN=0.	ANG	220
	IT=0	ANG	230
	B1=B1*CA	ANG	240
	TANG=X2*SIN(B1)/(X2*COS(B1)-X1)	ANG	250
	THET=ATAN(TANG)	ANG	260
	IF (THET.LT.0.0) THET=THET+PI	ANG	270
	SPHI=SIN(THET)	ANG	280
	ANG=THET/CA	ANG	290
	TN=THET	ANG	300
	TM=TN-0.5*CA	ANG	310
5	ANGLE=THET	ANG	320
	FBT=0.	ANG	330
	BETA=0.	ANG	340
	BET1=0	ANG	350
	BET2=0	ANG	360
	FBT1=0	ANG	370
	FBT2=0	ANG	380
	FBT3=0.0	ANG	390
	IF (B1.LE.0.0) GO TO 10	ANG	400
	Y=2.*THET	ANG	410
	IF (Y-PI.GT.1.0E-8) GO TO 45	ANG	420
	IF (IP.EQ.100) GO TO 30	ANG	430
	XMIN=X2*COS(B1)-RE	ANG	440
	IF (XMIN-H1) 40,20,20	ANG	450
10	HMIN=H2	ANG	460
	H2=H1	ANG	470
	H1=HMIN	ANG	480
15	ANGLE=0.5*PI	ANG	490
	THET=ANGLE	ANG	500
	SPHI=1.0	ANG	510

ANG=ANGLE/CA	ANG 520
20 IP=100	ANG 530
CALL POINT (H1,YN,N,NP,IP)	ANG 540
J1=N	ANG 550
TX1=TX(9)	ANG 560
25 CALL POINT (H2,YN,N,NP,IP)	ANG 570
IF (NP.EQ.1) N=N-1	ANG 580
J2=N	ANG 590
IF (J1.EQ.J2) TX1=TX1+YN-EH(9,J1)	ANG 600
30 DO 35 J=J1,J2	ANG 610
X1=RE+Z(J)	ANG 620
X2=RE+Z(J+1)	ANG 630
IF (J.EQ.J1) X1=RE+H1	ANG 640
IF (J.EQ.J2) X2=RE+H2	ANG 650
SALP=X1*SPHI/X2	ANG 660
ALP=ASIN(SALP)	ANG 670
RN=EH(9,J+1)/EH(9,J)	ANG 680
IF ((J+1).EQ.J2) RN=YN/EH(9,J)	ANG 690
IF (J.EQ.J1) RN=EH(9,J+1)/TX1	ANG 700
IF ((J+1).EQ.J2.AND.J.EQ.J1) RN=YN/TX1	ANG 710
BET=THET-ALP	ANG 720
FB=-TAN(ALP)	ANG 730
IF (J.NE.J1) FB=FB+TAN(THET)	ANG 740
FBT=FBT+FB	ANG 750
BETA=BETA+BET	ANG 760
TH1=THET/CA	ANG 770
BE=BET/CA	ANG 780
C=ALP/CA	ANG 790
IF (X2.EQ.RE+H2) C=PI-ALP	ANG 800
IF (SALP.GE.RN) RN=1.	ANG 810
SPHI=SALP/RN	ANG 820
THET=ASIN(SPHI)	ANG 830
35 CONTINUE	ANG 840
IF (B1.LE.0.0) GO TO 125	ANG 850
GO TO 115	ANG 860
40 CONTINUE	ANG 870
TANG=-TANG	ANG 880
ANGLE=PI-ANGLE	ANG 890
TN=ANGLE	ANG 900
ANG=ANGLE/CA	ANG 910
IF (H1.LE.0.0) GO TO 15	ANG 920
45 CONTINUE	ANG 930
IP=101	ANG 940
CALL POINT (H1,YN,N,NP1,IP)	ANG 950
TX1=TX(9)	ANG 960
YN1=YN	ANG 970
IF (NP1.EQ.1) N=N-1	ANG 980
J2=NL	ANG 990
IF (M.EQ.7) J2=ML	ANG 1000
J1=N	ANG 1010
J=J1+1	ANG 1020
IF (H2.GE.H1) GO TO 65	ANG 1030
CALL POINT (H2,YN,N,NP,IP)	ANG 1040

TX2=TX(9)	ANG 1050
YN2=YN	ANG 1060
J2=N	ANG 1070
IF (J1.EQ.J2) TX2=YN1+TX(9)-EH(9,J1)	ANG 1080
50 J=J-1	ANG 1090
X1=RE+Z(J+1)	ANG 1100
X2=RE+Z(J)	ANG 1110
IF (J.EQ.J1) X1=RE+H1	ANG 1120
IF (J.EQ.J2) X2=RE+H2	ANG 1130
SALP=X1*SPHI/X2	ANG 1140
HMIN=X1*SPHI-RE	ANG 1150
IF (SALP.LE.1.0) GO TO 55	ANG 1160
SALP=SPHI	ANG 1170
IF (HMIN.GT.H2) GO TO 80	ANG 1180
55 ALP=ASIN(SALP)	ANG 1190
THET=ASIN(SPHI)	ANG 1200
BET=ALP-THET	ANG 1210
BET1=BET1+BET	ANG 1220
FB=TAN(ALP)	ANG 1230
IF (J.NE.J1) FB=FB-TAN(THET)	ANG 1240
FBT1=FBT1+FB	ANG 1250
TH1=THET/CA	ANG 1260
BE=BET/CA	ANG 1270
AL=ALP/CA	ANG 1280
IF (X2.EQ.RE+H2) C=PI-ALP	ANG 1290
REF=EH(9,J)	ANG 1300
IF (J.EQ.J1) REF=YN1	ANG 1310
IF (J.EQ.J2) REF=TX2	ANG 1320
IF (J.EQ.1) GO TO 60	ANG 1330
RN=EH(9,J)/EH(9,J-1)	ANG 1340
IF (J.EQ.J1) RN=YN1/EH(9,J-1)	ANG 1350
IF (J.EQ.J2+1) RN=REF/TX2	ANG 1360
IF (J.EQ.J2) RN=REF/YN2	ANG 1370
IF (SALP.GE.RN) RN=1.	ANG 1380
SPHI=SALP*RN	ANG 1390
IF (Z(J).LE.H2) GO TO 60	ANG 1400
GO TO 50	ANG 1410
60 X1=X2	ANG 1420
IF (ABS(Z(J)-H2).LT.1.0E-10.AND.J.NE.1) GO TO 65	ANG 1430
GO TO 70	ANG 1440
65 J=J-1	ANG 1450
X1=RE+Z(J+1)	ANG 1460
IF (J.EQ.J1) X1=RE+H1	ANG 1470
IF (J.EQ.J2.AND.J.NE.J1) X1=RE+H2	ANG 1480
70 X2=RE+Z(J)	ANG 1490
HMIN=X1*SPHI-RE	ANG 1500
IF (HMIN.LE.0.0) GO TO 110	ANG 1510
IF (Z(J).LT.HMIN) GO TO 80	ANG 1520
REF=EH(9,J)	ANG 1530
IF (J.EQ.J2) REF=YN	ANG 1540
SALP=X1*SPHI/X2	ANG 1550
ALP=ASIN(SALP)	ANG 1560
THET=ASIN(SPHI)	ANG 1570

BET=ALP-THET	ANG 1580
FB=TAN(ALP)-TAN(THET)	ANG 1590
FBT2=FBT2+FB	ANG 1600
BET2=BET2+BET1	ANG 1610
BMIN=BET1+BET2	ANG 1620
AL=ALP/CA	ANG 1630
TH1=THET/CA	ANG 1640
RN=REF/EH(9,J-1)	ANG 1650
IF (SALP.GE.RN) RN=1.0	ANG 1660
SPHI=SALP*RN	ANG 1670
GO TO 65	ANG 1680
75 TX3=YN1+TX(9)-EH(9,J1)	ANG 1690
YN1=TX3	ANG 1700
IF (ABS(H2-Z(J+1)).LE.1.0E-5) YN1=TX(9)	ANG 1710
IF (ABS(H1-Z(J+1)).LE.1.0E-5) YN1=TX(9)	ANG 1720
RN=1.0	ANG 1730
GO TO 85	ANG 1740
80 CALL POINT (HMIN,YN,N,NP,IP)	ANG 1750
IP=102	ANG 1760
TX3=TX(9)	ANG 1770
IF (J.EQ.J1.AND.H2.GE.H1) GO TO 75	ANG 1780
IF (J.EQ.J1.OR.J.EQ.J2) TX3=YN2+TX(9)-EH(9,J)	ANG 1790
IF (HMIN.GT.H2) TX3=TX(9)	ANG 1800
IF (J.EQ.J1.AND.HMIN.GT.H2) GO TO 75	ANG 1810
RN=REF/TX3	ANG 1820
IF (SALP.GE.RN) RN=1.	ANG 1830
SPHI=SALP*RN	ANG 1840
X=X1*SPHI-RE	ANG 1850
DIF=ABS(HMIN-X)	ANG 1860
HMIN=X	ANG 1870
IF (DIF-1.0E-5) 85,85,80	ANG 1880
85 X2=RE+HMIN	ANG 1890
THET=ASIN(SPHI)	ANG 1900
IF (RN.EQ.1.0) FBT3=-TAN(THET)	ANG 1910
IF (RN.EQ.1.0) GO TO 90	ANG 1920
DNX=(TX3-1.0)*ALOG((TX3-1.0)/(REF-1.0))/(X2-X1)	ANG 1930
FBT3=-TAN(THET)*(1.0-1.0/(1.0+TX3/(X2*DNX)))	ANG 1940
90 BET=0.5*PI-THET	ANG 1950
BET2=BET2+BET	ANG 1960
BMIN=BET1+BET2	ANG 1970
IF (H2.GE.H1) GO TO 100	ANG 1980
BET=BET1+2.*BET2	ANG 1990
DB1=B1-BET1	ANG 2000
DB2=BET-B1	ANG 2010
DB3=ABS(BMIN-B1)	ANG 2020
IF (DB3.GT.DB1.AND.DB2.GT.DB1) GO TO 110	ANG 2030
IF (DB2.GT.DB3) GO TO 95	ANG 2040
IF (DB2.GT.DB1) GO TO 110	ANG 2050
BETA=BET	ANG 2060
FBT=FBT1+2.0*(FBT2+FBT3)	ANG 2070
LEN=1.	ANG 2080
GO TO 115	ANG 2090
95 BETA=BET1+BET2	ANG 2100

FBT=FBT1+FBT2+FBT3	ANG 2110
GO TO 115	ANG 2120
100 BETA=2.0*(BET1+BET2)	ANG 2130
LEN=1.	ANG 2140
FBT=2.0*(FBT1+FBT2+FBT3)	ANG 2150
WRITE (NOUT,130) J,BETA,FBT,FBT1,FBT2,FBT3,TX1,YN1	ANG:2160
IF (H2.EQ.H1) GO TO 115	ANG 2170
IP=103	ANG 2180
IF (NP1.EQ.1) J1=J1+1	ANG 2190
SPHI=SIN(ANGLE)	ANG 2200
IF (Z(J1+1).LE.H2) GO TO 105	ANG 2210
RN=TX1/YN1	ANG 2220
IF (SPHI.GE.RN) RN=1.	ANG 2230
SPHI=SPHI/RN	ANG 2240
THET=ASIN(SPHI)	ANG 2250
GO TO 25	ANG 2260
105 CALL POINT (H2,YN,N,NP,IP)	ANG 2270
TX1=TX1+YN-EH(9,J1)	ANG 2280
RN=TX1/YN1	ANG 2290
J2=J1	ANG 2300
IF (SPHI.GE.RN) RN=1.	ANG 2310
SPHI=SPHI/RN	ANG 2320
THET=ASIN(SPHI)	ANG 2330
GO TO 25	ANG 2340
110 BETA=BET1	ANG 2350
LEN=0.	ANG 2360
FBT=FBT1	ANG 2370
115 THET=ANGLE+(B1-BETA)/(1.+FBT/TANG)	ANG 2380
DBETA=BETA/CA	ANG 2390
B=BET1/CA	ANG 2400
TH1=THET/CA	ANG 2410
WRITE (NOUT,135) BETA,DBETA,FBT,TH1,TANG	ANG:2420
IF (THET.GT.TN.OR.THET.LT.TM) THET=(TN+TM)/2.	ANG 2430
TH1=THET/CA	ANG 2440
WRITE (NOUT,135) BET1,B,FBT,TH1	ANG:2450
TN1=TN/CA	ANG 2460
TM1=TM/CA	ANG 2470
WRITE (NOUT,140) TN,TM,TN1,TM1	ANG:2480
SPHI=SIN(THET)	ANG 2490
TANG=TAN(THET)	ANG 2500
IT=IT+1	ANG 2510
DBE=ABS(B1-BETA)	ANG 2520
DTH=ABS(ANGLE-THET)	ANG 2530
IF (IT.EQ.10) THET=0.5*(ANGLE+THET)	ANG 2540
IF (IT.EQ.10) GO TO 120	ANG 2550
IF (DBE.GT.1.0E-7.AND.DTH.GT.1.0E-7) GO TO 5	ANG 2560
120 ANGLE=THET/CA	ANG 2570
WRITE (NOUT,145) ANGLE,IT	ANG:2580
RETURN	ANG 2590
125 H1=H2	ANG 2600
ANGLE=C/CA	ANG 2610
WRITE (NOUT,145) ANGLE,IT	ANG:2620
RETURN	ANG 2630

C

130 FORMAT (I6,E16.7,8F13.8)

135 FORMAT (14H TOTAL BETA = ,E14.6,F15.6,7H,FBT = ,E14.6,7H THET =,F10.6,5HTANG=,F10.6)

140 FORMAT (5F12.6)

145 FORMAT (8X,/1H*,14HZENITH ANGLE =,F7.3,59H DEGREES \ RECOMPUTED

1 FROM SUBROUTINE ANGL (ITERATION,I3,1H))

END

ANG 2640

ANG 2650

ANG 2660

ANG 2670

ANG 2680

ANG:2690

ANG:2700

ANG 2710

	SUBROUTINE POINT (X,YN,N,NP,IP)	POI 10
C	REvised 12 DEC 79	POI 20
	DOUBLE PRECISION HZ,SEASN,VULCN	POI :21
	COMMON /CARD1/ MODEL,IHAZE,ITYPE,LEN,JP,IM,M1,M2,M3,ML,IEMISS,RO	POI 30
	1 ,TBOUND,ISEASN,IVULCN,VIS,JBMOD	POI *40
	COMMON /CARD2/ H1,H2,ANGLE,RANGE,BETA,HMIN,RE	POI 50
	COMMON /CARD3/ V1,V2,DV,AVW,CO,CW,W(15),E(15),CA,PI	POI 60
	COMMON /CNTRL/ LENST,KMAX,M,IJ,J1,JL,JMIN,JEXTRA,IL,IKMAX,NLL,NP1	POI 70
	1,IFIND,NL,IKLO	POI 80
	COMMON /MDATA/ Z(34),P(7,34),T(7,34),WH(7,34),WO(7,34)	POI 90
	1 ,SEASN(2),VULCN(5),VSB(9),HZ(15),HMX(34)	POI 100
	COMMON /DEVNUM/ NIN,NOUT,NSTOR,NPLT,NTBL	POI :101
	COMMON RELHUM(34),HSTOR(34),EH(15,34),ICH(4),VH(15),TX(15)	POI 110
	COMMON WLAY(34,15),WPATH(68,15),TBBY(68),PRES(68)	POI *120
	COMMON ABSC(4,40),EXTC(4,40),VX2(40)	POI 130
C	*****	POI 140
C	SUBROUTINE POINT COMPUTES THE MEAN REFR. INDEX ABOVE AND BELOW	POI 150
C	A GIVEN ALTITUDE AND INTERPOLATES EXPONENTIALLY TO DETERMINE THE	POI 160
C	EQUIVALENT ABSORBER AMOUNTS AT THAT ALTITUDE.	POI 170
C		POI 180
C	*****	POI 190
C		POI 200
C	X IS THE HEIGHT IN QUESTION	POI 210
C	TX(9) AND YN ARE THE MEAN REFRACTIVE INDICES ABOVE AND BELOW X	POI 220
C	N IS THE LEVEL INTEGER CORRESPONDING TO X OR THE LEVEL BELOW X	POI 230
C	NP =1 IF X COINCIDES WITH MODEL ATMOSPHERE LEVEL ,IF NOT NP = 0	POI 240
C	TX(1-8) ARE ABSORBER AMOUNTS PER KM AT HEIGHT X	POI 250
C	*****	POI 260
	N=NL	POI 270
	NP=0	POI 280
	IF (X.LT.0.0) X=Z(1)	POI 290
	IF (X.GT.Z(NL)) GO TO 20	POI 300
	DO 5 I=1,NL	POI 310
	N=I	POI 320
	IF (X-Z(I)) 10,20,5	POI 330
5	CONTINUE	POI 340
10	J2=N	POI 350
	N=N-1	POI 360
	MM1=M	POI 370
	IF(M1.GT.0.AND.M.LT.7) MM1=M1	POI 380
	MM2=M	POI 390
	IF(M2.GT.0.AND.M.LT.7) MM2=M	POI 400
	FAC=(X-Z(N))/(Z(J2)-Z(N))	POI 410
	PX1=P(MM1,N)*(P(MM1,J2)/P(MM1,N))**FAC	POI 420
	TX1=T(MM1,N)*(T(MM1,J2)/T(MM1,N))**FAC	POI 430
	WX1=WH(MM2,N)*(WH(MM2,J2)/WH(MM2,N))**FAC	POI 440
	TX(3)=CO*PX1/TX1-4.56E-6*WX1*TX1*CW	POI 450
	TX(2)=CO*P(MM1,J2)/T(MM1,J2)-4.56E-6*WH(MM2,J2)*T(MM1,J2)*CW	POI 460
	TX(1)=CO*P(MM1,N)/T(MM1,N)-4.56E-6*WH(MM2,N)*T(MM1,N)*CW	POI 470
	TX(9)=0.5E-6*(TX(2)+TX(3))	POI 480
	YN=0.5E-6*(TX(1)+TX(3))	POI 490
	IF (IP.EQ.0) GO TO 35	POI 500
	DO 15 K=1,KMAX	POI 510

IF (K.EQ.9) GO TO 15	POI 520
TX(K)=0.0	POI 530
IF (EH(K,N).GT.1000.0) GO TO 15	POI 540
IF (X.LE.100.0) TX(K)=EH(K,N)+FAC*(EH(K,J2)-EH(K,N))	POI 550
IF (EH(K,N).EQ.0.0.OR.EH(K,J2).EQ.0.0) GO TO 15	POI 560
TX(K)=EH(K,N)*(EH(K,J2)/EH(K,N))**FAC	POI 570
15 CONTINUE	POI 580
GO TO 35	POI 590
20 NP=1	POI 600
IF (IP.EQ.0) GO TO 30	POI 610
DO 25 K=1,KMAX	POI 620
25 TX(K)=EH(K,N)	POI 630
30 TX(9)=EH(9,N)-1.	POI 640
YN=0.0	POI 650
C CARDS B 24 AND 50 THROUGH 59 ARE NO LONGER REQUIRED	POI 660
IF (N.GT.1) YN=EH(9,N-1)-1.0	POI 670
35 CONTINUE	POI 680
IF (IP.EQ.1) WRITE (NOUT,45) X,N,NP,TX(9),YN,IP,(TX(K),K=1,8)	POI :690
IF (IP.EQ.1) WRITE (NOUT,40) (TX(K),K=12,14)	POI :700
TX(9)=TX(9)+1.	POI 710
YN=YN+1.	POI 720
RETURN	POI 730
C	POI 740
40 FORMAT (//5X,11H TX(12-14)=,3E10.3/)	POI 750
45 FORMAT (/ ,20H FROM POINT\ HEIGHT=,F10.4,6H KM,N=,I3,4H,NP=,I2,28H,POI	760
1REF. INDEX ABOVE & BELOW X=,2E11.4,4H,IP=,I3,/,12X,36HEQUIV. ABSORPOI	770
2BER AMOUNTS PER KM AT X=,8E10.3)	POI 780
END	POI 790

	SUBROUTINE EXABIN	EXA	10
C		EXA	20
C	LOADS EXTINCTION AND ABSORPTION COEFFICIENTS FOR THE FOUR	EXA	30
C	AEROSOL ALTITUDE REGIONS	EXA	40
C		EXA	50
	DOUBLE PRECISION HZ,SEASN,VULCN	EXA	:51
	COMMON /CARD1/ MODEL,IHAZE,ITYPE,LEN,JP,IM,M1,M2,M3,ML,IEMISS,RO	EXA	60
1	,TBOUND,ISEASN,IVULCN,VIS,JBMOD	EXA	*70
	COMMON /CARD2/ H1,H2,ANGLE,RANGE,BETA,HMIN,RE	EXA	80
	COMMON /CARD3/ V1,V2,DV,AVW,CO,CW,W(15),E(15),CA,PI	EXA	90
	COMMON /CNTRL/ LENST,KMAX,MD,IJ,J1,J2,JMIN,JEXTRA,IL,IKMAX,NLL,NP	EXA	100
1	,IFIND,NL,IKLO	EXA	110
	COMMON /MDATA/ Z(34),P(7,34),T(7,34),WH(7,34),WO(7,34)	EXA	120
1	,SEASN(2),VULCN(5),VSB(9),HZ(15),HMX(34)	EXA	130
	COMMON /DEVNUM/ NIN,NOUT,NSTOR,NPLT,NTBL	EXA	:131
	COMMON RELHUM(34),HSTOR(34),EH(15,34),ICH(4),VH(15),TX(15)	EXA	140
	COMMON WLAY(34,15),WPATH(68,15),TBBY(68),PRES(68)	EXA	*150
	COMMON ABSC(4,40),EXTC(4,40),VXO(40)	EXA	160
	COMMON /EXTDTA/ VX2(40),RUREXT(40,4),RURABS(40,4),URBEXT(40,4),	EXA	170
1	URBABS(40,4),OCNEXT(40,4),OCNABS(40,4),TROEXT(40,4),TROABS(40,4),	EXA	180
2	FG1EXT(40),FG1ABS(40),FG2EXT(40),FG2ABS(40)	EXA	190
3	,BSTEXT(40),BSTABS(40),AVOEXT(40),AVOABS(40),FVOEXT(40	EXA	200
4	),FVOABS(40),DMEEXT(40),DMEABS(40)	EXA	210
	DIMENSION RHZONE(4)	EXA	220
	DATA RHZONE /0.,70.,80.,99./	EXA	:230
	WRITE (NOUT,90) (ICH(I),I=1,4)	EXA	:240
C	CALL EXTDTA	EXA	:250
	DO 5 I=1,40	EXA	260
5	VXO(I)=VX2(I)	EXA	270
	II=1	EXA	280
	IF (IHAZE.EQ.7) II=2	EXA	290
	DO 85 M=II,4	EXA	300
	ITA=ICH(M)	EXA	310
	ITC=ICH(M)-7	EXA	320
	WRH=W(15)	EXA	330
	IF (ICH(M).EQ.6.AND.M.NE.1) WRH=70.	EXA	340
C	THIS CODING DOES NOT ALLOW TROP RH DEPENDENT ABOVE EH(7,I)	EXA	350
C	DEFAULTS TO TROPOSPHERIC AT 70. PERCENT	EXA	360
	DO 10 I=2,4	EXA	370
	IF (WRH.LT.RHZONE(I)) GO TO 15	EXA	380
10	CONTINUE	EXA	390
	I=4	EXA	400
15	II=I-1	EXA	410
	IF (WRH.GT.0.0.AND.WRH.LT.99.) X=ALOG(100.0-WRH)	EXA	420
	X1=ALOG(100.0-RHZONE(II))	EXA	430
	X2=ALOG(100.0-RHZONE(I))	EXA	440
	IF (WRH.GE.99.0) X=X2	EXA	450
	IF (WRH.LE.0.0) X=X1	EXA	460
	DO 80 N=1,40	EXA	470
	ABSC(M,N)=0.	EXA	480
	EXTC(M,N)=0.	EXA	490
	IF (ITA.GT.6) GO TO 45	EXA	500
	IF (ITA.LE.0) GO TO 80	EXA	510

C	RH DEPENDENT AEROSOLS	EXA	520
	GO TO (20,20,25,25,30,35), ITA	EXA	530
20	Y2=ALOG(RUREXT(N,I))	EXA	540
	Y1=ALOG(RUREXT(N,II))	EXA	550
	Z2=ALOG(RURABS(N,I))	EXA	560
	Z1=ALOG(RURABS(N,II))	EXA	570
	GO TO 40	EXA	580
25	Y2=ALOG(OCNEXT(N,I))	EXA	590
	Y1=ALOG(OCNEXT(N,II))	EXA	600
	Z2=ALOG(OCNABS(N,I))	EXA	610
	Z1=ALOG(OCNABS(N,II))	EXA	620
	GO TO 40	EXA	630
30	Y2=ALOG(URBEXT(N,I))	EXA	640
	Y1=ALOG(URBEXT(N,II))	EXA	650
	Z2=ALOG(URBABS(N,I))	EXA	660
	Z1=ALOG(URBABS(N,II))	EXA	670
	GO TO 40	EXA	680
35	Y2=ALOG(TROEXT(N,I))	EXA	690
	Y1=ALOG(TROEXT(N,II))	EXA	700
	Z2=ALOG(TROABS(N,I))	EXA	710
	Z1=ALOG(TROABS(N,II))	EXA	720
40	Y=Y1+(Y2-Y1)*(X-X1)/(X2-X1)	EXA	730
	ZK=Z1+(Z2-Z1)*(X-X1)/(X2-X1)	EXA	740
	ABSC(M,N)=EXP(ZK)	EXA	750
	EXTC(M,N)=EXP(Y)	EXA	760
	GO TO 80	EXA	770
45	IF (ITA.GT.14) GO TO 75	EXA	780
	IF (ITC.LT.1) GO TO 80	EXA	790
	GO TO (50,55,60,65,70,65,70), ITC	EXA	800
50	ABSC(M,N)=FG1ABS(N)	EXA	810
	EXTC(M,N)=FG1EXT(N)	EXA	820
	GO TO 80	EXA	830
55	ABSC(M,N)=FG2ABS(N)	EXA	840
	EXTC(M,N)=FG2EXT(N)	EXA	850
	GO TO 80	EXA	860
60	ABSC(M,N)=BSTABS(N)	EXA	870
	EXTC(M,N)=BSTEXT(N)	EXA	880
	GO TO 80	EXA	890
65	ABSC(M,N)=AVOABS(N)	EXA	900
	EXTC(M,N)=AVOEXT(N)	EXA	910
	GO TO 80	EXA	920
70	ABSC(M,N)=FVOABS(N)	EXA	930
	EXTC(M,N)=FVOEXT(N)	EXA	940
	GO TO 80	EXA	950
75	ABSC(M,N)=DMEABS(N)	EXA	960
	EXTC(M,N)=DMEEXT(N)	EXA	970
80	CONTINUE	EXA	980
85	CONTINUE	EXA	990
	WRITE (NOUT,95)	EXA	1000
C	WRITE (NOUT,100) (VX2(N),(EXTC(M,N),ABSC(M,N),M=1,4),N=1,40)	EXA	1010
	RETURN	EXA	1020
C		EXA	1030
	90 FORMAT (7H 1CH ,4I5)	EXA	1040

95 FORMAT (40H EXTINCTION AND ABSORPTION COEFFICIENTS)
100 FORMAT (F10.4,8F10.5)
END

EXA 1050
EXA 1060
EXA 1070

	SUBROUTINE PATH	PAT	10
C	MODIFIED FOR 5CM-1 BAND MODEL OPTION --- OCTOBER 1980	PAT	*11
C	REVISED 12 DEC 79	PAT	20
C	LOADS CUMULATIVE ABSORBER AMOUNTS INTO THE MATRIX WPATH FROM WLAY	PAT	30
C	FOR THE ATMOSPHERIC SLANT PATH	PAT	40
C	USED FOR RADIANCE CALCULATIONS	PAT	50
C		PAT	60
	DOUBLE PRECISION HZ,SEASN,VULCN	PAT	:61
	COMMON /CARD1/ MODEL, IHAZE, ITYPE, LEN, JP, IM, M1, M2, M3, ML, IEMISS, RO	PAT	70
1	,TBOUND, ISEASN, IVULCN, VIS, JBMOD	PAT	*80
	COMMON /CARD2/ H1, H2, ANGLE, RANGE, BETA, HMIN, RE	PAT	90
	COMMON /CARD3/ V1, V2, DV, AVW, CO, CW, W(15), E(15), CA, PI	PAT	100
	COMMON /CNTRL/ LENST, KMAX, M, IJ, J1, J2, JMIN, JEXTRA, IL, IKMAX, NLL, NP1	PAT	110
1	,IFIND, NL, IKLO	PAT	120
	COMMON /MDATA/ Z(34), P(7,34), T(7,34), WH(7,34), WO(7,34)	PAT	130
1	,SEASN(2), VULCN(5), VSB(9), HZ(15), HMIX(34)	PAT	140
	COMMON /DEVNUM/ NIN, NOUT, NSTOR, NPLT, NTBL	PAT	:141
	COMMON RELHUM(34), HSTOR(34), EH(15,34), ICH(4), VH(15), TX(15)	PAT	150
	COMMON WLAY(34,15), WPATH(68,15), TBBY(68), PRES(68)	PAT	*160
	COMMON ABSC(4,40), EXTC(4,40), VX2(40)	PAT	170
	IF (ITYPE.EQ.1) GO TO 60	PAT	180
	IF (J1.EQ.J2.AND.J1.EQ.JMIN) GO TO 60	PAT	190
	IF (ITYPE.EQ.2.AND.H1.EQ.H2) J2=J1	PAT	200
	IF (H2.GT.H1.AND.ANGLE.GT.90..AND.NP1.EQ.1) J1=J1-1	PAT	210
	IF (JEXTRA.EQ.1) J2=J2+1	PAT	220
	IF ((ITYPE.EQ.2).AND.(H1.GT.H2).AND.(LENST.EQ.1)) J2=J2-1	PAT	230
	IF (ITYPE.EQ.3) J2=NL	PAT	240
	IF(JP.EQ.0) WRITE (NOUT,70) J1,J2	PAT	:250
	IF(JP.EQ.0) WRITE (NOUT,75)	PAT	:260
	DO 5 IK=1,68	PAT	270
	TBBY(IK)=0.	PAT	280
	PRES(IK) = 0.	PAT	*281
	DO 5 K=1, KMAX	PAT	290
	WPATH(IK,K)=0.	PAT	300
5	CONTINUE	PAT	310
	LEN=0	PAT	320
	NLL=NL-1	PAT	330
	IL=J1+1	PAT	340
	IJ=IL+NLL	PAT	350
	DO 10 K=1, KMAX	PAT	360
	E(K)=0.	PAT	370
10	CONTINUE	PAT	380
	IF (ANGLE.GT.90.0) GO TO 15	PAT	390
	LEN=1.	PAT	400
	IL=J1-1	PAT	410
	HMIN=1.0E-6	PAT	420
	IJ=NL	PAT	430
15	CONTINUE	PAT	440
	DO 40 IK=1,68	PAT	450
	IF (LEN.EQ.0) IL=IL-1	PAT	460
	IF (LEN.EQ.1) IL=IL+1	PAT	470
	IJ=IJ-1	PAT	480
	IF (IL.EQ.0) GO TO 40	PAT	490

	DO 20 K=1,KMAX	PAT 500
C	CHECK FOR THE 5 CM-1 BAND MODEL OPTION.	PAT *501
C	WHEN USED, WPATH FOR THE FIRST THREE SPECIES	PAT *502
C	IS THE INCREMENTAL OPTICAL DEPTH FOR EACH LAYER.	PAT *503
	IF ((JBMOD.EQ.0) .OR. (K.GE.4)) GO TO 18	PAT *504
	WPATH(IK,K) = WLAY(IL,K)	PAT *505
	GO TO 20	PAT *506
18	CONTINUE	PAT *507
	W(K)=E(K)+WLAY(IL,K)	PAT 510
	WPATH(IK,K)=W(K)	PAT 520
20	CONTINUE	PAT 530
	IF (IL.LE.0.OR.IL.GE.NL) GO TO 25	PAT 540
	TBAR=(T(M,IL)+T(M,IL+1))*0.5	PAT 550
	IF(M1.GT.0.AND.M.LT.7) TBAR=(T(M1,IL)+T(M1,IL+1))*0.5	PAT 560
	PBAR = 0.5*(P(M,IL)+P(M,IL+1))	PAT *561
	IF(M1.GT.0 .AND. M.LT.7) PBAR = 0.5*(P(M1,IL)+P(M1,IL+1))	PAT *562
C		PAT 570
C	IF (JEXTRA.EQ.1) TBAR=(T(M,J1)+T(M,J1+1))*0.5	PAT 580
25	CONTINUE	PAT 590
	TBBY(IK)=TBAR	PAT 600
	PRES(IK) = PBAR	PAT *601
	DO 30 K=1,KMAX	PAT 610
	E(K)=W(K)	PAT 620
30	CONTINUE	PAT 630
	IF (ANGLE.LE.90.0.AND.IL.EQ.NLL) GO TO 50	PAT 640
	IF (ITYPE.EQ.3.AND.ANGLE.LE.90.0) GO TO 35	PAT 650
	IF (ITYPE.EQ.3.AND.LEN.EQ.1.AND.IL.EQ.J2) GO TO 50	PAT 660
	IF (ITYPE.EQ.2.AND.LENST.EQ.0.AND.IL.EQ.J2) GO TO 50	PAT 670
	IF (IL.EQ.JMIN.AND.HMIN.GT.0.0) LEN=1	PAT 680
	IF (IL.EQ.1.AND.HMIN.LE.0.0) GO TO 50	PAT 690
	IF (LEN.EQ.0) GO TO 35	PAT 700
	IF (IL.EQ.JMIN.AND.IJ.EQ.IL+NLL) IL=IL-1	PAT 710
	IF (ITYPE.EQ.2.AND.IL.EQ.J2) GO TO 50	PAT 720
35	CONTINUE	PAT 730
	IF(JP.EQ.0)WRITE (NOUT,80) IK,(WPATH(IK,K),K=1,8),WPATH(IK,10),	PAT :740
	1 WPATH(IK,11),TBBY(IK),PRES(IK)	PAT *750
40	CONTINUE	PAT 760
	IKMAX=68	PAT 770
	LEN=LENST	PAT 780
	IF(JP.NE.0) RETURN	PAT 790
	WRITE (NOUT,85)	PAT :800
	DO 45 IK=1,IKMAX	PAT 810
45	WRITE (NOUT,80) IK,(WPATH(IK,K),K=12,14)	PAT :820
	RETURN	PAT 830
50	CONTINUE	PAT 840
	IF(JP.EQ.0) WRITE (NOUT,80) IK,(WPATH(IK,K),K=1,8),WPATH(IK,10)	PAT :850
	1 ,WPATH(IK,11),TBBY(IK),PRES(IK)	PAT *860
	IKMAX=IK	PAT 870
	LEN=LENST	PAT 880
	IF(JP.NE.0) RETURN	PAT 890
	WRITE (NOUT,85)	PAT :900
	DO 55 IK=1,IKMAX	PAT 910
55	WRITE (NOUT,80) IK,(WPATH(IK,K),K=12,14)	PAT :920

RETURN	PAT 930
60 DO 65 K=1,KMAX	PAT 940
WPATH(1,K)=W(K)	PAT 950
65 CONTINUE	PAT 960
IF (M.EQ.0) J1=1	PAT 970
J2=J1	PAT 980
TBBY(1)=T(M,J1)	PAT 990
IF(M1.GT.0.AND.M.LT.7) TBBY(1)=T(M1,J1)	PAT 1000
PRES(1) = P(M,J1)	PAT*1001
IF (M1.GT.0 .AND. M.LT.7) PRES(1) = P(M1,J1)	PAT*1002
IKMAX=1	PAT 1010
IF(JP.EQ.0) WRITE (NOUT,70) J1,J2	PAT:1020
IF(JP.EQ.0) WRITE (NOUT,75)	PAT:1030
IK=1	PAT 1040
IKMAX=IK	PAT 1050
IF(JP.EQ.0) WRITE (NOUT,80) IK,(WPATH(IK,K),K=1,8),WPATH(IK,10),	PAT:1060
1 WPATH(IK,11),TBBY(IK),PRES(IK)	PAT:1070
HMIN=1.0E-6	PAT 1080
IF(JP.NE.0) RETURN	PAT 1090
WRITE (NOUT,85)	PAT:1100
WRITE (NOUT,80) IK,(WPATH(IK,K),K=12,14)	PAT:1110
RETURN	PAT 1120
	PAT 1130
	PAT 1140
C 70 FORMAT (9I3)	PAT 1150
75 FORMAT (//,20X,53H CUMULATIVE ABSORBER AMOUNTS FOR THE ATMOSPHERIC	PAT*1160
1 PATH,//9X,3HH2O,5X,4HCO2+,7X,2HO3,8X,2HN2,7X,5HH2O C,5X,5HMOL S,	PAT*1170
26X,4HAER1,5X,5HO3 UV,6X,5HH2O C,6X,4HHNO3,5X,4HTAVE,6X,4HPAVE)	PAT*1180
80 FORMAT (I5,1F10E10.3,0P2F10.3)	PAT 1190
85 FORMAT (//,2X,2HID,4X,4HAER2,7X,4HAER3,7X,4HAER4)	PAT 1200
END	

	SUBROUTINE TRANS	TRA 10
C	MODIFIED FOR 5CM-1 BAND MODEL OPTION — OCT. 1980	TRA *11
C	REVISED 16 JAN 1980	TRA 20
C	CALCULATES TRANSMITTANCE AND RADIANCE VALUES BETWEEN V1 AND V2	TRA 30
C	FOR A GIVEN ATMOSPHERIC SLANT PATH	TRA 40
C		TRA 50
	DOUBLE PRECISION HZ,SEASN,VULCN	TRA :51
	COMMON /CARD1/ MODEL,IHAZE,ITYPE,LEN,JP,IM,M1,M2,M3,ML,IEMISS,RO	TRA 60
1	,TBOUND,ISEASN,IVULCN,VIS,JBMOD	TRA *70
	COMMON /CARD2/ H1,H2,ANGLE,RANGE,BETA,HMIN,RE	TRA 80
	COMMON /CARD3/ V1,V2,DV,AVW,CO,CW,W(15),E(15),CA,PI	TRA 90
	COMMON /CNTRL/ LENST,KMAX,M,IJ,J1,J2,JMIN,JEXTRA,IL,IKMAX,NLL,NP1	TRA 100
1	,IFIND,NL,IKLO	TRA 110
	COMMON /MDATA/ Z(34),P(7,34),T(7,34),WH(7,34),WO(7,34)	TRA 120
1	,SEASN(2),VULCN(5),VSB(9),HZ(15),HMX(34)	TRA 130
	COMMON /DEVNUM/ NIN,NOUT,NSTOR,NPLT,NTBL	TRA :131
	COMMON RELHUM(34),HSTOR(34),EH(15,34),ICH(4),VH(15),TX(15)	TRA 140
	COMMON WLAY(34,15),WPATH(68,15),TBBY(68),PRES(68)	TRA *150
	COMMON ABSC(4,40),EXTC(4,40),VX2(40)	TRA 160
	COMMON /TRFWFO/ TR(67),FW(67),FO(67)	TRA 170
	COMMON /C4C5C8/ C4(133),C5(15),C8(102)	TRA 180
	COMMON /AER/ XX1,XX2,XX3,XX4,YY1,YY2,YY3,YY4	TRA 190
	DIMENSION ABS(15)	TRA 200
	FF(T,V)=1.190956E-16*(V**5)/(EXP(1.43879*V/T)-1.)	TRA 210
C	WATTS. CM-2 ST-1 MICRON-1	TRA 220
	RADMIN=1.0E+30	TRA :230
	RADMAX=0.	TRA 240
	VRMIN=0.	TRA 250
	VRMAX=0.	TRA 260
	SUMA=0.	TRA 270
	RADSUM=0.	TRA 280
	FACTOR=0.5	TRA 290
C	CALL C4DTA	TRA :300
C	CALL TRFN	TRA 310
C		TRA *311
C	CALL BMDATA WHEN USING THE 5CM-1 BAND MODEL OPTION	TRA *312
	IF (JBMOD.EQ.1) CALL BMDATA	TRA *313
	IV1=V1/5.	TRA 320
	IV2=V2/5.+99	TRA 330
	IV1=IV1*5	TRA 340
	IV2=IV2*5	TRA 350
	IF (IV1.LT.350) IV1=350	TRA 360
	IF (IV2.GT.50000) IV2=50000	TRA 370
	IF (DV.LT.5.) DV=5.	TRA :380
	IDV=DV	TRA 390
	IV=IV1-IDV	TRA 400
C	SET UP FILE NPLT FOR THE PRINT/PLOT OPTION	TRA :401
	ENDF = -1.	TRA :402
	WRITE (NPLT) V1,V2,DV	TRA :407
C		TRA :408
	ICOUNT=0	TRA 410
C	BEGINING OF TRANSMITTANCE CALCULATIONS	TRA 420
5	IV=IV+IDV	TRA 430

SUMV=0.	TRA 440
TLOLD=1.	TRA 450
TSOLD=1.	TRA 460
IKLO=1	TRA 470
IKHI = IKMAX	TRA *471
IF (IEMISS.EQ.0) IKHI = IKLO	TRA *480
DO 10 JK=1,11	TRA 490
ABS(JK)=0.	TRA 500
IF (JK.LE.3) ABS(JK)=-5.	TRA 510
10 CONTINUE	TRA 520
IF (JP.NE.0) GO TO 20	TRA 530
IF (ICOUNT.EQ.0) GO TO 15	TRA 540
IF (ICOUNT.EQ.50) GO TO 15	TRA 550
GO TO 20	TRA 560
15 ICOUNT=0	TRA 570
IF (IEMISS.EQ.0) WRITE (NOUT,255)	TRA :580
20 DO 25 K=1,KMAX	TRA 590
TX(K)=0.0	TRA 600
IF (K.LT.4) TX(K)=1.0	TRA 610
25 CONTINUE	TRA 620
ICOUNT=ICOUNT+1	TRA 630
SUM=0.0	TRA 640
V=IV	TRA 650
I=(IV-350)/5+1	TRA 660
C ***** HNO3	TRA 670
C HNO3 ABSORPTION CALCULATION	TRA 680
CALL HNO3 (V,ABS(11))	TRA 690
IF (IV.LT.670) GO TO 80	TRA 700
IF (IV.LE.3000) GO TO 45	TRA 710
C *** MOLECULAR SCATTERING	TRA 720
ABS(6)=V**4/(9.26799E+18-1.07123E+09*V**2)	TRA 730
IF (IV.LT.9200) GO TO 80	TRA 740
IF (IV.LT.13000) GO TO 65	TRA 750
C *** UV OZONE	TRA 760
IF (IV.LE.23400) GO TO 30	TRA 770
IF (IV.GE.27500) GO TO 35	TRA 780
GO TO 110	TRA 790
30 XI=(V-13000.0)/200.0+1.	TRA 800
GO TO 40	TRA 810
35 XI=(V-27500.0)/500.+57.	TRA 820
40 N=XI+1.001	TRA 830
XD=XI-FLOAT(N)	TRA 840
ABS(8)=C8(N)+XD*(C8(N)-C8(N-1))	TRA 850
IF (IV.GT.14500) GO TO 110	TRA 860
GO TO 65	TRA 870
C *** WATER VAPOR CONTINUUM 10 MICRON REGION	TRA 880
45 IF (IV.GT.1350) GO TO 50	TRA 890
ABS(5)=(4.18+5578.0*EXP(-7.87E-3*V))	TRA 900
GO TO 55	TRA 910
50 IF (IV.LT.2350) GO TO 60	TRA 920
C *** WATER VAPOR CONTINUUM 4 MICRON REGION	TRA 930
XI=(V-2350.0)/50.0+1.0	TRA 940
NH=XI+1.001	TRA 950

	XH=XI-FLOAT(NH)	TRA 960
	ABS(10)=C5(NH)+XH*(C5(NH)-C5(NH-1))	TRA 970
55	CONTINUE	TRA 980
	IF (IV.LE.1350.OR.IV.GT.2740) GO TO 80	TRA 990
C	*** NITROGEN CONTINUUM	TRA 1000
60	IF (IV.LT.2080) GO TO 80	TRA 1010
	K4=I-346	TRA 1020
	ABS(4)=C4(K4)	TRA 1030
	GO TO 80	TRA 1040
C	*** WATER VAPOUR	TRA 1050
65	IF (IV.LT.12800.AND.IV.GE.9875) GO TO 70	TRA 1060
	IF (IV.LE.14520.AND.IV.GE.13400) GO TO 75	TRA 1070
	GO TO 85	TRA 1080
70	I=I-135	TRA 1090
	GO TO 80	TRA 1100
75	I=I-255	TRA 1110
80	IF (JBMOD.NE.1) CALL C1DTA (ABS(1),I)	TRA*1120
85	CONTINUE	TRA 1130
C	*** UNIFORMLY MIXED GASES	TRA 1140
C		TRA*1141
C	SWITCH FOR THE 5CM-1 BAND MODEL	TRA*1142
	IF (JBMOD.EQ.1) GO TO 110	TRA*1143
	IF (IV.LT.8060.AND.IV.GE.500) GO TO 90	TRA 1150
	IF (IV.LT.13190.AND.IV.GT.12970) GO TO 95	TRA 1160
	GO TO 105	TRA 1170
90	J=I-30	TRA 1180
	GO TO 100	TRA 1190
95	J=(IV-12950)/5+1516	TRA 1200
100	CALL C2DTA (ABS(2),J)	TRA 1210
105	CONTINUE	TRA 1220
C	*** OZONE	TRA 1230
	IF (IV.LT.575.OR.IV.GT.3270) GO TO 110	TRA 1240
	L=I-45	TRA 1250
	CALL C3DTA (ABS(3),L)	TRA 1260
110	CONTINUE	TRA 1270
	CALL AEREXT (V)	TRA 1280
C	INITIAL CALL TO BMOD FOR EACH WAVENUMBER	TRA*1281
	IK = 0	TRA*1282
	IF (JBMOD.EQ.1) CALL BMOD(IK,V)	TRA*1283
C	START OF LAYER LOOP	TRA*1284
	DO 210 IK=IKLO,IKHI	TRA*1290
	IF (IEMISS.EQ.0) GO TO 120	TRA 1300
	DO 115 K=1,KMAX	TRA 1310
	W(K)=WPATH(IK,K)	TRA 1320
115	CONTINUE	TRA 1330
120	CONTINUE	TRA 1340
	SUM=0.	TRA 1350
	DO 125 JK=4,11	TRA 1360
	TX(JK)=ABS(JK)*W(JK)	TRA 1370
125	SUM=SUM+TX(JK)	TRA 1380
	TX(5)=TX(5)+TX(10)	TRA 1390
C		TRA*1391
C	SWITCH FOR THE 5CM-1 BAND MODEL OPTION	TRA*1392

IF (JBMOD.EQ.0) GO TO 128	TRA*1393
CALL BMOD(IK,V)	TRA*1394
C SKIP THE LOWTRAN5 PART FOR H2O, CO2+, AND -O3	TRA*1395
GO TO 185	TRA*1396
128 CONTINUE	TRA*1397
TX(1)=1.0	TRA 1400
K1=1	TRA 1410
IF (W(1).LT.1.0E-20) GO TO 145	TRA 1420
IF (ABS(1).LE.-5.0) GO TO 145	TRA 1430
WS1=ALOG10(W(1))+ABS(1)	TRA 1440
IF (WS1.LT.-2.3468) TX(1)=1.-.087787*EXP(1.855595*WS1)	TRA 1450
IF (WS1.LT.-2.3468) GO TO 145	TRA 1460
IF (WS1.GT.3.5682) GO TO 140	TRA 1470
IF (WS1.GT.2.0) K1=40	TRA 1480
DO 130 K=K1,67	TRA 1490
IF (WS1.LE.FW(K)) GO TO 135	TRA 1500
130 CONTINUE	TRA 1510
135 TX(1)=TR(K)+(TR(K-1)-TR(K))*(FW(K)-WS1)/(FW(K)-FW(K-1))	TRA 1520
GO TO 145	TRA 1530
140 TX(1)=0.0	TRA 1540
145 CONTINUE	TRA 1550
TX(2)=1.0	TRA 1560
K1=1	TRA 1570
IF (W(2).LT.1.0E-20) GO TO 165	TRA 1580
IF (ABS(2).LE.-5.0) GO TO 165	TRA 1590
WS2=ALOG10(W(2))+ABS(2)	TRA 1600
IF (WS2.LT.-2.3468) TX(2)=1.-.087787*EXP(1.855595*WS2)	TRA 1610
IF (WS2.LT.-2.3468) GO TO 165	TRA 1620
IF (WS2.GT.3.5682) GO TO 160	TRA 1630
IF (WS2.GT.2.0) K1=40	TRA 1640
DO 150 K=K1,67	TRA 1650
IF (WS2.LE.FW(K)) GO TO 155	TRA 1660
150 CONTINUE	TRA 1670
155 TX(2)=TR(K)+(TR(K-1)-TR(K))*(FW(K)-WS2)/(FW(K)-FW(K-1))	TRA 1680
GO TO 165	TRA 1690
160 TX(2)=0.0	TRA 1700
165 CONTINUE	TRA 1710
TX(3)=1.	TRA 1720
K1=1	TRA 1730
IF (W(3).LT.1.0E-20) GO TO 185	TRA 1740
IF (ABS(3).LE.-5.0) GO TO 185	TRA 1750
WS3=ALOG10(W(3))+ABS(3)	TRA 1760
IF (WS3.LT.-1.6778) TX(3)=1.-.055194*EXP(2.367853*WS3)	TRA 1770
IF (WS3.LT.-1.6778) GO TO 185	TRA 1780
IF (WS3.GT.3.9345) GO TO 180	TRA 1790
IF (WS3.GT.1.5) K1=36	TRA 1800
DO 170 K=K1,67	TRA 1810
IF (WS3.LE.FO(K)) GO TO 175	TRA 1820
170 CONTINUE	TRA 1830
175 TX(3)=TR(K)-(TR(K)-TR(K-1))*(FO(K)-WS3)/(FO(K)-FO(K-1))	TRA 1840
GO TO 185	TRA 1850
180 TX(3)=0.0	TRA 1860
185 CONTINUE	TRA 1870

TX(10)=YY1*W(7)+YY2*W(12)+YY3*W(13)+YY4*W(14)	TRA 1880
TX(7)=XX1*W(7)+XX2*W(12)+XX3*W(13)+XX4*W(14)	TRA 1890
SUM=SUM+TX(7)	TRA 1900
TX(9)=SUM	TRA 1910
DO 205 K=4,KMAX	TRA 1920
IF (TX(K).EQ.0.0) GO TO 195	TRA 1930
IF (TX(K).LE.0.1) GO TO 190	TRA 1940
IF (TX(K).GT.20.) GO TO 200	TRA 1950
TX(K)=EXP(-TX(K))	TRA 1960
GO TO 205	TRA 1970
190 TX(K)=1.0-TX(K)+0.5*TX(K)*TX(K)	TRA 1980
GO TO 205	TRA 1990
195 TX(K)=1.0	TRA 2000
GO TO 205	TRA 2010
200 TX(K)=0.	TRA 2020
205 CONTINUE	TRA 2030
TX(9)=TX(1)*TX(2)*TX(3)*TX(9)	TRA 2040
IF (IV.GE.13000) TX(3)=TX(8)	TRA 2050
ALAM=1.0E+04/V	TRA 2060
IF (IEMISS.EQ.0) GO TO 220	TRA 2070
BBIK=FF(TBBY(IK),V)	TRA 2080
TLNEW=(TX(9)*TX(10))/(TX(7)*TX(6))	TRA 2090
TSNEW=(TX(7)*TX(6))/TX(10)	TRA 2100
DTAU=TLOLD-TLNEW	TRA 2110
IF (DTAU.LT.1.0E-5.AND.TLNEW.LT.1.0E-5) GO TO 215	TRA 2120
SUMV=SUMV+0.5*BBIK*DTAU*(TSOLD+TSNEW)	TRA 2130
TLOLD=TLNEW	TRA 2140
TSOLD=TSNEW	TRA 2150
210 CONTINUE	TRA 2160
215 CONTINUE	TRA 2170
TAUG=0	TRA 2180
C ***** BLACKBODY LOCATED AT ANY H2 *****	TRA:2181
C IF (HMIN.LE.0.0.AND.IL.EQ.1) TAUG=TX(9)	TRA:2190
IF (TBOUND.LE.0.0) GO TO 218	TRA:2191
TAUG = TX(9)	TRA:2192
T1=TBOUND	TRA 2200
BBG = 0.0	TRA:2201
ARG = 1.43879*V/T1	TRA:2202
IF (ARG.LT.50.) BBG=FF(T1,V)*TAUG	TRA:2210
C IF (HMIN.LE.0.0) SUMV=SUMV+BBG	TRA:2220
SUMV = SUMV + BBG	TRA:2221
218 SUMVV=SUMV	TRA:2230
IF (IV.GT.IV1) FACTOR=1.0	TRA 2240
IF (IV.GE.IV2) FACTOR=0.5	TRA 2250
SUMV=(1.0E+04/V**2)*SUMV	TRA 2260
RADSUM=RADSUM+DV*FACTOR*SUMV	TRA 2270
IF (JP.EQ.0) WRITE (NOUT,265) V,ALAM,SUMV,SUMVV,RADSUM,TX(9)	TRA:2280
IF (SUMV.GE.RADMAX) VRMAX=V	TRA 2290
IF (SUMV.GE.RADMAX) RADMAX=SUMV	TRA 2300
IF (SUMV.LE.RADMIN) VRMIN=V	TRA 2310
IF (SUMV.LE.RADMIN) RADMIN=SUMV	TRA 2320
C WRITE (NSTOR,235) V,ALAM,SUMV,SUMVV,RADSUM,TX(9)	TRA:2330
WRITE (NPLT) SUMV,TX(9)	TRA:2331

220	TX(10)=1.-TX(10)	TRA 2340
	AB=1.-TX(9)	TRA 2350
	IF (IV.EQ.IV1.OR.IV.EQ.IV2) AB=0.5*AB	TRA 2360
	SUMA=SUMA+AB*DV	TRA 2370
	IF (IEMISS.EQ.1) GO TO 225	TRA 2380
	IF (JP.EQ.0) WRITE (NOUT,260) IV,ALAM, TX(9), (TX(K),K=1,7),TX(10),	TRA:2390
	1 SUMA, TX(11)	TRA:2400
C	IF(JP.EQ.0) WRITE (NOUT,483) IV,ALAM,EXTINC,ABSORB	TRA:2410
C	WRITE (NSTOR,240) IV,ALAM, TX(9), (TX(K),K=1,7),TX(10),TX(11)	TRA:2420
	WRITE (NPLT) SUMV, TX(9)	TRA:2421
225	CONTINUE	TRA 2430
	IF (IV.GE.IV2) GO TO 230	TRA 2440
	GO TO 5	TRA 2450
230	AB=1.0-SUMA/FLOAT(IV-IV1)	TRA 2460
	WRITE (NOUT,245) IV1,IV,SUMA,AB	TRA:2470
	IF (IEMISS.EQ.1) WRITE (NOUT,250) RADSUM,VRMIN,RADMIN,VRMAX,RADMAX	TRA:2480
	WRITE (NPLT) ENDF,ENDF	TRA:2481
	RETURN	TRA 2490
C		TRA 2500
235	FORMAT (F8.1,F13.6,3E13.5,F13.6)	TRA 2510
240	FORMAT(I6,11F9.4,5X,F9.4)	TRA 2520
245	FORMAT (27H INTEGRATED ABSORPTION FROM,15,3H TO,15,7H CM-1 =,F10.2	TRA 2530
	1,23HAVERAGE TRANSMITTANCE =,F6.4)	TRA 2540
250	FORMAT (22H INTEGRATED RADIANCE =,E12.5,13HWATT CM -2 SR,/7H RADMIT	TRA 2550
	1N,F12.3,E12.5,/,8H RADMAX ,F12.3,E12.5)	TRA 2560
255	FORMAT (1H1,/10X,32H FREQ WAVELENGTH TOTAL H2O,5X,4HCO2+,5X,	TRA 2570
	164HOZONE N2 CONT H2O CONT MOL SCAT AEROSOL AEROSOL INTEGRATE	TRA 2580
	2D,12H NITRIC ACID/11X,14H CM-1 MICRONS,8(4X,5HTRANS),4X,20H ABS	TRA 2590
	3 ABSORPTION ,4X,5HTRANS)	TRA 2600
260	FORMAT (10X,I6,10F9.4,F14.4,F9.4)	TRA 2610
265	FORMAT (30X,F8.1,F13.6,3E13.5,F13.6)	TRA 2620
	END	TRA 2630

C	SUBROUTINE AEREXT (V)	ATR	10
C		ATR	20
C	INTERPOLATES AEROSOL EXTINCTION AND ABSORPTION COEFFICIENT	ATR	30
C	FOR THE WAVENUMBER, V.	ATR	40
		ATR	50
	DOUBLE PRECISION HZ,SEASN,VULCN	ATR	:51
	COMMON /CARD1/ MODEL,IHAZE,ITYPE,LEN,JP,IM,M1,M2,M3,ML,IEMISS,RO	ATR	60
	1 ,TBOUND,ISEASN,IVULCN,VIS,JBMOD	ATR	*70
	COMMON /CARD2/ H1,H2,ANGLE,RANGE,BETA,HMIN,RE	ATR	80
	COMMON /CARD3/ V1,V2,DV,AVW,CO,CW,W(15),E(15),CA,PI	ATR	90
	COMMON /CNTRL/ LENST,KMAX,M,IJ,J1,J2,JMIN,JEXTRA,IL,IKMAX,NLL,NP1	ATR	100
	1,IFIND,NL,IKLO	ATR	110
	COMMON /MDATA/ Z(34),P(7,34),T(7,34),WH(7,34),WO(7,34)	ATR	120
	1 ,SEASN(2),VULCN(5),VSB(9),HZ(15),HMX(34)	ATR	130
	COMMON RELHUM(34),HSTOR(34),EH(15,34),ICH(4),VH(15),TX(15)	ATR	140
	COMMON WLAY(34,15),WPATH(68,15),TBBY(68),PRES(68)	ATR	*150
	COMMON ABSC(4,40),EXTC(4,40),VX2(40)	ATR	160
	COMMON /AER/ EXTV(4),ABSV(4)	ATR	170
	DO 5 I=1,4	ATR	180
	EXTV(I)=0.	ATR	190
	ABSV(I)=0.	ATR	200
	5 CONTINUE	ATR	210
	IF (IHAZE.EQ.0) RETURN	ATR	220
	ALAM=1.0E+4/V	ATR	230
	DO 10 N=1,40	ATR	240
	XD=ALAM-VX2(N)	ATR	250
	IF (XD) 15,10,10	ATR	260
	10 CONTINUE	ATR	270
	N=40	ATR	280
	15 VXD=VX2(N)-VX2(N-1)	ATR	290
	DO 20 I=1,4	ATR	300
	EXTV(I)=(EXTC(I,N)-EXTC(I,N-1))*XD/VXD+EXTC(I,N)	ATR	310
	ABSV(I)=(ABSC(I,N)-ABSC(I,N-1))*XD/VXD+ABSC(I,N)	ATR	320
	20 CONTINUE	ATR	330
	RETURN	ATR	340
	END	ATR	350

	SUBROUTINE HNO3 (V,HABS)	HNO	10
C		HNO	20
C	HNO3 STATISTICAL BAND PARAMETERS	HNO	30
C		HNO	40
	DIMENSION H1(15), H2(16), H3(13)	HNO	50
C	ARRAY H1 CONTAINS HNO3 ABS, COEF(CM-1ATM-1) FROM 850 TO 920 CM-1	HNO	60
	DATA H1/2.197,3.911,6.154,8.150,9.217,9.461,11.56,11.10,11.17,12.4	HNO	70
	10,10.49,7.509,6.136,4.899,2.866/	HNO	80
C	ARRAY H2 CONTAINS HNO3 ABS, COEF(CM-1ATM-1) FROM 1275 TO 1350 CM-1	HNO	90
	DATA H2/2.828,4.611,6.755,8.759,10.51,13.74,18.00,21.51,23.09,21.6	HNO	100
	18,21.32,16.82,16.42,17.87,14.86,8.716/	HNO	110
C	ARRAY H3 CONTAINS HNO3 ABS, COEF(CM-1ATM-1) FROM 1675 TO 1735 CM-1	HNO	120
	DATA H3/5.003,8.803,14.12,19.83,23.31,23.58,23.22,21.09,26.99,25.8	HNO	130
	14,24.79,17.68,9.420/	HNO	140
	HABS=0.	HNO	150
	IF (V.GE.850.0.AND.V.LE.920.0) GO TO 5	HNO	160
	IF (V.GE.1275.0.AND.V.LE.1350.0) GO TO 10	HNO	170
	IF (V.GE.1675.0.AND.V.LE.1735.0) GO TO 15	HNO	180
	RETURN	HNO	190
	5 I=(V-845.)/5.	HNO	200
	HABS=H1(I)	HNO	210
	RETURN	HNO	220
	10 I=(V-1270.)/5.	HNO	230
	HABS=H2(I)	HNO	240
	RETURN	HNO	250
	15 I=(V-1670.)/5.	HNO	260
	HABS=H3(I)	HNO	270
	RETURN	HNO	280
	END	HNO	290

	SUBROUTINE BMDATA	BMD 10
C		BMD 20
C	DEVELOPED OCTOBER 1980	BMD 30
C	BMDATA MAKES THE INITIAL TAPE READ AND CALULATES	BMD 40
C	WAVENUMBER-INDEPENDENT PARAMETERS FOR USE BY BMOD	BMD 50
C	BMDATA IS CALLED BY TRANS	BMD 60
	DOUBLE PRECISION HZ,SEASN,VULCN	BMD 70
	COMMON /CARD1/ MODEL,IHAZE,ITYPE,LEN,JP,IM,M1,M2,M3,ML,IEMISS,RO	BMD 80
1	,TBOUND,ISEASN,IVULCN,VIS,JBMOD	BMD 90
	COMMON /CARD2/ H1,H2,ANGLE,RANGE,BETA,HMIN,RE	BMD 100
	COMMON /CARD3/ V1,V2,DV,AVW,CO,CW,W(15),E(15),CA,PI	BMD 110
	COMMON /CARD4/ IXY	BMD 120
	COMMON /CNTRL/ LENST,KMAX,M,IJ,J1,J2,JMIN,JEXTRA,IL,IKMAX,NLL,NP1	BMD 130
1	,IFIND,NL,IKLO	BMD 140
	COMMON /MDATA/ Z(34),P(7,34),T(7,34),WH(7,34),WO(7,34)	BMD 150
1	,SEASN(2),VULCN(5),VSB(9),HZ(15),HMX(34)	BMD 160
	COMMON RELHUM(34),HSTOR(34),EH(15,34),ICH(4),VH(15),TX(15)	BMD 170
	COMMON WLAY(34,15),WPATH(68,15),TBBY(68),PRES(68)	BMD 180
	COMMON ABSC(4,40),EXTC(4,40),VX2(40)	BMD 190
	COMMON /DEVNUM/ NIN,NOUT,NSTOR,NPLT,NTBL	BMD 200
	COMMON /BMDCOM/ SD(5,4,20),OD(5,4,20),ZMWT(4,20),ALFO(4,20),	BMD 210
1	WT(68),JJ(68),IW,NTEMP,TBAND(5)	BMD 220
	DIMENSION UNITS(3)	BMD 230
	DATA KSPEC/4/	BMD 240
	DATA UNITS/.0125E5,1.0E5,1.0/	BMD 250
C		BMD 260
C	BAND MODEL PARAMETERS ARE STORED ON A BINARY TAPE (FILE NTBL)	BMD 270
C	IN BLOCKS OF 100CM-1.	BMD 280
C	KSPEC = 1 H2O	BMD 290
C	= 2 UNIFORMLY MIXED GASES	BMD 300
C	= 3 O3	BMD 310
C	= 4 TAIL CONTRIBUTIONS FROM H2O AND CO2 BANDS	BMD 320
C		BMD 330
	IKLO = 1	BMD 340
	NTBL = 12	BMD 350
C		BMD 360
C	READ THE FIRST BLOCK OF BAND MODEL PARAMETERS FROM THE TAPE	BMD 370
C	REWIND TAPE FILE AND READ THE TAPE HEADER	BMD 380
	REWIND NTBL	BMD 390
	READ (NTBL) VA,VB,NV,NTEMP,(TBAND(N),N=1,NTEMP)	BMD 400
C		BMD 410
C	CHECK WAVENUMBER RANGE ON THE TAPE	BMD 420
C		BMD 430
	IF (V1.LE.VB .AND. V2.GE.VA) GO TO 10	BMD 440
	WRITE (NOUT,902) V1,V2,VA,VB	BMD 450
	STOP	BMD 460
10	IF (V1.GE.VA) GO TO 15	BMD 470
	WRITE (NOUT,904) V1,VA	BMD 480
	V1 = VA	BMD 490
15	IF (V2.LE.VB) GO TO 20	BMD 500
	WRITE (NOUT,906) V2,VB	BMD 510
	V2 = VB	BMD 520
C		BMD 530

C	ADVANCE THE TAPE TO READ THE FIRST REQUIRED DATA BLOCK	BMD 540
20	IDV = INT(V1-VA+.00001)	BMD 550
	JBLOCK = IDV/100 + 1	BMD 560
	DO 30 J = 1,JBLOCK	BMD 570
	READ (NTBL) (((SD(IT,K,JV),OD(IT,K,JV),IT=1,NTEMP),ALFO(K,JV),	BMD 580
1	ZMWT(K,JV),K=1,KSPEC),JV=1,20)	BMD 590
30	CONTINUE	BMD 600
C	SET WAVENUMBER COUNTER TO ONE LESS THAN ITS PROPER VALUE FOR V1	BMD 610
	IW = (IDV-100*(JBLOCK-1))/5	BMD 620
C		BMD 630
C	RETURN WHEN ONLY THE SPECTRAL INTERVAL HAS BEEN CHANGED.	BMD 640
	IF (IXY.EQ.1) RETURN	BMD 650
C		BMD 660
C	WPATH MUST BE SPECIFIED WHEN THE ENTIRE PATH IS WITHIN ONE LAYER	BMD 670
	IF (ITYPE.EQ.1) GO TO 40	BMD 680
	IF (J1.EQ.J2 .AND. H1.EQ.H2) GO TO 40	BMD 690
	GO TO 50	BMD 700
40	DO 45 K=1,3	BMD 710
45	WPATH(1,K) = W(K)	BMD 720
C		BMD 730
C	CONVERT TO CONSISTENT UNITS FOR OPTICAL PATH--WPATH (CM AMAGATS)	BMD 740
C		BMD 750
50	DO 60 K = 1,3	BMD 760
	DO 60 IK = IKLO,IKMAX	BMD 770
60	WPATH(IK,K) = WPATH(IK,K)*UNITS(K)	BMD 780
C		BMD 790
C	CALCULATE WAVENUMBER-INDEPENDENT QUANTITIES	BMD 800
	DO 90 IK = IKLO,IKMAX	BMD 810
	TT = TBBY(IK)	BMD 820
	WT(IK) = SQRT(TT/273.15)	BMD 830
	PRES(IK) = PRES(IK)/1013.	BMD 840
C	SET TEMPERATURE INTERPOLATION INDICES FOR EACH LAYER	BMD 850
	DO 80 J = 1,NTEMP	BMD 860
	IF (TT.GT.TBAND(J)) GO TO 80	BMD 870
	JJ(IK) = J	BMD 880
	GO TO 90	BMD 890
80	CONTINUE	BMD 900
	JJ(IK) = NTEMP + 1	BMD 910
90	CONTINUE	BMD 920
	RETURN	BMD 930
902	FORMAT (40H TAPE OUT OF RANGE---REQUESTED (V1,V2) =,	BMD 940
1	2F8.0,5X,14HTAPE (VA,VB) =,2F8.0,5X,	BMD 950
2	25HPROGRAM STOPPED IN BMDATA)	BMD 960
904	FORMAT (15H LOWER LIMIT OF,F8.0,	BMD 970
1	29H CM-1 IS TOO SMALL---RESET TO,F8.0,5H CM-1)	BMD 980
906	FORMAT (15H UPPER LIMIT OF,F8.0,	BMD 990
1	29H CM-1 IS TOO LARGE---RESET TO,F8.0,5H CM-1)	BMD 1000
	END	BMD 1010

	SUBROUTINE BMOD(IK,V)	BMO	10
C	WRITTEN SEPT 1980	BMO	20
C	THIS SUBROUTINE CALCULATES THE TRANSMITTANCE AT A SPECTRAL	BMO	30
C	RESOLUTION OF 5 CM-1 FOR THE FOUR "SPECIES"	BMO	40
C	K = 1 H2O	BMO	50
C	2 WELL MIXED GASES---CO2,N2O,CH4,CO,O2	BMO	60
C	3 O3	BMO	70
C	4 H2O AND CO2 TAILS	BMO	80
C		BMO	90
	DOUBLE PRECISION HZ,SEASN,VULCN	BMO	100
	COMMON /CARD1/ MODEL,IHAZE,ITYPE,LEN,JP,IM,M1,M2,M3,ML,IEMISS,RO	BMO	110
1	,TBOUND,ISEASN,IVULCN,VIS,JBMOD	BMO	120
	COMMON /CARD2/ H1,H2,ANGLE,RANGE,BETA,HMIN,RE	BMO	130
	COMMON /CARD3/ V1,V2,DV,AVW,CO,CW,W(15),E(15),CA,PI	BMO	140
	COMMON /CNTRL/ LENST,KMAX,M,IJ,J1,J2,JMIN,JEXTRA,IL,IKMAX,NLL,NP1	BMO	150
1	,IFIND,NL,IKLO	BMO	160
	COMMON /MDATA/ Z(34),P(7,34),T(7,34),WH(7,34),WO(7,34)	BMO	170
1	,SEASN(2),VULCN(5),VSB(9),HZ(15),HMX(34)	BMO	180
	COMMON RELHUM(34),HSTOR(34),EH(15,34),ICH(4),VH(15),TX(15)	BMO	190
	COMMON WLAY(34,15),WPATH(68,15),TBBY(68),PRES(68)	BMO	200
	COMMON ABSC(4,40),EXTC(4,40),VX2(40)	BMO	210
	COMMON /DEVNUM/ NIN,NOUT,NSTOR,NPLT,NTBL	BMO	220
	COMMON /BMDCOM/ SD(5,4,20),OD(5,4,20),ZMWT(4,20),ALFO(4,20),	BMO	230
1	WT(68),JJ(68),IW,NTEMP,TBAND(5)	BMO	240
	DIMENSION S1(4),S2(4),S3(4),XS(4),FAC2(4),TRANS(5)	BMO	250
	DATA KSPEC/4/	BMO	260
C		BMO	270
C		BMO	280
C	IK=0 IS THE INITIAL CALL FOR EACH WAVENUMBER AND IS MADE PRIOR	BMO	290
C	TO THE LOOP OVER LAYERS	BMO	300
	IF (IK.GT.0) GO TO 40	BMO	310
C	IW IS THE COUNTER FOR READING THE DATA TAPES IN BLOCKS OF 20	BMO	320
	IW = IW + 1	BMO	330
	IF (IW.LE.20) GO TO 10	BMO	340
C	IF NECESSARY, READ THE NEXT 100 CM-1 BLOCK FROM THE TAPE	BMO	350
	READ (NTBL) (((SD(N,K,JV),OD(N,K,JV),N=1,NTEMP),ALFO(K,JV),	BMO	360
1	ZMWT(K,JV),K=1,KSPEC),JV=1,20)	BMO	370
	IW = 1	BMO	380
C	ZERO QUANTITIES FOR THE LAYER LOOP	BMO	390
10	DO 20 K = 1,KSPEC	BMO	400
	S1(K) = 0.0	BMO	410
	S2(K) = 0.0	BMO	420
	S3(K) = 0.0	BMO	430
	XS(K) = 0.0	BMO	440
	FAC2(K) = 0.0	BMO	450
20	IF (ZMWT(K,IW).GT.0.0) FAC2(K) = V*5.94E-6/SQRT(ZMWT(K,IW))	BMO	460
	RETURN	BMO	470
C		BMO	480
C		BMO	490
C		BMO	500
C	*** START CALCULATION OF MOLECULAR TRANSMITTANCE ***	BMO	510
C		BMO	520
	40 LMIN = IK	BMO	530

	LMAX = IK	BMO 540
C	FOR CALCULATING TAU ONLY, LOOP OVER ALL LAYERS -- LMAX = IKMAX	BMO 550
C	FOR RADIATION CALC'S, LAYER LOOP IS ALREADY IN TRANS - LMAX = IK	BMO 560
	IF (IEMISS.EQ.0) LMAX = IKMAX	BMO 570
	TRANS(5) = 1.0	BMO 580
C		BMO 590
C		BMO 600
C	START SPECIES LOOP	BMO 610
C	THE 4'TH SPECIES ARE H2O AND CO2 TAIL CONTRIBUTIONS	BMO 620
	DO 90 K = 1,KSPEC	BMO 630
	TRANS(K) = 1.0	BMO 640
C	CHECK FOR MINIMUM ABSORPTION FOR EACH SPECIES AT THIS WAVENUMBER	BMO 650
	IF ((SD(1,K,IW).LT.1.0E-14).AND.(K.NE.4))GO TO 90	BMO 660
C		BMO 670
C	START LAYER LOOP	BMO 680
	DO 60 L = LMIN,LMAX	BMO 690
	JT = JJ(L)	BMO 700
	TT = TBBY(L)	BMO 710
	CALL CALC(JT,NTEMP,TT,TBAND,SD(1,K,IW),OD(1,K,IW),ABSM,DINV)	BMO 720
	IF (K.NE.4) GO TO 50	BMO 730
C	LINE WING CONTINUUM COMPONENTS (K=4) ARE CALCULATED SEPARATELY	BMO 740
C	ABSM IS FOR THE CO2 TAIL---DINV IS FOR THE H2O TAIL	BMO 750
	S1(K) = S1(K) + DINV*WPATH(L,1)*PRES(L)	BMO 760
	S2(K) = S2(K) + ABSM*WPATH(L,2)*PRES(L)	BMO 770
	GO TO 60	BMO 780
C	REGULAR MOLECULAR CALCULATION (K=1,2,3)	BMO 790
	50 CONTINUE	BMO 800
C	(FAC1,XS(K)) = (INCREMENTAL,TOTAL) OPTICAL DEPTH	BMO 810
	FAC1 = WPATH(L,K)*ABSM	BMO 820
	IF(FAC1.LT.1.0E-4) GO TO 60	BMO 830
	XS(K) = XS(K) + FAC1	BMO 840
	FAC3 = FAC1*DINV	BMO 850
C	MEAN LORENTZ HALF WIDTH	BMO 860
	S1(K) = S1(K) + FAC3*PRES(L)/WT(L)	BMO 870
C	MEAN DOPLER HALF WIDTH	BMO 880
	S2(K) = S2(K) + FAC3*WT(L)	BMO 890
C	MEAN LINE DENSITY	BMO 900
	S3(K) = S3(K)+FAC3	BMO 910
	60 CONTINUE	BMO 920
C	CALCULATE EQUIVALENT WIDTH AND TRANSMITTANCE	BMO 930
	IF((K.EQ.KSPEC).OR.(XS(K).LT.1.0E-3)) GO TO 90	BMO 940
	ACBAR = ALFO(K,IW)*S1(K)/XS(K)	BMO 950
	ADBAR = FAC2(K)*S2(K)/XS(K)	BMO 960
	ODBAR = S3(K)/XS(K)	BMO 970
	CALL EWIDTH(XS(K),ACBAR,ADBAR,ODBAR,DV,WSL,TRANS(K))	BMO 980
	IF(TRANS(K).LT.1.0) GO TO 90	BMO 990
	WSL = WSL/DV	BMO 1000
	ANLINE = ODBAR*DV	BMO 1010
	TRANS(K) = (1.0-WSL)**ANLINE	BMO 1020
C	END OF SPECIES LOOP	BMO 1030
	90 CONTINUE	BMO 1040
C		BMO 1050
C	CONTRIBUTION OF H2O AND CO2 TAILS	BMO 1060

	IF (S1(4).GT.50.) S1(4) = 50.	BMO 1070
	TRANS(4) = EXP(-S1(4))	BMO 1080
	IF (S2(4).GE.50.) S2(4) = 50.	BMO 1090
	TRANS(5) = EXP(-S2(4))	BMO 1100
C	MULTIPLY IN TAIL CONTRIBUTIONS AND LOAD RESULTANT TRANSMITTANCES	BMO 1110
C	INTO THE PROPER LOWTRAN5 ARRAYS	BMO 1120
	TX(1) = TRANS(1)*TRANS(4)	BMO 1130
	TX(2) = TRANS(2)*TRANS(5)	BMO 1140
	TX(3) = TRANS(3)	BMO 1150
	RETURN	BMO 1160
	END	BMO 1170

	SUBROUTINE CALC(JT,NTEMP,TEMP,TBAND,X1,X2,ABSM,DINV)	CAL	10
C		CAL	20
C	CALC INTERPOLATES THE BAND MODEL PARAMETERS OVER TEMPERATURE TO	CAL	30
C	OBTAIN S/D AND 1/D FOR A GIVEN TEMPERATURE.	CAL	40
C	IT IS ASSUMED THAT THE BAND MODEL PARAMETERS ARE TABULATED FOR	CAL	50
C	THE WAVENUMBERS OF THE CALCULATION.	CAL	60
C		CAL	70
C	JT = INDEX FOR THE FIRST TBAND LARGER THAN TEMP	CAL	80
C	NTEMP = NUMBER OF TEMPERATURE POINTS FOR X1 AND X2	CAL	90
C	TBAND = TEMPERATURES FOR TABULATED BAND MODEL PARAMETERS	CAL	100
C	TEMP = TEMPERATURE FOR WHICH ABSM & DINV ARE NEEDED	CAL	110
C	X1 = S/D (ABSORPTION COEFFICIENT) FROM BMOD	CAL	120
C	X2 = 1/D (LINE SPACING) OR S/D FOR MIXED GASES' TAILS	CAL	130
C	ABSM = RETURNED VALUE OF S/D FOR INPUT TEMP	CAL	140
C	DINV = RETURNED VALUE OF 1/D FOR INPUT TEMP	CAL	150
C		CAL	160
	DIMENSION X1(1),X2(1),TBAND(1)	CAL	170
C		CAL	180
C***	LINEAR INTERPOLATING FUNCTION	CAL	190
	F1(Y1,Y2,T1,T2,T3) = Y1 + (Y2-Y1)*(T3-T1)/(T2-T1)	CAL	200
C		CAL	210
C		CAL	220
	IF (JT.GT.NTEMP) GO TO 30	CAL	230
	IF (JT.GT.1) GO TO 20	CAL	240
	ABSM = X1(1)	CAL	250
	DINV = X2(1)	CAL	260
	RETURN	CAL	270
20	JT1 = JT - 1	CAL	280
	ABSM = F1(X1(JT1),X1(JT),TBAND(JT1),TBAND(JT),TEMP)	CAL	290
	DINV = F1(X2(JT1),X2(JT),TBAND(JT1),TBAND(JT),TEMP)	CAL	300
	RETURN	CAL	310
30	ABSM = X1(NTEMP)	CAL	320
	DINV = X2(NTEMP)	CAL	330
	RETURN	CAL	340
	END	CAL	350

BLOCK DATA	BLK	10
DOUBLE PRECISION HZ,SEASN,VULCN	BLK	20
COMMON /CARD1/ MODEL, IHAZE, ITYPE, LEN, JP, IM, M1, M2, M3, ML, IEMISS, RO	BLK	30
1, TBOUND, ISEASN, IVULCN, VIS, JEMOD	BLK	40
COMMON /CARD2/ H1, H2, ANGLE, RANGE, BETA, HMIN, RE	BLK	50
COMMON /CARD3/ V1, V2, DV, AVW, CO, CW, W(15), E(15), CA, PI	BLK	60
COMMON /CNTRL/ LENST, KMAX, M, IJ, J1, J2, JMIN, JEXTRA, IL, IKMAX, NLL, NP1	BLK	70
1, IFIND, NL, IKLO	BLK	80
COMMON /MDATA/ Z(34), P(7, 34), T(7, 34), WH(7, 34), WO(7, 34)	BLK	90
1, SEASN(2), VULCN(5), VSB(9), HZ(15), HMX(34)	BLK	100
COMMON RELHUM(34), HSTOR(34), EH(15, 34), ICH(4), VH(15), TX(15)	BLK	110
COMMON WLAY(34, 15), WPATH(68, 15), TBBY(68), PRES(68)	BLK	120
COMMON ABSC(4, 40), EXTC(4, 40), VX22(40)	BLK	130
COMMON /PRFDA/ ZHT(34), HZ2K(34, 5), FAW150(34), FAW123(34), SPSU50(34),	BLK	140
1SPSU23(34), BASTFW(34), VUMOFW(34), HIVUFW(34), EXVUFW(34), BASTSS(34),	BLK	150
2VUMOSS(34), HIVUSS(34), EXVUSS(34), UPNATM(34), VUTONO(34),	BLK	160
3VUTOEX(34), EXUPAT(34)	BLK	170
COMMON /EXTDTA/ VX2(40), RUREXT(40, 4), RURABS(40, 4), URBEXT(40, 4),	BLK	180
1URBABS(40, 4), OCNEXT(40, 4), OCNABS(40, 4), TROEXT(40, 4), TROABS(40, 4),	BLK	190
2FG1EXT(40), FGIABS(40), FG2EXT(40), FG2ABS(40),	BLK	200
3 BSTEXT(40), BSTABS(40), AVOEXT(40), AVOABS(40), FVOEXT(40),	BLK	210
4 FVOABS(40), DMEEXT(40), DMEABS(40)	BLK	220
COMMON /TRFWFO/ TR(67), FW(67), FO(67)	BLK	230
COMMON /C4C5C8/ C4(133), C5(15), C8(102)	BLK	240
	BLK	250
DIMENSION PO(238), P1(114), P2(114), P3(10)	BLK	260
EQUIVALENCE (P, PO, P1), (P2, PO(115)), (P3, PO(229))	BLK	270
DIMENSION TO(238), T1(114), T2(114), T3(10)	BLK	280
EQUIVALENCE (T, TO, T1), (T2, TO(115)), (T3, TO(229))	BLK	290
DIMENSION WHO(238), WH1(114), WH2(114), WH3(10)	BLK	300
EQUIVALENCE (WH, WHO, WH1), (WH2, WHO(115)), (WH3, WHO(229))	BLK	310
DIMENSION WOO(238), WO1(114), WO2(114), WO3(10)	BLK	320
EQUIVALENCE (WO, WOO, WO1), (WO2, WOO(115)), (WO3, WOO(229))	BLK	330
DIMENSION RURXT1(80), RURXT2(80)	BLK	340
EQUIVALENCE (RUREXT, RURXT1), (RUREXT(1, 3), RURXT2)	BLK	350
DIMENSION RURBS1(80), RURBS2(80)	BLK	360
EQUIVALENCE (RURABS, RURBS1), (RURABS(1, 3), RURBS2)	BLK	370
DIMENSION URBXT1(80), URBXT2(80)	BLK	380
EQUIVALENCE (URBEXT, URBXT1), (URBEXT(1, 3), URBXT2)	BLK	390
DIMENSION URBBS1(80), URBBS2(80)	BLK	400
EQUIVALENCE (URBABS, URBBS1), (URBABS(1, 3), URBBS2)	BLK	410
DIMENSION OCNXT1(80), OCNXT2(80)	BLK	420
EQUIVALENCE (OCNEXT, OCNXT1), (OCNEXT(1, 3), OCNXT2)	BLK	430
DIMENSION OCNBS1(80), OCNBS2(80)	BLK	440
EQUIVALENCE (OCNABS, OCNBS1), (OCNABS(1, 3), OCNBS2)	BLK	450
DIMENSION TROXT1(80), TROXT2(80)	BLK	460
EQUIVALENCE (TROEXT, TROXT1), (TROEXT(1, 3), TROXT2)	BLK	470
DIMENSION TROBS1(80), TROBS2(80)	BLK	480
EQUIVALENCE (TROABS, TROBS1), (TROABS(1, 3), TROBS2)	BLK	490
DIMENSION C4A(114), C4B(19)	BLK	500
EQUIVALENCE (C4, C4A), (C4(115), C4B)	BLK	510
SUBROUTINE MDTA	BLK	520
	BLK	530

C	MODEL ATMOSPHERE DATA	BLK 540
C		BLK 550
C	DATA IATM/6/	BLK 560
	DATA NL/ 34/	BLK 570
	DATA Z /	BLK 580
1	0., 1., 2., 3., 4., 5., 6., 7., 8.,	BLK 590
2	9., 10., 11., 12., 13., 14., 15., 16., 17.,	BLK 600
3	18., 19., 20., 21., 22., 23., 24., 25., 30.,	BLK 610
4	35., 40., 45., 50., 70., 100., 99999./	BLK 620
	DATA P1/	BLK 630
*	1.013E+03, 1.013E+03, 1.018E+03, 1.010E+03, 1.013E+03, 1.013E+03,	BLK 640
*	0.000E-01, 9.040E+02, 9.020E+02, 8.973E+02, 8.960E+02, 8.878E+02,	BLK 650
*	8.986E+02, 0.000E-01, 8.050E+02, 8.020E+02, 7.897E+02, 7.929E+02,	BLK 660
*	7.775E+02, 7.950E+02, 0.000E-01, 7.150E+02, 7.100E+02, 6.938E+02,	BLK 670
*	7.000E+02, 6.798E+02, 7.012E+02, 0.000E-01, 6.330E+02, 6.280E+02,	BLK 680
*	6.081E+02, 6.160E+02, 5.932E+02, 6.166E+02, 0.000E-01, 5.590E+02,	BLK 690
*	5.540E+02, 5.313E+02, 5.410E+02, 5.158E+02, 5.405E+02, 0.000E-01,	BLK 700
*	4.920E+02, 4.870E+02, 4.627E+02, 4.730E+02, 4.467E+02, 4.722E+02,	BLK 710
*	0.000E-01, 4.320E+02, 4.260E+02, 4.016E+02, 4.130E+02, 3.853E+02,	BLK 720
*	4.111E+02, 0.000E-01, 3.780E+02, 3.720E+02, 3.473E+02, 3.590E+02,	BLK 730
*	3.308E+02, 3.565E+02, 0.000E-01, 3.290E+02, 3.240E+02, 2.992E+02,	BLK 740
*	3.107E+02, 2.829E+02, 3.080E+02, 0.000E-01, 2.860E+02, 2.810E+02,	BLK 750
*	2.568E+02, 2.677E+02, 2.418E+02, 2.650E+02, 0.000E-01, 2.470E+02,	BLK 760
*	2.430E+02, 2.199E+02, 2.300E+02, 2.067E+02, 2.270E+02, 0.000E-01,	BLK 770
*	2.130E+02, 2.090E+02, 1.882E+02, 1.977E+02, 1.766E+02, 1.940E+02,	BLK 780
*	0.000E-01, 1.820E+02, 1.790E+02, 1.610E+02, 1.700E+02, 1.510E+02,	BLK 790
*	1.658E+02, 0.000E-01, 1.560E+02, 1.530E+02, 1.378E+02, 1.460E+02,	BLK 800
*	1.291E+02, 1.417E+02, 0.000E-01, 1.320E+02, 1.300E+02, 1.178E+02,	BLK 810
*	1.250E+02, 1.103E+02, 1.211E+02, 0.000E-01, 1.110E+02, 1.110E+02,	BLK 820
	DATA P2/	BLK 830
*	1.007E+02, 1.080E+02, 9.431E+01, 1.035E+02, 0.000E-01, 9.370E+01,	BLK 840
*	9.500E+01, 8.610E+01, 9.280E+01, 8.058E+01, 8.850E+01, 0.000E-01,	BLK 850
*	7.890E+01, 8.120E+01, 7.350E+01, 7.980E+01, 6.882E+01, 7.565E+01,	BLK 860
*	0.000E-01, 6.660E+01, 6.950E+01, 6.280E+01, 6.860E+01, 5.875E+01,	BLK 870
*	6.467E+01, 0.000E-01, 5.650E+01, 5.950E+01, 5.370E+01, 5.890E+01,	BLK 880
*	5.014E+01, 5.529E+01, 0.000E-01, 4.800E+01, 5.100E+01, 4.580E+01,	BLK 890
*	5.070E+01, 4.277E+01, 4.729E+01, 0.000E-01, 4.090E+01, 4.370E+01,	BLK 900
*	3.910E+01, 4.360E+01, 3.647E+01, 4.047E+01, 0.000E-01, 3.500E+01,	BLK 910
*	3.760E+01, 3.340E+01, 3.750E+01, 3.109E+01, 3.467E+01, 0.000E-01,	BLK 920
*	3.000E+01, 3.220E+01, 2.860E+01, 3.227E+01, 2.649E+01, 2.972E+01,	BLK 930
*	0.000E-01, 2.570E+01, 2.770E+01, 2.430E+01, 2.780E+01, 2.256E+01,	BLK 940
*	2.549E+01, 0.000E-01, 1.220E+01, 1.320E+01, 1.110E+01, 1.340E+01,	BLK 950
*	1.020E+01, 1.197E+01, 0.000E-01, 6.000E+00, 6.520E+00, 5.180E+00,	BLK 960
*	6.610E+00, 4.701E+00, 5.746E+00, 0.000E-01, 3.050E+00, 3.330E+00,	BLK 970
*	2.530E+00, 3.400E+00, 2.243E+00, 2.871E+00, 0.000E-01, 1.590E+00,	BLK 980
*	1.760E+00, 1.290E+00, 1.810E+00, 1.113E+00, 1.491E+00, 0.000E-01,	BLK 990
*	8.540E-01, 9.510E-01, 6.820E-01, 9.870E-01, 5.719E-01, 7.978E-01,	BLK 1000
*	0.000E-01, 5.790E-02, 6.710E-02, 4.670E-02, 7.070E-02, 4.016E-02,	BLK 1010
*	5.520E-02, 0.000E-01, 3.000E-04, 3.000E-04, 3.000E-04, 3.000E-04,	BLK 1020
	DATA P3/	BLK 1030
*	3.000E-04, 3.008E-04, 0.000E-01, 0.000E-01, 0.000E-01, 0.000E-01,	BLK 1040
*	0.000E-01, 0.000E-01, 0.000E-01, 0.000E-01/	BLK 1050
	DATA T1 /	BLK 1060

* 3.000E+02,	2.940E+02,	2.722E+02,	2.870E+02,	2.571E+02,	2.881E+02,	BLK 1070
* 0.000E-01,	2.940E+02,	2.900E+02,	2.687E+02,	2.820E+02,	2.591E+02,	BLK 1080
* 2.816E+02,	0.000E-01,	2.880E+02,	2.850E+02,	2.652E+02,	2.760E+02,	BLK 1090
* 2.559E+02,	2.751E+02,	0.000E-01,	2.840E+02,	2.790E+02,	2.617E+02,	BLK 1100
* 2.710E+02,	2.527E+02,	2.687E+02,	0.000E-01,	2.770E+02,	2.730E+02,	BLK 1110
* 2.557E+02,	2.660E+02,	2.477E+02,	2.622E+02,	0.000E-01,	2.700E+02,	BLK 1120
* 2.670E+02,	2.497E+02,	2.600E+02,	2.409E+02,	2.557E+02,	0.000E-01,	BLK 1130
* 2.640E+02,	2.610E+02,	2.437E+02,	2.530E+02,	2.341E+02,	2.492E+02,	BLK 1140
* 0.000E-01,	2.570E+02,	2.550E+02,	2.377E+02,	2.460E+02,	2.273E+02,	BLK 1150
* 2.427E+02,	0.000E-01,	2.500E+02,	2.480E+02,	2.317E+02,	2.390E+02,	BLK 1160
* 2.206E+02,	2.362E+02,	0.000E-01,	2.440E+02,	2.420E+02,	2.257E+02,	BLK 1170
* 2.320E+02,	2.172E+02,	2.297E+02,	0.000E-01,	2.370E+02,	2.350E+02,	BLK 1180
* 2.197E+02,	2.250E+02,	2.172E+02,	2.232E+02,	0.000E-01,	2.300E+02,	BLK 1190
* 2.290E+02,	2.192E+02,	2.250E+02,	2.172E+02,	2.168E+02,	0.000E-01,	BLK 1200
* 2.240E+02,	2.220E+02,	2.187E+02,	2.250E+02,	2.172E+02,	2.166E+02,	BLK 1210
* 0.000E-01,	2.170E+02,	2.160E+02,	2.182E+02,	2.250E+02,	2.172E+02,	BLK 1220
* 2.166E+02,	0.000E-01,	2.100E+02,	2.160E+02,	2.177E+02,	2.250E+02,	BLK 1230
* 2.172E+02,	2.166E+02,	0.000E-01,	2.040E+02,	2.160E+02,	2.172E+02,	BLK 1240
* 2.250E+02,	2.172E+02,	2.166E+02,	0.000E-01,	1.970E+02,	2.160E+02,	BLK 1250
DATA T2 /						BLK 1260
* 2.167E+02,	2.250E+02,	2.166E+02,	2.166E+02,	0.000E-01,	1.950E+02,	BLK 1270
* 2.160E+02,	2.162E+02,	2.250E+02,	2.160E+02,	2.166E+02,	0.000E-01,	BLK 1280
* 1.990E+02,	2.160E+02,	2.157E+02,	2.250E+02,	2.154E+02,	2.166E+02,	BLK 1290
* 0.000E-01,	2.030E+02,	2.170E+02,	2.152E+02,	2.250E+02,	2.148E+02,	BLK 1300
* 2.166E+02,	0.000E-01,	2.070E+02,	2.180E+02,	2.152E+02,	2.250E+02,	BLK 1310
* 2.141E+02,	2.166E+02,	0.000E-01,	2.110E+02,	2.190E+02,	2.152E+02,	BLK 1320
* 2.250E+02,	2.136E+02,	2.176E+02,	0.000E-01,	2.150E+02,	2.200E+02,	BLK 1330
* 2.152E+02,	2.250E+02,	2.130E+02,	2.186E+02,	0.000E-01,	2.170E+02,	BLK 1340
* 2.220E+02,	2.152E+02,	2.250E+02,	2.124E+02,	2.196E+02,	0.000E-01,	BLK 1350
* 2.190E+02,	2.230E+02,	2.152E+02,	2.260E+02,	2.118E+02,	2.206E+02,	BLK 1360
* 0.000E-01,	2.210E+02,	2.240E+02,	2.152E+02,	2.280E+02,	2.112E+02,	BLK 1370
* 2.216E+02,	0.000E-01,	2.320E+02,	2.340E+02,	2.174E+02,	2.350E+02,	BLK 1380
* 2.160E+02,	2.265E+02,	0.000E-01,	2.430E+02,	2.450E+02,	2.278E+02,	BLK 1390
* 2.470E+02,	2.222E+02,	2.365E+02,	0.000E-01,	2.540E+02,	2.580E+02,	BLK 1400
* 2.432E+02,	2.620E+02,	2.347E+02,	2.534E+02,	0.000E-01,	2.650E+02,	BLK 1410
* 2.700E+02,	2.585E+02,	2.740E+02,	2.470E+02,	2.642E+02,	0.000E-01,	BLK 1420
* 2.700E+02,	2.760E+02,	2.657E+02,	2.770E+02,	2.593E+02,	2.706E+02,	BLK 1430
* 0.000E-01,	2.190E+02,	2.180E+02,	2.307E+02,	2.160E+02,	2.457E+02,	BLK 1440
* 2.197E+02,	0.000E-01,	2.100E+02,	2.100E+02,	2.102E+02,	2.100E+02,	BLK 1450
DATA T3 /						BLK 1460
* 2.100E+02,	2.100E+02,	0.000E-01,	2.100E+02,	2.100E+02,	2.100E+02,	BLK 1470
* 2.100E+02,	2.100E+02,	2.100E+02,	0.000E-01,			BLK 1480
DATA WH1 /						BLK 1490
* 1.900E+01,	1.400E+01,	3.500E+00,	9.100E+00,	1.200E+00,	5.900E+00,	BLK 1500
* 0.000E-01,	1.300E+01,	9.300E+00,	2.500E+00,	6.000E+00,	1.200E+00,	BLK 1510
* 4.200E+00,	0.000E-01,	9.300E+00,	5.900E+00,	1.800E+00,	4.200E+00,	BLK 1520
* 9.400E-01,	2.900E+00,	0.000E-01,	4.700E+00,	3.300E+00,	1.200E+00,	BLK 1530
* 2.700E+00,	6.800E-01,	1.800E+00,	0.000E-01,	2.200E+00,	1.900E+00,	BLK 1540
* 6.600E-01,	1.700E+00,	4.100E-01,	1.100E+00,	0.000E-01,	1.500E+00,	BLK 1550
* 1.000E+00,	3.800E-01,	1.000E+00,	2.000E-01,	6.400E-01,	0.000E-01,	BLK 1560
* 8.500E-01,	6.100E-01,	2.100E-01,	5.400E-01,	9.800E-02,	3.800E-01,	BLK 1570
* 0.000E-01,	4.700E-01,	3.700E-01,	8.500E-02,	2.900E-01,	5.400E-02,	BLK 1580
* 2.100E-01,	0.000E-01,	2.500E-01,	2.100E-01,	3.500E-02,	1.300E-01,	BLK 1590

* 1.100E-02, 1.200E-02, 0.000E-01, 1.200E-01, 1.200E-01, 1.600E-02, BLK 1600
 * 4.200E-02, 8.400E-02, 4.600E-02, 0.000E-01, 5.000E-02, 6.400E-02, BLK 1610
 * 7.500E-02, 1.500E-02, 5.500E-03, 1.800E-02, 0.000E-01, 1.700E-02, BLK 1620
 * 2.200E-02, 6.900E-03, 9.400E-03, 3.800E-03, 8.200E-03, 0.000E-01, BLK 1630
 * 6.000E-03, 6.000E-03, 6.000E-03, 6.000E-03, 2.600E-03, 3.700E-03, BLK 1640
 * 0.000E-01, 1.800E-03, 1.800E-03, 1.800E-03, 1.800E-03, 1.800E-03, BLK 1650
 * 1.800E-03, 0.000E-01, 1.000E-03, 1.000E-03, 1.000E-03, 1.000E-03, BLK 1660
 * 1.000E-03, 8.400E-04, 0.000E-01, 7.600E-04, 7.600E-04, 7.600E-04, BLK 1670
 * 7.600E-04, 7.600E-04, 7.200E-04, 0.000E-01, 6.400E-04, 6.400E-04, BLK 1680
 DATA WH2 / BLK 1690
 * 6.400E-04, 6.400E-04, 6.400E-04, 6.100E-04, 0.000E-01, 5.600E-04, BLK 1700
 * 5.600E-04, 5.600E-04, 5.600E-04, 5.600E-04, 5.200E-04, 0.000E-01, BLK 1710
 * 5.000E-04, 5.000E-04, 5.000E-04, 5.000E-04, 5.000E-04, 4.400E-04, BLK 1720
 * 0.000E-01, 4.900E-04, 4.900E-04, 4.900E-04, 4.900E-04, 4.900E-04, BLK 1730
 * 4.400E-04, 0.000E-01, 4.500E-04, 4.500E-04, 4.500E-04, 4.500E-04, BLK 1740
 * 4.500E-04, 4.400E-04, 0.000E-01, 5.100E-04, 5.100E-04, 5.100E-04, BLK 1750
 * 5.100E-04, 5.100E-04, 4.800E-04, 0.000E-01, 5.100E-04, 5.100E-04, BLK 1760
 * 5.100E-04, 5.100E-04, 5.100E-04, 5.200E-04, 0.000E-01, 5.400E-04, BLK 1770
 * 5.400E-04, 5.400E-04, 5.400E-04, 5.400E-04, 5.700E-04, 0.000E-01, BLK 1780
 * 6.000E-04, 6.000E-04, 6.000E-04, 6.000E-04, 6.000E-04, 6.100E-04, BLK 1790
 * 0.000E-01, 6.700E-04, 6.700E-04, 6.700E-04, 6.700E-04, 6.700E-04, BLK 1800
 * 6.600E-04, 0.000E-01, 3.600E-04, 3.600E-04, 3.600E-04, 3.600E-04, BLK 1810
 * 3.600E-04, 3.800E-04, 0.000E-01, 1.100E-04, 1.100E-04, 1.100E-04, BLK 1820
 * 1.100E-04, 1.100E-04, 1.600E-04, 0.000E-01, 4.300E-05, 4.300E-05, BLK 1830
 * 4.300E-05, 4.300E-05, 4.300E-05, 6.700E-05, 0.000E-01, 1.900E-05, BLK 1840
 * 1.900E-05, 1.900E-05, 1.900E-05, 1.900E-05, 3.200E-05, 0.000E-01, BLK 1850
 * 6.300E-06, 6.300E-06, 6.300E-06, 6.300E-06, 6.300E-06, 1.200E-05, BLK 1860
 * 0.000E-01, 1.400E-07, 1.400E-07, 1.400E-07, 1.400E-07, 1.400E-07, BLK 1870
 * 1.500E-07, 0.000E-01, 1.000E-09, 1.000E-09, 1.000E-09, 1.000E-09, BLK 1880
 DATA WH3 / BLK 1890
 * 1.000E-09, 1.000E-09, 0.000E-01, 0.000E-01, 0.000E-01, 0.000E-01, BLK 1900
 * 0.000E-01, 0.000E-01, 0.000E-01, 0.000E-01 / BLK 1910
 DATA W01 / BLK 1920
 * 5.600E-05, 6.000E-05, 6.000E-05, 4.900E-05, 4.100E-05, 5.400E-05, BLK 1930
 * 0.000E-01, 5.600E-05, 6.000E-05, 5.400E-05, 5.400E-05, 4.100E-05, BLK 1940
 * 5.400E-05, 0.000E-01, 5.400E-05, 6.000E-05, 4.900E-05, 5.600E-05, BLK 1950
 * 4.100E-05, 5.400E-05, 0.000E-01, 5.100E-05, 6.200E-05, 4.900E-05, BLK 1960
 * 5.800E-05, 4.300E-05, 5.000E-05, 0.000E-01, 4.700E-05, 6.400E-05, BLK 1970
 * 4.900E-05, 6.000E-05, 4.500E-05, 4.600E-05, 0.000E-01, 4.500E-05, BLK 1980
 * 6.600E-05, 5.800E-05, 6.400E-05, 4.700E-05, 4.600E-05, 0.000E-01, BLK 1990
 * 4.300E-05, 6.900E-05, 6.400E-05, 7.100E-05, 4.900E-05, 4.500E-05, BLK 2000
 * 0.000E-01, 4.100E-05, 7.500E-05, 7.700E-05, 7.500E-05, 7.100E-05, BLK 2010
 * 4.900E-05, 0.000E-01, 3.900E-05, 7.900E-05, 9.000E-05, 7.900E-05, BLK 2020
 * 9.000E-05, 5.200E-05, 0.000E-01, 3.900E-05, 8.600E-05, 1.200E-04, BLK 2030
 * 1.100E-04, 1.600E-04, 7.100E-05, 0.000E-01, 3.900E-05, 9.000E-05, BLK 2040
 * 1.600E-04, 1.300E-04, 2.400E-04, 9.000E-05, 0.000E-01, 4.100E-05, BLK 2050
 * 1.100E-04, 2.100E-04, 1.800E-04, 3.200E-04, 1.300E-04, 0.000E-01, BLK 2060
 * 4.300E-05, 1.200E-04, 2.600E-04, 2.100E-04, 4.300E-04, 1.600E-04, BLK 2070
 * 0.000E-01, 4.500E-05, 1.500E-04, 3.000E-04, 2.600E-04, 4.700E-04, BLK 2080
 * 1.700E-04, 0.000E-01, 4.500E-05, 1.800E-04, 3.200E-04, 2.800E-04, BLK 2090
 * 4.900E-04, 1.900E-04, 0.000E-01, 4.700E-05, 1.900E-04, 3.400E-04, BLK 2100
 * 3.200E-04, 5.600E-04, 2.100E-04, 0.000E-01, 4.700E-05, 2.100E-04, BLK 2110
 DATA W02 / BLK 2120

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* 3.600E-04, 3.400E-04, 6.200E-04, 2.400E-04, 0.000E-01, 6.900E-05, BLK 2130
* 2.400E-04, 3.900E-04, 3.900E-04, 6.200E-04, 2.800E-04, 0.000E-01, BLK 2140
* 9.000E-05, 2.800E-04, 4.100E-04, 4.100E-04, 6.200E-04, 3.200E-04, BLK 2150
* 0.000E-01, 1.400E-04, 3.200E-04, 4.300E-04, 4.100E-04, 6.000E-04, BLK 2160
* 3.500E-04, 0.000E-01, 1.900E-04, 3.400E-04, 4.500E-04, 3.900E-04, BLK 2170
* 5.600E-04, 3.800E-04, 0.000E-01, 2.400E-04, 3.600E-04, 4.300E-04, BLK 2180
* 3.600E-04, 5.100E-04, 3.800E-04, 0.000E-01, 2.800E-04, 3.600E-04, BLK 2190
* 4.300E-04, 3.200E-04, 4.700E-04, 3.900E-04, 0.000E-01, 3.200E-04, BLK 2200
* 3.400E-04, 3.900E-04, 3.000E-04, 4.300E-04, 3.800E-04, 0.000E-01, BLK 2210
* 3.400E-04, 3.200E-04, 3.600E-04, 2.800E-04, 3.600E-04, 3.600E-04, BLK 2220
* 0.000E-01, 3.400E-04, 3.000E-04, 3.400E-04, 2.600E-04, 3.200E-04, BLK 2230
* 3.400E-04, 0.000E-01, 2.400E-04, 2.000E-04, 1.900E-04, 1.400E-04, BLK 2240
* 1.500E-04, 2.000E-04, 0.000E-01, 9.200E-05, 9.200E-05, 9.200E-05, BLK 2250
* 9.200E-05, 9.200E-05, 1.100E-04, 0.000E-01, 4.100E-05, 4.100E-05, BLK 2260
* 4.100E-05, 4.100E-05, 4.100E-05, 4.900E-05, 0.000E-01, 1.300E-05, BLK 2270
* 1.300E-05, 1.300E-05, 1.300E-05, 1.300E-05, 1.700E-05, 0.000E-01, BLK 2280
* 4.300E-06, 4.300E-06, 4.300E-06, 4.300E-06, 4.300E-06, 4.000E-06, BLK 2290
* 0.000E-01, 8.600E-08, 8.600E-08, 8.600E-08, 8.600E-08, 8.600E-08, BLK 2300
* 8.600E-08, 0.000E-01, 4.300E-11, 4.300E-11, 4.300E-11, 4.300E-11, BLK 2310
DATA W03 / BLK 2320
* 4.300E-11, 4.300E-11, 0.000E-01, 0.000E-01, 0.000E-01, 0.000E-01, BLK 2330
* 0.000E-01, 0.000E-01, 0.000E-01, 0.000E-01/ BLK 2340
C HMX(I)=HNO3 VOLUME MIXING RATIOS TIMES E+9 FROM EVANS PROFILE BLK 2350
DATA HMX/8*0.,1.E-30,0.1,0.33,0.8,1.2,1.4,1.6,1.8,1.9,2.0,2.1,2.3,FLX 2360
1,3.0,3.7,4.2,5.2,6.0,3.8,2.6,0.22,1.E-30,5*0.0/ FLX 2370
DATA VSB /23.,5.,23.,5.,5.,50.,23.,0.2,0.5/ BLK 2380
DATA HZ(1)/8H RURAL /,HZ(2)/8H RURAL /, BLK 2390
1HZ(3)/8H MARITIME /,HZ(4)/8H MARITIME /,HZ(5)/8H URBAN /, BLK 2400
2HZ(6)/8H TROPOSPH /,HZ(7)/8H USER DEF /,HZ(8)/8H FOG1 (A) /, BLK 2410
3HZ(9)/8H FOG2 (R) / BLK 2420
4,HZ(10)/8H BACK STR /,HZ(11)/8H AGED VOL /,HZ(12)/8H FRESH VO / BLK 2430
4 ,HZ(13)/8H AGED VOL /,HZ(14)/8H FRESH VO / BLK 2440
5 ,HZ(15)/8H MET DUST / BLK 2450
DATA SEASN(1)/8H SPRG SUM/,SEASN(2)/8H FAL WINT/ BLK 2460
DATA VULCN(1)/8H STR BKGR/,VULCN(2)/8H AG V-MDV/, BLK 2470
1VULCN(3)/8H FR V-HIV/,VULCN(4)/8H AG V-HIV/,VULCN(5)/8H FR V-MDV/ BLK 2480
DATA HMX(9),HMX(29)/2*1.E-30/ FLX 2490
C SUBROUTINE PRFDTA BLK 2500
C BLK 2510
C AEROSOL PROFILE DATA BLK 2520
C BLK 2530
DATA ZHT / BLK 2540
* 0., 1., 2., 3., 4., 5., 6., 7., 8., BLK 2550
* 9., 10., 11., 12., 13., 14., 15., 16., 17., BLK 2560
* 18., 19., 20., 21., 22., 23., 24., 25., 30., BLK 2570
* 35., 40., 45., 50., 70., 100.,99999./ BLK 2580
DATA HZ2K/6.62E-02, 4.15E-02, 2.60E-02, 31*0., BLK 2590
* 1.58E-01, 9.91E-02, 6.21E-02, 31*0., BLK 2600
* 3.79E-01, 3.79E-01, 6.21E-02, 31*0., BLK 2610
* 7.70E-01, 7.70E-01, 6.21E-02, 31*0., BLK 2620
* 1.94E+00, 1.94E+00, 6.21E-02, 31*0./ BLK 2630
DATA FAW150 / 3*0., BLK 2640
1 1.14E-02, 6.43E-03, 4.85E-03, 3.54E-03, 2.31E-03, 1.41E-03, BLK 2650

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2 9.80E-04,24*0./		BLK 2660
DATA FAWI23	/ 3*0.,	BLK 2670
1 2.72E-02, 1.20E-02, 4.85E-03, 3.54E-03, 2.31E-03, 1.41E-03,		BLK 2680
2 9.80E-04,24*0./		BLK 2690
DATA SPSU50	/ 3*0.,	BLK 2700
1 1.46E-02, 1.02E-02, 9.31E-03, 7.71E-03, 6.23E-03, 3.37E-03,		BLK 2710
2 1.82E-03,24*0./		BLK 2720
DATA SPSU23	/ 3*0.,	BLK 2730
1 3.46E-02, 1.85E-02, 9.31E-03, 7.71E-03, 6.23E-03, 3.37E-03,		BLK 2740
2 1.82E-03,24*0./		BLK 2750
DATA BASTFW	/ 10*0.,	BLK 2760
1 7.87E-04, 7.14E-04, 6.64E-04, 6.23E-04, 6.45E-04, 6.43E-04,		BLK 2770
2 6.41E-04, 6.00E-04, 5.62E-04, 4.91E-04, 4.23E-04, 3.52E-04,		BLK 2780
3 2.95E-04, 2.42E-04, 1.90E-04, 1.50E-04, 3.32E-05,7*0./		BLK 2790
DATA VUMOFW	/ 10*0.,	BLK 2800
1 1.38E-03, 1.79E-03, 2.21E-03, 2.75E-03, 2.89E-03, 2.92E-03,		BLK 2810
2 2.73E-03, 2.46E-03, 2.10E-03, 1.71E-03, 1.35E-03, 1.09E-03,		BLK 2820
3 8.60E-04, 6.60E-04, 5.15E-04, 4.09E-04, 7.60E-05,7*0./		BLK 2830
DATA HIVUFW	/ 10*0.,	BLK 2840
1 1.71E-03, 2.31E-03, 3.25E-03, 4.52E-03, 6.40E-03, 7.81E-03,		BLK 2850
2 9.42E-03, 1.07E-02, 1.10E-02, 8.60E-03, 5.10E-03, 2.70E-03,		BLK 2860
3 1.46E-03, 8.90E-04, 5.80E-04, 4.09E-04, 7.60E-05,7*0./		BLK 2870
DATA EXVUFW	/ 10*0.,	BLK 2880
1 1.71E-03, 2.31E-03, 3.25E-03, 4.52E-03, 6.40E-03, 1.01E-02,		BLK 2890
2 2.35E-02, 6.10E-02, 1.00E-01, 4.00E-02, 9.15E-03, 3.13E-03,		BLK 2900
3 1.46E-03, 8.90E-04, 5.80E-04, 4.09E-04, 7.60E-05,7*0./		BLK 2910
DATA BASTSS	/ 10*0.,	BLK 2920
1 1.14E-03, 7.99E-04, 6.41E-04, 5.17E-04, 4.42E-04, 3.95E-04,		BLK 2930
2 3.82E-04, 4.25E-04, 5.20E-04, 5.81E-04, 5.89E-04, 5.02E-04,		BLK 2940
3 4.20E-04, 3.00E-04, 1.98E-04, 1.31E-04, 3.32E-05,7*0./		BLK 2950
DATA VUMOSS	/ 10*0.,	BLK 2960
1 1.85E-03, 2.12E-03, 2.45E-03, 2.80E-03, 2.89E-03, 2.92E-03,		BLK 2970
2 2.73E-03, 2.46E-03, 2.10E-03, 1.71E-03, 1.35E-03, 1.09E-03,		BLK 2980
3 8.60E-04, 6.60E-04, 5.15E-04, 4.09E-04, 7.60E-05,7*0./		BLK 2990
DATA HIVUSS	/ 10*0.,	BLK 3000
1 1.85E-03, 2.12E-03, 2.45E-03, 2.80E-03, 3.60E-03, 5.23E-03,		BLK 3010
2 8.11E-03, 1.20E-02, 1.52E-02, 1.53E-02, 1.17E-02, 7.09E-03,		BLK 3020
3 4.50E-03, 2.40E-03, 1.28E-03, 7.76E-04, 7.60E-05,7*0./		BLK 3030
DATA EXVUSS	/ 10*0.,	BLK 3040
1 1.85E-03, 2.12E-03, 2.45E-03, 2.80E-03, 3.60E-03, 5.23E-03,		BLK 3050
2 8.11E-03, 1.27E-02, 2.32E-02, 4.85E-02, 1.00E-01, 5.50E-02,		BLK 3060
3 6.10E-03, 2.40E-03, 1.28E-03, 7.76E-04, 7.60E-05,7*0./		BLK 3070
DATA UPNATM	/ 26*0.,	BLK 3080
1 3.32E-05, 1.64E-05, 7.99E-06, 4.01E-06, 2.10E-06, 1.60E-07,		BLK 3090
2 9.31E-10, 0. /		BLK 3100
DATA VUTONO	/ 26*0.,	BLK 3110
1 7.60E-05, 2.45E-05, 7.99E-06, 4.01E-06, 2.10E-06, 1.60E-07,		BLK 3120
2 9.31E-10, 0. /		BLK 3130
DATA VUTOEX	/ 26*0.,	BLK 3140
1 7.60E-05, 7.20E-05, 6.95E-05, 6.60E-05, 5.04E-05, 1.03E-05,		BLK 3150
2 4.50E-07, 0. /		BLK 3160
DATA EXUPAT	/ 26*0.,	BLK 3170
1 3.32E-05, 4.25E-05, 5.59E-05, 6.60E-05, 5.04E-05, 1.03E-05,		BLK 3180

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2 4.50E-07, 0. /
CCC      0-2KM
CCC      HZ2K=5 VIS PROFILES- 50KM,23KM,10KM,5KM,2KM
CCC      >2-9KM
CCC      FAWI50=FALL/WINTER 50KM VIS
CCC      FAWI23=FALL/WINTER 23KM VIS
CCC      SPSU50=SPRING/SUMMER 50KM VIS
CCC      SPSU23=SPRING/SUMMER 23KM VIS
CCC      >9-30KM
CCC      BASTFW=BACKGROUND STRATOSPHERIC FALL/WINTER
CCC      VUMOFW=MODERATE VOLCANIC FALL/WINTER
CCC      HIVUFW=HIGH VOLCANIC FALL/WINTER
CCC      EXVUFW=EXTREME VOLCANIC FALL/WINTER
CCC      BASTSS,VUMOSS,HIVUSS,EXVUSS= SPRING/SUMMER
CCC      >30-100KM
CCC      UPNATM=NORMAL UPPER ATMOSPHERIC
CCC      VUTONO=TRANSITION FROM VOLCANIC TO NORMAL
CCC      VUTOEX=TRANSITION FROM VOLCANIC TO EXTREME
CCC      EXUPAT=EXTREME UPPER ATMOSPHERIC
CCC      READ IN AEROSOL MODELS EXTINCTION AND ABSORPTION COEFFICIENTS
C      SUBROUTINE EXTDIA
C
C      AEROSOL EXTINCTION AND ABSORPTION DATA
C
DATA VX2 /
* .2000, .3000, .3371, .5500, .6943, 1.0600, 1.5360,
* 2.0000, 2.2500, 2.5000, 2.7000, 3.0000, 3.3923, 3.7500,
* 4.5000, 5.0000, 5.5000, 6.0000, 6.2000, 6.5000, 7.2000,
* 7.9000, 8.2000, 8.7000, 9.0000, 9.2000, 10.0000, 10.5910,
* 11.0000, 11.5000, 12.5000, 14.8000, 15.0000, 16.4000, 17.2000,
* 18.5000, 21.3000, 25.0000, 30.0000, 40.0000/
DATA RURXT1 /
1 2.09291, 1.74582, 1.60500, 1.00000, .75203, .41943, .24070,
2 .14709, .13304, .12234, .13247, .11196, .10437, .09956,
3 .09190, .08449, .07861, .07025, .07089, .07196, .07791,
4 .04481, .04399, .12184, .12658, .12829, .09152, .08076,
5 .07456, .06880, .06032, .04949, .05854, .06000, .06962,
6 .05722, .06051, .05177, .04589, .04304,
1 2.09544, 1.74165, 1.59981, 1.00000, .75316, .42171, .24323,
2 .15108, .13608, .12430, .13222, .13823, .11076, .10323,
3 .09475, .08728, .08076, .07639, .07797, .07576, .07943,
4 .04899, .04525, .12165, .12741, .12778, .09032, .07962,
5 .07380, .06880, .06329, .05791, .06646, .06639, .07443,
6 .06304, .06443, .05538, .04867, .04519/
DATA RURXT2 /
1 2.07082, 1.71456, 1.57962, 1.00000, .76095, .43228, .25348,
2 .16456, .14677, .13234, .13405, .20316, .12873, .11506,
3 .10481, .09709, .08918, .09380, .09709, .08791, .08601,
4 .06247, .05601, .11905, .12595, .12348, .08741, .07703,
5 .07266, .07044, .07443, .08146, .08810, .08563, .08962,
6 .08051, .07677, .06658, .05747, .05184,
1 1.66076, 1.47886, 1.40139, 1.00000, .80652, .50595, .32259,
2 .23468, .20772, .18532, .17348, .35114, .20006, .17386,

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3	.16139,	.15424,	.14557,	.16215,	.16766,	.14994,	.14032,	BLK 3720
4	.12968,	.12601,	.13551,	.13582,	.13228,	.11070,	.09994,	BLK 3730
5	.09873,	.10418,	.13241,	.15924,	.16139,	.15949,	.15778,	BLK 3740
6	.15184,	.13848,	.12563,	.11076,	.09601/			BLK 3750
DATA RURBS1 /								BLK 3760
1	.67196,	.11937,	.08506,	.05930,	.05152,	.05816,	.05006,	BLK 3770
2	.01968,	.02070,	.02101,	.05652,	.02785,	.01316,	.00867,	BLK 3780
3	.01462,	.01310,	.01627,	.02013,	.02165,	.02367,	.03538,	BLK 3790
4	.02823,	.03962,	.06778,	.07285,	.08120,	.04032,	.03177,	BLK 3800
5	.02557,	.02342,	.02177,	.02627,	.03943,	.03114,	.03696,	BLK 3810
6	.02956,	.03500,	.03241,	.03297,	.03380,			BLK 3820
1	.62968,	.10816,	.07671,	.05380,	.04684,	.05335,	.04614,	BLK 3830
2	.01829,	.01899,	.01962,	.05525,	.06816,	.01652,	.00867,	BLK 3840
3	.01544,	.01373,	.01627,	.02892,	.02829,	.02532,	.03487,	BLK 3850
4	.02835,	.03854,	.06684,	.07272,	.08038,	.03987,	.03247,	BLK 3860
5	.02816,	.02816,	.03101,	.03741,	.04829,	.04032,	.04399,	BLK 3870
6	.03734,	.03956,	.03601,	.03525,	.03563/			BLK 3880
DATA RURES2 /								BLK 3890
1	.51899,	.08278,	.05816,	.04082,	.03570,	.04158,	.03620,	BLK 3900
2	.01513,	.01481,	.01633,	.05278,	.13690,	.02494,	.00886,	BLK 3910
3	.01804,	.01582,	.01677,	.04816,	.04367,	.03013,	.03443,	BLK 3920
4	.02930,	.03677,	.06209,	.06911,	.07475,	.03892,	.03494,	BLK 3930
5	.03513,	.03968,	.05152,	.06241,	.06937,	.06203,	.06215,	BLK 3940
6	.05614,	.05209,	.04608,	.04196,	.04095,			BLK 3950
1	.21943,	.02848,	.01943,	.01342,	.01171,	.01437,	.01323,	BLK 3960
2	.01152,	.00696,	.01329,	.06108,	.24690,	.05323,	.01430,	BLK 3970
3	.03361,	.02949,	.02652,	.09437,	.08506,	.05348,	.04627,	BLK 3980
4	.04380,	.04557,	.05380,	.05715,	.05899,	.04861,	.05253,	BLK 3990
5	.06171,	.07437,	.10152,	.12019,	.12190,	.11734,	.11411,	BLK 4000
6	.10766,	.09487,	.08430,	.07348,	.06861/			BLK 4010
DATA URBXT1 /								BLK 4020
1	1.88816,	1.63316,	1.51867,	1.00000,	.77785,	.47095,	.30006,	BLK 4030
2	.21392,	.19405,	.17886,	.18127,	.16133,	.14785,	.14000,	BLK 4040
3	.12715,	.11880,	.11234,	.10601,	.10500,	.10361,	.10342,	BLK 4050
4	.08766,	.08652,	.11937,	.12139,	.12297,	.09797,	.09057,	BLK 4060
5	.08595,	.08196,	.07563,	.06696,	.07209,	.06842,	.07177,	BLK 4070
6	.06354,	.06177,	.05373,	.04728,	.04051,			BLK 4080
1	1.95582,	1.64994,	1.53070,	1.00000,	.77614,	.46639,	.29487,	BLK 4090
2	.21051,	.18943,	.17285,	.17209,	.21418,	.15354,	.14051,	BLK 4100
3	.12728,	.11861,	.11089,	.11329,	.11323,	.10563,	.10247,	BLK 4110
4	.08696,	.08361,	.12013,	.12418,	.12304,	.09614,	.08842,	BLK 4120
5	.08487,	.08285,	.08361,	.08430,	.08880,	.08449,	.08601,	BLK 4130
6	.07835,	.07323,	.06367,	.05500,	.04747/			BLK 4140
DATA URBXT2 /								BLK 4150
1	1.96430,	1.64032,	1.52392,	1.00000,	.77709,	.46253,	.28690,	BLK 4160
2	.20310,	.17981,	.16101,	.15614,	.26475,	.15456,	.13563,	BLK 4170
3	.12215,	.11361,	.10500,	.11715,	.11753,	.10392,	.09766,	BLK 4180
4	.08443,	.08057,	.10943,	.11342,	.11063,	.08703,	.08025,	BLK 4190
5	.07886,	.08032,	.09101,	.10070,	.10386,	.09943,	.09886,	BLK 4200
6	.09152,	.08247,	.07152,	.06089,	.05253,			BLK 4210
1	1.41266,	1.33816,	1.29114,	1.00000,	.83646,	.55025,	.35342,	BLK 4220
2	.25285,	.21576,	.18310,	.16215,	.37854,	.20494,	.16665,	BLK 4230
3	.14778,	.13892,	.12943,	.15525,	.15709,	.13513,	.12481,	BLK 4240

4	.11759,	.11494,	.11487,	.11329,	.11108,	.09911,	.09209,	BLK 4250
5	.09342,	.10120,	.13177,	.15696,	.15766,	.15513,	.15203,	BLK 4260
6	.14532,	.13038,	.11785,	.10411,	.09101/			BLK 4270
DATA URBBS1 /								BLK 4280
1	.78437,	.58975,	.54285,	.36184,	.29222,	.20886,	.15658,	BLK 4290
2	.12329,	.11462,	.10747,	.11797,	.10025,	.08759,	.08184,	BLK 4300
3	.07506,	.07006,	.06741,	.06601,	.06544,	.06449,	.06665,	BLK 4310
4	.06278,	.06949,	.07316,	.07462,	.08101,	.05753,	.05272,	BLK 4320
5	.04899,	.04734,	.04494,	.04443,	.05133,	.04348,	.04443,	BLK 4330
6	.03994,	.03981,	.03633,	.03468,	.03146,			BLK 4340
1	.69032,	.49367,	.45165,	.29741,	.24070,	.17399,	.13146,	BLK 4350
2	.10354,	.09589,	.09025,	.10411,	.15101,	.07880,	.06949,	BLK 4360
3	.06570,	.06095,	.05829,	.07171,	.06797,	.05975,	.06013,	BLK 4370
4	.05589,	.06051,	.07139,	.07494,	.07956,	.05525,	.05184,	BLK 4380
5	.05089,	.05291,	.05886,	.06380,	.06880,	.06127,	.06019,	BLK 4390
6	.05525,	.05070,	.04500,	.04076,	.03741/			BLK 4400
DATA URBBS2 /								BLK 4410
1	.54848,	.37101,	.33734,	.21949,	.17785,	.12968,	.09854,	BLK 4420
2	.07804,	.07165,	.06791,	.08563,	.19639,	.06722,	.05316,	BLK 4430
3	.05316,	.04886,	.04620,	.07570,	.06899,	.05291,	.05101,	BLK 4440
4	.04734,	.05025,	.06171,	.06570,	.06854,	.04892,	.04797,	BLK 4450
5	.05057,	.05665,	.07127,	.08095,	.08411,	.07728,	.07475,	BLK 4460
6	.06886,	.06019,	.05222,	.04538,	.04171,			BLK 4470
1	.15975,	.10000,	.09013,	.05785,	.04671,	.03424,	.02633,	BLK 4480
2	.02525,	.01975,	.02354,	.06241,	.26690,	.05810,	.02285,	BLK 4490
3	.03810,	.03386,	.03044,	.09627,	.08557,	.05405,	.04576,	BLK 4500
4	.04392,	.04424,	.04671,	.04791,	.04861,	.04684,	.05177,	BLK 4510
5	.06158,	.07475,	.10342,	.12146,	.12177,	.11734,	.11335,	BLK 4520
6	.10608,	.09171,	.08063,	.06968,	.06475/			BLK 4530
DATA OCNXT1 /								BLK 4540
1	1.47576,	1.32614,	1.26171,	1.00000,	.88133,	.70297,	.56487,	BLK 4550
2	.46006,	.42044,	.38310,	.35076,	.42266,	.32278,	.28810,	BLK 4560
3	.24905,	.21184,	.16734,	.14791,	.21532,	.15076,	.12057,	BLK 4570
4	.10038,	.10703,	.15070,	.15665,	.14639,	.10228,	.08367,	BLK 4580
5	.07373,	.06829,	.05044,	.04373,	.04962,	.06158,	.07703,	BLK 4590
6	.07234,	.06297,	.05481,	.05329,	.08741,			BLK 4600
1	1.36924,	1.25443,	1.20835,	1.00000,	.91367,	.77089,	.64987,	BLK 4610
2	.54886,	.50247,	.45038,	.38209,	.50589,	.43766,	.38076,	BLK 4620
3	.31658,	.27475,	.22215,	.21019,	.27570,	.21057,	.16949,	BLK 4630
4	.14209,	.14215,	.16956,	.17082,	.16025,	.11665,	.09759,	BLK 4640
5	.09215,	.09373,	.10532,	.12570,	.13000,	.13633,	.14291,	BLK 4650
6	.13506,	.11475,	.09658,	.08291,	.10348/			BLK 4660
DATA OCNXT2 /								BLK 4670
1	1.22259,	1.14627,	1.11842,	1.00000,	.94766,	.87538,	.80418,	BLK 4680
2	.72930,	.68582,	.62165,	.49962,	.67949,	.66468,	.59253,	BLK 4690
3	.49551,	.44671,	.37886,	.35924,	.43367,	.37019,	.30842,	BLK 4700
4	.26437,	.25228,	.24905,	.23975,	.22766,	.17804,	.15316,	BLK 4710
5	.15373,	.16791,	.22361,	.28348,	.28677,	.29082,	.29038,	BLK 4720
6	.27810,	.23867,	.20209,	.16430,	.14943,			BLK 4730
1	1.09133,	1.06601,	1.05620,	1.00000,	.97506,	.94791,	.94203,	BLK 4740
2	.93671,	.92867,	.90411,	.80253,	.89222,	.94462,	.92146,	BLK 4750
3	.85797,	.82595,	.76747,	.68646,	.78209,	.75266,	.68658,	BLK 4760
4	.62722,	.60228,	.56335,	.53728,	.51861,	.43449,	.37196,	BLK 4770

5	.35899,	.37316,	.46854,	.58234,	.58690,	.60348,	.60563,	BLK 4780
6	.60000,	.55392,	.50367,	.43576,	.35949/			BLK 4790
DATA OCNBS1								BLK 4800
1	.30987,	.04354,	.02880,	.01797,	.01468,	.01766,	.01582,	BLK 4810
2	.00816,	.01146,	.01677,	.03310,	.03380,	.00715,	.00443,	BLK 4820
3	.00500,	.00601,	.00753,	.01595,	.02943,	.00994,	.01367,	BLK 4830
4	.01671,	.02538,	.03481,	.03405,	.03601,	.01608,	.01310,	BLK 4840
5	.01152,	.01082,	.01070,	.01563,	.02063,	.03171,	.03810,	BLK 4850
6	.03741,	.03804,	.03759,	.04209,	.07892,			BLK 4860
1	.23367,	.03127,	.02070,	.01297,	.01063,	.01285,	.01190,	BLK 4870
2	.00937,	.00911,	.01576,	.05576,	.23487,	.03949,	.00905,	BLK 4880
3	.02057,	.01816,	.01665,	.08025,	.08044,	.03677,	.03139,	BLK 4890
4	.03190,	.03766,	.04532,	.04544,	.04715,	.03405,	.03614,	BLK 4900
5	.04329,	.05424,	.07823,	.09728,	.10057,	.10247,	.10222,	BLK 4910
6	.09551,	.08241,	.07158,	.06506,	.09203/			BLK 4920
DATA OCNBS2								BLK 4930
1	.13025,	.01557,	.01013,	.00646,	.00532,	.00665,	.00722,	BLK 4940
2	.01335,	.00728,	.01810,	.09835,	.37329,	.09703,	.01968,	BLK 4950
3	.05114,	.04342,	.03709,	.17456,	.16468,	.08785,	.06880,	BLK 4960
4	.06589,	.06791,	.07247,	.07329,	.07449,	.07025,	.07962,	BLK 4970
5	.09899,	.12481,	.17867,	.22019,	.22228,	.22051,	.21595,	BLK 4980
6	.20335,	.17278,	.14677,	.12171,	.12430,			BLK 4990
1	.03506,	.00323,	.00215,	.00139,	.00114,	.00171,	.00532,	BLK 5000
2	.03082,	.01101,	.03741,	.20101,	.47608,	.21165,	.05234,	BLK 5010
3	.12886,	.11215,	.09684,	.32810,	.31778,	.20513,	.16658,	BLK 5020
4	.15956,	.15842,	.15905,	.15968,	.16051,	.16506,	.18323,	BLK 5030
5	.21709,	.25652,	.33222,	.39639,	.39854,	.40297,	.40025,	BLK 5040
6	.39025,	.35468,	.32006,	.27715,	.25348/			BLK 5050
DATA TROXT1								BLK 5060
1	2.21222,	1.82753,	1.67032,	1.00000,	.72424,	.35272,	.15234,	BLK 5070
2	.05165,	.03861,	.02994,	.04671,	.02462,	.01538,	.01146,	BLK 5080
3	.01032,	.00816,	.00861,	.00994,	.01057,	.01139,	.01747,	BLK 5090
4	.01494,	.02418,	.03165,	.03386,	.04247,	.01601,	.01215,	BLK 5100
5	.00937,	.00861,	.00823,	.01139,	.01924,	.01234,	.01348,	BLK 5110
6	.01114,	.01297,	.01266,	.01418,	.01487,			BLK 5120
1	2.21519,	1.82266,	1.66557,	1.00000,	.72525,	.35481,	.15449,	BLK 5130
2	.05475,	.04044,	.03082,	.04620,	.05272,	.01867,	.01266,	BLK 5140
3	.01127,	.00886,	.00886,	.01449,	.01399,	.01228,	.01728,	BLK 5150
4	.01475,	.02285,	.03215,	.03494,	.04285,	.01652,	.01304,	BLK 5160
5	.01101,	.01120,	.01297,	.01753,	.02468,	.01741,	.01766,	BLK 5170
6	.01513,	.01557,	.01456,	.01532,	.01582/			BLK 5180
DATA TROXT2								BLK 5190
1	2.19082,	1.79462,	1.64456,	1.00000,	.73297,	.36443,	.16278,	BLK 5200
2	.06468,	.04658,	.03399,	.04538,	.11892,	.02835,	.01646,	BLK 5210
3	.01386,	.01076,	.00968,	.02551,	.02222,	.01468,	.01690,	BLK 5220
4	.01437,	.01994,	.03127,	.03513,	.04076,	.01722,	.01513,	BLK 5230
5	.01519,	.01791,	.02538,	.03272,	.03816,	.03038,	.02886,	BLK 5240
6	.02551,	.02228,	.01937,	.01804,	.01791,			BLK 5250
1	1.75696,	1.54829,	1.45962,	1.00000,	.77816,	.43139,	.21778,	BLK 5260
2	.11329,	.08101,	.05506,	.04943,	.25291,	.06816,	.03703,	BLK 5270
3	.02601,	.01968,	.01468,	.04962,	.04247,	.02234,	.01797,	BLK 5280
4	.01532,	.01633,	.02259,	.02487,	.02595,	.01728,	.01892,	BLK 5290
5	.02399,	.03247,	.05285,	.06462,	.06608,	.05930,	.05525,	BLK 5300

6	.04861,	.03753,	.02968,	.02348,	.02165/		BLK 5310
	DATA TROBS1 /						BLK 5320
1	.69671,	.09905,	.06563,	.04101,	.03354,	.03627,	BLK 5330
2	.00873,	.00918,	.00930,	.03215,	.01285,	.00513,	BLK 5340
3	.00557,	.00494,	.00646,	.00867,	.00937,	.01025,	BLK 5350
4	.01481,	.02418,	.02886,	.03070,	.04032,	.01494,	BLK 5360
5	.00873,	.00816,	.00797,	.01133,	.01911,	.01215,	BLK 5370
6	.01101,	.01291,	.01266,	.01418,	.01487,		BLK 5380
1	.65000,	.08791,	.05816,	.03652,	.02994,	.03278,	BLK 5390
2	.00810,	.00842,	.00867,	.03139,	.03949,	.00646,	BLK 5400
3	.00595,	.00519,	.00646,	.01304,	.01247,	.01095,	BLK 5410
4	.01449,	.02278,	.02930,	.03184,	.04063,	.01544,	BLK 5420
5	.01044,	.01076,	.01272,	.01741,	.02462,	.01722,	BLK 5430
6	.01506,	.01551,	.01456,	.01532,	.01582/		BLK 5440
	DATA TROBS2 /						BLK 5450
1	.52804,	.06367,	.04158,	.02633,	.02184,	.02443,	BLK 5460
2	.00658,	.00646,	.00709,	.02949,	.10013,	.00968,	BLK 5470
3	.00677,	.00582,	.00646,	.02361,	.01994,	.01266,	BLK 5480
4	.01386,	.01968,	.02848,	.03203,	.03854,	.01620,	BLK 5490
5	.01462,	.01747,	.02513,	.03253,	.03797,	.03019,	BLK 5500
6	.02538,	.02215,	.01930,	.01797,	.01791,		BLK 5510
1	.19829,	.01842,	.01215,	.00791,	.00665,	.00778,	BLK 5520
2	.00361,	.00253,	.00399,	.02570,	.20690,	.01715,	BLK 5530
3	.00873,	.00728,	.00658,	.04481,	.03525,	.01646,	BLK 5540
4	.01310,	.01468,	.01956,	.02184,	.02367,	.01608,	BLK 5550
5	.02342,	.03203,	.05234,	.06399,	.06538,	.05867,	BLK 5560
6	.04810,	.03715,	.02949,	.02335,	.02158/		BLK 5570
	DATA FG1EXT /						BLK 5580
1	.98519,	.99158,	.99089,	1.00000,	1.00576,	1.01747,	BLK 5590
2	1.04146,	1.04696,	1.05323,	1.05886,	1.04899,	1.06823,	BLK 5600
3	1.09272,	1.10367,	1.11684,	1.10430,	1.11367,	1.12899,	BLK 5610
4	1.17209,	1.18278,	1.20133,	1.21266,	1.21949,	1.22677,	BLK 5620
5	1.05684,	.98291,	1.01120,	1.10911,	1.11462,	1.14671,	BLK 5630
6	1.18544,	1.21582,	1.24614,	1.26842,	1.20500/		BLK 5640
	DATA FG1ABS /						BLK 5650
1	.00013,	0.00000,	0.00000,	0.00000,	0.00000,	.00095,	BLK 5660
2	.10861,	.03892,	.13272,	.47133,	.49696,	.45785,	BLK 5670
3	.37373,	.34601,	.31867,	.55190,	.55025,	.49987,	BLK 5680
4	.45943,	.45918,	.46089,	.46241,	.46386,	.47196,	BLK 5690
5	.51468,	.53101,	.55266,	.58665,	.58899,	.60367,	BLK 5700
6	.62335,	.64120,	.65627,	.66278,	.66392/		BLK 5710
	DATA FG2EXT /						BLK 5720
1	.94791,	.96215,	.97063,	1.00000,	1.00937,	1.05177,	BLK 5730
2	1.29570,	1.39203,	1.41120,	1.04715,	1.10816,	1.43285,	BLK 5740
3	1.18709,	1.04367,	.82354,	.71747,	.92405,	.79342,	BLK 5750
4	.47677,	.43171,	.36734,	.33259,	.31184,	.24139,	BLK 5760
5	.24006,	.28816,	.42671,	.56861,	.57266,	.58089,	BLK 5770
6	.54247,	.43981,	.34475,	.24905,	.19291/		BLK 5780
	DATA FG2ABS /						BLK 5790
1	0.00000,	0.00000,	0.00000,	0.00000,	0.00000,	.00013,	BLK 5800
2	.01987,	.00620,	.02323,	.17209,	.57930,	.19810,	BLK 5810
3	.09639,	.08000,	.06582,	.34589,	.32703,	.17025,	BLK 5820
4	.11816,	.11627,	.11519,	.11538,	.11601,	.12329,	BLK 5830

5	.18633,	.24057,	.35411,	.44886,	.45095,	.45215,	.44278,	BLK 5840
6	.41778,	.34430,	.27823,	.21063,	.17867/			BLK 5850
	DATA BSTEXT /							BLK 5860
1	1.48671,	1.55462,	1.51506,	1.00000,	.70633,	.28867,	.09994,	BLK 5870
2	.04184,	.02728,	.01848,	.01335,	.06513,	.08930,	.06532,	BLK 5880
3	.04766,	.04278,	.05810,	.05367,	.04392,	.03342,	.04456,	BLK 5890
4	.11867,	.14709,	.12734,	.09291,	.08778,	.05019,	.04070,	BLK 5900
5	.05734,	.03576,	.01975,	.01892,	.01956,	.03665,	.04152,	BLK 5910
6	.01715,	.01620,	.00835,	.00633,	.00589/			BLK 5920
	DATA BSTABS /							BLK 5930
1	0.00000,	0.00000,	0.00000,	0.00000,	0.00000,	0.00000,	.00019,	BLK 5940
2	.00127,	.00158,	.00291,	.00405,	.05880,	.08297,	.06019,	BLK 5950
3	.04519,	.04133,	.05703,	.05266,	.04304,	.03285,	.04437,	BLK 5960
4	.11816,	.14633,	.12639,	.09215,	.08722,	.04968,	.04044,	BLK 5970
5	.05709,	.03551,	.01962,	.01892,	.01949,	.03665,	.04146,	BLK 5980
6	.01709,	.01620,	.00835,	.00633,	.00589/			BLK 5990
	DATA AVOEXT /							BLK 6000
1	1.14880,	1.19171,	1.18013,	1.00000,	.84873,	.53019,	.27968,	BLK 6010
2	.14551,	.11070,	.08633,	.07184,	.06076,	.04506,	.03399,	BLK 6020
3	.02095,	.01538,	.01266,	.01019,	.00994,	.01044,	.01361,	BLK 6030
4	.01791,	.02278,	.02918,	.03108,	.03234,	.03456,	.03184,	BLK 6040
5	.02772,	.02475,	.01715,	.01563,	.01665,	.01646,	.01734,	BLK 6050
6	.01772,	.01076,	.01051,	.01133,	.01329/			BLK 6060
	DATA AVOABS /							BLK 6070
1	.44816,	.11259,	.08500,	.05272,	.04082,	.02449,	.01487,	BLK 6080
2	.01019,	.00867,	.00842,	.00842,	.00949,	.00741,	.00487,	BLK 6090
3	.00316,	.00335,	.00399,	.00449,	.00525,	.00665,	.01114,	BLK 6100
4	.01652,	.02177,	.02437,	.02506,	.02658,	.03006,	.02861,	BLK 6110
5	.02513,	.02285,	.01620,	.01532,	.01633,	.01620,	.01709,	BLK 6120
6	.01741,	.01057,	.01038,	.01127,	.01329/			BLK 6130
	DATA FVOEXT /							BLK 6140
1	.88715,	.92532,	.94013,	1.00000,	1.03013,	1.05975,	1.01171,	BLK 6150
2	.88677,	.82538,	.76361,	.71563,	.67424,	.60589,	.55057,	BLK 6160
3	.45222,	.37646,	.32316,	.25319,	.22728,	.20525,	.17810,	BLK 6170
4	.14481,	.14152,	.37639,	.44551,	.44405,	.42222,	.36462,	BLK 6180
5	.32551,	.27519,	.16728,	.10627,	.10861,	.10886,	.11665,	BLK 6190
6	.13127,	.10108,	.08557,	.06411,	.05741/			BLK 6200
	DATA FVOABS /							BLK 6210
1	.41582,	.22892,	.19108,	.14468,	.12475,	.09158,	.06601,	BLK 6220
2	.04943,	.04367,	.04342,	.04399,	.05076,	.04133,	.02829,	BLK 6230
3	.01924,	.01981,	.02297,	.02475,	.02778,	.03411,	.05335,	BLK 6240
4	.07133,	.08816,	.15342,	.18506,	.19354,	.20791,	.18449,	BLK 6250
5	.16101,	.13759,	.08456,	.06886,	.07278,	.07367,	.07956,	BLK 6260
6	.08785,	.06032,	.05747,	.05133,	.05323/			BLK 6270
	DATA DMEEXT /							BLK 6280
1	1.05019,	1.05880,	1.05259,	1.00000,	.94949,	.81456,	.66051,	BLK 6290
2	.54380,	.49133,	.44677,	.41671,	.38063,	.34778,	.32804,	BLK 6300
3	.29722,	.27506,	.25082,	.22620,	.21652,	.20253,	.17266,	BLK 6310
4	.14905,	.14234,	.14082,	.15057,	.16399,	.23608,	.24481,	BLK 6320
5	.27791,	.25076,	.15272,	.09601,	.09456,	.14576,	.12373,	BLK 6330
6	.18348,	.12190,	.12924,	.08538,	.04108/			BLK 6340
	DATA DMEABS /							BLK 6350
1	.00063,	.00152,	.00184,	.00506,	.00791,	.01829,	.03728,	BLK 6360

2	.06158,	.07538,	.08943,	.10051,	.11614,	.13310,	.14348,	BLK 6370
3	.14633,	.13728,	.12462,	.11184,	.10709,	.10076,	.09006,	BLK 6380
4	.08734,	.09000,	.10304,	.11905,	.13437,	.19551,	.20095,	BLK 6390
5	.22494,	.18418,	.09285,	.06665,	.06823,	.12329,	.10551,	BLK 6400
6	.16184,	.09835,	.10582,	.06759,	.03247/			BLK 6410
CCC								BLK 6420
CCC	ALTITUDE REGIONS FOR AEROSOL EXTINCTION COEFFICIENTS							BLK 6430
CCC								BLK 6440
CCC								BLK 6450
CCC	0-2KM							BLK 6460
CCC	RUREXT=RURAL EXTINCTION RURABS=RURAL ABSORPTION							BLK 6470
CCC	URBEXT=URBAN EXTINCTION URBABS=URBAN ABSORPTION							BLK 6480
CCC	OCNEXT=MARITIME EXTINCTION OCNABS=MARITIME ABSORPTION							BLK 6490
CCC	TROEXT=TROSPHER EXTINCTION TROABS=TROSPHER ABSORPTION							BLK 6500
CCC	FG1EXT=FOG1 .2KM VIS EXTINCTION FG1ABS=FOG1 ABSORPTION							BLK 6510
CCC	FG2EXT=FOG2 .5KM VIS EXTINCTION FG2ABS=FOG2 ABSORPTION							BLK 6520
CCC	>2-9KM							BLK 6530
CCC	TROEXT=TROSPHER EXTINCTION TROABS=TROSPHER ABSORPTION							BLK 6540
CCC	>9-30KM							BLK 6550
CCC	BSTEXT=BACKGROUND STRATOSPHERIC EXTINCTION							BLK 6560
CCC	BSTABS=BACKGROUND STRATOSPHERIC ABSORPTION							BLK 6570
CCC	AVOEXT=AGED VOLCANIC EXTINCTION							BLK 6580
CCC	AVOABS=AGED VOLCANIC ABSORPTION							BLK 6590
CCC	FVOEXT=FRESH VOLCANIC EXTINCTION							BLK 6600
CCC	FVOABS=FRESH VOLCANIC ABSORPTION							BLK 6610
CCC	>30-100KM							BLK 6620
CCC	DMEEXT=METEORIC DUST EXTINCTION							BLK 6630
CCC	DMEABS=METEORIC DUST ABSORPTION							BLK 6640
C	SUBROUTINE TRFN							BLK 6650
C	LOWTRAN TRANSMITTANCE FUNCTIONS							BLK 6660
	DATA TR /							BLK 6670
1	.9990,	.9980,	.9960,	.9940,	.9920,	.9900,	.9800,	BLK 6680
2	.9600,	.9500,	.9400,	.9300,	.9200,	.9100,	.9000,	BLK 6690
3	.8600,	.8400,	.8200,	.8000,	.7800,	.7600,	.7400,	BLK 6700
4	.7000,	.6800,	.6600,	.6400,	.6200,	.6000,	.5800,	BLK 6710
5	.5400,	.5200,	.5000,	.4800,	.4600,	.4400,	.4200,	BLK 6720
6	.3800,	.3600,	.3400,	.3200,	.3000,	.2800,	.2600,	BLK 6730
7	.2200,	.2000,	.1800,	.1600,	.1400,	.1200,	.1000,	BLK 6740
8	.0600,	.0400,	.0300,	.0200,	.0150,	.0100,	.0080,	BLK 6750
9	.0040,	.0020,	.0010/					BLK 6760
	DATA FW /							BLK 6770
1	-2.3468,	-2.0362,	-1.6990,	-1.4815,	-1.3279,	-1.2007,	-.7825,	BLK 6780
2	-.3468,	-.1938,	-.0655,	.0414,	.1553,	.2430,	.3324,	BLK 6790
3	.6128,	.7243,	.8261,	.9191,	1.0000,	1.0792,	1.1461,	BLK 6800
4	1.2672,	1.3284,	1.3892,	1.4409,	1.4955,	1.5441,	1.5966,	BLK 6810
5	1.6857,	1.7340,	1.7782,	1.8261,	1.8692,	1.9191,	1.9638,	BLK 6820
6	2.0607,	2.1038,	2.1461,	2.1875,	2.2304,	2.2788,	2.3263,	BLK 6830
7	2.4183,	2.4698,	2.5159,	2.5740,	2.6284,	2.6902,	2.7559,	BLK 6840
8	2.9031,	3.0000,	3.0607,	3.1461,	3.2041,	3.2718,	3.3054,	BLK 6850
9	3.3979,	3.4914,	3.5682/					BLK 6860
	DATA FO /							BLK 6870
1	-1.6778,	-1.3980,	-1.1192,	-.9508,	-.8239,	-.7258,	-.4318,	BLK 6880
2	-.1074,	0.0000,	.0969,	.1761,	.2304,	.3010,	.3522,	BLK 6890

	3 .5563, .6435, .7243, .7924, .8573, .9191, .9731, 1.0253,	BLK 6900
	4 1.0719, 1.1173, 1.1614, 1.2095, 1.2480, 1.2900, 1.3263, 1.3617,	BLK 6910
	5 1.3979, 1.4393, 1.4698, 1.4983, 1.5314, 1.5682, 1.6021, 1.6335,	BLK 6920
	6 1.6721, 1.7076, 1.7482, 1.7924, 1.8325, 1.8865, 1.9395, 2.0000,	BLK 6930
	7 2.0607, 2.1206, 2.1903, 2.2552, 2.3385, 2.4313, 2.5185, 2.6435,	BLK 6940
	8 2.7853, 2.9777, 3.1072, 3.2553, 3.3617, 3.4771, 3.5563, 3.6233,	BLK 6950
	9 3.7076, 3.8325, 3.9345/	BLK 6960
C	SUBROUTINE C4DTA	BLK 6970
C	N2 CONTINUUM	BLK 6980
C	C4 LOCATION 1 V = 2080 CM-1	BLK 6990
C	C4 LOCATION 133 V = 2740 CM-1	BLK 7000
	DATA C4A /	BLK 7010
	1 2.93E-04, 3.86E-04, 5.09E-04, 6.56E-04, 8.85E-04, 1.06E-03,	BLK 7020
	2 1.31E-03, 1.73E-03, 2.27E-03, 2.73E-03, 3.36E-03, 3.95E-03,	BLK 7030
	3 5.46E-03, 7.19E-03, 9.00E-03, 1.13E-02, 1.36E-02, 1.66E-02,	BLK 7040
	4 1.96E-02, 2.16E-02, 2.36E-02, 2.63E-02, 2.90E-02, 3.15E-02,	BLK 7050
	5 3.40E-02, 3.66E-02, 3.92E-02, 4.26E-02, 4.60E-02, 4.95E-02,	BLK 7060
	6 5.30E-02, 5.65E-02, 6.00E-02, 6.30E-02, 6.60E-02, 6.89E-02,	BLK 7070
	7 7.18E-02, 7.39E-02, 7.60E-02, 7.84E-02, 8.08E-02, 8.39E-02,	BLK 7080
	8 8.70E-02, 9.13E-02, 9.56E-02, 1.08E-01, 1.20E-01, 1.36E-01,	BLK 7090
	9 1.52E-01, 1.60E-01, 1.69E-01, 1.60E-01, 1.51E-01, 1.37E-01,	BLK 7100
	\$ 1.23E-01, 1.19E-01, 1.16E-01, 1.14E-01, 1.12E-01, 1.12E-01,	BLK 7110
	\$ 1.11E-01, 1.11E-01, 1.12E-01, 1.14E-01, 1.13E-01, 1.12E-01,	BLK 7120
	\$ 1.09E-01, 1.07E-01, 1.02E-01, 9.90E-02, 9.50E-02, 9.00E-02,	BLK 7130
	\$ 8.65E-02, 8.20E-02, 7.65E-02, 7.05E-02, 6.50E-02, 6.10E-02,	BLK 7140
	\$ 5.50E-02, 4.95E-02, 4.50E-02, 4.00E-02, 3.75E-02, 3.50E-02,	BLK 7150
	\$ 3.10E-02, 2.65E-02, 2.50E-02, 2.20E-02, 1.95E-02, 1.75E-02,	BLK 7160
	\$ 1.60E-02, 1.40E-02, 1.20E-02, 1.05E-02, 9.50E-03, 9.00E-03,	BLK 7170
	\$ 8.00E-03, 7.00E-03, 6.50E-03, 6.00E-03, 5.50E-03, 4.75E-03,	BLK 7180
	\$ 4.00E-03, 3.75E-03, 3.50E-03, 3.00E-03, 2.50E-03, 2.25E-03,	BLK 7190
	\$ 2.00E-03, 1.85E-03, 1.70E-03, 1.60E-03, 1.50E-03, 1.50E-03/	BLK 7200
	DATA C4B /	BLK 7210
	1 1.54E-03, 1.50E-03, 1.47E-03, 1.34E-03, 1.25E-03, 1.06E-03,	BLK 7220
	2 9.06E-04, 7.53E-04, 6.41E-04, 5.09E-04, 4.04E-04, 3.36E-04,	BLK 7230
	3 2.86E-04, 2.32E-04, 1.94E-04, 1.57E-04, 1.31E-04, 1.02E-04,	BLK 7240
	4 8.07E-05/	BLK 7250
C	4M H2O CONTINUUM	BLK 7260
C	C5 LOCATION 1 V = 2350 CM-1	BLK 7270
C	C5 LOCATION 15 V = 2420 CM-1	BLK 7280
	DATA C5 /	BLK 7290
	1 0.00, .19, .15, .12, .10, .09, .10, .12, .15, .17,	BLK 7300
	2 .20, .24, .28, .33, 0.00/	BLK 7310
C	OZONE U.V. + VISIBLE	BLK 7320
C	C8 LOCATION 1 V = 13000 CM-1	BLK 7330
C	C8 LOCATION 56 V = 24200 CM-1	BLK 7340
C	DV = 200 CM-1	BLK 7350
C	C8 LOCATION 57 V = 27500 CM-1	BLK 7360
C	C8 LOCATION 102 V = 50000 CM-1	BLK 7370
C	DV = 500 CM-1	BLK 7380
	DATA C8 /	BLK 7390
	1 4.50E-03, 8.00E-03, 1.07E-02, 1.10E-02, 1.27E-02, 1.71E-02,	BLK 7400
	2 2.00E-02, 2.45E-02, 3.07E-02, 3.84E-02, 4.78E-02, 5.67E-02,	BLK 7410
	3 6.54E-02, 7.62E-02, 9.15E-02, 1.00E-01, 1.09E-01, 1.20E-01,	BLK 7420

4	1.28E-01,	1.12E-01,	1.11E-01,	1.16E-01,	1.19E-01,	1.13E-01,	BLK 7430
5	1.03E-01,	9.24E-02,	8.28E-02,	7.57E-02,	7.07E-02,	6.58E-02,	BLK 7440
6	5.55E-02,	4.77E-02,	4.06E-02,	3.87E-02,	3.82E-02,	2.94E-02,	BLK 7450
7	2.09E-02,	1.80E-02,	1.91E-02,	1.66E-02,	1.17E-02,	7.70E-03,	BLK 7460
8	6.10E-03,	8.50E-03,	6.10E-03,	3.70E-03,	3.20E-03,	3.10E-03,	BLK 7470
9	2.55E-03,	1.98E-03,	1.40E-03,	8.25E-04,	2.50E-04,	0.	BLK 7480
	\$ 0.	0.	5.65E-04,	2.04E-03,	7.35E-03,	2.03E-02,	BLK 7490
	\$ 4.98E-02,	1.18E-01,	2.46E-01,	5.18E-01,	1.02E+00,	1.95E+00,	BLK 7500
	\$ 3.79E+00,	6.65E+00,	1.24E+01,	2.20E+01,	3.67E+01,	5.95E+01,	BLK 7510
	\$ 8.50E+01,	1.26E+02,	1.68E+02,	2.06E+02,	2.42E+02,	2.71E+02,	BLK 7520
	\$ 2.91E+02,	3.02E+02,	3.03E+02,	2.94E+02,	2.77E+02,	2.54E+02,	BLK 7530
	\$ 2.26E+02,	1.96E+02,	1.68E+02,	1.44E+02,	1.17E+02,	9.75E+01,	BLK 7540
	\$ 7.65E+01,	6.04E+01,	4.62E+01,	3.46E+01,	2.52E+01,	2.00E+01,	BLK 7550
	\$ 1.57E+01,	1.20E+01,	1.00E+01,	8.80E+00,	8.30E+00,	8.60E+00/	BLK 7560
	END						BLK 7570

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SUBROUTINE CIDTA (CILL,L)
C      WATER VAPOR
C      C1 LOCATION 1 V = 350 CM-1
C      C1 LOCATION 1770 V = 9195 CM-1
C      C1 LOCATION 1771 V = 9875 CM-1
C      C1 LOCATION 2355 V = 12795 CM-1
C      C1 LOCATION 2356 V = 12350 CM-1
C      C1 LOCATION 2580 V = 14520 CM-1
C      COMMON /C1/C1(2580)
C      DIMENSION C1(2580)
C      DIMENSION C1A(190),C1B(190),C1C(190),C1D(190),C1E(190),C1F(190),
1 C1G(190),C1H(190),C1I(190),C1J(190),C1K(190),C1L(190),C1M(190),
2 C1N(110)
C      EQUIVALENCE (C1,C1A),(C1(191),C1B),(C1(381),C1C),(C1(571),C1D),
1 (C1(761),C1E),(C1(951),C1F),(C1(1141),C1G),(C1(1331),C1H),
2 (C1(1521),C1I),(C1(1711),C1J),(C1(1901),C1K),(C1(2091),C1L),
3 (C1(2281),C1M),(C1(2471),C1N)
C      DATA C1(I),I= 1, 190)
C      DATA C1A/
1 3.93, 3.72, 3.54, 3.42, 3.37, 3.37, 3.36, 3.33, 3.25, 3.13,
2 3.02, 2.96, 2.97, 3.00, 3.08, 3.12, 3.08, 3.03, 3.00, 3.01,
3 3.03, 3.07, 3.05, 3.01, 2.94, 2.83, 2.71, 2.62, 2.58, 2.57,
4 2.62, 2.67, 2.72, 2.71, 2.60, 2.46, 2.35, 2.26, 2.22, 2.23,
5 2.19, 2.17, 2.17, 2.20, 2.26, 2.34, 2.42, 2.39, 2.20, 2.01,
6 1.92, 1.83, 1.78, 1.79, 1.81, 1.84, 1.83, 1.80, 1.71, 1.51,
7 1.39, 1.30, 1.25, 1.18, 1.19, 1.18, 1.21, 1.33, 1.47, 1.53,
8 1.54, 1.36, 1.12, .89, .69, .49, .60, .71, .79, .99,
9 .86, .73, .53, .43, .51, .52, .67, .73, .80, .83,
$ .80, .63, .47, .32, -.08, -.21, -.29, -.21, -.01, .08,
$ .16, .09, -.03, -.21, -.37, -.35, -.30, -.31, -.37, -.42,
$ -.48, -.42, -.40, -.39, -.43, -.77, -.83, -.88, -.79, -.60,
$ -.50, -.42, -.39, -.38, -.37, -.40, -.51, -.67, -.82, -.58,
$ -.40, -.32, -.21, -.09, -.18, -.16, -.19, -.28, -.33, -.35,
$ -.28, -.22, -.10, -.05, -.11, -.13, -.27, -.27, -.18, -.06,
$ .11, .23, .26, .19, .11, 0.00, -.09, .02, .08, .12,
$ .22, .28, .39, .54, .68, .75, .79, .79, .71, .69,
$ .76, .88, 1.01, 1.16, 1.18, 1.14, 1.05, 1.02, 1.11, 1.23,
$ 1.41, 1.75, 1.83, 1.99, 2.05, 2.03, 2.00, 1.96, 1.90, 1.86/
C      DATA(C1(I),I= 191, 380)/
C      DATA C1B/
1 1.91, 2.08, 2.24, 2.41, 2.63, 2.68, 2.67, 2.73, 2.79, 2.81,
2 2.91, 2.93, 3.02, 3.16, 3.23, 3.30, 3.34, 3.43, 3.57, 3.59,
3 3.59, 3.58, 3.57, 3.61, 3.71, 3.71, 3.69, 3.64, 3.60, 3.68,
4 3.80, 3.95, 4.05, 4.05, 4.02, 3.99, 3.96, 4.01, 4.13, 4.22,
5 4.35, 4.49, 4.58, 4.62, 4.63, 4.61, 4.57, 4.56, 4.56, 4.53,
6 4.49, 4.46, 4.40, 4.28, 4.14, 3.92, 3.63, 3.35, 3.16, 3.10,
7 3.24, 3.47, 3.66, 3.80, 3.93, 4.00, 4.04, 4.15, 4.23, 4.31,
8 4.35, 4.31, 4.23, 4.20, 4.24, 4.28, 4.35, 4.42, 4.42, 4.44,
9 4.46, 4.40, 4.30, 4.22, 4.13, 4.07, 4.12, 4.19, 4.22, 4.23,
$ 4.16, 4.04, 3.99, 3.94, 3.93, 3.91, 3.86, 3.83, 3.80, 3.78,
$ 3.70, 3.54, 3.40, 3.30, 3.31, 3.42, 3.52, 3.52, 3.49, 3.41,
$ 3.21, 3.14, 3.10, 3.08, 3.11, 2.98, 2.88, 2.78, 2.74, 2.76,
$ 2.72, 2.76, 2.82, 2.85, 2.86, 2.75, 2.64, 2.60, 2.61, 2.64,
C1D :10
C1D :20
C1D :30
C1D :40
C1D :50
C1D :60
C1D :70
C1D :80
C1D :90
C1D :91
C1D :92
C1D :93
C1D :94
C1D :95
C1D :96
C1D :97
C1D :98
C1D :100
C1D :101
C1D :110
C1D :120
C1D :130
C1D :140
C1D :150
C1D :160
C1D :170
C1D :180
C1D :190
C1D :200
C1D :210
C1D :220
C1D :230
C1D :240
C1D :250
C1D :260
C1D :270
C1D :280
C1D :290
C1D :300
C1D :301
C1D :310
C1D :320
C1D :330
C1D :340
C1D :350
C1D :360
C1D :370
C1D :380
C1D :390
C1D :400
C1D :410
C1D :420
C1D :430

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\$ 2.56, 2.49, 2.37, 2.25, 2.14, 2.08, 2.11, 2.20, 2.31, 2.28,
 \$ 2.15, 2.06, 1.98, 2.03, 2.05, 1.96, 1.84, 1.72, 1.64, 1.59,
 \$ 1.57, 1.57, 1.60, 1.63, 1.51, 1.38, 1.07, .91, .87, .92,
 \$ 1.04, 1.01, .92, .84, .92, .97, 1.01, 1.06, 1.10, 1.06,
 \$ 1.01, .91, .79, .55, .47, .41, .39, .38, .34, .33,
 \$.36, .43, .48, .45, .38, .27, .21, .22, .29, .37/

C1D 440
 C1D 450
 C1D 460
 C1D 470
 C1D 480
 C1D 490

C DATA(C1(I),I= 381, 570)/
 DATA C1C/

C1D :500
 C1D :501

1 .38, .37, .29, .19, .13, .11, .03, -.05, -.12, -.24,
 2 -.31, -.39, -.43, -.50, -.59, -.68, -.73, -.80, -.92, -1.06,
 3 -1.14, -1.22, -1.27, -1.28, -1.33, -1.32, -1.43, -1.51, -1.63, -1.74,
 4 -1.82, -1.98, -2.09, -2.21, -2.21, -2.24, -2.27, -2.36, -2.51, -2.65,
 5 -2.70, -2.63, -2.57, -2.56, -2.59, -2.67, -2.69, -2.67, -2.68, -2.62,
 6 -2.52, -2.42, -2.29, -2.14, -2.00, -1.87, -1.71, -1.51, -1.39, -1.27,
 7 -1.12, -1.01, -.89, -.75, -.68, -.57, -.47, -.42, -.32, -.27,
 8 -.26, -.19, -.13, -.11, -.01, .05, .08, .17, .25, .31,
 9 .41, .43, .44, .43, .36, .35, .31, .25, .25, .22,
 \$.21, .33, .49, .65, .76, .71, .51, .30, .13, .10,
 \$.17, .24, .31, .38, .45, .51, .56, .60, .63, .62,
 \$.63, .64, .66, .69, .76, .75, .74, .70, .62, .53,
 \$.46, .39, .38, .37, .38, .42, .47, .50, .58, .69,
 \$.67, .62, .64, .68, .76, .90, 1.11, 1.13, 1.10, .97,
 \$.98, 1.17, 1.38, 1.52, 1.70, 1.76, 1.84, 1.92, 1.90, 1.87,
 \$ 1.91, 2.02, 2.13, 2.10, 2.18, 2.22, 2.25, 2.03, 2.01, 1.77,
 \$ 1.93, 2.19, 2.28, 2.14, 2.15, 2.22, 2.01, 2.14, 2.26, 2.36,
 \$ 2.51, 2.66, 2.73, 2.68, 2.69, 2.64, 2.22, 1.95, 1.61, 1.11,
 \$.88, .83, .89, 1.20, 1.62, 1.82, 1.99, 2.01, 2.14, 2.16/

C1D 510
 C1D 520
 C1D 530
 C1D 540
 C1D 550
 C1D 560
 C1D 570
 C1D 580
 C1D 590
 C1D 600
 C1D 610
 C1D 620
 C1D 630
 C1D 640
 C1D 650
 C1D 660
 C1D 670
 C1D 680
 C1D 690

C DATA(C1(I),I= 571, 760)/
 DATA C1D/

C1D :700
 C1D :701

1 2.21, 2.30, 2.33, 2.42, 2.50, 2.51, 2.49, 2.46, 2.42, 2.37,
 2 2.37, 2.33, 2.31, 2.43, 2.56, 2.61, 2.63, 2.60, 2.50, 2.38,
 3 2.41, 2.34, 2.31, 2.32, 2.40, 2.27, 2.32, 2.22, 2.09, 2.08,
 4 2.17, 2.41, 2.77, 2.68, 2.49, 2.29, 2.23, 2.42, 2.61, 2.58,
 5 2.49, 2.40, 2.39, 2.51, 2.60, 2.68, 2.68, 2.70, 2.82, 2.83,
 6 2.82, 2.81, 2.84, 2.86, 2.91, 2.96, 3.03, 3.08, 3.21, 3.30,
 7 3.40, 3.52, 3.49, 3.46, 3.51, 3.54, 3.56, 3.55, 3.57, 3.61,
 8 3.71, 3.80, 3.92, 3.99, 4.06, 4.02, 4.06, 4.12, 4.28, 4.30,
 9 4.22, 4.32, 4.42, 4.53, 4.64, 4.55, 4.40, 4.28, 4.32, 4.38,
 \$ 4.37, 4.24, 4.13, 4.14, 4.20, 4.25, 4.32, 4.35, 4.31, 4.27,
 \$ 4.25, 4.27, 4.31, 4.36, 4.41, 4.52, 4.59, 4.71, 4.79, 4.81,
 \$ 4.73, 4.61, 4.42, 4.28, 4.08, 4.00, 3.88, 3.86, 3.92, 3.98,
 \$ 4.12, 4.18, 4.31, 4.37, 4.42, 4.50, 4.53, 4.58, 4.59, 4.61,
 \$ 4.61, 4.59, 4.53, 4.49, 4.44, 4.41, 4.40, 4.34, 4.30, 4.26,
 \$ 4.09, 3.98, 3.87, 3.78, 3.77, 3.79, 3.75, 3.72, 3.62, 3.56,
 \$ 3.51, 3.48, 3.32, 3.18, 3.07, 2.96, 2.87, 2.80, 2.68, 2.58,
 \$ 2.59, 2.51, 2.59, 2.57, 2.50, 2.42, 2.32, 2.20, 2.12, 2.00,
 \$ 1.92, 1.79, 1.63, 1.60, 1.69, 1.78, 2.04, 2.00, 1.81, 1.70,
 \$ 1.63, 1.61, 1.60, 1.49, 1.14, 1.35, 1.64, 1.69, 1.70, 1.59/

C1D 710
 C1D 720
 C1D 730
 C1D 740
 C1D 750
 C1D 760
 C1D 770
 C1D 780
 C1D 790
 C1D 800
 C1D 810
 C1D 820
 C1D 830
 C1D 840
 C1D 850
 C1D 860
 C1D 870
 C1D 880
 C1D 890

C DATA(C1(I),I= 761, 950)/
 DATA C1E/

C1D :900
 C1D :901

1 1.45, 1.29, 1.19, 1.08, 1.02, 1.04, 1.10, 1.16, 1.20, 1.23,
 2 1.22, 1.08, 1.08, 1.06, .89, .93, .73, .58, .54, .77,
 3 .81, .74, .71, .57, .49, .43, .38, .12, .10, .20,

C1D 910
 C1D 920
 C1D 930

4	.41, .37, .31, .11, -.13, -.21, -.32, -.36, -.39, -.33,	C1D 940
5	-.39, -.45, -.50, -.56, -.62, -.68, -.77, -.84, -.91, -1.00,	C1D 950
6	-1.11, -1.19, -1.28, -1.31, -1.39, -1.43, -1.48, -1.52, -1.57, -1.60,	C1D 960
7	-1.61, -1.60, -1.58, -1.51, -1.42, -1.32, -1.26, -1.16, -1.00, -.83,	C1D 970
8	-.71, -.61, -.52, -.43, -.36, -.30, -.21, -.19, -.17, -.15,	C1D 980
9	-.13, -.17, -.19, -.12, -.06, -.01, 0.00, -.11, -.23, -.32,	C1D 990
\$	-.44, -.51, -.48, -.47, -.42, -.40, -.40, -.39, -.37, -.35,	C1D 1000
\$	-.48, -.75, -1.13, -1.58, -1.80, -1.66, -1.52, -1.35, -1.19, -1.02,	C1D 1010
\$	-.88, -.66, -.65, -.63, -.62, -.66, -.73, -.79, -.88, -.84,	C1D 1020
\$	-.70, -.59, -.43, -.39, -.50, -.61, -.74, -.79, -.76, -.69,	C1D 1030
\$	-.62, -.59, -.52, -.48, -.48, -.42, -.39, -.38, -.33, -.29,	C1D 1040
\$	-.26, -.23, -.22, -.28, -.37, -.50, -.60, -.60, -.51, -.46,	C1D 1050
\$	-.42, -.43, -.45, -.35, -.24, -.14, -.08, -.08, 0.00, .11,	C1D 1060
\$	.32, .43, .42, .32, .23, .22, .28, .45, .55, .62,	C1D 1070
\$	.65, .71, .75, .80, .83, .85, .87, .90, .93, 1.00,	C1D 1080
\$	1.04, 1.15, 1.22, 1.32, 1.31, 1.32, 1.33, 1.48, 1.78, 1.87/	C1D 1090
C	DATA(C1(I),I= 951,1140)/	C1D:1100
	DATA C1F/	C1D:1101
1	2.01, 1.92, 1.86, 1.89, 1.92, 1.98, 2.03, 2.39, 2.31, 2.48,	C1D 1110
2	2.70, 2.71, 2.76, 2.78, 2.70, 2.77, 3.08, 2.94, 3.05, 2.94,	C1D 1120
3	3.23, 3.20, 3.19, 3.32, 3.11, 3.41, 3.31, 3.36, 3.46, 3.36,	C1D 1130
4	3.39, 3.50, 3.41, 3.22, 3.19, 2.98, 2.78, 2.98, 3.02, 2.82,	C1D 1140
5	2.98, 2.86, 2.92, 2.92, 3.05, 3.22, 3.60, 3.78, 3.81, 3.96,	C1D 1150
6	3.76, 3.62, 3.34, 3.08, 3.31, 3.16, 3.37, 3.41, 3.30, 3.33,	C1D 1160
7	3.33, 3.51, 3.48, 3.43, 3.52, 3.31, 3.40, 3.58, 3.61, 3.49,	C1D 1170
8	3.46, 3.42, 3.19, 3.18, 3.30, 3.00, 2.99, 3.21, 3.11, 3.14,	C1D 1180
9	3.10, 2.72, 2.81, 2.95, 2.69, 2.73, 2.72, 2.47, 2.51, 2.60,	C1D 1190
\$	2.42, 2.37, 2.73, 1.91, 1.87, 1.81, 1.78, 1.53, 1.51, 1.62,	C1D 1200
\$	1.59, 1.50, 1.42, 1.32, 1.22, 1.12, 1.08, 1.02, .97, .92,	C1D 1210
\$	.90, .87, .84, .82, .79, .78, .76, .75, .72, .71,	C1D 1220
\$	.71, .70, .69, .67, .61, .59, .52, .48, .41, .39,	C1D 1230
\$	.38, .33, .32, .30, .30, .30, .29, .28, .27, .26,	C1D 1240
\$	.25, .23, .22, .21, .20, .18, .14, .13, .06, .01,	C1D 1250
\$	-.03, -.07, -.11, -.16, -.21, -.24, -.29, -.32, -.38, -.41,	C1D 1260
\$	-.45, -.50, -.54, -.61, -.69, -.76, -.84, -.90, -.97, -1.01,	C1D 1270
\$	-1.10, -1.13, -1.19, -1.22, -1.28, -1.30, -1.33, -1.36, -1.39, -1.43,	C1D 1280
\$	-1.48, -1.50, -1.52, -1.57, -1.61, -1.66, -1.70, -1.72, -1.78, -1.81/	C1D 1290
C	DATA(C1(I),I=1141,1330)/	C1D:1300
	DATA C1G/	C1D:1301
1	-1.89, -1.92, -2.00, -2.08, -2.16, -2.24, -2.31, -2.40, -2.48, -2.54,	C1D 1310
2	-2.61, -2.71, -2.83, -2.95, -3.10, -5.00, -5.00, -5.00, -5.00, -5.00,	C1D 1320
3	-5.00, -5.00, -5.00, -5.00, -5.00, -5.00, -5.00, -5.00, -5.00, -5.00,	C1D 1330
4	-5.00, -5.00, -5.00, -5.00, -5.00, -5.00, -5.00, -5.00, -5.00, -5.00,	C1D 1340
5	-5.00, -5.00, -5.00, -5.00, -5.00, -5.00, -5.00, -5.00, -5.00, -5.00,	C1D 1350
6	-5.00, -5.00, -5.00, -5.00, -5.00, -5.00, -5.00, -5.00, -5.00, -5.00,	C1D 1360
7	-5.00, -5.00, -5.00, -5.00, -5.00, -5.00, -5.00, -5.00, -5.00, -5.00,	C1D 1370
8	-5.00, -5.00, -5.00, -5.00, -5.00, -5.00, -5.00, -5.00, -5.00, -5.00,	C1D 1380
9	-5.00, -5.00, -5.00, -5.00, -5.00, -5.00, -5.00, -5.00, -5.00, -5.00,	C1D 1390
\$	-3.78, -3.33, -3.01, -2.82, -2.68, -2.49, -2.30, -2.13, -2.00, -1.81,	C1D 1400
\$	-1.60, -1.41, -1.13, -.90, -.79, -.63, -.48, -.36, -.28, -.16,	C1D 1410
\$	-.06, .08, .20, .28, .41, .54, .69, .80, .92, 1.04,	C1D 1420
\$	1.19, 1.19, 1.01, .98, 1.02, 1.19, 1.29, 1.30, 1.29, 1.38,	C1D 1430
\$	1.19, 1.39, 1.42, 1.43, 1.70, 1.62, 1.54, 1.41, 1.53, 1.86,	C1D 1440

\$ 1.96, 1.97, 2.02, 2.01, 1.94, 1.94, 1.83, 2.03, 2.21, 2.42,	C1D 1450
\$ 2.30, 2.16, 2.02, 2.02, 2.02, 2.13, 1.90, 1.71, 2.01, 1.56,	C1D 1460
\$ 1.56, 1.51, 1.30, 1.63, 1.64, 1.67, 1.70, 2.22, 2.39, 2.38,	C1D 1470
\$ 2.30, 1.93, 2.39, 2.49, 2.52, 2.57, 2.21, 2.18, 2.40, 2.41,	C1D 1480
\$ 2.45, 2.51, 2.23, 2.49, 2.30, 2.61, 2.72, 2.52, 2.63, 2.56/	C1D 1490
C DATA(C1(I),I=1331,1520)/	C1D:1500
DATA C1H/	C1D:1501
1 2.51, 2.70, 2.62, 2.62, 2.80, 2.74, 2.79, 2.74, 2.70, 2.88,	C1D 1510
2 2.81, 2.72, 2.76, 2.84, 2.92, 2.98, 2.88, 2.88, 3.02, 3.08,	C1D 1520
3 3.26, 3.03, 3.14, 3.28, 3.03, 3.11, 3.15, 3.30, 3.31, 3.22,	C1D 1530
4 3.00, 3.06, 3.34, 3.40, 3.37, 3.32, 3.08, 3.09, 3.09, 3.01,	C1D 1540
5 3.07, 3.07, 3.31, 3.21, 3.31, 3.67, 3.58, 3.79, 3.70, 3.49,	C1D 1550
6 3.39, 3.11, 3.13, 3.01, 3.10, 3.01, 3.18, 3.32, 3.43, 3.35,	C1D 1560
7 3.40, 3.39, 3.39, 3.51, 3.54, 3.42, 3.50, 3.67, 3.59, 3.63,	C1D 1570
8 3.66, 3.48, 3.39, 3.29, 3.31, 3.41, 3.23, 3.32, 3.12, 2.91,	C1D 1580
9 2.91, 2.75, 2.78, 2.72, 2.62, 2.58, 2.32, 2.22, 2.00, 1.97,	C1D 1590
\$ 1.68, 1.62, 1.64, 1.53, 1.56, 1.51, 1.52, 1.48, 1.42, 1.42,	C1D 1600
\$ 1.40, 1.41, 1.43, 1.56, 1.52, 1.51, 1.52, 1.39, 1.39, 1.30,	C1D 1610
\$ 1.09, 1.16, 1.21, 1.20, 1.22, 1.20, 1.18, 1.20, 1.19, 1.17,	C1D 1620
\$ 1.10, 1.10, 1.09, 1.10, 1.11, 1.04, .98, .90, .86, .90,	C1D 1630
\$.90, .90, .86, .71, .79, .70, .71, .67, .62, .53,	C1D 1640
\$.42, .31, .20, .01, -.08, -.17, -.26, -.35, -.44, -.53,	C1D 1650
\$ -.63, -.73, -.83, -.93, -1.04, -1.14, -1.24, -1.34, -1.44, -1.54,	C1D 1660
\$ -1.64, -1.74, -1.84, -1.94, -2.04, -2.14, -2.24, -2.34, -2.44, -2.54,	C1D 1670
\$ -2.64, -2.74, -2.84, -2.94, -3.04, -3.14, -3.24, -3.34, -3.44, -3.54,	C1D 1680
\$ -3.64, -3.74, -3.84, -3.94, -4.04, -5.00, -5.00, -5.00, -5.00, -5.00/	C1D 1690
C DATA(C1(I),I=1521,1710)/	C1D:1700
DATA C1I/	C1D:1701
1-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C1D 1710
2-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C1D 1720
3-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C1D 1730
4-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C1D 1740
5-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C1D 1750
6-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C1D 1760
7-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C1D 1770
8-4.15,-4.06,-3.97,-3.88,-3.79,-3.70,-3.61,-3.52,-3.43,-3.34,	C1D 1780
9-3.25,-3.16,-3.07,-2.98,-2.89,-2.80,-2.71,-2.62,-2.53,-2.44,	C1D 1790
\$ -2.35,-2.26,-2.18,-2.09,-2.00,-1.91,-1.82,-1.73,-1.64,-1.55,	C1D 1800
\$ -1.46,-1.37,-1.28,-1.19,-1.10,-1.01, -.92, -.83, -.74, -.65,	C1D 1810
\$ -.56, -.47, -.38, -.29, -.20, -.14, -.09, -.02, .03, .10,	C1D 1820
\$.17, .22, .30, .35, .41, .45, .42, .40, .43, .46,	C1D 1830
\$.50, .59, .71, .84, .93, 1.01, 1.06, 1.07, 1.02, 1.01,	C1D 1840
\$ 1.12, 1.23, 1.24, 1.28, 1.34, 1.43, 1.52, 1.56, 1.59, 1.56,	C1D 1850
\$ 1.51, 1.61, 1.50, 1.70, 1.82, 1.92, 1.94, 1.89, 1.81, 1.45,	C1D 1860
\$ 1.30, 1.28, 1.43, 1.50, 1.49, 1.55, 1.48, 1.32, 1.39, 1.53,	C1D 1870
\$ 1.82, 2.23, 2.61, 2.51, 2.20, 1.86, 1.61, 1.19, 1.32, 1.52,	C1D 1880
\$ 1.70, 1.90, 2.01, 1.92, 1.91, 2.12, 2.10, 2.01, 2.18, 1.99/	C1D 1890
C DATA(C1(I),I=1711,1900)/	C1D:1900
DATA C1J/	C1D:1901
1 2.11, 2.28, 2.21, 2.13, 2.00, 1.91, 1.92, 1.97, 1.88, 1.91,	C1D 1910
2 1.91, 1.92, 1.93, 1.74, 1.61, 1.58, 1.27, 1.20, 1.18, 1.11,	C1D 1920
3 .99, .86, .71, .60, .44, .31, .19, .03, -.07, -.21,	C1D 1930
4 -.35, -.49, -.64, -.79, -.94, -1.11, -1.24, -1.41, -1.57, -1.73,	C1D 1940

5-1.91,-2.09,-2.27,-2.45,-2.63,-2.81,-2.99,-3.18,-3.37,-3.56,	C1D 1950
6-3.75,-3.94,-4.13,-4.31,-4.49,-4.66,-4.83,-4.99,-5.14,-5.28,	C1D 1960
7-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-4.68,-4.26,	C1D 1970
8-3.89,-3.57,-3.32,-3.11,-2.91,-2.89,-2.79,-2.74,-2.63,-2.47,	C1D 1980
9-2.29,-2.20,-2.17,-2.23,-2.27,-2.32,-2.12,-2.08,-2.07,-2.07,	C1D 1990
\$-2.07,-1.98,-1.77,-1.70,-1.63,-1.60,-1.59,-1.43,-1.21,-1.15,	C1D 2000
\$-1.09,-1.13,-1.29,-1.19,-.98,-.93,-.87,-.91,-.88,-.71,	C1D 2010
\$-.62,-.59,-.58,-.63,-.58,-.39,-.22,-.14,-.06,-.01,	C1D 2020
\$-.01,-.08,-.20,-.16,-.02,.18,.32,.42,.37,.23,	C1D 2030
\$.12,.15,.28,.43,.59,.58,.53,.44,.39,.38,	C1D 2040
\$.35,.23,.26,.19,.08,.10,.18,.27,.38,.43,	C1D 2050
\$.32,.37,.58,.64,.87,.98,1.00,1.02,1.13,1.08,	C1D 2060
\$1.08,1.16,1.16,1.30,1.41,1.40,1.32,1.32,1.37,1.42,	C1D 2070
\$1.50,1.42,1.38,1.36,1.38,1.49,1.63,1.62,1.62,1.70,	C1D 2080
\$1.68,1.60,1.56,1.56,1.63,1.64,1.56,1.49,1.49,1.52/	C1D 2090
C DATA(C1(I),I=1901,2090)/	C1D:2100
DATA C1K/	C1D:2101
1 1.58, 1.62, 1.62, 1.61, 1.61, 1.62, 1.63, 1.71, 1.72, 1.70,	C1D 2110
2 1.70, 1.67, 1.62, 1.66, 1.70, 1.67, 1.56, 1.49, 1.42, 1.38,	C1D 2120
3 1.26, 1.20, 1.13, 1.14, 1.19, 1.29, 1.50, 1.72, 1.86, 1.78,	C1D 2130
4 1.82, 1.88, 1.82, 1.89, 1.99, 2.00, 2.14, 2.04, 2.02, 2.02,	C1D 2140
5 1.98, 1.90, 1.83, 1.81, 1.72, 1.69, 1.59, 1.50, 1.36, 1.20,	C1D 2150
6 .98, .63, .43, .29, .16, .05, .02, .03, .03, .01,	C1D 2160
7 -.08, -.18, -.20, -.11, -.06, -.03, -.14, -.21, -.08, -.06,	C1D 2170
8 .10, .18, .11, .32, .42, .44, .38, .28, .42, .43,	C1D 2180
9 .41, .33, .32, .41, .50, .46, .31, .18, .08, .20,	C1D 2190
\$.21, .34, .36, .28, .35, .39, .42, .38, .32, .30,	C1D 2200
\$.16, -.01, -.23, -.41, -.52, -.48, -.58, -.61, -.48, -.23,	C1D 2210
\$-.03, .21, .36, .39, .47, .44, .40, .51, .59, .53,	C1D 2220
\$.69, .57, .48, .52, .62, .59, .55, .50, .32, .26,	C1D 2230
\$.11, -.08, -.10, -.16, -.43, -.62, -.88,-1.09,-1.16,-1.31,	C1D 2240
\$-1.45,-1.49,-1.78,-1.91,-2.01,-1.97,-1.97,-1.97,-1.97,-2.26,	C1D 2250
\$-2.20,-2.01,-1.99,-2.00,-2.04,-2.37,-2.49,-2.44,-2.36,-2.32,	C1D 2260
\$-2.19,-2.10,-2.25,-2.16,-2.36,-2.44,-2.40,-2.49,-2.48,-2.43,	C1D 2270
\$-2.40,-2.36,-2.40,-2.49,-2.59,-2.68,-2.89,-3.28,-3.51,-3.74,	C1D 2280
\$-3.97,-4.20,-4.43,-4.66,-4.89,-5.00,-5.00,-5.00,-5.00,-5.00/	C1D 2290
C DATA(C1(I),I=2091,2280)/	C1D:2300
DATA C1L/	C1D:2301
1-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C1D 2310
2-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C1D 2320
3-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C1D 2330
4-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C1D 2340
5-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C1D 2350
6-5.00,-5.00,-5.00,-5.00,-5.00,-3.71,-3.56,-3.40,-3.21,-3.06,	C1D 2360
7-2.90,-2.74,-2.60,-2.46,-2.32,-2.17,-2.03,-1.87,-1.79,-1.74,	C1D 2370
8-1.83,-1.82,-1.71,-1.59,-1.49,-1.46,-1.46,-1.49,-1.49,-1.25,	C1D 2380
9-1.24,-1.08,-.90,-1.06,-.91,-.91,-1.01,-.99,-.87,-.92,	C1D 2390
\$-.79,-.42,-.54,-.38,-.42,-.48,-.34,-.27,-.17,-.28,	C1D 2400
\$-.38,-.22,-.30,-.08,-.01,-.20,.06,.10,.06,.14,	C1D 2410
\$-.12,-.02,-.02,-.13,-.11,-.10,-.06,-.05,-.04,-.10,	C1D 2420
\$-.04,-.06,-.21,-.38,-.61,-.40,-.31,-.42,-.58,-.57,	C1D 2430
\$-.54,-.24,.11,.51,.81,.79,.62,.26,-.31,-.67,	C1D 2440
\$-.80,-.88,-.50,-.39,-.10,.09,.06,.08,.16,.21,	C1D 2450

	\$.13, .32, .35, .51, .60, .51, .51, .40, .40, .43,	C1D 2460
	\$.42, .33, .43, .34, .22, .13, -.11, -.31, -.41,	C1D 2470
	\$ -.41, -.39, -.53, -.69, -.84, -.88, -1.01, -1.10, -1.19, -1.29,	C1D 2480
	\$ -1.45, -1.49, -1.67, -1.67, -1.51, -1.66, -1.60, -1.69, -1.83, -1.51/	C1D 2490
C	DATA(C1(I),I=2281,2470)/	C1D:2500
	DATA C1M/	C1D:2501
	1-1.42,-1.40,-1.24,-1.38,-1.31,-1.30,-1.30,-1.28,-1.39,-1.33,	C1D 2510
	2-1.40,-1.35,-1.37,-1.39,-1.41,-1.49,-1.48,-1.56,-1.47,-1.46,	C1D 2520
	3-1.41,-1.42,-1.48,-1.41,-1.31,-1.15,-1.13,-1.20,-1.41,-1.88,	C1D 2530
	4-2.08,-2.08,-2.22,-2.35,-2.35,-1.98,-1.92,-1.78,-1.57,-1.69,	C1D 2540
	5-1.70,-1.70,-1.66,-1.84,-1.50,-1.56,-1.42,-1.29,-1.38,-1.28,	C1D 2550
	6-1.48,-1.58,-1.44,-1.53,-1.48,-1.48,-1.58,-1.58,-1.69,-1.79,	C1D 2560
	7-2.00,-2.16,-1.99,-2.23,-2.04,-2.04,-2.39,-2.74,-3.09,-3.44,	C1D 2570
	8-3.79,-4.14,-4.49,-4.84,-5.19,-2.46,-2.26,-1.99,-2.01,-2.14,	C1D 2580
	9-2.31,-2.15,-2.01,-1.99,-2.14,-2.41,-2.12,-1.99,-1.84,-1.79,	C1D 2590
	\$ -1.71,-1.78,-1.72,-1.68,-1.78,-1.52,-1.38,-1.29,-1.22, -.91,	C1D 2600
	\$ -.90,-1.01, -.76, -.90, -.90, -.90,-1.19,-1.00, -.79, -.68,	C1D 2610
	\$ -.68, -.73, -.85, -.85, -.61, -.61, -.48, -.51, -.92, -.83,	C1D 2620
	\$ -.61, -.41, -.29, -.29, -.61, -.74, -.19, -.18, 0.00, .19,	C1D 2630
	\$ -.10, .20, .20, .02, .20, -.01, .18, .28, .11, 0.00,	C1D 2640
	\$ -.37, -.10, .02, .16, .20, 0.00, .09, .09, .09, .07,	C1D 2650
	\$.22, .11, .11, .21, .09, .21, .20, .37, .28, .07,	C1D 2660
	\$.09, -.29, -.69, -.69, -.74, -.88,-1.01, -.86, -.54, -.19,	C1D 2670
	\$.19, .23, .21, .29, .28, .29, .52, .54, .51, .60,	C1D 2680
	\$.40, .49, .48, .46, .49, .27, .06, -.33, -.81,-1.17/	C1D 2690
C	DATA(C1(I),I=2471,2580)/	C1D:2700
	DATA C1N/	C1D:2701
	1-1.11,-1.37,-1.52,-1.54,-1.94,-2.06,-2.06,-2.14,-1.96,-2.00,	C1D 2710
	2-2.00,-2.08,-2.23,-2.31,-2.31,-2.53,-2.31,-2.31,-2.31,-2.28,	C1D 2720
	3-2.34,-2.34,-1.91,-1.82,-1.69,-1.56,-1.84,-1.91,-1.75,-1.83,	C1D 2730
	4-1.76,-1.54,-1.98,-1.80,-1.68,-1.69,-1.56,-1.60,-1.71,-1.36,	C1D 2740
	5-1.36,-1.44,-1.48,-1.40,-1.48,-1.36,-1.45,-1.49,-1.85,-1.39,	C1D 2750
	6-1.23,-1.18,-1.18,-1.34,-1.36,-1.23,-1.23,-1.37,-1.30,-1.40,	C1D 2760
	7-1.28,-1.27,-1.37,-1.32,-1.32,-1.22,-1.28,-1.38,-1.69,-2.07,	C1D 2770
	8-2.42,-2.58,-2.58,-2.80,-2.58,-2.43,-1.88,-1.60,-1.26,-1.16,	C1D 2780
	9-1.23,-1.10,-1.23,-1.10, -.83, -.80, -.80, -.80, -.98, -.97,	C1D 2790
	\$ -.97, -.91, -.92,-1.13,-1.24,-1.50,-1.89,-2.18,-2.32,-2.63,	C1D 2800
	\$ -3.91,-4.20,-4.49,-4.78,-5.07,-5.07,-5.07,-5.07,-5.07,-5.07/	C1D 2810
	C1LL=C1(L)	C1D:2820
	RETURN	C1D 2830
	END	C1D 2840

	SUBROUTINE C2DTA (C2L,L)	C2D	10
C	UNIFORMLY MIXED GASES	C2D	20
C	C2 LOCATION 1 V = 500 CM-1	C2D	30
C	C2 LOCATION 1515 V = 8070 CM-1	C2D	40
C	C2 LOCATION 1516 V = 12950 CM-1	C2D	50
C	C2 LOCATION 1575 V = 13245 CM-1	C2D	60
C	COMMON/C2/ C2(1575)	C2D	:70
	DIMENSION C2(1575)	C2D	:71
	DIMENSION C2A(190),C2B(190),C2C(190),C2D(190),C2E(190),C2F(190),	C2D	:72
	* C2G(190),C2H(190),C2I(55)	C2D	:73
	EQUIVALENCE (C2,C2A),(C2(191),C2B),(C2(381),C2C),(C2(571),C2D),	C2D	:74
	* (C2(761),C2E),(C2(951),C2F),(C2(1141),C2G),(C2(1331),C2H),	C2D	:75
	* (C2(1521),C2I)	C2D	:76
C	DATA(C2(I),I= 1, 190)/	C2D	:80
	DATA C2A/	C2D	:81
	1-4.25,-3.70,-3.20,-2.75,-1.90,-1.73,-1.51,-1.29,-1.11, -.91,	C2D	90
	2 -.71, -.51, -.30, -.06, .22, .49, .76, 1.08, 1.29, 1.56,	C2D	100
	3 1.76, 1.91, 2.08, 2.23, 2.36, 2.51, 2.72, 2.90, 3.12, 3.37,	C2D	110
	4 3.56, 3.69, 3.79, 3.86, 3.88, 3.86, 3.73, 3.58, 3.38, 3.17,	C2D	120
	5 2.86, 2.73, 2.52, 2.31, 2.17, 2.01, 1.89, 1.77, 1.63, 1.47,	C2D	130
	6 1.21, .92, .53, .23, -.17, -.53, -.74, -.81, -.84, -.88,	C2D	140
	7-1.00,-1.18,-1.42,-1.61,-1.86,-2.10,-2.29,-2.51,-2.72,-2.91,	C2D	150
	8-3.14,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C2D	160
	9-5.00,-2.68,-2.47,-2.19,-1.97,-1.71,-1.50,-1.32,-1.21,-1.13,	C2D	170
	\$-1.09,-1.11,-1.10,-1.09,-1.01,-1.01,-1.11,-1.33,-1.66,-2.13,	C2D	180
	\$-2.51,-2.83,-2.71,-2.39,-2.09,-1.78,-1.59,-1.33,-1.18,-1.01,	C2D	190
	\$-.96, -.91, -.90, -.87, -.80, -.79, -.86,-1.07,-1.28,-1.69,	C2D	200
	\$-2.11,-2.74,-3.09,-3.50,-3.03,-2.58,-2.23,-1.89,-1.54,-1.28,	C2D	210
	\$-1.13,-1.11,-1.16,-1.20,-1.23,-1.21,-1.17,-1.12,-1.15,-1.19,	C2D	220
	\$-1.20,-1.17,-1.02, -.89, -.68, -.42, -.24, -.01, .18, .40,	C2D	230
	\$.57, .77, .96, 1.07, 1.13, 1.11, 1.08, 1.15, 1.27, 1.33,	C2D	240
	\$ 1.44, 1.40, 1.13, .89, .63, .54, .65, .78, .81, .86,	C2D	250
	\$.82, .68, .47, .14, -.12, -.48, -.92,-1.43,-1.89,-2.32,	C2D	260
	\$-2.81,-5.00,-5.00,-5.00,-3.14,-2.47,-2.00,-1.71,-1.59,-1.61/	C2D	270
C	DATA(C2(I),I= 191, 380)/	C2D	:280
	DATA C2B/	C2D	:281
	1-1.69,-1.82,-1.87,-1.90,-1.94,-2.04,-2.10,-2.23,-2.32,-2.48,	C2D	290
	2-2.71,-2.88,-3.09,-2.99,-2.43,-2.00,-1.69,-1.42,-1.38,-1.49,	C2D	300
	3-1.70,-2.01,-2.41,-2.64,-2.63,-2.49,-2.38,-2.27,-2.16,-2.05,	C2D	310
	4-1.94,-1.83,-1.76,-1.71,-1.70,-1.72,-1.81,-1.92,-2.03,-2.27,	C2D	320
	5-2.61,-3.21,-4.01,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C2D	330
	6-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C2D	340
	7-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C2D	350
	8-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-4.30,-3.42,-3.17,-2.98,	C2D	360
	9-2.83,-2.71,-2.67,-2.67,-2.68,-2.58,-2.33,-2.01,-1.64,-1.32,	C2D	370
	\$ -.97, -.76, -.63, -.59, -.60, -.63, -.69, -.87,-1.08,-1.26,	C2D	380
	\$-1.53,-1.87,-1.91,-1.93,-2.02,-2.21,-2.48,-2.80,-3.08,-3.11,	C2D	390
	\$-3.09,-2.93,-2.76,-2.39,-2.01,-1.69,-1.36, -.99, -.63, -.28,	C2D	400
	\$ 0.00, .08, .11, .12, .12, .07, .01, -.08, -.23, -.40,	C2D	410
	\$ -.51, -.53, -.57, -.60, -.61, -.73, -.81, -.95,-1.05,-1.02,	C2D	420
	\$ -.91, -.68, -.41, -.09, .18, .41, .76, 1.00, 1.18, 1.39,	C2D	430
	\$ 1.51, 1.58, 1.68, 1.71, 1.80, 1.91, 2.02, 2.18, 2.32, 2.50,	C2D	440
	\$ 2.61, 2.69, 2.81, 2.89, 2.96, 3.04, 3.14, 3.27, 3.41, 3.55,	C2D	450

	\$ 3.72, 3.90, 4.03, 4.22, 4.42, 4.61, 4.71, 4.73, 4.65, 4.63,	C2D 460
	\$ 4.72, 4.78, 4.79, 4.50, 3.62, 3.28, 2.79, 2.30, 1.86, 1.35/	C2D 470
C	DATA(C2(I),I= 381, 570)/	C2D :480
	DATA C2C/	C2D :481
	1 .62, -.24,-1.69,-2.18,-2.01,-1.79,-1.53,-1.32,-1.20,-1.15,	C2D 490
	2-1.12,-1.18,-1.25,-1.26,-1.20,-1.17,-1.20,-1.32,-1.54,-1.84,	C2D 500
	3-2.16,-2.30,-2.26,-2.01,-1.71,-1.36,-1.06, -.81, -.61, -.49,	C2D 510
	4 -.45, -.47, -.49, -.46, -.37, -.31, -.34, -.49, -.75,-1.11,	C2D 520
	5-1.43,-2.01,-2.60,-2.89,-2.87,-2.74,-2.51,-2.42,-2.38,-2.39,	C2D 530
	6-2.42,-2.46,-2.48,-2.49,-2.43,-2.43,-2.46,-2.53,-2.68,-2.74,	C2D 540
	7-2.82,-2.87,-2.83,-2.82,-2.79,-2.71,-2.66,-2.49,-2.40,-2.32,	C2D 550
	8-2.26,-2.23,-2.20,-2.09,-2.02,-1.96,-1.88,-1.84,-1.86,-1.86,	C2D 560
	9-1.87,-1.83,-1.79,-1.73,-1.68,-1.64,-1.69,-1.74,-1.79,-1.87,	C2D 570
	\$-1.78,-1.63,-1.50,-1.37,-1.21,-1.00, -.83, -.69, -.53, -.41,	C2D 580
	\$ -.30, -.19, -.09, -.04, .02, .10, .16, .18, .23, .26,	C2D 590
	\$.27, .26, .24, .22, .17, .12, .07, -.01, -.07, -.09,	C2D 600
	\$.32, .72, .91, 1.12, 1.03, .67, .18, -.11, -.38, -.29,	C2D 610
	\$ -.17, -.08, 0.00, .09, .13, .18, .24, .27, .29, .30,	C2D 620
	\$.29, .26, .23, .21, .13, .09, .02, -.04, -.18, -.32,	C2D 630
	\$ -.51, -.72, -.98,-1.18,-1.50,-1.62,-1.81,-2.04,-2.29,-2.49,	C2D 640
	\$-2.62,-2.87,-3.03,-3.21,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C2D 650
	\$-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-4.01,-3.38,-3.01,-2.63,	C2D 660
	\$-2.32,-2.09,-1.98,-1.94,-2.00,-2.14,-2.26,-2.20,-2.02,-1.82/	C2D 670
C	DATA(C2(I),I= 571, 760)/	C2D :680
	DATA C2D/	C2D :681
	1-1.59,-1.43,-1.38,-1.46,-1.64,-1.90,-2.09,-2.54,-2.91,-3.28,	C2D 690
	2-3.61,-3.72,-3.64,-3.50,-3.41,-3.37,-3.30,-3.16,-3.01,-2.76,	C2D 700
	3-2.51,-2.20,-1.80,-1.49,-1.22, -.97, -.72, -.49, -.20, .03,	C2D 710
	4 .20, .36, .51, .61, .67, .83, 1.00, 1.22, 1.38, 1.56,	C2D 720
	5 1.70, 1.86, 2.01, 2.20, 2.31, 2.47, 2.61, 2.76, 2.92, 3.01,	C2D 730
	6 3.05, 3.02, 2.98, 2.98, 3.01, 3.03, 2.97, 2.78, 2.44, 2.13,	C2D 740
	7 1.83, 1.59, 1.49, 1.50, 1.67, 1.94, 2.22, 2.50, 2.71, 2.93,	C2D 750
	8 3.12, 3.18, 3.17, 3.15, 3.21, 3.26, 3.19, 2.98, 2.59, 2.14,	C2D 760
	9 1.70, 1.22, .55, -.27,-1.09,-2.54,-3.00,-2.94,-2.78,-2.68,	C2D 770
	\$-2.61,-2.60,-2.63,-2.60,-2.57,-2.53,-2.57,-2.64,-2.77,-3.04,	C2D 780
	\$-3.38,-3.98,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C2D 790
	\$-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C2D 800
	\$-5.00,-4.00,-3.73,-3.62,-3.59,-3.53,-3.56,-3.57,-3.53,-3.51,	C2D 810
	\$-3.45,-3.37,-3.26,-3.21,-3.18,-3.27,-3.36,-3.60,-3.96,-5.00,	C2D 820
	\$-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C2D 830
	\$-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C2D 840
	\$-5.00,-5.00,-5.00,-5.00,-4.62,-4.07,-3.89,-3.76,-3.67,-3.56,	C2D 850
	\$-3.42,-3.35,-3.26,-3.18,-3.14,-3.11,-3.09,-3.10,-3.12,-3.23,	C2D 860
	\$-3.30,-3.38,-3.37,-3.29,-3.14,-3.08,-3.00,-2.93,-2.89,-2.91/	C2D 870
C	DATA(C2(I),I= 761, 950)/	C2D :880
	DATA C2E/	C2D :881
	1-3.00,-3.08,-3.16,-3.31,-3.48,-3.71,-3.98,-5.00,-5.00,-5.00,	C2D 890
	2-5.00,-4.52,-3.98,-3.69,-3.42,-3.18,-2.95,-2.77,-2.61,-2.48,	C2D 900
	3-2.41,-2.41,-2.40,-2.38,-2.34,-2.27,-2.21,-2.31,-2.48,-2.73,	C2D 910
	4-3.21,-4.13,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C2D 920
	5-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C2D 930
	6-5.00,-5.00,-4.13,-4.02,-3.99,-3.96,-3.87,-3.73,-3.51,-3.29,	C2D 940
	7-3.13,-2.99,-2.84,-2.73,-2.69,-2.68,-2.69,-2.65,-2.62,-2.59,	C2D 950

8-2.57,-2.62,-2.81,-3.04,-3.21,-3.39,-3.42,-3.36,-3.21,-3.03,	C2D 960
9-2.93,-2.80,-2.64,-2.52,-2.37,-2.28,-2.20,-2.13,-2.07,-2.02,	C2D 970
\$-1.96,-1.88,-1.78,-1.63,-1.44,-1.31,-1.20,-1.08,-.98,-.94,	C2D 980
\$-.86,-.76,-.52,-.31,-.08,.13,.30,.37,.36,.36,	C2D 990
\$.35,.35,.39,.46,.48,.41,.23,-.08,-.38,-.67,	C2D 1000
\$-.88,-.96,-.98,-.87,-.67,-.36,-.12,.14,.44,.68,	C2D 1010
\$.90,1.11,1.19,1.24,1.25,1.26,1.27,1.51,1.59,1.50,	C2D 1020
\$ 1.28,.71,.11,-.28,-.67,-1.32,-1.61,-1.58,-1.42,-1.18,	C2D 1030
\$-.91,-.59,-.27,-.06,.29,.57,.73,.92,.81,.73,	C2D 1040
\$.79,.91,1.01,1.03,.88,.72,.63,.38,.12,-.21,	C2D 1050
\$-.47,-.67,-1.23,-1.67,-2.31,-2.76,-3.24,-3.49,-3.51,-3.47,	C2D 1060
\$-3.39,-3.37,-3.43,-3.53,-3.50,-3.36,-3.18,-3.07,-2.96,-3.08/	C2D 1070
C DATA(C2(I),I= 951,1140)/	C2D: 1080
DATA C2F/	C2D: 1081
1-3.14,-3.12,-3.23,-3.07,-2.83,-2.47,-2.23,-2.07,-1.91,-1.78,	C2D 1090
2-1.63,-1.46,-1.27,-1.23,-1.26,-1.40,-1.57,-1.98,-2.28,-2.87,	C2D 1100
3-3.74,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C2D 1110
4-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C2D 1120
5-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C2D 1130
6-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C2D 1140
7-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C2D 1150
8-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C2D 1160
9-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C2D 1170
\$-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C2D 1180
\$-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C2D 1190
\$-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C2D 1200
\$-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C2D 1210
\$-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C2D 1220
\$-5.00,-5.00,-4.91,-4.79,-4.61,-4.48,-4.40,-4.29,-4.17,-3.90,	C2D 1230
\$-3.73,-3.59,-3.62,-3.72,-3.73,-3.69,-3.31,-3.12,-2.91,-2.63,	C2D 1240
\$-2.41,-2.27,-2.16,-2.11,-2.28,-2.29,-2.21,-2.06,-1.91,-1.99,	C2D 1250
\$-2.27,-2.59,-2.98,-3.35,-3.69,-3.79,-3.68,-3.53,-3.46,-3.39,	C2D 1260
\$-3.31,-3.18,-2.97,-2.69,-2.39,-2.11,-1.83,-1.58,-1.49,-1.22/	C2D 1270
C DATA(C2(I),I=1141,1330)/	C2D: 1280
DATA C2G/	C2D: 1281
1-1.08,-.89,-.68,-.54,-.71,-.79,-.78,-.66,-.49,-.54,	C2D 1290
2-.86,-1.37,-2.08,-2.44,-3.46,-3.72,-3.74,-3.59,-3.22,-2.98,	C2D 1300
3-2.52,-2.21,-1.64,-1.34,-1.08,-.86,-.72,-.61,-.70,-.72,	C2D 1310
4-.67,-.57,-.38,-.51,-.97,-1.36,-1.89,-2.74,-3.18,-4.21,	C2D 1320
5-4.57,-4.62,-4.78,-4.87,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C2D 1330
6-4.93,-4.46,-3.99,-3.45,-2.99,-2.63,-2.30,-2.09,-2.02,-2.12,	C2D 1340
7-2.18,-2.13,-2.04,-1.78,-1.83,-2.08,-2.28,-2.81,-3.01,-3.15,	C2D 1350
8-3.22,-3.29,-3.58,-3.89,-4.46,-4.88,-5.00,-5.00,-5.00,-5.00,	C2D 1360
9-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C2D 1370
\$-4.81,-4.52,-4.11,-3.69,-3.09,-2.99,-2.91,-2.89,-3.19,-3.20,	C2D 1380
\$-3.36,-3.62,-3.89,-3.92,-3.73,-3.53,-3.37,-3.19,-3.02,-2.79,	C2D 1390
\$-2.52,-2.36,-2.24,-2.19,-2.32,-2.41,-2.29,-2.06,-2.00,-2.18,	C2D 1400
\$-2.47,-2.91,-3.57,-4.89,-5.00,-5.00,-5.00,-5.00,-5.00,-4.61,	C2D 1410
\$-4.18,-3.89,-3.57,-3.30,-3.02,-2.74,-2.51,-2.20,-1.98,-1.73,	C2D 1420
\$-1.57,-1.38,-1.21,-1.11,-.98,-.87,-.78,-.60,-.37,-.18,	C2D 1430
\$-.04,-.04,-.06,-.16,-.18,-.19,-.23,-.45,-1.02,-1.97,	C2D 1440
\$-2.70,-3.71,-4.01,-4.20,-4.35,-4.58,-4.73,-4.81,-5.00,-5.00,	C2D 1450
\$-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C2D 1460

C	\$-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00/ DATA(C2(I),I=1331,1520)/ DATA C2H/ 1-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00, 2-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00, 3-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00, 4-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00, 5-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00, 6-5.00,-5.00,-5.00,-4.71,-4.31,-3.99,-3.68,-3.50,-3.34,-3.22, 7-3.23,-3.25,-3.24,-3.18,-3.10,-3.07,-3.18,-3.41,-3.67,-4.12, 8-4.68,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-4.51,-4.18, 9-3.73,-3.48,-3.17,-2.96,-2.73,-2.63,-2.58,-2.59,-2.57,-2.49, \$-2.42,-2.38,-2.48,-2.62,-3.02,-3.49,-4.16,-5.00,-5.00,-5.00, \$-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-4.87,-4.50, \$-4.21,-3.90,-3.66,-3.56,-3.51,-3.51,-3.51,-3.49,-3.41,-3.34, \$-3.34,-3.47,-3.60,-3.87,-4.23,-4.59,-5.00,-5.00,-5.00,-5.00, \$-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-4.93, \$-4.51,-4.10,-3.78,-3.32,-3.03,-2.74,-2.43,-2.08,-1.83,-1.59, \$-1.29,-1.02,-.81,-.70,-.73,-.90,-1.08,-1.19,-1.35,-1.47, \$-1.57,-1.66,-1.80,-1.91,-2.04,-2.18,-2.33,-2.47,-2.61,-2.78, \$-2.97,-3.10,-3.28,-3.44,-3.63,-3.81,-3.98,-4.15,-4.32,-4.61, \$-4.71,-4.80,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-4.32/ DATA(C2(I),I=1521,1575)/ DATA C2I/ 1-3.24,-2.59,-2.12,-1.82,-1.57,-1.34,-1.16,-1.02,-.82,-.64, 2 -.48,-.33,-.14,-.06,.08,.21,.39,.52,.61,.72, 3 .85,.96,1.02,1.12,1.18,1.21,1.17,1.08,.98,.90, 4 .97,1.13,1.37,1.58,1.74,1.70,1.48,1.13,.73,.22, 5 -.51,-1.57,-3.48,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00, 6-5.00,-5.00,-5.00,-5.00,-5.00/ C2L=C2(L) RETURN END	C2D 1470 C2D:1480 C2D:1481 C2D 1490 C2D 1500 C2D 1510 C2D 1520 C2D 1530 C2D 1540 C2D 1550 C2D 1560 C2D 1570 C2D 1580 C2D 1590 C2D 1600 C2D 1610 C2D 1620 C2D 1630 C2D 1640 C2D 1650 C2D 1660 C2D 1670 C2D:1680 C2D:1681 C2D 1690 C2D 1700 C2D 1710 C2D 1720 C2D 1730 C2D 1740 C2D 1750 C2D 1760 C2D 1770
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	SUBROUTINE C3DTA (C3L,L)	C3D 10
C	OZONE	C3D 20
C	C3 LOCATION 1 V = 575 CM-1	C3D 30
C	C3 LOCATION 510 V = 3270 CM-1	C3D 40
C	COMMON /C3/ C3(540)	C3D 50
	DIMENSION C3(540),C3A(190),C3B(190),C3C(160)	C3D :51
	EQUIVALENCE (C3,C3A),(C3(191),C3B),(C3(381),C3C)	C3D :52
C	DATA(C3(I),I= 1, 190)/	C3D :60
	DATA C3A/	C3D :61
	1-4.15,-3.51,-3.00,-2.54,-2.12,-1.76,-1.50,-1.21, -.86, -.49,	C3D 70
	2 -.29, -.10, .02, .12, .24, .32, .43, .52, .58, .65,	C3D 80
	3 .72, .79, .76, .72, .68, .64, .68, .79, .83, .83,	C3D 90
	4 .80, .78, .68, .56, .49, .42, .34, .26, .14, .02,	C3D 100
	5 -.14, -.35, -.51, -.74, -.88,-1.17,-1.40,-1.58,-2.11,-2.47,	C3D 110
	6-2.83,-3.24,-3.59,-3.94,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C3D 120
	7-5.00,-5.00,-5.00,-5.00,-5.00,-4.46,-4.00,-3.50,-3.14,-2.78,	C3D 130
	8-2.41,-2.10,-1.78,-1.49,-1.20, -.20, .15, .35, .57, .78,	C3D 140
	9 .95, 1.20, 1.40, 1.65, 1.80, 1.97, 2.10, 2.21, 2.31, 2.38,	C3D 150
	\$ 2.40, 2.42, 2.58, 2.52, 2.20, 2.48, 2.54, 2.45, 2.30, 2.00,	C3D 160
	\$ 1.20, .95, .92, .90, .90, .89, .90, .92, .94, .95,	C3D 170
	\$.96, .95, .90, .80, .68, .55, .40, .30, .19, .08,	C3D 180
	\$ -.02, -.11, -.22, -.41, -.56, -.71, -.89,-1.03,-1.18,-1.33,	C3D 190
	\$-1.60,-1.76,-1.90,-2.02,-2.21,-2.46,-2.59,-2.79,-3.00,-3.22,	C3D 200
	\$-3.61,-4.16,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C3D 210
	\$-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C3D 220
	\$-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C3D 230
	\$-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C3D 240
	\$-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00/	C3D 250
C	DATA(C3(I),I= 191, 380)/	C3D :260
	DATA C3B/	C3D :261
	1-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C3D 270
	2-5.00,-5.00,-5.00,-5.00,-4.16,-3.91,-3.66,-3.41,-3.05,-2.69,	C3D 280
	3-2.44,-2.19,-2.03,-1.86,-1.71,-1.56,-1.48,-1.39,-1.26,-1.13,	C3D 290
	4 -.97, -.81, -.65, -.48, -.35, -.22, -.14, -.06, -.02, -.09,	C3D 300
	5 -.18, -.14, .06, .26, -.02, -.42, -.80, -.82, -.80, -.74,	C3D 310
	6 -.74, -.79, -.84, -.89, -.85, -.81, -.76, -.70, -.68, -.64,	C3D 320
	7 -.65, -.66, -.72, -.78, -.84, -.90,-1.02,-1.14,-1.24,-1.33,	C3D 330
	8-1.47,-1.61,-1.77,-1.92,-1.98,-2.04,-2.08,-2.09,-2.06,-2.03,	C3D 340
	9-1.98,-1.93,-1.87,-1.82,-1.76,-1.71,-1.65,-1.59,-1.51,-1.44,	C3D 350
	\$-1.36,-1.28,-1.18,-1.08, -.98, -.88, -.78, -.69, -.59, -.49,	C3D 360
	\$ -.37, -.25, -.18, -.10, 0.00, .16, .27, .38, .57, .75,	C3D 370
	\$.93, 1.11, 1.20, 1.33, 1.44, 1.46, 1.48, 1.48, 1.64, 1.58,	C3D 380
	\$ 1.49, 1.23, .66, .38, -.33, -.71, -.66, -.58, -.49, -.44,	C3D 390
	\$ -.40, -.40, -.46, -.53, -.64, -.76, -.89,-1.01,-1.14,-1.26,	C3D 400
	\$-1.40,-1.55,-1.69,-1.83,-1.98,-2.13,-2.28,-2.43,-2.64,-2.86,	C3D 410
	\$-3.07,-3.28,-3.50,-3.72,-3.94,-5.00,-5.00,-5.00,-5.00,-5.00,	C3D 420
	\$-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C3D 430
	\$-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C3D 440
	\$-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00/	C3D 450
C	DATA(C3(I),I= 381, 540)/	C3D :460
	DATA C3C/	C3D :461
	1-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C3D 470
	2-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C3D 480

3-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,-5.00,	C3D 490
4-5.00,-5.00,-5.00,-4.16,-3.97,-3.77,-3.58,-3.38,-3.07,-2.75,	C3D 500
5-2.44,-2.12,-1.85,-1.57,-1.30,-1.07,-.98,-.94,-.89,-.85,	C3D 510
6 -.81,-.77,-.72,-.68,-.63,-.58,-.53,-.48,-.41,-.34,	C3D 520
7 -.26,-.19,-.17,-.18,-.19,-.46,-.79,-1.12,-1.45,-1.75,	C3D 530
8-2.38,-2.97,-3.57,-4.16,-5.00,-5.00,-5.00,-4.16,-3.90,-3.63,	C3D 540
9-3.37,-3.10,-2.79,-2.47,-2.15,-1.84,-1.73,-1.63,-1.52,-1.41,	C3D 550
\$-1.33,-1.25,-1.17,-1.09,-1.02,-.96,-.89,-.82,-.73,-.68,	C3D 560
\$ -.54,-.42,-.27,-.12,.03,.18,.25,.31,.39,.47,	C3D 570
\$.48,.49,.50,.50,.48,.46,.23,.01,-.11,-.33,	C3D 580
\$ -.55,-.77,-.83,-.88,-.94,-.92,-.91,-.90,-.85,-.80,	C3D 590
\$ -.76,-.71,-.69,-.67,-.66,-.65,-.65,-.66,-.67,-.68,	C3D 600
\$ -.70,-.72,-.82,-.93,-1.03,-1.14,-1.24,-1.34,-1.51,-1.68,	C3D 610
\$-2.13,-2.57,-2.92,-3.26,-3.71,-4.16,-5.00,-5.00,-5.00,-5.00/	C3D 620
C3L=C3(L)	C3D 630
RETURN	C3D 640
END	C3D 650

C	SUBROUTINE EWIDTH(XSTAR,ACBAR,ADBAR,ODBAR,DV,WSL,TTRANS)	EWI	10
C		EWI	20
C	THIS SUBROUTINE CALCULATES THE EQUIVALENT WIDTH OF A	EWI	30
C	VOIGT LINE IN A FINITE SPECTRAL INTERVAL	EWI	40
C		EWI	50
	DATA IENTER,ISTEP,NALF,XSMIN,XSMAX,CDRAT /0,2,3,1.0,50.0,0.1/	EWI	60
	DATA RTPI,C1,C2,RT2 /1.7724539,0.8325546,0.4697186,1.4142136/	EWI	70
C		EWI	80
C	RTPI = SQRT(PI)	EWI	90
C	C1 = SQRT(ALOG(2.))	EWI	100
C	C2 = SQRT(ALOG(2.)/PI)	EWI	110
C	RT2 = SQRT(2.)	EWI	120
C		EWI	130
	IF(IENTER.GT.0) GO TO 1	EWI	140
	HALFDV = DV/2.	EWI	150
	NMAX = ISTEP*NALF	EWI	160
	IENTER = 1	EWI	170
	1 CONTINUE	EWI	180
C		EWI	190
C	FIND LARGER LINEWIDTH, COLLISION(ALFC) OR DOPPLER(ALFD)	EWI	200
C		EWI	210
	ALFC = ACBAR/ODBAR	EWI	220
	ALFD = ADBAR/ODBAR	EWI	230
	RAT = ALFC/ALFD	EWI	240
	ALFMAX = ALFC	EWI	250
	IF(RAT.LT.1.0) ALFMAX = ALFD	EWI	260
C		EWI	270
C	CHECK FOR WEAK LINE LIMIT	EWI	280
C		EWI	290
	XS = XSTAR/(ALFMAX*ODBAR)	EWI	300
	IF(XS.LT.XSMIN) GO TO 30	EWI	310
C		EWI	320
C	DEFINE INTEGRATION PARAMETERS	EWI	330
C		EWI	340
	DELW = ALFMAX/ISTEP	EWI	350
	C3 = XSTAR*C2/ADBAR	EWI	360
	C4 = C1/ALFD	EWI	370
	Y = C1*RAT	EWI	380
	DELX = 0.5*DELW*C4	EWI	390
	XMIN = NMAX*DELW*C4	EWI	400
	SUM = 0.0	EWI	410
C		EWI	420
C	CHECK FOR DOPPLER LIMIT	EWI	430
C		EWI	440
	IF(RAT.LT.CDRAT) GO TO 20	EWI	450
C		EWI	460
C	CHECK FOR STRONG LINE LIMIT	EWI	470
C		EWI	480
	IF(XS.GT.XSMAX) GO TO 20	EWI	490
C		EWI	500
C	EVALUATE VOIGT LINESHAPE	EWI	510
C		EWI	520
	X = XMIN + DELX	EWI	530

	DO 10 I = 1,NMAX	EWI 540
	X = X - 2.*DELX	EWI 550
	CALL CPF12(X,Y,WR,WI,WR1)	EWI 560
C		EWI 570
C	INTEGRATE	EWI 580
C		EWI 590
	FAC = C3*WR	EWI 600
	IF (FAC.GT.6.0) GO TO 20	EWI 610
	EXP0 = EXP(-FAC)	EWI 620
	FAC = C3*WR1	EWI 630
	EXP1 = EXP(FAC*DELX)	EWI 640
	SUM = SUM + EXP0*(EXP1 - 1./EXP1)/FAC	EWI 650
	10 CONTINUE	EWI 660
C		EWI 670
C	CALCULATE ASYMPTOTIC CONTRIBUTION TO EQUIVALENT WIDTH	EWI 680
C		EWI 690
	20 FAC = SQRT(Y*C3/RTPI)	EWI 700
	U1 = FAC/XMIN	EWI 710
	U2 = FAC/(C4*HALFDV)	EWI 720
	ASYMP = 0.0	EWI 730
	IF(U2.LT.4.0) ASYMP = EXP(-U2*U2)/U2	EWI 740
	IF(U1.LT.4.0) ASYMP = ASYMP-EXP(-U1*U1)/U1	EWI 750
	ASYMP = ASYMP+RTPI*(ERFU(U2)-ERFU(U1))	EWI 760
	ASYMP = ASYMP*FAC	EWI 770
C		EWI 780
C	WSL = EQUIVALENT WIDTH OF A SINGLE LINE (CM-1)	EWI 790
C		EWI 800
	WSL = DV - 2.0*(SUM+ASYMP)/C4	EWI 810
	IF(RAT.LT.CDRAT) GO TO 40	EWI 820
	IF(WSL.LT.0.0) WSL = 0.0	EWI 830
	IF(WSL.GT.DV) WSL = DV	EWI 840
	RETURN	EWI 850
C		EWI 860
C	BEERS LAW FOR WEAK LINE LIMIT	EWI 870
C		EWI 880
	30 TTRANS = EXP(-XSTAR)	EWI 890
	RETURN	EWI 900
C		EWI 910
C	DOPPLER LIMIT	EWI 920
C		EWI 930
	40 C3 = XSTAR*C1/(ADBAR*RT2)	EWI 940
	WSL = RT2*ALFD*SQRT(ALOG(1.+C3*C3))/C1 + WSL	EWI 950
	RETURN	EWI 960
	END	EWI 970

C	SUBROUTINE CPF12(X,Y,WR,WI,WR1)	CPF	10
C		CPF	20
C	ROUTINE COMPUTES THE REAL (WR) AND IMAGINARY (WI) PARTS OF THE	CPF	30
C	COMPLEX PROBABILITY FUNCTION $W(Z)=EXP(-Z**2)*ERFC(-I*Z)$ IN THE	CPF	40
C	UPPER HALF-PLANE $Z=X+I*Y$ (I.E. FOR $Y>0$)	CPF	50
C	MAXIMUM RELATIVE ERROR OF WR IS $<2.0E-06$, THAT OF WI $<5.0E-06$	CPF	60
C	THIS ROUTINE DEVELOPED BY J.HUMLICEK, REF. JQSRT,VOL21,P309(1980)	CPF	70
C		CPF	80
	DIMENSION T(6),C(6),S(6)	CPF	90
	DATA T/.314240376,.947788391,1.59768264,	CPF	100
1	2.27950708,3.02063703,3.8897249/,	CPF	110
2	C/1.01172805,-.75197147,1.2557727E-2,	CPF	120
3	1.00220082E-2,-2.42068135E-4,5.00848061E-7/,	CPF	130
4	S/1.393237,.231152406,-.155351466,	CPF	140
5	6.21836624E-3,9.19082986E-5,-6.27525958E-7/	CPF	150
	WR = 0.	CPF	160
	WI = 0.	CPF	170
	Y1 = Y + 1.5	CPF	180
	Y2 = Y1*Y1	CPF	190
C	IF HIGH RELATIVE ACCURACY IN REGION II IS NOT REQUIRED, THE	CPF	200
C	FOLLOWING 20 LINES MAY BE DELETED.	CPF	210
C	IF ((Y.GT.0.85) .OR. (ABS(X).LT.18.1*Y+1.65)) GO TO 2	CPF	220
C****	REGION II	CPF	230
C	IF (ABS(X).LT.12.) WR = EXP(-X*X)	CPF	240
C	Y3 = Y + 3.	CPF	250
C	DO 1 I = 1,6	CPF	260
C	R = X-T(I)	CPF	270
C	R2 = R*R	CPF	280
C	D = 1./(R2+Y2)	CPF	290
C	D1 = Y1*D	CPF	300
C	D2 = R*D	CPF	310
C	WR = WR + Y*(C(I)*(R*D2-1.5*D1)+S(I)*Y3*D2)/(R2+2.25)	CPF	320
C	R = X+T(I)	CPF	330
C	R2 = R*R	CPF	340
C	D = 1./(R2+Y2)	CPF	350
C	D3 = Y1*D	CPF	360
C	D4 = R*D	CPF	370
C	WR = WR + Y*(C(I)*(R*D4-1.5*D3)-S(I)*Y3*D4)/(R2+2.25)	CPF	380
C	1 WI = WI + C(I)*(D2+D4) + S(I)*(D1-D3)	CPF	390
C	GO TO 4	CPF	400
C****	REGION I	CPF	410
2	DO 3 I = 1,6	CPF	420
	R = X-T(I)	CPF	430
	D = 1./(R*R+Y2)	CPF	440
	D1 = Y1*D	CPF	450
	D2 = R*D	CPF	460
	R = X+T(I)	CPF	470
	D = 1./(R*R+Y2)	CPF	480
	D3 = Y1*D	CPF	490
	D4 = R*D	CPF	500
	WR = WR + C(I)*(D1+D3) - S(I)*(D2-D4)	CPF	510
3	WI = WI + C(I)*(D2+D4) + S(I)*(D1-D3)	CPF	520
C****	CALCULATE FIRST DERIVATIVE OF W(Z) FOR VOIGT PROFILE	CPF	530

4 CONTINUE
WR1 = 2.*(Y*WI-X*WR)
RETURN
END

CPF 540
CPF 550
CPF 560
CPF 570

C	SUBROUTINE LIB(MSLTO,LPLT)	LIB 10
C		LIB 20
C		LIB 30
C	LIB CALLS THE SLIT FUNCTION ROUTINE, SETS	LIB 40
C	UP THE OUTPUT AND THEN PLOTS	LIB 50
C		LIB 60
C		LIB 70
C	*****	LIB 80
C	***** IMPLEMENTATION NOTE *****	LIB 90
C	*****	LIB 100
C	1) TITLE ASSIGNMENTS WILL HAVE TO BE CHANGED FOR MACHINES THAT	LIB 110
C	STORE MORE THAN 4 CHARACTERS PER WORD (UNIVAC + CDC)	LIB 120
C	VARIABLES EFFECTED: XTIT, YTIT, BLANK, TITLE, NCWD	LIB 130
C	FORMAT STATEMENTS : 900, 902	LIB 140
C	2) PLOTTER INITIALIZATION MAY HAVE TO BE CHANGED	LIB 150
C	CALLS EFFECTED: INITP\$	LIB 160
C	3) PLOTTER TERMINATION MAY NEED CHANGING	LIB 170
C	CALLS EFFECTED: ENDPLT	LIB 180
C	4) FOR THE PRIME: COMPILE WITH SHORT INTEGER AND INCLUDE THE	LIB 190
C	INTEGER*4 STATMENT	LIB 200
C		LIB 210
C		LIB 220
C	INTEGER*4 NIN,NOUT,NSTOR,NPLT,NTBL,IXY,MSLTO,LPLT	LIB 230
	COMMON/CARD4/ IXY	LIB 240
	LOGICAL PLTR,PRTR	LIB 250
	DIMENSION XTIT(5,2),YTIT(7,3)	LIB 260
	DIMENSION XTITLE(20),YTITLE(20),TITLE(20),IXT(2),IYT(3)	LIB 270
	DIMENSION XSS(8),SS(8)	LIB 280
	COMMON /DEVNUM/ NIN,NOUT,NSTOR,NPLT,NTBL	LIB 290
	COMMON /PLTDEV/ NSCR,NPLTR	LIB 300
	COMMON/XBLOCK/XTITLE,XAXIS,XINIT,XSCALE,DXT,NMINX	LIB 310
	COMMON/YBLOCK/YTITLE,YAXIS,YINIT,YSCALE,DYT,NMINY	LIB 320
	COMMON/MAXY/YMAX	LIB 330
	COMMON/PBLOCK/TITLE,ICHAR,JCHAR,KCHAR	LIB 340
	COMMON/SETUP/ITYPE,ISLOT,NEWT,IPRT	LIB 350
	DATA XTIT/4HWAVE,4HLENG,4HHTH ,4H(MIC,4HRON),	LIB 360
	* 4HWAVE,4HNUMB,4HER ,4H(CM-,4H1) /	LIB 370
	DATA YTIT/4HTRAN,4HSMIT,4HTANC,4HE ,4H ,4H ,4H ,	LIB 380
	* 4HRADI,4HANCE,4H (W,4H/SR/,4HCM2/,4HMICR,4HON) ,	LIB 390
	* 4HRADI,4HANCE,4H (W,4H/SR/,4HCM2/,4HCM-1,4H) /	LIB 400
	DATA IYT/13,27,25/,IXT/20,18/	LIB 410
C		LIB 420
	DATA XORG,YORG/1.,1./,BLANK/4H /,NCWD/4/	LIB 430
C	SET PLOT DEVICE NUMBERS	LIB 440
	NSCR = 11	LIB 450
	NPLTR = 4	LIB 460
C		LIB 470
	PRTR=.FALSE.	LIB 480
	PLTR=.FALSE.	LIB 490
	READ(NIN,900) TITLE	LIB 500
	DO 10 I=1,20	LIB 510
	KCHAR=21-I	LIB 520
	IF(TITLE(KCHAR).NE.BLANK) GO TO 15	LIB 530

10	CONTINUE	LIB	540
15	KCHAR=KCHAR*NCWD	LIB	550
	READ(NIN,904) MSLT,MPRTN,MPLTN,NSN,WIDTHN,SHIFTN	LIB	560
	IF(MSLT.EQ. 0 .AND. MSLTO.EQ. 0) STOP 3	LIB	570
	IF(MSLT.EQ. 0) GO TO 20	LIB	580
	MPRT=MPRTN	LIB	590
	MPLT=MPLTN	LIB	600
	NS=NSN	LIB	610
	WIDTH=WIDTHN	LIB	620
	SHIFT=SHIFTN	LIB	630
	JSLOT=MSLT	LIB	640
C		LIB	650
C	SET UP FOR TRANSMISSION AND RADIANCE OUTPUT	LIB	660
C		LIB	670
20	DO 75 ITYPE=1,2	LIB	680
	ITY=3-ITYPE	LIB	690
	REWIND NPLT	LIB	700
	REWIND NSCR	LIB	710
	YMAX=0.	LIB	720
	IPRT=1	LIB	730
	IF(IABS(MPRT).EQ.ITY .OR. MPRT.EQ.0) IPRT=-1	LIB	740
	IF(IPRT.GT. 0) WRITE(NOUT,902) TITLE	LIB	750
C		LIB	760
C	READ IN SLIT FUNCTION INFO	LIB	770
C		LIB	780
	IF(MSLT.EQ. 0) GO TO 35	LIB	790
	IF(PRTR) GO TO 30	LIB	800
	IF(JSLOT.EQ.1) GO TO 30	LIB	810
	READ(NIN,906) (XSS(I),I=1,NS)	LIB	820
	READ(NIN,906) (SS(1),1=1,NS)	LIB	830
30	PRTR=.TRUE.	LIB	840
C		LIB	850
C	GET PLOT INFO	LIB	860
C		LIB	870
	IF (LPLT.NE.0 .OR. MPLT.EQ.0) GO TO 35	LIB	880
	LPLT = 1	LIB	890
C	OPEN PLOTTER ON FIRST CALL	LIB	900
	CALL INITPS(NPLTR,0)	LIB	910
	CALL PLOT (XORG,YORG,-3)	LIB	920
35	ISLOT=1	LIB	930
	IF(IABS(MPLT).EQ.ITY .OR. MPLT.EQ.0) ISLOT=-1	LIB	940
	IF(IPRT.LT.0 .AND. ISLOT.LT.0) GO TO 75	LIB	950
	NEWT=1	LIB	960
	IF(MPLT.LT. 0) NEWT=-1	LIB	970
	IF(ISLOT.LT.0) GO TO 55	LIB	980
	IF(PLTR .OR. MSLT.EQ.0) GO TO 40	LIB	990
	READ(NIN,908) XAXIS,XINIT,XEND,DXT,NMINX	LIB	1000
	READ(NIN,908) YAXIS,YINI,YEND,DY,NMINY	LIB	1010
	PLTR=.TRUE.	LIB	1020
40	IX=(NEWT+1)/2 + 1	LIB	1030
	ESCALE=(XEND-XINIT)/XAXIS	LIB	1040
	YINIT=YINI	LIB	1050
	YSCALE=(YEND-YINIT)/YAXIS	LIB	1060

DTT=DY	LIB 1070
DO 45 I=1,5	LIB 1080
45 XTITLE(I)=XTIT(I,IX)	LIB 1090
ICHR=IXT(IX)	LIB 1100
IX=IX+1	LIB 1110
IF(ITYPE .EQ. 1) IX=1	LIB 1120
DO 50 I=1,7	LIB 1130
50 YTITLE(I)=YTIT(I,IX)	LIB 1140
JCHR=IYT(IX)	LIB 1150
C	LIB 1160
C CALCULATE AND OUTPUT	LIB 1170
C	LIB 1180
55 IF (JSLOT.EQ.1) GO TO 65	LIB 1190
WRITE(NOUT,910) WIDTH,SHIFT,NS	LIB 1200
WRITE(NOUT,912) (SS(I),I=1,NS)	LIB 1210
WRITE(NOUT,914) (XSS(I),I=1,NS)	LIB 1220
CALL GEN(WIDTH,SHIFT,XSS,SS,NS)	LIB 1230
GO TO 70	LIB 1240
65 WRITE(NOUT,916)	LIB 1250
CALL ALL	LIB 1260
70 CONTINUE	LIB 1270
IF(ISLOT.GT.0) CALL PLOT(XAXIS+5.0,0.0,-3)	LIB 1280
75 CONTINUE	LIB 1290
MSLTO=JSLOT	LIB 1300
C REWIND NPLT IN CASE THERE IS ANOTHER CALCULATION	LIB 1310
REWIND NPLT	LIB 1320
C CLOSE PLOTTER ON LAST CALCULATION	LIB 1330
IF (IXY.EQ.0 .AND. LPLT.EQ.1) CALL ENDPLT	LIB 1340
RETURN	LIB 1350
C	LIB 1360
900 FORMAT(20A4)	LIB 1370
902 FORMAT(1H1,30X,20A4)	LIB 1380
904 FORMAT(4I2,2X,2F10.0)	LIB 1390
906 FORMAT(8F10.5)	LIB 1400
908 FORMAT(4E10.4,I10)	LIB 1410
910 FORMAT(//1X,22H VARIABLE SLIT FUNCTION/1X,6H WIDTH=,F10.5,4X,	LIB 1420
1 6H SHIFT=,F10.5,4X,20H NO. OF DEFINING PTS=,I2)	LIB 1430
912 FORMAT(1X,8HYS ARE ,8F10.3)	LIB 1440
914 FORMAT(1X,8HXS ARE ,8F10.3)	LIB 1450
916 FORMAT(//1X,25H NO SLIT FUNCTION USED	LIB 1460
END	LIB 1470

///)

	SUBROUTINE ALL	ALL	10
C		ALL	20
C		ALL	30
C	PRINTS/PLOTS UNDEGRADED SPECTRUM	ALL	40
C		ALL	50
C		ALL	60
C	*****	ALL	70
C	***** IMPLEMENTATION NOTE *****	ALL	80
C	*****	ALL	90
C	FOR THE PRIME: COMPILE WITH SHORT INTEGER AND INCLUDE THE	ALL	100
C	INTEGER*4 STATMENT	ALL	110
C		ALL	120
C		ALL	130
C	INTEGER*4 NIN,NOUT,NSTOR,NPLT,NTBL	ALL	140
	DOUBLE PRECISION DVM,XFF	ALL	150
	DIMENSION Y(363),X(363),V(2)	ALL	160
	COMMON /DEVNUM/ NIN,NOUT,NSTOR,NPLT,NTBL	ALL	170
	COMMON/BLOCK2/Y,X	ALL	180
	COMMON/VS/ VS1,VS2	ALL	190
	COMMON/SETUP/ITYPE,ISLOT,NEWT,IPRT	ALL	200
	READ(NPLT) VS1,VS2,DV	ALL	210
	DVM=DV	ALL	220
	XFF = VS1 - DVM	ALL	230
	N = 0	ALL	240
10	READ(NPLT) V(2),V(1)	ALL	250
	IF (V(1).EQ.-1. .AND. V(2).EQ.-1.) GO TO 20	ALL	260
	XFF = XFF + DVM	ALL	270
	N = N + 1	ALL	280
	X(N) = XFF	ALL	290
	Y(N) = V(ITYPE)	ALL	300
	IF (N.EQ.360) CALL WRTDAT(N,X,Y)	ALL	310
	GO TO 10	ALL	320
20	IF (N.NE.0) CALL WRTDAT(N,X,Y)	ALL	330
	CALL WRTDAT(N,X,Y)	ALL	340
	CALL PROUT	ALL	350
	RETURN	ALL	360
	END	ALL	370

	SUBROUTINE GEN(WIDTH,SHIFT,XSS,SS,NS)	GEN 10
C		GEN 20
C		GEN 30
C	SLIT FUNCTION	GEN 40
C		GEN 50
C		GEN 60
C	*****	GEN 70
C	**** IMPLEMENTATION NOTE ****	GEN 80
C	*****	GEN 90
C	FOR THE PRIME: COMPILE WITH SHORT INTEGER AND INCLUDE THE	GEN 100
C	INTEGER*4 STATMENT	GEN 110
C		GEN 120
C	INTEGER*4 NIN,NOUT,NSTOR,NPLT,NTBL	GEN 130
	DOUBLE PRECISION DVM,XMID,XFF	GEN 140
	LOGICAL FIRST	GEN 150
	DIMENSION ARRAY(360),F(360),Y(363),X(363)	GEN 160
	DIMENSION XS(8),S(8),XSS(1),SS(1),XC(8),V(2)	GEN 170
	COMMON /DEVNUM/ NIN,NOUT,NSTOR,NPLT,NTBL	GEN 180
	COMMON/BLOCK1/F	GEN 190
	COMMON/BLOCK2/Y,X	GEN 200
	COMMON/BLOCK3/ARRAY	GEN 210
	COMMON/VS/ VS1,VS2	GEN 220
	COMMON/SETUP/ITYPE,ISLOT,NEWT,IPRT	GEN 230
C		GEN 240
C	NDEG = ORDER OF THE INTERPOLATION --- NS MUST BE AT LEAST NDEG+1	GEN 250
C		GEN 260
	DATA NDEG/1/	GEN 270
C		GEN 280
	FIRST=.TRUE.	GEN 290
	N=0	GEN 300
	READ(NPLT) VS1,VS2,DV	GEN 310
	DVM=DV	GEN 320
	XFF = VS1 - DVM	GEN 330
C		GEN 340
C	NORMALIZE SLIT FUNCTION	GEN 350
C		GEN 360
	IF(WIDTH .GE. 1800.) GO TO 96	GEN 370
	IF(DVM .GE. WIDTH) GO TO 95	GEN 380
	FAC=WIDTH/(XSS(NS)-XSS(1))	GEN 390
	DO 20 IS=1,NS	GEN 400
	XS(IS)=FAC*(XSS(IS)-XSS(1)) - .5*WIDTH	GEN 410
	S(IS)=SS(IS)	GEN 420
20	CONTINUE	GEN 430
	IF(DVM .GT. .3333*WIDTH) WRITE(NOUT,902)	GEN 440
	XMID=XF - DVM	GEN 450
C		GEN 460
25	NF = 0	GEN 470
30	READ(NPLT) V(2),V(1)	GEN 480
	IF (V(1).EQ.-1. .AND. V(2).EQ.-1.) GO TO 50	GEN 490
	XFF = XFF + DVM	GEN 500
	IF (NF.EQ.0) XF = XFF	GEN 510
	NF = NF + 1	GEN 520
	F(NF) = V(ITYPE)	GEN 530

	IF (NF.NE.360) GO TO 30	GEN 540
C		GEN 550
C	CALCULATE SLIT FUNCTION	GEN 560
C		GEN 570
50	IF(NF .EQ. 0) GO TO 90	GEN 580
	XMID=XMID + SHIFT	GEN 590
	DO 55 I=1,NS	GEN 600
55	XC(I)=XS(I) + XMID	GEN 610
	SUM=0.	GEN 620
	AREA=0.	GEN 630
	IXX=(XC(1)-XF)/DVM	GEN 640
	IF(IXX.LT.0 .AND. FIRST) GO TO 50	GEN 650
	XX=FLOAT(IXX-1)*DVM + XF	GEN 660
	IX=IXX	GEN 670
60	XX=XX+DVM	GEN 680
	IX=IX+1	GEN 690
	IF(XX .GT. XC(NS)) GO TO 75	GEN 700
	IF(IX .GT. NF) GO TO 80	GEN 710
	TERPV=TERP(XX,XC,S,NDEG,NS,IER)	GEN 720
	AREA=AREA + TERPV	GEN 730
	IF(IX .GE. 1) GO TO 70	GEN 740
C	GET DATA FROM BEFORE CURRENT DATA BLOCK	GEN 750
	J=IABS(IX) + 1	GEN 760
	SUM=SUM + TERPV*ARRAY(J)	GEN 770
	GO TO 60	GEN 780
C		GEN 790
70	SUM=SUM + TERPV*F(IX)	GEN 800
	GO TO 60	GEN 810
75	N=N + 1	GEN 820
	X(N)=XMID	GEN 830
	Y(N)=SUM/AREA	GEN 840
	IF(N .EQ. 360) CALL WRTDAT(N,X,Y)	GEN 850
	GO TO 50	GEN 860
C		GEN 870
C	STORE THE END OF THIS INFO BEFORE READING IN THE NEXT BLOCK	GEN 880
C		GEN 890
80	IF (NF.NE.360) GO TO 90	GEN 900
	DO 85 I=IXX,NF	GEN 910
	IX=NF-I+1	GEN 920
	ARRAY(IX)=F(I)	GEN 930
85	CONTINUE	GEN 940
	XMID=XMID-SHIFT	GEN 950
	FIRST = .FALSE.	GEN 960
	GO TO 25	GEN 970
C		GEN 980
90	IF (N.NE.0) CALL WRTDAT(N,X,Y)	GEN 990
	CALL WRTDAT(N,X,Y)	GEN 1000
	CALL PROUT	GEN 1010
	RETURN	GEN 1020
C		GEN 1030
95	WRITE(NOUT,904)	GEN 1040
	STOP 2	GEN 1050
96	WRITE(NOUT,905)	GEN 1060

STOP 7
902 FORMAT(38H0**WARNING** WIDTH IS LESS THAN 3.*DV)
904 FORMAT(33H0**ERROR** WIDTH SMALLER THAN DV)
905 FORMAT(35H0**ERROR** WIDTH GREATER THAN 1800)
END

GEN 1070
GEN 1080
GEN 1090
GEN 1100
GEN 1110

	SUBROUTINE PROUT	PRO 10
C		PRO 20
C		PRO 30
C	PRINT OUTPUT AND PLOT CURVES	PRO 40
C		PRO 50
C		PRO 60
C	*****	PRO 70
C	***** IMPLEMENTATION NOTE *****	PRO 80
C	*****	PRO 90
C	1) TITLE ASSIGNMENTS WILL HAVE TO BE CHANGED FOR MACHINES THAT	PRO 100
C	STORE MORE THAN 4 CHARACTERS PER WORD (UNIVAC + CDC)	PRO 110
C	VARIABLES EFFECTED: TNORM1, TNORM2	PRO 120
C	2) FOR THE PRIME: COMPILER WITH SHORT INTEGER AND INCLUDE THE	PRO 130
C	INTEGER*4 STATEMENT	PRO 140
C		PRO 150
C		PRO 160
C	INTEGER*4 NIN,NOUT,NSTOR,NPLT,NTBL	PRO 170
	LOGICAL FIRST	PRO 180
	DIMENSION XTITLE(20),YTITLE(20),TITLE(20),TNORM1(5)	PRO 190
	DIMENSION Y(360),X(360),XX(363),YY(363),OUT(4,3)	PRO 200
	COMMON /DEVNUM/ NIN,NOUT,NSTOR,NPLT,NTBL	PRO 210
	COMMON /PLTDEV/ NSCR,NPLTR	PRO 220
	COMMON/BLOCK1/X	PRO 230
	COMMON/BLOCK2/YY,XX	PRO 240
	COMMON/BLOCK3/Y	PRO 250
	COMMON/XBLOCK/XTITLE,XAXIS,XINIT,XSCALE,DXT,NMINX	PRO 260
	COMMON/YBLOCK/YTITLE,YAXIS,YINIT,YSCALE,DYT,NMINY	PRO 270
	COMMON/MAXY/YMAX	PRO 280
	COMMON/PBLOCK/TITLE,ICHAR,JCHAR,KCHAR	PRO 290
	COMMON/VS/ VS1,VS2	PRO 300
	COMMON/SETUP/ITYPE,ISLOT,NEWT,IPRT	PRO 310
	DATA TNORM1/4H NO,4HRMAL,4HIZED,4H TO ,4H10.(/	PRO 320
	DATA TNORM2/4H) /	PRO 330
C		PRO 340
	FIRST=.TRUE.	PRO 350
	IF(ISLOT .LT. 0) GO TO 40	PRO 360
C		PRO 370
C	SET UP FOR PLOTTING	PRO 380
C		PRO 390
	IF(NEWT .GT. 0) GO TO 30	PRO 400
	VSX=VS1	PRO 410
	VS1=1.E+4/VS2	PRO 420
	VS2=1.E+4/VSX	PRO 430
C	SET APPROPRIATE MAXIMA FOR AXIS	PRO 440
30	IF(XINIT .LE. 0.) XINIT=VS1	PRO 450
	IF(XSCALE .LE. 0.) XSCALE=(VS2-XINIT)/XAXIS	PRO 460
	IF(DXT .LE. 0.) DXT=XSCALE	PRO 470
	IF(NMINX .LE. 0) NMINX=9	PRO 480
	IF(YSCALE .GT. 0) GO TO 35	PRO 490
	IEXP=ALOG10(YMAX)	PRO 500
	IF(YMAX .LT. 1.) IEXP=IEXP-1	PRO 510
	IF(IEXP .EQ. -1) IEXP=0	PRO 520
	YMAX=INT(YMAX/10.**IEXP + .99)	PRO 530

YINIT=YINIT/10.**IEXP	PRO	540
YSCALE=(YMAX-YINIT)/YAXIS	PRO	550
NMINY=9	PRO	560
DTT=YSCALE	PRO	570
GO TO 45	PRO	580
35 YCHECK=YINIT+YAXIS*YSCALE	PRO	590
IF(YMAX.LE.YCHECK) IEXP=INT(ALOG10(YCHECK))-1	PRO	600
IF(YMAX.GT.YCHECK) IEXP=INT(ALOG10(YMAX))-1	PRO	610
IF(IEXP.EQ.-1) IEXP=0	PRO	620
YINIT=YINIT/10.**IEXP	PRO	630
IF(YMAX.GT.YCHECK) YMAX=INT(YMAX/10.**IEXP+.99)	PRO	640
IF(YMAX.GT.YCHECK) YSCALE=(YMAX-YINIT)/YAXIS	PRO	650
IF(YMAX.LE.YCHECK) YSCALE=YSCALE/10.**IEXP	PRO	660
IF(YMAX.GT.YCHECK) DTT=YSCALE	PRO	670
IF(YMAX.LE.YCHECK) DTT=DTT/10.**IEXP	PRO	680
45 XEND=XSCALE*XAXIS*1.01 + XINIT	PRO	690
C	PRO	700
C PLOT AXES AND ANNOTATION	PRO	710
C	PRO	720
CALL AXIS(0.0,0.0,XTITLE,-ICHAR,XAXIS,0.0,XINIT,XSCALE,DTT,NMINX)	PRO	730
CALL AXIS(0.0,YAXIS,TITLE,+KCHAR,XAXIS,0.0,XINIT,XSCALE,DTT,NMINX)	PRO	740
CALL AXIS(0.0,0.0,YTITLE,+JCHAR,YAXIS,90.0,YINIT,YSCALE,DTT,NMINY)	PRO	750
CALL AXIS(XAXIS,0.0,4H , -4, YAXIS,90.0,YINIT,YSCALE,DTT,NMINY)	PRO	760
IF(IEXP.EQ.0) GO TO 40	PRO	770
CALL SYMBOL(XAXIS+1.,3.*YAXIS/40.,YAXIS/40.,TNORM1,90.0,20)	PRO	780
CALL WHERE(XNORM,YNORM,DUMFAC)	PRO	790
TEXP=IEXP	PRO	800
CALL NUMBER(XNORM,YNORM,YAXIS/40.,TEXP,90.0,-1)	PRO	810
CALL WHERE(XNORM,YNORM,DUMFAC)	PRO	820
CALL SYMBOL(XNORM,YNORM,YAXIS/40.,TNORM2,90.0,4)	PRO	830
C	PRO	840
40 N1=0	PRO	850
REWIND NSCR	PRO	860
10 READ(NSCR) N	PRO	870
IF(N.EQ.0) RETURN	PRO	880
READ(NSCR) (X(I),Y(I),I=1,N)	PRO	890
IF(ISLOT.LT.0) GO TO 55	PRO	900
DO 25 I=1,N	PRO	910
XPT=X(I)	PRO	920
YPT=Y(I)	PRO	930
IF(NEWT .GT. 0) GO TO 20	PRO	940
IF(ITYPE .EQ. 1) GO TO 15	PRO	950
YPT=1.E-4*YPT*XPT*XPT	PRO	960
15 XPT=1.E+4/XPT	PRO	970
20 IF(XPT .GT. XEND) GO TO 26	PRO	980
IF(XPT .LT. XINIT) GO TO 25	PRO	990
N1=N1+1	PRO	1000
XX(N1)=XPT	PRO	1010
YY(N1)=YPT	PRO	1020
25 CONTINUE	PRO	1030
26 DO 50 I=1,N1	PRO	1040
50 YY(I)=YY(I)/10.**IEXP	PRO	1050
XX(N1+1)=XINIT	PRO	1060

	XX(N1+2)=XSCALE	PRO 1070
	YY(N1+1)=YINIT	PRO 1080
	YY(N1+2)=YSCALE	PRO 1090
C		PRO 1100
C	PLOT LINE	PRO 1110
C		PRO 1120
	IF(N1 .LE. 1) GO TO 55	PRO 1130
	CALL LINE(XX,YY,N1,1,0,0)	PRO 1140
	XX(1)=XX(N1)	PRO 1150
	YY(1)=YY(N1)*10.**IEXP	PRO 1160
	N1=1	PRO 1170
C		PRO 1180
C	OUTPUT INFO TO UNIT #NOUT	PRO 1190
C		PRO 1200
	55 IF(IPRT .LT. 0) GO TO 10	PRO 1210
	IF(.NOT.FIRST) WRITE(NOUT,901)	PRO 1220
	IF(ITYPE.EQ.1.AND.FIRST) WRITE(NOUT,902)	PRO 1230
	IF(ITYPE.EQ.2.AND.FIRST) WRITE(NOUT,903)	PRO 1240
	FIRST = .FALSE.	PRO 1250
	DO 90 II=1,N,180	PRO 1260
	NN=II+179	PRO 1270
	IF(NN .GT. N) NN=N	PRO 1280
	NN3=(NN-II+1)/3	PRO 1290
	IF(NN3*3 .NE. NN-II+1) NN3=NN3+1	PRO 1300
	NI=II+NN3-1	PRO 1310
	IF(ITYPE.EQ.2) GO TO 60	PRO 1320
	WRITE(NOUT,904)	PRO 1330
	WRITE(NOUT,905)	PRO 1340
	GO TO 65	PRO 1350
	60 WRITE(NOUT,906)	PRO 1360
	WRITE(NOUT,907)	PRO 1370
	65 DO 85 I=II,NI	PRO 1380
	DO 75 NCOL=1,3	PRO 1390
	I1=I + (NCOL-1)*NN3	PRO 1400
	IF(I1 .GT. NN) GO TO 80	PRO 1410
	IF(ITYPE .EQ. 2) GO TO 70	PRO 1420
	OUT(2,NCOL)=X(I1)	PRO 1430
	OUT(1,NCOL)=1.E+4/X(I1)	PRO 1440
	OUT(3,NCOL)=Y(I1)	PRO 1450
	OUT(4,NCOL)=Y(I1)	PRO 1460
	GO TO 75	PRO 1470
	70 OUT(3,NCOL)=1.E+4/X(I1)	PRO 1480
	OUT(4,NCOL)=1.E-4*Y(I1)*X(I1)*X(I1)	PRO 1490
	OUT(1,NCOL)=X(I1)	PRO 1500
	OUT(2,NCOL)=Y(I1)	PRO 1510
	75 CONTINUE	PRO 1520
	NCOL=4	PRO 1530
	80 NCOL=NCOL - 1	PRO 1540
	IF(ITYPE.EQ.1) WRITE(NOUT,908) ((OUT(J,K),J=1,4),K=1,NCOL)	PRO 1550
	IF(ITYPE.EQ.2) WRITE(NOUT,909) ((OUT(J,K),J=1,4),K=1,NCOL)	PRO 1560
	85 CONTINUE	PRO 1570
	90 CONTINUE	PRO 1580
	GO TO 10	PRO 1590

901	FORMAT(1H1)	PRO 1600
902	FORMAT(1H1,54X,25HATMOSPHERIC TRANSMITTANCE)	PRO 1610
903	FORMAT(1H1,51X,32HRADIATION (WATTS/SR/CM**2/UNITS))	PRO 1620
904	FORMAT(/2(1X,6HLAMBDA,7X,1HV,9X,13HTRANSMITTANCE,10X),	PRO 1630
1	1X,6HLAMBDA,7X,1HV,9X,13HTRANSMITTANCE)	PRO 1640
905	FORMAT(2(1X,7HMICRONS,4X,4HCM-1,31X),1X,7HMICRONS,4X,4HCM-1)	PRO 1650
906	FORMAT(/2(4X,1HV,6X,9HRADIATION,4X,6HLAMBDA,2X,9HRADIATION,4X),	PRO 1660
1	4X,1HV,6X,9HRADIATION,4X,6HLAMBDA,2X,9HRADIATION)	PRO 1670
907	FORMAT(2(3X,4HCM-1,4X,8HPER CM-1,4X,7HMICRONS,3X,6HPER UM,6X),	PRO 1680
1	3X,4HCM-1,4X,8HPER CM-1,4X,7HMICRONS,3X,6HPER UM)	PRO 1690
908	FORMAT(2(1X,F7.4,3X,F7.2,5X,F4.2,5X,F7.5,8X),	PRO 1700
1	1X,F7.4,3X,F7.2,5X,F4.2,5X,F7.5)	PRO 1710
909	FORMAT(2(1X,OPF7.2,2X,1PE10.4,3X,OPF7.4,2X,1PE9.3,4X),	PRO 1720
1	1X,OPF7.2,2X,1PE10.4,3X,OPF7.4,2X,1PE9.3)	PRO 1730
	END	PRO 1740

SUBROUTINE WRTDAT(N,X,Y)	WRT 10
C	WRT 20
C	WRT 30
C WRITES INFO ON UNIT #NSCR IN BINARY	WRT 40
C SETS UP DATA FOR PROUT	WRT 50
C	WRT 60
C	WRT 70
C*****	WRT 80
C**** IMPLEMENTATION NOTE ****	WRT 90
C*****	WRT 100
C FOR THE PRIME: COMPILE WITH SHORT INTEGER	WRT 110
C	WRT 120
C	WRT 130
LOGICAL FLAG	WRT 140
DIMENSION X(1),Y(1)	WRT 150
COMMON /PLTDEV/ NSCR,NPLTR	WRT 160
COMMON/MAXY/YMAX	WRT 170
COMMON/SETUP/ITYPE,ISLOT,NEWT,IPRT	WRT 180
C	WRT 190
WRITE(NSCR) N	WRT 200
IF(N .EQ. 0) RETURN	WRT 210
IF(ISLOT .LT.0) GO TO 20	WRT 220
FLAG=NEWT.LT.0 .AND. ITYPE.EQ.2	WRT 230
DO 10 I=1,N	WRT 240
YI=Y(I)	WRT 250
IF(FLAG) YI=1.E-04*YI*X(I)**2	WRT 260
10 YMAX=AMAX1(YI,YMAX)	WRT 270
20 WRITE(NSCR) (X(I),Y(I),I=1,N)	WRT 280
N=0	WRT 290
RETURN	WRT 300
END	WRT 310

FUNCTION TERP(XC,X,Y,NDEG,NPTS,IER)	TER 10
C	TER 20
C	TER 30
C	TER 40
FUNCTION PERFORMS NEWTONS INTERPOLATION FOR DISCRETE DATA	TER 50
AS A FUNCTION OF ONE VARIABLE	TER 60
C	TER 70
WHERE XC - INDEPENDENT VARIABLE AT WHICH THE INTERPOLATED	TER 80
VALUE OF THE DEPENDENT VARIABLE IS DESIRED	TER 90
C	TER 100
X - TABLE OF INDEPENDENT VARIABLE VALUES IN INCREASING	TER 110
ORDER	TER 120
C	TER 130
Y - CORRESPONDING TABLE OF DEPENDENT VARIABLE VALUES	TER 140
C	TER 150
NDEG - ORDER OF THE INTERPOLATING POLYNOMIAL USED (MAX - 10)	TER 160
C	TER 170
NPTS - NUMBER OF ENTRIES IN X AND Y	TER 180
C	TER 190
IER - RETURN CODE:	TER 200
C	TER 210
0 - INTERPOLATION WAS PERFORMED	TER 220
C	TER 230
-1 - EXTRAPOLATION BELOW TABLE VALUES	TER 240
C	TER 250
1 - EXTRAPOLATION ABOVE TABLE VALUES	TER 260
C	TER 270
ROUTINE MODIFIED FROM 'THE COMPUTING TECHNOLOGY CENTER	TER 280
C	TER 290
NUMERICAL ANALYSIS LIBRARY', O.R.N.L.	TER 300
C	TER 310
C*****	TER 320
C**** IMPLEMENTATION NOTE ****	TER 330
C*****	TER 340
C	TER 350
FOR THE PRIME: COMPILE WITH SHORT INTEGER	TER 360
C	TER 370
C	TER 380
DIMENSION X(1),Y(1),Y1(11)	TER 390
INTEGER HI	TER 400
C	TER 410
NFIT=NDEG + 1	TER 420
N=NFIT	TER 430
IF(N .GT. NPTS) N=NPTS	TER 440
IF(XC-X(1)) 50,20,10	TER 450
10 IF(XC .GT. X(NPTS)) GO TO 70	TER 460
20 IER=0	TER 470
DO 30 I=1,NPTS	TER 480
IF(XC - X(I)) 40,120,30	TER 490
30 CONTINUE	TER 500
40 LOW=I - (N+1)/2	TER 510
IF(LOW .LE. 0) GO TO 60	TER 520
HI=LOW + N - 1	TER 530
IF(HI .GT. NPTS) GO TO 80	TER 540
GO TO 90	TER 550
C	TER 560
C	TER 570
XC LT X(1)	TER 580
C	TER 590
50 IER=-1	TER 600
60 HI=N	TER 610
LOW=1	TER 620
GO TO 90	TER 630
C	TER 640

C	XC GT X(NPTS)	TER	540
C		TER	550
	70 IER=1	TER	560
	80 LOW=NPTS - N + 1	TER	570
	HI=NPTS	TER	580
C		TER	590
C	INTERPOLATE	TER	600
C		TER	610
	90 CON=1.	TER	620
	Y1(1)=Y(LOW)	TER	630
	TERP=Y(LOW)	TER	640
	IM=LOW - 1	TER	650
	IL=LOW + 1	TER	660
	DO 110 K=IL,HI	TER	670
	VAL=TERP	TER	680
	IA=K - LOW	TER	690
	IS=IA + 1	TER	700
	Y1(IS)=Y(K)	TER	710
	DO 100 I=1,IA	TER	720
	IR=IM + I	TER	730
	100 Y1(IS) = (Y1(I)-Y1(IS))/(X(IR)-X(K))	TER	740
	CON=CON*(XC-X(K-1))	TER	750
	110 TERP=VAL + CON*Y1(IS)	TER	760
	RETURN	TER	770
	120 TERP=Y(I)	TER	780
	RETURN	TER	790
	END	TER	800

APPENDIX E

SAMPLE CASES

AD-A091 972

AERODYNE RESEARCH INC BEDFORD MA CENTER FOR ELECTRO--ETC F/G 4/1
ADDITION OF A 5/CM SPECTRAL RESOLUTION BAND MODEL OPTION TO LOW--ETC(U)
OCT 80 D C ROBERTSON, L S BERNSTEIN, R HAIMES N60530-80-C-0087
ARI-RR-232 NL

UNCLASSIFIED

END

DATE

FILED

81-2

DTIC

1J

275.

3 1 2 0 0 1 180. 0.0
100. 2500. 5.
4
1900. 2500. 5.

4
1900. 2500. 5.
1 3 3

10
4
1900. 2500. 5.
1 3 3

2000 - TRIANG SLIT - 2000-1
2 3 3 40. 1.
-1. 0. 1.
0. 1. 0.
6. 1900. 2500. 100.
5. 0.0 4.0E-07 0.0E-07

9

3 1 2 0 1 1
0
1900. 2500. 5.
1 3 3

0J

275.

2000 - TRIANG SLIT - 2000-1
2 3 3 40. 1.
-1. 0. 1.
0. 1. 0.
6. 1900. 2500. 100.
5. 0.0 4.0E-07 0.0E-07

9

3 1 2 0 1 1
0
1900. 2500. 5.
1 3 3

1 PROGRAM WILL BE EXECUTED IN THE EMISSION MODE
THE 'SCH-1' BAND MODEL OPTION WILL BE USED

3 1 2 0 0 0 0 1 0.000 275.000 0 0 0.000 1
100.000 0.000 180.000 0.000 0.000
N1=100.000NM, N2= 0.000NM, ANGLE=180.000DEG, RANGE = 100.00NM, BETA=0.00000
1900.000 2500.000 5.000

SLANT PATH BETWEEN ALTITUDES N1 AND N2 WHERE N1 =100.000 NM N2 = 0.000 NM, ZENITH ANGLE =180.000 DEGREES

HAZE MODEL = 23.0 NM VISUAL RANGE AT SEA LEVEL

MODEL ATMOSPHERE 3 = MIDLATITUDE WINTER

HAZE MODEL 1 = RURAL VIS= 23.0NM

SEASON = FALL WINT

VERTICAL PROFILE AEROSOL MODEL = STR BCR

FREQUENCY RANGE V1= 1900.0 CM-1 TO V2= 2500.0 CM-1 FOR DV = 5.0 CM-1 (4.00 - 5.26 MICRONS)

1

ID	ALT	P	T	N2O	CO2+	O3	N2	H2O(10N)	MOLS	(N-1)	O3(UV)
1	0.00	1018.000	272.200	3.500E-01	1.000E-01	2.800E-03	8.121E-01	3.288E-03	1.000E 00	2.741E-04	2.800E-03
2	1.00	897.300	268.700	2.500E-01	9.003E-01	2.520E-03	6.433E-01	1.862E-03	9.003E-01	2.444E-04	2.520E-03
3	2.00	789.700	265.200	1.800E-01	8.029E-01	2.287E-03	5.002E-01	1.074E-03	8.029E-01	2.180E-04	2.287E-03
4	3.00	693.800	261.700	1.200E-01	7.149E-01	2.287E-03	4.002E-01	5.453E-04	7.149E-01	1.948E-04	2.287E-03
5	4.00	608.100	255.700	8.800E-02	6.413E-01	2.287E-03	3.183E-01	2.116E-04	6.413E-01	1.745E-04	2.287E-03
6	5.00	531.300	249.700	5.800E-02	5.737E-01	2.287E-03	2.518E-01	1.549E-01	5.737E-01	1.560E-04	2.287E-03
7	6.00	462.700	243.700	2.100E-02	5.120E-01	2.287E-03	1.981E-01	1.022E-05	5.120E-01	1.390E-04	2.287E-03
8	7.00	401.600	237.700	8.500E-03	4.564E-01	3.593E-03	1.549E-01	1.022E-05	4.564E-01	1.235E-04	3.593E-03
9	8.00	347.300	231.700	3.500E-03	4.042E-01	4.200E-03	1.204E-01	3.099E-06	4.042E-01	1.094E-04	4.200E-03
10	9.00	299.200	225.700	1.600E-03	3.573E-01	5.600E-03	9.232E-02	1.120E-06	3.573E-01	9.644E-05	5.600E-03
11	10.00	256.800	219.700	7.500E-04	3.152E-01	7.467E-03	7.127E-02	4.268E-07	3.152E-01	8.415E-05	7.467E-03
12	11.00	219.900	215.200	6.900E-04	2.703E-01	9.800E-03	5.244E-02	3.396E-07	2.703E-01	7.220E-05	9.800E-03
13	12.00	188.200	218.700	6.000E-04	2.320E-01	1.213E-02	3.854E-02	2.537E-07	2.320E-01	6.192E-05	1.213E-02
14	13.00	161.000	218.200	1.800E-04	1.902E-01	1.400E-02	2.810E-02	6.003E-08	1.902E-01	5.311E-05	1.400E-02
15	14.00	137.800	217.700	1.000E-04	1.707E-01	1.491E-02	2.081E-02	2.809E-08	1.707E-01	4.553E-05	1.491E-02
16	15.00	117.800	217.200	7.600E-05	1.462E-01	1.587E-02	1.526E-02	1.819E-08	1.462E-01	3.901E-05	1.587E-02
17	16.00	100.700	216.700	6.400E-05	1.253E-01	1.680E-02	1.119E-02	1.310E-08	1.253E-01	3.363E-05	1.680E-02
18	17.00	86.100	216.200	5.600E-05	1.074E-01	1.820E-02	8.207E-03	9.811E-09	1.074E-01	2.863E-05	1.820E-02
19	18.00	73.500	215.700	5.000E-05	9.168E-02	1.913E-02	6.002E-03	7.497E-09	9.168E-02	2.451E-05	1.913E-02
20	19.00	62.800	215.200	4.900E-05	7.869E-02	2.007E-02	4.397E-03	6.308E-09	7.869E-02	2.097E-05	2.007E-02
21	20.00	53.700	215.200	4.500E-05	6.729E-02	2.100E-02	3.215E-03	4.966E-09	6.729E-02	1.791E-05	2.100E-02
22	21.00	45.800	215.200	5.100E-05	5.739E-02	2.007E-02	2.339E-03	4.862E-09	5.739E-02	1.528E-05	2.007E-02
23	22.00	39.100	215.200	5.100E-05	4.899E-02	2.007E-02	1.704E-03	4.187E-09	4.899E-02	1.305E-05	2.007E-02
24	23.00	33.400	215.200	5.400E-05	4.185E-02	1.820E-02	1.244E-03	3.841E-09	4.185E-02	1.114E-05	1.820E-02
25	24.00	28.600	215.200	6.000E-05	3.584E-02	1.680E-02	9.119E-04	3.734E-09	3.584E-02	9.227E-06	1.680E-02
26	25.00	24.300	215.200	6.700E-05	3.065E-02	1.587E-02	6.583E-04	3.646E-09	3.065E-02	6.351E-06	1.587E-02
27	30.00	11.100	217.400	3.600E-05	1.377E-02	8.867E-03	1.353E-04	9.047E-10	1.377E-02	2.859E-06	8.867E-03
28	35.00	5.180	227.800	1.100E-05	6.132E-03	4.293E-03	2.747E-05	1.203E-10	6.132E-03	1.284E-06	4.293E-03

29 40.00 2.330 243.200 4.300E-06 2.805E-03 1.913E-03 5.940E-06 2.225E-11 2.805E-03 5.964E-07 1.913E-03
 30 45.00 1.250 258.500 1.900E-06 1.346E-04 6.047E-04 1.409E-06 4.942E-12 1.346E-04 6.047E-04 1.409E-06
 31 50.00 0.682 265.700 6.300E-07 6.921E-04 2.007E-04 8.780E-07 6.921E-04 2.007E-04 8.780E-07 6.921E-04
 32 70.00 0.047 236.700 1.400E-08 5.458E-05 4.013E-06 2.190E-09 1.302E-15 5.458E-05 2.190E-09 4.013E-06
 33 100.00 0.000 210.200 1.000E-10 3.848E-07 2.007E-09 1.039E-13 6.038E-20 3.848E-07 2.007E-09 1.039E-13
 34 99999.00 0.000 210.000 0.000E-01 0.000E-01 0.000E-01 0.000E-01 0.000E-01 0.000E-01 0.000E-01 0.000E-01

HORIZONTAL PROFILES

29	ALT	P	T	W20(4M)	WMO3	AER1	AER2	AER3	AER4	(AER1+4M)	RM
1	0.00	1018.000	272.200	6.488E-02	0.000E-01	1.500E-01	0.000E-01	0.000E-01	0.000E-01	1.217E-01	7.703E-01
2	1.00	897.300	268.700	4.330E-02	0.000E-01	9.910E-02	0.000E-01	0.000E-01	0.000E-01	6.979E-01	7.042E-01
3	2.00	789.700	263.200	2.918E-02	0.000E-01	6.210E-02	0.000E-01	0.000E-01	0.000E-01	4.061E-01	6.540E-01
4	3.00	693.800	261.700	1.820E-02	0.000E-01	0.000E-01	2.720E-02	0.000E-01	0.000E-01	0.000E-01	0.000E-01
5	4.00	608.100	253.700	9.846E-03	0.000E-01	0.000E-01	1.200E-02	0.000E-01	0.000E-01	0.000E-01	0.000E-01
6	5.00	531.300	249.700	5.604E-03	0.000E-01	0.000E-01	4.850E-03	0.000E-01	0.000E-01	0.000E-01	0.000E-01
7	6.00	462.700	243.700	3.074E-03	0.000E-01	0.000E-01	3.540E-03	0.000E-01	0.000E-01	0.000E-01	0.000E-01
8	7.00	401.600	237.700	1.239E-03	0.000E-01	0.000E-01	2.310E-03	0.000E-01	0.000E-01	0.000E-01	0.000E-01
9	8.00	347.300	231.700	5.108E-04	4.042E-35	0.000E-01	1.410E-03	0.000E-01	0.000E-01	0.000E-01	0.000E-01
10	9.00	299.200	223.700	2.348E-04	3.575E-06	0.000E-01	9.800E-04	0.000E-01	0.000E-01	0.000E-01	0.000E-01
11	10.00	256.800	219.700	1.127E-04	1.040E-05	0.000E-01	0.000E-01	7.870E-04	0.000E-01	0.000E-01	0.000E-01
12	11.00	219.900	219.200	0.884E-05	2.164E-05	0.000E-01	0.000E-01	7.140E-04	0.000E-01	0.000E-01	0.000E-01
13	12.00	180.200	218.700	6.703E-05	2.784E-05	0.000E-01	0.000E-01	6.440E-04	0.000E-01	0.000E-01	0.000E-01
14	13.00	161.000	218.200	1.745E-05	2.785E-05	0.000E-01	0.000E-01	6.230E-04	0.000E-01	0.000E-01	0.000E-01
15	14.00	137.800	217.700	0.416E-06	2.731E-05	0.000E-01	0.000E-01	6.430E-04	0.000E-01	0.000E-01	0.000E-01
16	15.00	117.800	217.200	5.547E-06	2.632E-05	0.000E-01	0.000E-01	6.430E-04	0.000E-01	0.000E-01	0.000E-01
17	16.00	100.700	216.700	4.031E-06	2.381E-05	0.000E-01	0.000E-01	6.410E-04	0.000E-01	0.000E-01	0.000E-01
18	17.00	86.100	216.200	3.074E-06	2.148E-05	0.000E-01	0.000E-01	6.000E-04	0.000E-01	0.000E-01	0.000E-01
19	18.00	73.500	215.700	2.377E-06	1.930E-05	0.000E-01	0.000E-01	5.620E-04	0.000E-01	0.000E-01	0.000E-01
20	19.00	62.800	215.200	2.020E-06	1.810E-05	0.000E-01	0.000E-01	4.910E-04	0.000E-01	0.000E-01	0.000E-01
21	20.00	53.700	215.200	1.584E-06	2.019E-05	0.000E-01	0.000E-01	4.230E-04	0.000E-01	0.000E-01	0.000E-01
22	21.00	45.800	215.200	1.533E-06	2.123E-05	0.000E-01	0.000E-01	3.520E-04	0.000E-01	0.000E-01	0.000E-01
23	22.00	39.100	215.200	1.309E-06	2.058E-05	0.000E-01	0.000E-01	2.940E-04	0.000E-01	0.000E-01	0.000E-01
24	23.00	33.400	215.200	1.126E-06	2.176E-05	0.000E-01	0.000E-01	2.420E-04	0.000E-01	0.000E-01	0.000E-01
25	24.00	28.600	215.200	1.126E-06	2.150E-05	0.000E-01	0.000E-01	1.900E-04	0.000E-01	0.000E-01	0.000E-01
26	25.00	24.300	215.200	1.069E-06	1.157E-05	0.000E-01	0.000E-01	1.500E-04	0.000E-01	0.000E-01	0.000E-01
27	30.00	11.100	217.400	2.462E-07	3.580E-06	0.000E-01	0.000E-01	3.320E-05	0.000E-01	0.000E-01	0.000E-01
28	35.00	5.180	227.800	3.644E-08	1.349E-07	0.000E-01	0.000E-01	0.000E-01	1.840E-05	0.000E-01	0.000E-01
29	40.00	2.530	243.200	3.469E-09	2.805E-07	0.000E-01	0.000E-01	0.000E-01	7.990E-06	0.000E-01	0.000E-01
30	45.00	1.290	258.500	5.627E-10	0.000E-01	0.000E-01	0.000E-01	0.000E-01	4.010E-06	0.000E-01	0.000E-01
31	50.00	0.682	265.700	8.562E-11	0.000E-01	0.000E-01	0.000E-01	0.000E-01	2.100E-06	0.000E-01	0.000E-01
32	70.00	0.047	236.700	2.816E-13	0.000E-01	0.000E-01	0.000E-01	0.000E-01	1.600E-07	0.000E-01	0.000E-01
33	100.00	0.000	210.200	2.286E-17	0.000E-01	0.000E-01	0.000E-01	0.000E-01	9.310E-10	0.000E-01	0.000E-01
34	99999.00	0.000	210.000	0.000E-01	0.000E-01	0.000E-01	0.000E-01	0.000E-01	0.000E-01	0.000E-01	0.000E-01

FROM POINT\ HEIGHT= 100.0000 RM= 33.00~1.REF. INDEX ABOVE & BELOW X= 0.000E 00 0.000E 00.1P= 1
 EQUIV. ABSORBER AMOUNTS PER RM AT X= 0.100E-09 0.385E-06 0.201E-08 0.104E-12 0.604E-19 0.385E-06 0.000E 00 0.201E-08

TR(12-14)= 0.000E 00 0.000E 00 0.931E-09

FROM POINT\ HEIGHT= 0.0000 RM= 1.00~1.REF. INDEX ABOVE & BELOW X= 0.279E-03 0.000E 00.1P= 1
 EQUIV. ABSORBER AMOUNTS PER RM AT X= 0.350E 00 0.101E 01 0.280E-02 0.812E 00 0.129E-02 0.101E 01 0.150E 00 0.280E-02

WITTEL MOVIES

WITKAL MOVIES

E-5

10	10.000	4.017E-03	2.342E	00	3.494E-01	3.119E-01	1.672E-04	2.342E	00	0.000E-01	3.694E-01	-0.000	0.000	0.000	180.000	91.00
9	9.000	4.224E-04	3.737E-04	0.000E-01	7.922E-01	7.922E-01	1.181E-04	4.224E-04	3.737E-04	0.000E-01	7.922E-01	-0.000	0.000	0.000	180.000	92.00
9	9.000	6.440E-03	2.748E	00	3.744E-01	4.177E-01	3.613E-06	2.748E	00	0.000E-01	3.744E-01	-0.000	0.000	0.000	180.000	92.00
8	8.000	7.771E-04	3.737E-04	1.180E-03	7.922E-01	7.922E-01	1.181E-04	7.771E-04	3.737E-04	1.180E-03	7.922E-01	-0.000	0.000	0.000	180.000	93.00
8	8.000	1.204E-02	3.176E	00	3.703E-01	5.544E-01	9.567E-06	3.176E	00	0.000E-01	3.703E-01	-0.000	0.000	0.000	180.000	93.00
7	7.000	1.597E-03	3.737E-04	2.999E-03	7.922E-01	7.922E-01	1.181E-04	1.597E-03	3.737E-04	2.999E-03	7.922E-01	-0.000	0.000	0.000	180.000	94.00
7	7.000	2.307E-02	3.659E	00	3.814E-01	2.796E-01	3.044E-05	3.659E	00	0.000E-01	3.814E-01	-0.000	0.000	0.000	180.000	94.00
6	6.000	3.612E-03	3.737E-04	3.879E-03	7.922E-01	7.922E-01	1.181E-04	3.612E-03	3.737E-04	3.879E-03	7.922E-01	-0.000	0.000	0.000	180.000	95.00
6	6.000	5.459E-02	4.201E	00	3.844E-01	5.533E-01	9.038E-05	4.201E	00	0.000E-01	3.844E-01	-0.000	0.000	0.000	180.000	95.00
5	5.000	7.823E-03	3.737E-04	1.003E-02	7.922E-01	7.922E-01	1.181E-04	7.823E-03	3.737E-04	1.003E-02	7.922E-01	-0.000	0.000	0.000	180.000	96.00
5	5.000	1.051E-01	4.807E	00	3.849E-01	1.237E	00	2.328E-04	4.807E	00	0.000E-01	3.849E-01	-0.000	0.000	180.000	96.00
4	4.000	1.534E-02	3.737E-04	1.791E-02	7.922E-01	7.922E-01	1.181E-04	1.534E-02	3.737E-04	1.791E-02	7.922E-01	-0.000	0.000	0.000	180.000	97.00
4	4.000	1.994E-01	5.404E	00	3.892E-01	1.594E	00	5.851E-04	5.404E	00	0.000E-01	3.892E-01	-0.000	0.000	180.000	97.00
3	3.000	2.897E-02	3.737E-04	3.648E-02	7.922E-01	7.922E-01	1.181E-04	2.897E-02	3.737E-04	3.648E-02	7.922E-01	-0.000	0.000	0.000	180.000	98.00
3	3.000	3.433E-01	6.241E	00	3.912E-01	2.044E	00	1.364E-03	6.241E	00	0.000E-01	3.912E-01	-0.000	0.000	180.000	98.00
2	2.000	5.218E-02	3.737E-04	3.648E-02	7.922E-01	7.922E-01	1.181E-04	5.218E-02	3.737E-04	3.648E-02	7.922E-01	-0.000	0.000	0.000	180.000	99.00
2	2.000	5.559E-01	7.050E	00	3.939E-01	2.618E	00	2.793E-03	7.050E	00	0.000	3.939E-01	-0.000	0.000	180.000	99.00
1	1.000	8.707E-02	3.737E-04	3.648E-02	7.922E-01	7.922E-01	1.181E-04	8.707E-02	3.737E-04	3.648E-02	7.922E-01	-0.000	0.000	0.000	180.000	100.00
1	1.000	8.527E-01	8.042E	00	3.965E-01	3.341E	00	5.297E-03	8.042E	00	2.051E-01	3.965E-01	-0.000	0.000	180.000	100.00
0	0.000	1.412E-01	3.737E-04	3.648E-02	7.922E-01	7.922E-01	1.181E-04	1.412E-01	3.737E-04	3.648E-02	7.922E-01	-0.000	0.000	0.000	180.000	1.000

CLUBSOMER ENJOY THE BEST OF BOTH WORLDS

WATER VAPOR ON CH-2	CO2 ETC. IN	OXONE ATM CM	NITROGEN (CONT) IN	H2O (CONT) ON CH-2	MOL SCAT IN	ABR1	OXONE(U-V ATM CM NITRIC ACID
0.8536 66	0.0048 61	0.3978 00	0.3348 61	0.3308-02 0.1418 00	0.0048 01	0.2058 60	0.3978 00 0.3746-03

CUMULATIVE AVERAGE AMOUNTS FOR THE AEROSOLIC PAT.

[illegible]

14	4.942E-05	8.490E-02	1.954E-02	1.904E-02	4.550E-08	5.834E-01	0.000E-01	2.484E-01	1.381E-05	1.774E-04	215.450	68.150
15	5.264E-05	9.824E-02	1.863E-02	2.409E-02	5.409E-08	6.828E-01	0.000E-01	2.670E-01	1.651E-05	1.977E-04	215.950	79.000
16	3.978E-05	1.159E-01	1.743E-02	3.369E-02	6.344E-08	7.987E-01	0.000E-01	2.843E-01	2.005E-05	2.203E-04	216.450	93.400
17	6.965E-05	1.352E-01	1.629E-02	4.878E-02	8.090E-08	9.338E-01	0.000E-01	3.008E-01	2.479E-05	2.453E-04	216.950	109.250
18	8.733E-05	1.579E-01	1.537E-02	6.664E-02	1.037E-07	1.097E-01	0.000E-01	3.161E-01	3.167E-05	2.720E-04	217.450	127.800
19	1.339E-04	1.841E-01	1.444E-02	9.094E-02	1.454E-07	1.274E-01	0.000E-01	3.304E-01	4.403E-05	2.994E-04	217.950	149.400
20	3.464E-04	2.149E-01	1.304E-02	1.241E-01	2.799E-07	1.491E-01	0.000E-01	3.434E-01	8.086E-05	3.274E-04	218.450	174.600
21	6.434E-04	2.504E-01	1.092E-02	1.692E-01	5.743E-07	1.741E-01	0.000E-01	3.543E-01	1.582E-04	3.570E-04	218.950	204.050
22	7.878E-04	2.919E-01	8.570E-03	2.303E-01	9.554E-07	2.033E-01	0.000E-01	3.631E-01	2.577E-04	3.673E-04	219.450	238.350
23	1.119E-03	3.349E-01	6.470E-03	3.119E-01	1.072E-06	2.368E-01	0.000E-01	3.694E-01	4.226E-04	3.737E-04	222.700	278.000
24	2.423E-03	3.797E-01	4.058E-03	4.177E-01	3.613E-06	2.748E-01	0.000E-01	3.744E-01	7.771E-04	3.737E-04	228.700	323.250
25	5.623E-03	4.285E-01	3.881E-03	5.544E-01	9.567E-06	3.174E-01	0.000E-01	3.783E-01	1.597E-03	3.737E-04	234.700	374.450
26	1.301E-02	4.820E-01	3.277E-03	7.294E-01	3.044E-05	3.659E-01	0.000E-01	3.814E-01	3.615E-03	3.737E-04	240.700	432.150
27	2.843E-02	5.414E-01	2.841E-03	9.333E-01	9.038E-05	4.201E-01	0.000E-01	3.844E-01	7.823E-03	3.737E-04	246.700	497.000
28	5.064E-02	6.059E-01	2.487E-03	1.237E-01	2.328E-04	4.807E-01	0.000E-01	3.869E-01	1.534E-02	3.737E-04	252.700	569.700
29	9.029E-02	6.771E-01	2.284E-03	1.594E-01	5.851E-04	5.484E-01	0.000E-01	3.892E-01	2.893E-02	3.737E-04	258.700	650.950
30	1.479E-01	7.573E-01	2.285E-03	2.044E-01	1.364E-03	6.241E-01	0.000E-01	3.915E-01	5.218E-02	3.737E-04	263.450	741.750
31	2.124E-01	8.487E-01	2.394E-03	2.618E-01	2.791E-03	7.090E-01	0.000E-01	3.938E-01	8.707E-02	3.737E-04	264.950	843.500
32	2.960E-01	9.322E-01	2.654E-03	3.341E-01	5.297E-03	8.042E-01	0.000E-01	3.963E-01	1.412E-01	3.737E-04	270.450	957.650

ID	ARR2	ARR3	ARR4
1	0.000E-01	0.000E-01	9.272E-07
2	0.000E-01	0.000E-01	1.600E-05
3	0.000E-01	0.000E-01	3.074E-05
4	0.000E-01	0.000E-01	5.962E-05
5	0.000E-01	0.000E-01	1.181E-04
6	0.000E-01	0.000E-01	1.181E-04
7	0.000E-01	3.870E-04	1.181E-04
8	0.000E-01	5.558E-04	1.181E-04
9	0.000E-01	7.703E-04	1.181E-04
10	0.000E-01	1.039E-03	1.181E-04
11	0.000E-01	1.360E-03	1.181E-04
12	0.000E-01	1.744E-03	1.181E-04
13	0.000E-01	2.202E-03	1.181E-04
14	0.000E-01	2.727E-03	1.181E-04
15	0.000E-01	3.307E-03	1.181E-04
16	0.000E-01	3.923E-03	1.181E-04
17	0.000E-01	4.564E-03	1.181E-04
18	0.000E-01	5.209E-03	1.181E-04
19	0.000E-01	5.842E-03	1.181E-04
20	0.000E-01	6.485E-03	1.181E-04
21	0.000E-01	7.134E-03	1.181E-04
22	0.000E-01	7.722E-03	1.181E-04
23	0.000E-01	7.922E-03	1.181E-04
24	1.180E-03	7.922E-03	1.181E-04
25	2.999E-03	7.922E-03	1.181E-04
26	5.878E-03	7.922E-03	1.181E-04
27	1.003E-02	7.922E-03	1.181E-04
28	1.791E-02	7.922E-03	1.181E-04
29	3.648E-02	7.922E-03	1.181E-04
30	3.648E-02	7.922E-03	1.181E-04
31	3.648E-02	7.922E-03	1.181E-04
32	3.648E-02	7.922E-03	1.181E-04

RADIANCE (WATTS/CM²-STER-UM)

WVL (MICRON)	PER CM ⁻¹	PER MICRON	INTEGRAL	TRANS
1900.0	5.263158	0.30192E-06	0.10099E-03	0.75479E-06
1905.0	5.249363	0.25153E-06	0.91282E-04	0.20125E-05
1910.0	5.235601	0.16495E-06	0.60177E-04	0.28372E-05
1915.0	5.221931	0.25401E-06	0.93151E-04	0.41073E-05
1920.0	5.208333	0.11935E-06	0.43997E-04	0.47040E-05
1925.0	5.194805	0.18011E-06	0.66741E-04	0.56046E-05
1930.0	5.181347	0.28513E-06	0.10621E-03	0.70302E-05
1935.0	5.167958	0.22611E-06	0.83912E-04	0.81507E-05
1940.0	5.154638	0.23529E-06	0.88554E-04	0.93272E-05
1945.0	5.141388	0.12318E-06	0.46599E-04	0.99431E-05
1950.0	5.128204	0.26317E-06	0.10007E-03	0.11259E-04
1955.0	5.115089	0.21948E-06	0.83884E-04	0.12356E-04
1960.0	5.102040	0.23221E-06	0.89206E-04	0.13517E-04
1965.0	5.089058	0.18841E-06	0.65026E-04	0.14359E-04
1970.0	5.076141	0.27824E-06	0.10798E-03	0.15751E-04
1975.0	5.063291	0.26120E-06	0.10189E-03	0.17057E-04
1980.0	5.050505	0.27081E-06	0.10617E-03	0.18411E-04
1985.0	5.037783	0.25542E-06	0.10064E-03	0.19688E-04
1990.0	5.025126	0.13106E-06	0.51902E-04	0.20343E-04
1995.0	5.012531	0.19234E-06	0.76453E-04	0.21304E-04
2000.0	5.000000	0.21615E-06	0.86459E-04	0.22387E-04
2005.0	4.987531	0.25263E-06	0.10156E-03	0.23650E-04
2010.0	4.975124	0.20590E-06	0.83186E-04	0.24679E-04
2015.0	4.962779	0.16792E-06	0.68179E-04	0.25519E-04
2020.0	4.950495	0.18168E-06	0.74124E-04	0.26427E-04
2025.0	4.938272	0.18889E-06	0.77457E-04	0.27372E-04
2030.0	4.926108	0.23340E-06	0.96182E-04	0.28539E-04
2035.0	4.914004	0.21914E-06	0.90752E-04	0.29634E-04
2040.0	4.901960	0.16004E-06	0.66612E-04	0.30435E-04
2045.0	4.889976	0.17774E-06	0.74330E-04	0.31323E-04
2050.0	4.878048	0.18075E-06	0.75959E-04	0.32227E-04
2055.0	4.866179	0.17894E-06	0.75573E-04	0.33122E-04
2060.0	4.854368	0.15210E-06	0.64544E-04	0.33882E-04
2065.0	4.842616	0.11959E-06	0.50995E-04	0.34480E-04
2070.0	4.830917	0.15849E-06	0.67912E-04	0.35273E-04
2075.0	4.819277	0.98463E-07	0.42394E-04	0.35765E-04
2080.0	4.807692	0.11315E-06	0.48955E-04	0.36331E-04
2085.0	4.796163	0.16534E-06	0.63181E-04	0.37057E-04
2090.0	4.784689	0.12379E-06	0.54072E-04	0.37676E-04
2095.0	4.773270	0.12627E-06	0.55420E-04	0.38308E-04
2100.0	4.761905	0.13652E-06	0.60204E-04	0.38990E-04
2105.0	4.750593	0.12237E-06	0.54224E-04	0.39602E-04
2110.0	4.739336	0.13314E-06	0.59284E-04	0.40248E-04
2115.0	4.728132	0.12918E-06	0.53374E-04	0.40848E-04
2120.0	4.716981	0.10487E-06	0.47133E-04	0.41388E-04
2125.0	4.705882	0.10224E-06	0.46178E-04	0.41900E-04
2130.0	4.694836	0.11988E-06	0.54388E-04	0.42499E-04
2135.0	4.683840	0.13504E-06	0.61553E-04	0.43174E-04
2140.0	4.672896	0.14114E-06	0.64635E-04	0.43800E-04
2145.0	4.662004	0.13894E-06	0.63928E-04	0.44575E-04
2150.0	4.651162	0.13969E-06	0.64572E-04	0.45273E-04
2155.0	4.640370	0.12877E-06	0.59799E-04	0.45917E-04

2160.0	4.629629	0.11533E-06	0.53004E-04	0.46493E-04	0.612729
2165.0	4.618937	0.11908E-06	0.52813E-04	0.47089E-04	0.604641
2170.0	4.608294	0.11498E-06	0.54143E-04	0.47664E-04	0.6062876
2175.0	4.597701	0.10262E-06	0.48543E-04	0.48177E-04	0.579612
2180.0	4.587155	0.98869E-07	0.46904E-04	0.48671E-04	0.535944
2185.0	4.576458	0.78330E-07	0.37397E-04	0.49063E-04	0.39610
2190.0	4.566210	0.64974E-07	0.31163E-04	0.49188E-04	0.268996
2195.0	4.555808	0.57561E-07	0.27734E-04	0.49675E-04	0.228025
2200.0	4.545454	0.49282E-07	0.23852E-04	0.49922E-04	0.160458
2205.0	4.535147	0.41344E-07	0.20102E-04	0.50129E-04	0.111564
2210.0	4.524886	0.34699E-07	0.16947E-04	0.50302E-04	0.074570
2215.0	4.514672	0.34850E-07	0.18079E-04	0.50486E-04	0.088704
2220.0	4.504504	0.35013E-07	0.17256E-04	0.50661E-04	0.095095
2225.0	4.494382	0.42041E-07	0.20813E-04	0.50872E-04	0.144223
2230.0	4.484304	0.27561E-07	0.13704E-04	0.51009E-04	0.047550
2235.0	4.474273	0.22771E-07	0.11375E-04	0.51123E-04	0.021232
2240.0	4.464285	0.21839E-07	0.10958E-04	0.51232E-04	0.017494
2245.0	4.454343	0.21004E-07	0.10587E-04	0.51337E-04	0.020192
2250.0	4.444444	0.14981E-07	0.75839E-05	0.51412E-04	0.006180
2255.0	4.434569	0.15214E-07	0.77376E-05	0.51488E-04	0.007457
2260.0	4.424778	0.94343E-08	0.48187E-05	0.51534E-04	0.001104
2265.0	4.415010	0.79151E-08	0.40604E-05	0.51575E-04	0.000407
2270.0	4.405286	0.67660E-08	0.34884E-05	0.51609E-04	0.000093
2275.0	4.395604	0.66161E-08	0.34242E-05	0.51642E-04	0.000094
2280.0	4.385964	0.79751E-08	0.41648E-05	0.51682E-04	0.000087
2285.0	4.376368	0.81253E-08	0.42424E-05	0.51723E-04	0.000034
2290.0	4.366812	0.59089E-08	0.30987E-05	0.51752E-04	0.000001
2295.0	4.357298	0.53284E-08	0.28063E-05	0.51779E-04	0.000000
2300.0	4.347826	0.52173E-08	0.27600E-05	0.51805E-04	0.000000
2305.0	4.338394	0.48928E-08	0.25994E-05	0.51829E-04	0.000000
2310.0	4.329004	0.49120E-08	0.26211E-05	0.51854E-04	0.000001
2315.0	4.319654	0.54344E-08	0.29124E-05	0.51881E-04	0.000000
2320.0	4.310345	0.54503E-08	0.29337E-05	0.51908E-04	0.000001
2325.0	4.301075	0.65703E-08	0.35517E-05	0.51941E-04	0.000000
2330.0	4.291845	0.68772E-08	0.37334E-05	0.51974E-04	0.000000
2335.0	4.282655	0.63180E-08	0.34447E-05	0.52007E-04	0.000000
2340.0	4.273504	0.67579E-08	0.37004E-05	0.52041E-04	0.000000
2345.0	4.264392	0.63713E-08	0.35037E-05	0.52073E-04	0.000000
2350.0	4.255319	0.52404E-08	0.28940E-05	0.52099E-04	0.000000
2355.0	4.246284	0.67377E-08	0.37367E-05	0.52133E-04	0.000000
2360.0	4.237288	0.59608E-08	0.31199E-05	0.52162E-04	0.000000
2365.0	4.228330	0.59170E-08	0.33093E-05	0.52192E-04	0.000000
2370.0	4.219409	0.47188E-08	0.26503E-05	0.52216E-04	0.000000
2375.0	4.210526	0.38123E-08	0.21504E-05	0.52235E-04	0.000000
2380.0	4.201640	0.29977E-08	0.16960E-05	0.52258E-04	0.000000
2385.0	4.192872	0.60895E-08	0.24639E-05	0.52280E-04	0.000191
2390.0	4.184100	0.26038E-07	0.14873E-04	0.52410E-04	0.126078
2395.0	4.175364	0.40101E-07	0.23002E-04	0.52611E-04	0.436099
2400.0	4.166666	0.41894E-07	0.24131E-04	0.52820E-04	0.511641
2405.0	4.158004	0.42164E-07	0.24390E-04	0.53031E-04	0.542842
2410.0	4.149377	0.42223E-07	0.24524E-04	0.53242E-04	0.570119
2415.0	4.140786	0.42044E-07	0.24522E-04	0.53452E-04	0.590551
2420.0	4.132231	0.41659E-07	0.24397E-04	0.53661E-04	0.600292
2425.0	4.123711	0.41564E-07	0.24442E-04	0.53869E-04	0.628901

4.9383	2035.00	0.44	0.44220	4.4843	2230.00	0.05	0.04755	4.1068	2435.00	0.46	0.6563
4.9261	2036.00	0.91	0.90827	4.4743	2235.00	0.02	0.02123	4.0984	2440.00	0.46	0.6578
4.9140	2035.00	0.80	0.79649	4.4643	2240.00	0.02	0.01749	4.0900	2445.00	0.67	0.6691
4.9020	2040.00	0.33	0.32803	4.4543	2245.00	0.02	0.02019	4.0816	2450.00	0.48	0.6795
4.8900	2045.00	0.53	0.52904	4.4444	2250.00	0.01	0.00610	4.0733	2455.00	0.71	0.7054
4.8780	2050.00	0.67	0.67036	4.4346	2255.00	0.01	0.00746	4.0650	2460.00	0.74	0.7394
4.8662	2055.00	0.68	0.68167	4.4248	2260.00	0.00	0.00110	4.0568	2465.00	0.75	0.7466
4.8544	2060.00	0.67	0.67005	4.4150	2265.00	0.00	0.00041	4.0486	2470.00	0.75	0.7453
4.8426	2065.00	0.23	0.22829	4.4053	2270.00	0.00	0.00009	4.0404	2475.00	0.75	0.7537
4.8309	2070.00	0.63	0.63056	4.3956	2275.00	0.00	0.00009	4.0323	2480.00	0.77	0.7716
4.8193	2075.00	0.25	0.24638	4.3860	2280.00	0.00	0.00000	4.0241	2485.00	0.81	0.8062
4.8077	2080.00	0.34	0.33676	4.3764	2285.00	0.00	0.00003	4.0161	2490.00	0.82	0.8239
4.7962	2085.00	0.59	0.58947	4.3668	2290.00	0.00	0.00000	4.0080	2495.00	0.83	0.8312
4.7847	2090.00	0.59	0.59267	4.3573	2295.00	0.00	0.00000	4.0000	2500.00	0.86	0.8550
4.7733	2095.00	0.50	0.50234	4.3478	2300.00	0.00	0.00000	4.0000		0.00	
4.7619	2100.00	0.63	0.62780	4.3384	2305.00	0.00	0.00000	4.0000		0.00	

U.62780 4.3384 2303.00
WOOD - MADIR VIEWING - CMMO TO SPACE

AND SLIT FUNCTION USED

RADIATION (WATTS/CM ² /UNITS)					
V	RADIATION PER CM ⁻¹	LAMBDA MICRONS	RADIATION PER CM ⁻¹	V	RADIATION PER CM ⁻¹
1900.0	3.0192E-07	5.2632	4.7506	2310.0	4.9120E-09
1905.0	3.2153E-07	5.2493	4.7393	2315.0	5.4348E-09
1910.0	3.6495E-07	5.2356	4.7281	2320.0	5.4505E-09
1915.0	3.5401E-07	5.2219	4.7170	2325.0	5.7034E-09
1920.0	3.1935E-07	5.2083	4.7059	2330.0	6.8772E-09
1925.0	3.8011E-07	5.1948	4.6948	2335.0	6.1806E-09
1930.0	3.6513E-07	5.1813	4.6838	2340.0	6.7579E-09
1935.0	3.2241E-07	5.1680	4.6729	2345.0	6.7154E-09
1940.0	3.3329E-07	5.1546	4.6620	2350.0	5.2404E-09
1945.0	3.2318E-07	5.1414	4.6512	2355.0	6.7371E-09
1950.0	3.6317E-07	5.1282	4.6404	2360.0	5.9608E-09
1955.0	3.1948E-07	5.1151	4.6296	2365.0	5.9170E-09
1960.0	3.3221E-07	5.1020	4.6189	2370.0	4.7188E-09
1965.0	3.6618E-07	5.0891	4.6083	2375.0	3.8123E-09
1970.0	3.7824E-07	5.0763	4.5977	2380.0	6.0797E-09
1975.0	3.6120E-07	5.0633	4.5872	2385.0	6.0895E-09
1980.0	3.7081E-07	5.0505	4.5767	2390.0	3.6038E-08
1985.0	3.5542E-07	5.0378	4.5662	2395.0	4.0101E-08
1990.0	3.1304E-07	5.0251	4.5558	2400.0	4.1894E-08
1995.0	3.7635E-07	5.0123	4.5453	2405.0	4.2168E-08
2000.0	3.1615E-07	5.0000	4.5351	2410.0	4.2223E-08
2005.0	3.5263E-07	4.9875	4.5249	2415.0	4.2044E-08
2010.0	3.0590E-07	4.9751	4.5147	2420.0	4.1594E-08
2015.0	3.6792E-07	4.9628	4.5045	2425.0	4.1564E-08
2020.0	3.1816E-07	4.9505	4.4944	2430.0	4.1723E-08
2025.0	3.8889E-07	4.9383	4.4843	2435.0	4.0658E-08
2030.0	3.3340E-07	4.9261	4.4743	2440.0	3.9781E-08
2035.0	3.2194E-07	4.9140	4.4643	2445.0	3.9476E-08
2040.0	3.3448E-06	4.9000			

WAVELENGTH (microns)	TRANSMITTANCE	WAVELENGTH (microns)	TRANSMITTANCE	WAVELENGTH (microns)	TRANSMITTANCE	WAVELENGTH (microns)	TRANSMITTANCE
2040.00	1.6006E-07	4.9020	6.661E-05	2245.00	2.1004E-08	4.4543	1.059E-03
2045.00	1.7774E-07	4.8900	7.433E-05	2250.00	1.4981E-08	4.4444	7.584E-06
2050.00	1.8075E-07	4.8780	7.596E-05	2255.00	1.5216E-08	4.4346	7.718E-06
2055.00	1.7894E-07	4.8662	7.557E-05	2260.00	9.4343E-09	4.4248	4.819E-06
2060.00	1.5210E-07	4.8544	6.453E-05	2265.00	7.9151E-09	4.4150	4.061E-06
2065.00	1.1959E-07	4.8426	5.099E-05	2270.00	6.7660E-09	4.4053	3.466E-06
2070.00	1.3845E-07	4.8309	6.791E-05	2275.00	6.6181E-09	4.3956	3.424E-06
2075.00	9.8443E-08	4.8193	4.739E-05	2280.00	7.9751E-09	4.3860	4.146E-06
2080.00	1.1313E-07	4.8077	4.896E-05	2285.00	8.1253E-09	4.3764	4.242E-06
2085.00	1.4514E-07	4.7962	6.318E-05	2290.00	5.9089E-09	4.3668	3.099E-06
2090.00	1.2379E-07	4.7847	5.407E-05	2295.00	5.3284E-09	4.3573	2.804E-06
2095.00	1.2627E-07	4.7733	5.542E-05	2300.00	5.2173E-09	4.3478	2.760E-06
2100.00	1.3632E-07	4.7619	6.020E-05	2305.00	4.8928E-09	4.3384	2.600E-06

1 PROGRAM WILL BE EXECUTED IN THE TRANSMISSION MODE

10 0 0 0 0 0 0 0 0 0.000 0.000 0 0 0.000 0

BMOD - TRIANG SLIT - 20CM-I

VARIABLE SLIT FUNCTION
WIDTH= 40.00000 SHIFT= 5.00000 NO. OF DEFINING PTS= 3

YS ARE 0.000 1.000 0.000
XS ARE -1.000 0.000 1.000

ATMOSPHERIC TRANSMITTANCE

LAMBDA MICRONS	V CM-I	TRANSMITTANCE	LAMBDA MICRONS	V CM-I	TRANSMITTANCE	LAMBDA MICRONS	V CM-I	TRANSMITTANCE			
5.0000	1920.00	0.14	0.13758	4.7393	2110.00	0.56	0.55562	4.3678	2300.00	0.00	0.0000
5.1948	1925.00	0.17	0.17315	4.7281	2115.00	0.54	0.54218	4.3584	2305.00	0.00	0.0000
5.1813	1930.00	0.22	0.21734	4.7170	2120.00	0.54	0.54133	4.3490	2310.00	0.00	0.0000
5.1640	1935.00	0.23	0.23232	4.7059	2125.00	0.56	0.56143	4.3397	2315.00	0.00	0.0000
5.1546	1940.00	0.24	0.24398	4.6948	2130.00	0.60	0.60095	4.3303	2320.00	0.00	0.0000
5.1414	1945.00	0.25	0.24858	4.6838	2135.00	0.65	0.65442	4.3211	2325.00	0.00	0.0000
5.1282	1950.00	0.26	0.26145	4.6729	2140.00	0.70	0.70242	4.2918	2330.00	0.00	0.0000
5.1151	1955.00	0.30	0.29544	4.6620	2145.00	0.73	0.72964	4.2827	2335.00	0.00	0.0000
5.1020	1960.00	0.35	0.35314	4.6512	2150.00	0.74	0.73580	4.2735	2340.00	0.00	0.0000
5.0891	1965.00	0.43	0.42898	4.6404	2155.00	0.72	0.71847	4.2644	2345.00	0.00	0.0000
5.0761	1970.00	0.53	0.53461	4.6296	2160.00	0.69	0.68709	4.2553	2350.00	0.00	0.0000
5.0633	1975.00	0.58	0.57723	4.6189	2165.00	0.66	0.65849	4.2463	2355.00	0.00	0.0000
5.0505	1980.00	0.57	0.57215	4.6083	2170.00	0.61	0.61308	4.2373	2360.00	0.00	0.0000
5.0378	1985.00	0.52	0.52452	4.5977	2175.00	0.53	0.53395	4.2283	2365.00	0.00	0.0000
5.0251	1990.00	0.45	0.45236	4.5872	2180.00	0.48	0.48124	4.2194	2370.00	0.00	0.0000
5.0125	1995.00	0.45	0.45156	4.5767	2185.00	0.39	0.38987	4.2105	2375.00	0.01	0.0079
4.9975	2000.00	0.47	0.47095	4.5662	2190.00	0.30	0.30443	4.2017	2380.00	0.04	0.0430
4.9875	2005.00	0.50	0.49745	4.5558	2195.00	0.23	0.23146	4.1929	2385.00	0.11	0.1101
4.9751	2010.00	0.49	0.48717	4.5453	2200.00	0.17	0.17270	4.1841	2390.00	0.21	0.2112
4.9628	2015.00	0.48	0.47563	4.5351	2205.00	0.13	0.13269	4.1754	2395.00	0.33	0.3321
4.9505	2020.00	0.50	0.50067	4.5249	2210.00	0.11	0.10967	4.1667	2400.00	0.44	0.4354
4.9383	2025.00	0.53	0.53243	4.5147	2215.00	0.10	0.09711	4.1580	2405.00	0.51	0.5122
4.9261	2030.00	0.60	0.59560	4.5045	2220.00	0.09	0.08853	4.1494	2410.00	0.56	0.5605
4.9140	2035.00	0.62	0.61727	4.4944	2225.00	0.08	0.08043	4.1408	2415.00	0.59	0.5858
4.9020	2040.00	0.60	0.59815	4.4843	2230.00	0.06	0.06255	4.1322	2420.00	0.61	0.6054
4.8900	2045.00	0.59	0.59040	4.4743	2235.00	0.04	0.04376	4.1237	2425.00	0.62	0.6232
4.8780	2050.00	0.56	0.55842	4.4643	2240.00	0.03	0.02833	4.1152	2430.00	0.64	0.6380

2000.00 1.2463E-07 4.8077 5.393E-05 2270.00 8.0511E-09 4.4053 4.149E-06 2460.00 3.8362E-08 4.0450 2.322E-05
 2005.00 1.273E-07 4.7963 5.534E-05 2275.00 7.3820E-09 4.3956 3.821E-06 2465.00 3.7936E-08 4.0568 2.305E-05
 2050.00 1.2608E-07 4.7847 5.542E-05 2280.00 7.1699E-09 4.3860 3.727E-06 2470.00 3.7475E-08 4.0486 2.286E-05
 2095.00 1.2573E-07 4.7733 5.672E-05 2285.00 6.8766E-09 4.3764 3.590E-06 2475.00 3.7038E-08 4.0404 2.269E-05
 2100.00 1.2540E-07 4.7619 5.707E-05 2290.00 6.3682E-09 4.3668 3.340E-06 2480.00 3.6668E-08 4.0323 2.255E-05
 2105.00 1.2613E-07 4.7506 5.589E-05 2295.00 5.8510E-09 4.3573 3.082E-06

1 PROGRAM WILL BE EXECUTED IN THE EMISSION MODE

3 1 2 0 1 0 0 0 1 0.000 275.000 0 0 0.000 0

SLANT PATH BETWEEN ALTITUDES M1 AND M2 WHERE M1 = 100.000 KM M2 = 0.000 KM, ZENITH ANGLE = 180.000 DEGREES

BASE MODEL = 23.0 KM VISUAL RANGE AT SEA LEVEL

MODEL ATMOSPHERE 3 = MIDLATITUDE WINTER

BASE MODEL 1 = RURAL VIS = 23.0 KM

SEASON = FAL WINT

VERTICAL PROFILE AEROSOL MODEL = STR BEGE

FREQUENCY RANGE V1 = 1900.0 CM-1 TO V2 = 2500.0 CM-1 FOR DV = 5.0 CM-1 (4.00 - 5.26 MICRONS)

FROM POINT\ HEIGHT= 100.0000 KM, M= 33, MP= 1, REF. INDEX ABOVE & BELOW X= 0.0000E 00, 1P= 1
 EQUIV. ABSORBER AMOUNTS PER KM AT X= 0.150E-15 0.539E-11 0.517E-11 0.104E-12 0.604E-19 0.385E-06 0.000E 00 0.201E-08

TE(12-14)= 0.000E 00 0.000E 00 0.931E-09

FROM POINT\ HEIGHT= 0.0000 KM, M= 1, MP= 1, REF. INDEX ABOVE & BELOW X= 0.2739E-03 0.0000E 00, 1P= 1
 EQUIV. ABSORBER AMOUNTS PER KM AT X= 0.352E 00 0.101E 01 0.281E-02 0.812E 00 0.329E-02 0.101E 01 0.158E 00 0.280E-02

TE(12-14)= 0.000E 00 0.000E 00 0.000E 00

MINI = -0371.223
 -0371.223

EQUIVALENT SEA LEVEL ABSORBER AMOUNTS

WATER VAPOUR CH CH-2	CO2 ETC. IN	OZONE ATM CH	NITROGEN (CONT) IN	N2O (CONT) CH CH-2	MOL SCAT IN	AERI	OZONE(U-V) ATM CH	NITRIC ACID
W(1-8)= 0.701E 00	0.474E 01	0.137E 00	0.334E 01	0.530E-02	0.804E 01	0.205E 00	0.397E 00	0.374E-03

W(12-15)= 3.648E-02 <th>7.922E-03 <th>1.181E-04 <th>7.168E 01 </th></th></th>	7.922E-03 <th>1.181E-04 <th>7.168E 01 </th></th>	1.181E-04 <th>7.168E 01 </th>	7.168E 01
AER2	AER3	AER4	R.M. MEAN

ICH 1 6 10 15

EXTINCTION AND ABSORPTION COEFFICIENTS

RADIANCE(WATTS/CH2-STER-XXX)
 PER CH-1 PER MICRON

INTEGRAL

TRANS

1

INTEGRATED ABSORPTION FROM 1900 TO 2500 CM-1 = 378.88 AVERAGE TRANSMITTANCE = 0.3685
 INTEGRATED RADIANCE = 0.562166 - DAVATT CM -2 SE
 RADWIN 2375.000 0.329256-08
 RADMAX 1900.000 0.222556-06

LOW5 - RADIR VIEWING - GRND TO SPACE

NO SLIT FUNCTION USED

ATMOSPHERIC TRANSMITTANCE

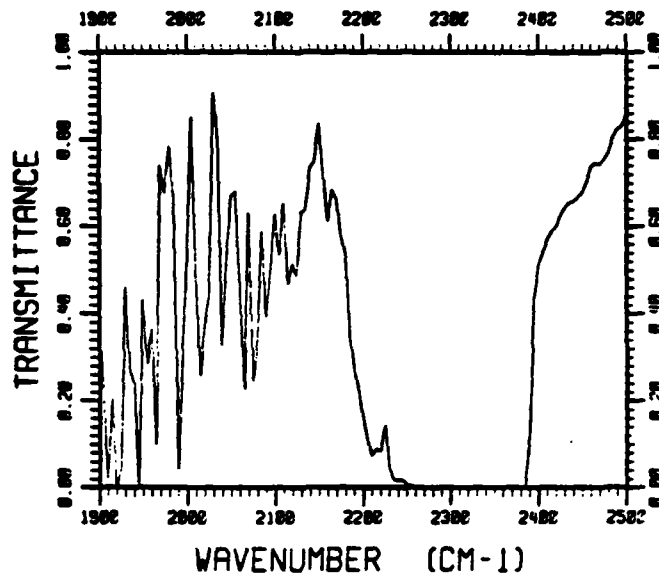
LAMBDA MICRONS	V CM-1	TRANSMITTANCE	LAMBDA MICRONS	V CM-1	TRANSMITTANCE	LAMBDA MICRONS	V CM-1	TRANSMITTANCE	LAMBDA MICRONS	V CM-1	TRANSMITTANCE
5.2632	1900.00	0.15	4.7506	2105.00	0.62	4.61916			4.3290	2310.00	0.00
5.2493	1905.00	0.14	4.7393	2110.00	0.63	0.61916			4.3197	2315.00	0.00
5.2356	1910.00	0.12	4.7281	2115.00	0.62	0.63489			4.3103	2320.00	0.00
5.2219	1915.00	0.11	4.7170	2120.00	0.62	0.61916			4.3011	2325.00	0.00
5.2083	1920.00	0.10	4.7059	2125.00	0.63	0.63250			4.2918	2330.00	0.00
5.1948	1925.00	0.14	4.6948	2130.00	0.67	0.64890			4.2827	2335.00	0.00
5.1813	1930.00	0.18	4.6838	2135.00	0.72	0.71772			4.2735	2340.00	0.00
5.1680	1935.00	0.20	4.6729	2140.00	0.72	0.72089			4.2644	2345.00	0.00
5.1546	1940.00	0.19	4.6620	2145.00	0.73	0.73488			4.2553	2350.00	0.00
5.1416	1945.00	0.18	4.6512	2150.00	0.74	0.73621			4.2463	2355.00	0.00
5.1282	1950.00	0.22	4.6404	2155.00	0.73	0.73412			4.2373	2360.00	0.00
5.1151	1955.00	0.23	4.6296	2160.00	0.73	0.72608			4.2283	2365.00	0.00
5.1020	1960.00	0.30	4.6189	2165.00	0.71	0.71288			4.2194	2370.00	0.00
5.0891	1965.00	0.35	4.6083	2170.00	0.67	0.67176			4.2107	2375.00	0.00
5.0761	1970.00	0.40	4.5977	2175.00	0.63	0.62612			4.2017	2380.00	0.00
5.0633	1975.00	0.43	4.5872	2180.00	0.53	0.52801			4.1929	2385.00	0.03
5.0505	1980.00	0.41	4.5767	2185.00	0.44	0.44461			4.1841	2390.00	0.11
5.0378	1985.00	0.38	4.5662	2190.00	0.38	0.37919			4.1754	2395.00	0.28
5.0251	1990.00	0.33	4.5558	2195.00	0.31	0.30507			4.1667	2400.00	0.45
5.0125	1995.00	0.34	4.5455	2200.00	0.26	0.25614			4.1580	2405.00	0.58
5.0000	2000.00	0.40	4.5351	2205.00	0.23	0.22723			4.1494	2410.00	0.65
4.9875	2005.00	0.44	4.5249	2210.00	0.19	0.19103			4.1408	2415.00	0.66
4.9751	2010.00	0.47	4.5147	2215.00	0.18	0.17958			4.1322	2420.00	0.67
4.9628	2015.00	0.45	4.5045	2220.00	0.15	0.15111			4.1237	2425.00	0.68
4.9505	2020.00	0.44	4.4944	2225.00	0.12	0.11927			4.1152	2430.00	0.68
4.9383	2025.00	0.47	4.4843	2230.00	0.09	0.09010			4.1068	2435.00	0.69
4.9261	2030.00	0.52	4.4743	2235.00	0.05	0.03433			4.0984	2440.00	0.69
4.9140	2035.00	0.55	4.4643	2240.00	0.03	0.03016			4.0900	2445.00	0.70
4.9020	2040.00	0.57	4.4543	2245.00	0.01	0.01262			4.0816	2450.00	0.72
4.8900	2045.00	0.54	4.4444	2250.00	0.01	0.00656			4.0733	2455.00	0.73
4.8780	2050.00	0.54	4.4346	2255.00	0.00	0.00369			4.0650	2460.00	0.75
4.8662	2055.00	0.52	4.4248	2260.00	0.00	0.00150			4.0568	2465.00	0.76
4.8544	2060.00	0.51	4.4150	2265.00	0.00	0.00073			4.0486	2470.00	0.77
4.8426	2065.00	0.49	4.4053	2270.00	0.00	0.00000			4.0404	2475.00	0.79
4.8309	2070.00	0.52	4.3956	2275.00	0.00	0.00000			4.0323	2480.00	0.80
4.8193	2075.00	0.55	4.3860	2280.00	0.00	0.00000			4.0241	2485.00	0.82
4.8077	2080.00	0.61	4.3764	2285.00	0.00	0.00000			4.0161	2490.00	0.83
4.7962	2085.00	0.64	4.3668	2290.00	0.00	0.00000			4.0080	2495.00	0.85
4.7847	2090.00	0.64	4.3573	2295.00	0.00	0.00000			4.0000	2500.00	0.86
4.7733	2095.00	0.63	4.3478	2300.00	0.00	0.00000					

AND SLIT FUNCTION USED

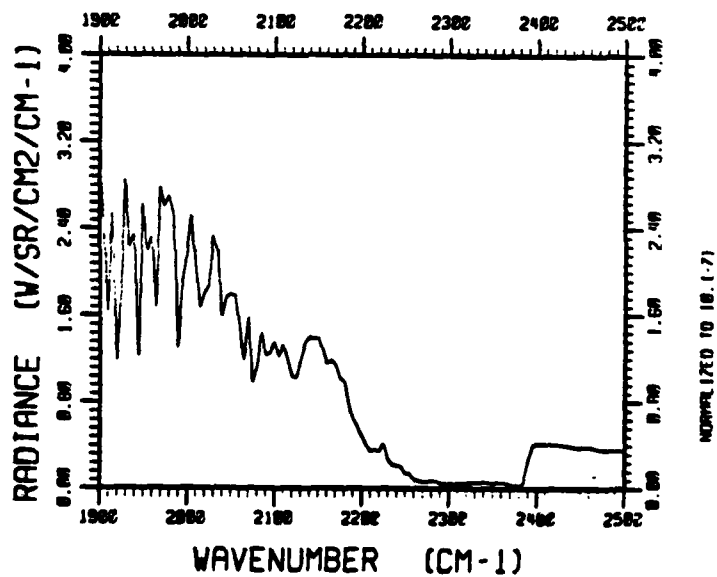
RADIATION (WATTS/SQ CM/2 UNITS)

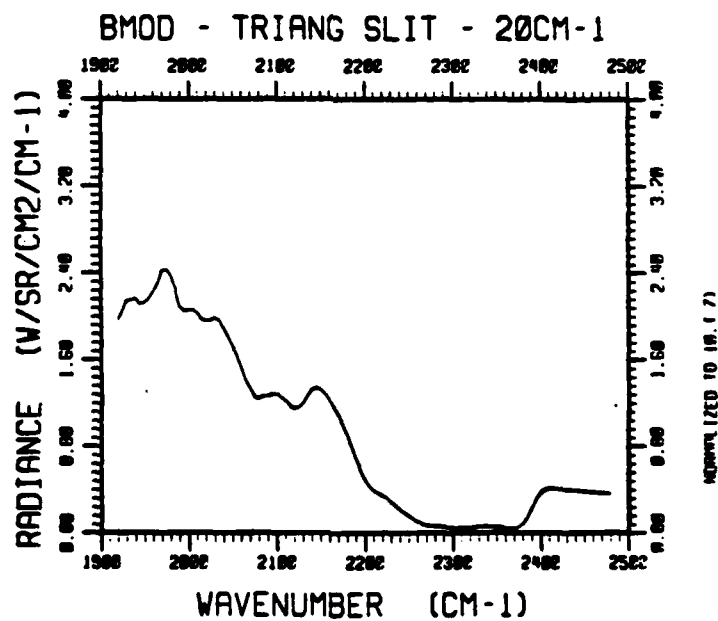
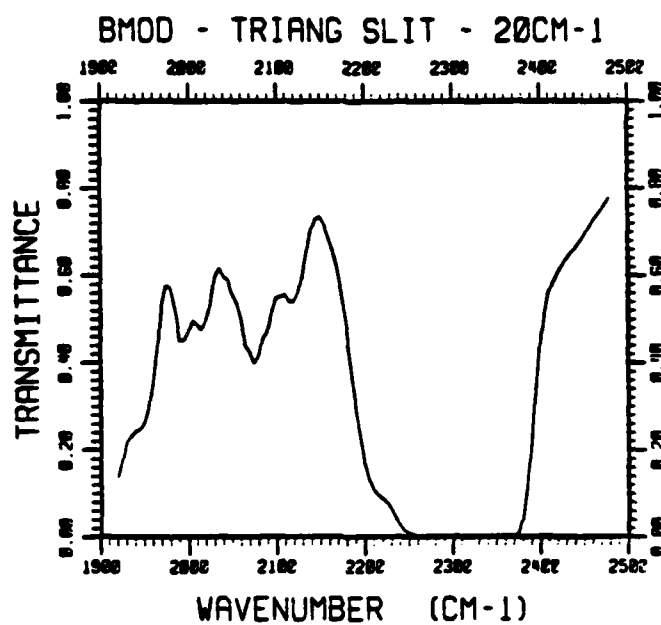
[illegible]

BMOD - NADIR VIEWING - GRND TO SPACE

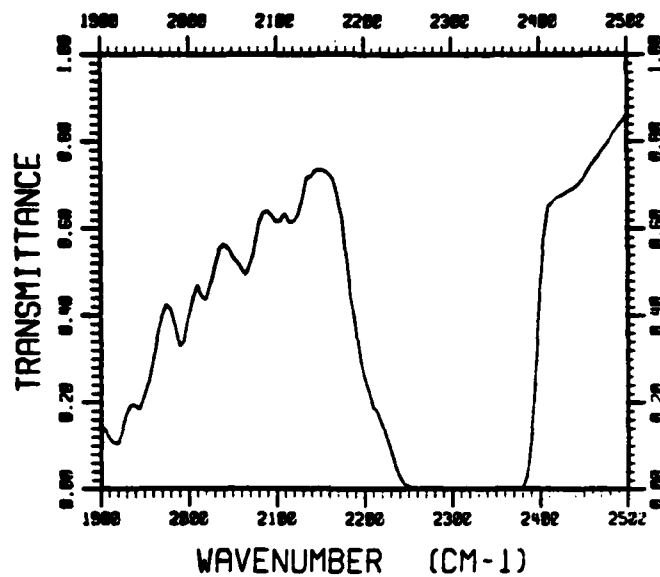


BMOD - NADIR VIEWING - GRND TO SPACE

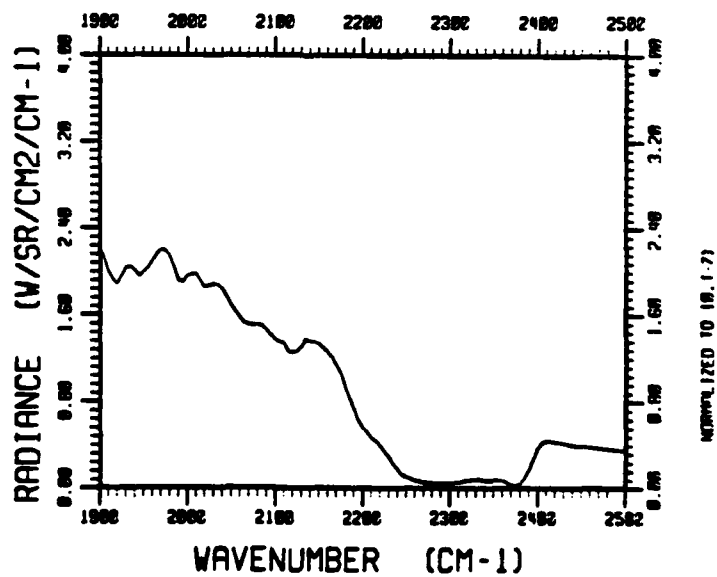




LOW5 - NADIR VIEWING - GRND TO SPACE



LOW5 - NADIR VIEWING - GRND TO SPACE



3	1	2	0	1	0	275.	1J
100.	0.	100.	0.0				
400.	9995.	5.					
4							
0000 - GND TO SPACE (MADIR VIEWING) - 5 CH-1 RES.							
1	1	1					
9.595							
3.							
10							
0							
0000 - SLIT FCH - 20CH-1							
2	1	3	40.	5.			
-1.	0.	1.					
0.	1.	0.					
9.595							
5.							
3	1	2	0	1	0	275.	0J
100.	0.	100.	0.0				
1900.	2500.	5.					
0							
1005 - MADIR VIEWING - GND TO SPACE							
1	1	1					
5.	1900.	2500.	100.	9			
6.	0.0	1.	.2	9			

[illegible]

NAZIS HOVEL - 23.0 KM VISUAL RANGE AT SEA LEVEL

MODEL AEROSOLING 3 - MIDLATITUDE WINTER

RAZOR MODEL 1 • RURAL V18-23.000

SEASIDE - PALM BEACH

VERTICAL PROFILE AEROSOL MODEL - 170 PAGE

FREQUENCY RANGE V1= 400.0 CH-1 TO V2= 9995.0 CH-1 FOR BW = 5.0 CH-1 (1.00 - 25.00 MICRONS)

FROM POINT\ INCH= 100.0000 IN, N= 33, MP= 1.427. INDEX ABOVE & BELOW X= 0.000000 00 0.000000 00.1P= 1
EQUIL, AVERAGE MOMENTS PER IN AT X= 0.1000-09 0.3958-06 0.2018-08 0.1048-12 0.6048-19 0.3958-06 0.0000 00 0.2018-08

TX(12-14)= 0.0000 00 0.0000 00 0.9312-09

FROM POINT/WEIGHT- 0.0000 ON IN- 1.0000 INDEX ABOVE & BELOW X= 0.2744E-03 0.0000E 00.1P= 1
EQUIT. APPRAISAL AMOUNTS PER SN AT X= 0.350E 00 0.101E 01 0.280E-02 0.812E 00 0.329E-02 0.101E 01 0.150E 00 0.280E-02

TX(12-14)= 0.0000 00 0.0000 00 0.0000 00
 TX(15) = -6371.223
 -6371.223

EQUIVALENT SEA LEVEL ASSUMED ANCIENTS

	WATER VAPOR CM CM-2	CO2 ETC. CM	OZONE ATM CM	NITROGEN (CONT) CM	H2O (CONT) CM CM-2	MOL SCAT CM	ABS I	OZONE (B-V ATM CM	NITRIC ACID
W (1-8)-	0.65% 00	0.8048 01	0.1978 00	0.3348 01	0.5302-02 0.1418 00	0.8048 01	0.2058 00	0.3978 00 0.3748-03	

ICR	W(12-13)- EXTINCTION AND ABSORPTION COEFFICIENTS	AE22	AE23	AE24	B.M. MEAN
1	3.648E-02	7.921E-03	1.101E-04	7.168E 01	
6					
10					
15					

INTEGRATED ABSORPTION FROM 400 TO 995 CM-1 = 4239.74 AVERAGE TRANSMITTANCE = 0.5561
 MOD - GRD TO SPACE (NADIR VIEWING) - 5 CM-1 RES.

AND SLIT FUNCTION USED

1

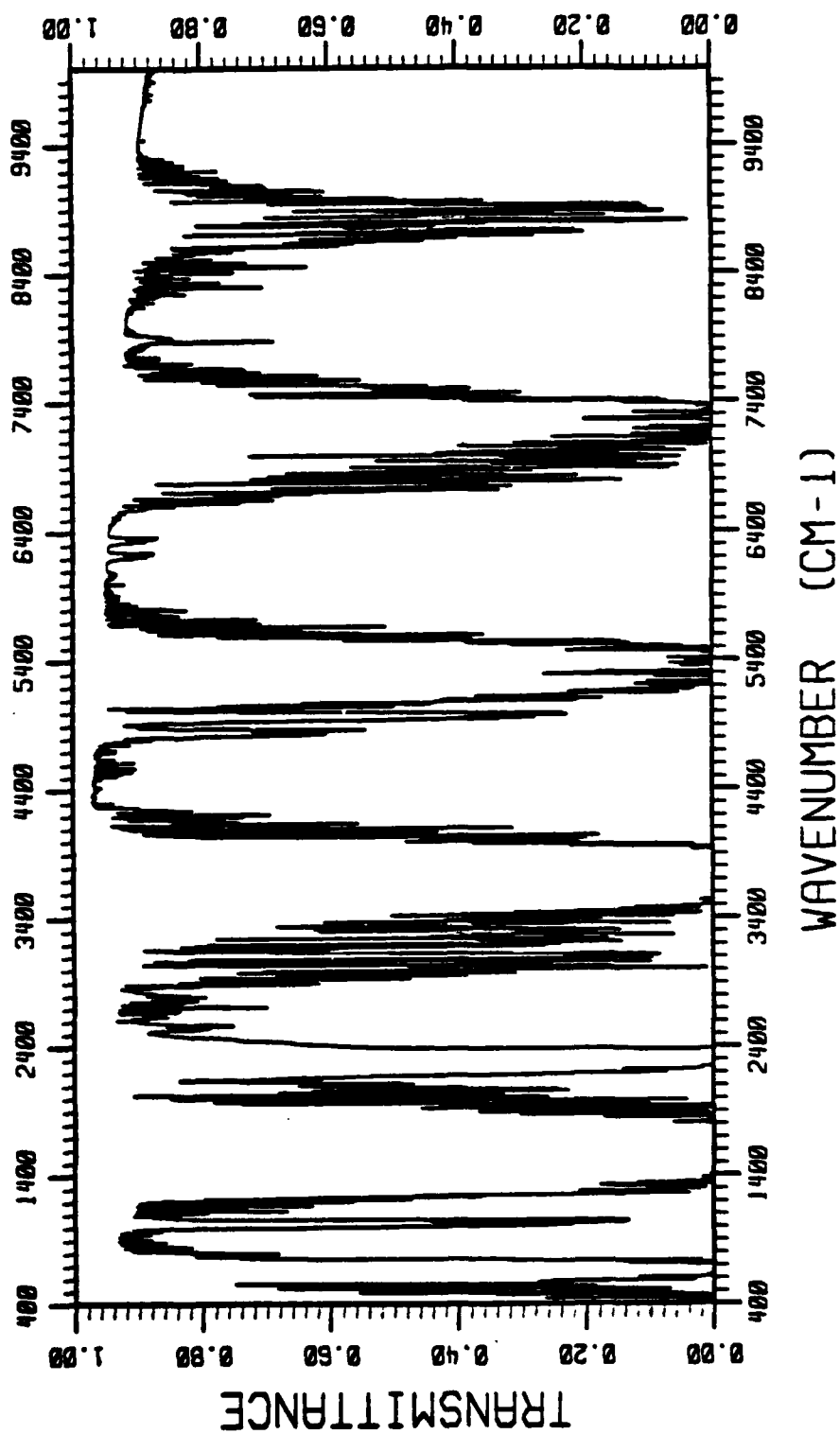
E-22

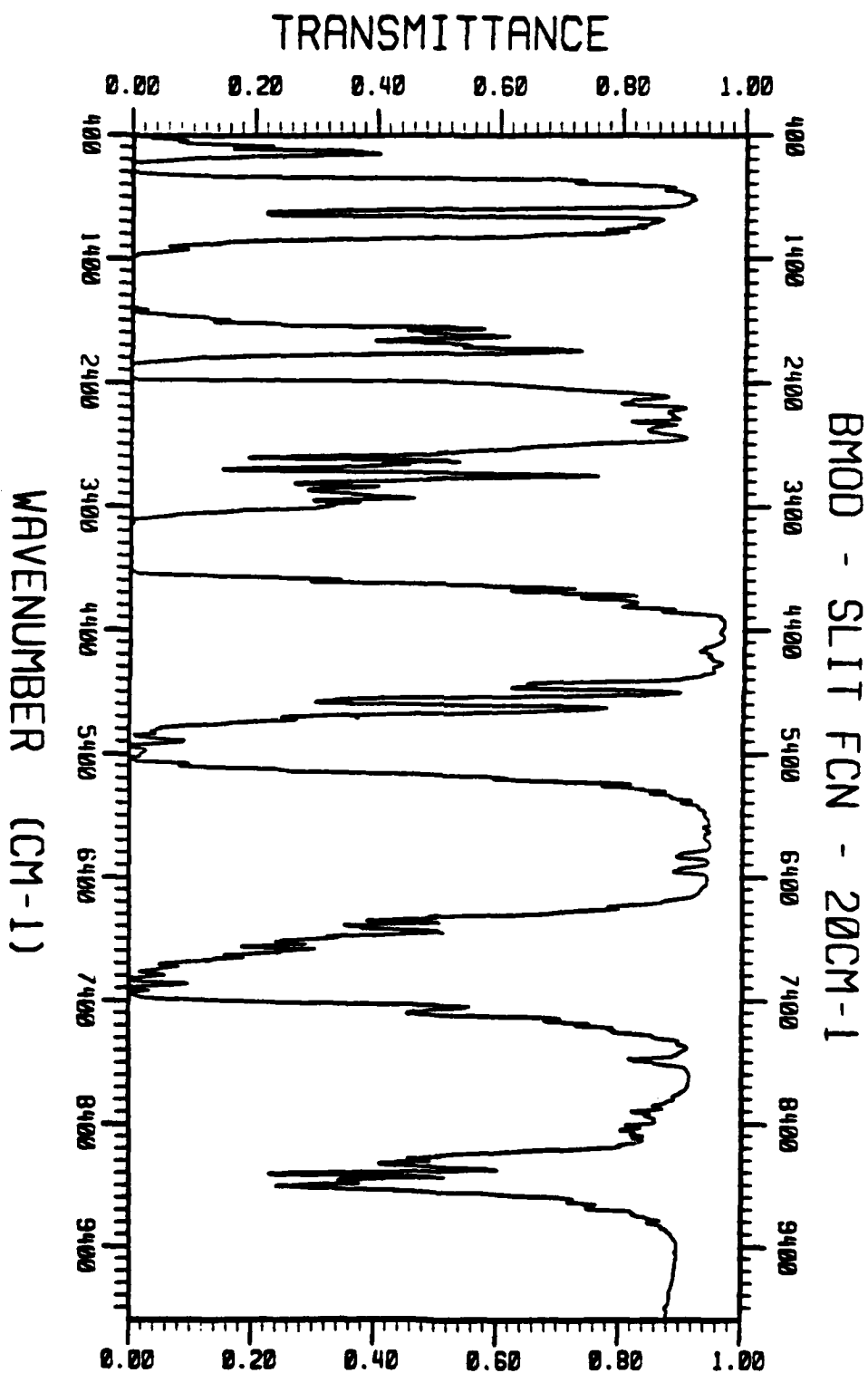
LAMBDA MICRONS	V CM-1	TRANSMITTANCE	LAMBDA MICRONS	V CM-1	TRANSMITTANCE	LAMBDA MICRONS	V CM-1	TRANSMITTANCE	LAMBDA MICRONS	V CM-1	TRANSMITTANCE
13.4320	640.00	0.00	0.00002	10.4383	940.00	0.92	0.91563	0.645	1240.00	0.63	0.6314
13.3979	645.00	0.00	0.00000	10.5820	955.00	0.92	0.91630	0.36	1245.00	0.36	0.3645
13.3666	650.00	0.00	0.00000	10.5283	950.00	0.88	0.88176	0.47	1250.00	0.47	0.4690
13.3672	655.00	0.00	0.00000	10.4712	955.00	0.90	0.90026	0.39	1255.00	0.39	0.3859
13.3315	660.00	0.00	0.00000	10.4167	960.00	0.93	0.93143	0.14	1260.00	0.14	0.1390
13.3376	665.00	0.00	0.00000	10.3627	965.00	0.92	0.92262	0.17	1265.00	0.17	0.1672
14.3234	670.00	0.00	0.00000	10.3093	970.00	0.89	0.89160	0.04	1270.00	0.04	0.0393
14.8140	675.00	0.00	0.00000	10.2564	975.00	0.86	0.86480	0.21	1275.00	0.21	0.2075
14.7059	680.00	0.00	0.00000	10.2041	980.00	0.91	0.90846	0.21	1280.00	0.21	0.2116
14.5905	685.00	0.00	0.00000	10.1523	985.00	0.91	0.91246	0.14	1285.00	0.14	0.1407
14.4820	690.00	0.00	0.00000	10.1010	990.00	0.89	0.89405	0.09	1290.00	0.09	0.0897
14.3805	695.00	0.00	0.00002	10.0503	995.00	0.85	0.85229	0.08	1295.00	0.08	0.0750
7.4923	1300.00	0.10	0.10473	6.2500	1600.00	0.00	0.00441	0.37	1900.00	0.37	0.3696
7.4628	1305.00	0.01	0.01362	6.2305	1605.00	0.00	0.00004	0.22	1905.00	0.22	0.2175
7.4336	1310.00	0.11	0.10813	6.2112	1610.00	0.00	0.00000	0.02	1910.00	0.02	0.0211
7.4046	1315.00	0.01	0.01281	6.1919	1615.00	0.00	0.00000	0.21	1915.00	0.21	0.2055
7.3756	1320.00	0.02	0.02194	6.1728	1620.00	0.00	0.00000	0.00	1920.00	0.00	0.0008
7.3472	1325.00	0.16	0.16494	6.1538	1625.00	0.00	0.00000	0.04	1925.00	0.04	0.0424
7.3188	1330.00	0.18	0.17868	6.1350	1630.00	0.00	0.00000	0.46	1930.00	0.46	0.4590
7.2906	1335.00	0.03	0.03190	6.1162	1635.00	0.00	0.00000	0.27	1935.00	0.27	0.2719
7.2627	1340.00	0.00	0.00036	6.0976	1640.00	0.00	0.00000	0.24	1940.00	0.24	0.2396
7.2349	1345.00	0.12	0.12078	6.0790	1645.00	0.00	0.00000	0.81	1945.00	0.81	0.8052
7.2074	1350.00	0.07	0.06853	6.0606	1650.00	0.00	0.00000	0.43	1950.00	0.43	0.4315
7.1801	1355.00	0.05	0.04999	6.0423	1655.00	0.00	0.00000	0.29	1955.00	0.29	0.2850
7.1529	1360.00	0.01	0.00943	6.0241	1660.00	0.00	0.00000	0.32	1960.00	0.32	0.3659
7.1257	1365.00	0.00	0.00107	6.0060	1665.00	0.00	0.00000	0.10	1965.00	0.10	0.1001
7.0984	1370.00	0.01	0.00677	5.9880	1670.00	0.00	0.00000	0.74	1970.00	0.74	0.7410
7.0712	1375.00	0.00	0.00045	5.9701	1675.00	0.00	0.00000	0.68	1975.00	0.68	0.6774
7.0440	1380.00	0.02	0.01693	5.9524	1680.00	0.00	0.00000	0.78	1980.00	0.78	0.7825
7.0168	1385.00	0.02	0.01950	5.9347	1685.00	0.00	0.00000	0.67	1985.00	0.67	0.6717
6.9896	1390.00	0.00	0.00007	5.9172	1690.00	0.00	0.00000	0.04	1990.00	0.04	0.0424
6.9624	1395.00	0.00	0.00000	5.8997	1695.00	0.00	0.00000	0.31	1995.00	0.31	0.3066
6.9352	1400.00	0.00	0.00002	5.8824	1700.00	0.00	0.00000	0.52	2000.00	0.52	0.5180
6.9080	1405.00	0.00	0.00060	5.8651	1705.00	0.00	0.00000	0.85	2005.00	0.85	0.8513
6.8808	1410.00	0.01	0.00685	5.8480	1710.00	0.00	0.00000	0.49	2010.00	0.49	0.4851
6.8536	1415.00	0.00	0.00136	5.8309	1715.00	0.00	0.00000	0.86	2015.00	0.86	0.8590
6.8264	1420.00	0.00	0.00000	5.8140	1720.00	0.00	0.00000	0.37	2020.00	0.37	0.3675
6.7992	1425.00	0.00	0.00002	5.7971	1725.00	0.00	0.00001	0.44	2025.00	0.44	0.4420
6.7720	1430.00	0.00	0.00001	5.7803	1730.00	0.00	0.00000	0.91	2030.00	0.91	0.9081
6.7448	1435.00	0.00	0.00000	5.7637	1735.00	0.00	0.00000	0.80	2035.00	0.80	0.7965
6.7176	1440.00	0.00	0.00137	5.7471	1740.00	0.00	0.00000	0.33	2040.00	0.33	0.3278
6.6904	1445.00	0.00	0.00259	5.7307	1745.00	0.00	0.00000	0.53	2045.00	0.53	0.5288
6.6632	1450.00	0.00	0.00000	5.7143	1750.00	0.00	0.00000	0.67	2050.00	0.67	0.6702
6.6360	1455.00	0.00	0.00000	5.6980	1755.00	0.00	0.00000	0.68	2055.00	0.68	0.6815
6.6088	1460.00	0.00	0.00004	5.6818	1760.00	0.00	0.00000	0.47	2060.00	0.47	0.4690
6.5816	1465.00	0.00	0.00000	5.6657	1765.00	0.00	0.00056	0.23	2065.00	0.23	0.2281
6.5544	1470.00	0.00	0.00000	5.6497	1770.00	0.00	0.00000	0.63	2070.00	0.63	0.6304
6.5272	1475.00	0.00	0.00000	5.6338	1775.00	0.00	0.00000	0.25	2075.00	0.25	0.2442
6.5000	1480.00	0.00	0.00001	5.6180	1780.00	0.00	0.00000	0.34	2080.00	0.34	0.3366
6.4728	1485.00	0.00	0.00000	5.6022	1785.00	0.00	0.00102	0.59	2085.00	0.59	0.5893
6.4456	1490.00	0.00	0.00000	5.5866	1790.00	0.00	0.00008	0.39	2090.00	0.39	0.3925

4.4090	1495.00	0.00	0.00000	5.5710	1795.00	0.00	0.00000	4.7333	2095.00	0.50	0.5022
4.4447	1500.00	0.00	0.00000	5.5556	1800.00	0.00	0.00000	4.7619	2100.00	0.63	0.6277
4.4453	1505.00	0.00	0.00000	5.5402	1805.00	0.02	0.01652	4.7506	2105.00	0.54	0.5351
4.4223	1510.00	0.00	0.00000	5.5249	1815.00	0.00	0.00038	4.7393	2110.00	0.65	0.6514
4.4007	1515.00	0.00	0.00000	5.5096	1815.00	0.07	0.04613	4.7281	2115.00	0.47	0.4685
4.3789	1520.00	0.00	0.00000	5.4943	1820.00	0.06	0.03660	4.7170	2120.00	0.51	0.5133
4.3574	1525.00	0.00	0.00000	5.4795	1825.00	0.00	0.00004	4.7059	2125.00	0.49	0.4870
4.3359	1530.00	0.00	0.00000	5.4645	1830.00	0.00	0.00000	4.6948	2130.00	0.63	0.6325
4.3147	1535.00	0.00	0.00000	5.4496	1835.00	0.00	0.00106	4.6838	2135.00	0.44	0.4365
4.2935	1540.00	0.00	0.00000	5.4348	1840.00	0.01	0.01100	4.6729	2140.00	0.73	0.7338
4.2723	1545.00	0.00	0.00000	5.4201	1845.00	0.00	0.00000	4.6620	2145.00	0.75	0.7495
4.2516	1550.00	0.00	0.00000	5.4054	1850.00	0.00	0.00377	4.6512	2150.00	0.84	0.8371
4.2309	1555.00	0.00	0.00000	5.3908	1855.00	0.18	0.17525	4.6404	2155.00	0.72	0.7199
4.2103	1560.00	0.00	0.00000	5.3763	1860.00	0.04	0.04120	4.6296	2160.00	0.61	0.6125
4.1898	1565.00	0.00	0.00000	5.3619	1865.00	0.01	0.01658	4.6189	2165.00	0.68	0.6848
4.1694	1570.00	0.00	0.00000	5.3476	1870.00	0.00	0.00241	4.6083	2170.00	0.66	0.6627
4.1492	1575.00	0.00	0.00000	5.3333	1875.00	0.13	0.12975	4.5977	2175.00	0.58	0.5784
4.1291	1580.00	0.00	0.00000	5.3191	1880.00	0.30	0.30674	4.5872	2180.00	0.56	0.5557
4.1091	1585.00	0.00	0.00344	5.3050	1885.00	0.10	0.10267	4.5767	2185.00	0.35	0.3504
4.2093	1590.00	0.00	0.00206	5.2910	1890.00	0.01	0.00896	4.5662	2190.00	0.27	0.2608
4.2696	1595.00	0.00	0.00088	5.2770	1895.00	0.03	0.03508	4.5558	2195.00	0.23	0.2199

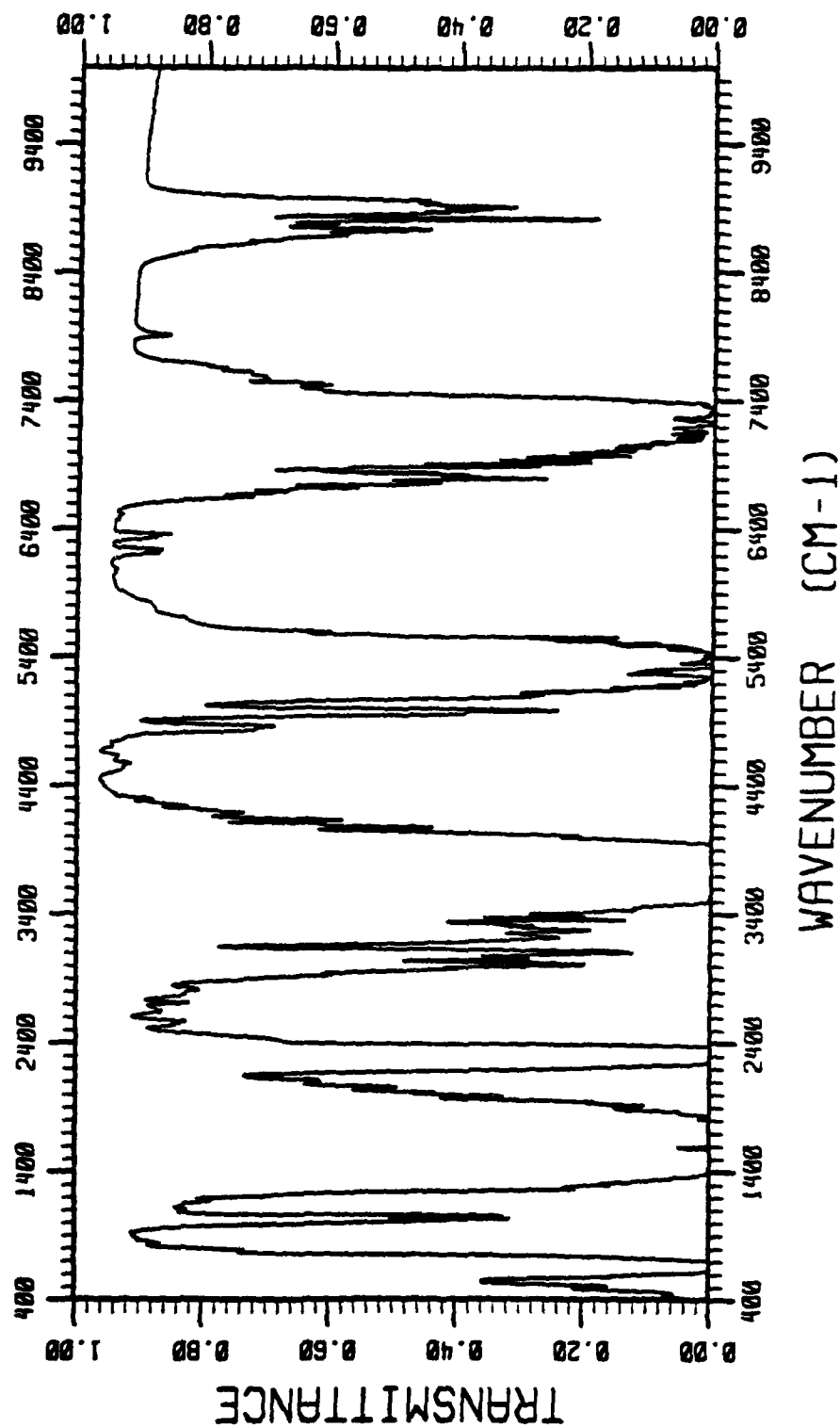
LAMBDA MICRONS	V CH-1	TRANSMITTANCE	LAMBDA MICRONS	V CH-1	TRANSMITTANCE	LAMBDA MICRONS	V CH-1	TRANSMITTANCE	LAMBDA MICRONS	V CH-1	TRANSMITTANCE
4.5435	2200.00	0.16	0.16036	4.0000	2500.00	0.84	0.83378	3.3714	2800.00	0.79	0.7946
4.5351	2205.00	0.11	0.11148	3.9920	2505.00	0.87	0.86578	3.3651	2805.00	0.89	0.8902
4.5269	2210.00	0.07	0.07450	3.9841	2510.00	0.87	0.87326	3.3587	2810.00	0.89	0.8850
4.5147	2215.00	0.09	0.08871	3.9761	2515.00	0.87	0.87303	3.3524	2815.00	0.82	0.8193
4.5045	2220.00	0.09	0.08502	3.9683	2520.00	0.89	0.88550	3.3461	2820.00	0.89	0.8922
4.4944	2225.00	0.14	0.14412	3.9604	2525.00	0.88	0.88429	3.3398	2825.00	0.89	0.8919
4.4843	2230.00	0.05	0.04750	3.9526	2530.00	0.88	0.87512	3.3336	2830.00	0.89	0.8885
4.4743	2235.00	0.02	0.02120	3.9448	2535.00	0.85	0.85241	3.3273	2835.00	0.91	0.9085
4.4643	2240.00	0.02	0.01747	3.9370	2540.00	0.84	0.84158	3.3211	2840.00	0.90	0.9022
4.4543	2245.00	0.02	0.02016	3.9293	2545.00	0.80	0.80235	3.3149	2845.00	0.90	0.8976
4.4444	2250.00	0.01	0.00609	3.9216	2550.00	0.80	0.79859	3.3088	2850.00	0.92	0.9182
4.4346	2255.00	0.01	0.00744	3.9139	2555.00	0.79	0.78883	3.3026	2855.00	0.90	0.8985
4.4248	2260.00	0.00	0.00110	3.9063	2560.00	0.85	0.85367	3.2965	2860.00	0.93	0.9286
4.4150	2265.00	0.00	0.00041	3.8986	2565.00	0.86	0.85837	3.2904	2865.00	0.88	0.8823
4.4053	2270.00	0.00	0.00009	3.8911	2570.00	0.79	0.79141	3.2843	2870.00	0.92	0.9158
4.3956	2275.00	0.00	0.00000	3.8835	2575.00	0.75	0.75197	3.2783	2875.00	0.86	0.8599
4.3860	2280.00	0.00	0.00009	3.8760	2580.00	0.77	0.77364	3.2722	2880.00	0.91	0.9076
4.3764	2285.00	0.00	0.00003	3.8685	2585.00	0.83	0.82671	3.2662	2885.00	0.80	0.8027
4.3668	2290.00	0.00	0.00000	3.8610	2590.00	0.87	0.86940	3.2602	2890.00	0.92	0.9218
4.3573	2295.00	0.00	0.00000	3.8536	2595.00	0.89	0.89243	3.2542	2895.00	0.83	0.8321
4.3478	2300.00	0.00	0.00000	3.8462	2600.00	0.90	0.90241	3.2483	2900.00	0.82	0.8229
4.3384	2305.00	0.00	0.00000	3.8388	2605.00	0.90	0.90016	3.2423	2905.00	0.62	0.6171
4.3290	2310.00	0.00	0.00000	3.8314	2610.00	0.91	0.90765	3.2364	2910.00	0.84	0.8391
4.3197	2315.00	0.00	0.00000	3.8241	2615.00	0.93	0.92487	3.2305	2915.00	0.65	0.6511
4.3103	2320.00	0.00	0.00000	3.8168	2620.00	0.88	0.88403	3.2247	2920.00	0.71	0.7104
4.3011	2325.00	0.00	0.00000	3.8095	2625.00	0.88	0.88451	3.2188	2925.00	0.63	0.6287
4.2918	2330.00	0.00	0.00000	3.8023	2630.00	0.91	0.91293	3.2130	2930.00	0.73	0.7337
4.2827	2335.00	0.00	0.00000	3.7951	2635.00	0.87	0.87090	3.2072	2935.00	0.48	0.4754
4.2735	2340.00	0.00	0.00000	3.7879	2640.00	0.85	0.85264	3.2014	2940.00	0.65	0.6486

BMOD - GND TO SPACE (NADIR VIEWING) - 5 CM-1 RES.





LOW5 - GND TO SPACE (NADIR VIEWING) - 20 CM-1 RES.



APPENDIX F
SUGGESTED IMPLEMENTATION PROCEDURE

F. SUGGESTED IMPLEMENTATION PROCEDURE

The following procedure is suggested to get the modified version of LOWTRAN5 operational.

1. Read the Tape

The 9-track 800 BPI EBCDIC tape, supplied by Aerodyne Research, Inc., contains the following information.

FILE NO.	DESCRIPTION	RECORD LENGTH	BLOCK SIZE	NO. OF BLOCKS
1	SOURCE LISTING OF MODIFIED LOWTRAN5	80	800	435
2	BINARY TRANSLATION PROGRAM	80	800	5
3	FORMATTED BAND MODEL PARAMETERS	120	1200	769
4	TEST CASE INPUT	80	800	3
5	TEST CASE OUTPUT	132	1320	76

2. Convert Formatted Band Model Parameters to Binary

Once the tape has been successfully read onto the user's system, the formatted band model parameters (file 3) should be converted to a binary file. It is assumed at this point that the user has created a disc file containing the formatted band model parameters. The conversion to binary is accomplished by using the program in file 2. The source listing of this program can be found in Appendix G. The user has the option of converting only a subset of the band model parameters to binary if storage space and/or storage

charges are a problem. Instructions for using the binary conversion program are included in the source listing. Once the binary conversion is completed, the user can delete the formatted band model parameter from the system.

3. Compilation and Modification of Source Program

Before attempting compilation of the source program in file 1 the user should obtain a listing and compare it to the one enclosed in this report. Furthermore, the user should read all of Section 3 of this report in order to decide what specific lines of code must be modified in order to be compatible with his system. If the user already has a version of LOWTRANS operational, it is possible, although not recommended, to implement the BMOD option by making only the required modifications outlined in Section 3.

Users with a CALCOMP compatible plotter should find it straightforward to utilize the enclosed plotting package. The modifications required are outlined in subsection 3.3.1 and Appendix A. If the user decides to not use the plotting package, the statements listed in Table A.2 should be commented out.

The Aerodyne plot package uses file 9 to write the data (in binary) for subsequent use in plotting. Since file 7 (the regular LOWTRANS output file) has formatted data, it was decided not to change its format in case the user already has a plot package that uses file 7. We have commented out the references to file 7, since it is not used in our version. It is easily activated by removing the comments from the following lines:

LOW 1239, LOW 228-2310, LOW 2380
TRA 2330, TRA 2420

The word size for Hollerith formats on the PRIME 400 is 4 characters while it is 6 and 10 respectively for UNIVAC and CDC machines. We have changed some literals in LOWTRAN5 from 10 characters to 8 by defining HZ, SEASN and VULCN as double precision. If this format is not compatible with the user's machine (e.g., CDC and UNIVAC), the following statements must be appropriately modified:

LOW	1119
NSM	61, 340-370
HPR	51
GEO	71
ANG	11
POI	21
EXA	51
PAT	61
TRA	51
ATR	51
BMD	70
BMO	100
BLK	20, 2390-2480
LIB	270, 360-400, 510, 511, 1080, 1370, 1390
PRO	190, 320-330

4. Run the Test Case

Run the sample case to verify that the code is operating as expected. The input and output are both on the tape (Files 4 and 5, respectively), and correspond to the first sample case in Appendix E. These cases can be run before getting the plots operational by setting MPLT = 0. When MPLT = 0, no calls to external plotting subroutines are made. The test case is for an

observer at 100 km looking at the earth surface. Both transmittance and radiation are calculated for the $1900\text{--}2500\text{ cm}^{-1}$ spectral region. Three cases are calculated:

1. BMOD option (JBMOD = 1)
2. Slit Function (MODEL = 0)
3. Regular LOWTRAN5 (JBMOD = 0)

Plots from these three cases are also in Appendix E.

APPENDIX G

FORMATTED TO BINARY TRANSLATION PROGRAM

```

C PROGRAM BINWRT(TAPE5,TAPE6)
C FORMATTED READ AND BINARY WRITE MODULE FOR THE BAND MODEL
C MODIFICATION OF LOWTRAN 5 (OCTOBER 1980)
C
C DIMENSION SD(5,4,20),OD(5,4,20),ZMWT(4,20),ALFO(4,20),TBAND(5)
C DATA KSPEC/4/,NOUT/6/,KIN/5/
C
C FILE UNIT NUMBERS: NIN = 5 (FORMATTED DATA FILE)
C NOUT = 6 (BINARY DATA FILE)
C
C READ TAPE HEADER
C READ (NIN,600) VA,VB,NV,NTEMP,(TRAND(N),N=1,NTEMP)
C
C IF ONLY A SUBSET OF THE TAPE IS WANTED ON THE BINARY FILE, MODIFY
C THE VALUES OF VBOT AND VTOP BELOW TO THE DESIRED RANGE.
C THE DEFAULT VALUES ARE:
C VA = 400. CM-1 AND VB = 9995. CM-1
C (VA AND VB ARE THE VALUES ON THE TAPE HEADER.)
C SINCE THE TAPE IS BLOCKED IN GROUPS OF 20 WAVENUMBER POINTS, VROT
C SHOULD BE A MULTIPLE OF 100 AND VTOP SHOULD BE XX95.
C VROT = VA
C VTOP = VB
C
C CHECK FOR 100 CM-1 BLOCKS IN CASE VBOT.NE.VA OR VTOP.NE.VB
C VBOT = 100.*INT(VROT/100.+0.001)
C VTOP = 100.*INT(VTOP/100.+0.001) + 95.
C IF (VBOT.LE.VA) VBOT = VA
C IF (VTOP.GE.VB) VTOP = VB
C WRITE (NOUT) VBOT,VTOP,NV,NTEMP,(TBAND(N),N=1,NTEMP)
C
C DETERMINE BLOCK NOS. IN WHICH VBOT & VTOP FALL
C ILOW = INT((VBOT-VA)/100.+0.001) + 1
C IHI = INT((VTOP-VA)/100.+0.001) + 1
C
C DO 10 IBLK=1,IHI
C READ(NIN,610) (((SD(N,K,IW),OD(N,K,IW),N=1,NTEMP),ALFO(K,IW),
C & ZMWT(K,IW),K=1,KSPEC),IW=1,20)
C IF (IBLK.LT.ILOW) GO TO 10
C WRITE (NOUT) (((SD(N,K,IW),OD(N,K,IW),N=1,NTEMP),ALFO(K,IW),
C & ZMWT(K,IW),K=1,KSPEC),IW=1,20)
10 CONTINUE
C ENDFILE NOUT
C
C STOP
600 FORMAT(2F10.0,2I5,5F5.0)
610 FORMAT(10E10.3,F10.3,F10.1)
C END

```