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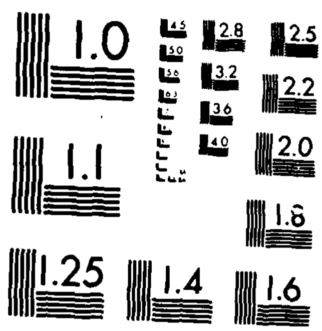

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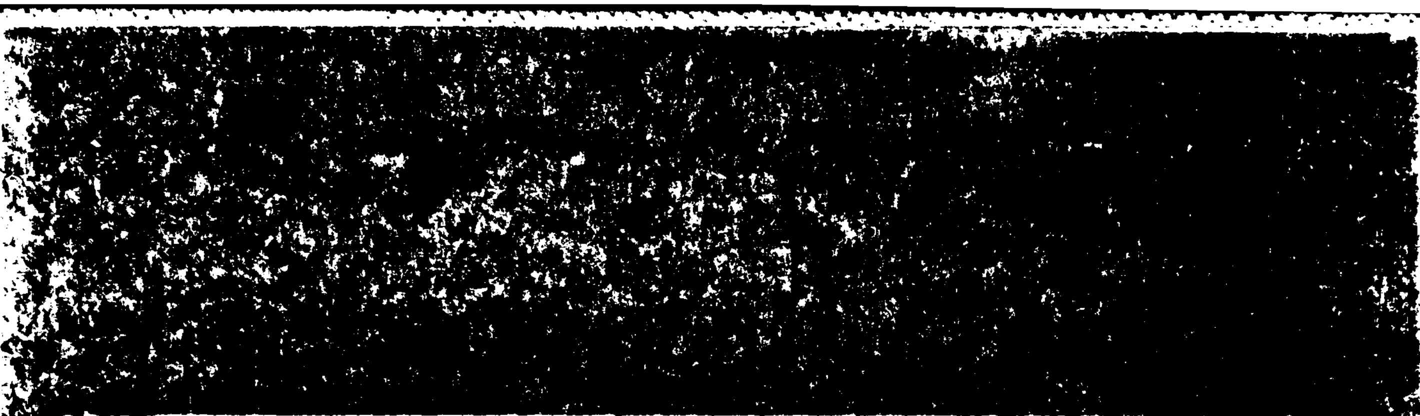

A Study of Sea Ice Kinematics and Their Relationships to Arctic Ambient Noise

Part 3
Section 3 - Ambient Noise

Science Applications International Corp.

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ice kinematics
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report details the kinematic analysis of sea ice motion data collected during the Arctic Ice Dynamics Joint Experiment (AIDJEX) in the Beaufort Sea. In addition, relationships between the ice kinematic parameters and associated ambient noise are presented. These relationships were determined by an extensive correlation process between the noise and ice motion time histories. Time scales of the various modes of ice motion were calculated by season. Also, seasonal time and space scales were calculated for ambient noise at 10 Hz, 32 Hz, and 1000 Hz. Contents of the section [illegible] (over)

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Appendix G

Seasonal Arctic Ambient Noise Temporal Autocorrelations, Beaufort Sea, 1975-1976

This appendix shows graphically the autocorrelations of the AIDJEX 10 Hz, 32 Hz, and 1000 Hz ambient noise signals for phase lags up to three days (at 3 hr intervals). These autocorrelations were calculated for each station at which noise data were available. One month of data was used, and each season is represented:

Summer - noise data from August 1975,
Fall - noise data from November 1975,
Winter - noise data from February 1976, and
Spring - noise data from May 1976.

Although the use of decibell units gives results that are important for the Navy operationally, these units do not always give a true indication of the physics involved in generating the noise. Thus, this appendix also gives the autocorrelations for the ambient noise in terms of pressure amplitude (relative to 1 μPa) using

$$\text{Pressure Amplitude} = 10^{(dB/20)}.$$

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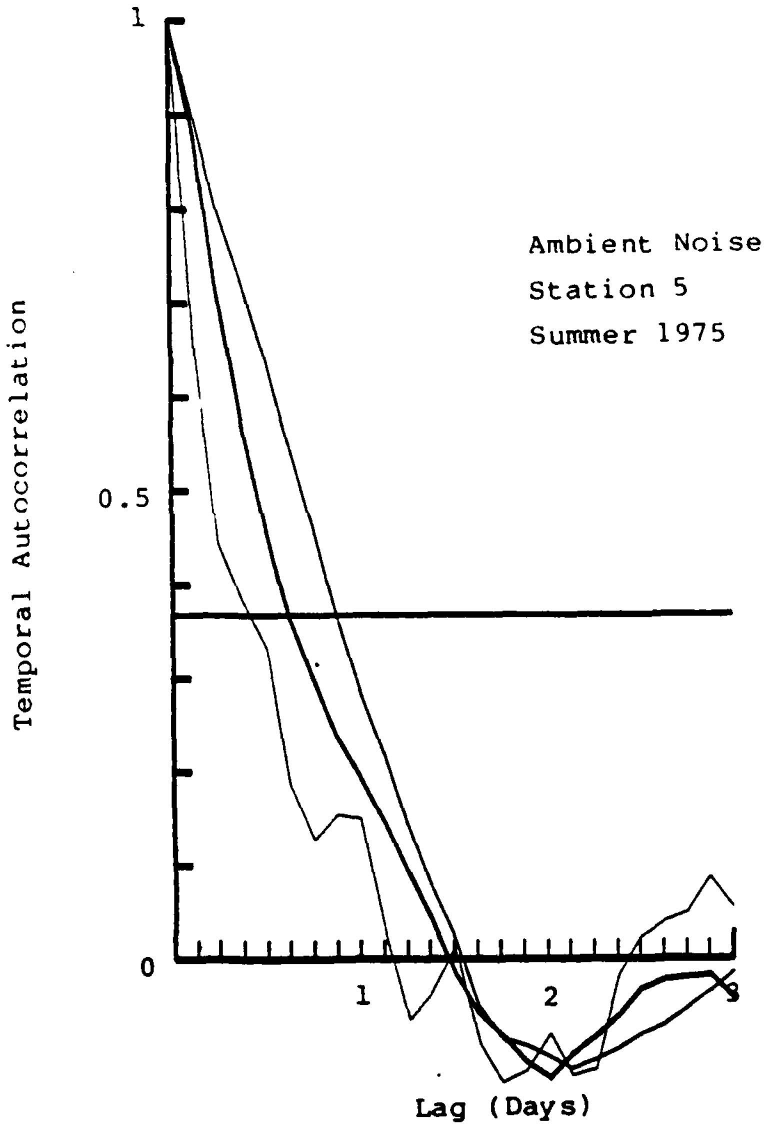


Fig. G.1. Ambient noise autocorrelations, Station 5, based on summer AIDJEX noise data (dB): 10 Hz (lightest line), 32 Hz (darker line), and 1000 Hz (darkest line).

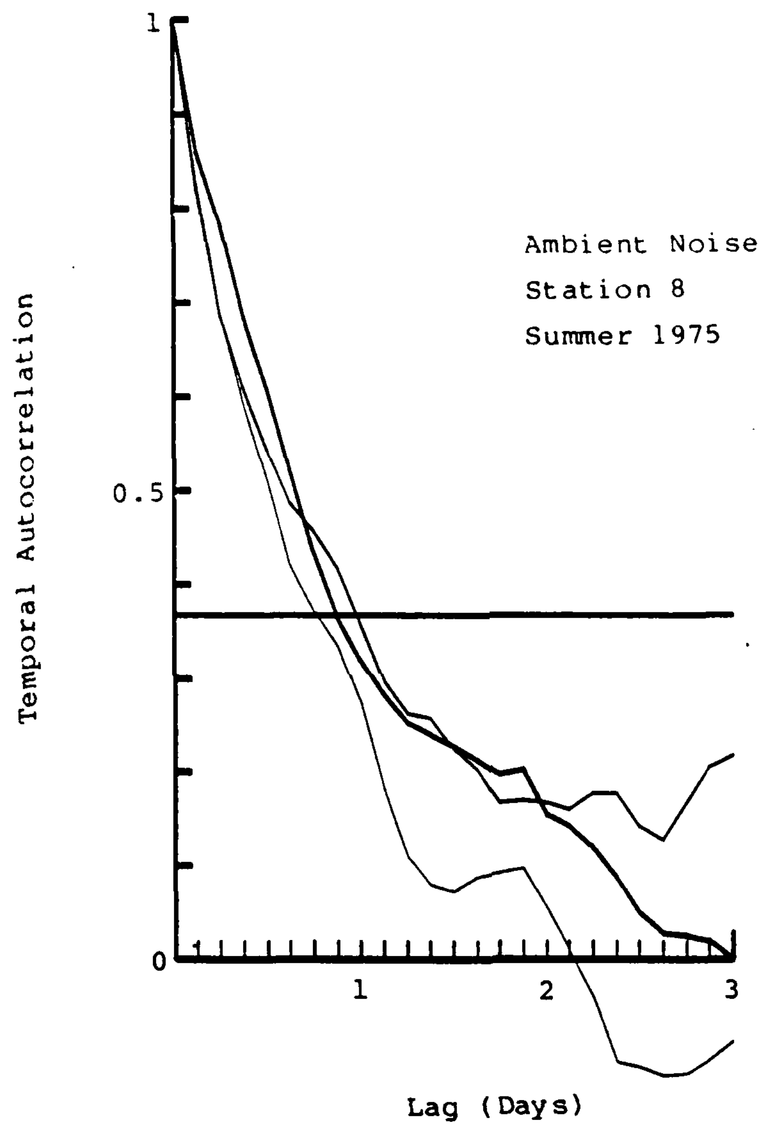


Fig. G.2. Ambient noise autocorrelations, Station 8, based on summer AIDJEX noise data (dB): 10 Hz (lightest line), 32 Hz (darker line), and 1000 Hz (darkest line).

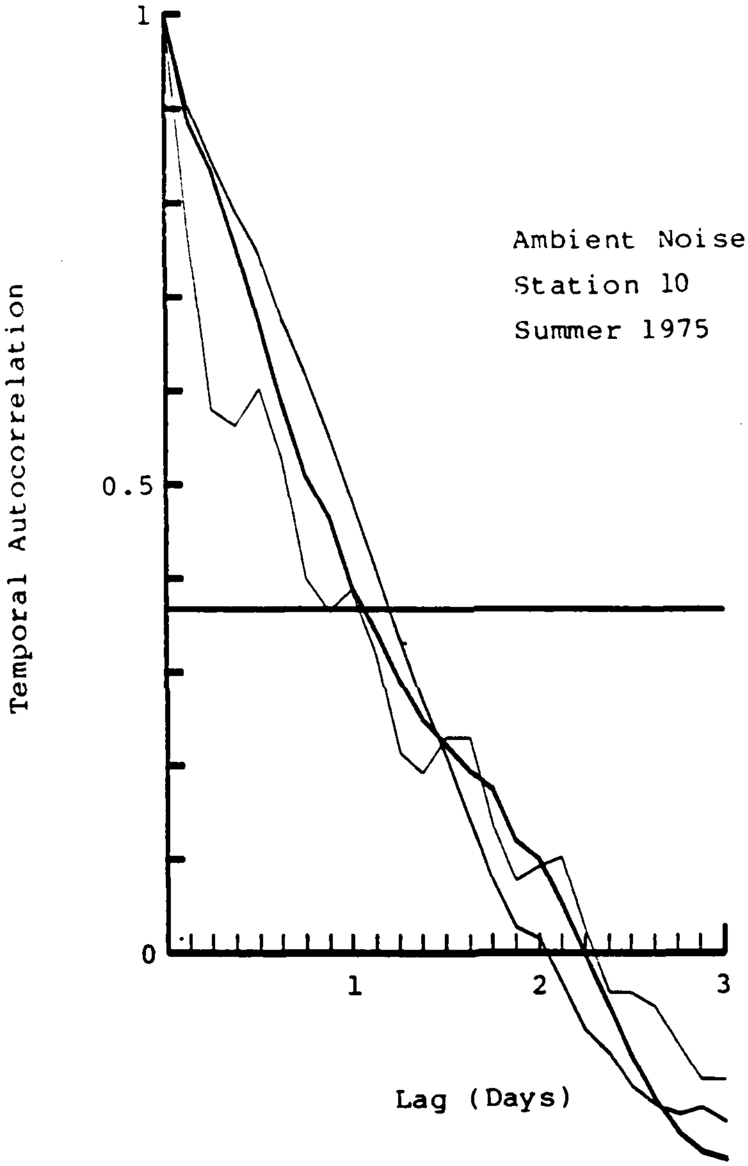
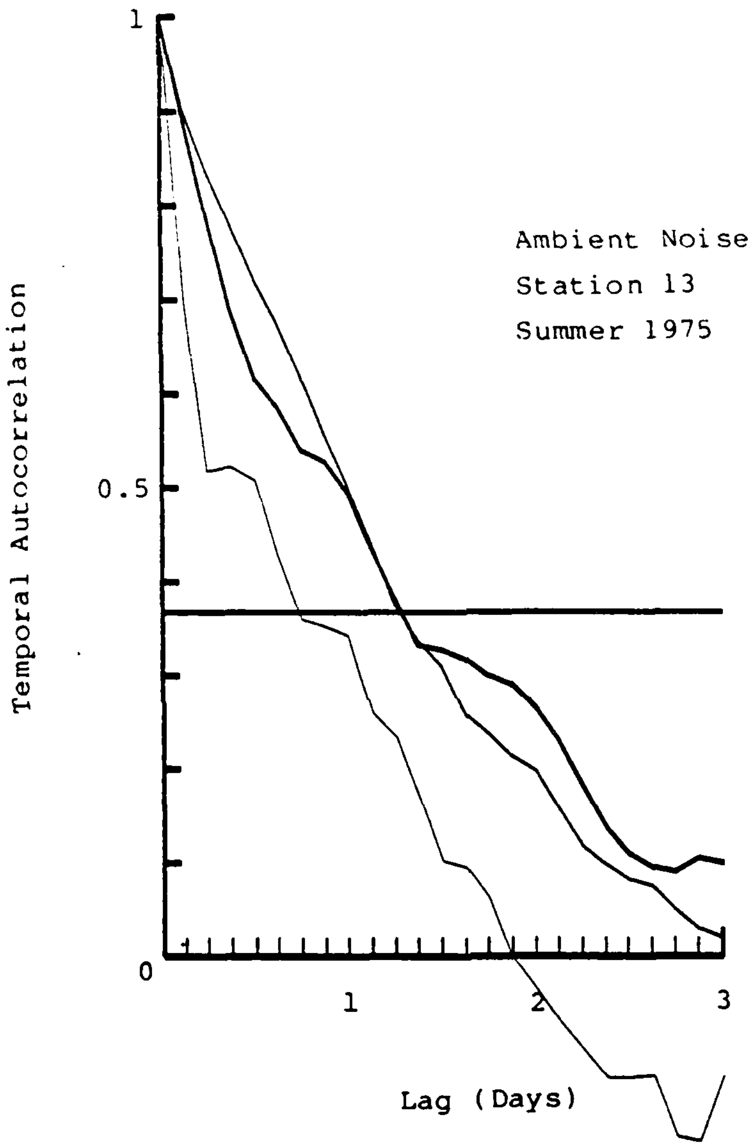


Fig. G.3. Ambient noise autocorrelations, Station 10, based on summer AIDJEX noise data (dB): 10 Hz (lightest line), 32 Hz (darker line), and 1000 Hz (darkest line).



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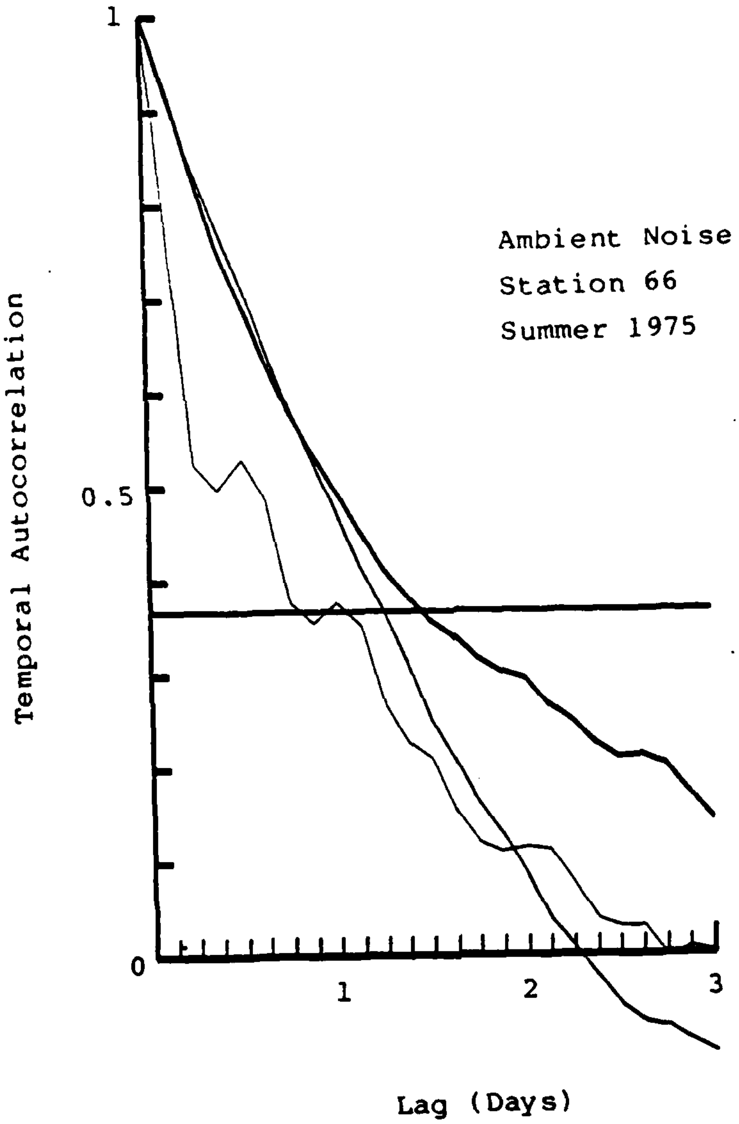

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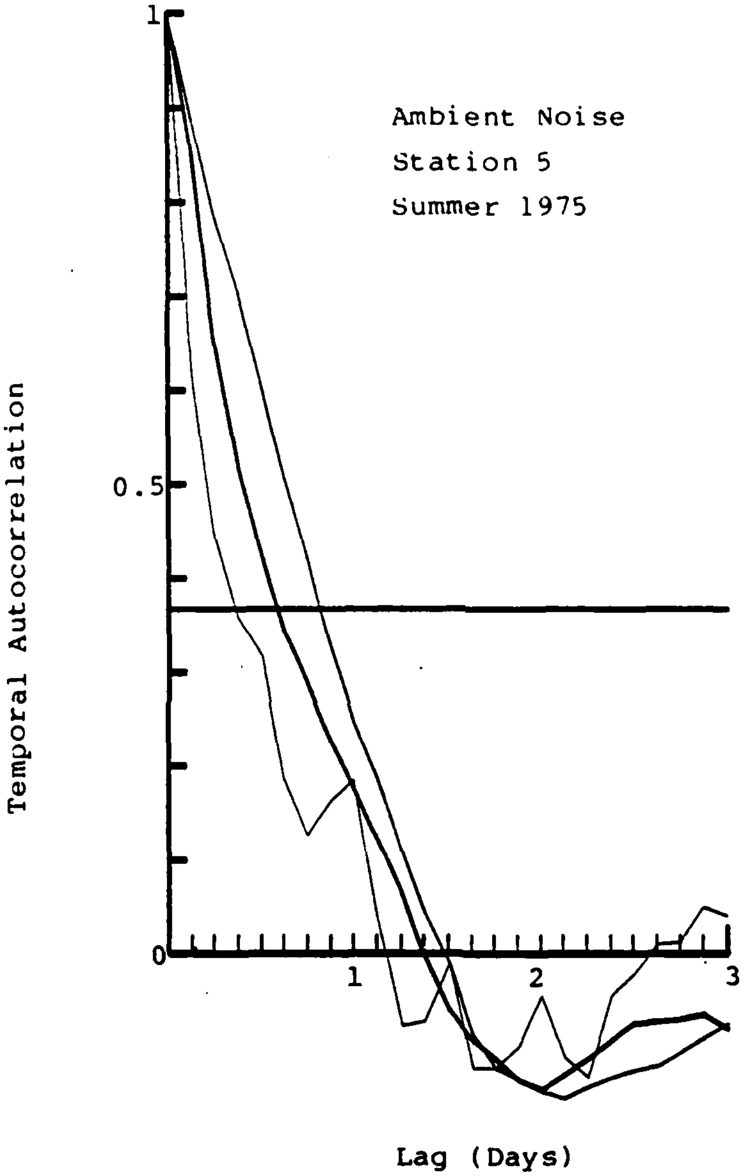
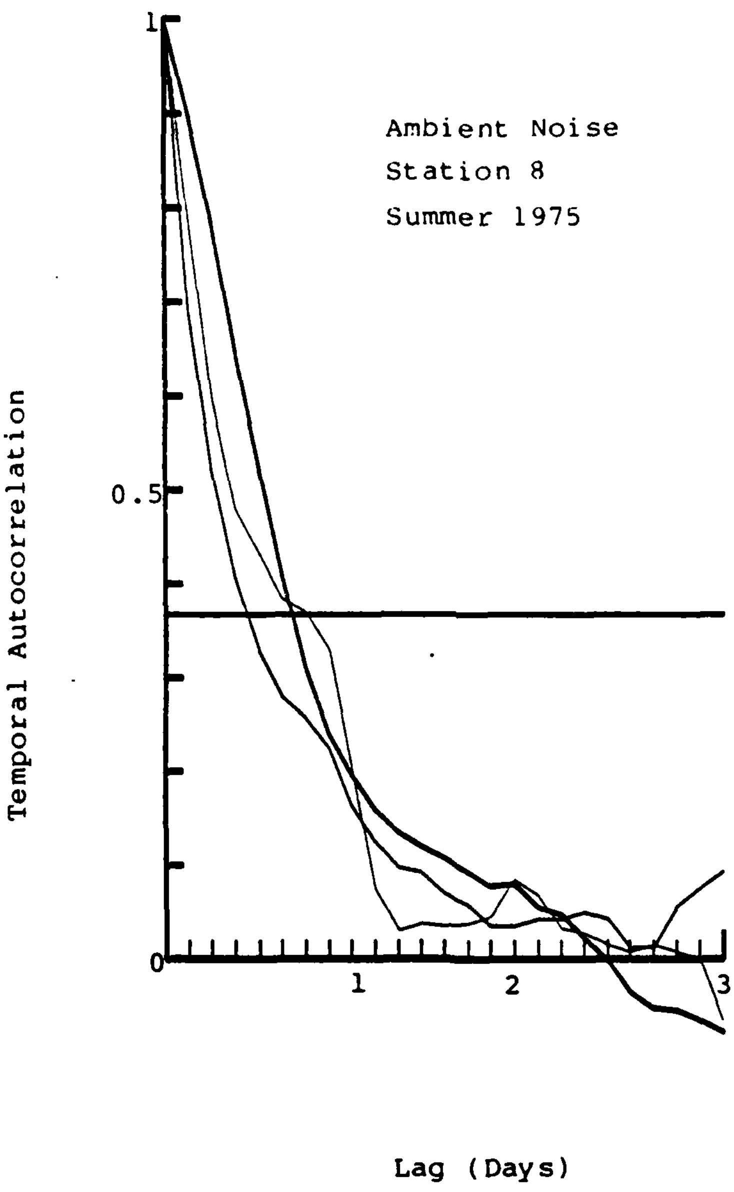


Fig. G.6. Ambient noise autocorrelations, Station 5, based on summer AIDJEX noise data (pressure amplitude): 10 Hz (lightest line), 32 Hz (darker line), and 1000 Hz (darkest line).



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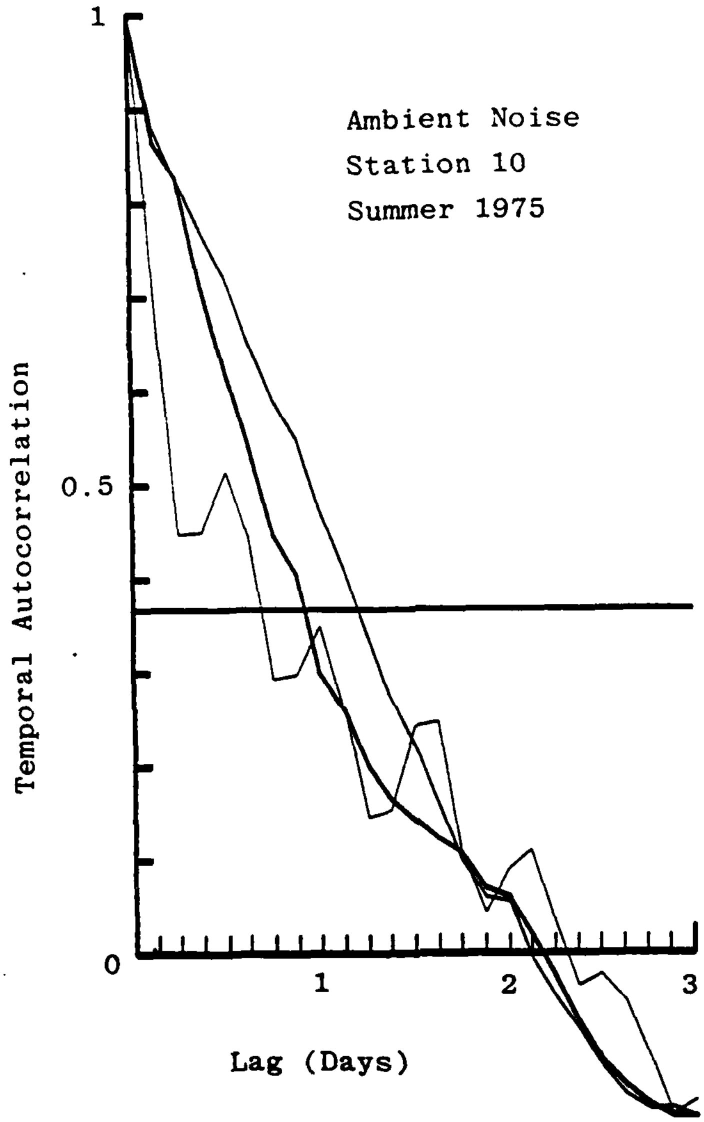

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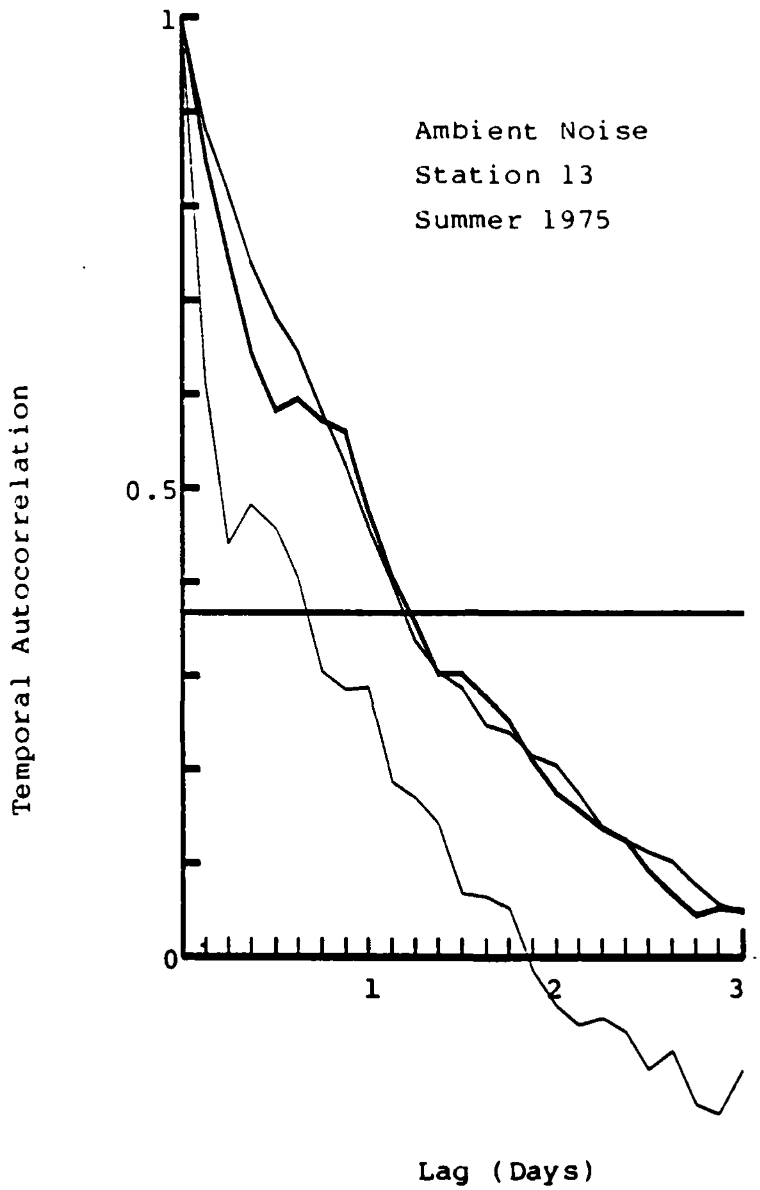

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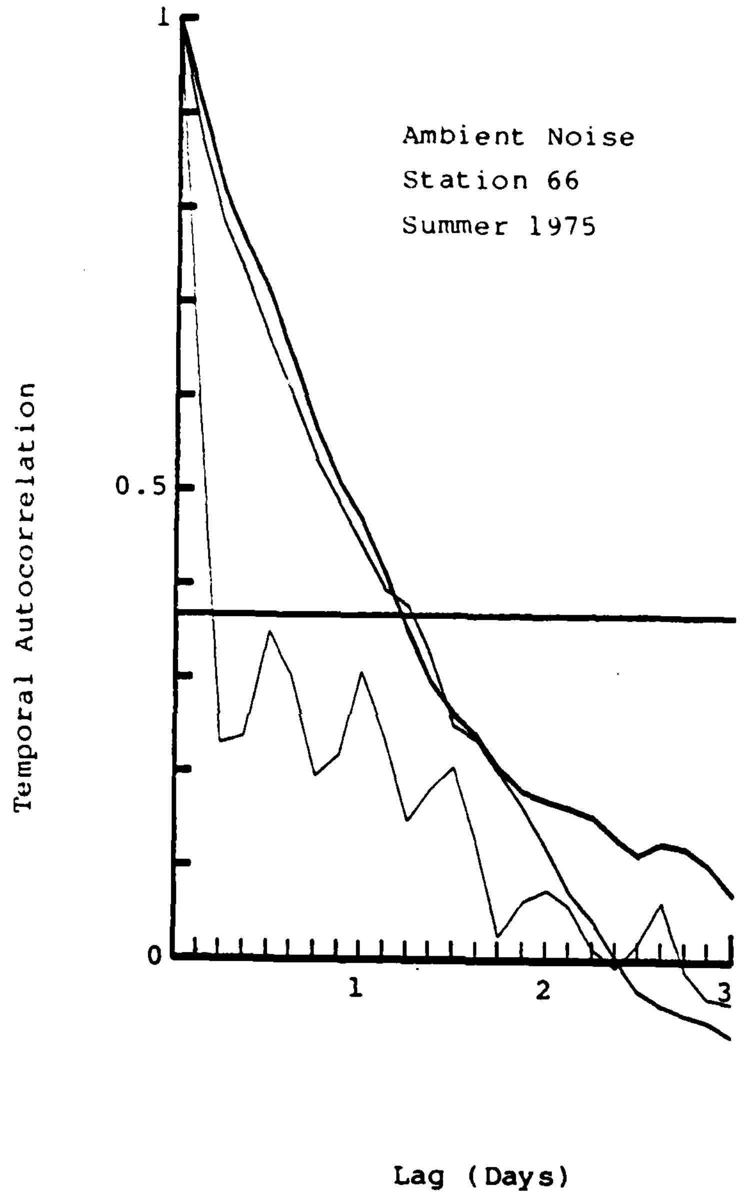

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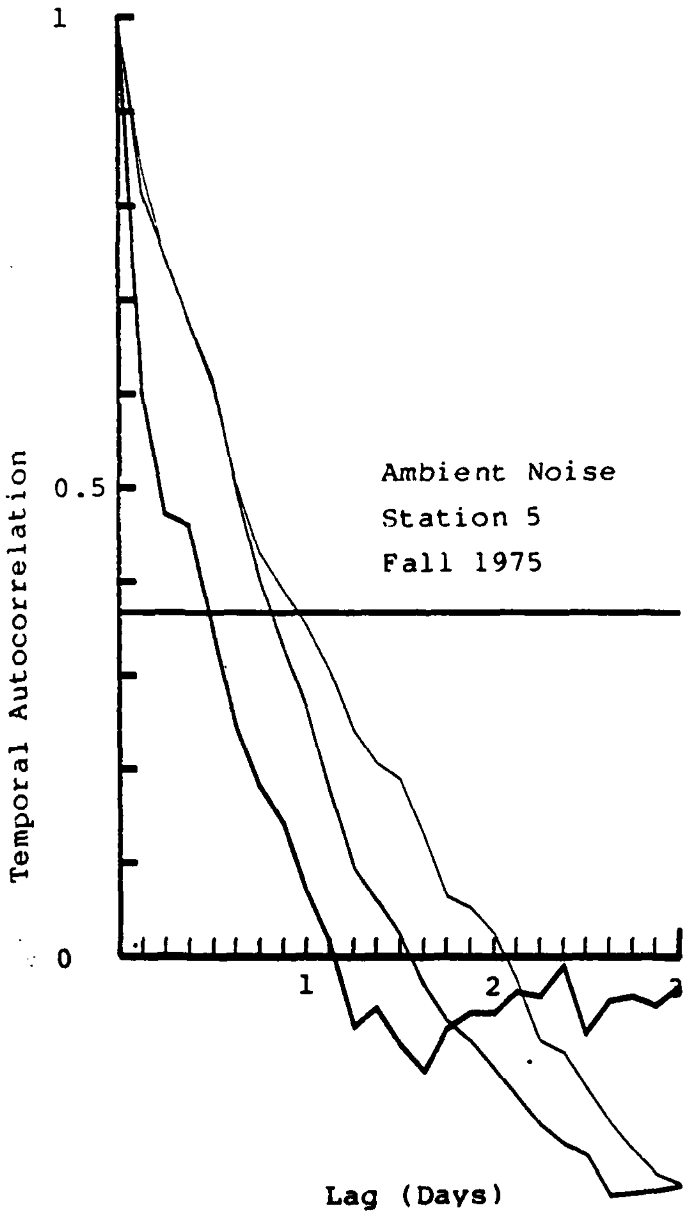

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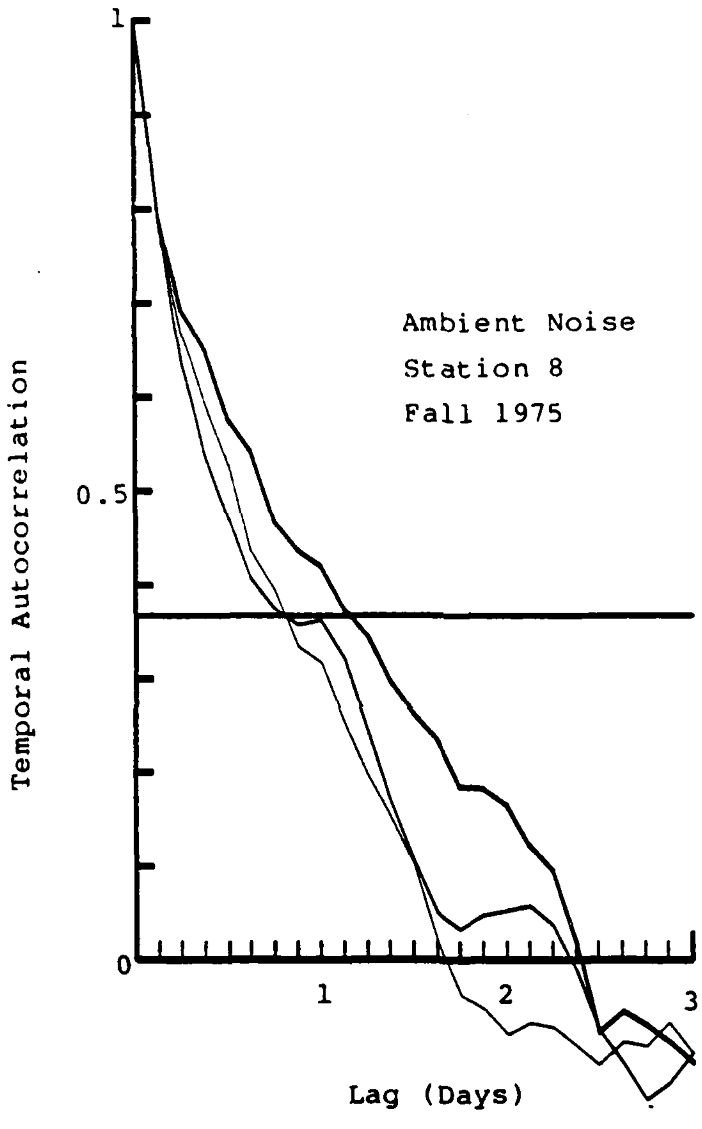

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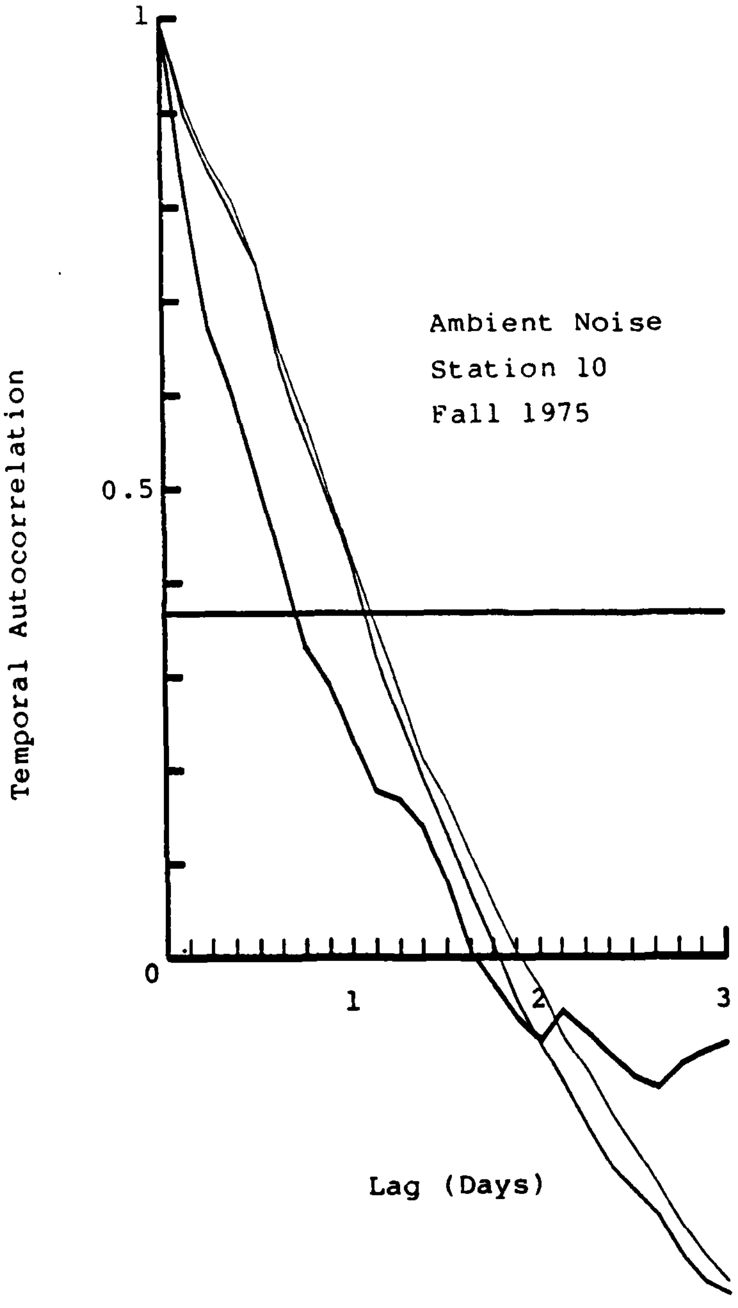


Fig. G.13. Ambient noise autocorrelations, Station 10, based on fall AIDJEX noise data (dB): 10 Hz (lightest line), 32 Hz (darker line), and 1000 Hz (darkest line).

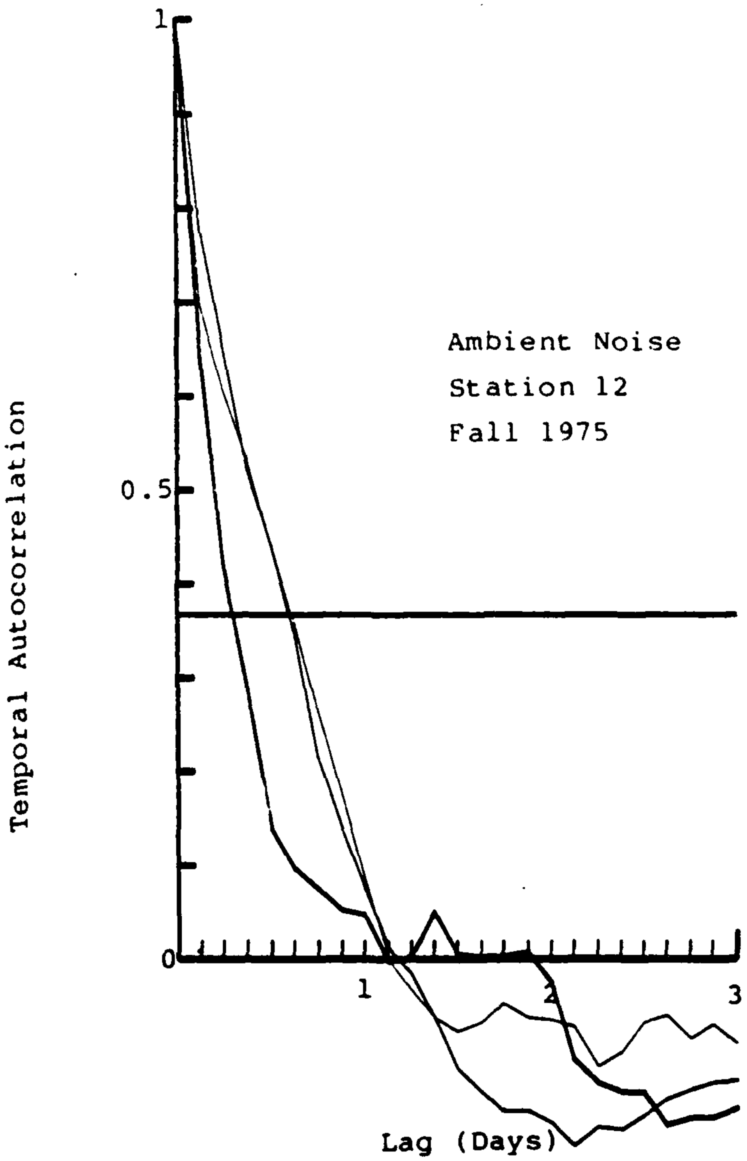
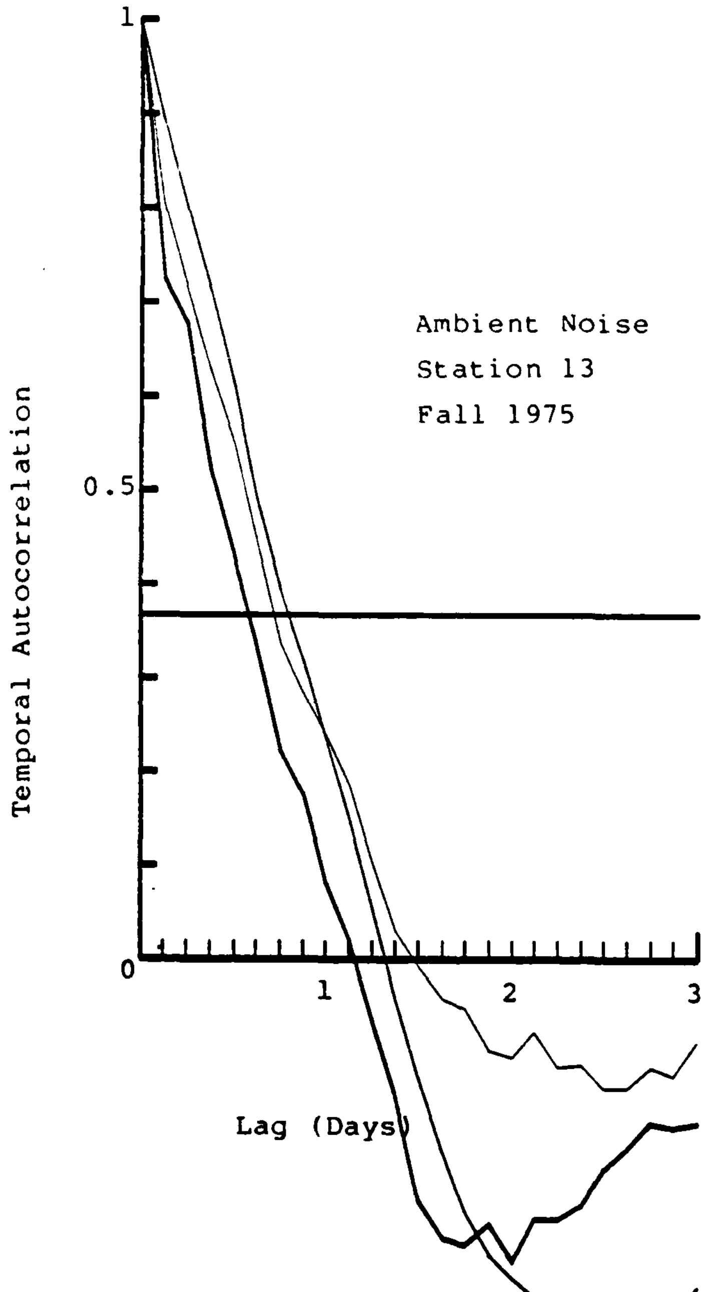


Fig. G.14. Ambient noise autocorrelations, Station 12, based on fall AIDJEX noise data (dB): 10 Hz (lightest line), 32 Hz (darker line), and 1000 Hz (darkest line).



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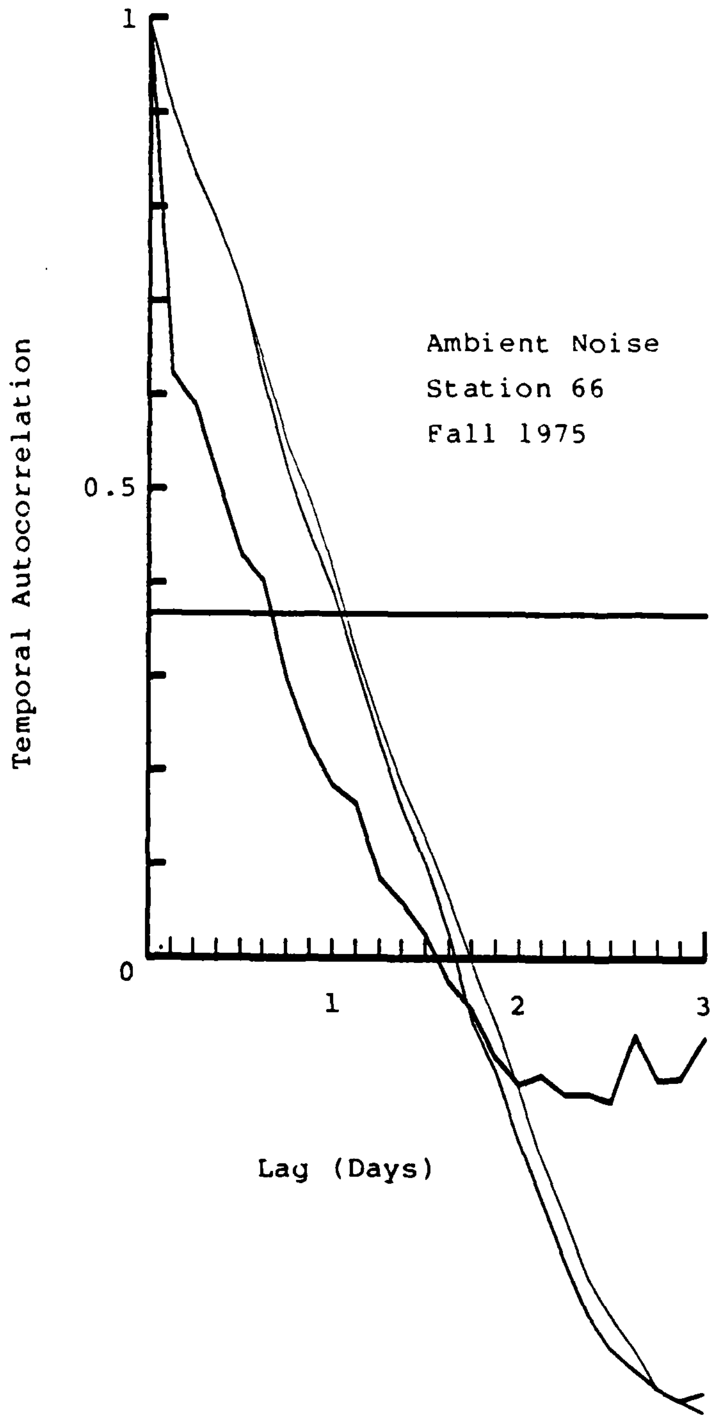

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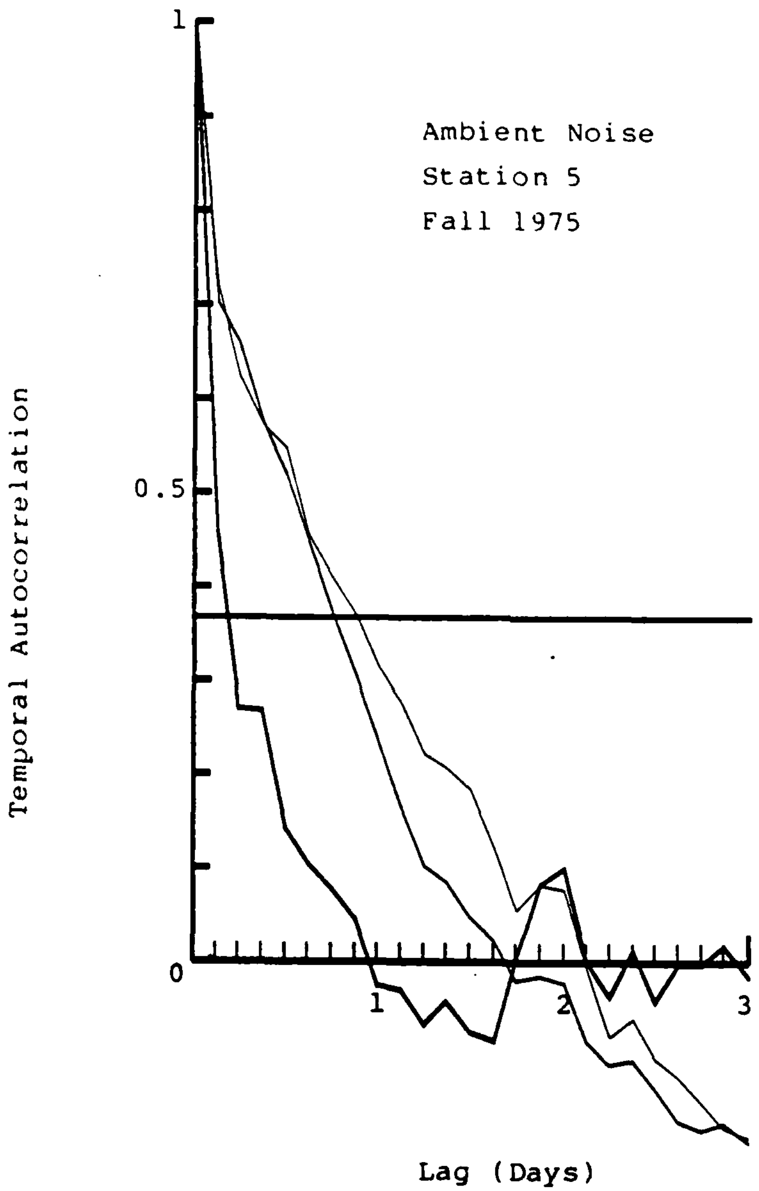

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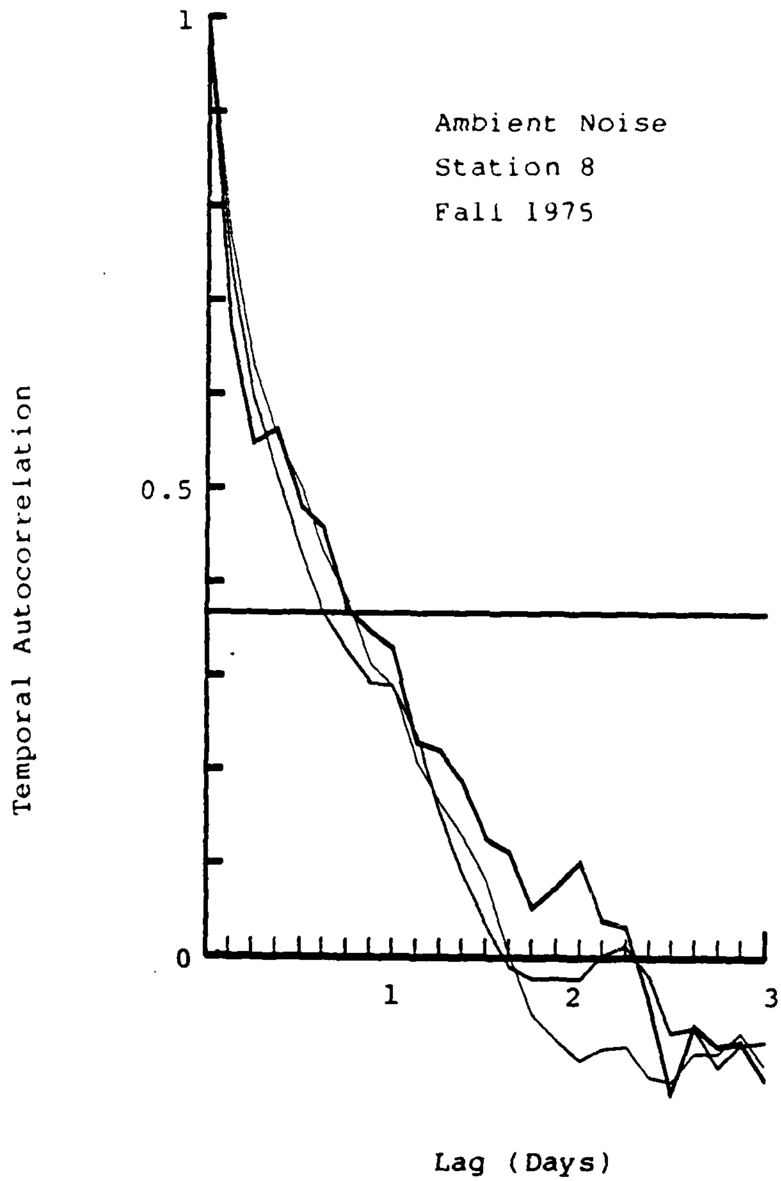

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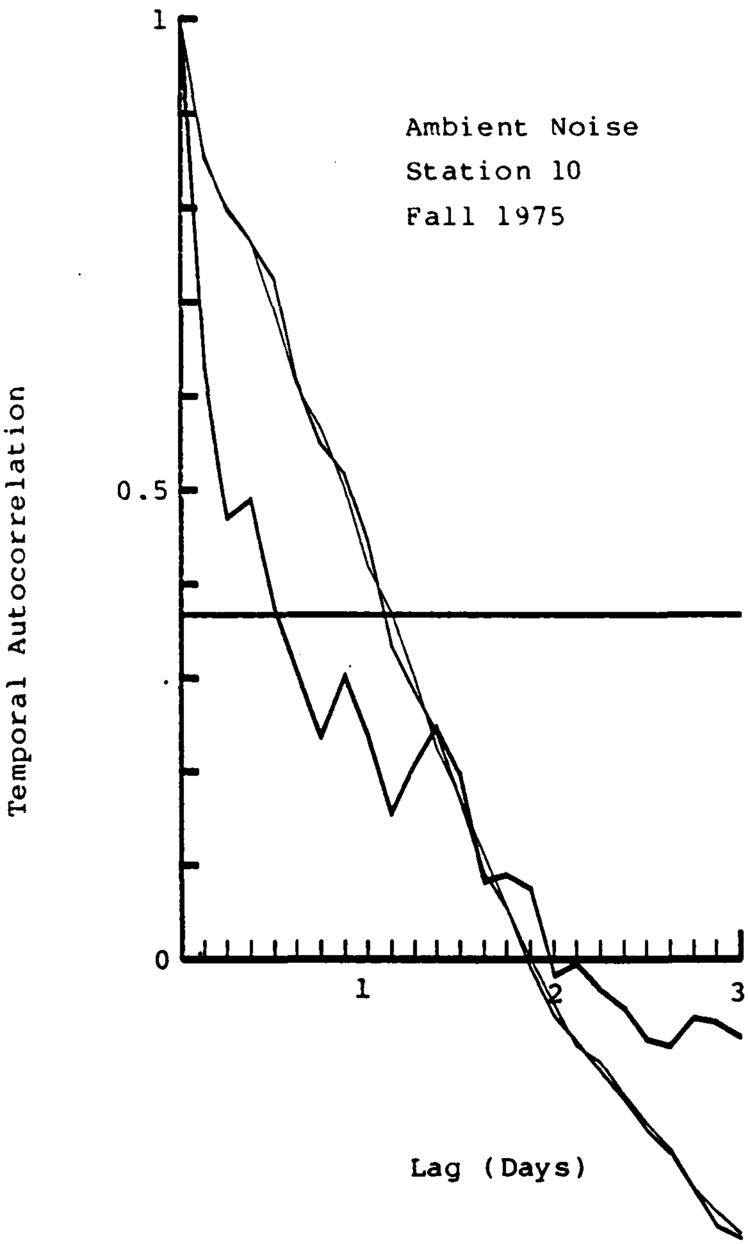

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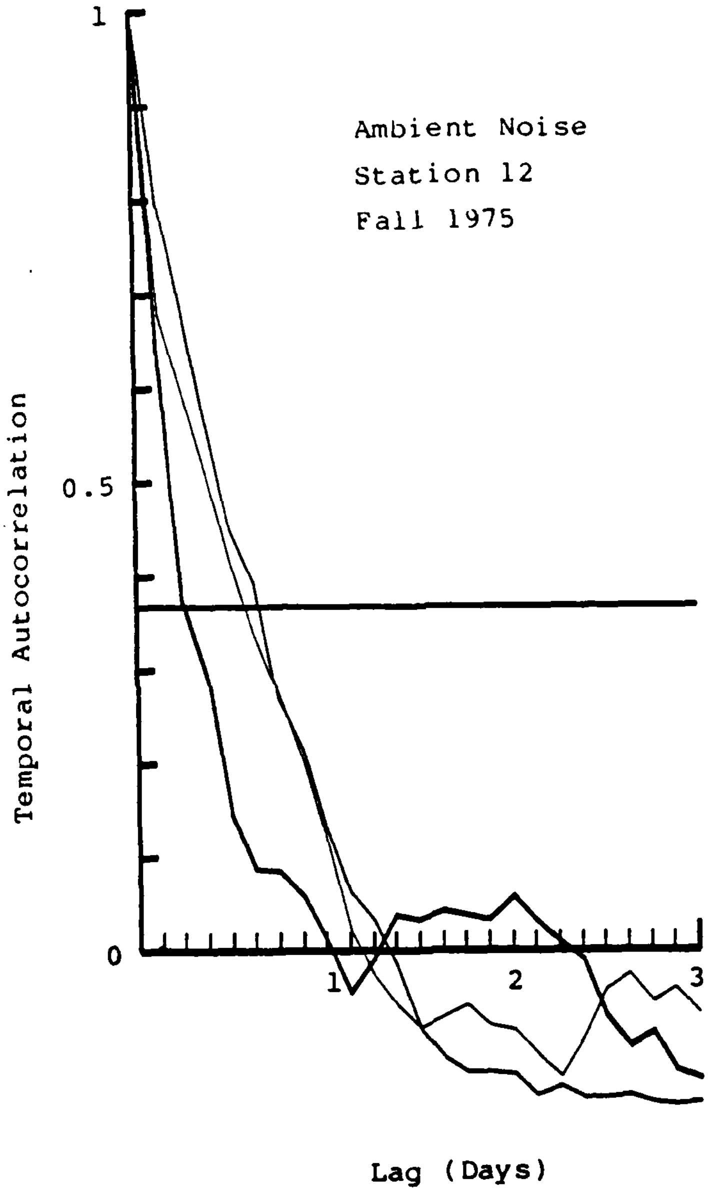

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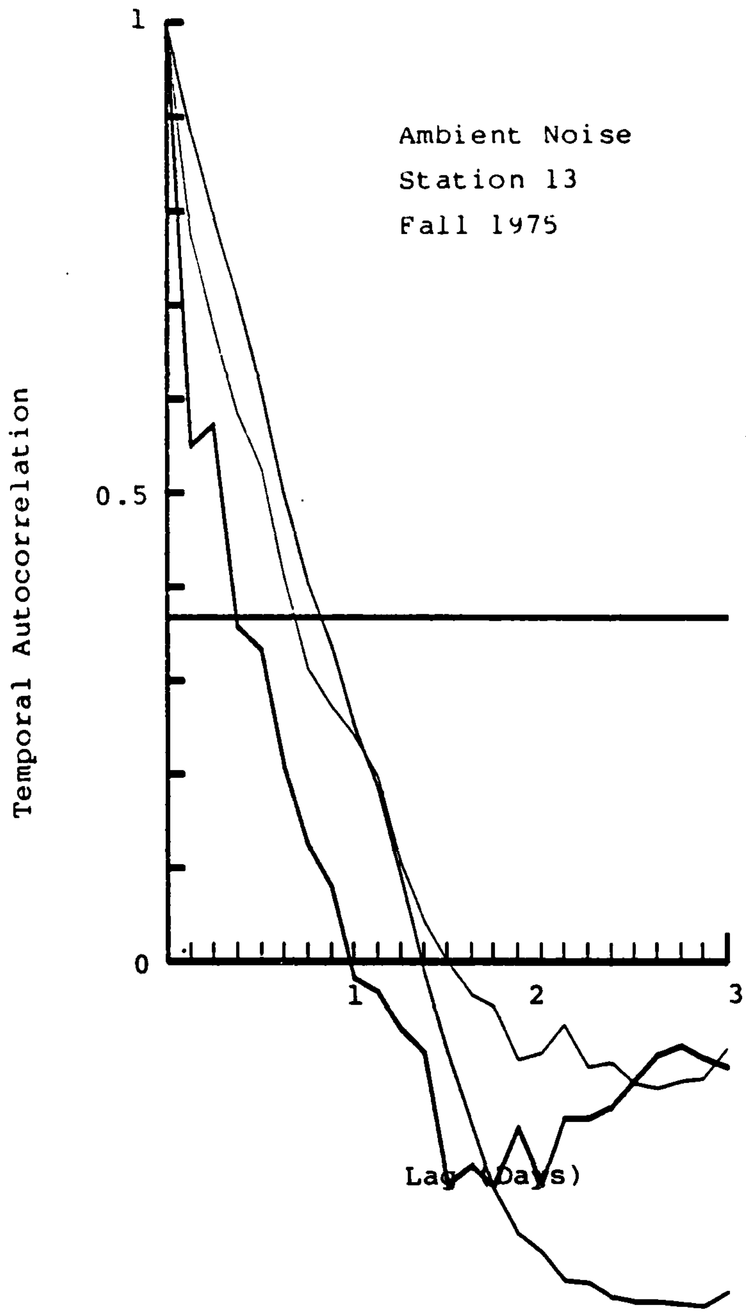

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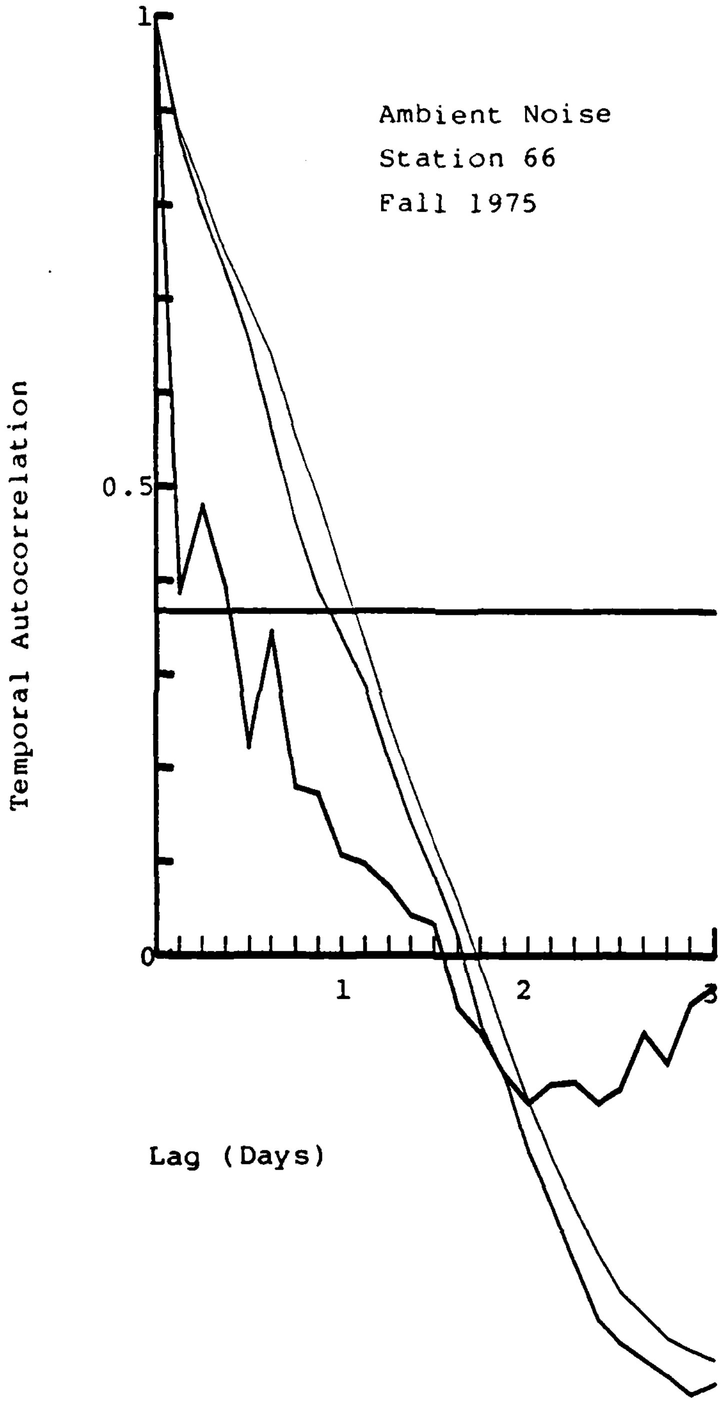

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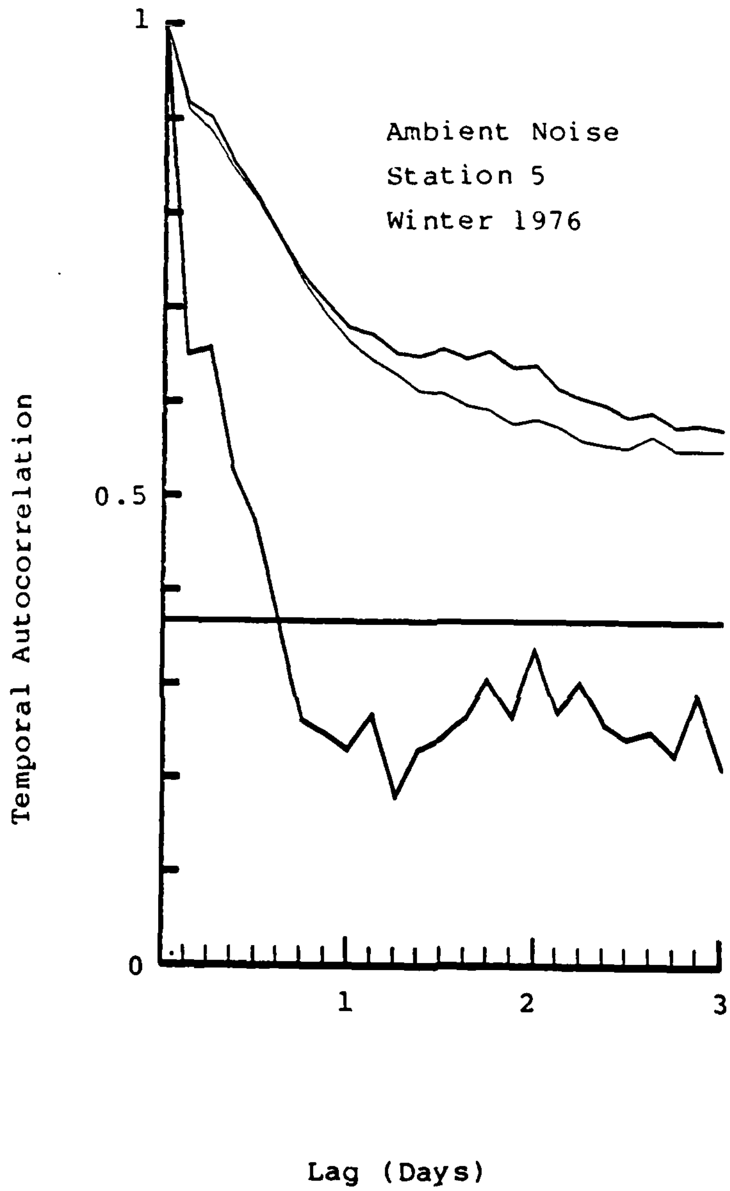

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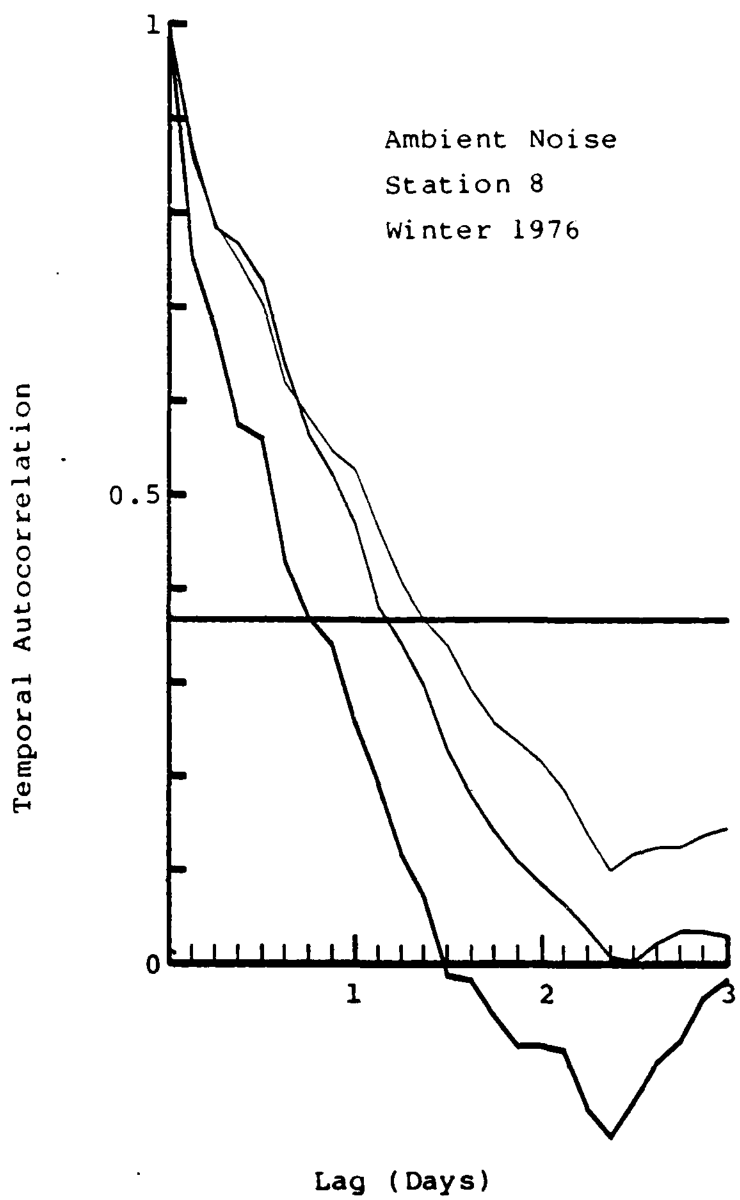

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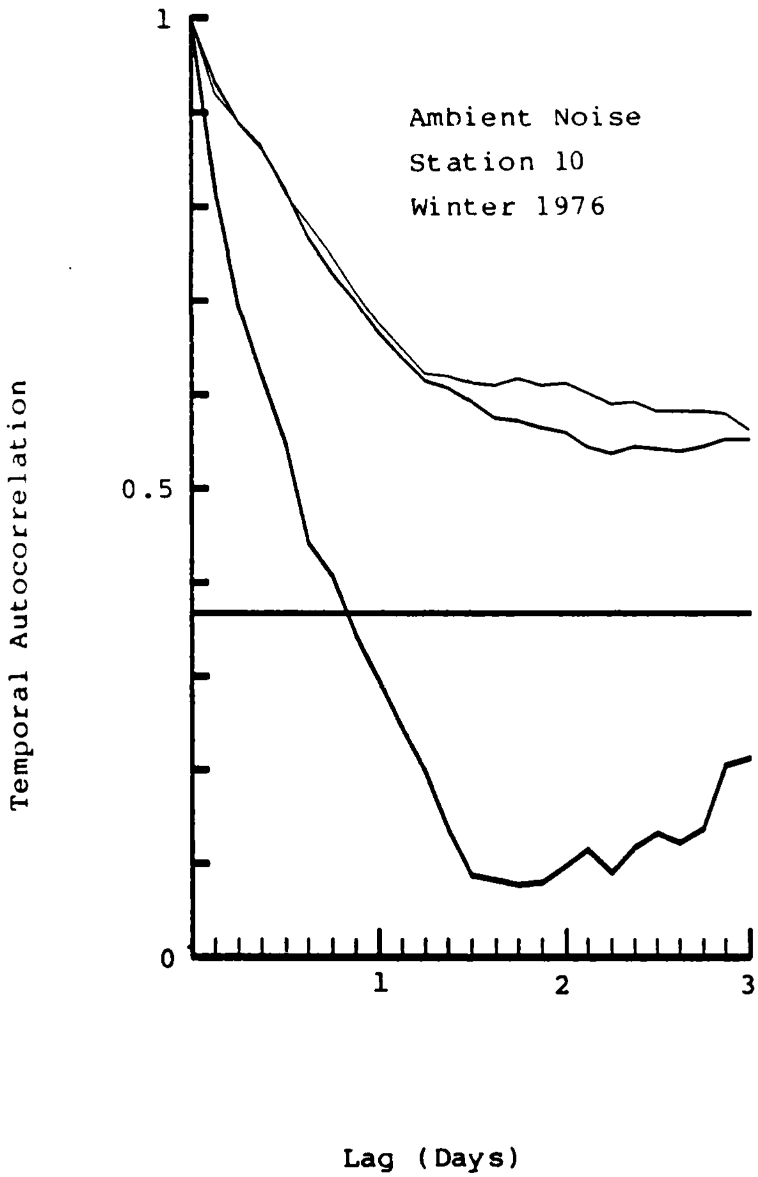

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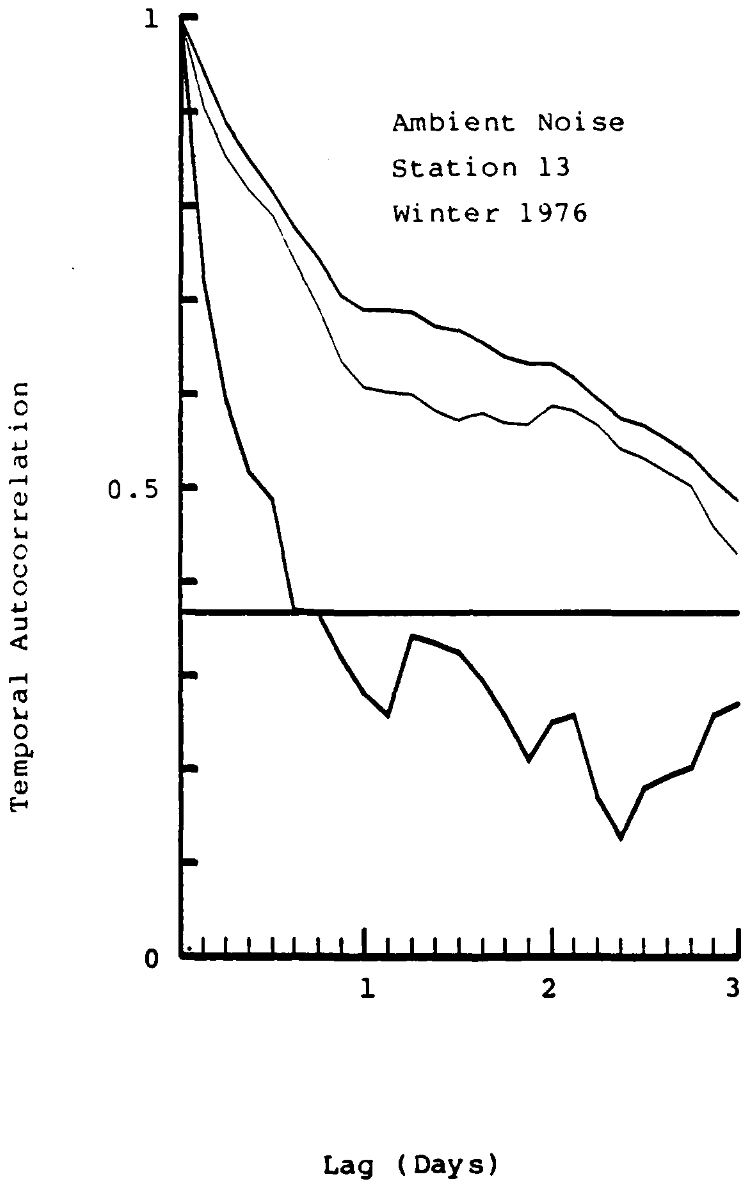

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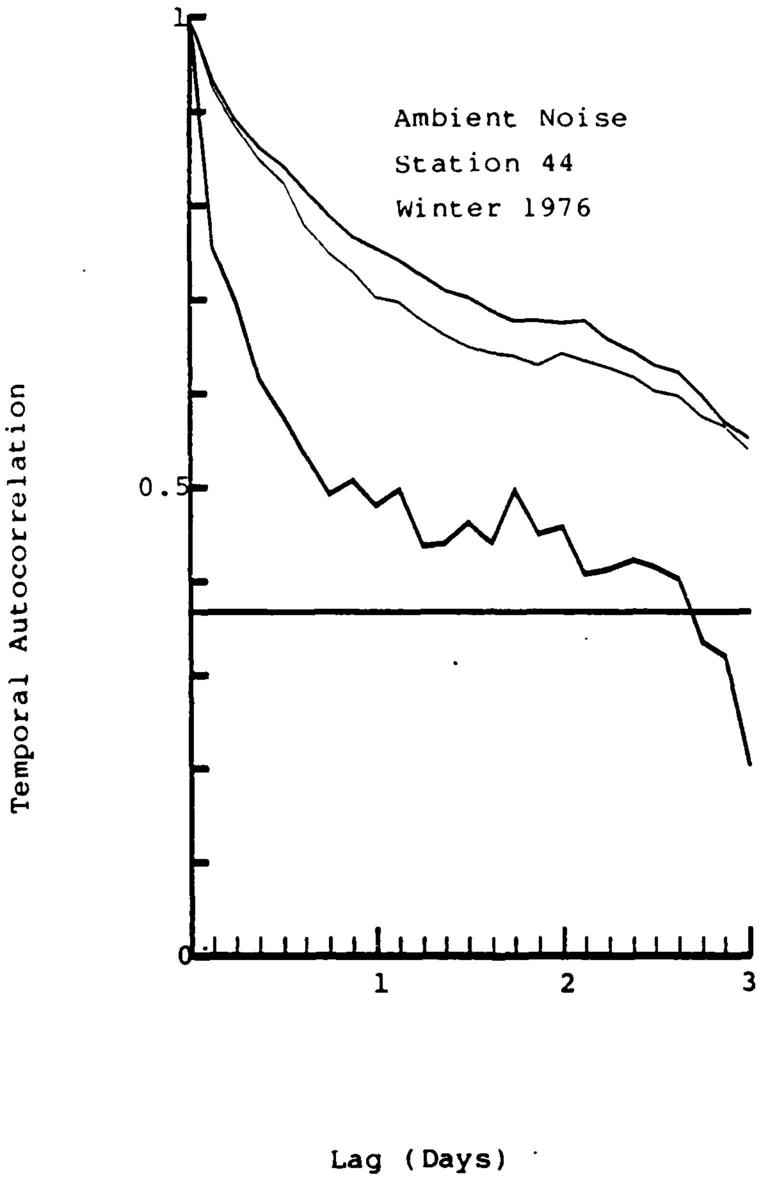

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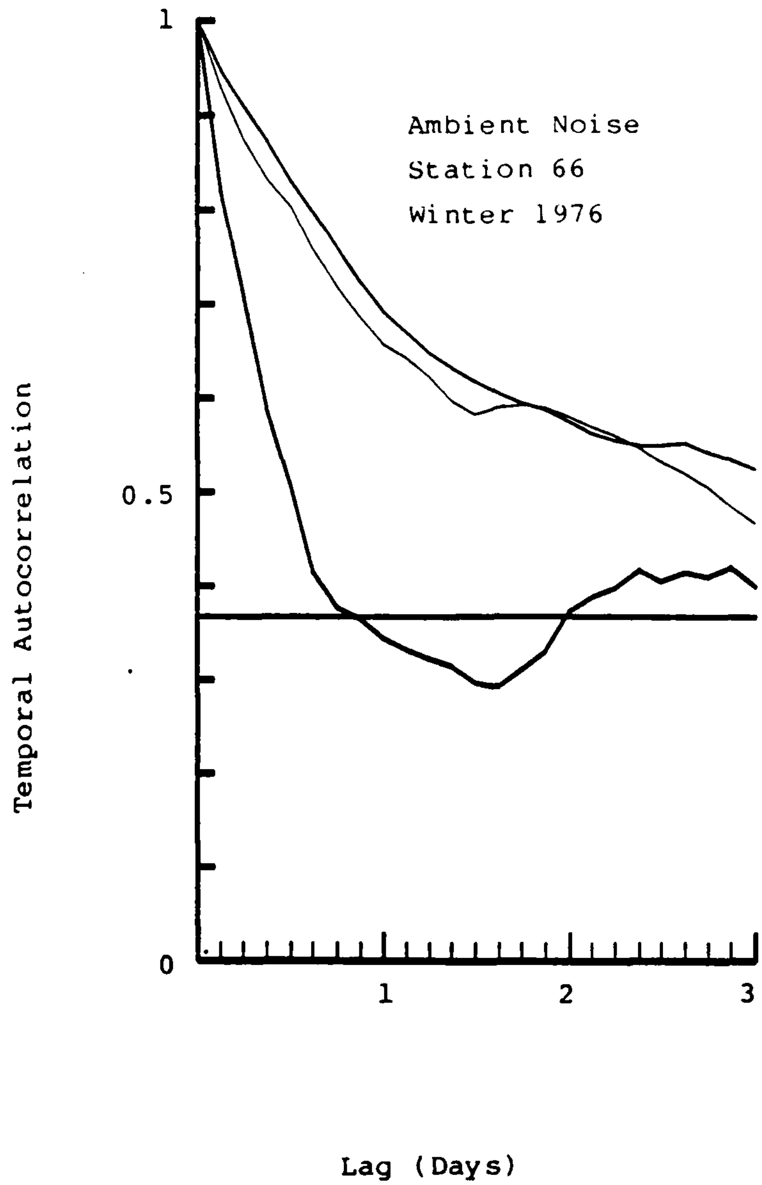

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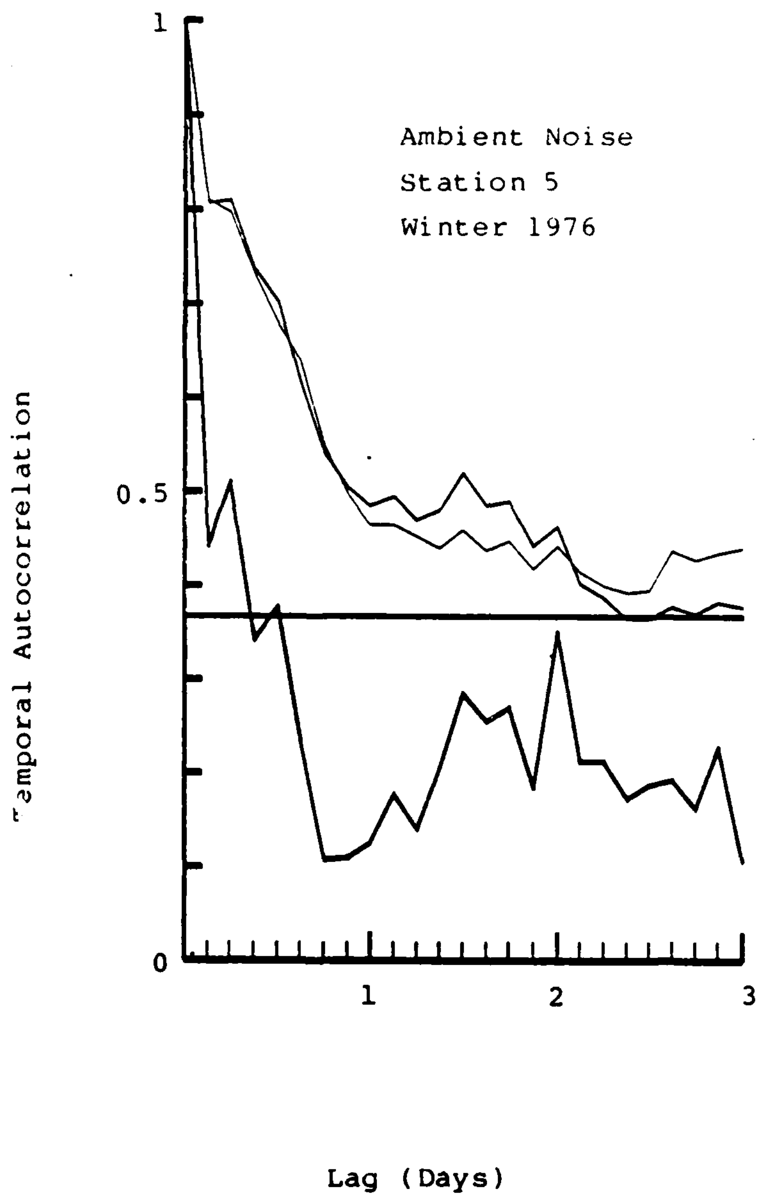

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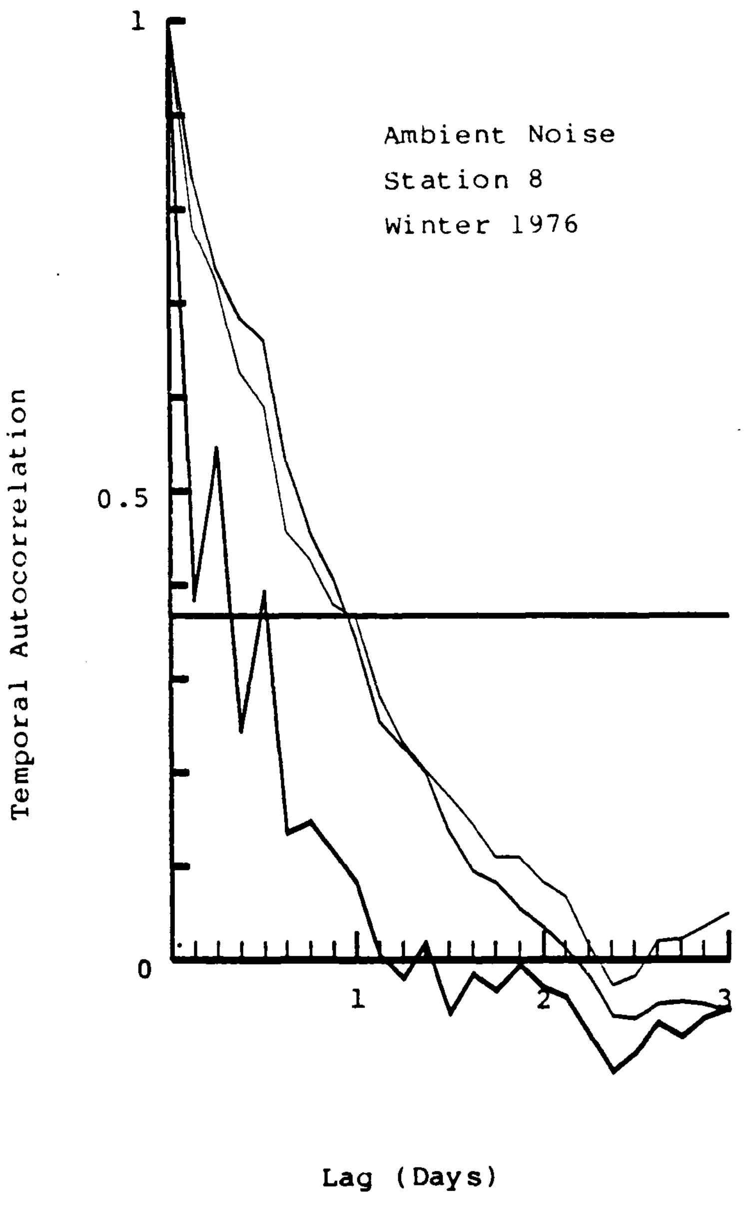

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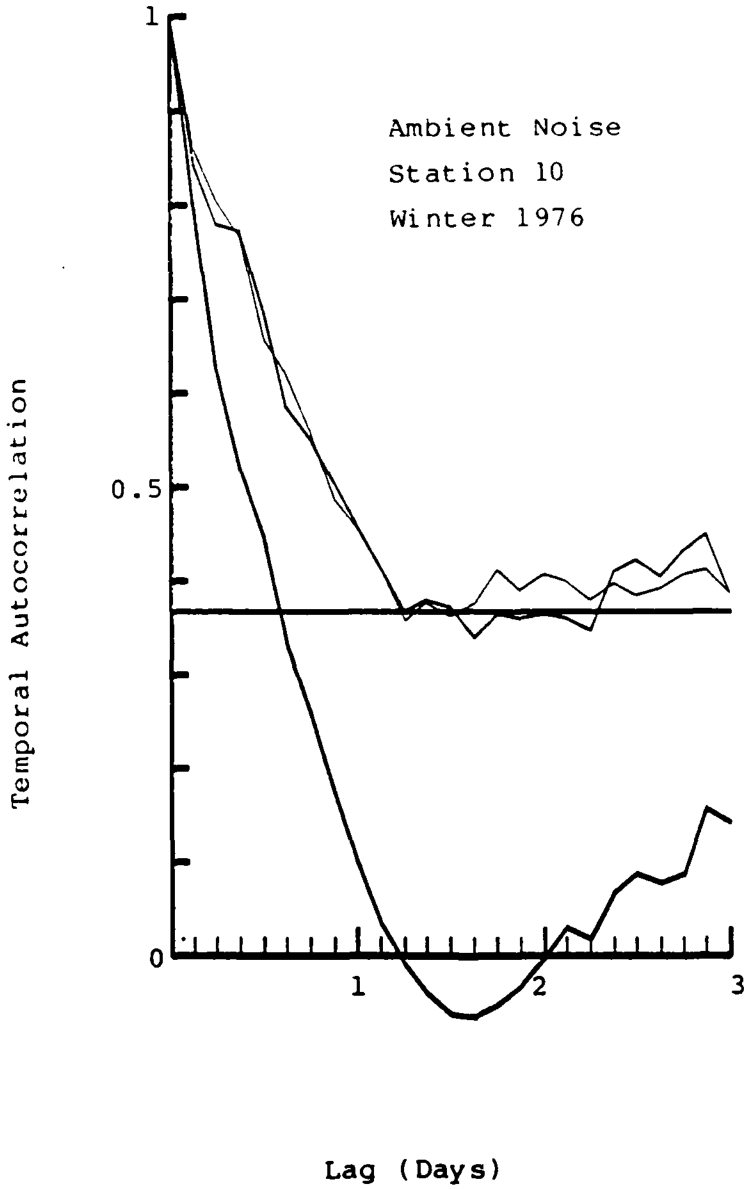

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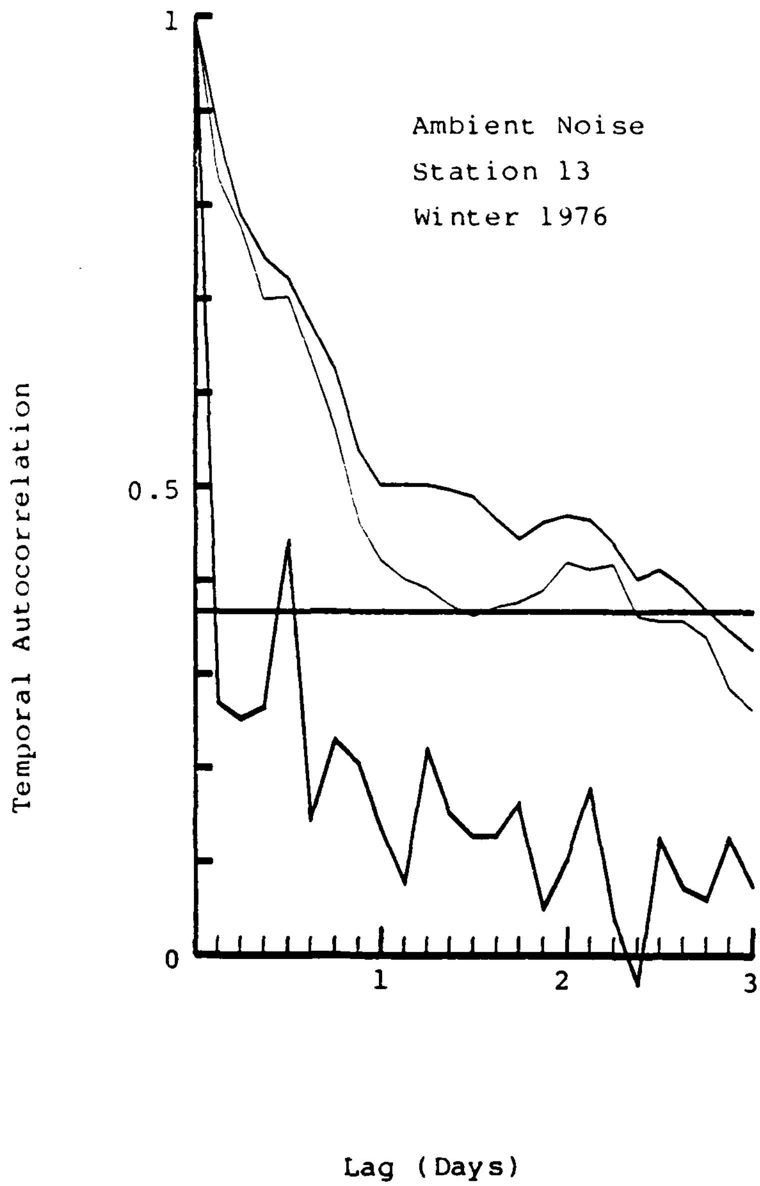

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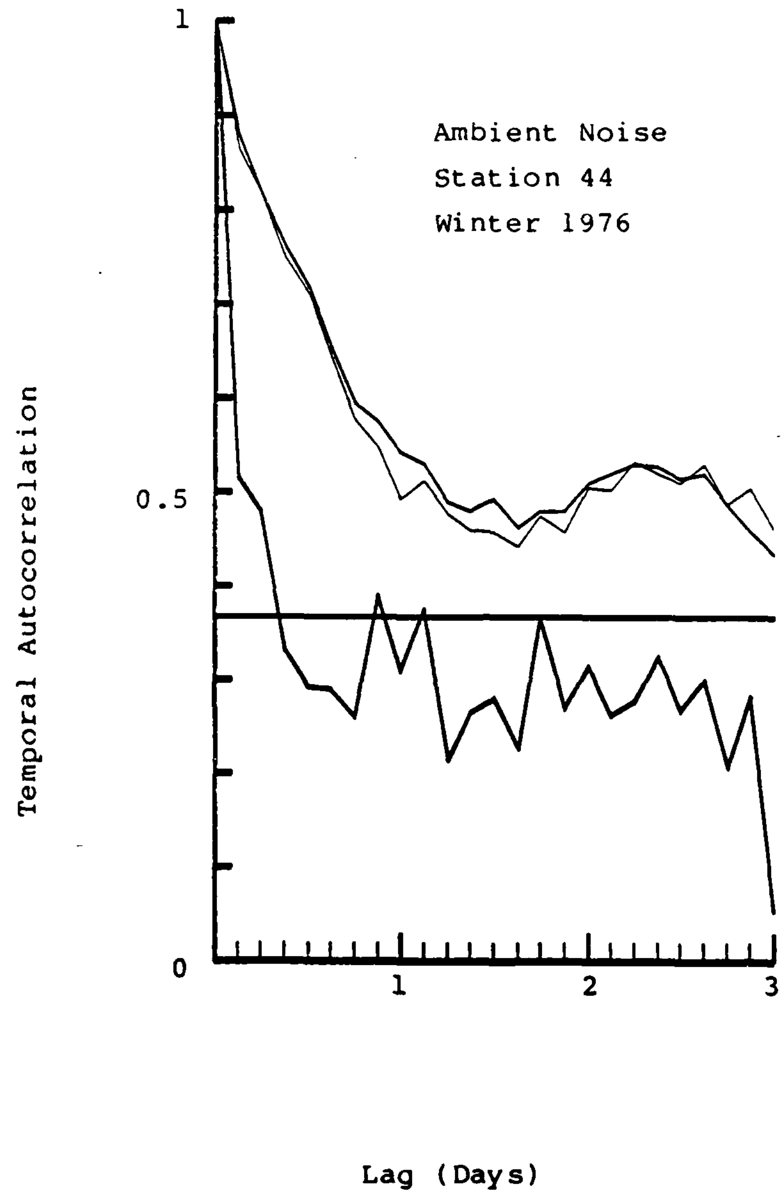

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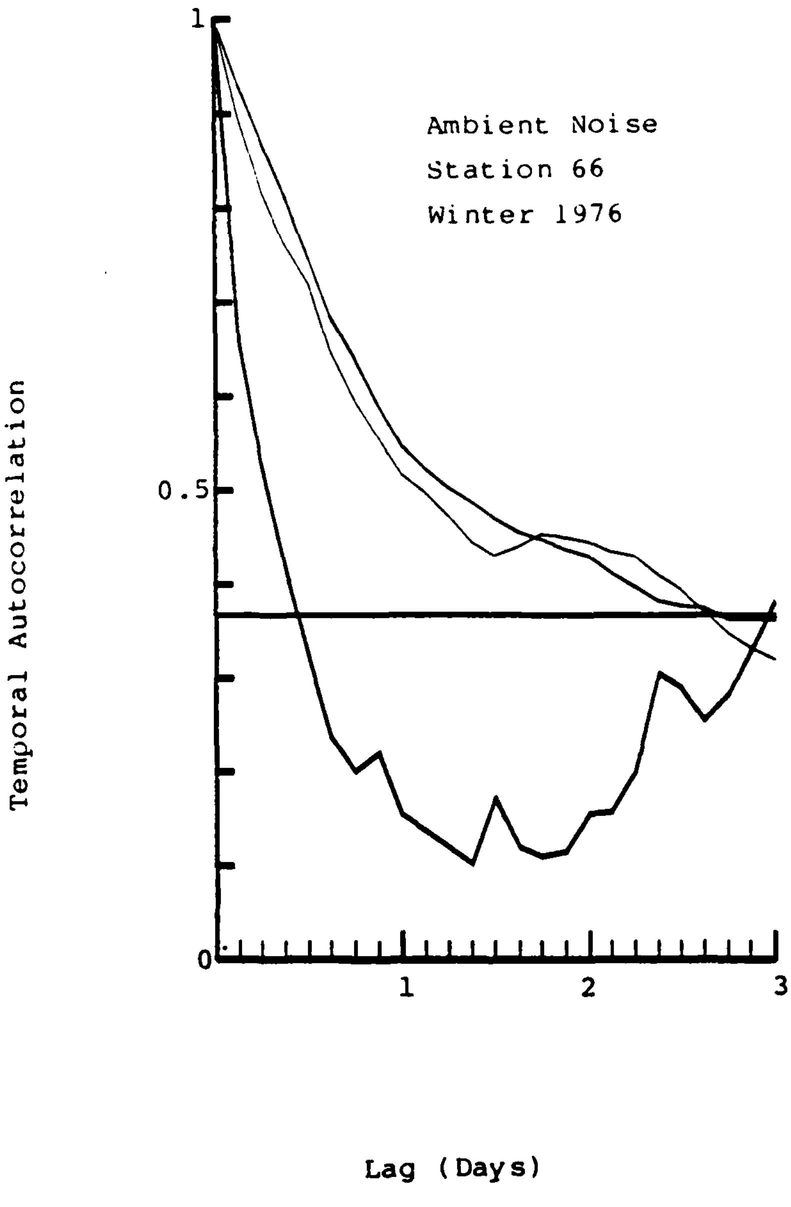

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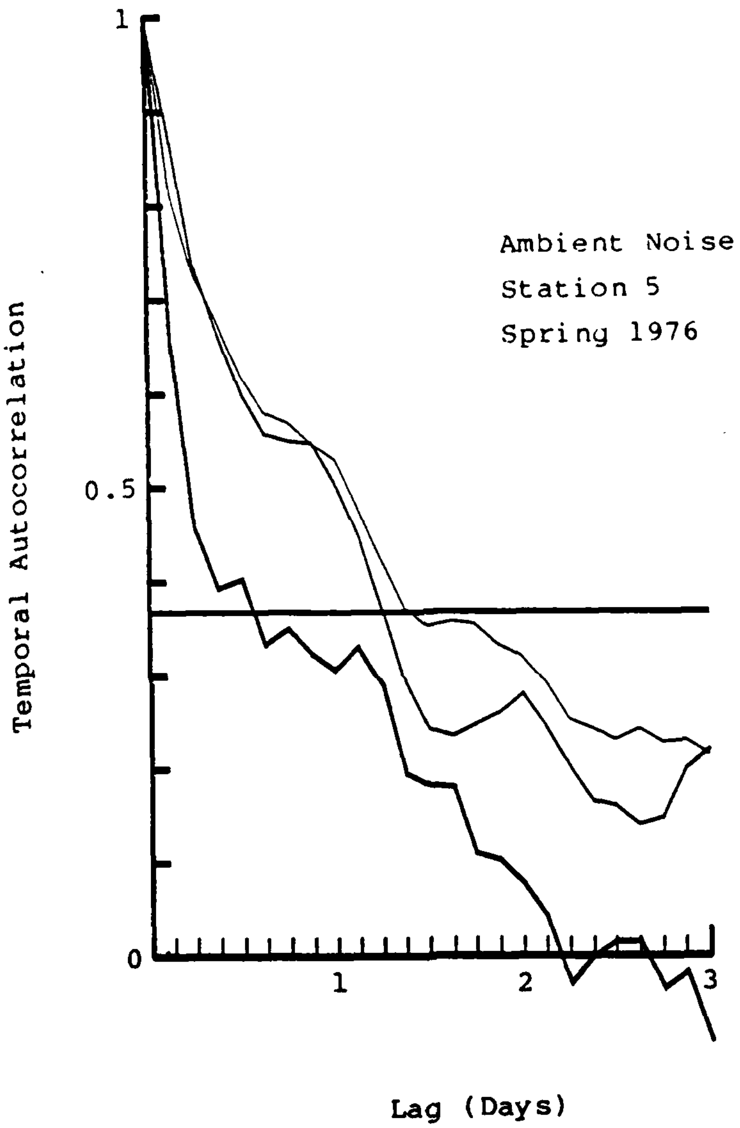

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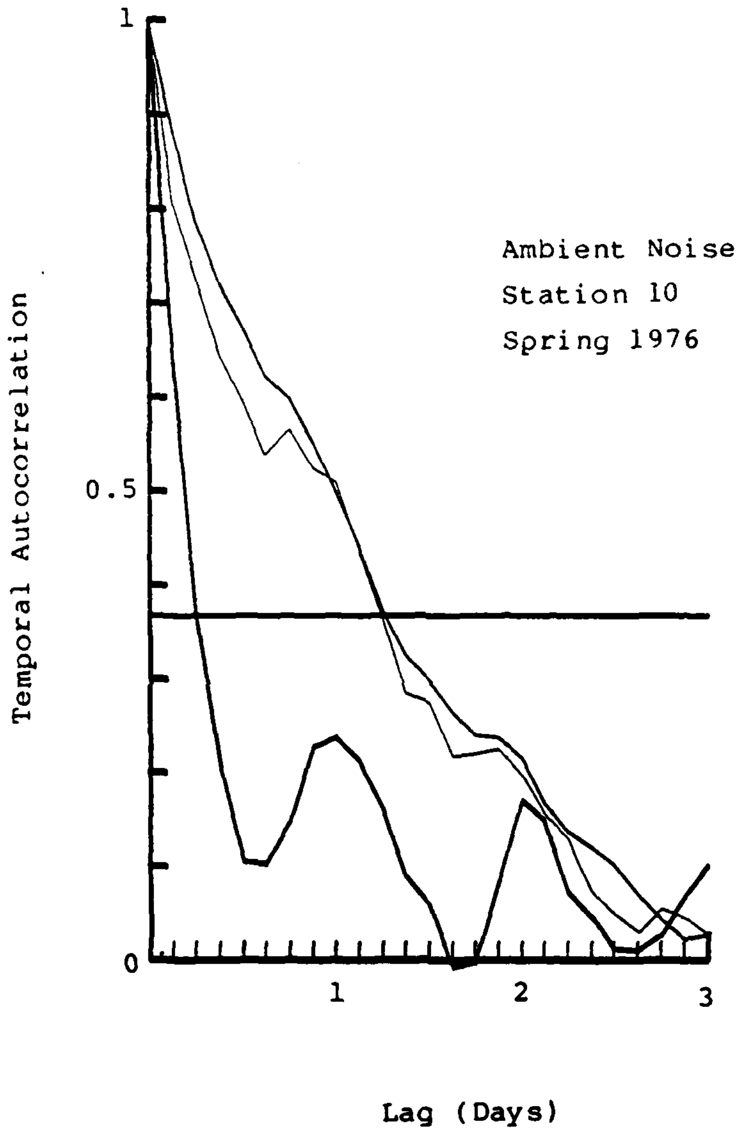

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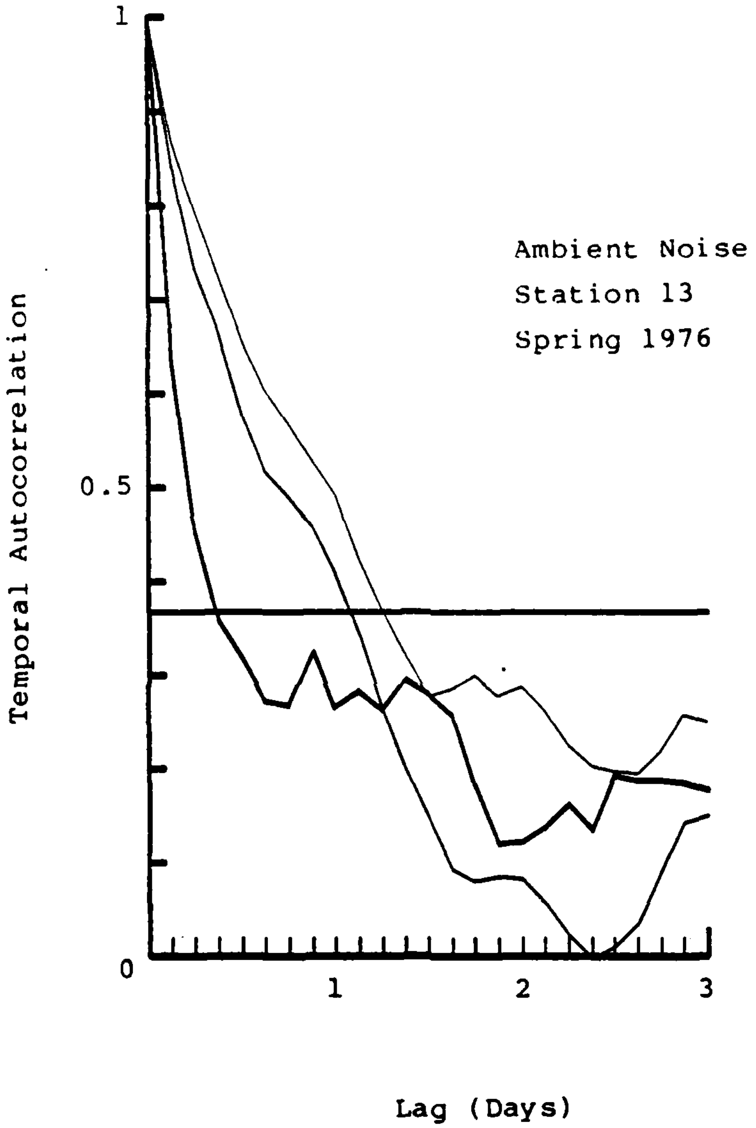

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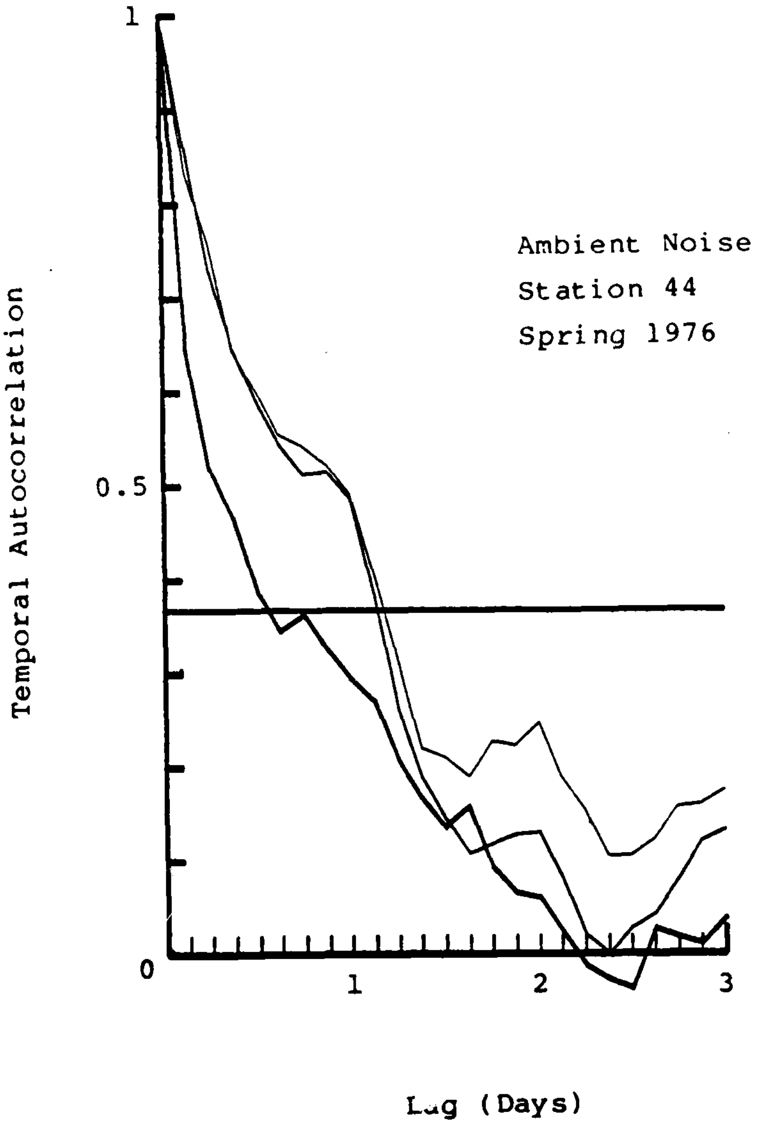

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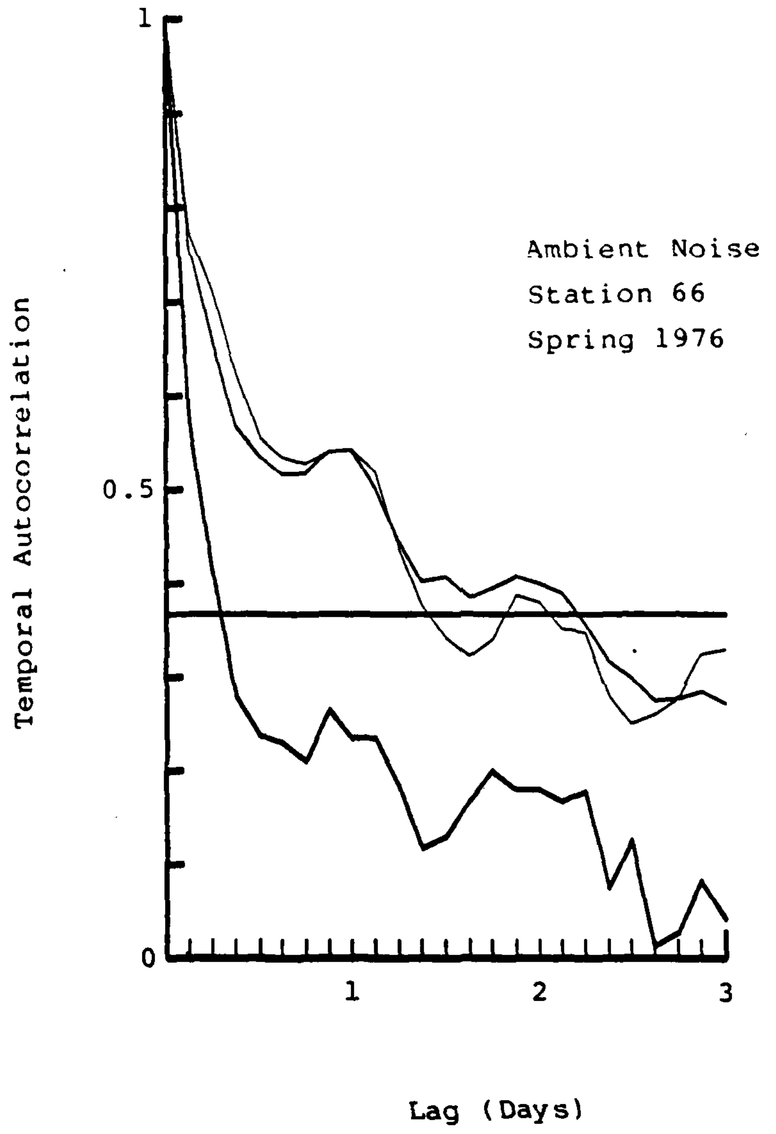

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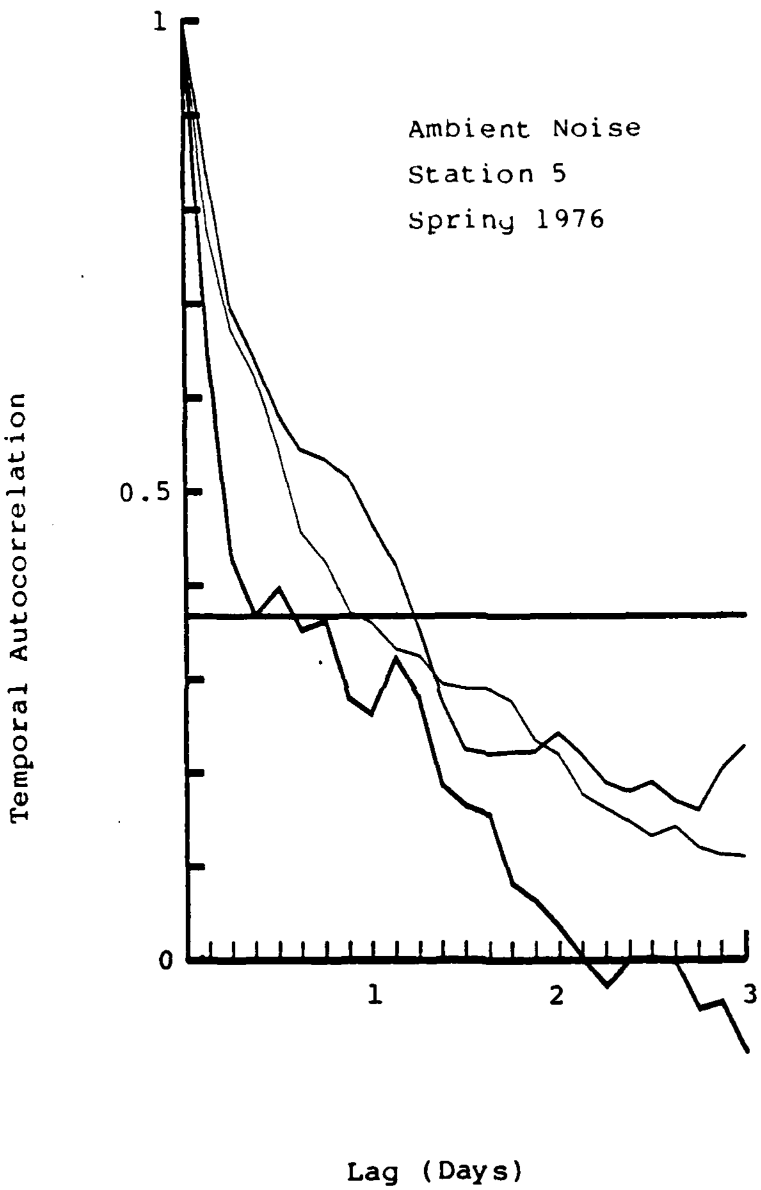

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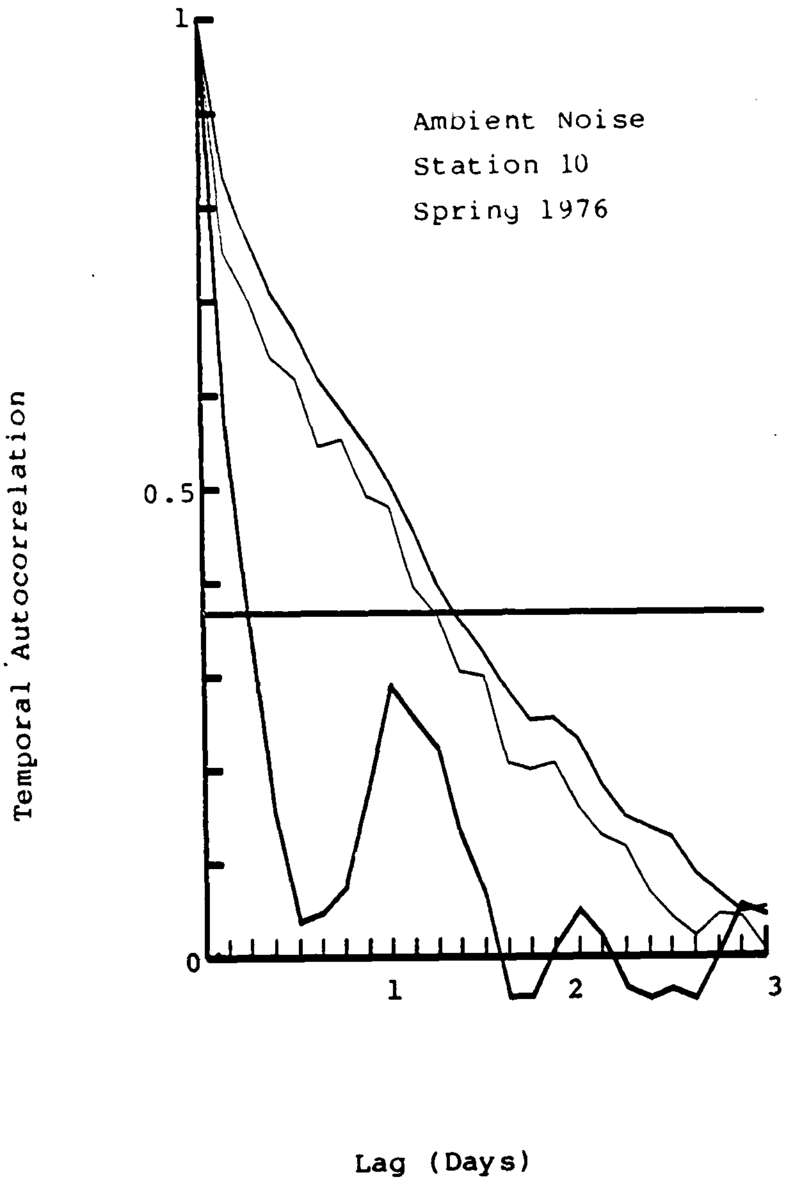

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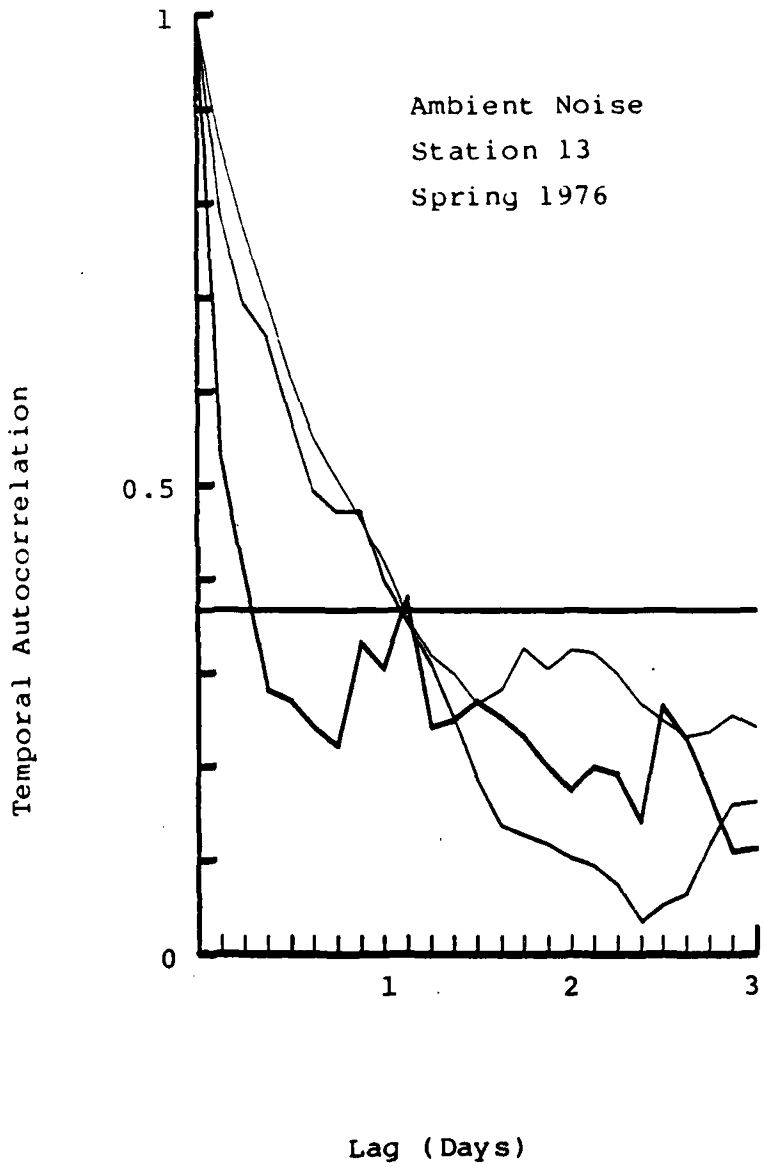

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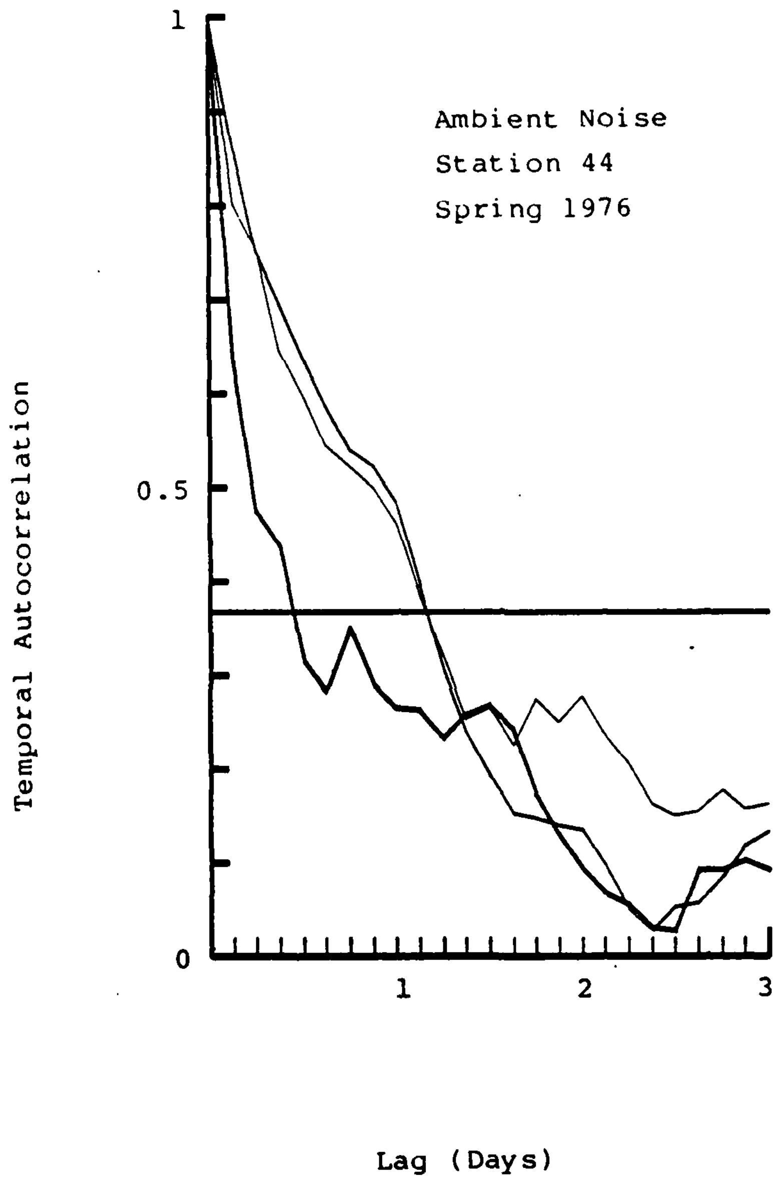

Fig. G.43. Ambient noise autocorrelations, Station 44, based on spring AIDJEX noise data (pressure amplitude): 10 Hz (lightest line), 32 Hz (darker line), and 1000 Hz (darkest line).

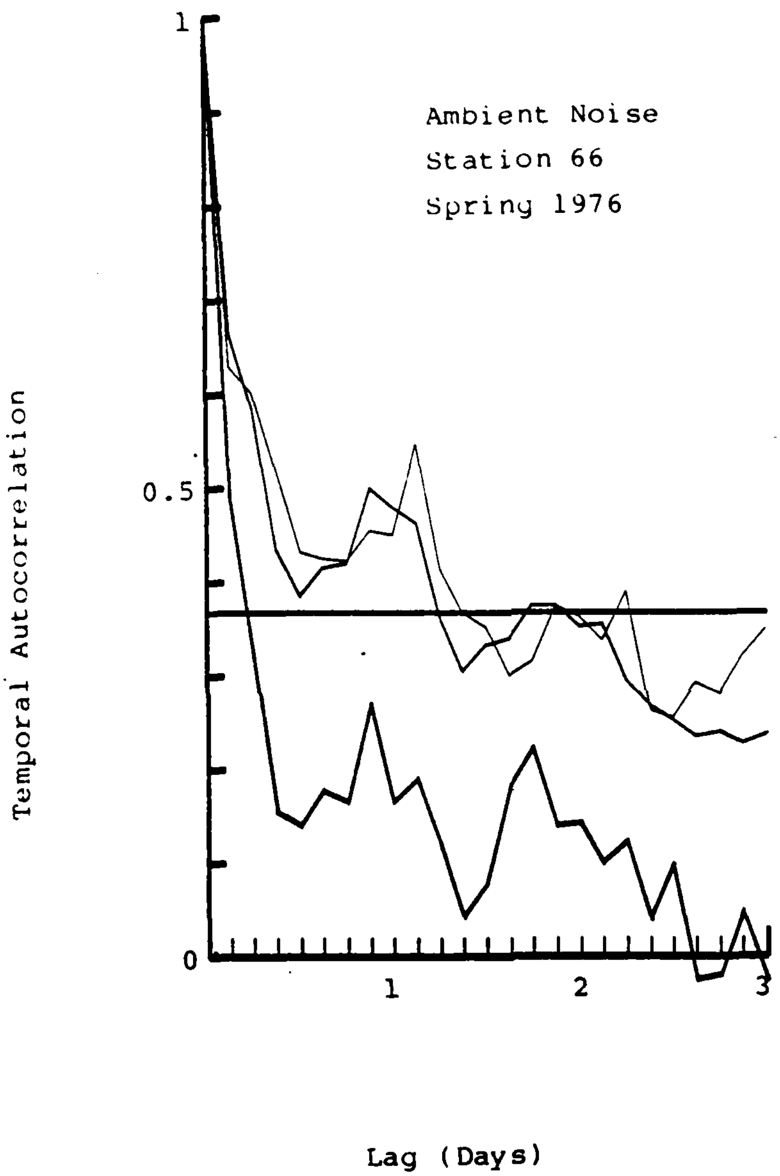

Fig. G.44. Ambient noise autocorrelations, Station 66, based on spring AIDJEX noise data (pressure amplitude): 10 Hz (lightest line), 32 Hz (darker line), and 1000 Hz (darkest line).

Appendix H

Seasonal Arctic Ambient Noise Spatial Autocorrelations, Beaufort Sea, 1975-1976

This appendix depicts graphically Arctic ambient noise spatial correlations using the AIDJEX 10 Hz, 32 Hz, and 1000 Hz noise data. One month of noise data from all stations were used in the calculations, each station correlated with all the others. Spatial autocorrelations were calculated for each season:

Summer - noise data from August 1975,
Fall - noise data from November 1975,
Winter - noise data from February 1976, and
Spring - noise data from May 1976.

As in the temporal autocorrelations, the results in this appendix are given for the data in decibells and in pressure amplitudes.

Since the correlation between any two stations covers a monthly period, the distance between the two stations is not constant. This variation in distance is represented in the correlation plot by a horizontal line, the projection of which onto the x axis (distance) represents the maximum difference in the separations of the two stations during the month:

Maximum Variation in Station Separation =
Maximum Distance Between Stations -
Minimum Distance Between Stations.

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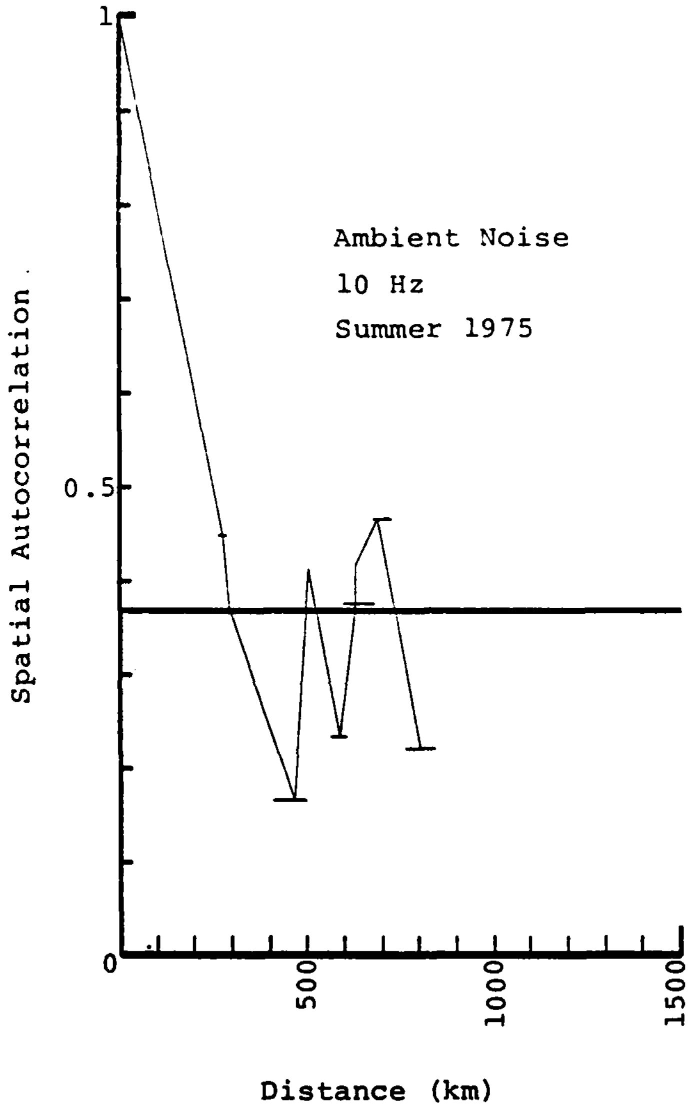

Fig. H.1. Spatial autocorrelations, 10 Hz (dB), based on the AIDJEX noise data.

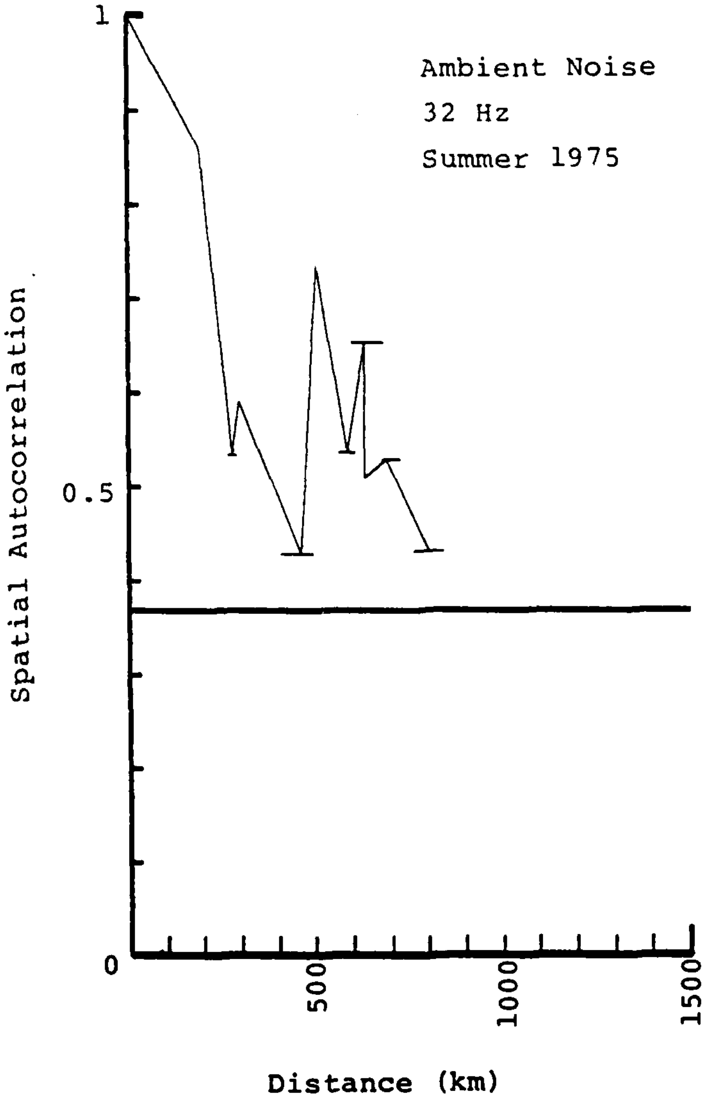

Fig. H.2. Spatial autocorrelations, 32 Hz (dB), based on the AIDJEX noise data.

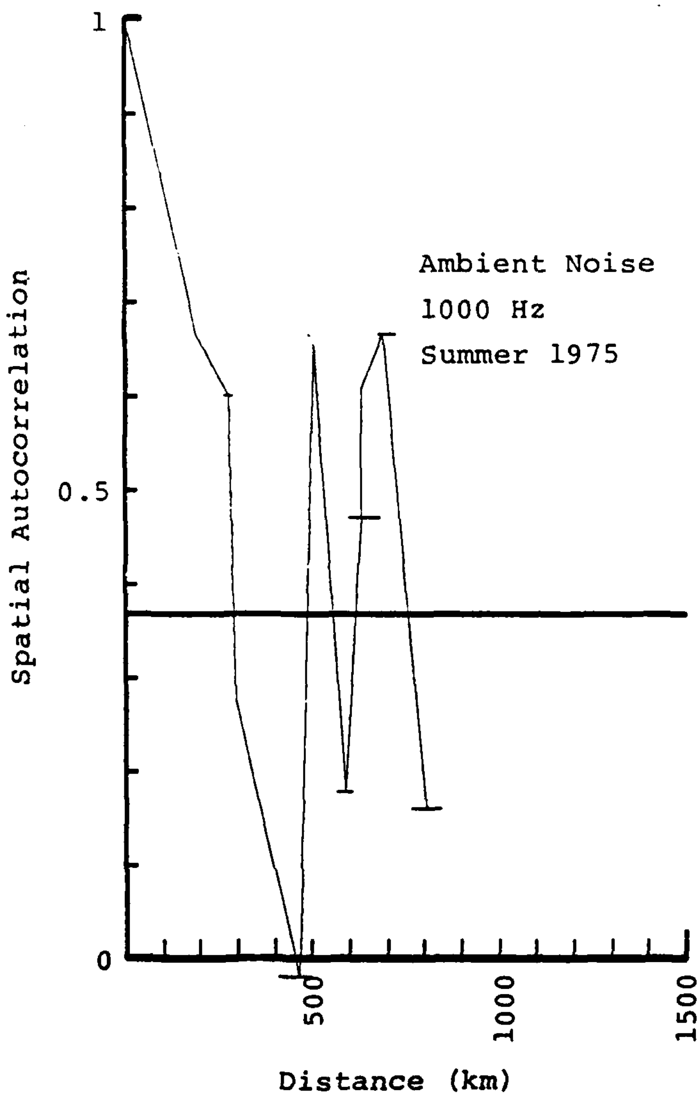

Fig. H.3. Spatial autocorrelations, 1000 Hz (dB), based on the AIDJEX noise data.

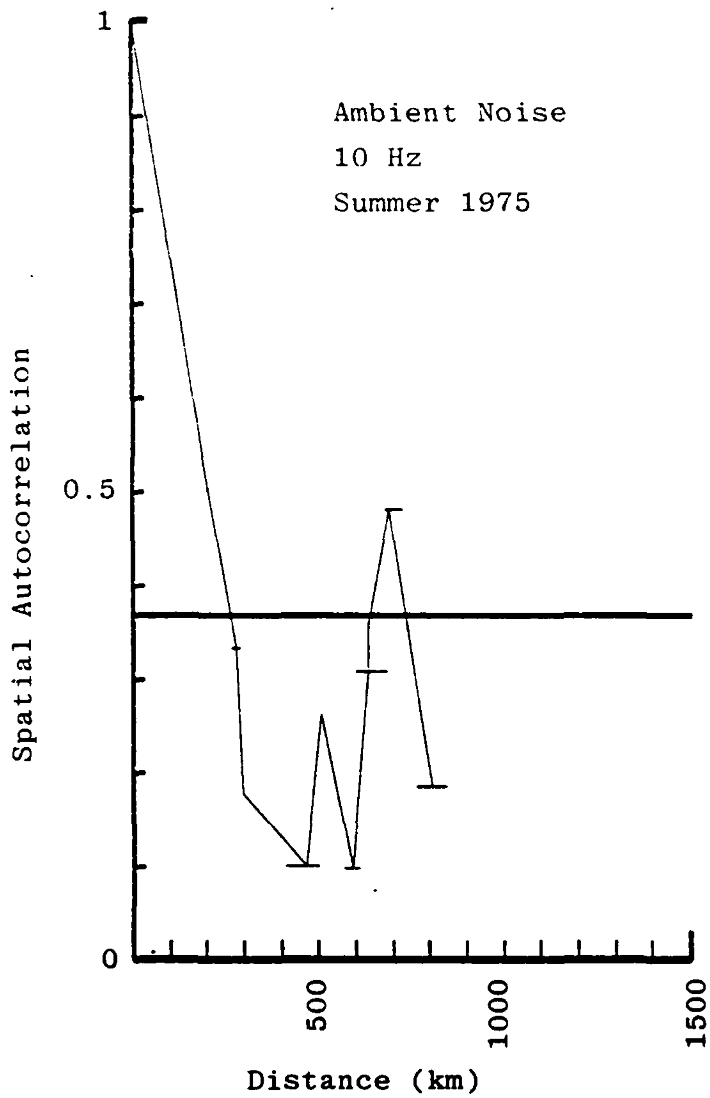

Fig. H.4. Spatial autocorrelations, 10 Hz (pressure amplitude), based on the AIDJEX noise data.

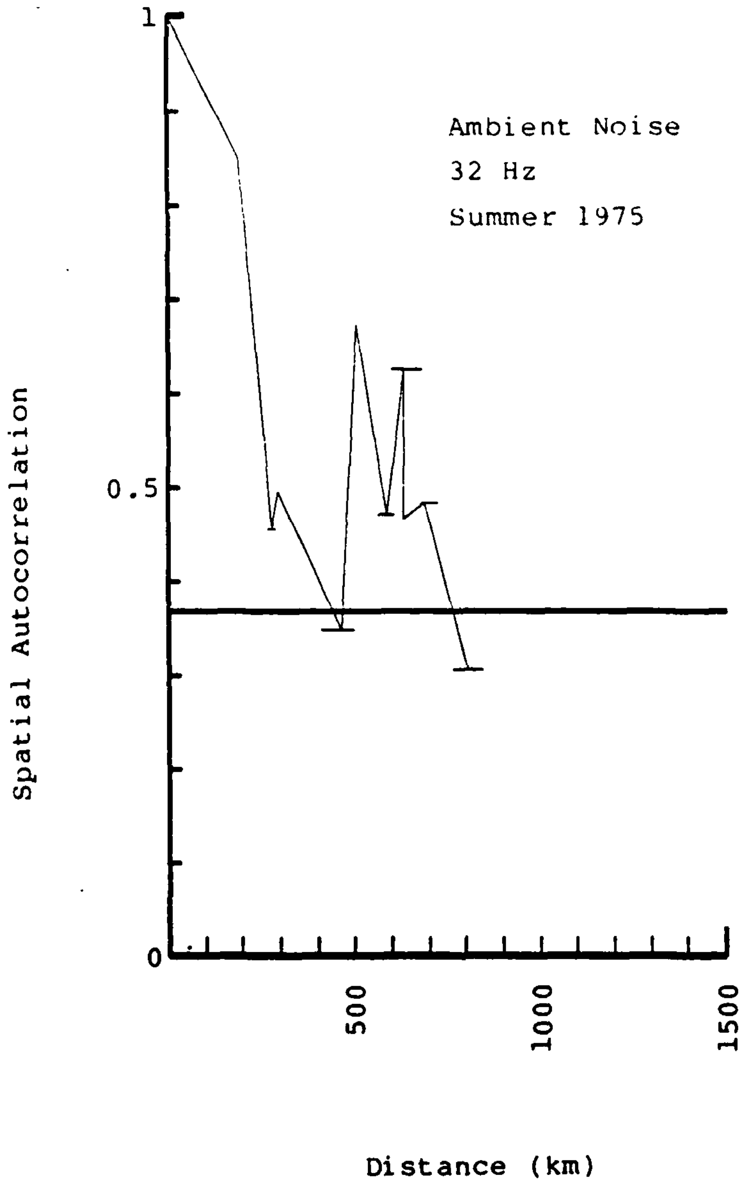

Fig. H.5. Spatial autocorrelations, 32 Hz (pressure amplitude), based on the AIDJEX noise data.

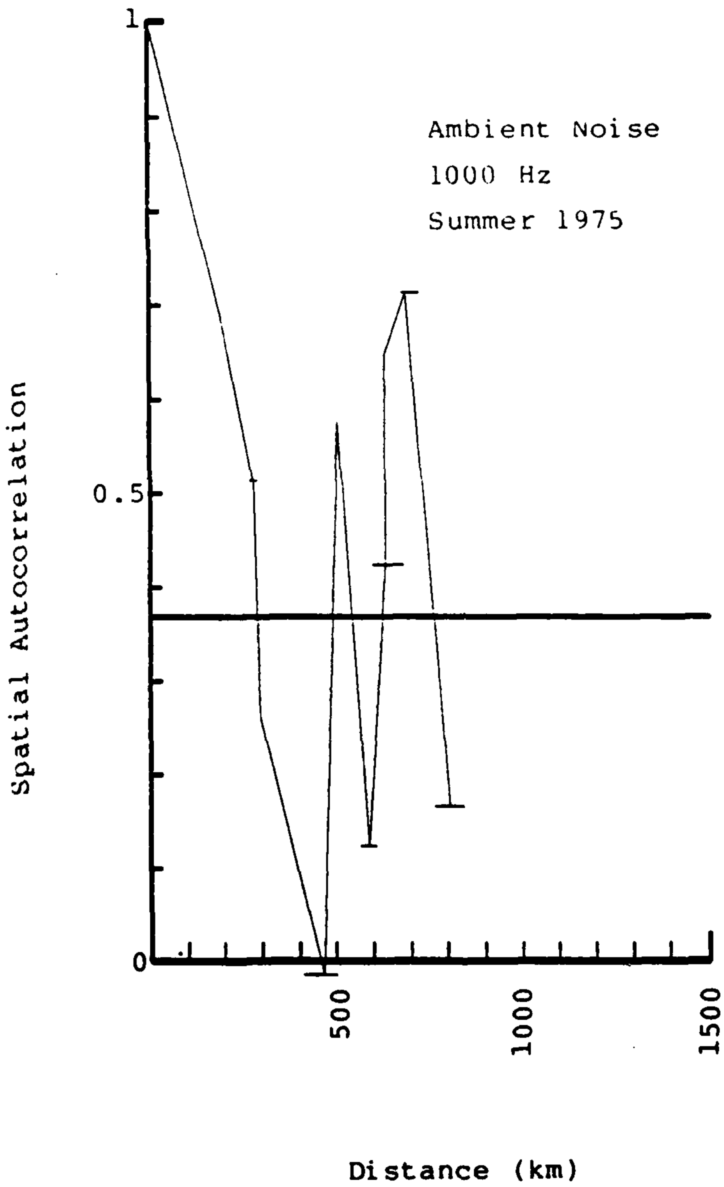

Fig. H.6. Spatial autocorrelations, 1000 Hz (pressure amplitude), based on the AIDJEX noise data.

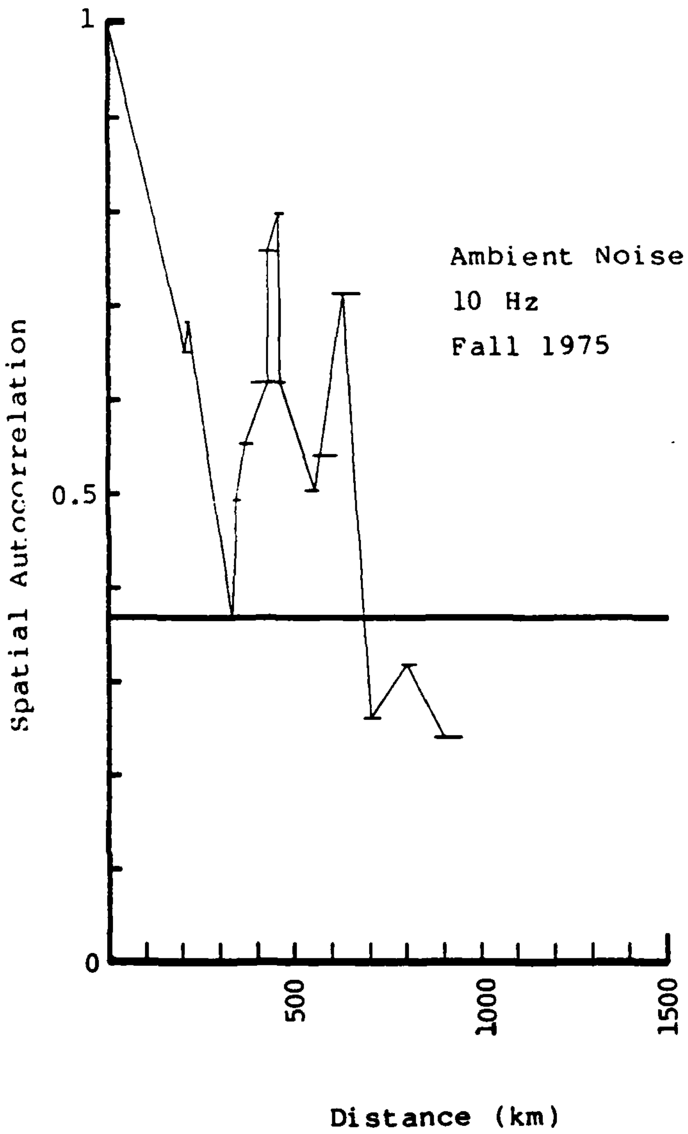

Fig. H.7. Spatial autocorrelations, 10 Hz (dB), based on the AIDJEX noise data.

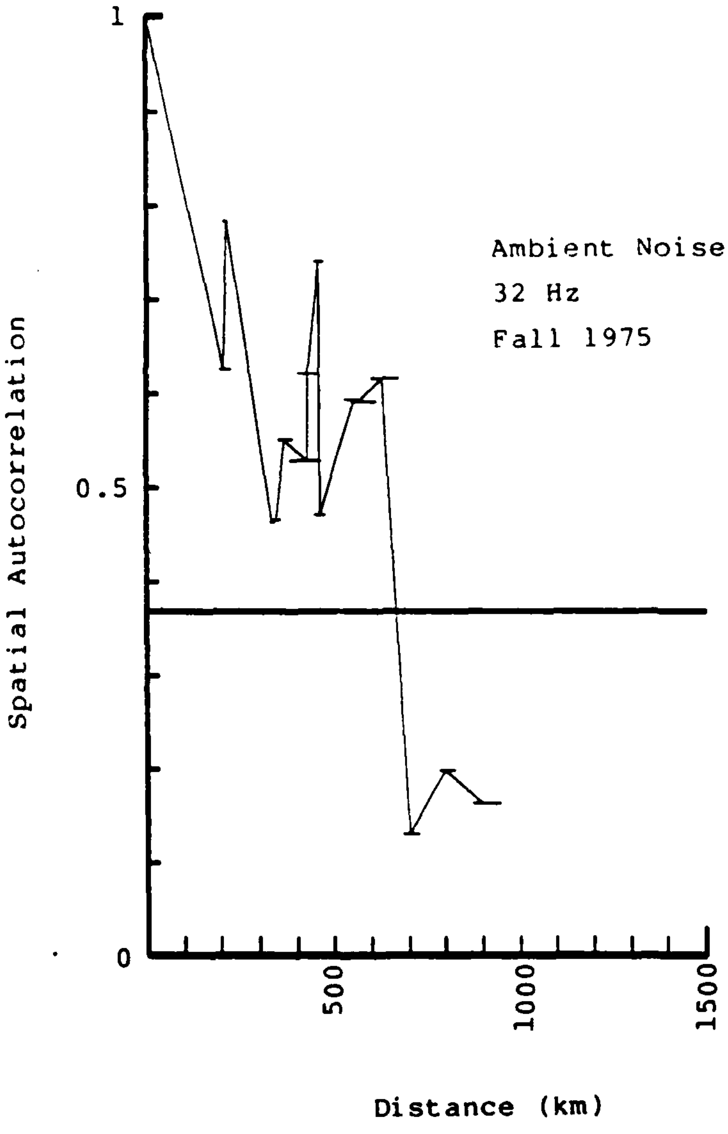

Fig. H.8. Spatial autocorrelations, 32 Hz (dB), based on the AIDJEX noise data.

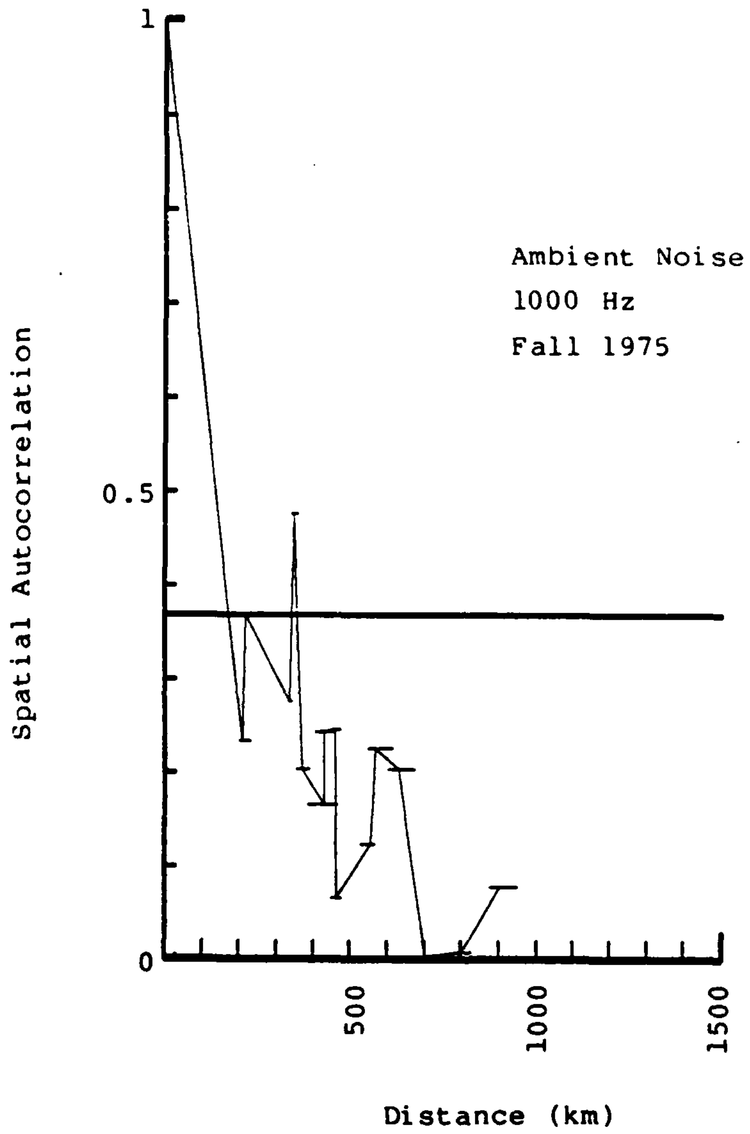

Fig. H.9. Spatial autocorrelations, 1000 Hz (dB), based on the AIDJEX noise data.

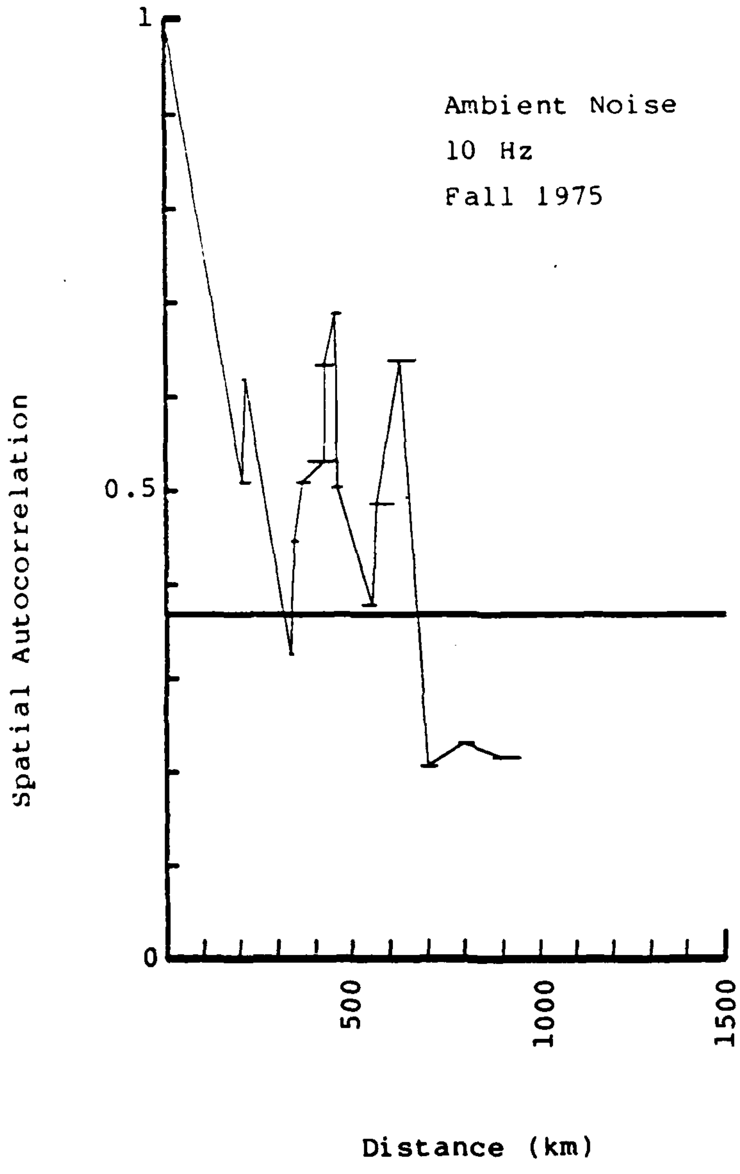

Fig. H.10. Spatial autocorrelations, 10 Hz (pressure amplitude), based on the AIDJEX noise data.

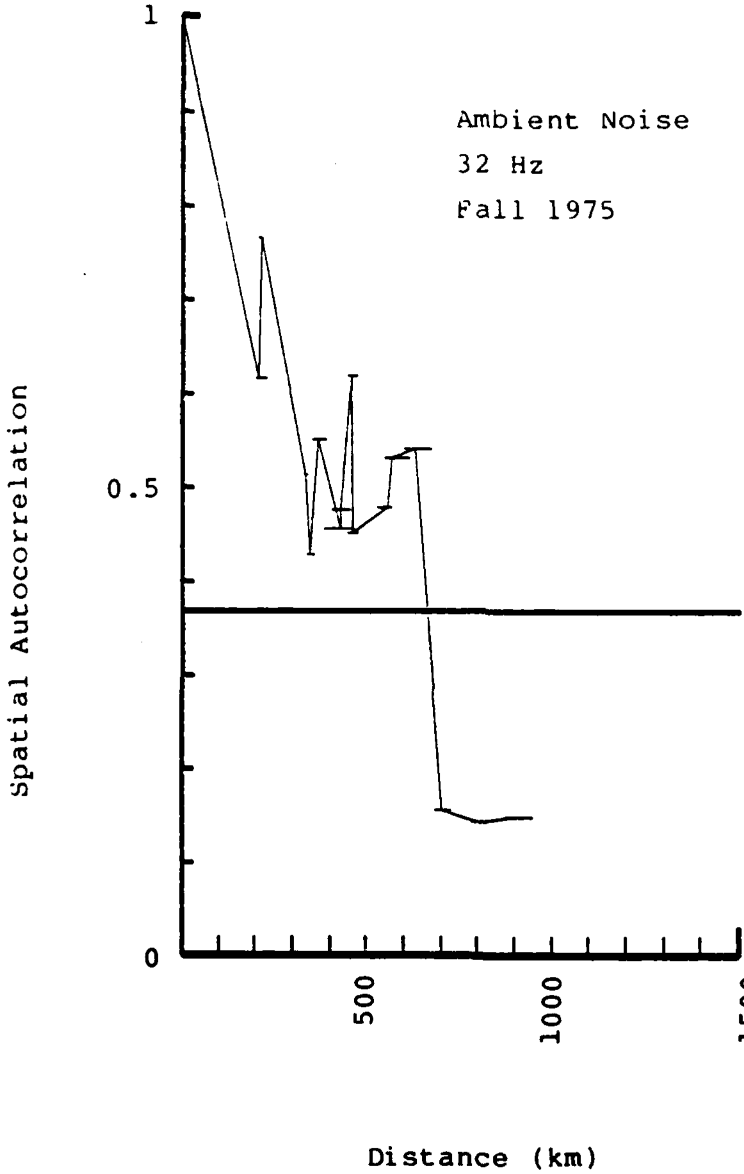

Fig. H.11. Spatial autocorrelations, 32 Hz (pressure amplitude), based on the AIDJEX noise data.

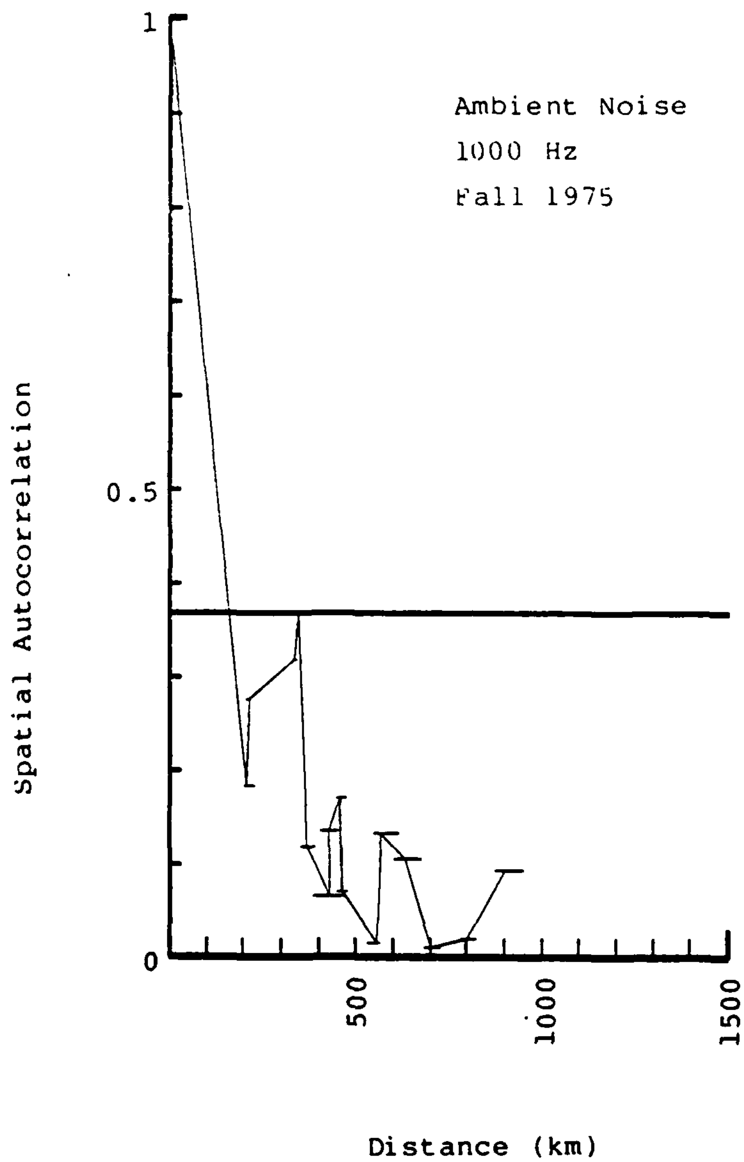

Fig. H.12. Spatial autocorrelations, 1000 Hz (pressure amplitude), based on the AIDJEX noise data.

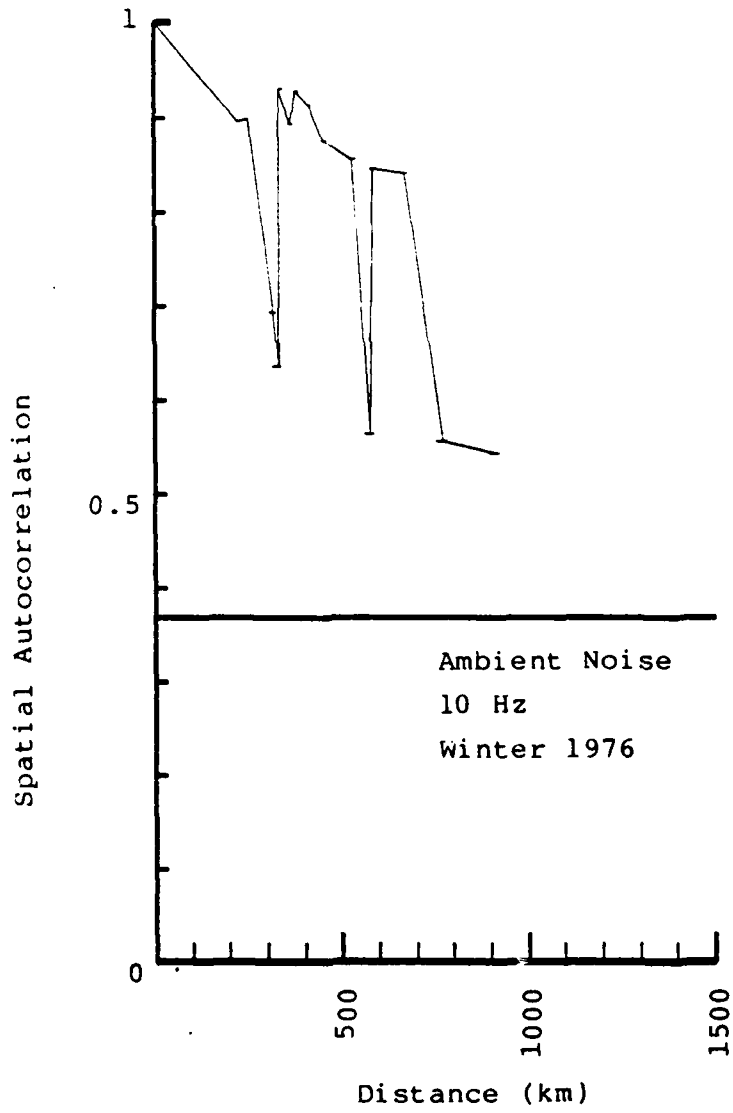

Fig. H.13. Spatial autocorrelations, 10 Hz (dB), based on the AIDJEX noise data.

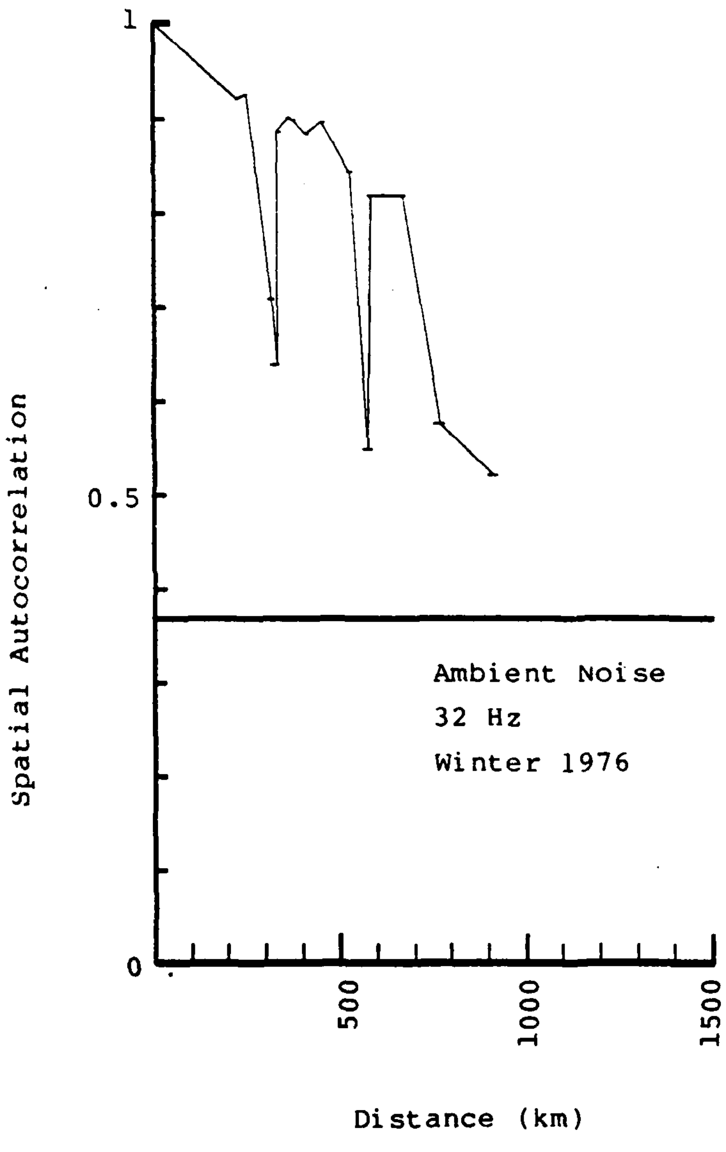

Fig. H.14. Spatial autocorrelations, 32 Hz (dB), based on the AIDJEX noise data.

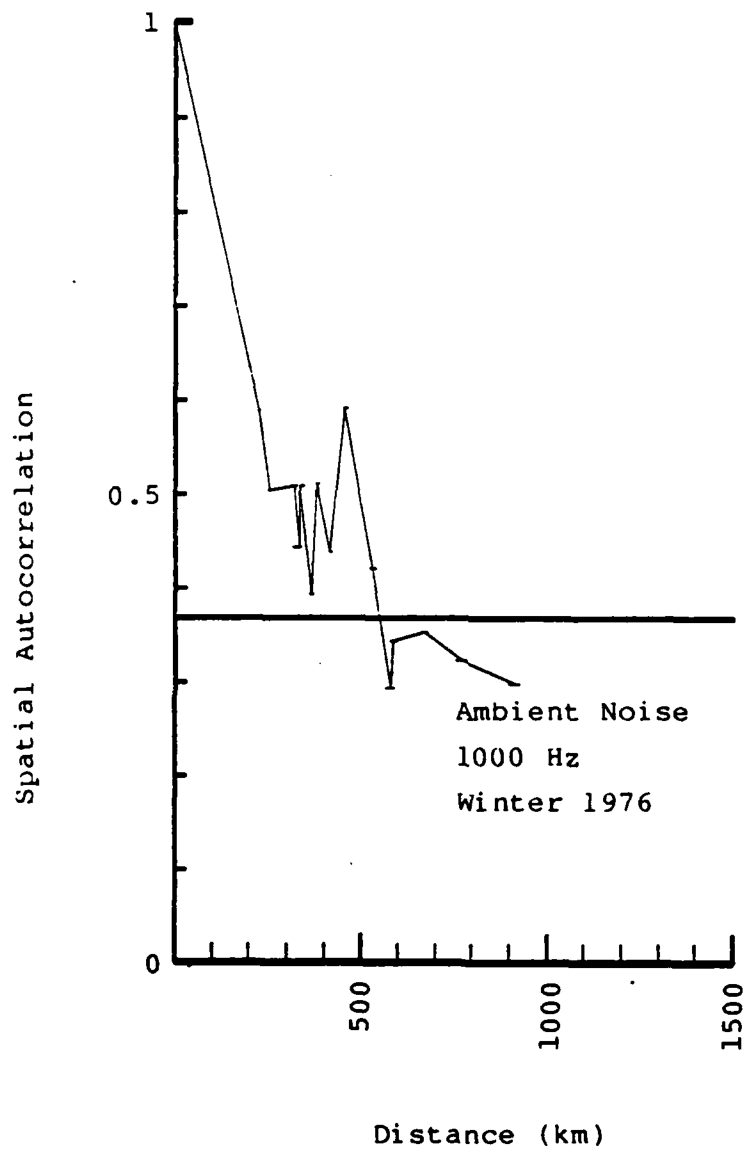

Fig. H.15. Spatial autocorrelations, 1000 Hz (dB), based on the AIDJEX noise data.

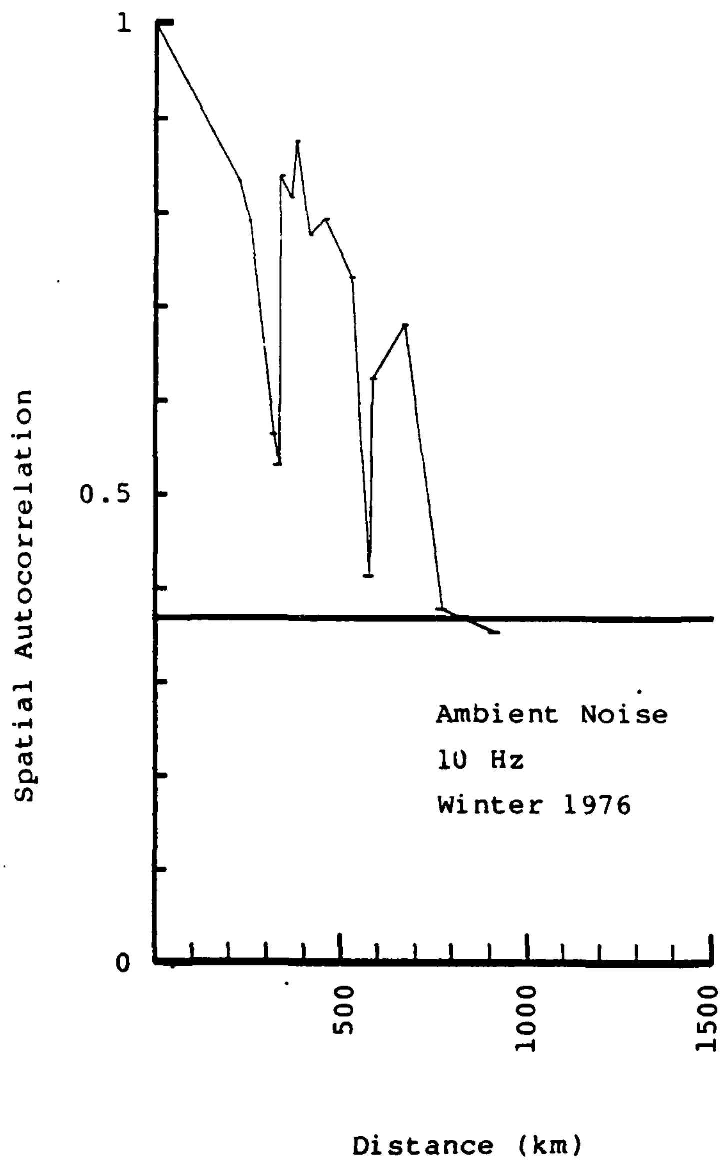

Fig. H.16. Spatial autocorrelations, 10 Hz (pressure amplitude), based on the AIDJEX noise data.

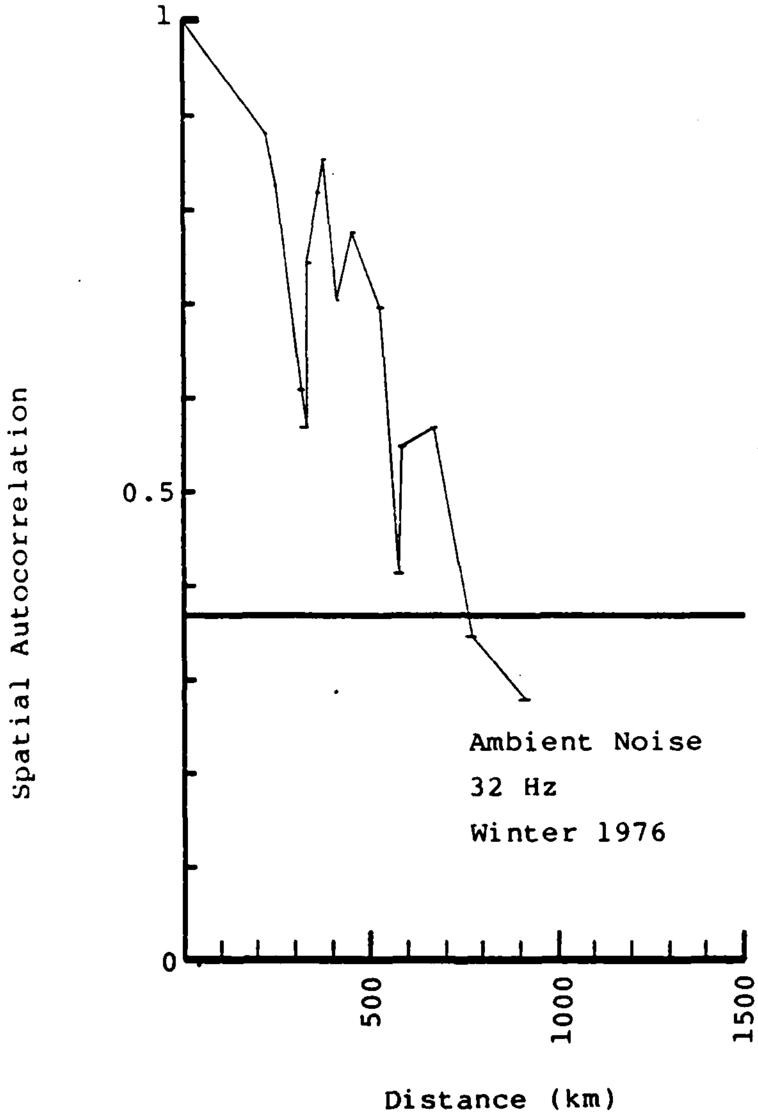

Fig. H.17. Spatial autocorrelations, 32 Hz (pressure amplitude), based on the AIDJEX noise data.

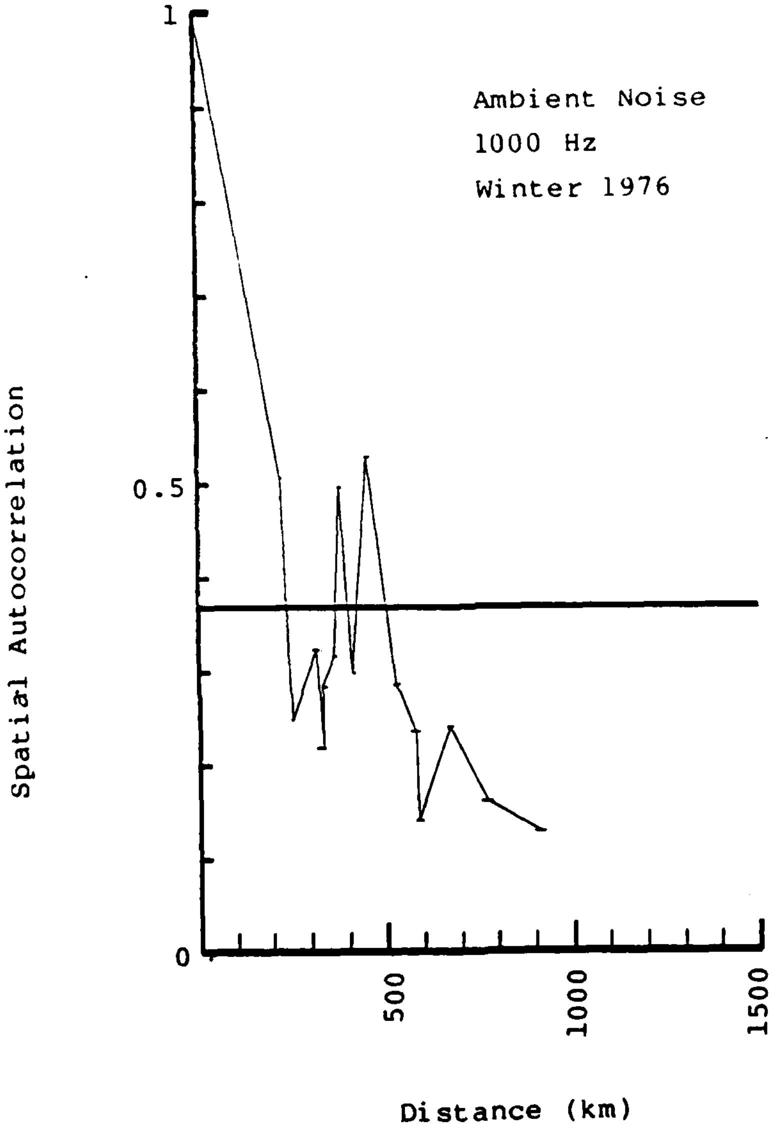

Fig. H.18. Spatial autocorrelations, 1000 Hz (pressure amplitude), based on the AIDJEX noise data.

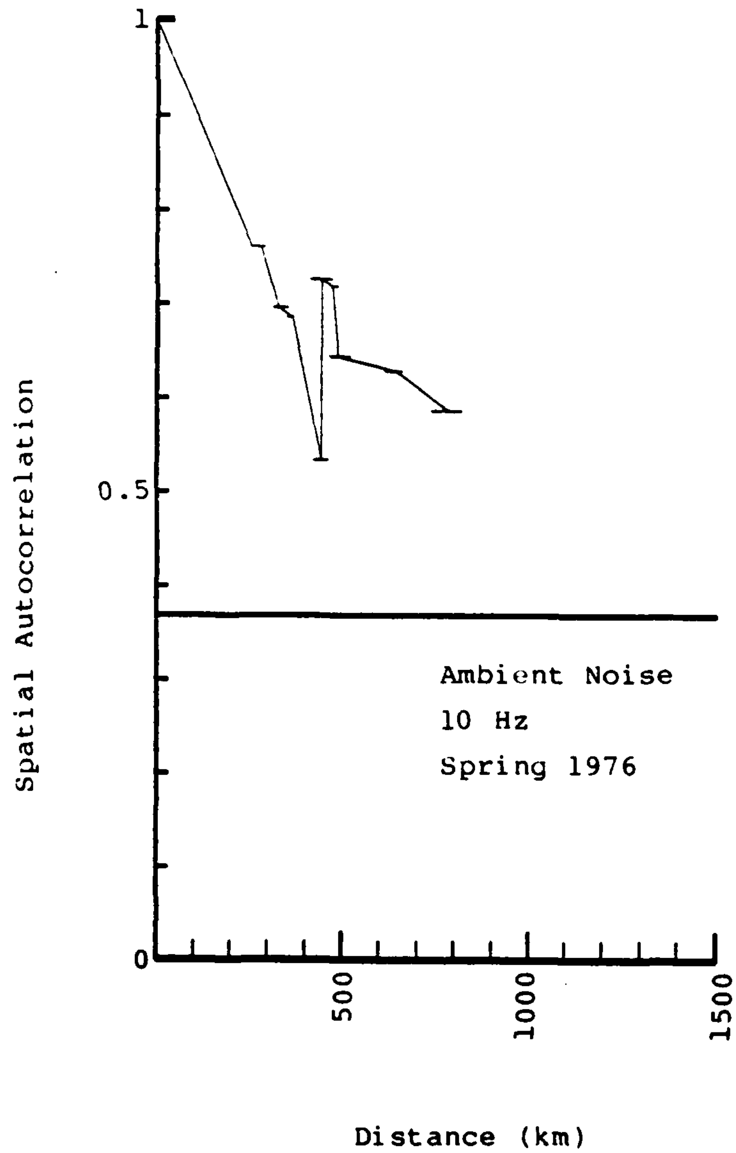

Fig. H.19. Spatial autocorrelations, 10 Hz (dB), based on the AIDJEX noise data.

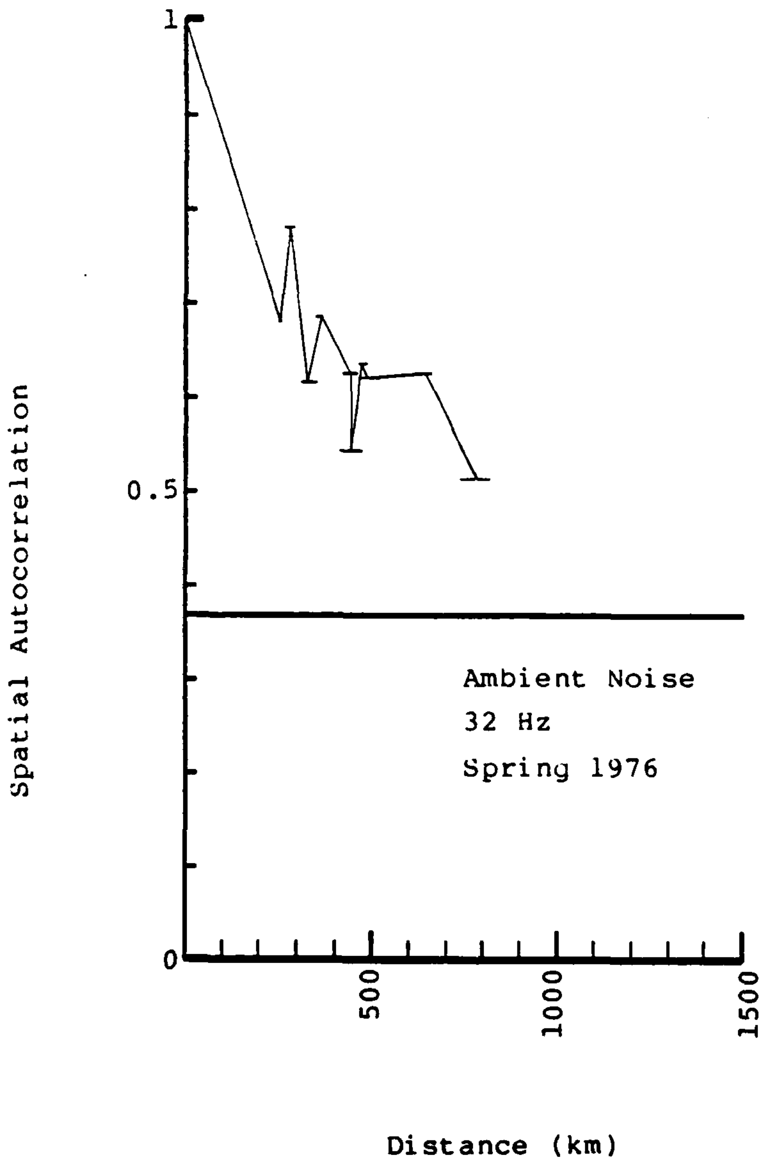

Fig. H.20. Spatial autocorrelations, 32 Hz (dB), based on the AIDJEX noise data.

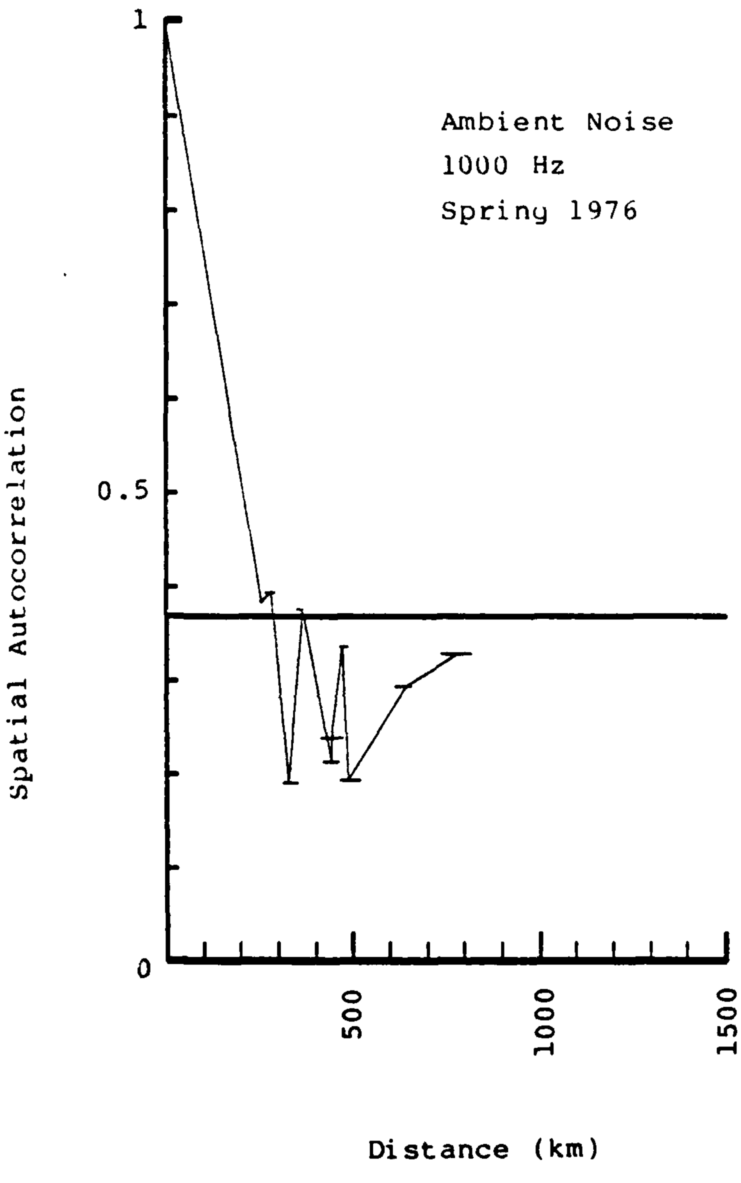

Fig. H.21. Spatial autocorrelations, 1000 Hz (dB), based on the AIDJEX noise data.

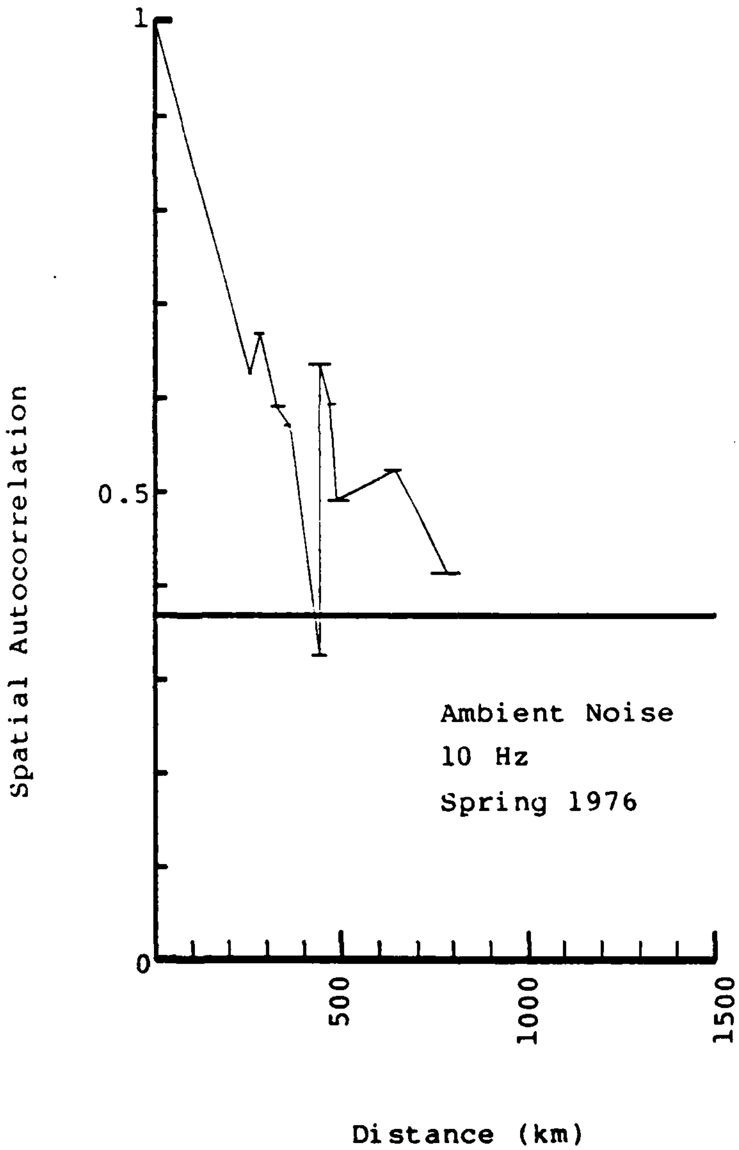

Fig. H.22. Spatial autocorrelations, 10 Hz (pressure amplitude), based on the AIDJEX noise data.

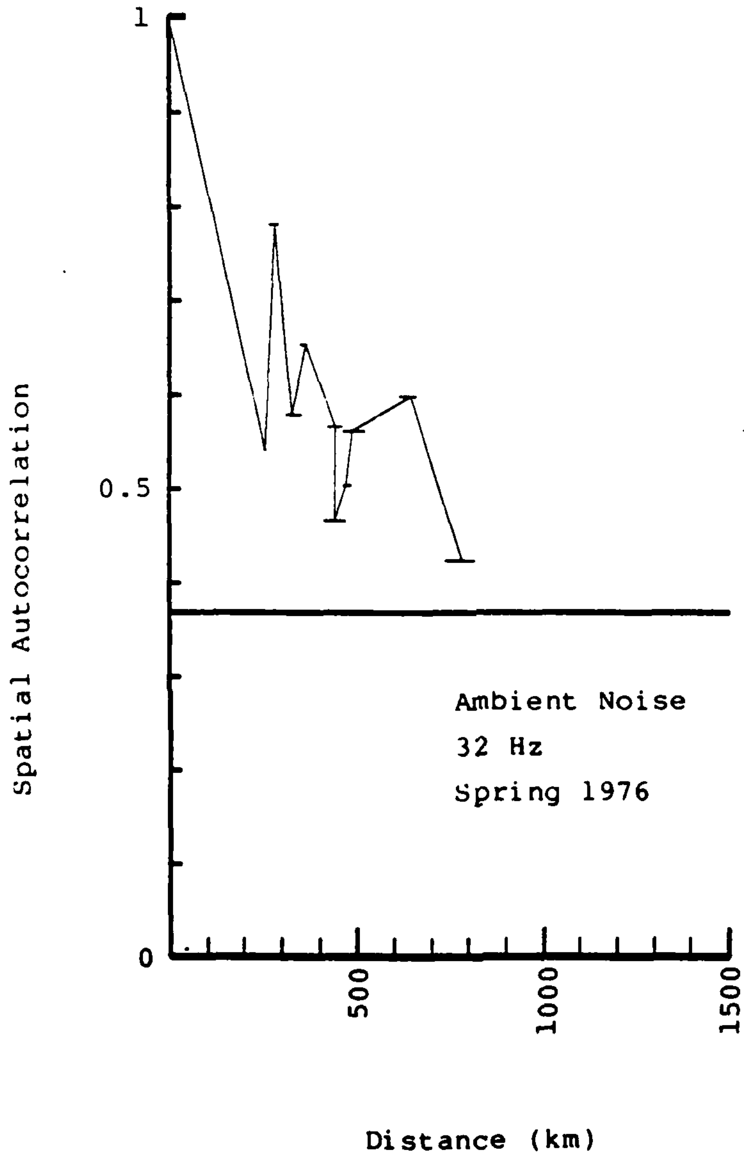

Fig. H.23. Spatial autocorrelations, 32 Hz (pressure amplitude), based on the AIDJEX noise data.

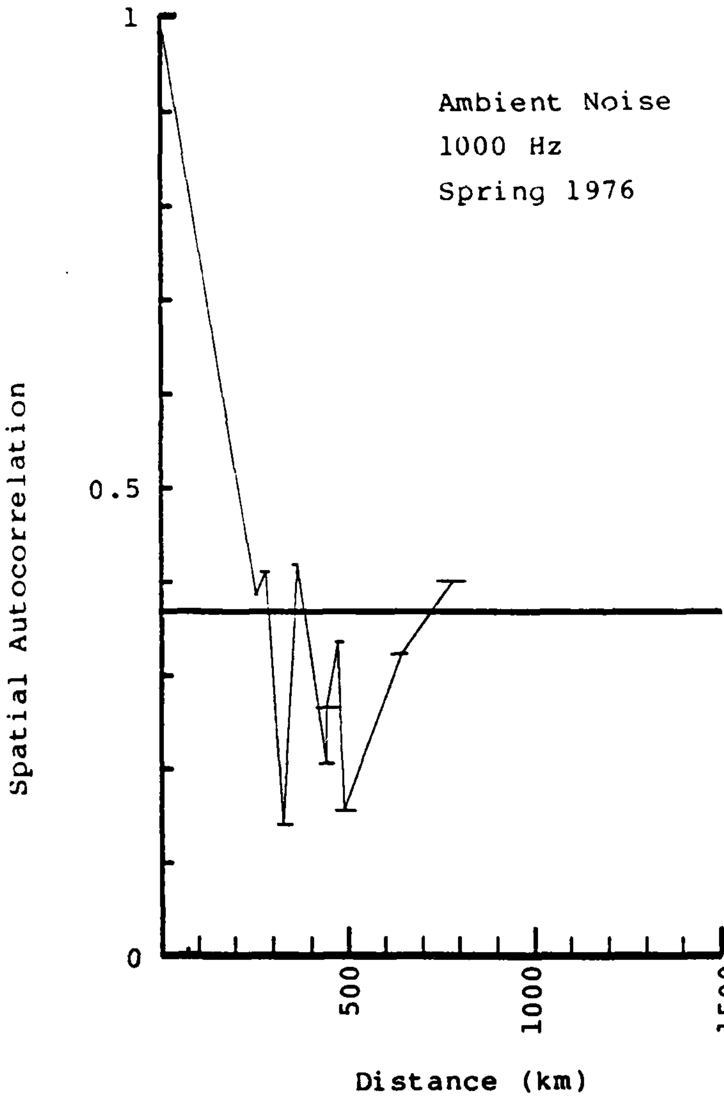

Fig. H.24. Spatial autocorrelations, 1000 Hz (pressure amplitude), based on the AIDJEX noise data.

Appendix I

Seasonal Arctic Ambient Noise Power Spectra, Beaufort Sea, 1975-1976

This appendix shows the power spectra plots of the AIDJEX 10 Hz, 32 Hz, and 1000 Hz ambient noise signals collected at Station 10 (southern part of the Beaufort Sea). We present only the Station 10 results due to the close proximity of that station to the AIDJEX manned camp array throughout the experiment and since much of the spectral information for the other stations is contained in the temporal autocorrelation calculations (Appendix G).

One month of data was used in the spectral density calculations, and each season is represented:

Summer - noise data from August 1975,
Fall - noise data from November 1975,
Winter - noise data from February 1976, and
Spring - noise data from May 1976.

The power spectra were calculated for both pressure amplitude (relative to 1 Pa) and decibell units.

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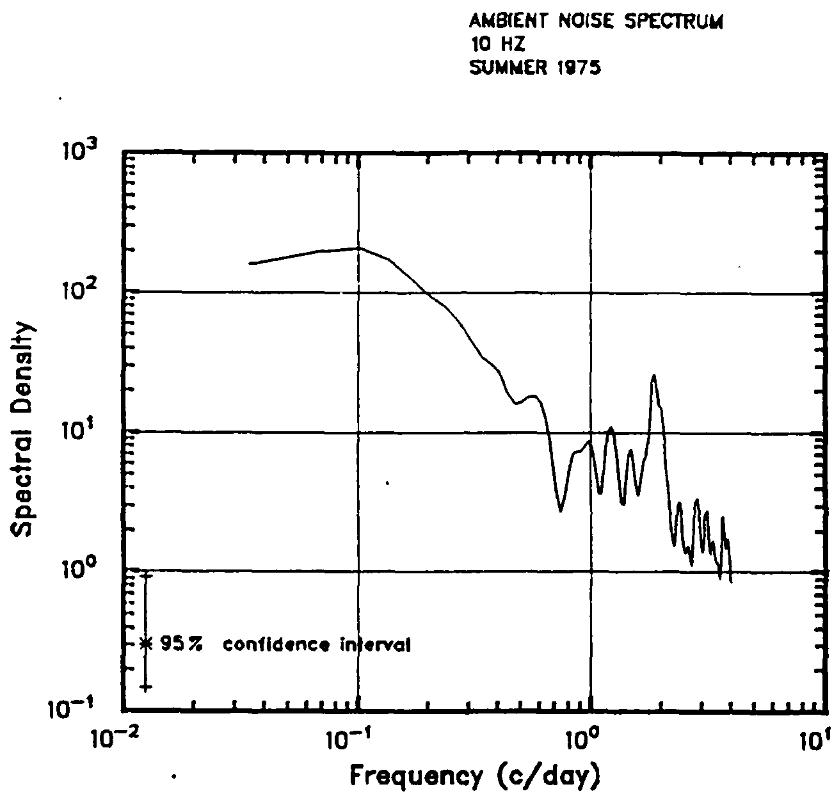

Fig. I.1. Spectral density of the 10 Hz ambient noise signal based on the AIDJEX noise data (dB) from Station 10, August 1975.

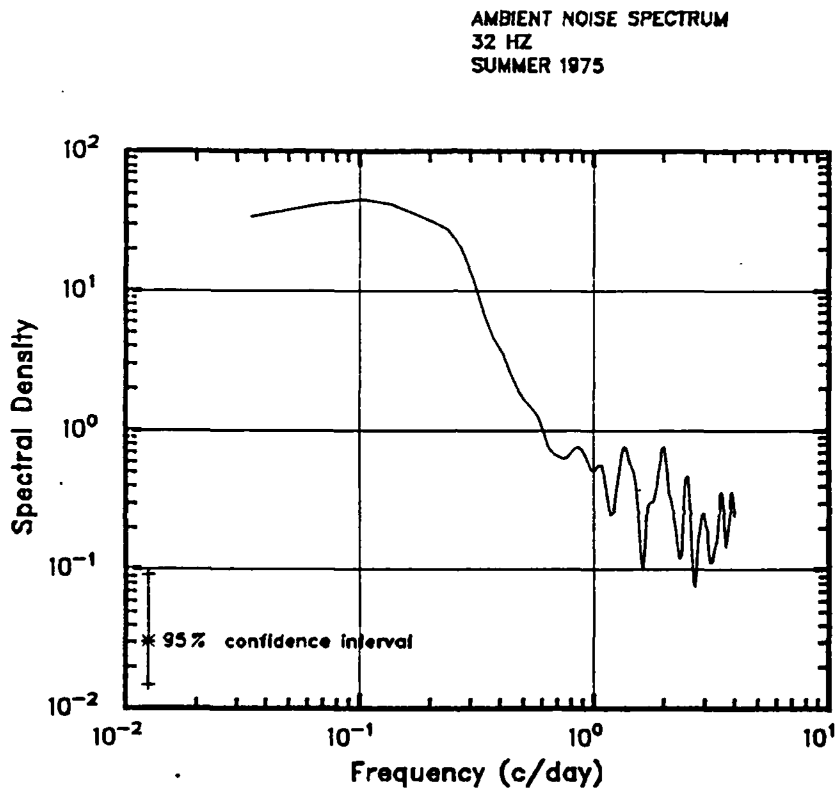

Fig. I.2. Spectral density of the 32 Hz ambient noise signal based on the AIDJEX noise data (dB) from Station 10, August 1975.

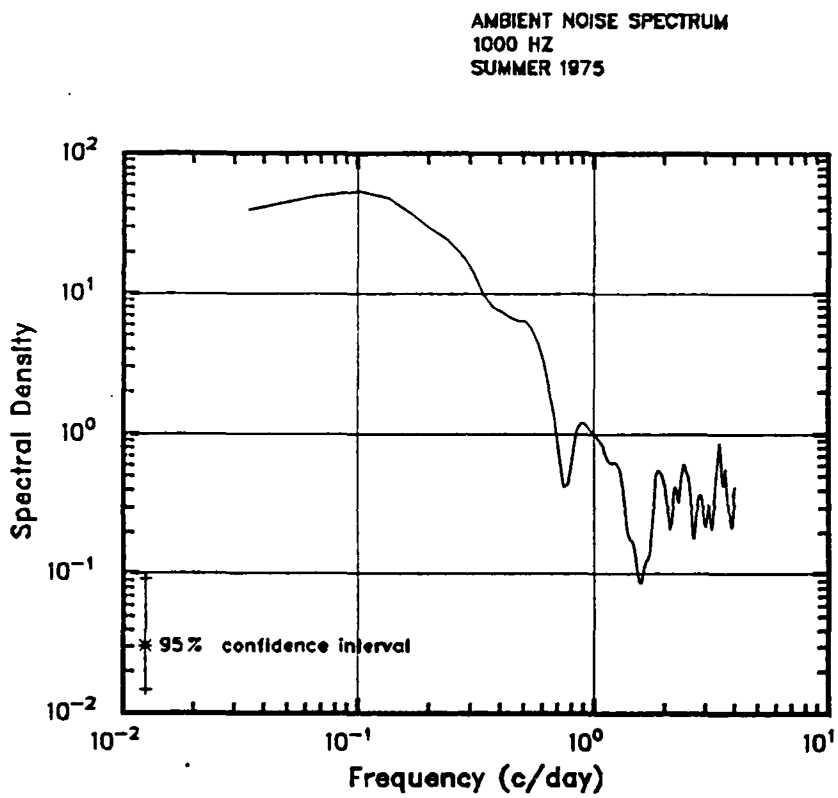

Fig. I.3. Spectral density of the 1000 Hz ambient noise signal based on the AIDJEX noise data (dB) from Station 10, August 1975.

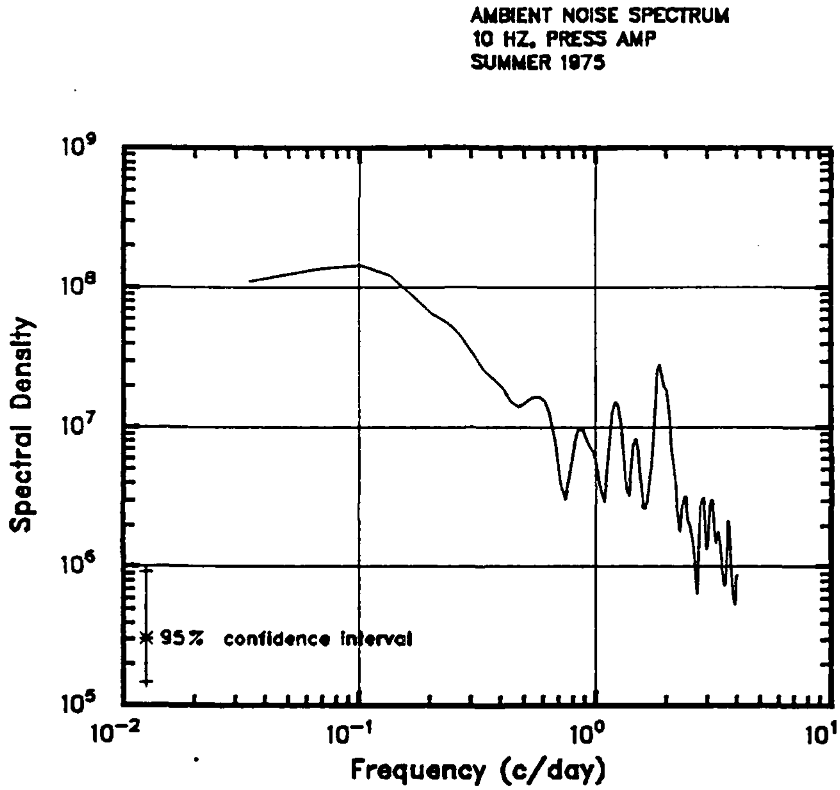

Fig. I.4. Spectral density of the 10 Hz ambient noise data (pressure amplitude) from Station 10, August 1975.

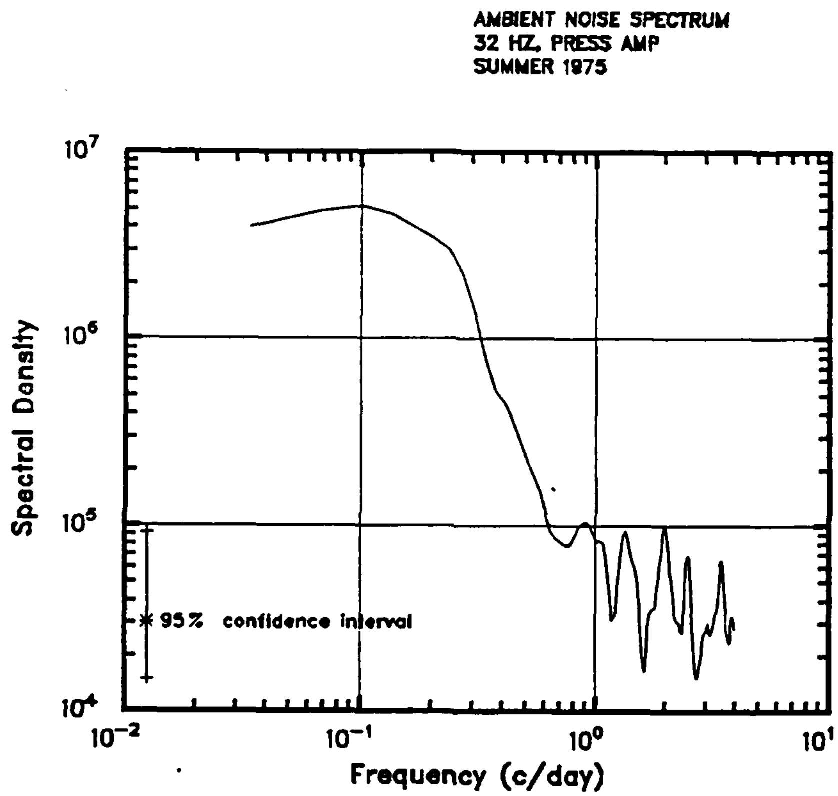

Fig. I.5. Spectral density of the 32 Hz ambient noise data (pressure amplitude) from Station 10, August 1975.

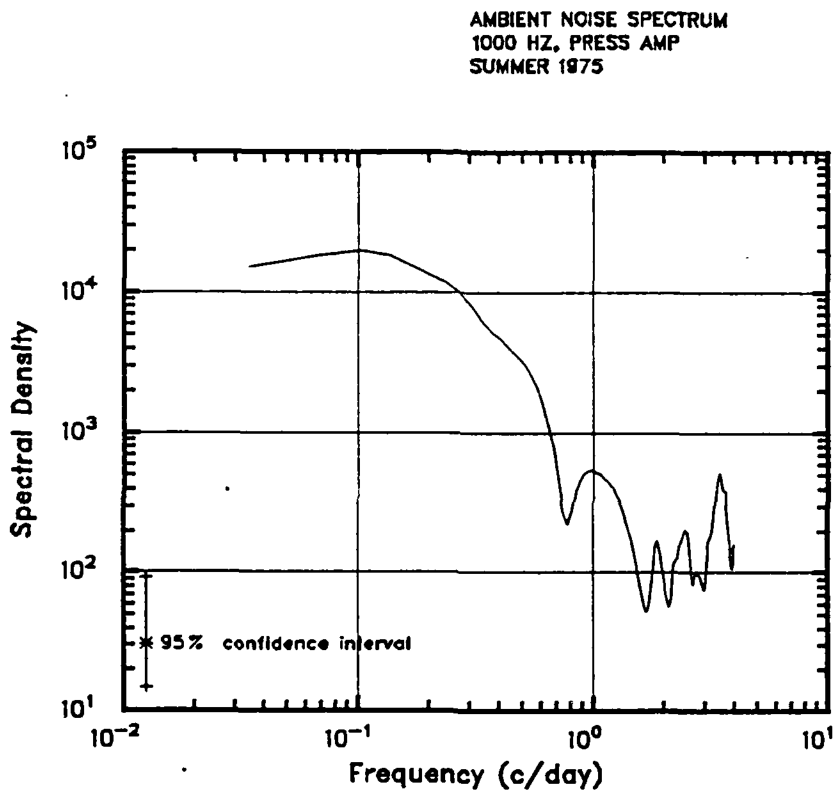

Fig. I.6. Spectral density of the 1000 Hz ambient noise data (pressure amplitude) from Station 10, August 1975.

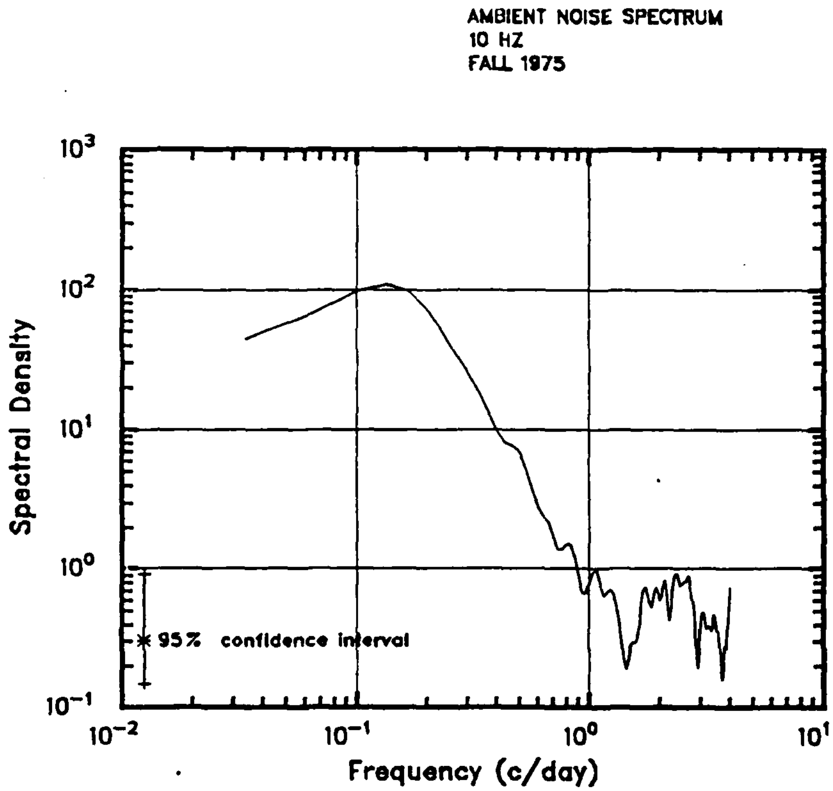

Fig. I.7. Spectral density of the 10 Hz ambient noise data (dB) from Station 10, November 1975.

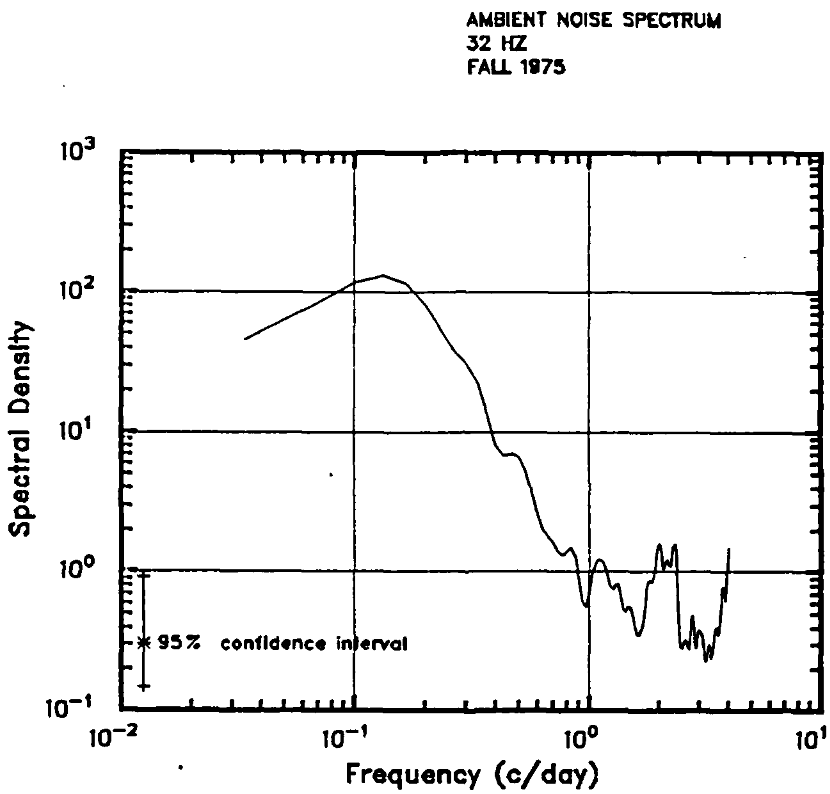

Fig. I.8. Spectral density of the 32 Hz ambient noise data (dB) from Station 10, November 1975.

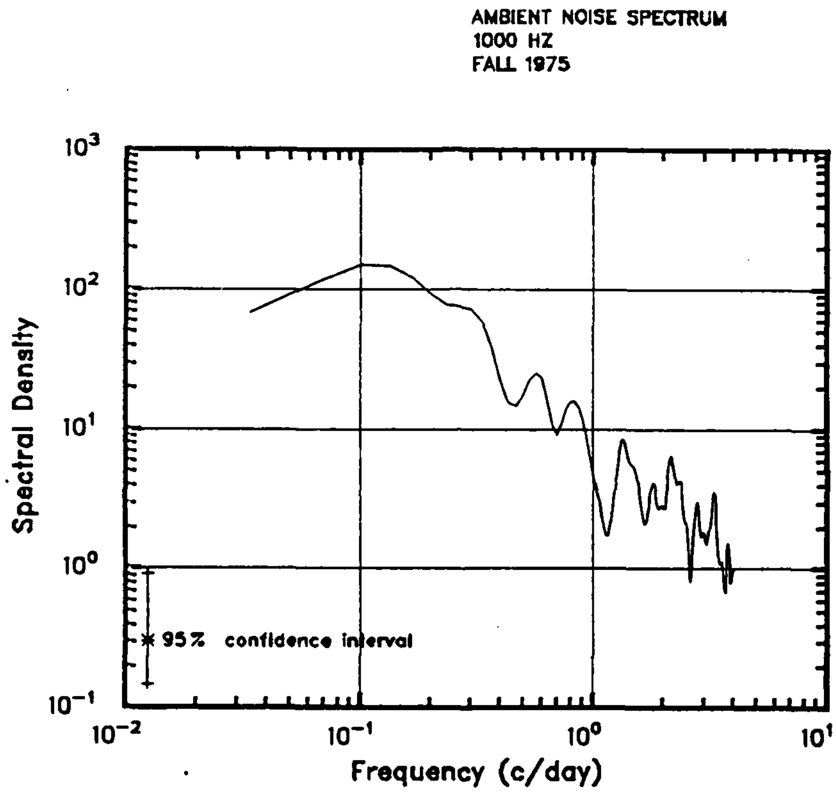

Fig. I.9. Spectral density of the 1000 Hz ambient noise data (dB) from Station 10, November 1975.

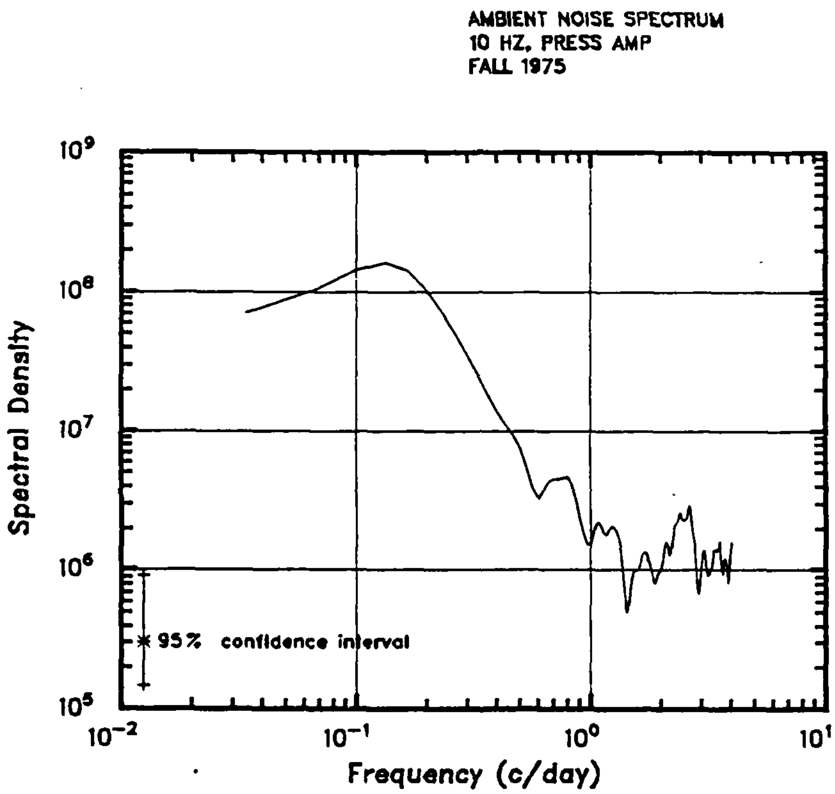

Fig. I.10. Spectral density of the 10 Hz ambient noise data (pressure amplitude) from Station 10, November 1975.

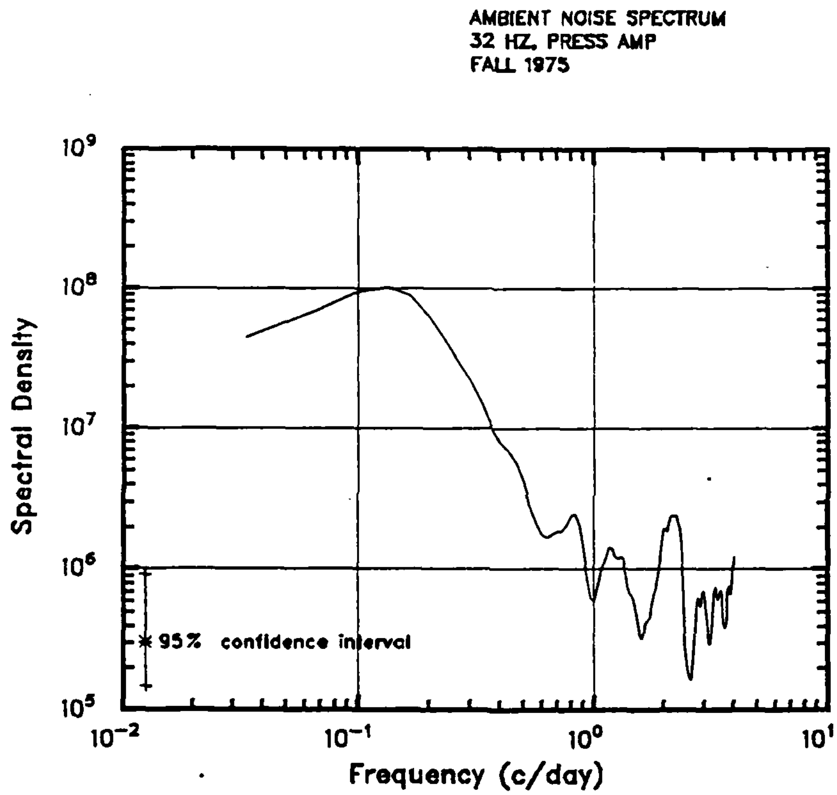

Fig. I.11. Spectral density of the 32 Hz ambient noise data (pressure amplitude) from Station 10, November 1975.

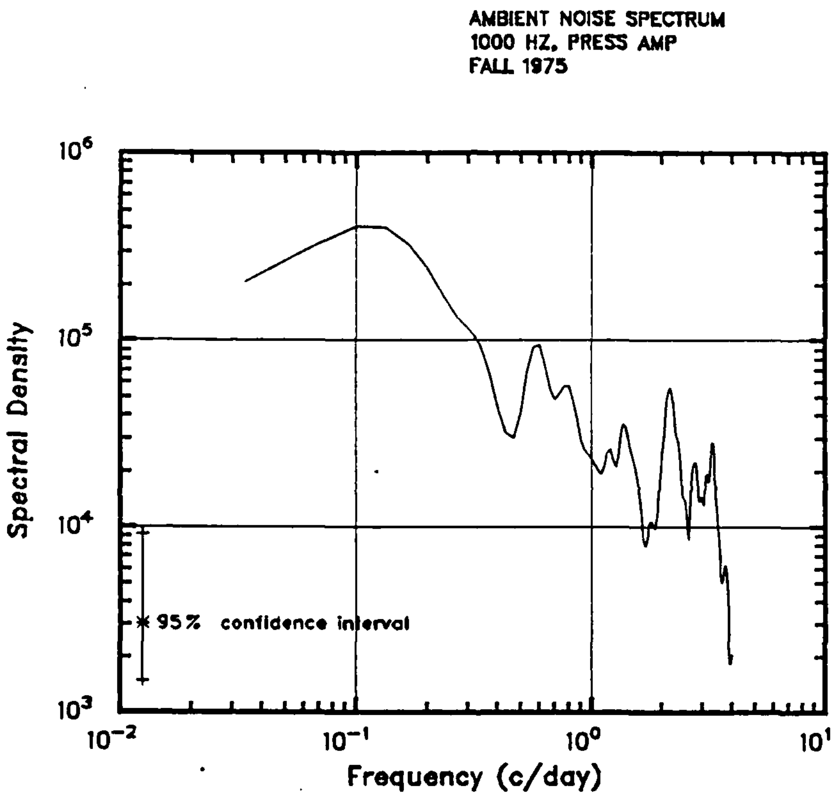

Fig. I.12. Spectral density of the 1000 Hz ambient noise data (pressure amplitude) from Station 10, November 1975.

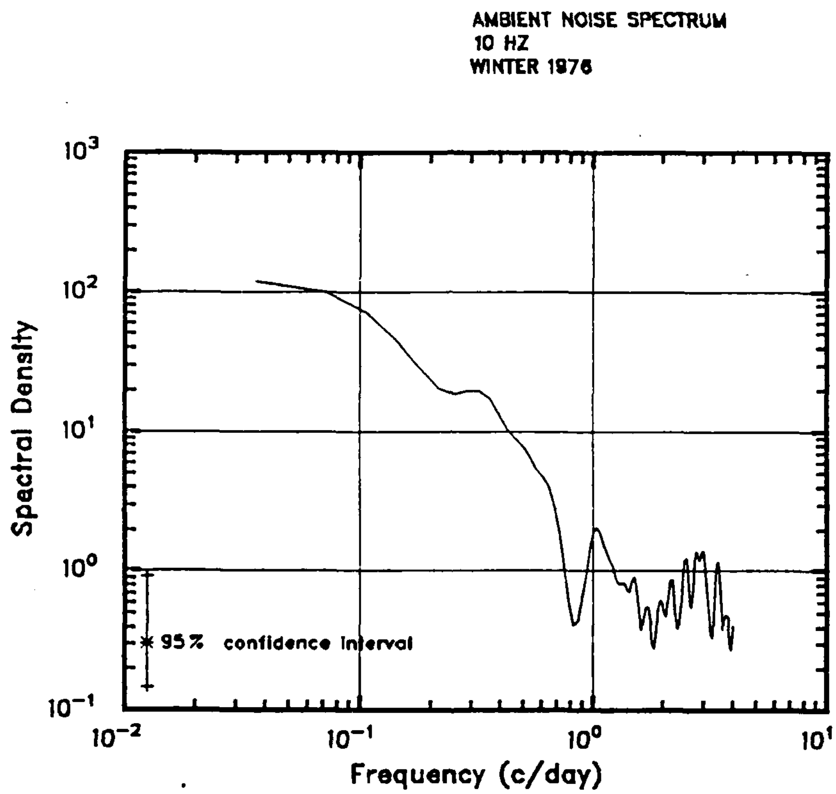

Fig. I.13. Spectral density of the 10 Hz ambient noise data (dB) from Station 10, February 1976.

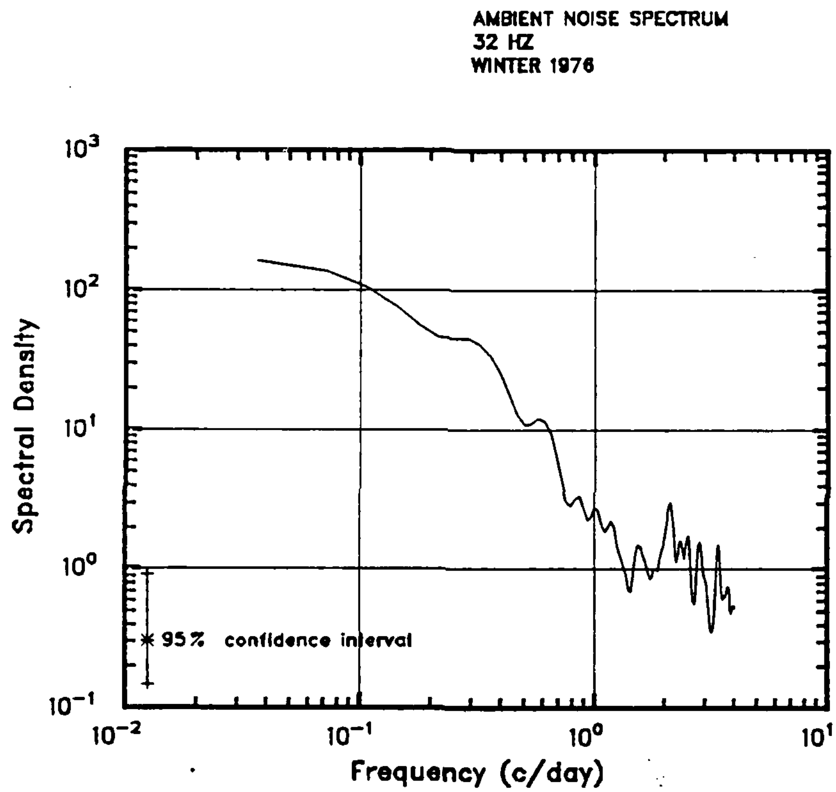

Fig. I.14. Spectral density of the 32 Hz ambient noise data (dB) from Station 10, February 1976.

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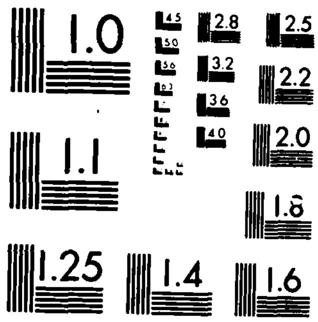

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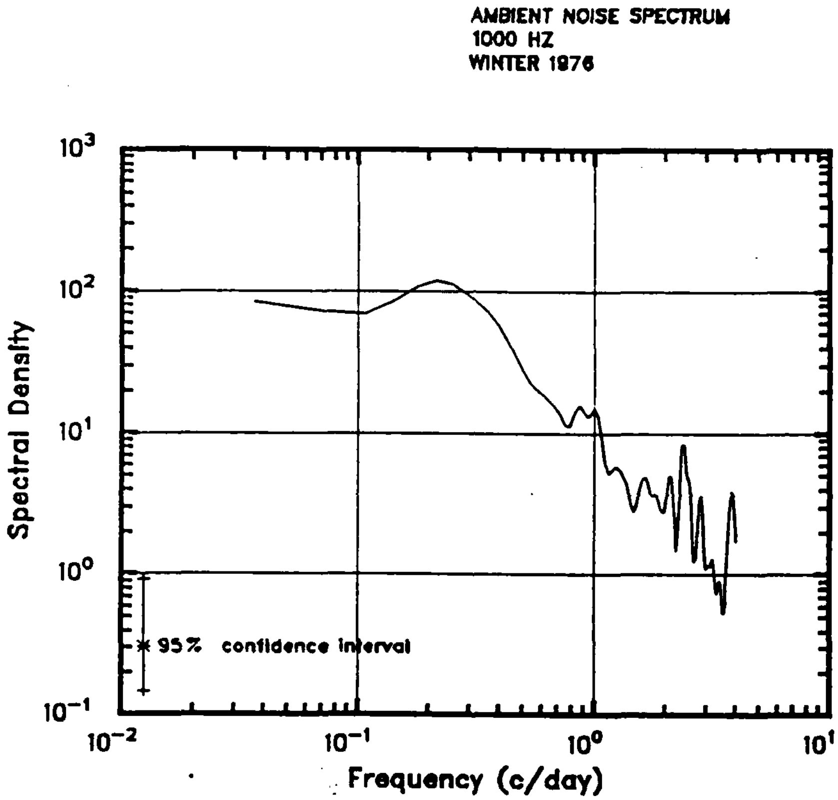


Fig. I.15. Spectral density of the 1000 Hz ambient noise data (dB) from Station 10, February 1976.

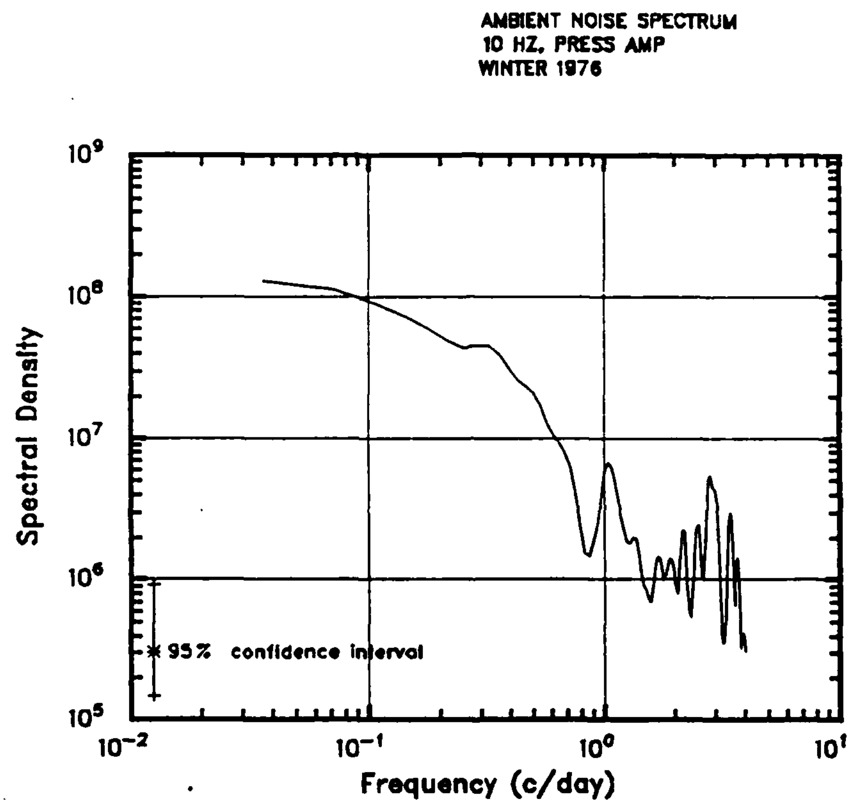
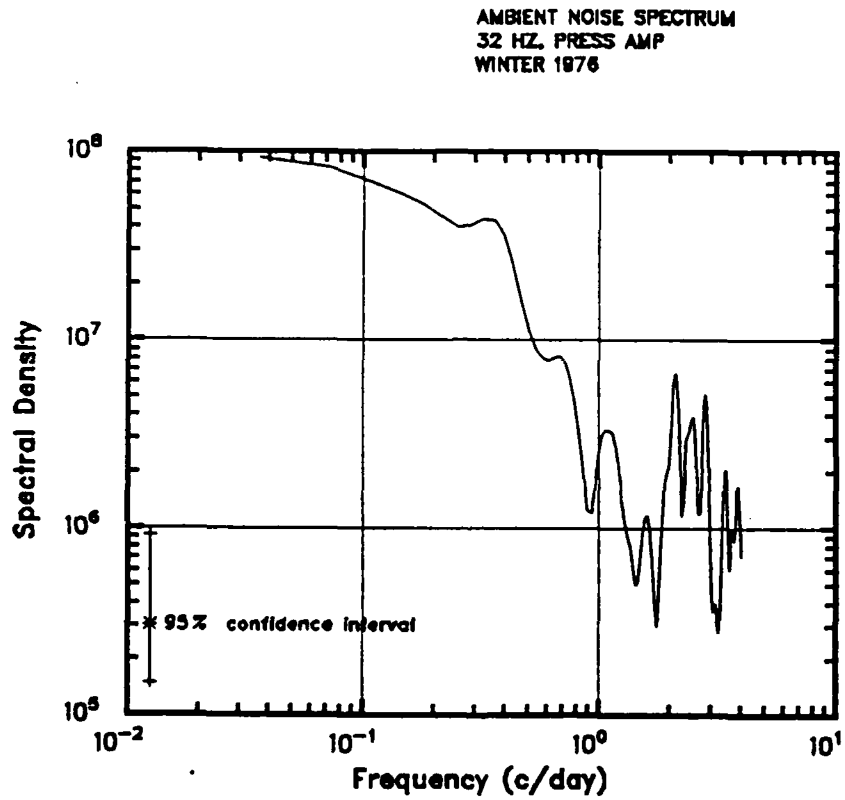


Fig. I.16. Spectral density of the 10 Hz ambient noise data (pressure amplitude) from Station 10, February 1976.



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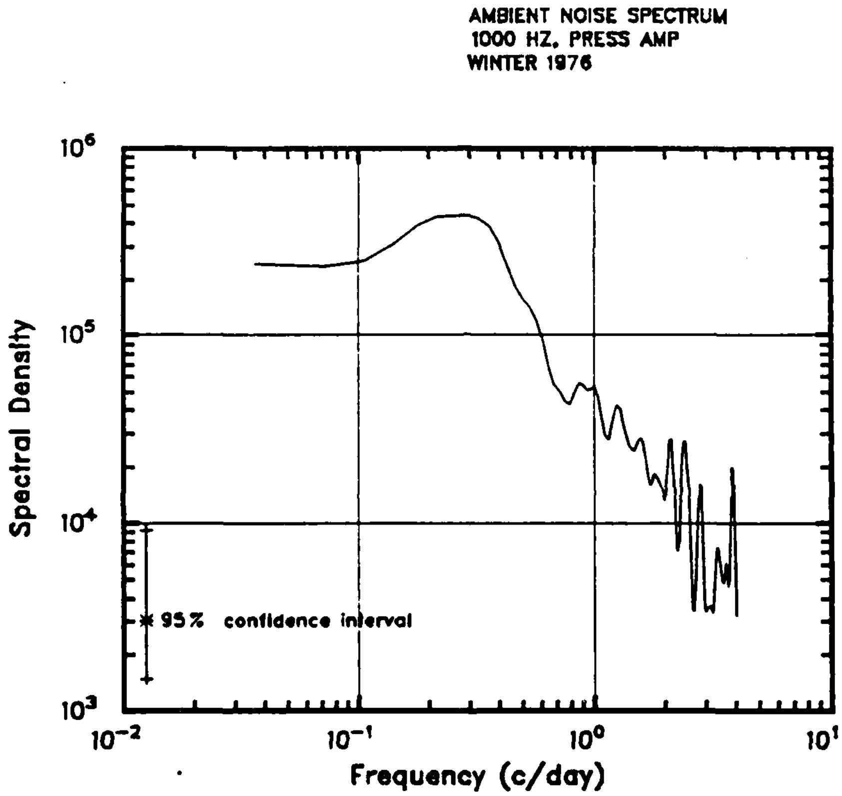

Fig. I.18. Spectral density of the 1000 Hz ambient noise data (pressure amplitude) from Station 10, February 1976.

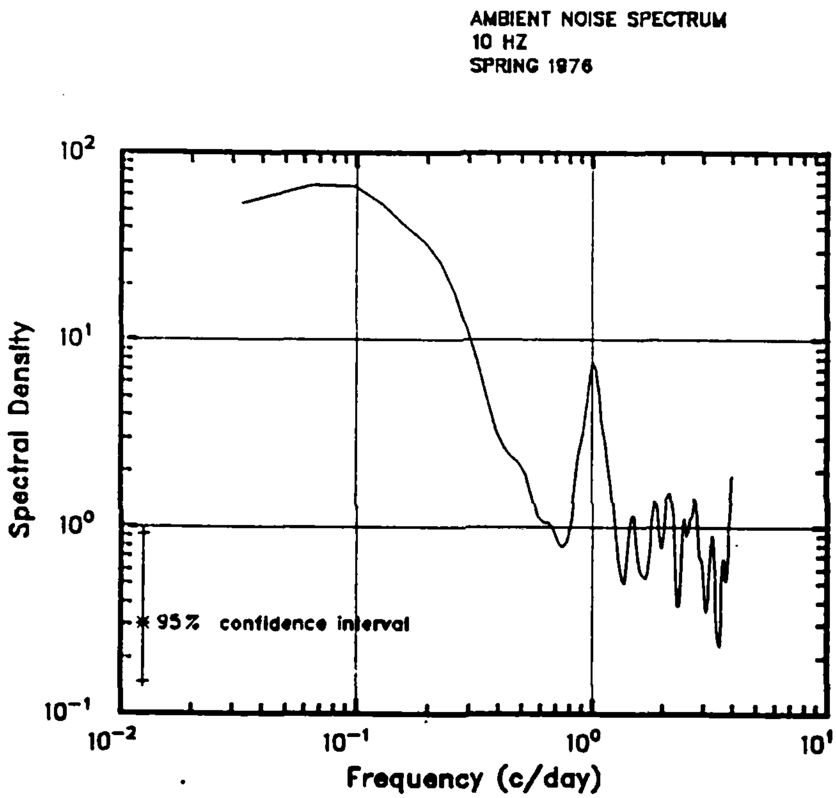

Fig. I.19. Spectral density of the 10 Hz ambient noise data (dB) from Station 10, May 1976.

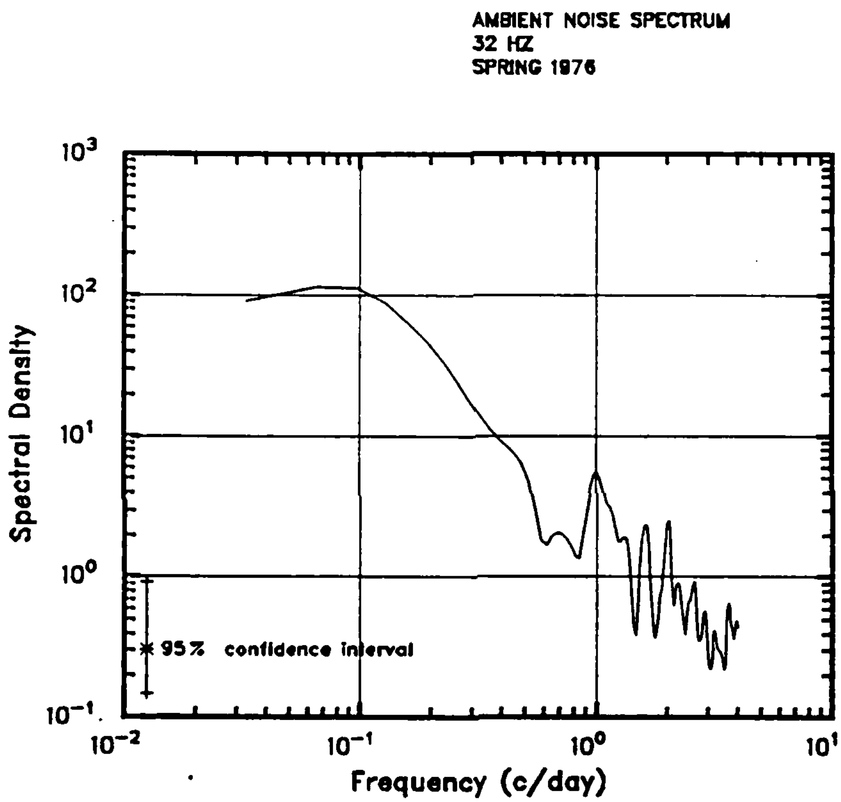

Fig. I.20. Spectral density of the 32 Hz ambient noise data (dB) from Station 10, May 1976.

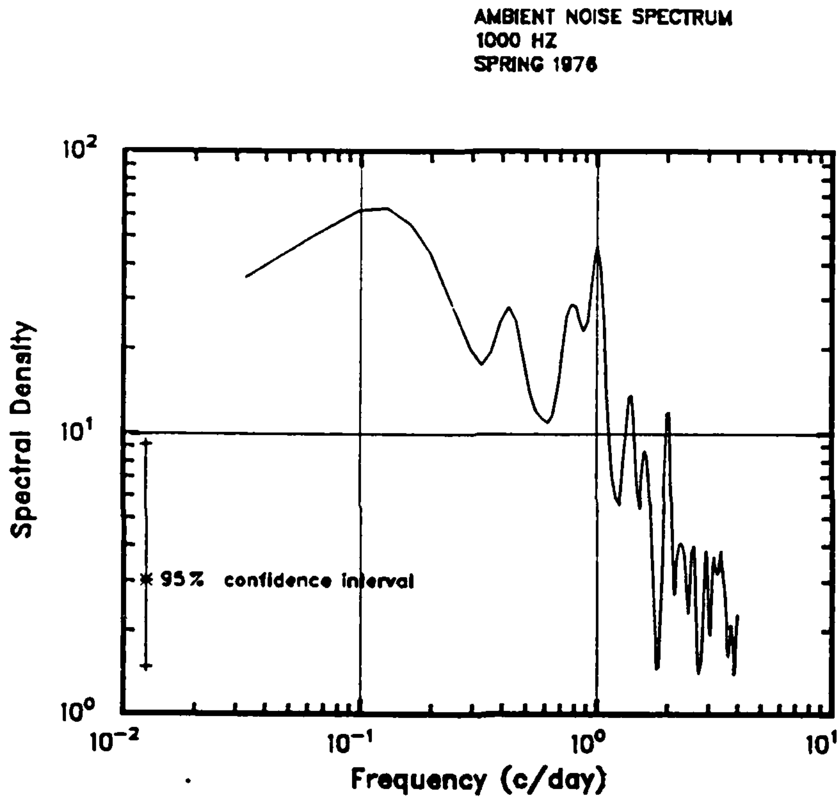

Fig. I.21. Spectral density of the 1000 Hz ambient noise data (dB) from Station 10, May 1976.

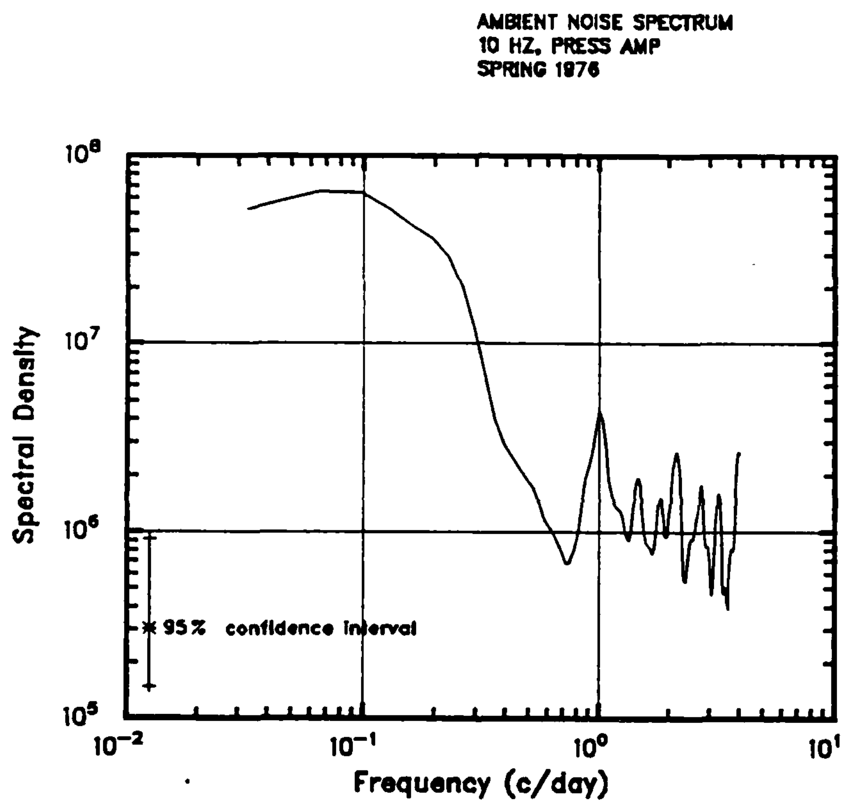

Fig. I.22. Spectral density of the 10 Hz ambient noise data (pressure amplitude) from Station 10, May 1976.

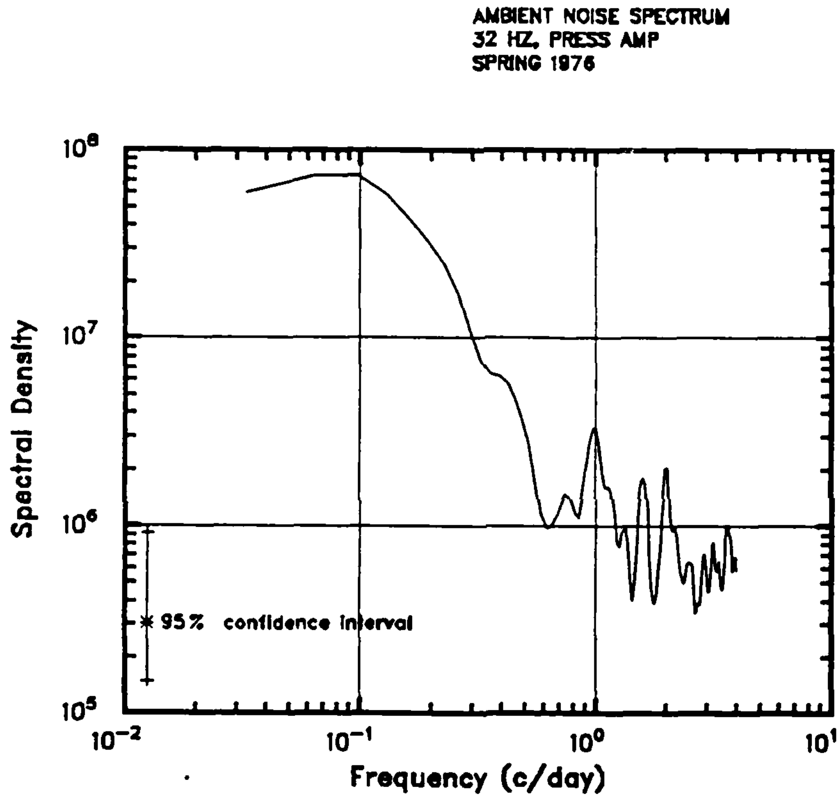

Fig. I.23. Spectral density of the 32 Hz ambient noise data (pressure amplitude) from Station 10, May 1976.

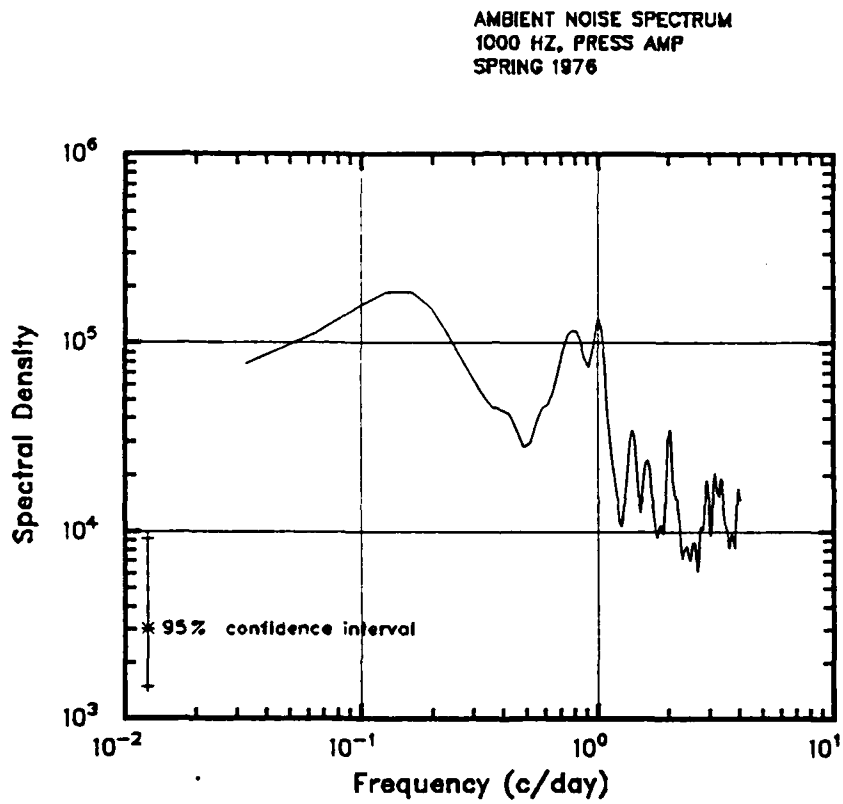

Fig. I.24. Spectral density of the 1000 Hz ambient noise data (pressure amplitude) from Station 10, May 1976.

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