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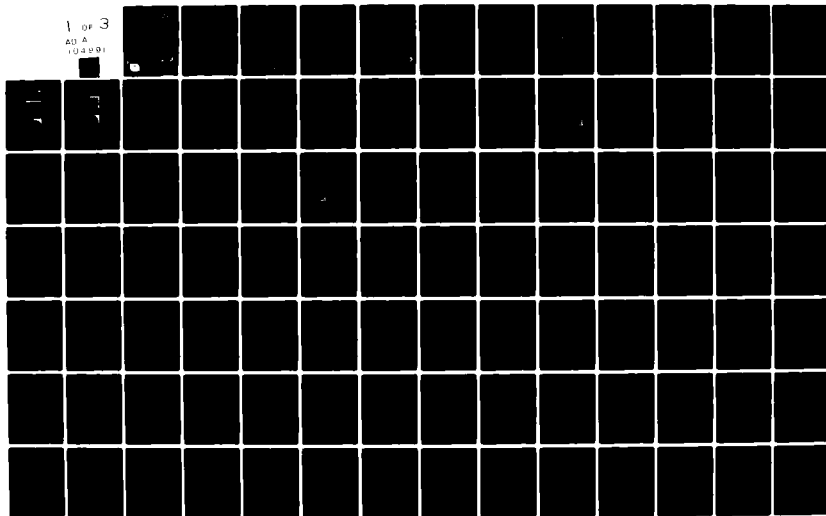
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IDA PAPER P-1570

**ADVERSE WEATHER AND NIGHT CAPABILITY:
A CALL FOR ACTION**

Volume II

APPENDIX. Data Base for Selected Important Military Locations

Lucien M. Biberman

June 1981

**Prepared for
Office of the Under Secretary of Defense for Research and Engineering**

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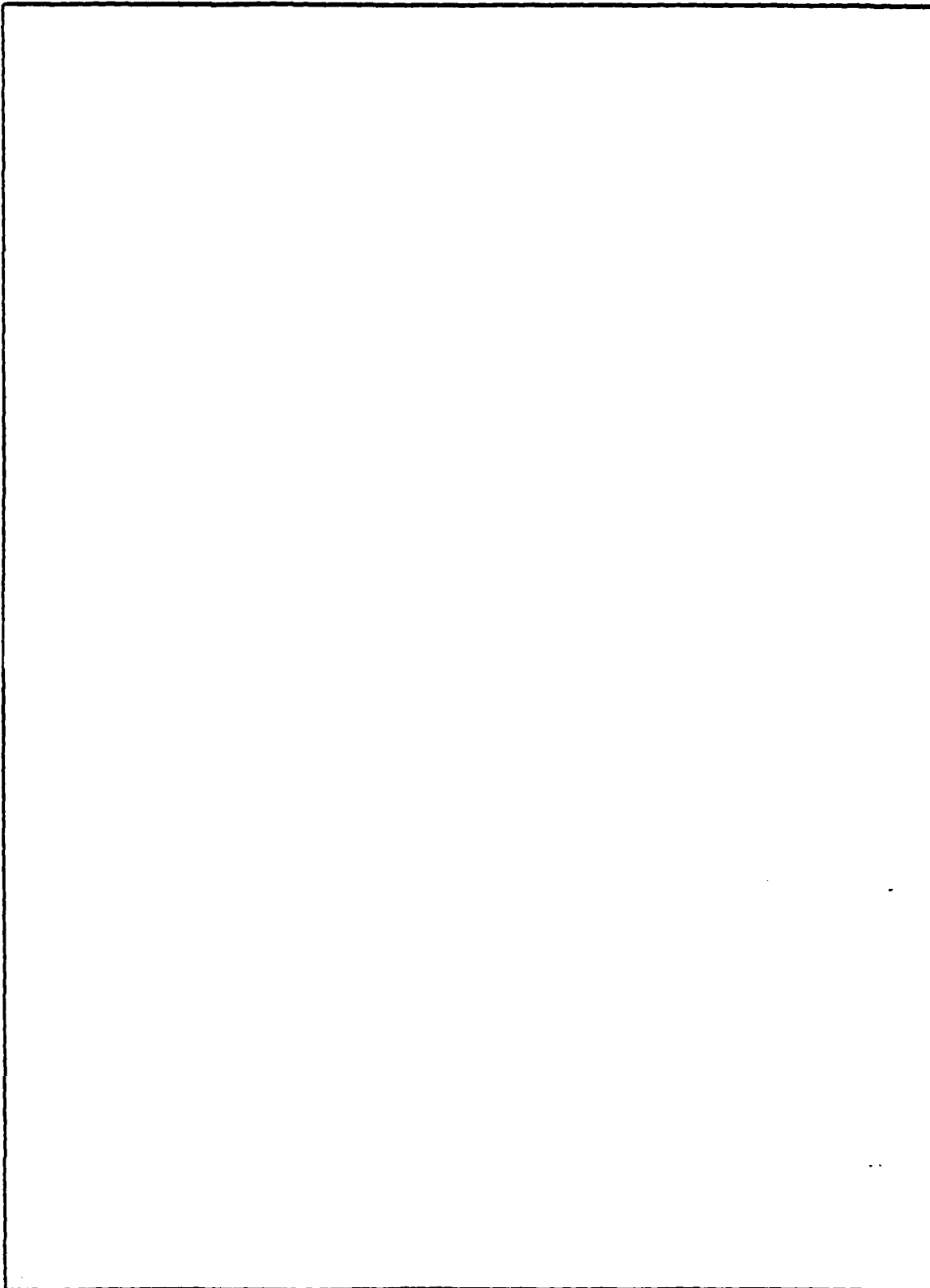
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APPENDIX. Data Base for Selected Important Military Locations

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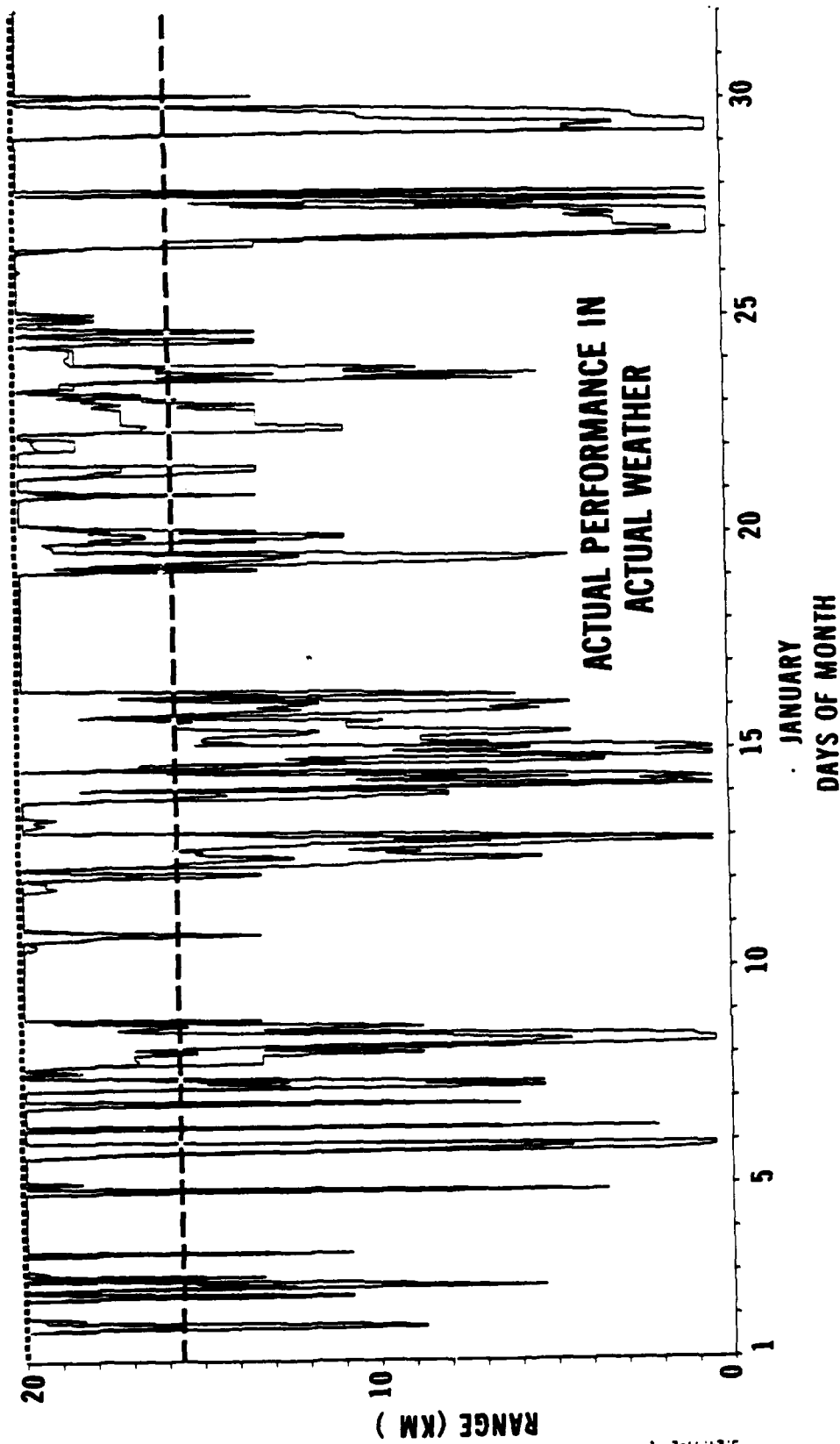
INTRODUCTION

The purpose of this appendix is to provide a small collection of pertinent data illustrating the statistical variation in absolute humidity, relative humidity, and visibility, three quantities that grossly affect the performance of a large class of weapon systems used to acquire targets, or guide munitions.

These statistics, like any other statistics, can be badly misused and Fig. 1 shows a typical example. The usual weapon system design is based upon a set of assumed weather parameters, and the system performance is often quoted on the basis of the best of such conditions. Sometimes, the system designer righteously uses average weather statistics. Actually, the systems often are used near the best conditions 75% of the time and near the worst 25% of the time, so system performance is rarely 75% of maximum but rather at or near maximum 75% of the time and nearly inoperative 25% of the time. This is shown typically in Fig. 1.

The short-term variations of weather are illustrated in Tables 1 and 2, where the wide excursions in such quantities as visibility due to rapid changes in air temperature but slow changes in air mass can give rise to creation or dispersal of fogs. See Figs. 2 and 3 for such graphical data for January and July.

We observe that the collecting of data on values such as visibility is not so good, even at American-controlled military installations. When it comes to foreign data, we find it highly questionable.



3-27-81-1

FIGURE 1. Performance in optimum, average and actual weather

TABLE 1. WEATHER DATA FOR 8 JANUARY 1970, HANNOVER, GERMANY

Month	Day	Hour	Dew Point, °C	Air Temp., °C	Visibility, km	Cloud Cover, eighths	Lumb Factor	Wind Velocity, knots	Wind Direction, deg	Barometric Pressure, millibars (every 3rd hour)
1	8	0100	-5	-4	1.6	8	0.35	5	60	
1	8	0200	-5	-4	1.6	8	0.35	4	80	
1	8	0300	-5	-4	2.0	8	0.35	5	80	1027
1	8	0400	-5	-5	1.6	8	0.35	7	70	
1	8	0500	-6	-5	1.2	8	0.35	8	100	
1	8	0600	-8	-7	0.4	8	0.35	9	110	1027
1	8	0700	-8	-7	0.4	8	0.35	8	90	
1	8	0800	-8	-7	0.3	8	0.35	8	90	
1	8	0900	-8	-7	0.4	8	0.35	9	90	1028
1	8	1000	-9	-8	0.6	8	0.35	8	90	
1	8	1100	-9	-8	0.6	8	0.35	7	100	
1	8	1200	-9	-8	1.3	8	0.35	10	90	1028
1	8	1300	-9	-8	1.8	8	0.35	8	90	
1	8	1400	-9	-8	2.0	7	0.55	8	90	
1	8	1500	-8	-7	1.8	7	0.55	13	90	1026
1	8	1600	-8	-8	1.6	7	0.76	14	80	
1	8	1700	-8	-7	1.8	7	0.76	12	100	
1	8	1800	-8	-7	2.5	6	0.90	12	100	1026
1	8	1900	-8	-7	2.0	6	0.90	15	110	
1	8	2000	-8	-7	3.5	3	0.90	15	110	
1	8	2100	-8	-7	3.0	6	0.90	17	90	1025
1	8	2200	-8	-8	3.0	7	0.76	13	90	
1	8	2300	-8	-7	3.0	7	0.76	17	100	
1	8	2400	-8	-6	4.0	7	0.76	17	90	1024

TABLE 2. WEATHER DATA FOR 8 AUGUST 1970, HANNOVER, GERMANY

Month	Day	Hour	Dew Point, °C	Air Temp., °C	Visibility, km	Cloud Cover, eighths	Lumb Factor	Wind Velocity, knots	Wind Direction, deg	Barometric Pressure, millibars (every 3rd hour)
8	8	0100	16	17	6.0	8	0.55	0	0	
8	8	0200	15	16	6.0	8	0.55	2	90	
8	8	0300	15	16	5.0	8	0.55	2	90	1012
8	8	0400	15	16	5.0	8	0.55	2	40	
8	8	0500	15	16	5.0	7	0.55	2	90	
8	8	0600	17	17	4.0	7	0.55	5	50	1012
8	8	0700	17	19	4.0	7	0.55	4	70	
8	8	0800	19	20	4.0	6	0.76	6	60	
8	8	0900	19	22	5.0	7	0.55	7	90	1012
8	8	1000	19	23	7.0	6	0.55	9	100	
8	8	1100	16	24	9.0	6	0.76	10	90	
8	8	1200	16	23	7.0	8	0.55	10	100	1011
8	8	1300	17	19	3.0	8	1.20	8	220	
8	8	1400	17	17	7.0	8	1.20	4	90	
8	8	1500	17	17	3.0	8	0.35	1	90	1012
8	8	1600	17	18	8.0	6	0.55	2	90	
8	8	1700	17	18	8.0	8	0.35	4	10	
8	8	1800	17	18	7.0	7	0.55	2	360	1012
8	8	1900	16	16	3.8	5	0.76	4	350	
8	8	2000	16	16	3.0	8	0.35	5	270	
8	8	2100	15	16	3.0	8	0.35	6	310	1012
8	8	2200	16	16	4.0	8	0.35	5	310	
8	8	2300	16	16	2.0	8	0.35	5	250	

JANUARY 1970

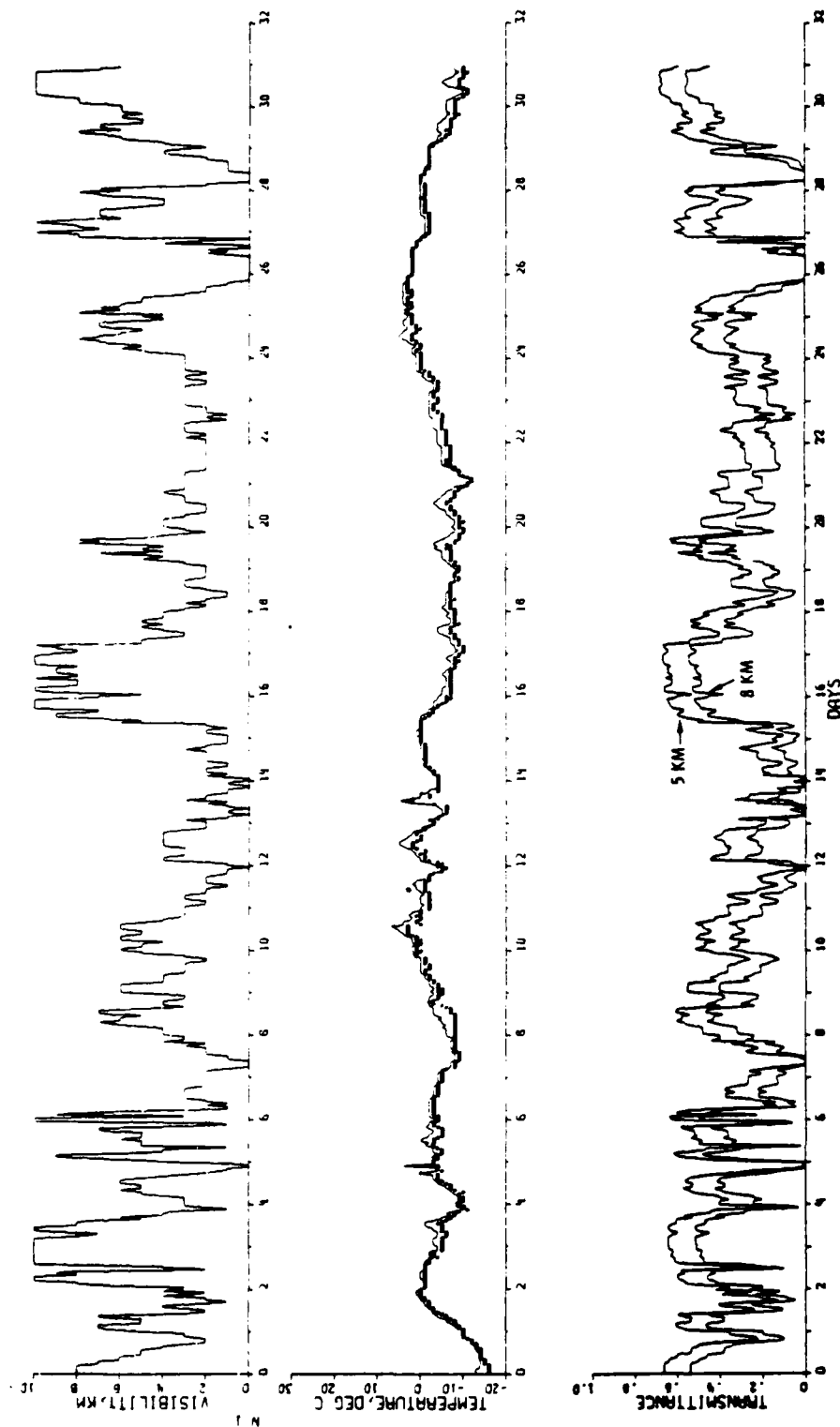


FIGURE 2. Hourly Visibility, Air Temperature (—), Dew Point (o), and Corresponding Computed Atmospheric Transmittance at 8.5-11 μ m for Ranges of 5 and 8 km; Hannover, Germany; January 1970. (Visibility curve is truncated at 10 km. Each tick on abscissa marks end of a day.)

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JULY 1970

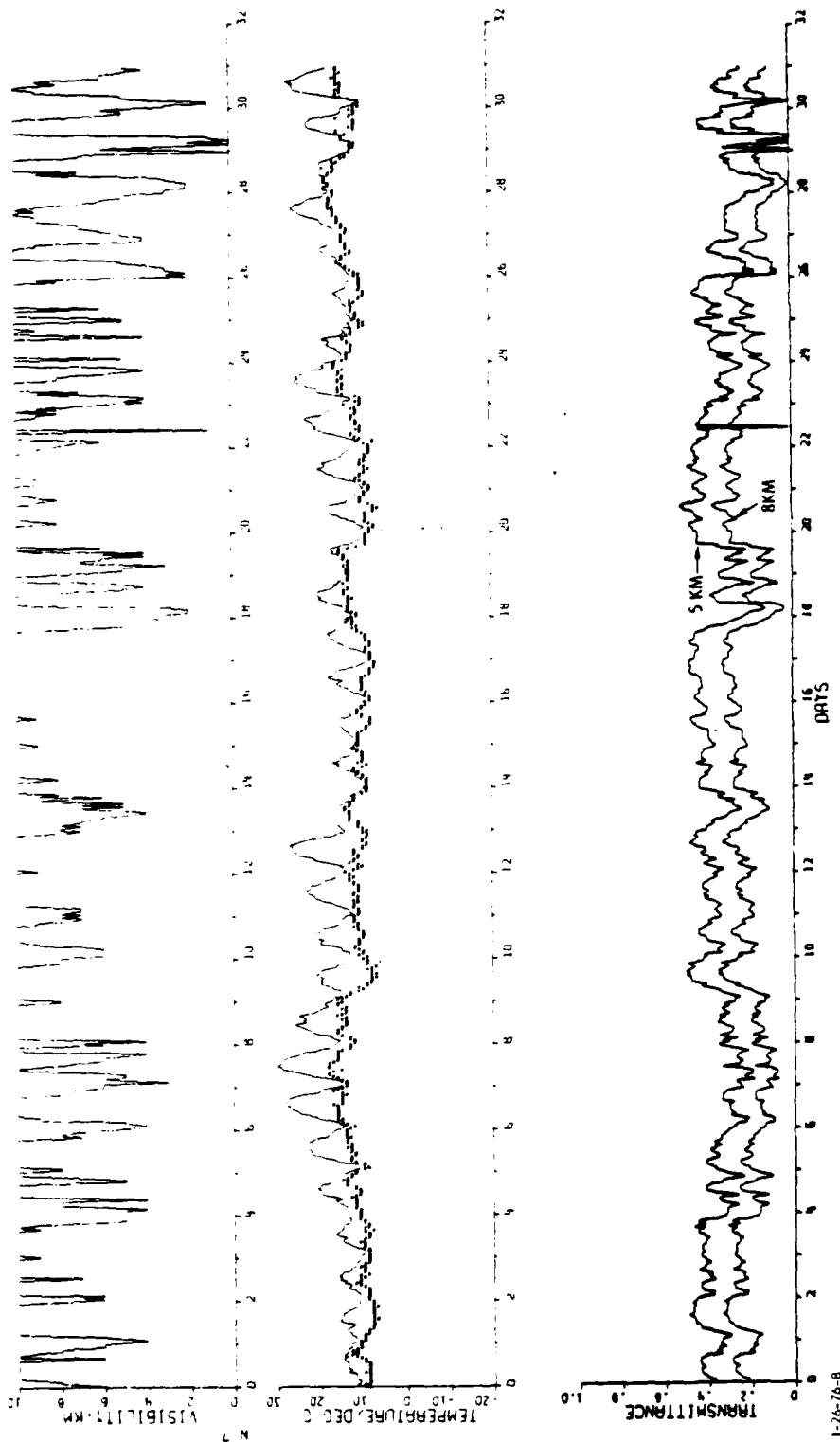


FIGURE 3. Hourly Visibility, Air Temperature (—), Dew Point (o), and Corresponding Computed Atmospheric Transmittance at 8.5-11 μ m for Ranges of 5 and 8 km; Hannover, Germany; July 1970. (Visibility curve is truncated at 10 km. Each tick on abscissa marks end of a day.)

The USAF Environmental Technical Applications Center (ETAC) maintains weather data files including such quantities as relative humidity and visibility recorded hourly for locations around the world. Examining examples of the relative humidity data, we find fairly smooth and reasonable distributions as shown in Figs. 4 and 5 for two examples (Ankara, Turkey, in December and Aviano, Italy, in November). Unfortunately, the visibility data does not remotely match that smooth, nearly gaussian spread. This inconsistency casts doubt upon the validity of such visibility data as input to an aerosol model for predicting system performance.

Much can be said about the quality of visibility data or lack thereof. The quality of the data is dependent to some extent upon the motivation of the observers. Visibility is determined in daytime from a series of sightings of silhouetted objects against the sky. As the atmosphere gets hazy, the dark object against the bright sky gets "filled in" by scattered light that reduces the contrast of the dark target against the sky. At some degree of haziness the scattered light renders the object undetectable or just on the threshold of detection. To make estimates, one should have a series of such objects at known distances more or less evenly spaced throughout the range span of interest.

In some locations there are few such objects, and no additional special markers are installed. As a result, the data tend to bunch about the ranges at which an observer has a known marker, and no observation can be made where there is no such marker.

Weather stations run by the U.S. Air Force tend to find or to provide markers, but it has been suggested that the visibility data shown in Figs. 4 and 5 are more representative of the available silhouetted features of the observing-site skyline than of the turbidity of the atmosphere. These are nevertheless not atypical of the foreign visibility data available.

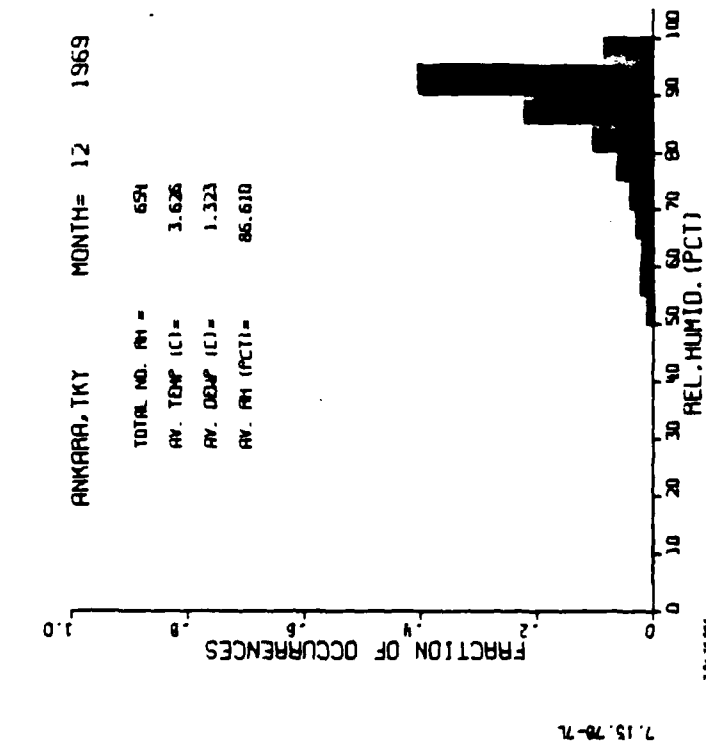
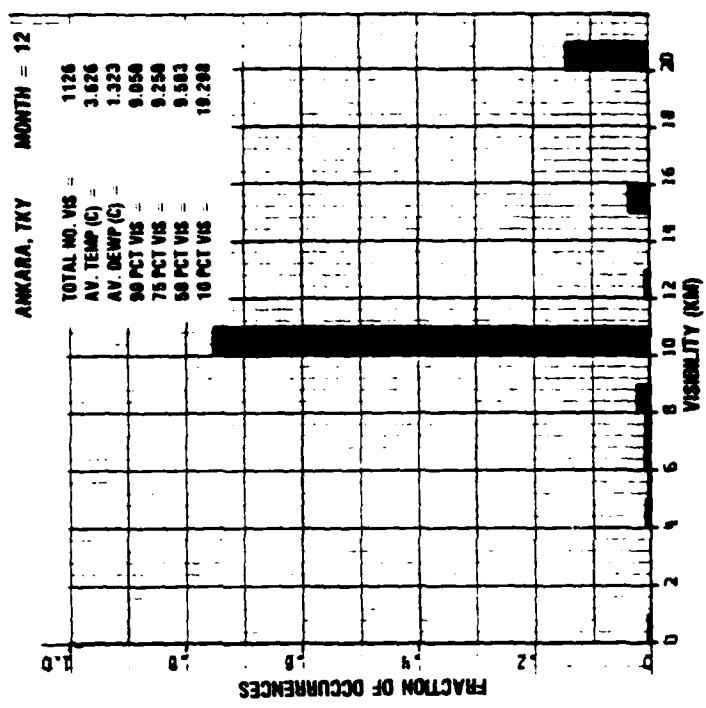


FIGURE 4. Relative humidity and visibility statistics, Ankara, Turkey.

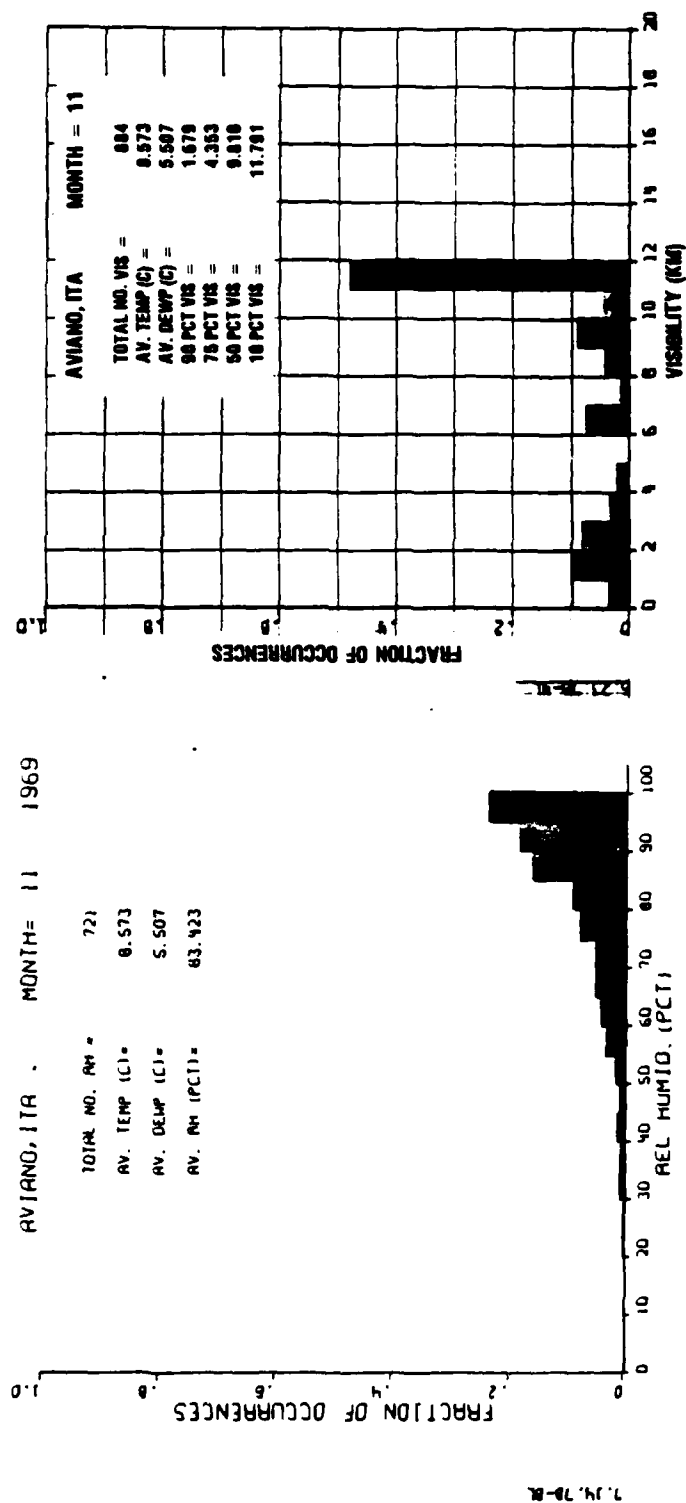


FIGURE 5. Relative humidity and visibility statistics, Aviano, Italy.

By international convention, visibilities exceeding 9999 m are usually reported as 9999 m in aviation weather data, but there are deviations from this practice. Thus, some observers may report anything over 10 km as infinite, while others--even at the same station--may actually report a specific marker at, say, 11 or 16 or 20 km, if one exists and is just visible. These variations in the reporting of visibility are of little help when it comes to solving

$$\beta_{aer} = \frac{\text{factor}}{\text{visibility}} ,$$

where β_{aer} is the extinction coefficient due to atmospheric aerosols, a quantity needed for scaling aerosol effects and computing performance for optical, electrooptical, and infrared systems.

With such reservations in mind about the precision of such measured data, we present the statistics for nearly twenty locations that are important to the military.

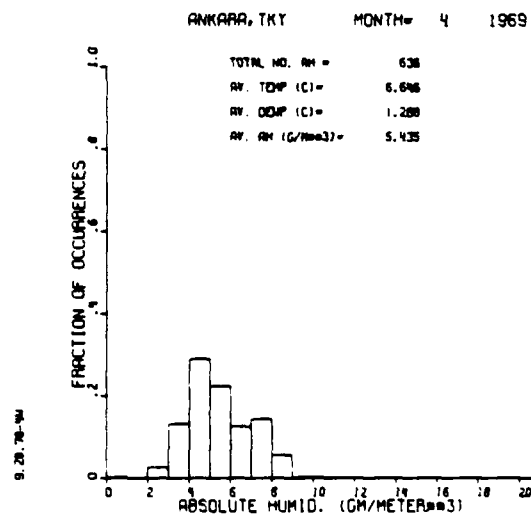
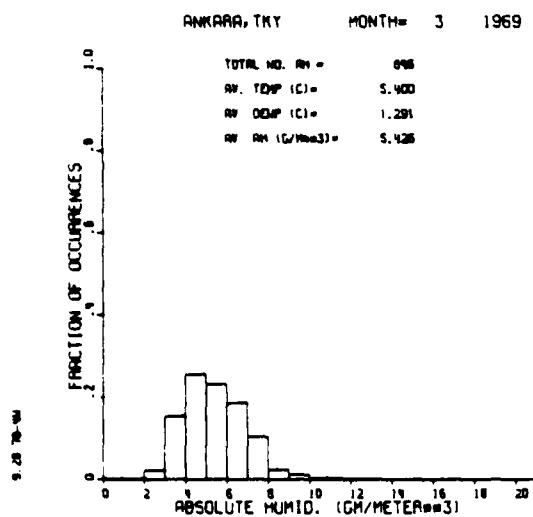
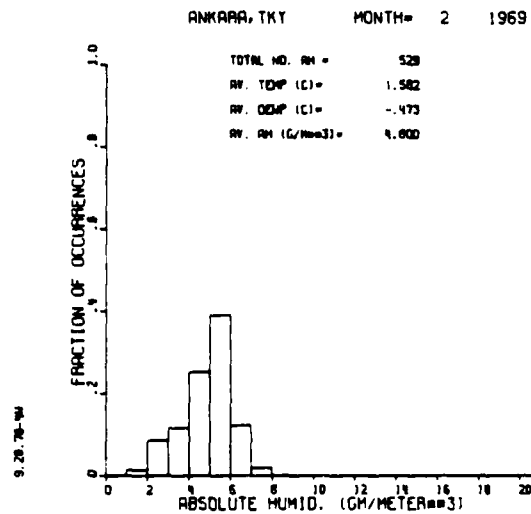
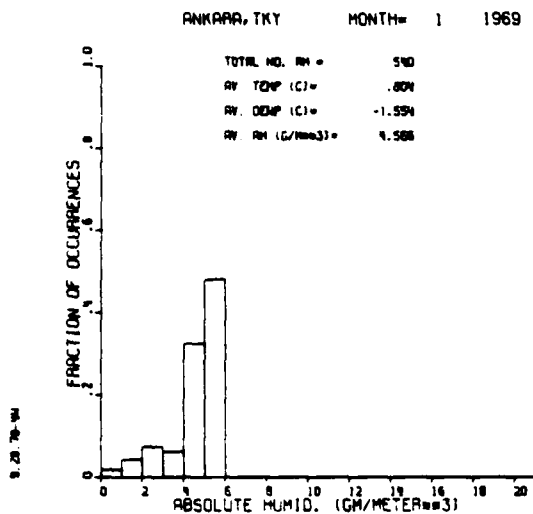
The following figures show absolute humidity, relative humidity and visibility for the 19 locations listed below. The data for each location is given month by month, four months per page, first for absolute humidity, then for relative humidity, and then for visibility. The locations are arranged in alphabetical order:

Ankara, Turkey	Istanbul, Turkey
Aviano, Italy	Oslo, Norway
Bangalore, India	Poznan, Poland
Beersheva, Israel	Praha, Czechoslovakia
Cairo, Egypt	Pusan, South Korea
Chiai, Taiwan	Seoul, South Korea
Fairbanks, Alaska	Stuttgart, West Germany
Guantanamo, Cuba	Tehran, Iran
Hamburg, West Germany	Tempelhof (West Berlin), Germany
Howard AFB, Panama	

ANKARA, TURKEY

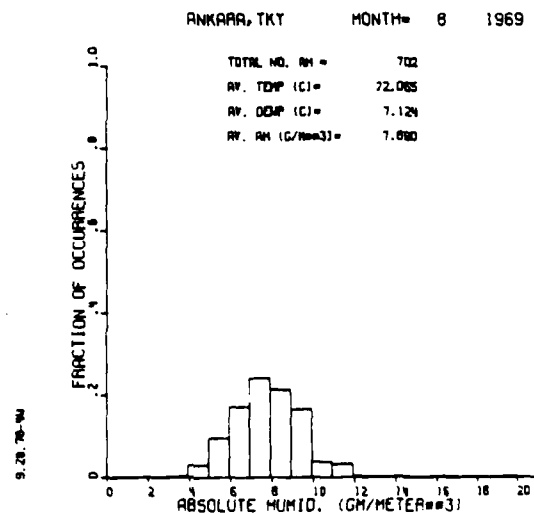
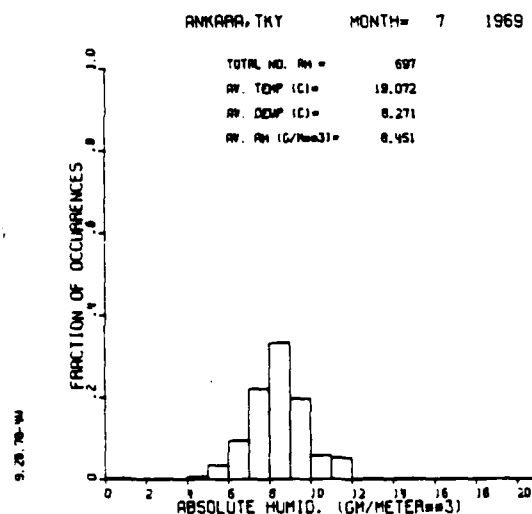
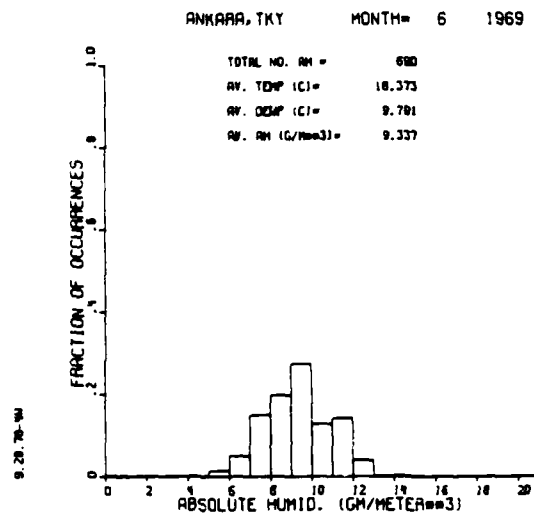
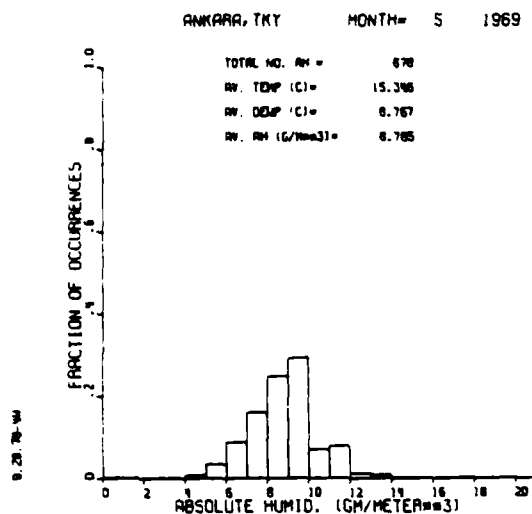
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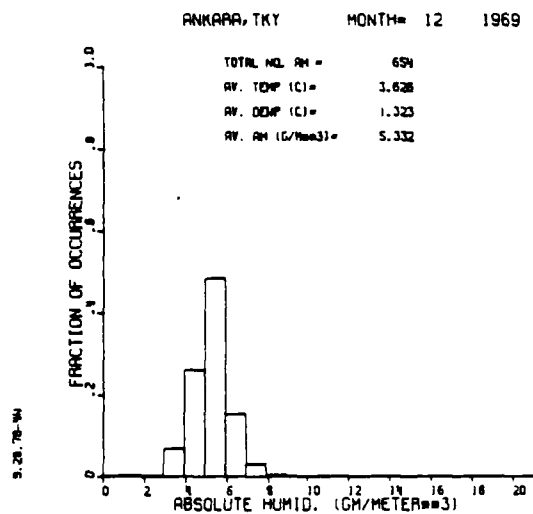
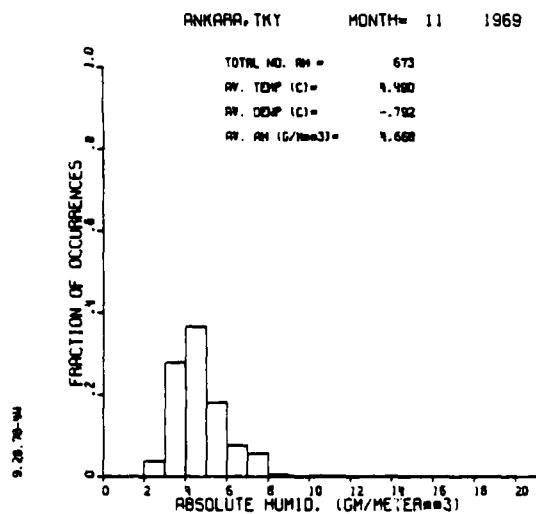
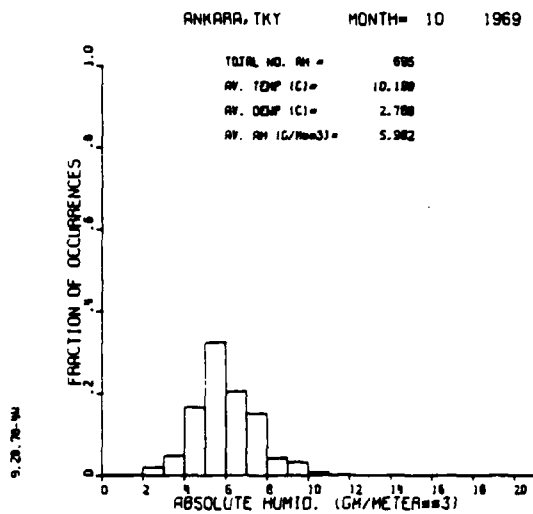
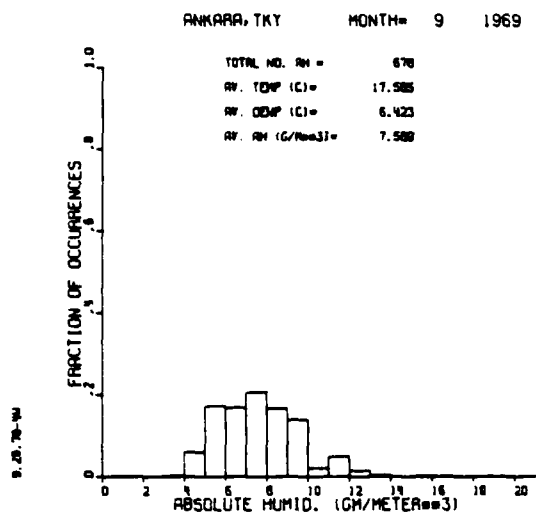
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FIGURE 6. Absolute humidity statistics, Ankara, Turkey, January-April 1969.



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FIGURE 7. Absolute humidity statistics, Ankara, Turkey, May-August 1969.



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FIGURE 8. Absolute humidity statistics, Ankara, Turkey, September-December 1969.

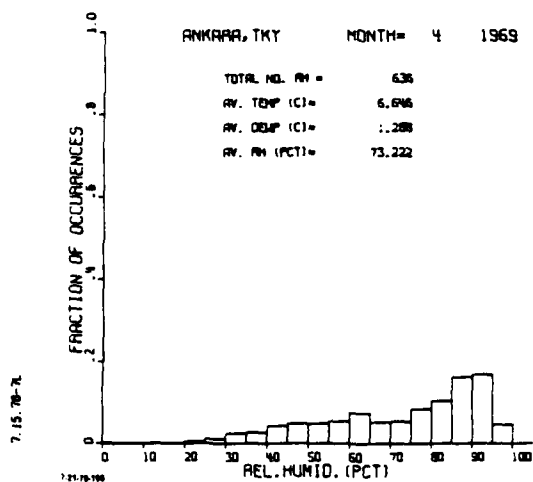
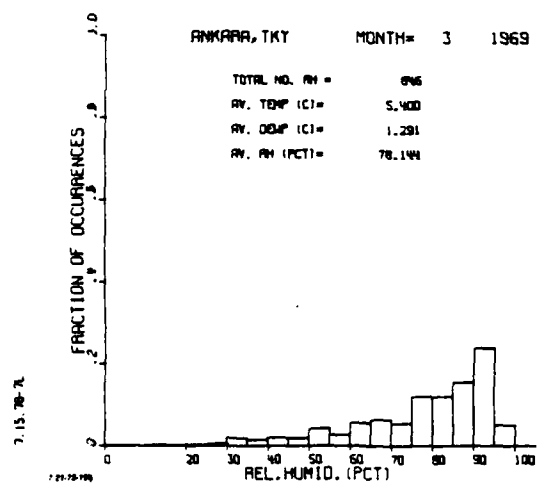
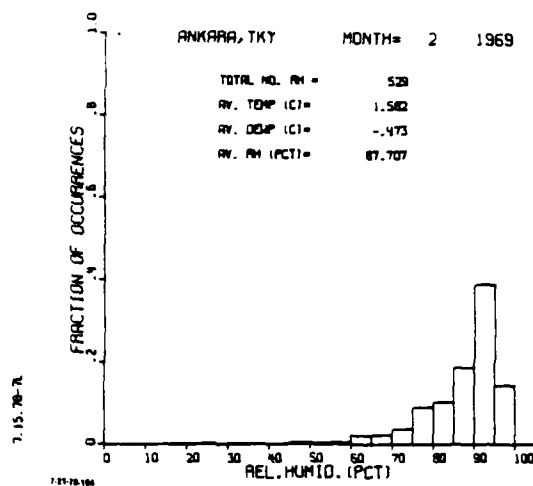
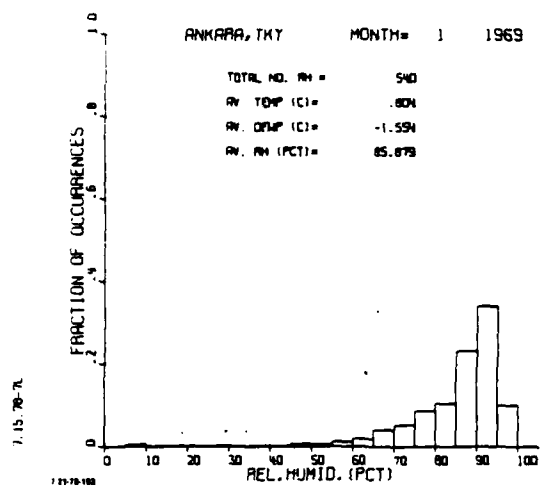


FIGURE 9. Relative humidity statistics, Ankara, Turkey, January-April 1969.

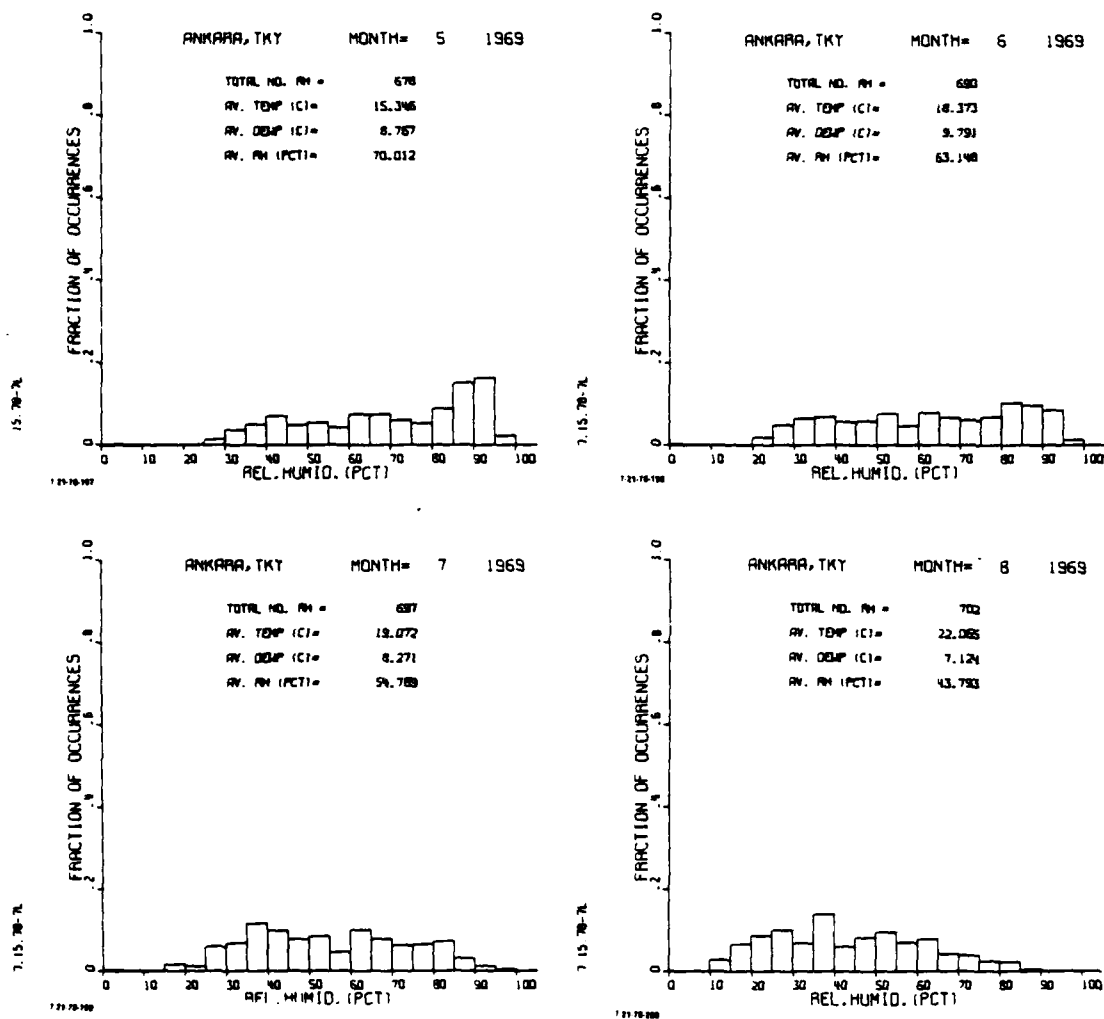


FIGURE 10. Relative humidity statistics, Ankara, Turkey, May-August 1969.

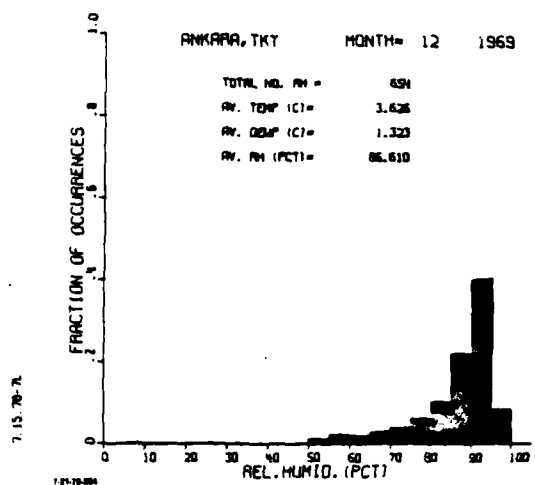
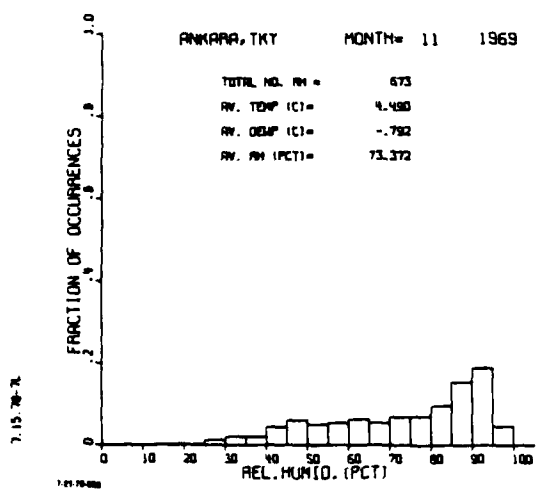
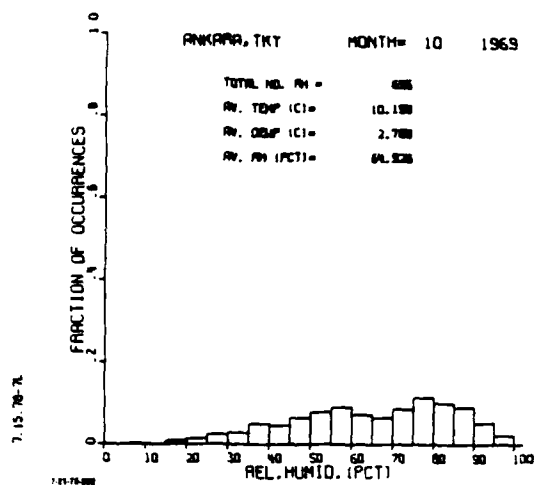
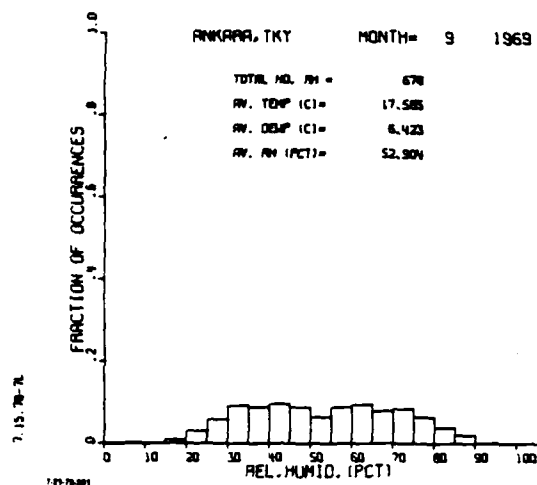
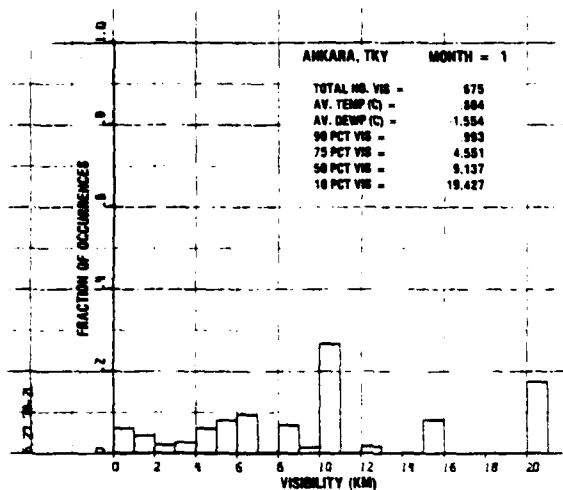
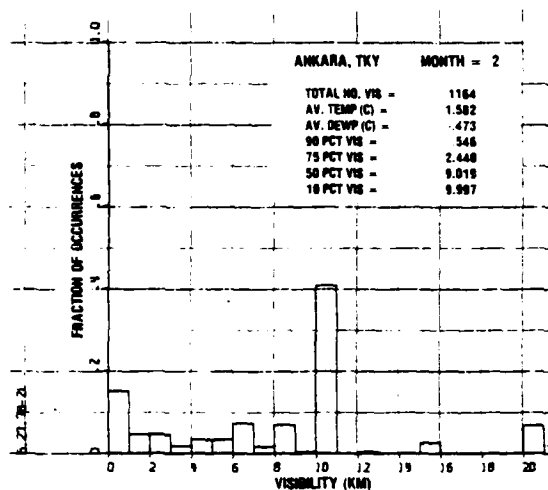


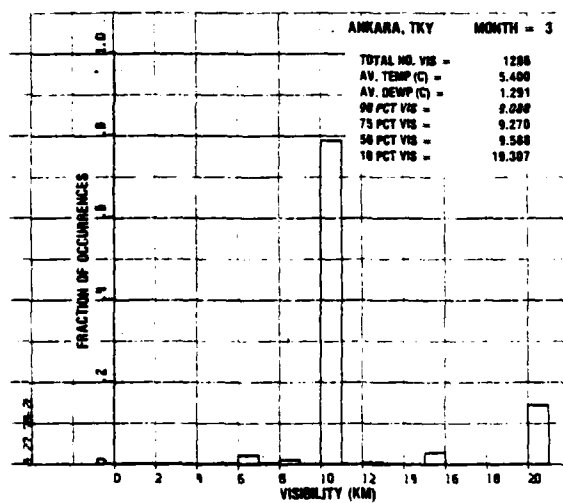
FIGURE 11. Relative humidity statistics, Ankara, Turkey, September-December 1969.



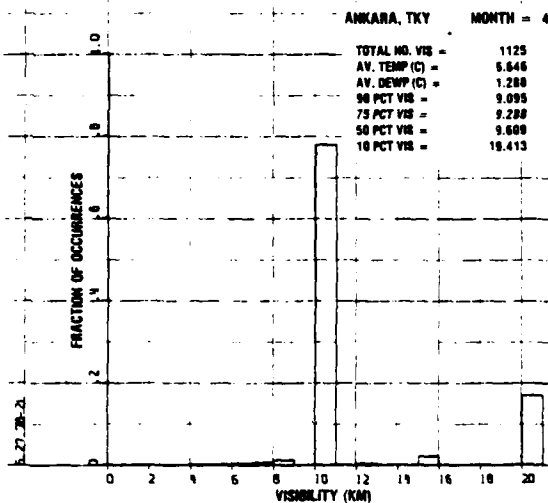
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FIGURE 12. Visibility statistics, Ankara, Turkey, January-April 1969.

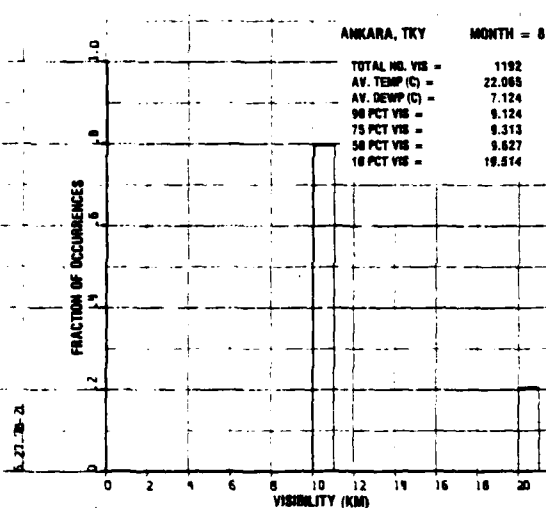
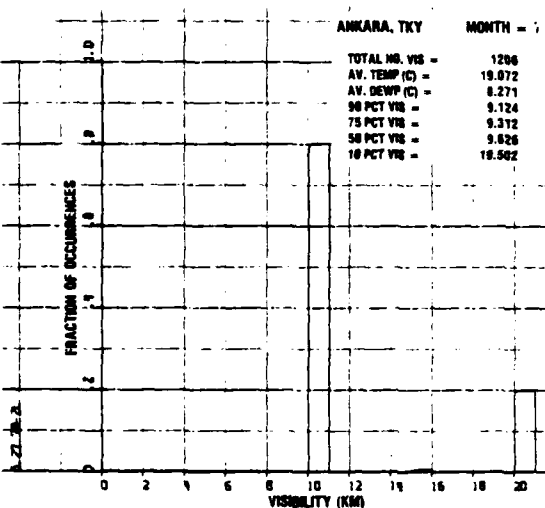
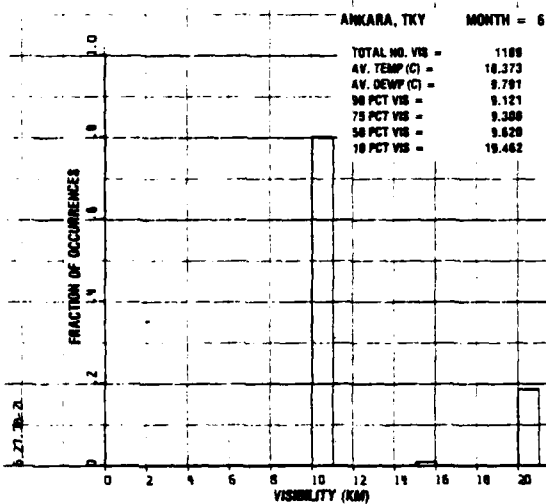
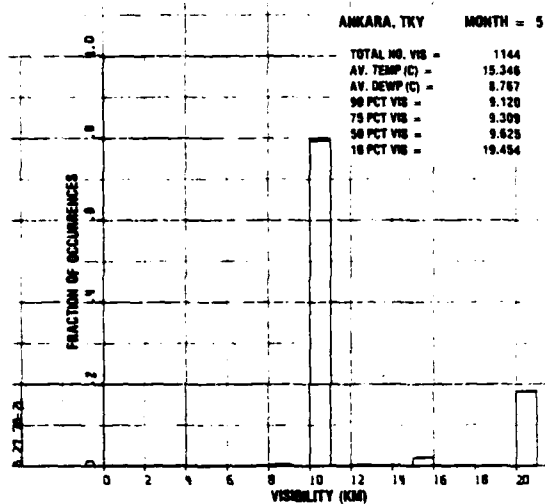


FIGURE 13. Visibility statistics, Ankara, Turkey, May-August 1969.

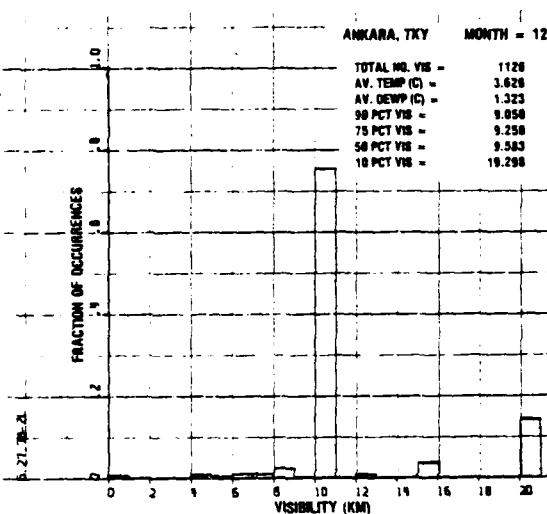
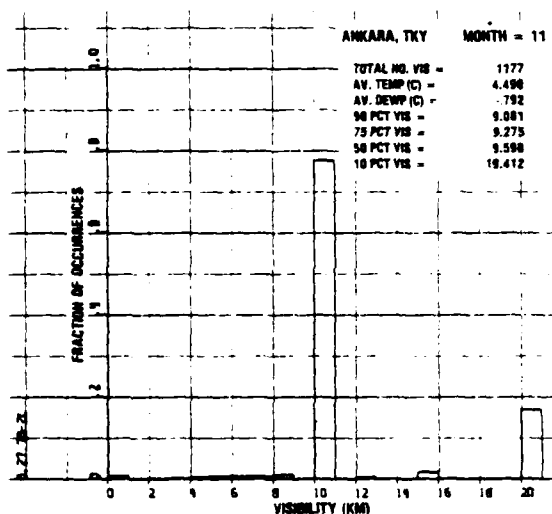
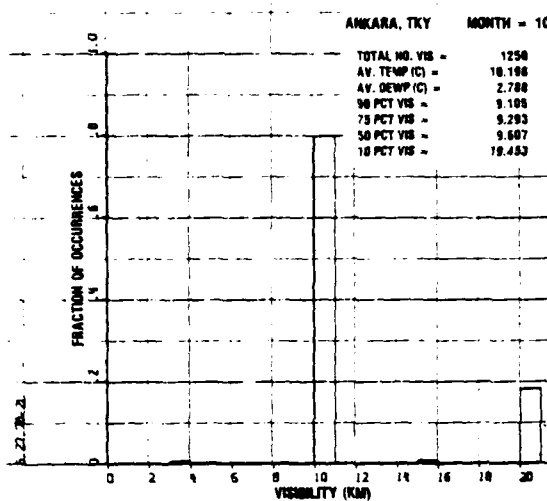
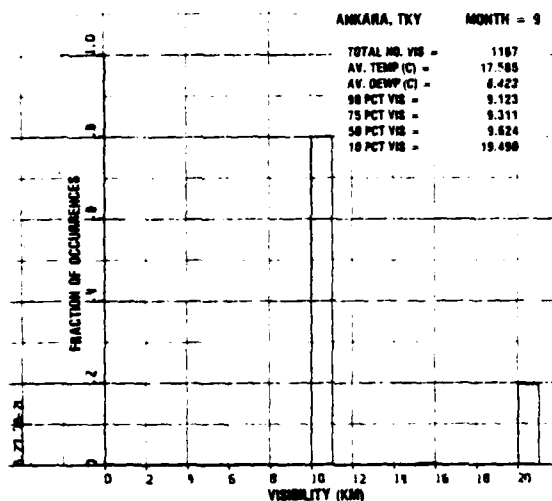
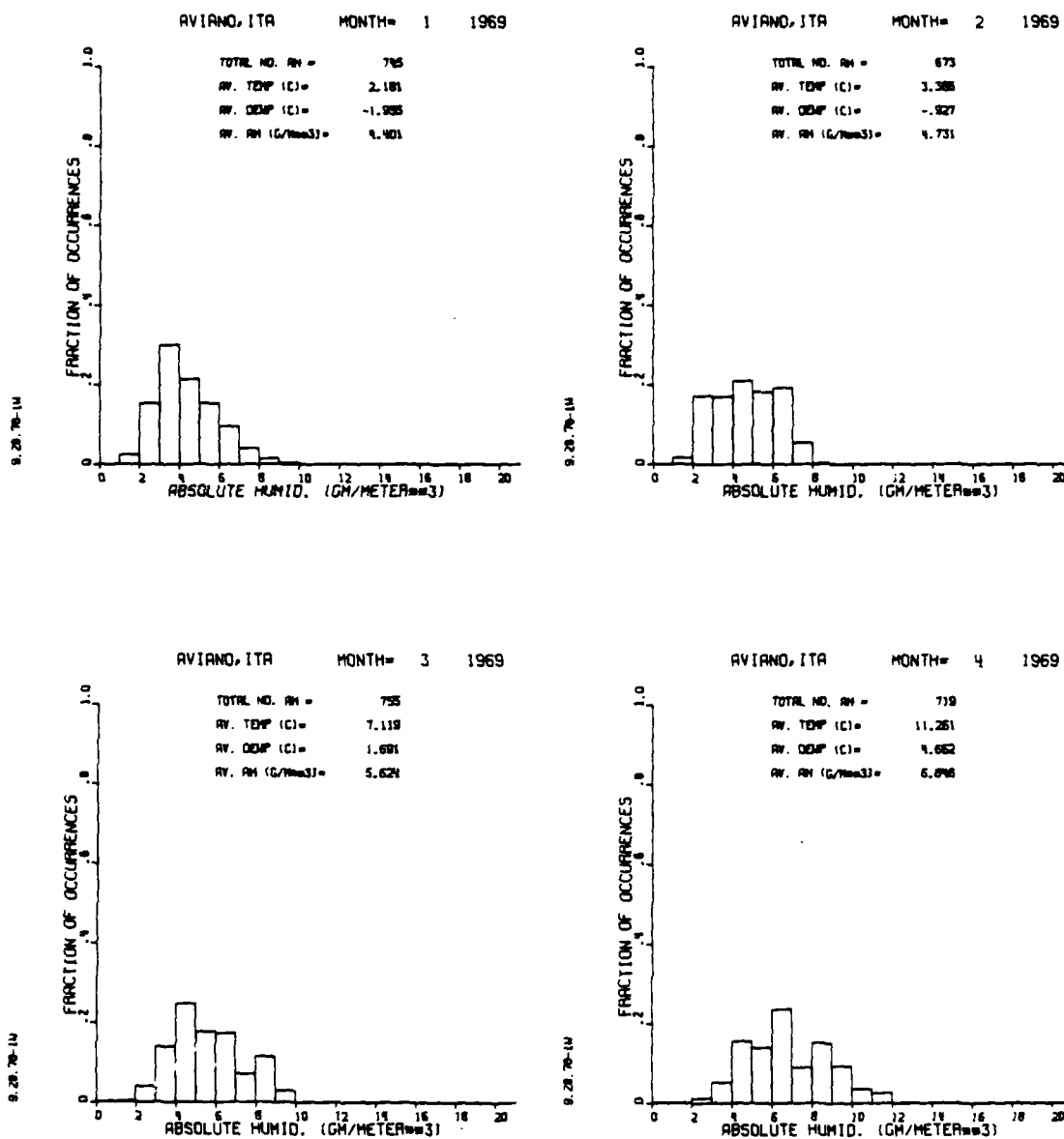


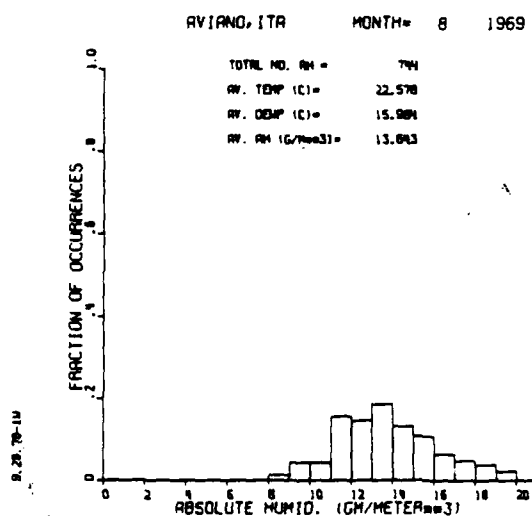
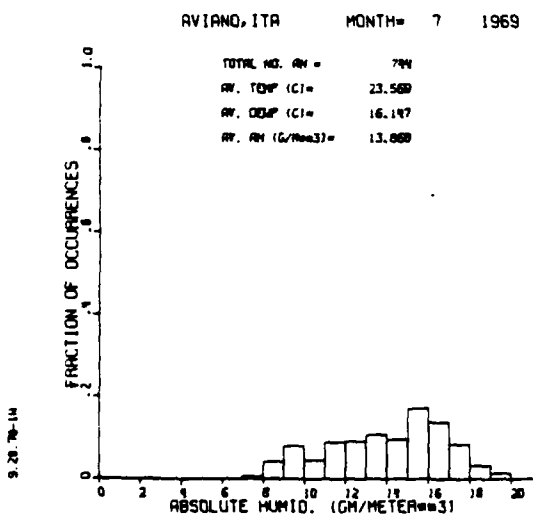
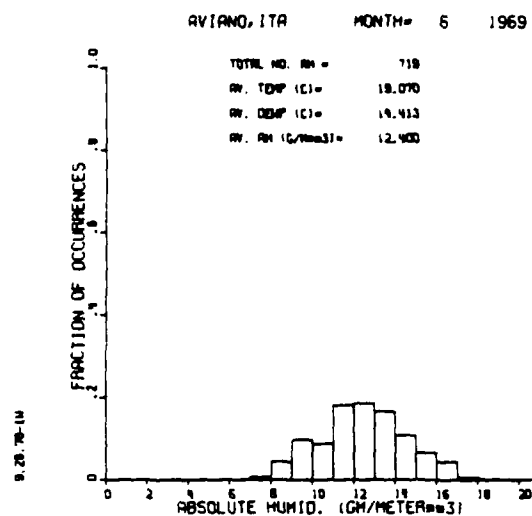
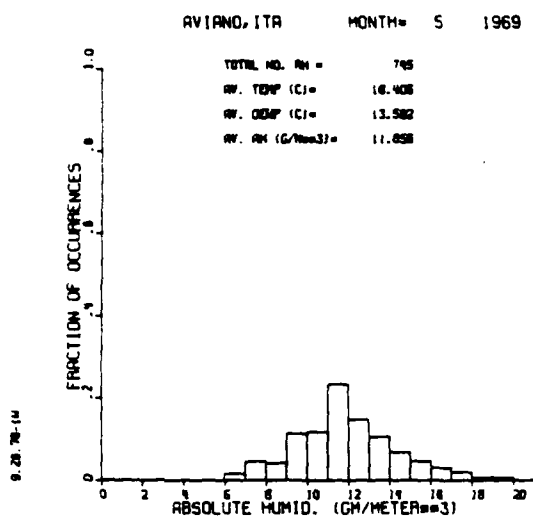
FIGURE 14. Visibility statistics, Ankara, Turkey, September-December 1969.

AVIANO, ITALY



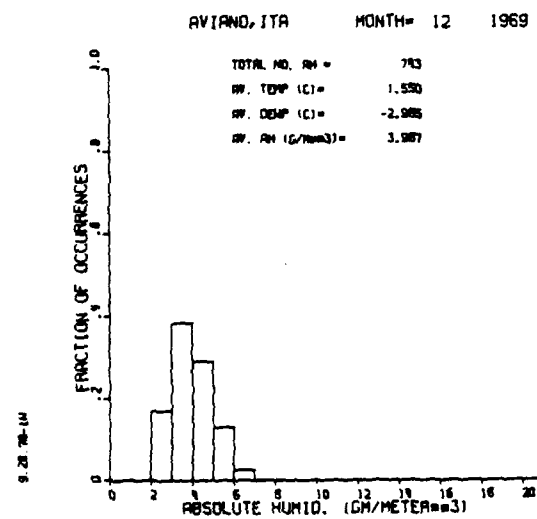
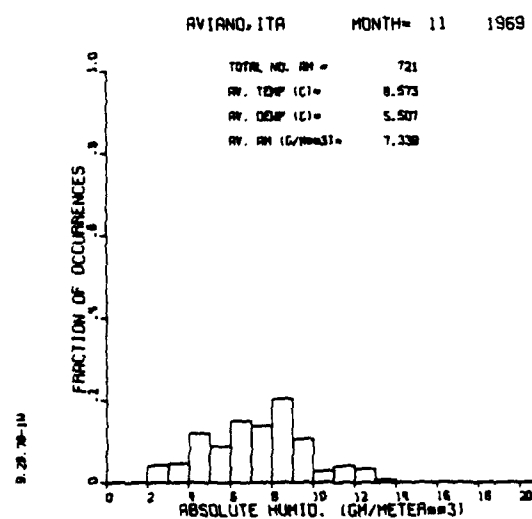
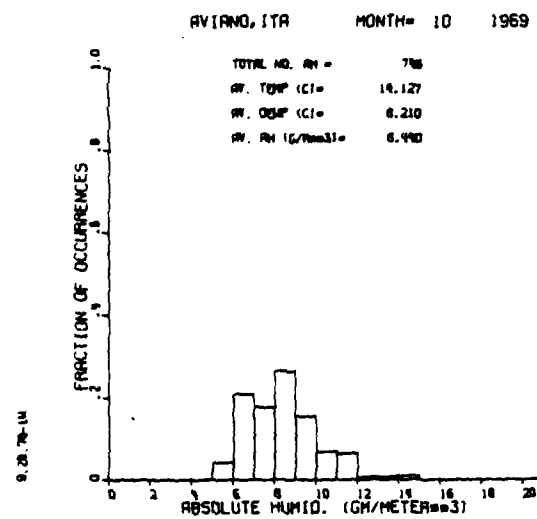
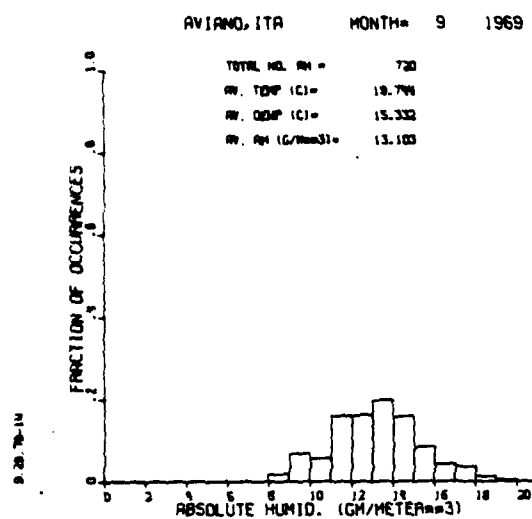
18-4-78-48

FIGURE 15. Absolute humidity statistics, Aviano, Italy, January-April 1969.



18-4-78-48

FIGURE 16. Absolute humidity statistics, Aviano, Italy, May-August 1969.



18-4-78-58

FIGURE 17. Absolute humidity statistics, Aviano, Italy, September-December 1969.

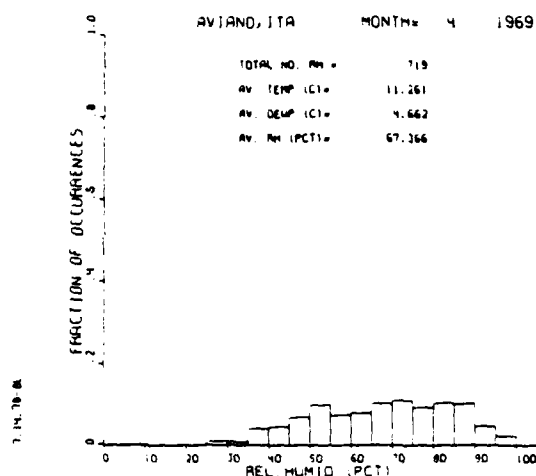
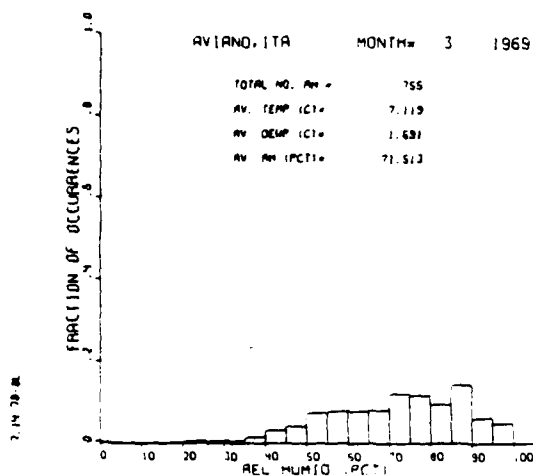
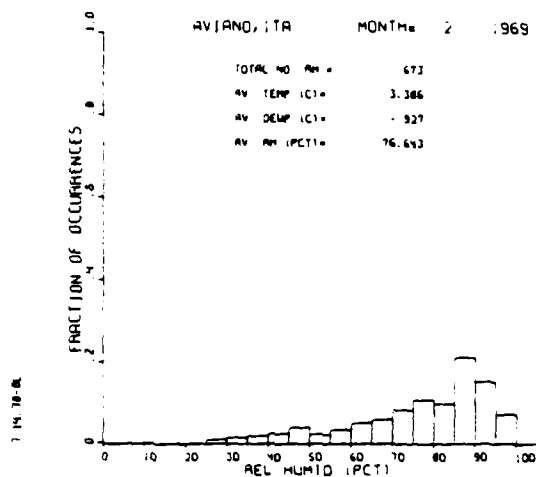
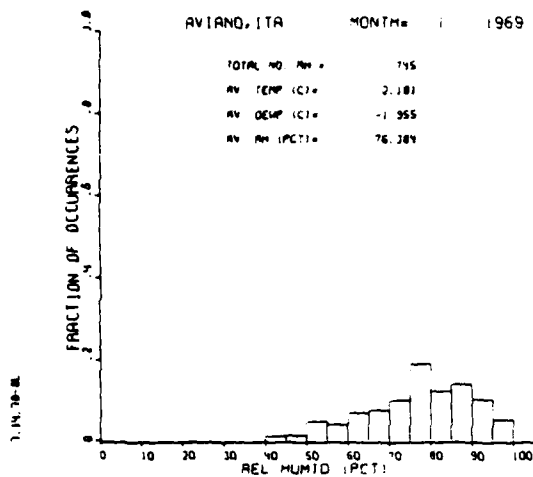
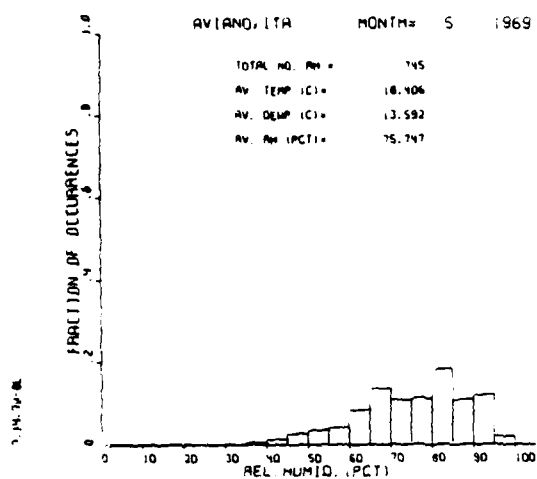
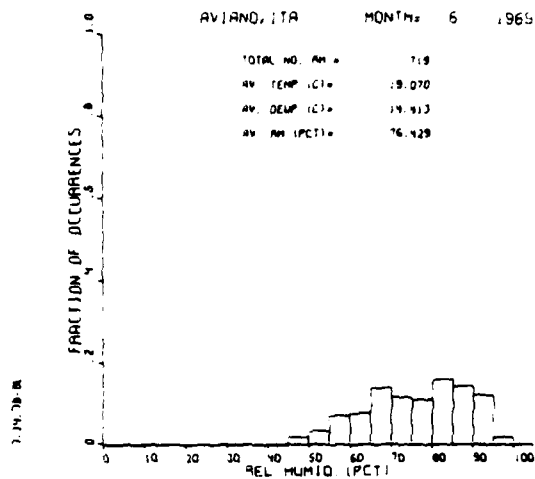


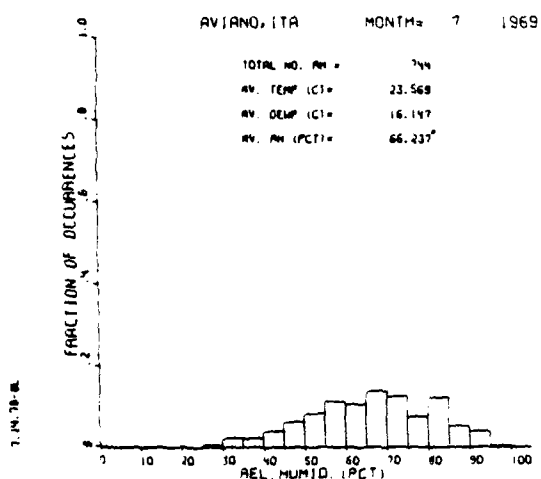
FIGURE 18. Relative humidity statistics, Aviano, Italy, January-April 1969.



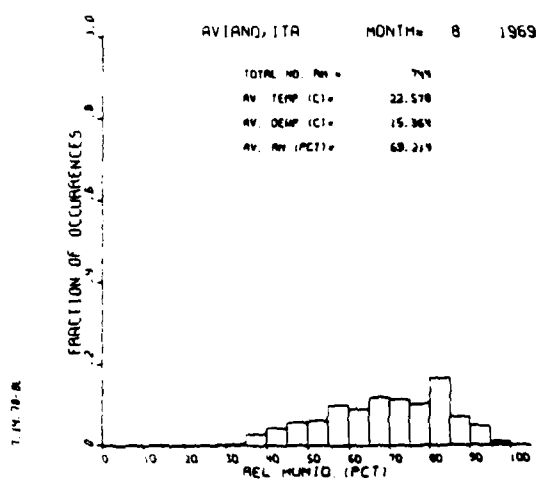
7.21.78-100



7.21.78-100



7.21.78-100



7.21.78-100

FIGURE 19. Relative humidity statistics, Aviano, Italy, May-August 1969.

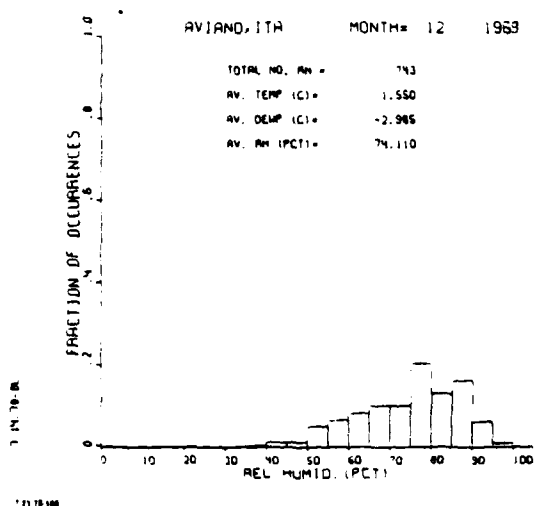
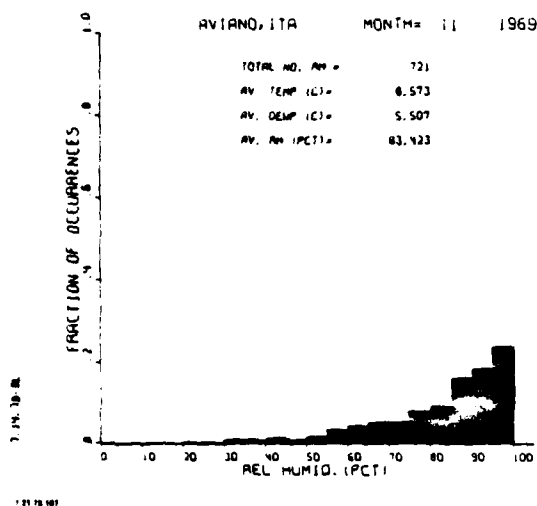
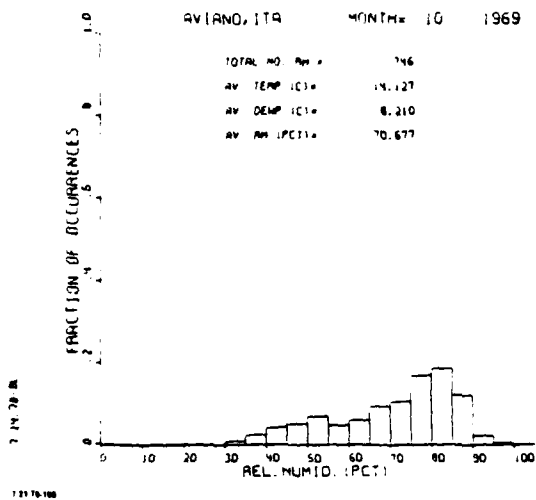
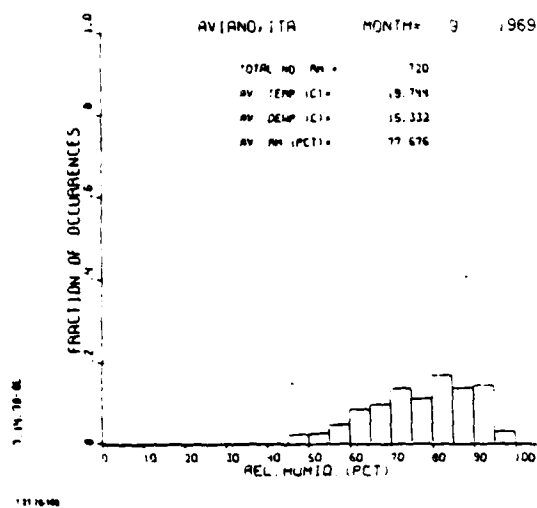
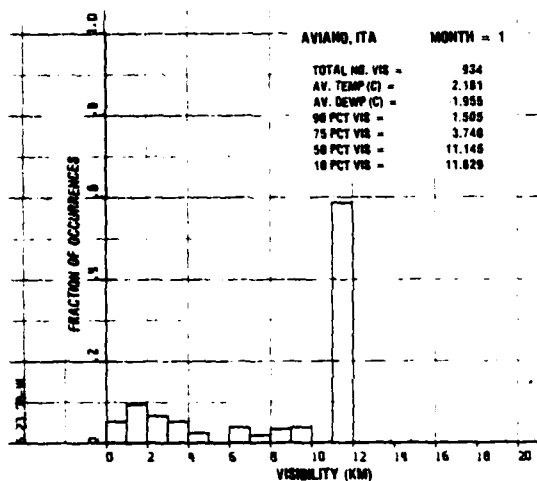
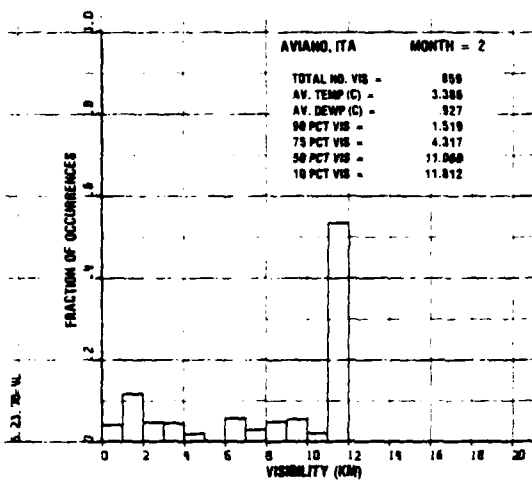


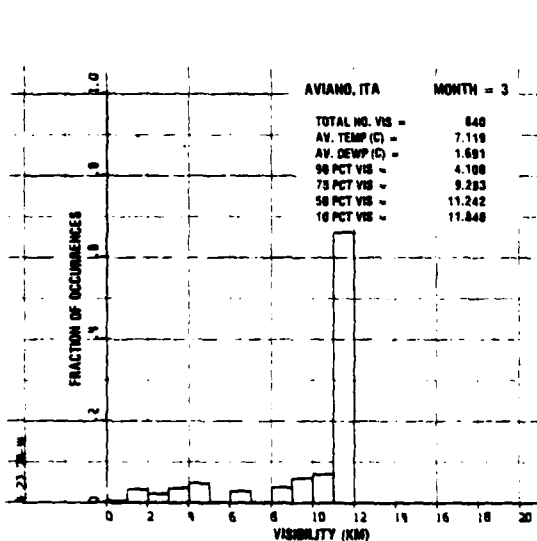
FIGURE 20. Relative humidity statistics, Aviano, Italy, September-December 1969.



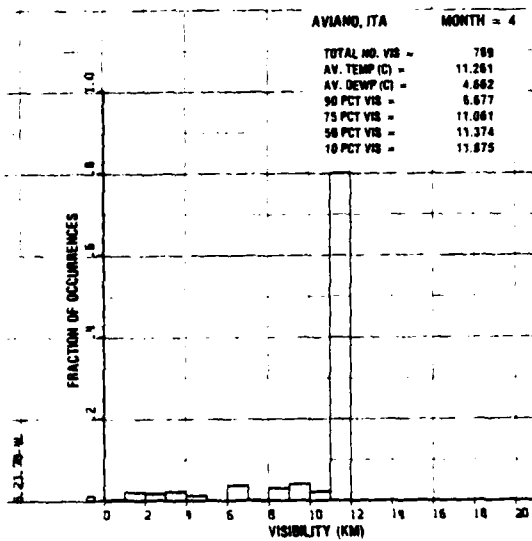
6 30 70 100



6 30 70 100



6 30 70 100



6 30 70 100

FIGURE 21. Visibility statistics, Aviano, Italy, January-April 1969.

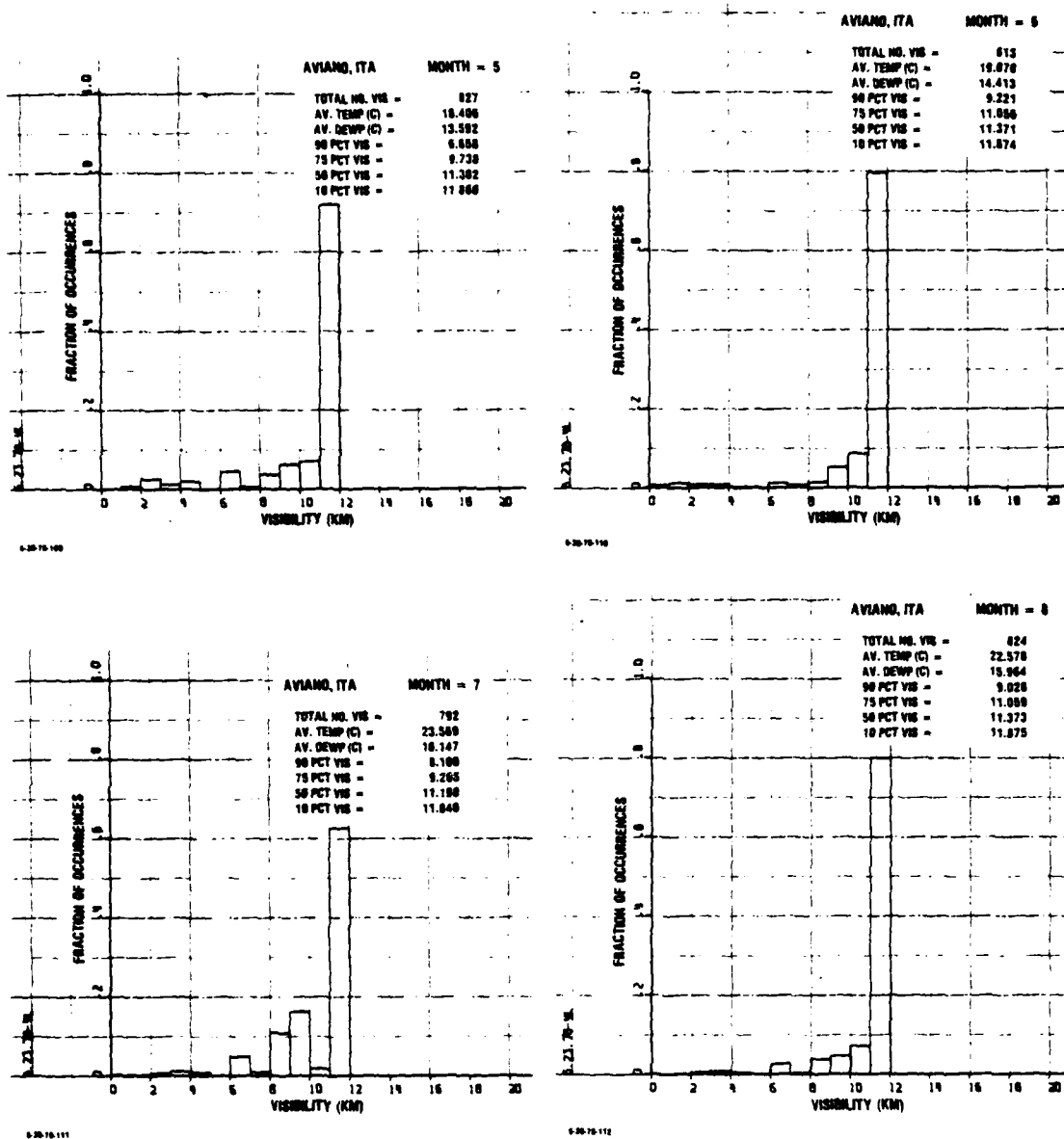


FIGURE 22. Visibility statistics, Aviano, Italy, May-August 1969.

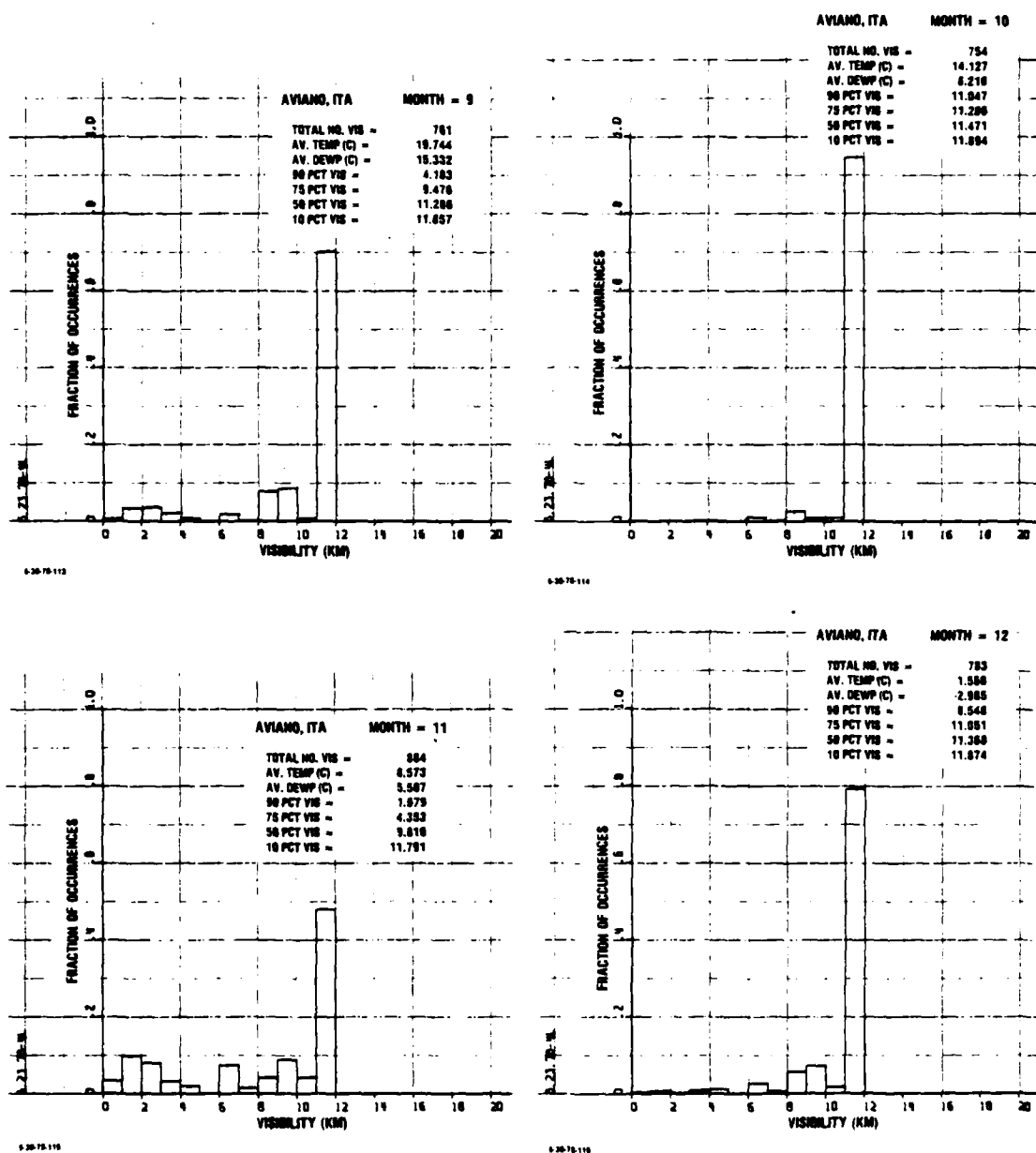
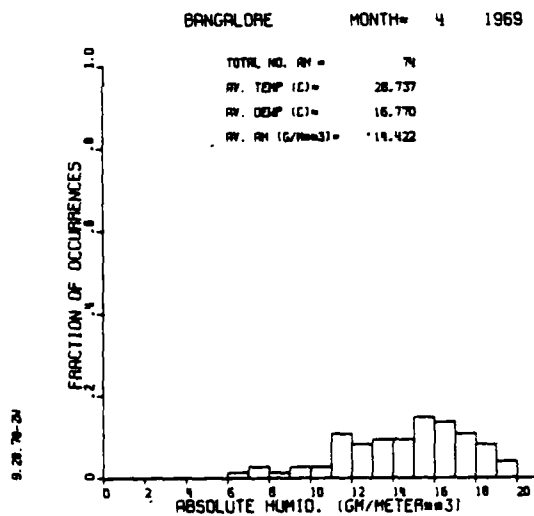
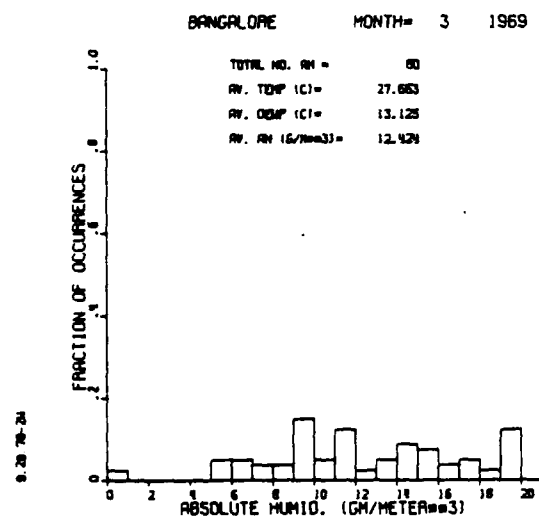
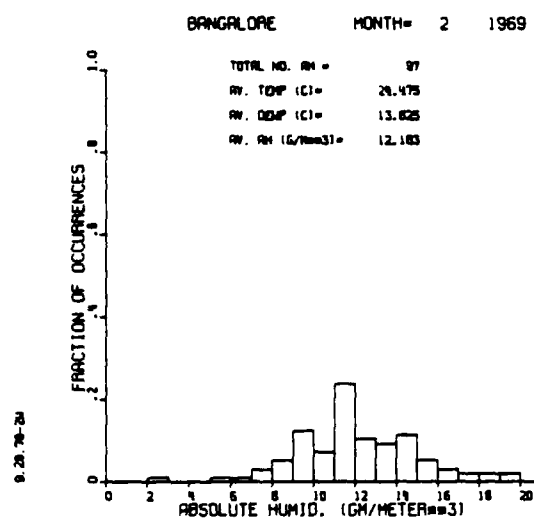
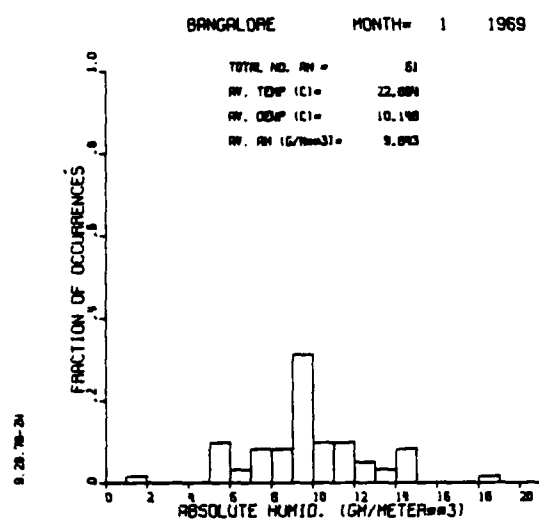


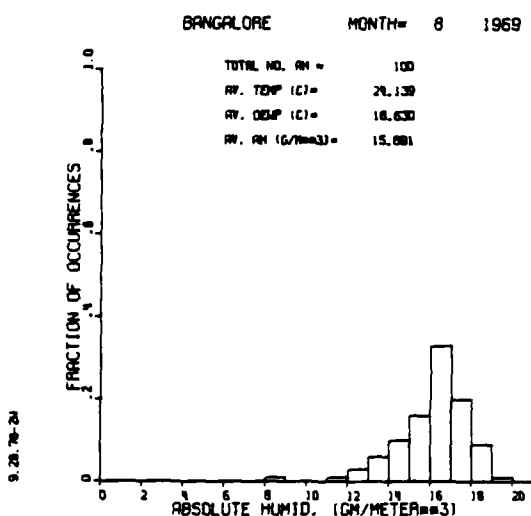
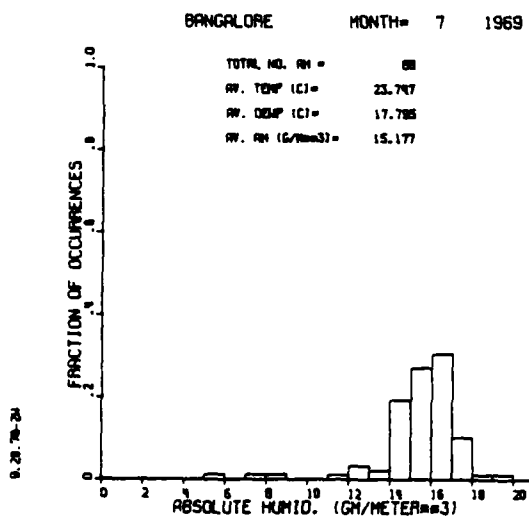
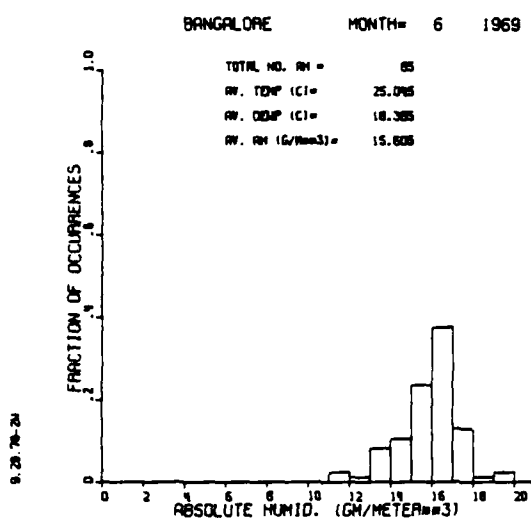
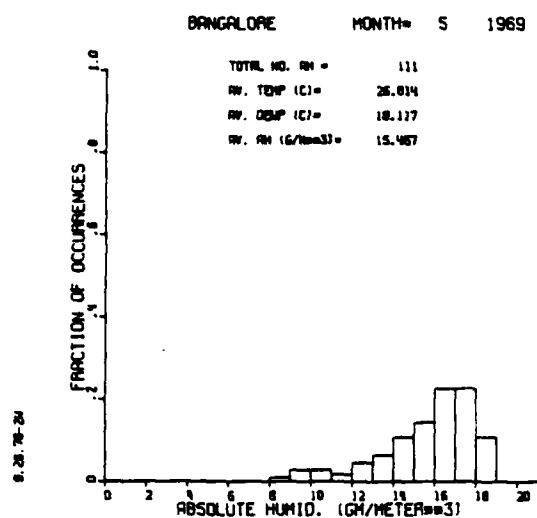
FIGURE 23. Visibility statistics, Aviano, Italy, September-December 1969.

BANGALORE, INDIA



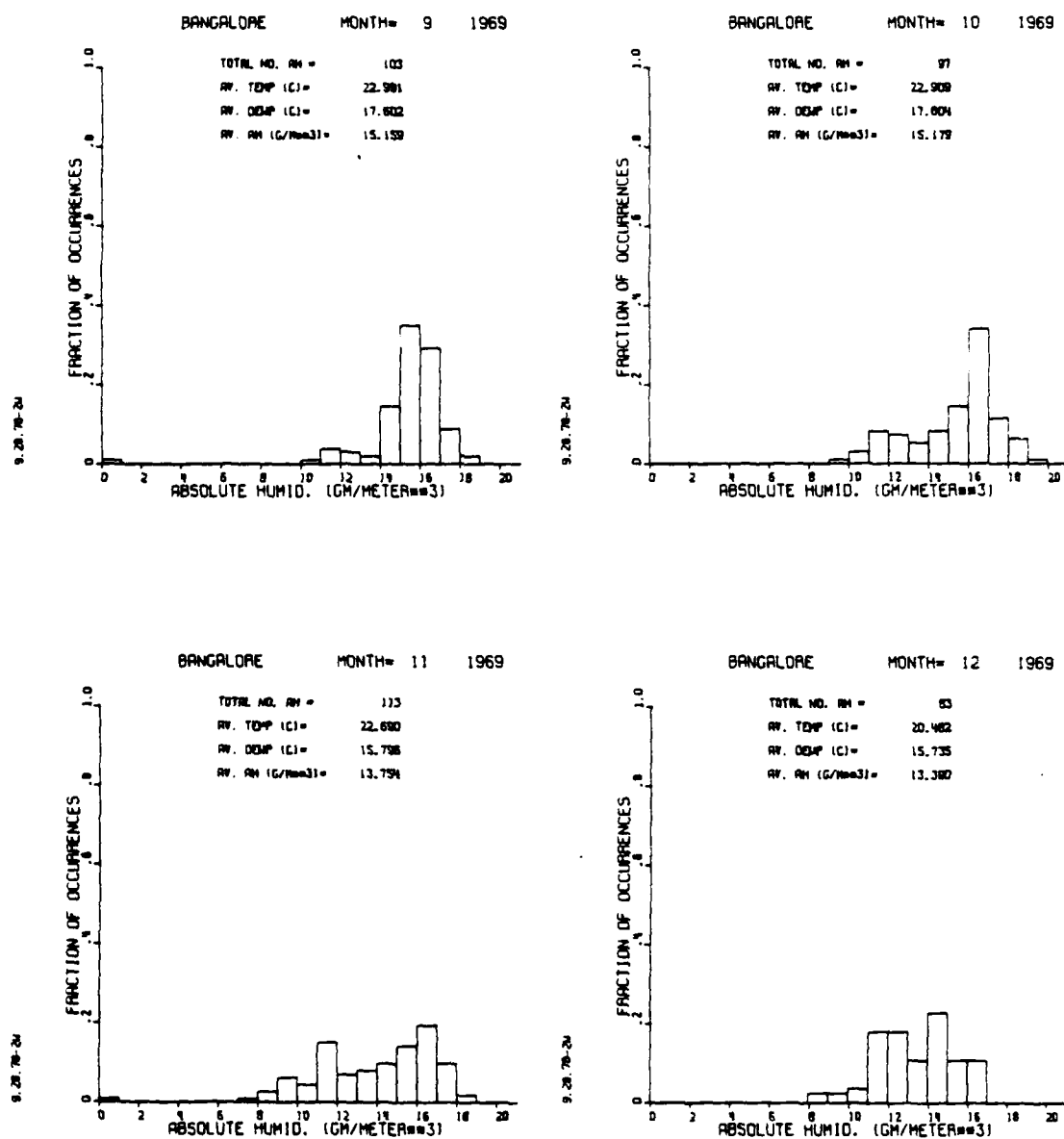
18-4-78-51

FIGURE 24. Absolute humidity statistics, Bangalore, India, January-April 1969.



10-4-78-52

FIGURE 25. Absolute humidity statistics, Bangalore, India, May-August 1969.



10-4-78-53

FIGURE 26. Absolute humidity statistics, Bangalore, India, September-December 1969.

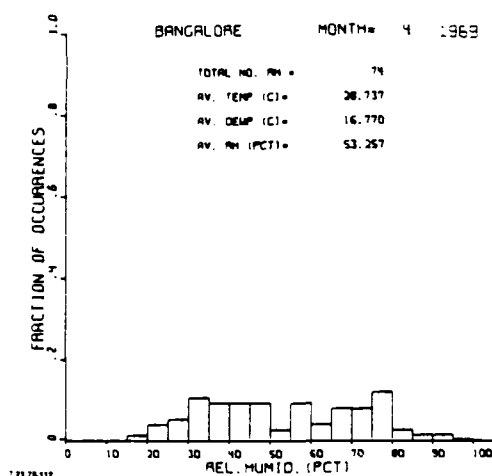
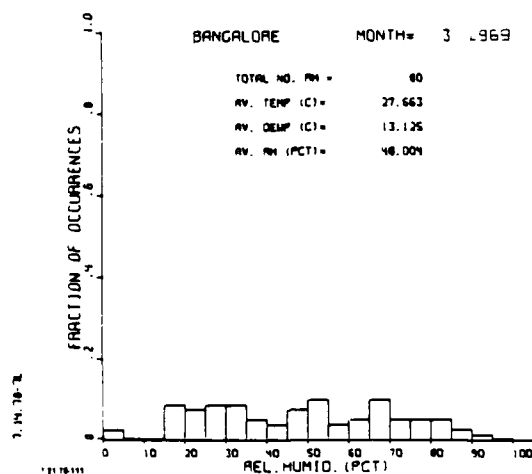
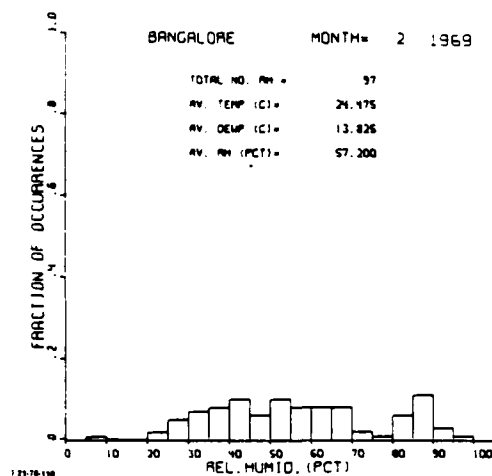
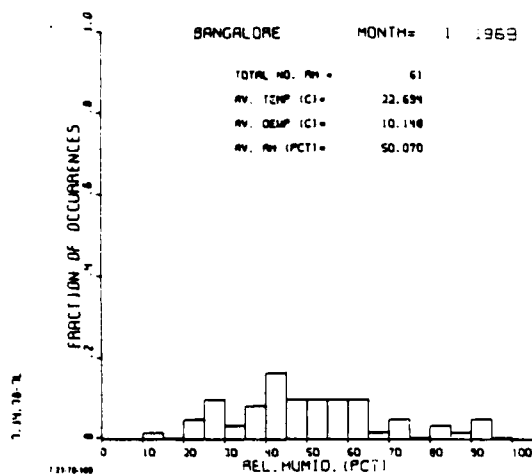


FIGURE 27. Relative humidity statistics, Bangalore, India, January-April 1969.

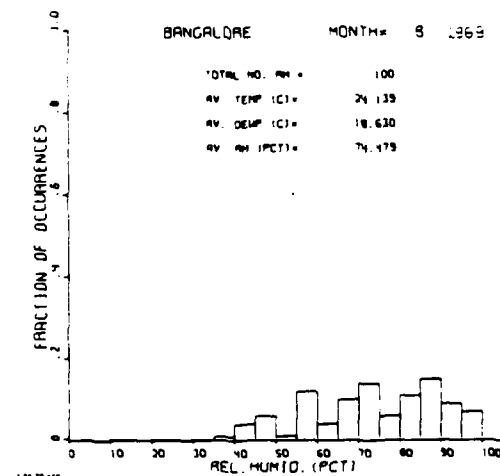
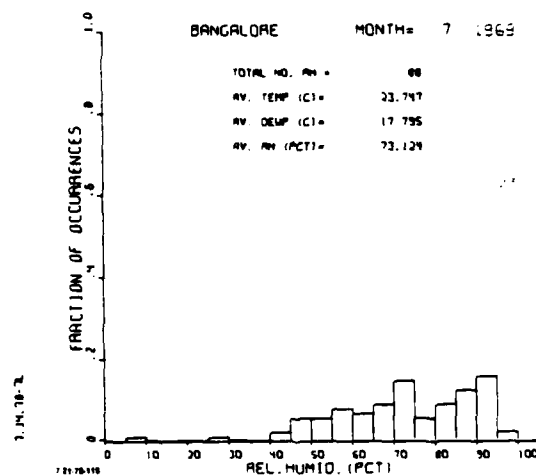
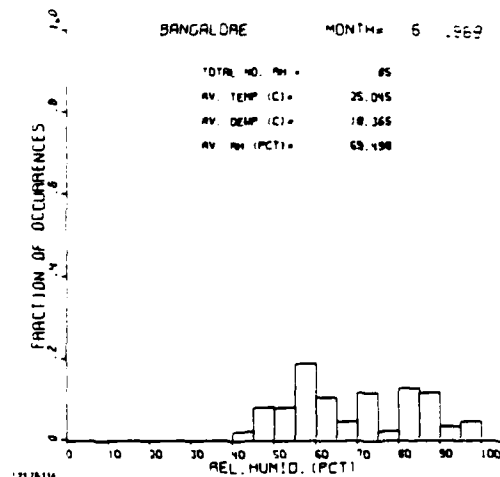
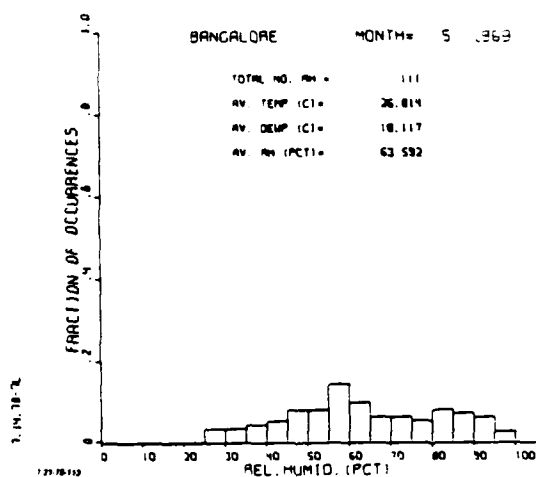


FIGURE 28. Relative humidity statistics, Bangalore, India, May-August 1969.

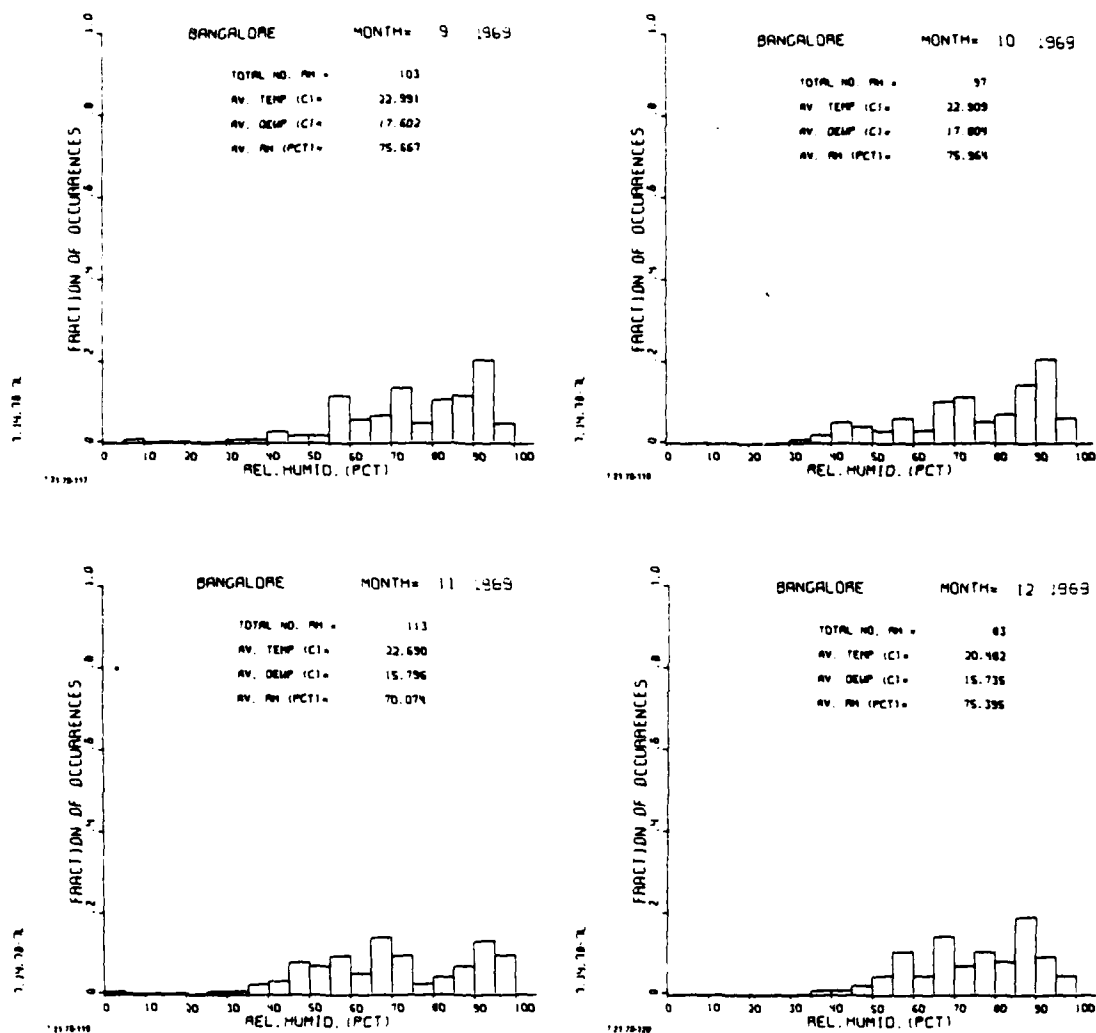


FIGURE 29. Relative humidity statistics, Bangalore, India, September-December 1969.

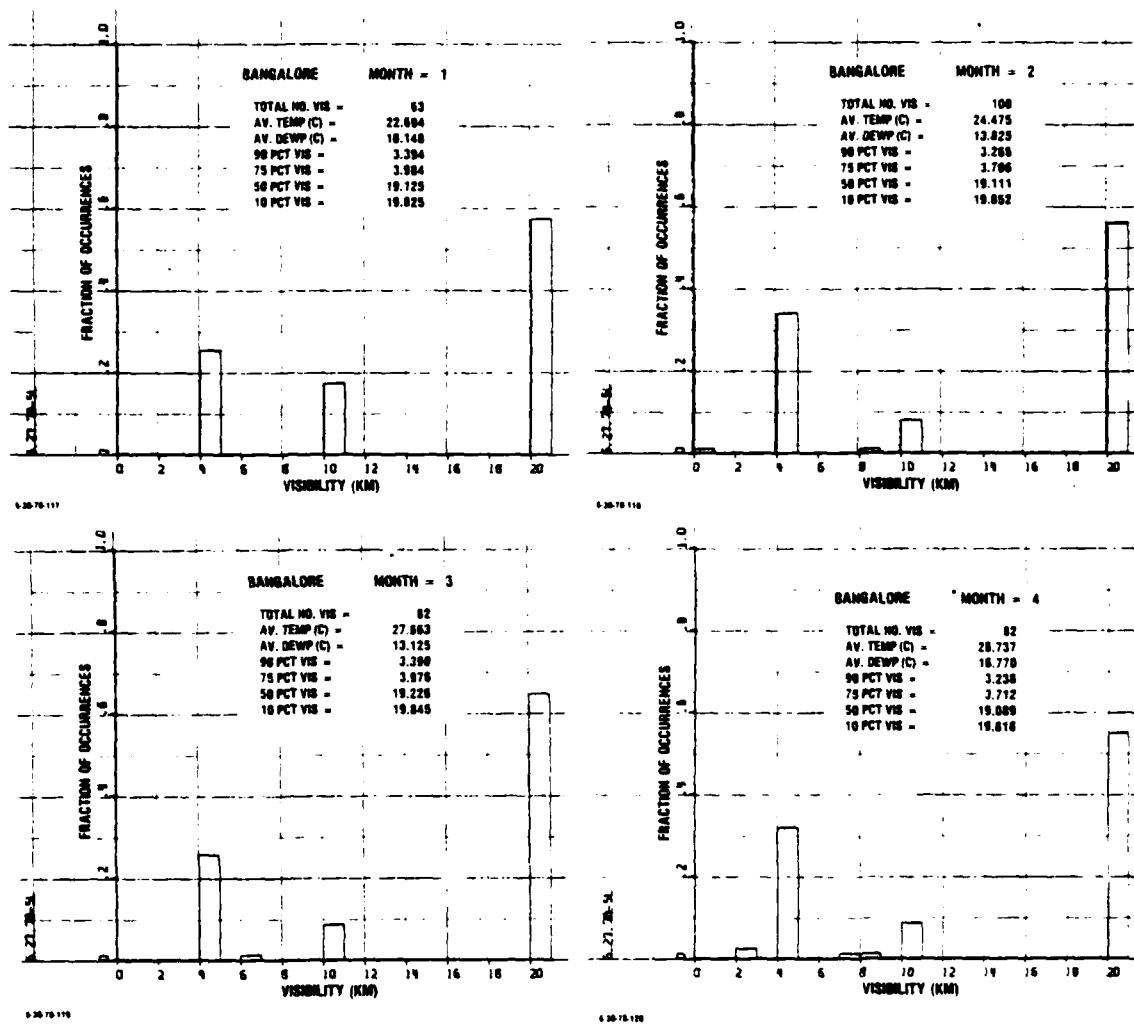


FIGURE 30. Visibility statistics, Bangalore, India, January-April 1969.

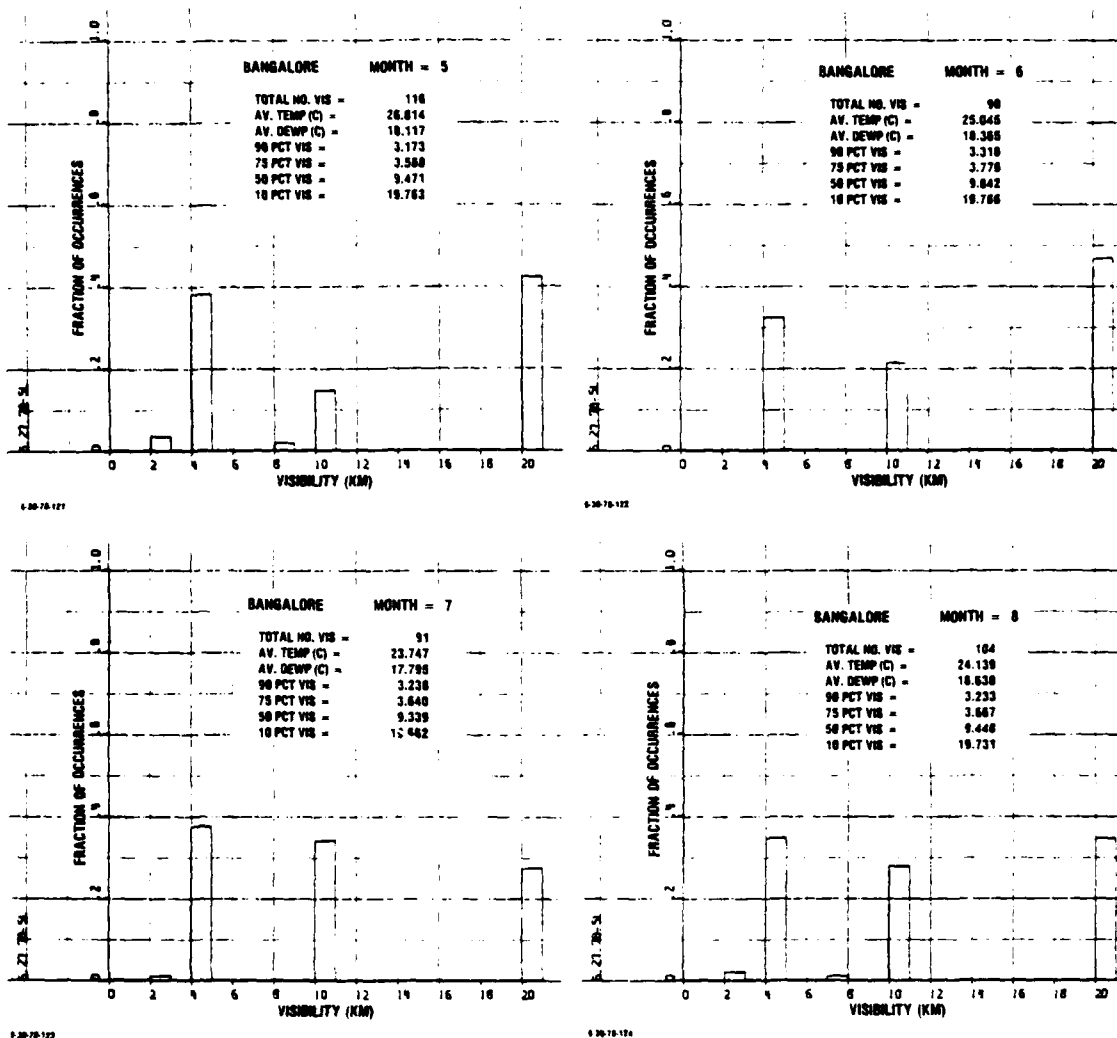


FIGURE 31. Visibility statistics, Bangalore, India, May-August 1969.

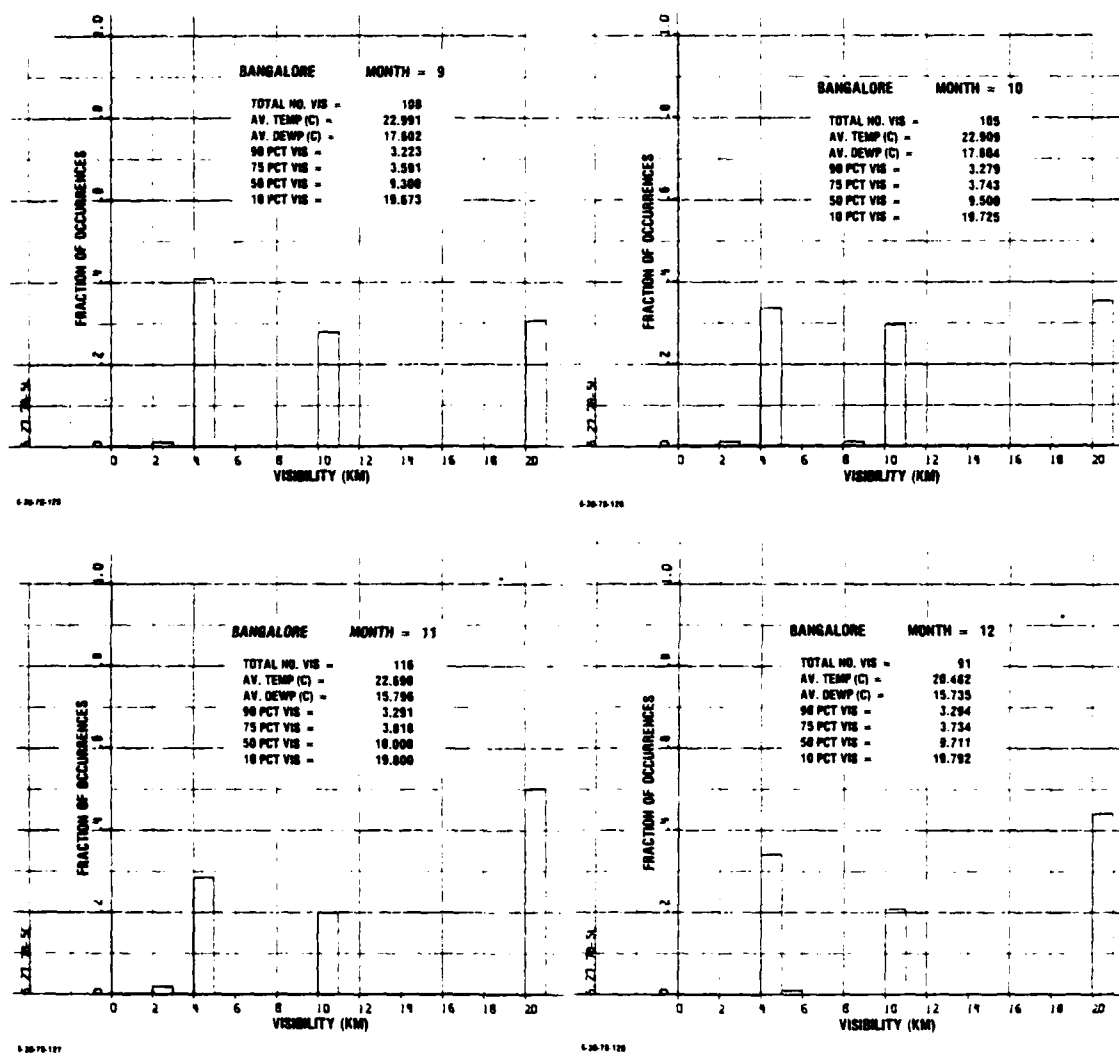
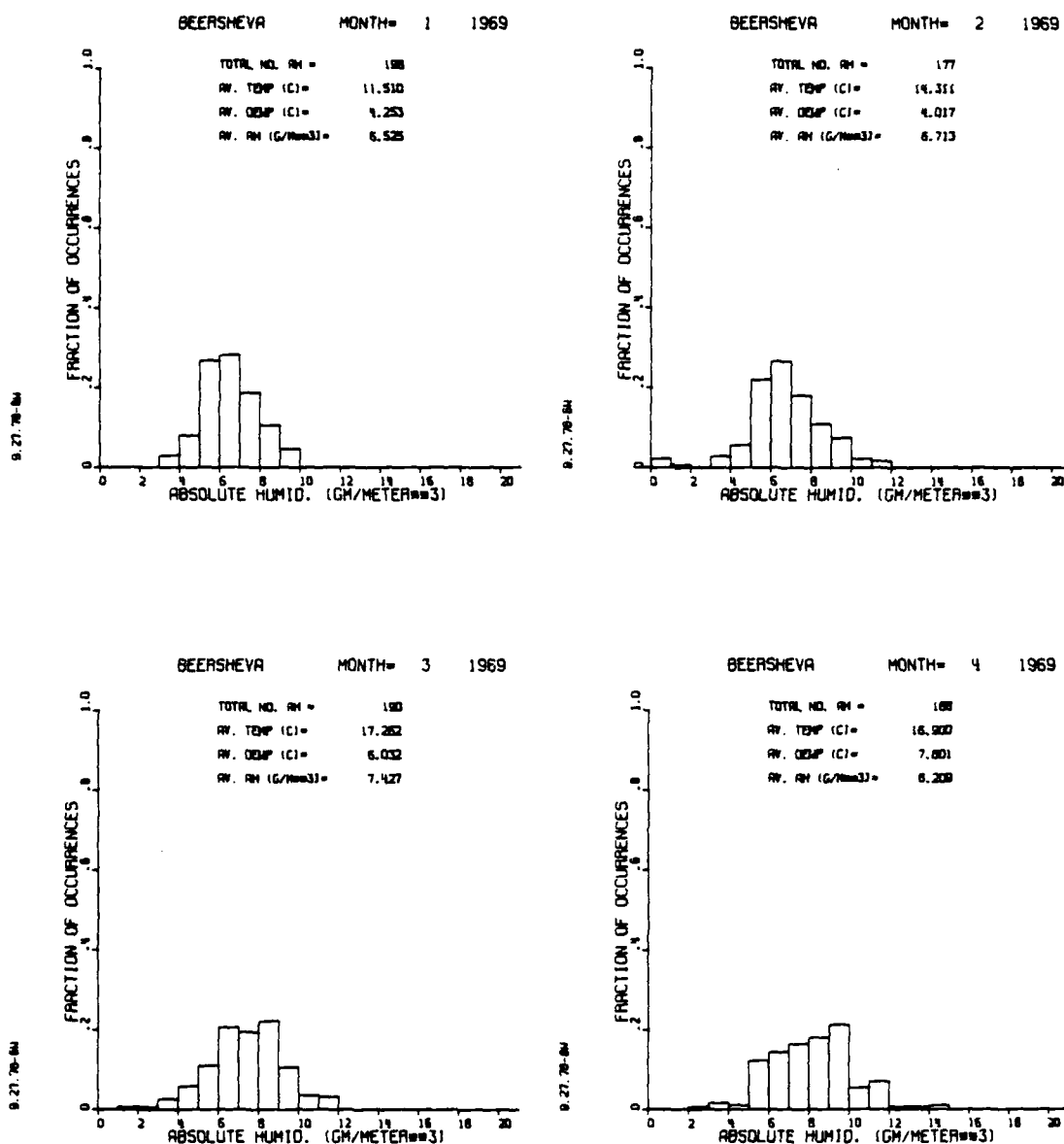


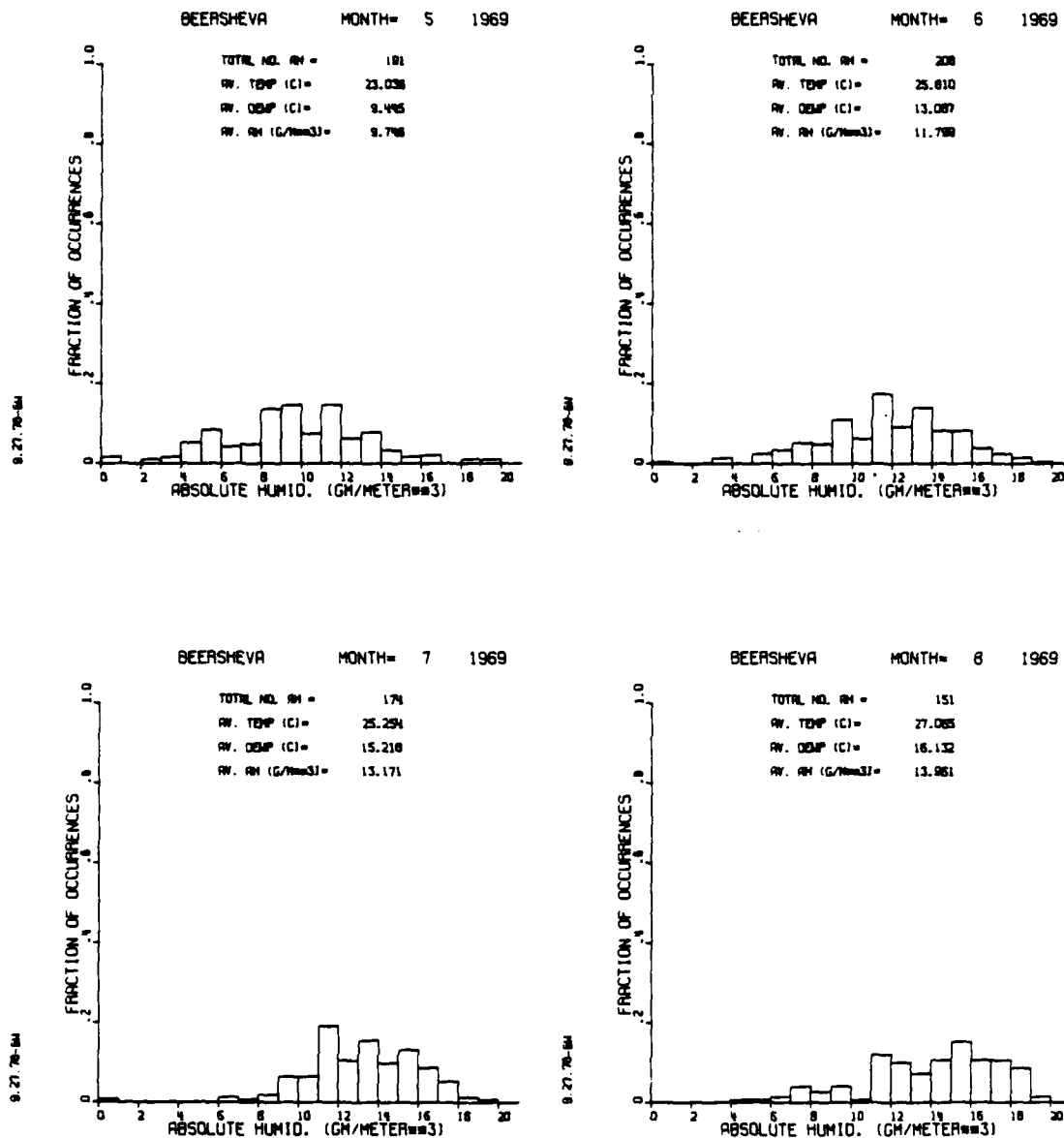
FIGURE 32. Visibility statistics, Bangalore, India, September-December 1969.

BEERSHEVA, ISRAEL



16-4-78-57

FIGURE 33. Absolute humidity statistics, Beersheva, Israel, January-April 1969.



18-4-78-88

FIGURE 34. Absolute humidity statistics, Beersheva, Israel, May-August 1969.

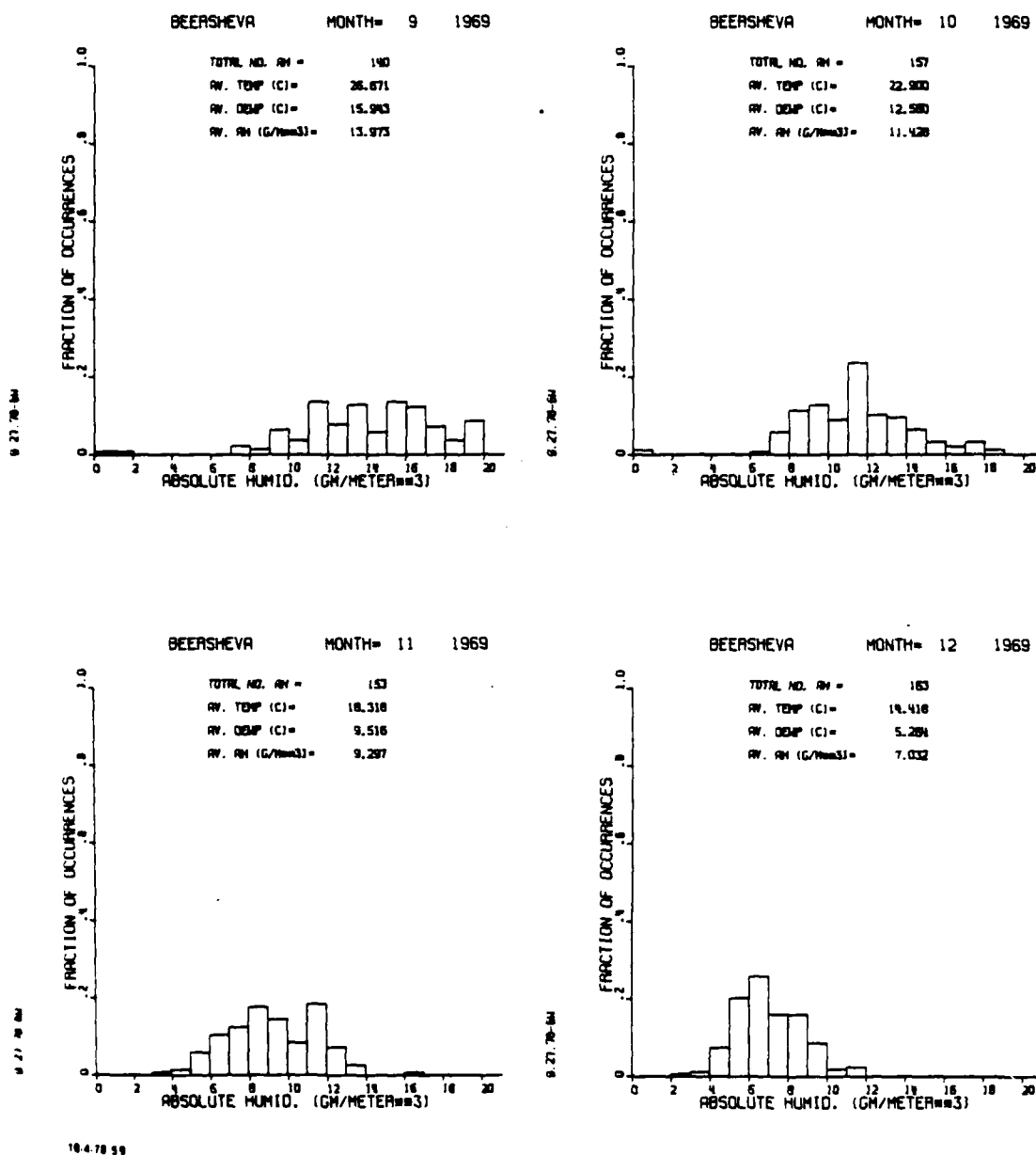


FIGURE 35. Absolute humidity statistics, Beersheva, Israel, September-December 1969.

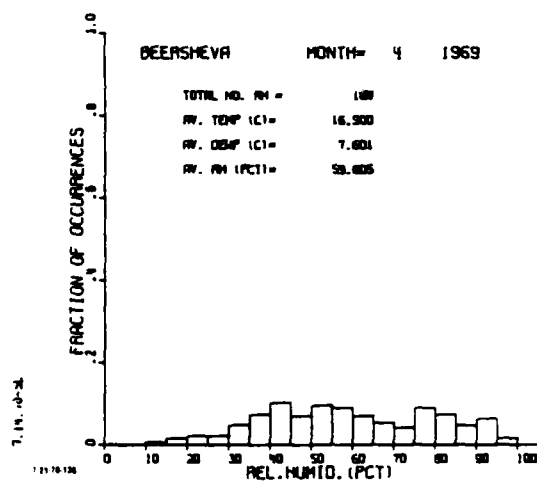
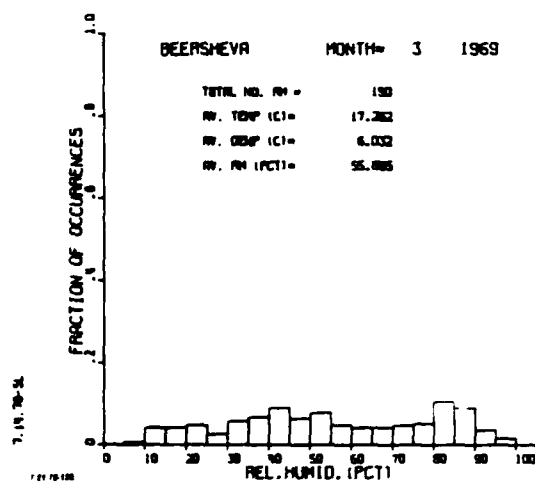
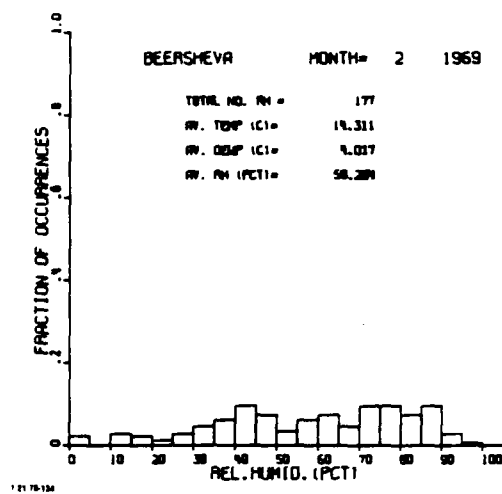
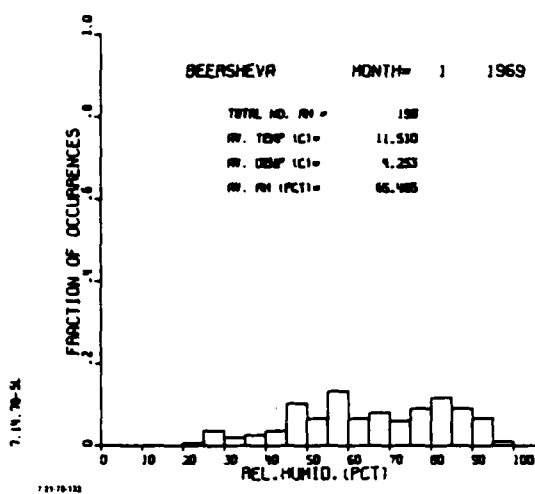


FIGURE 36. Relative humidity statistics, Beersheva, Israel, January-April 1969.

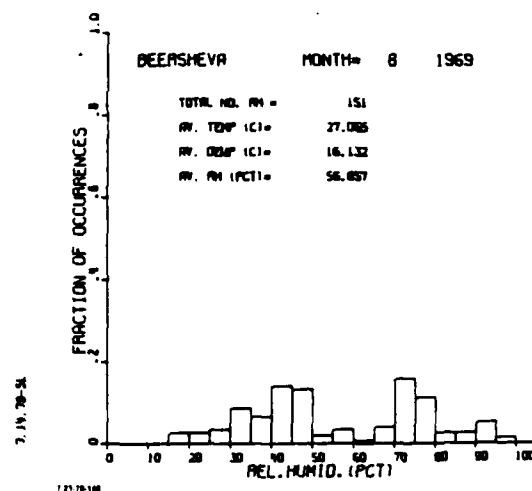
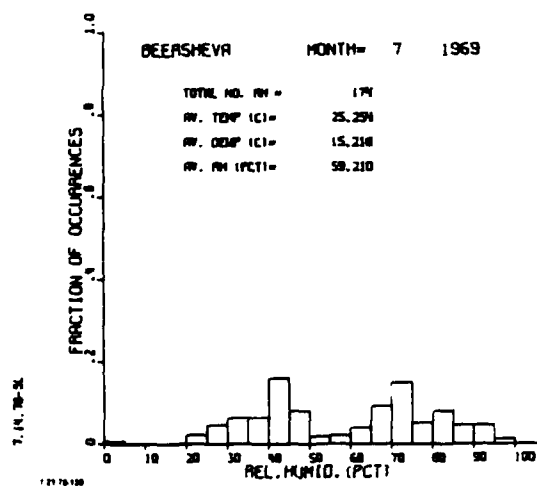
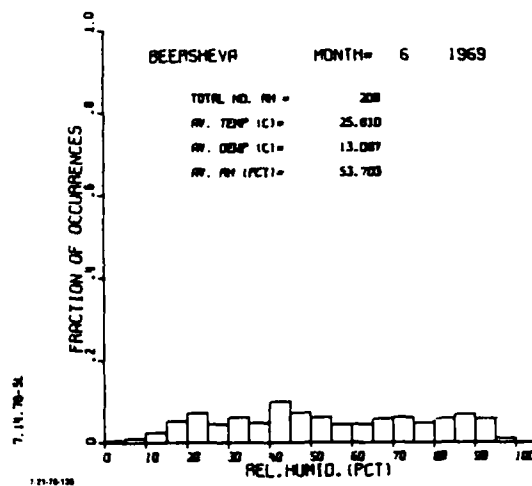
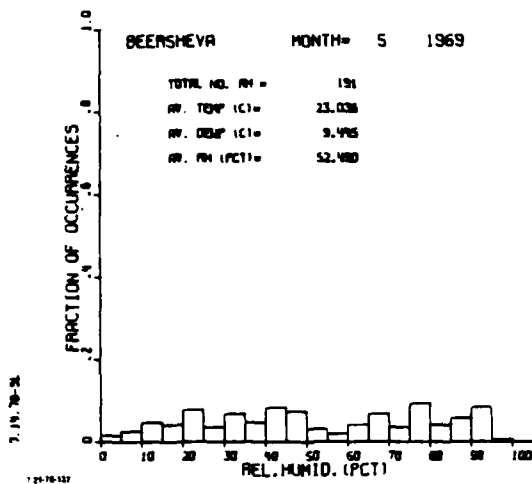


FIGURE 37. Relative humidity statistics, Beersheva, Israel, May-August 1969.

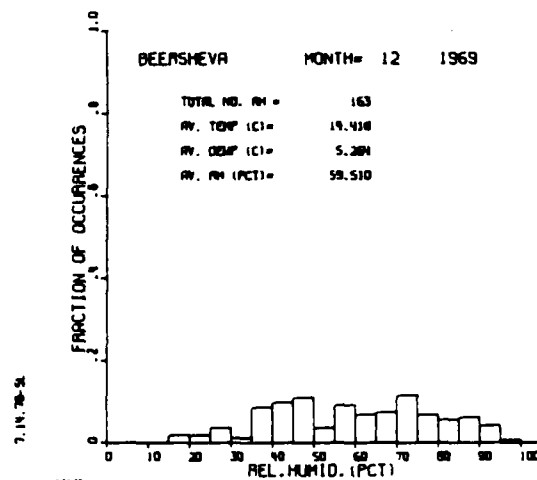
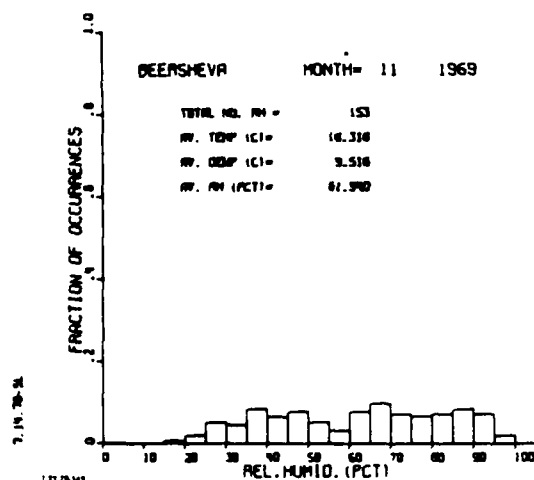
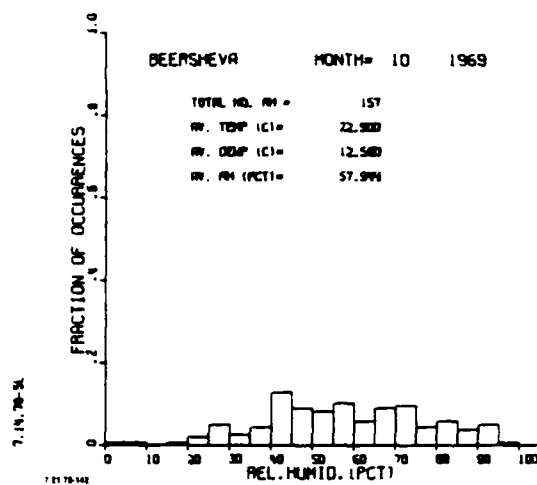
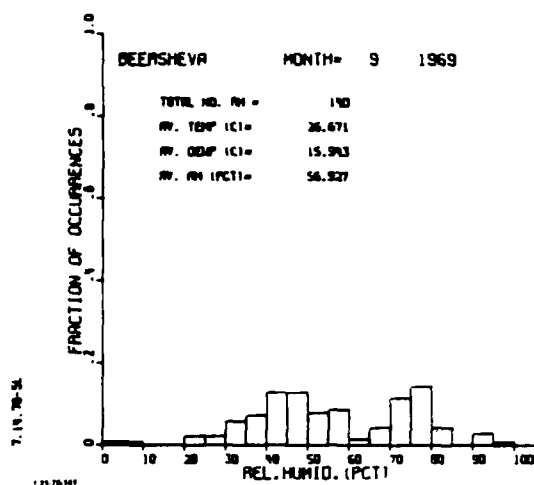


FIGURE 38. Relative humidity statistics, Beersheva, Israel, September-December 1969.

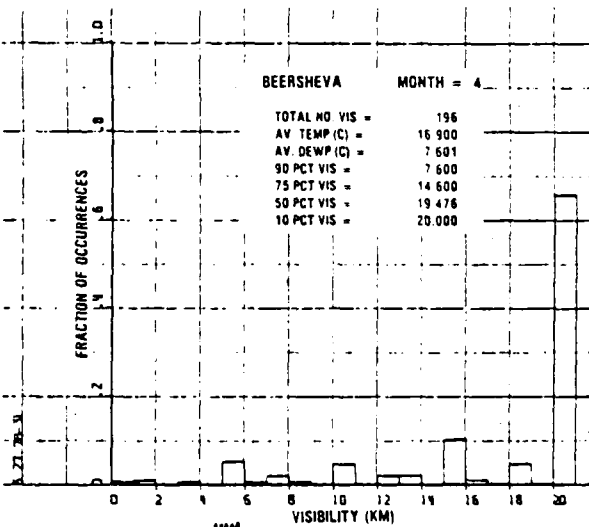
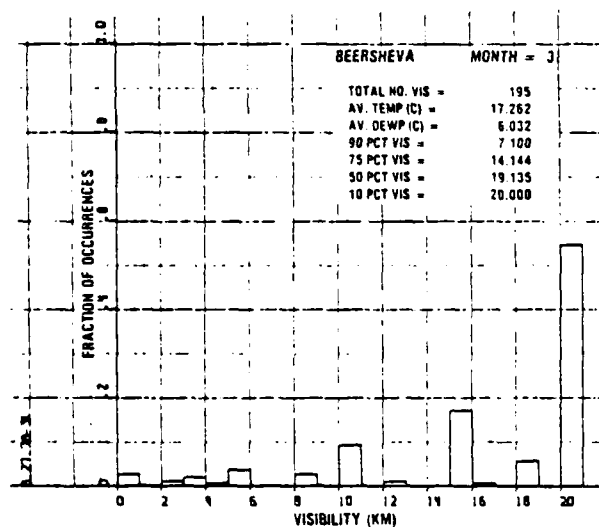
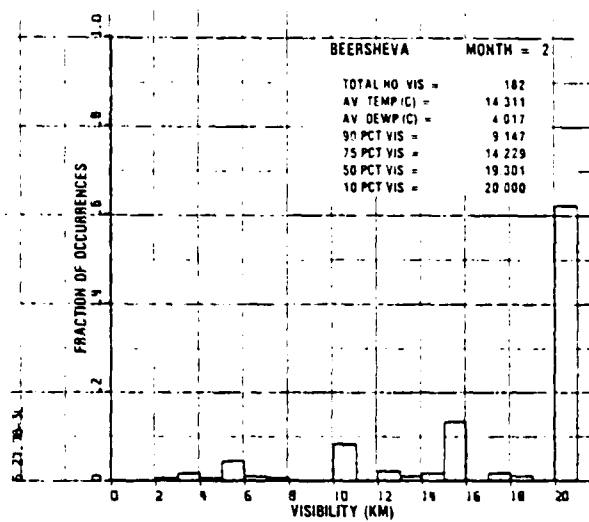
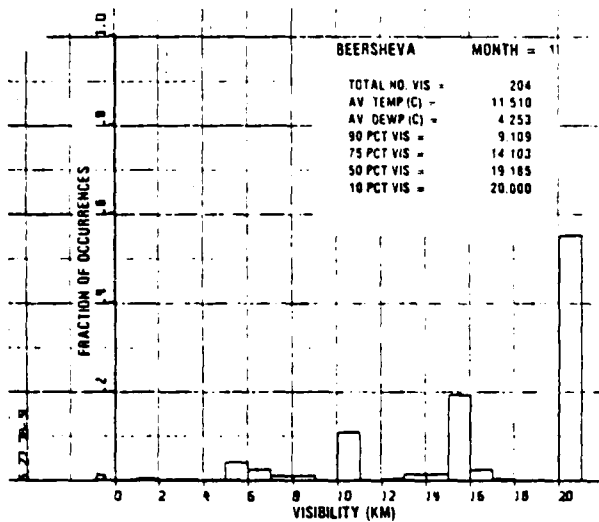


FIGURE 39. Visibility statistics, Beersheva, Israel, January-April 1969.

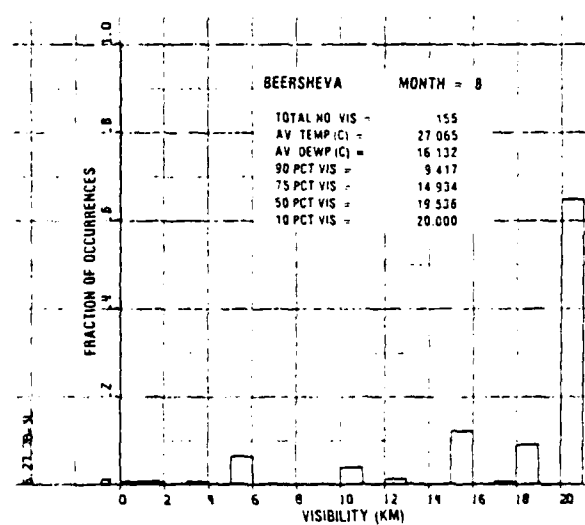
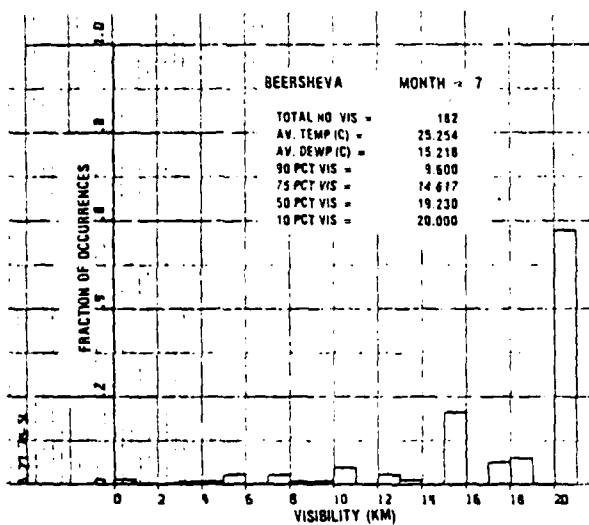
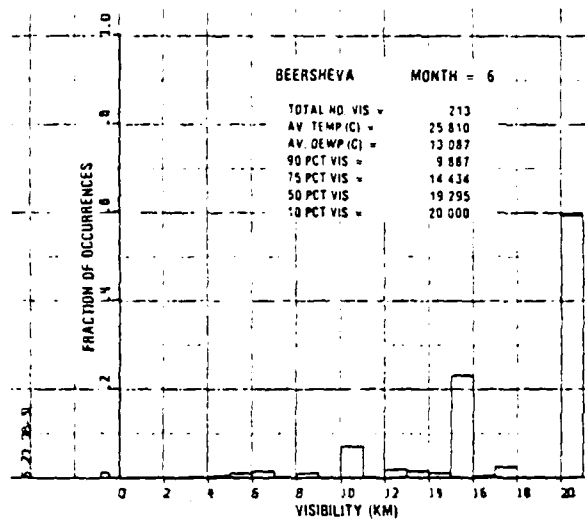
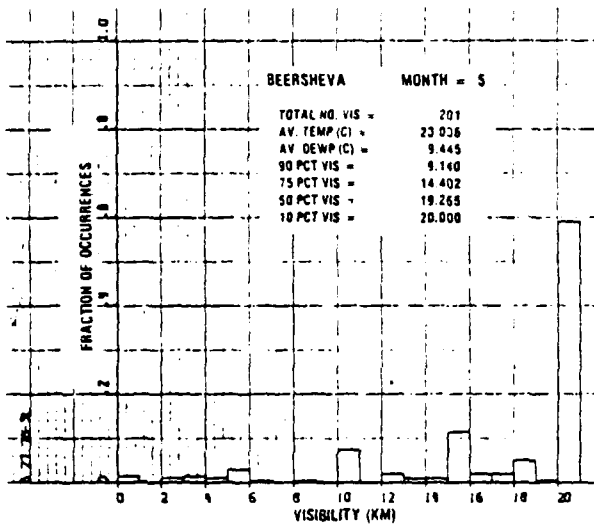


FIGURE 40. Visibility statistics, Beersheva, Israel, May-August 1969.

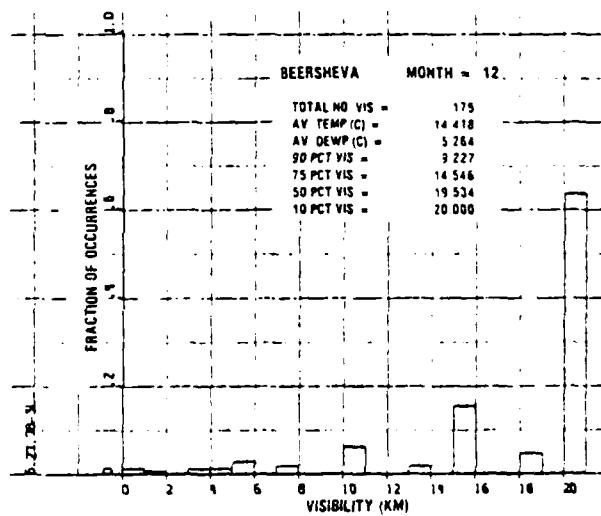
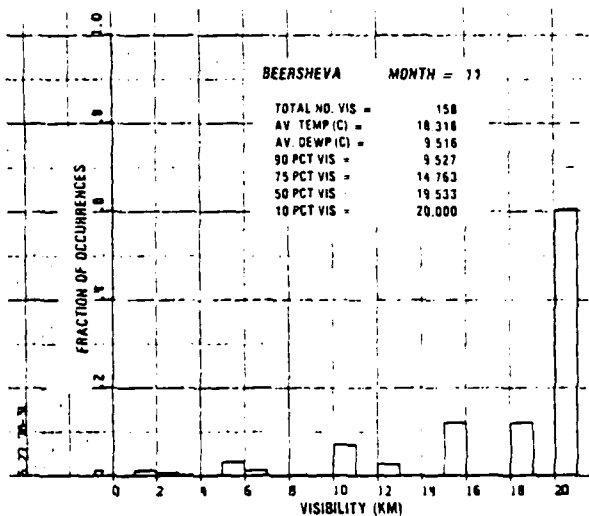
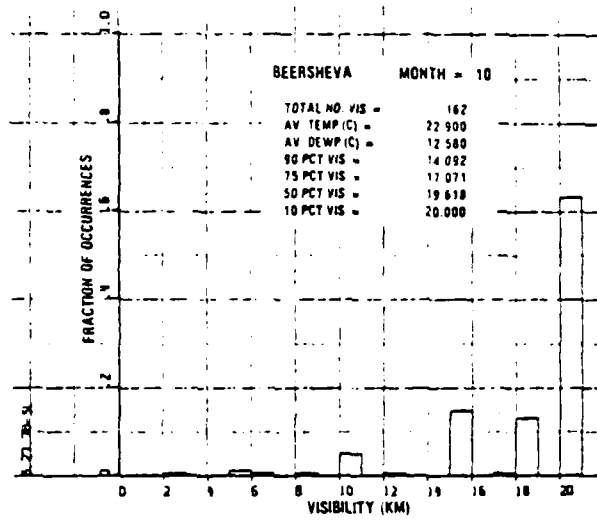
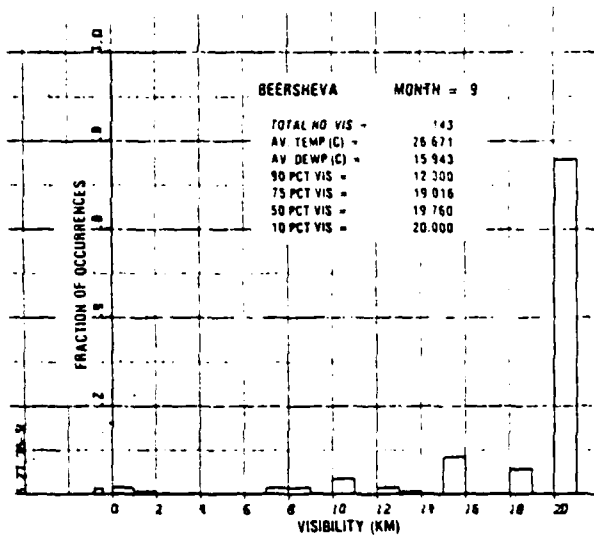
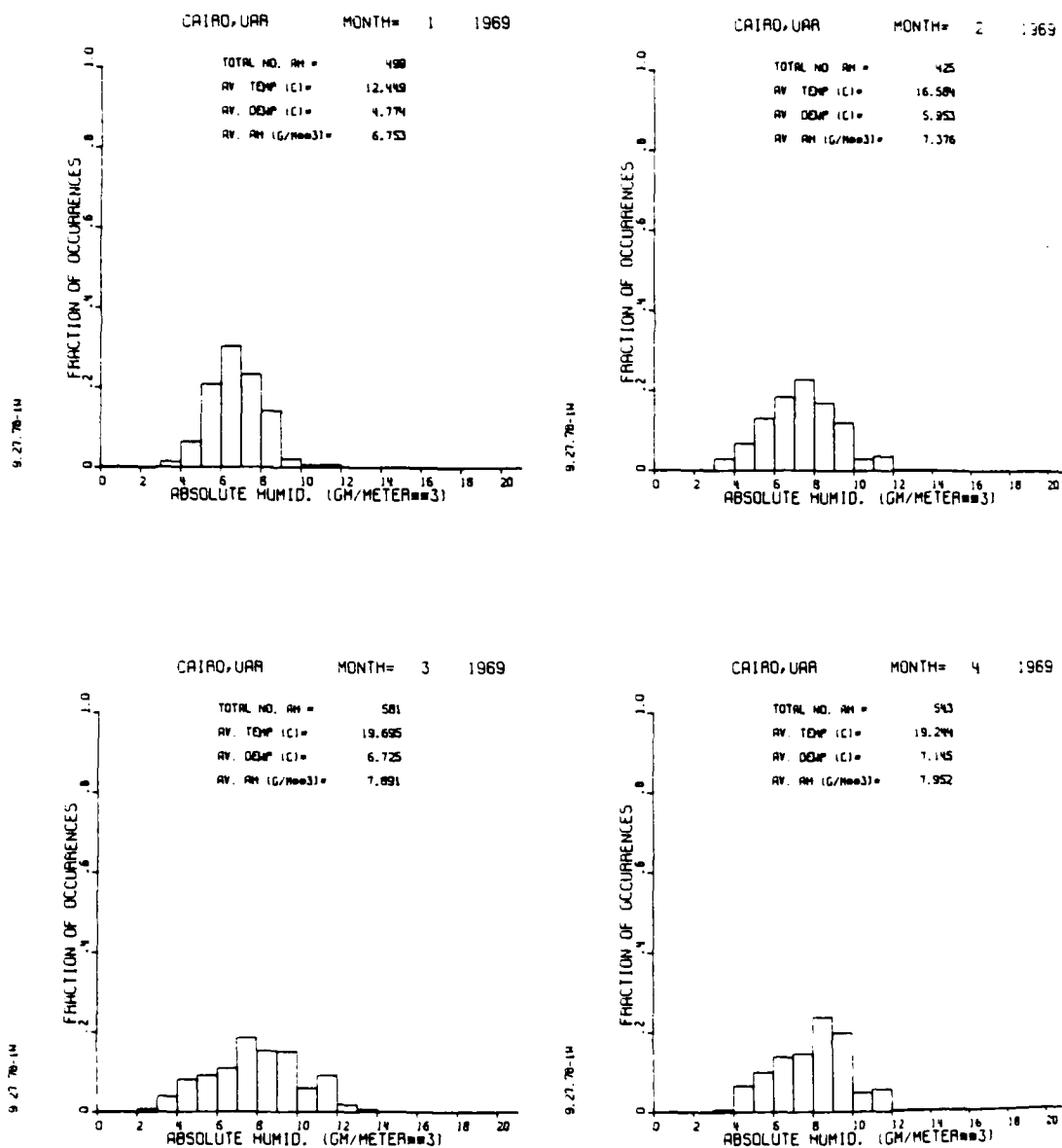


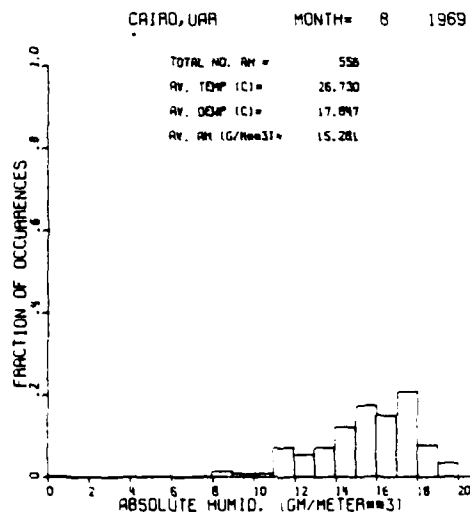
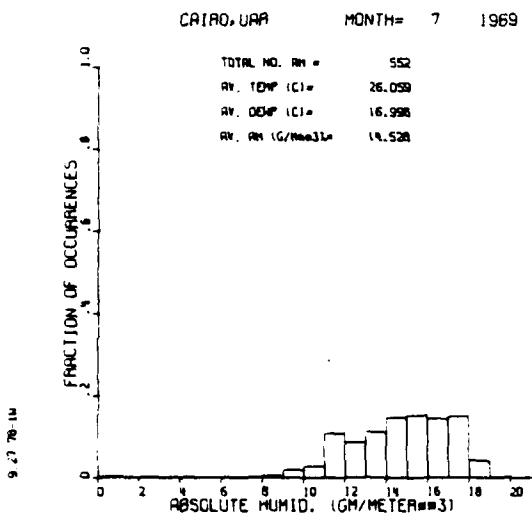
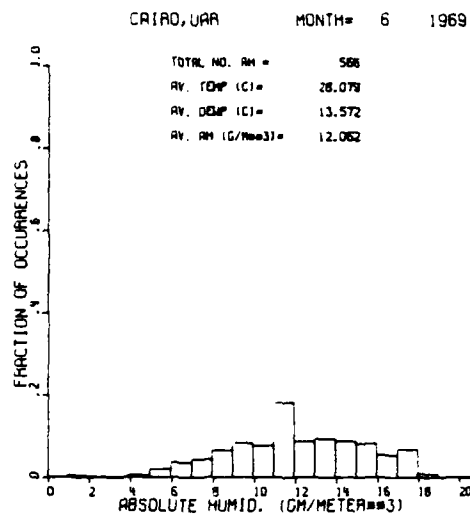
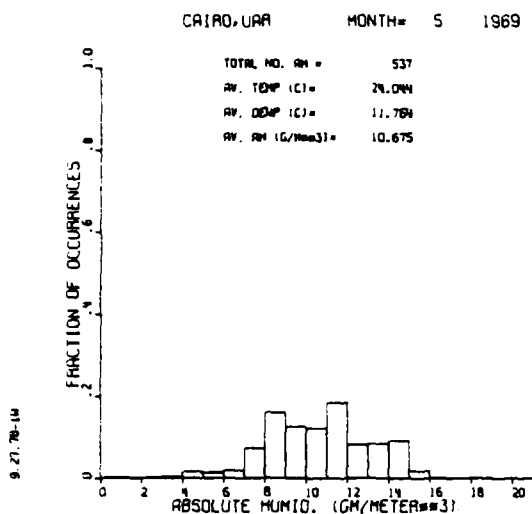
FIGURE 41. Visibility statistics, Beersheva, Israel, September-December 1969.

CAIRO, EGYPT



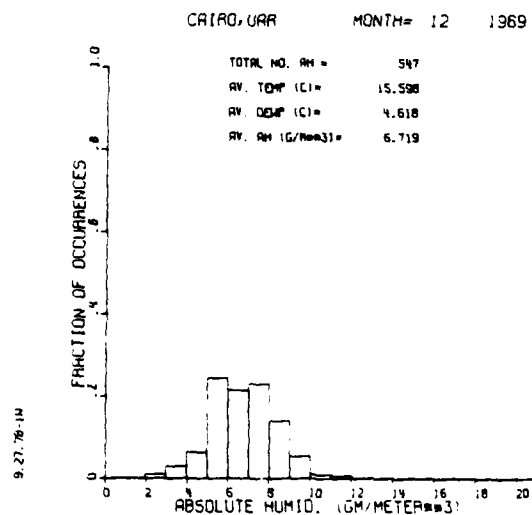
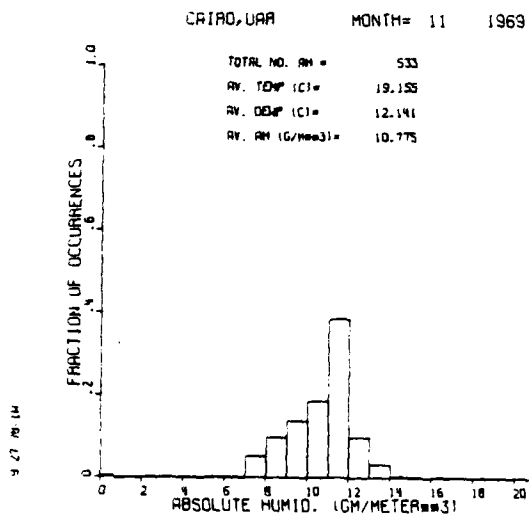
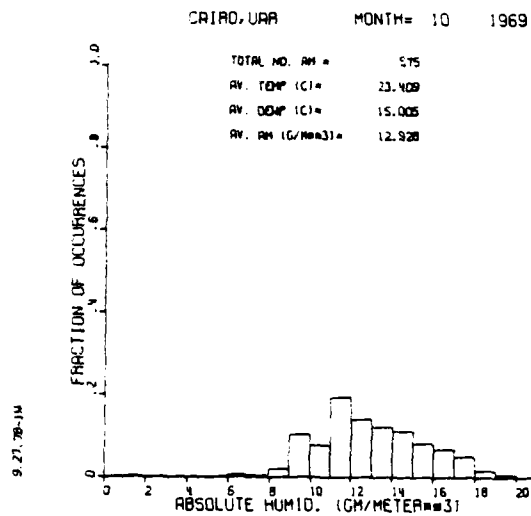
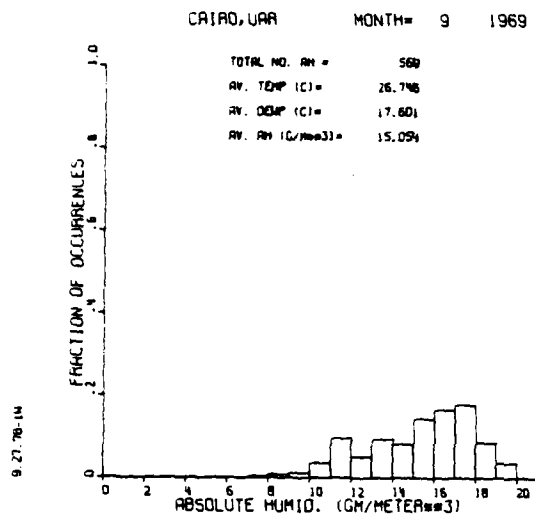
18-4-78-84

FIGURE 42. Absolute humidity statistics, Cairo, Egypt, January-April 1969.



16-4-78-85

FIGURE 43. Absolute humidity statistics, Cairo, Egypt, May-August 1969.



18-4-78-88

FIGURE 44. Absolute humidity statistics, Cairo, Egypt, September-December 1969.

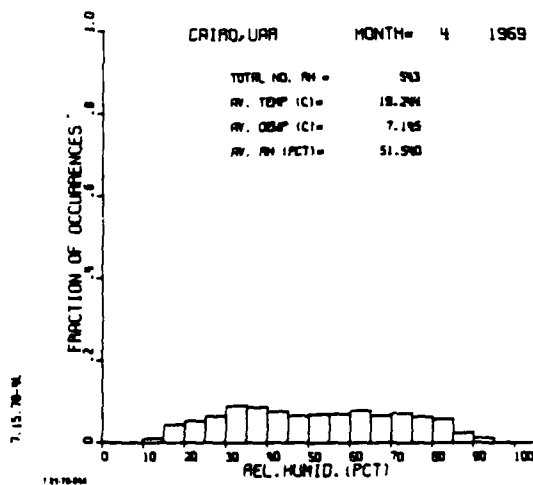
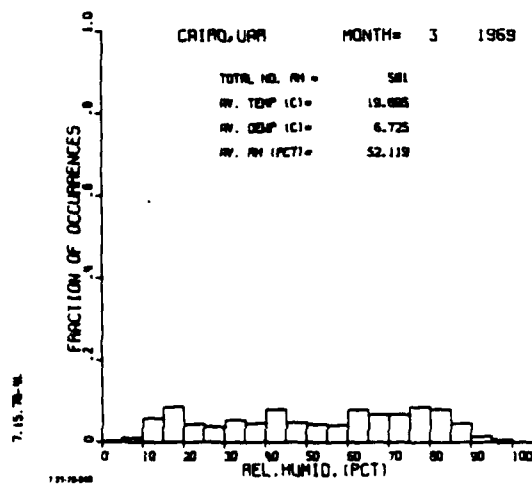
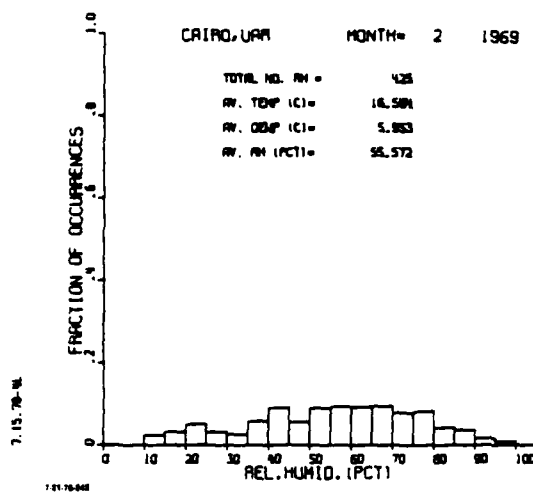
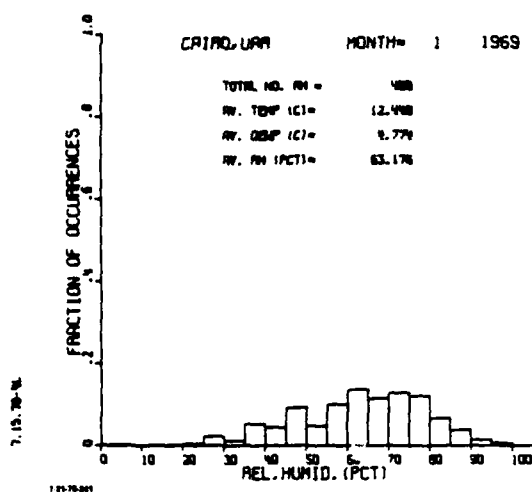


FIGURE 45. Relative humidity statistics, Cairo, Egypt, January-April 1969.

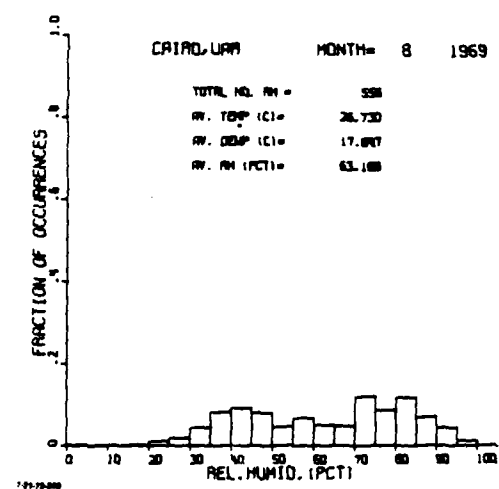
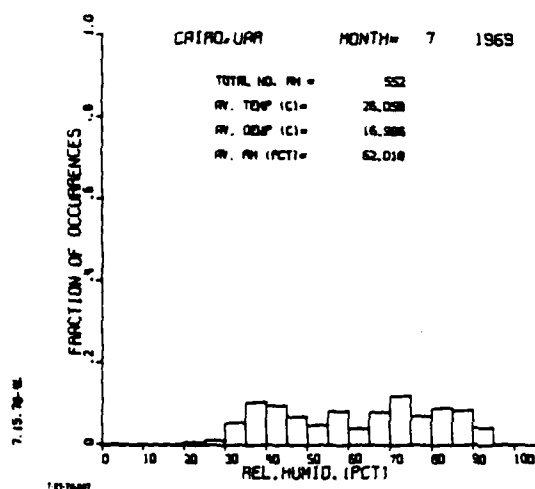
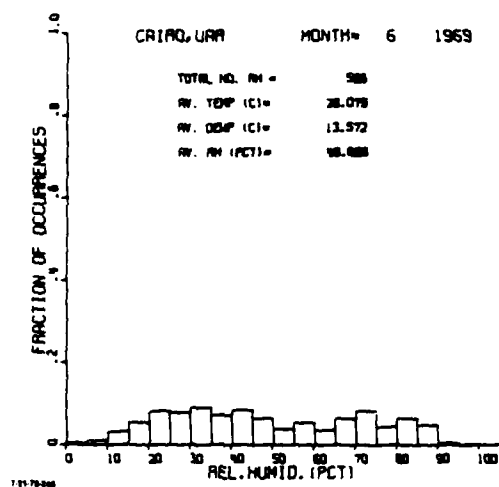
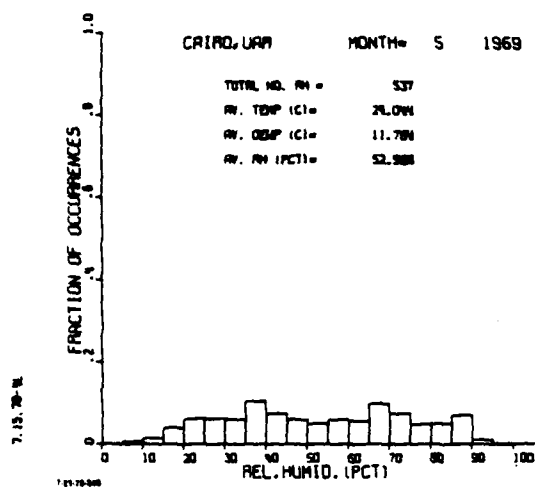


FIGURE 46. Relative humidity statistics, Cairo, Egypt, May-August 1969.

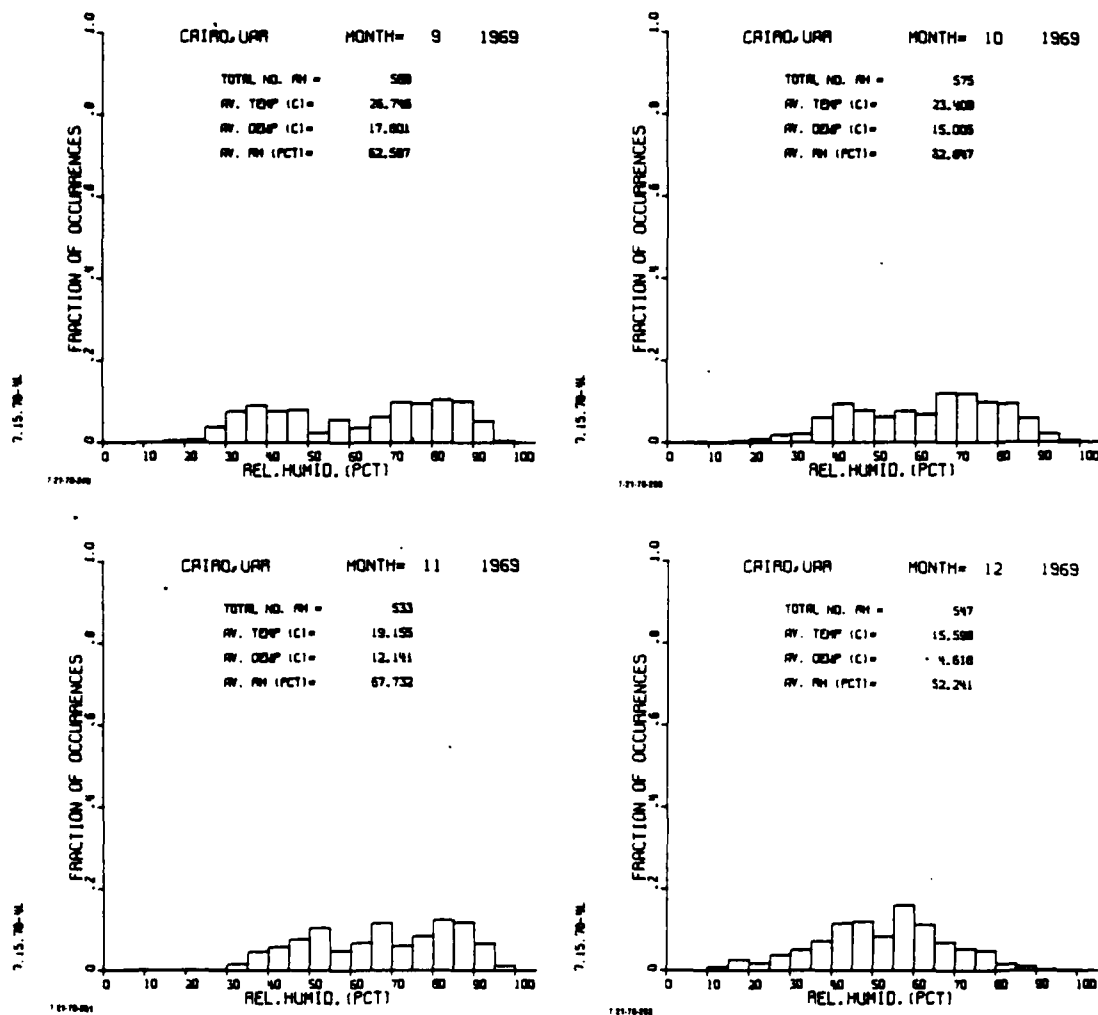


FIGURE 47. Relative humidity statistics, Cairo, Egypt, September-December 1969.

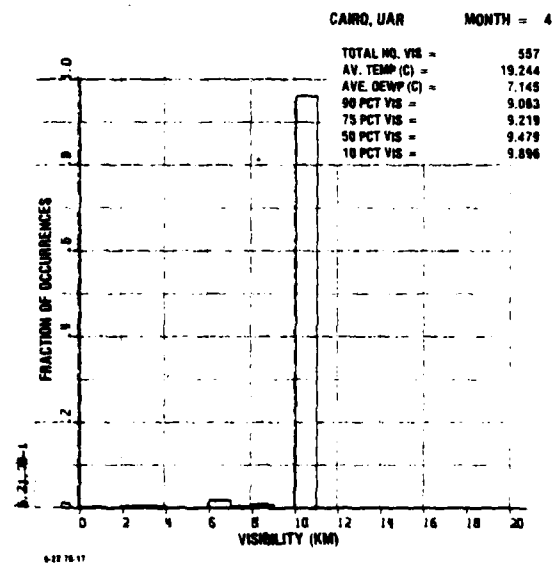
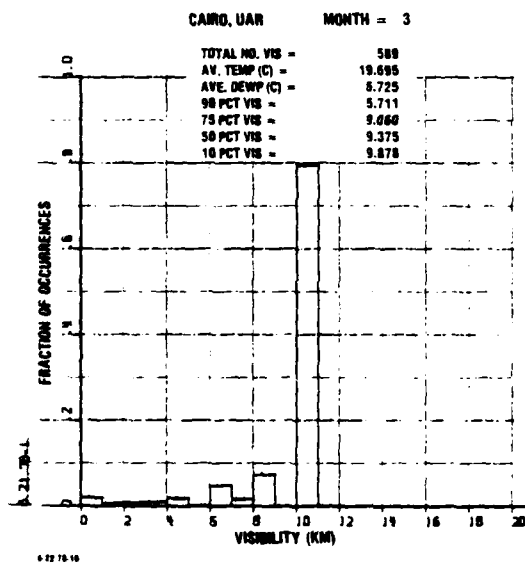
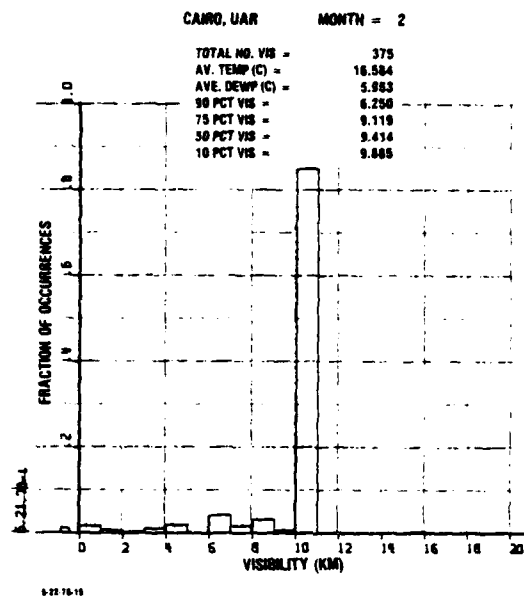
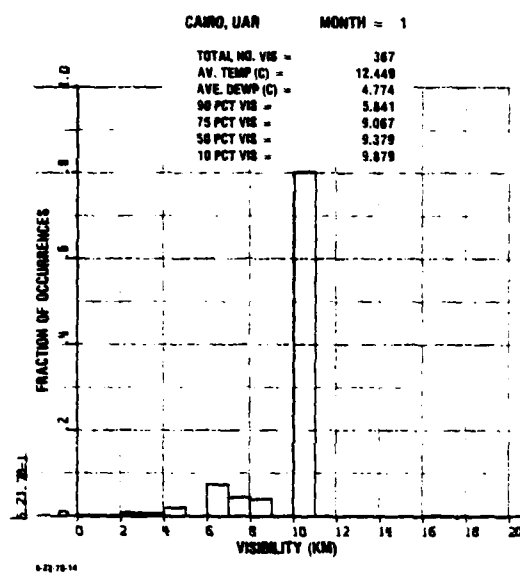


FIGURE 48. Visibility statistics, Cairo, Egypt, January-April 1969.

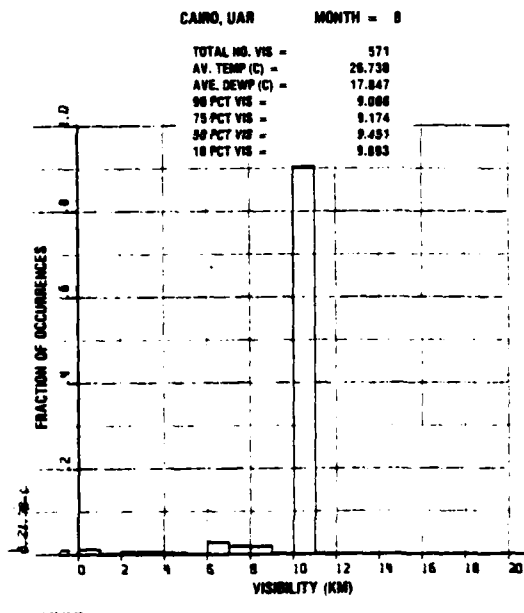
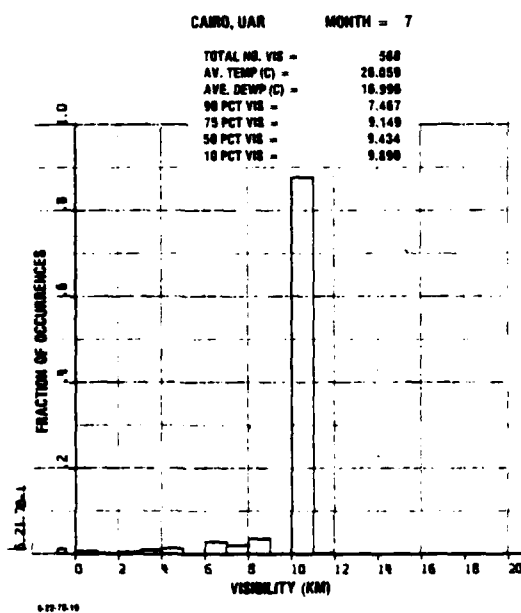
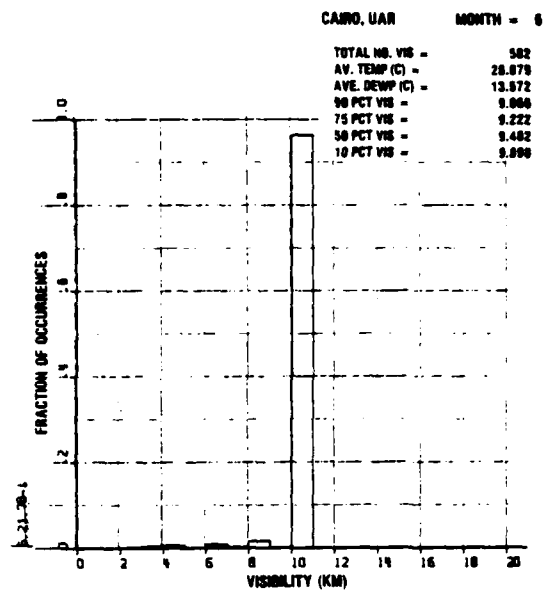
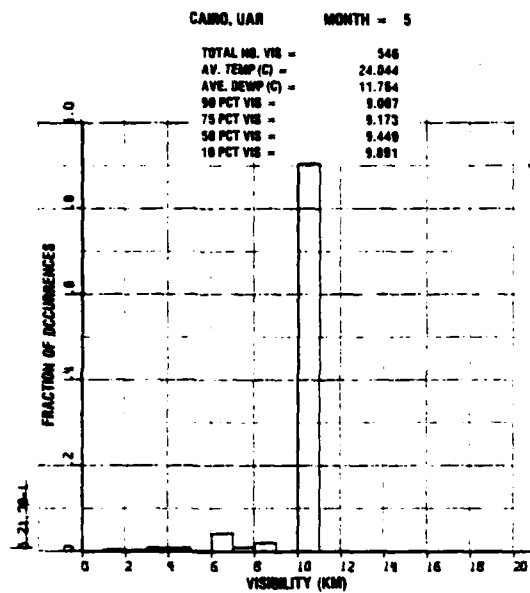


FIGURE 49. Visibility statistics, Cairo, Egypt, May-August 1969.

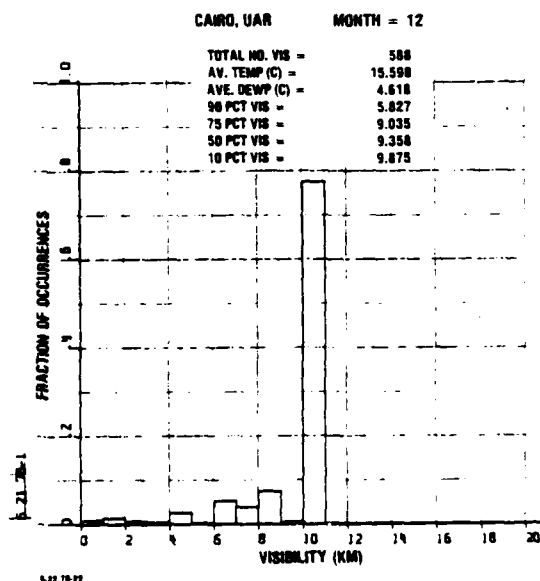
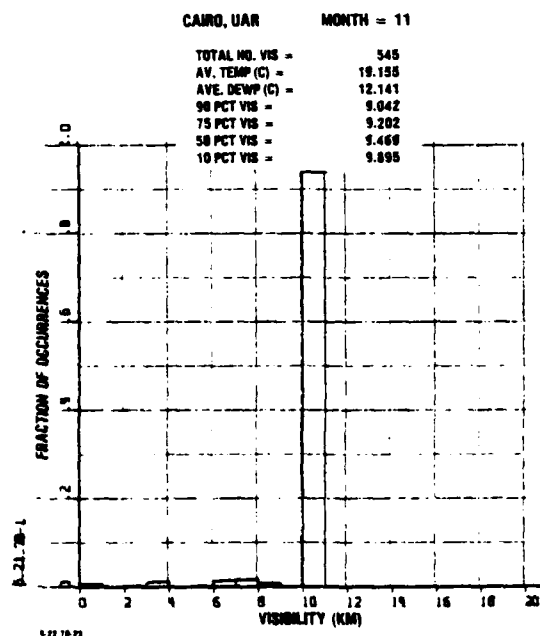
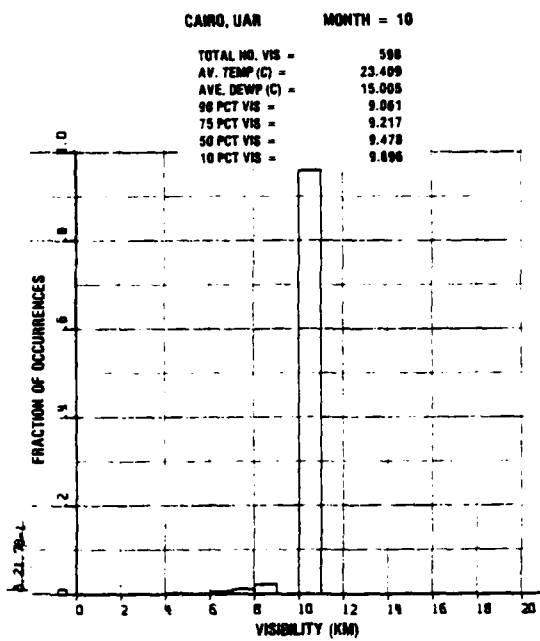
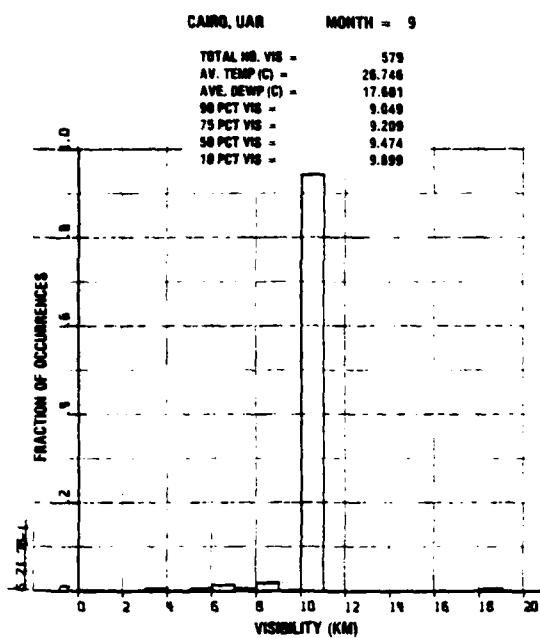
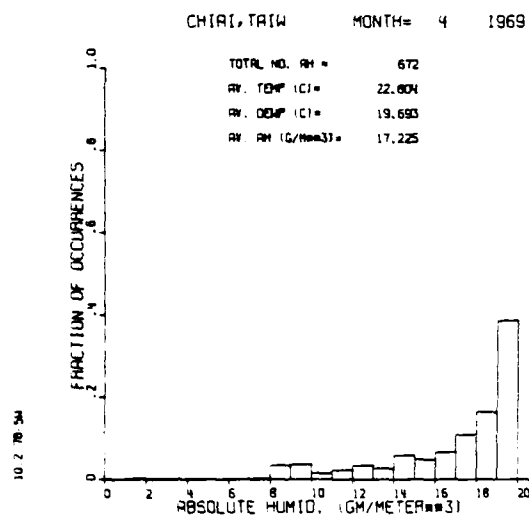
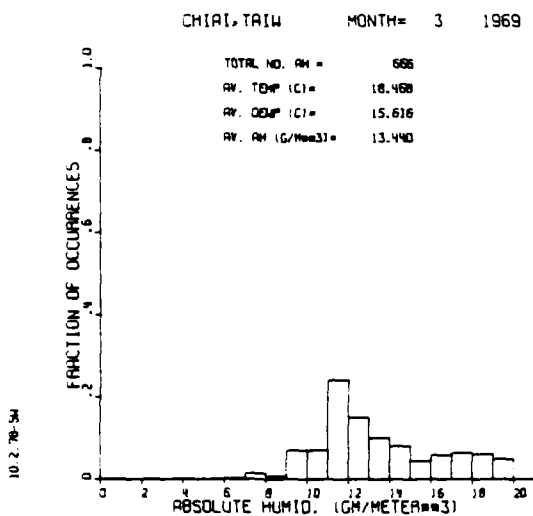
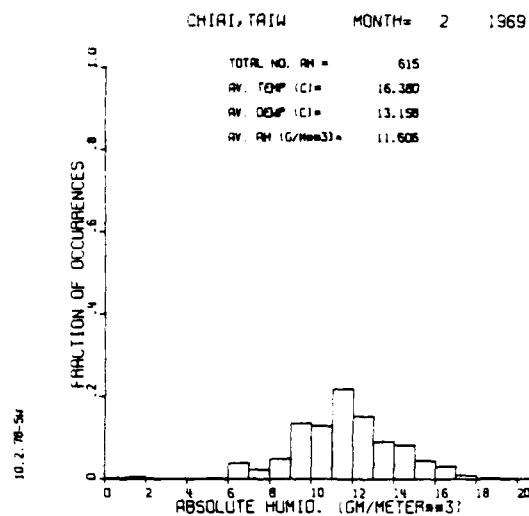
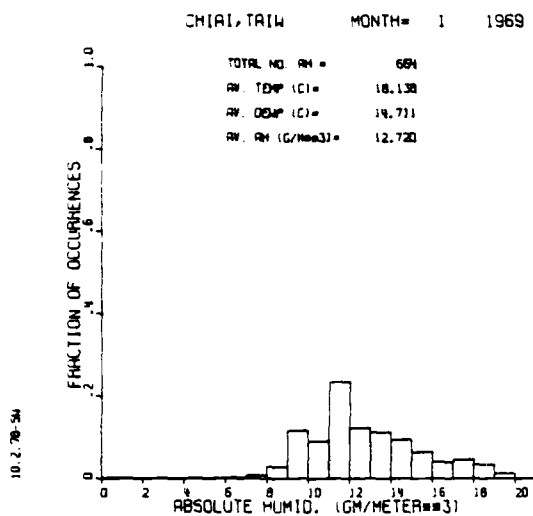


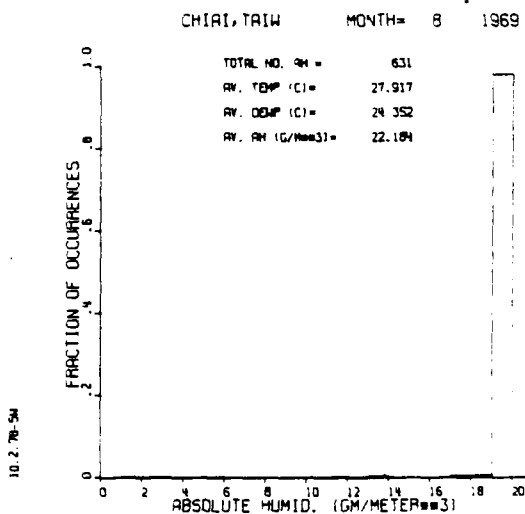
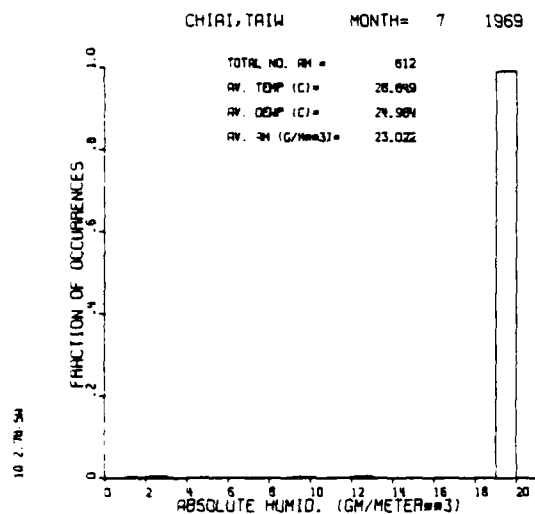
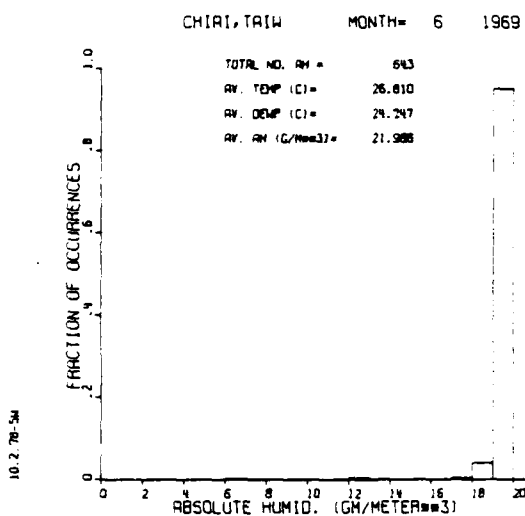
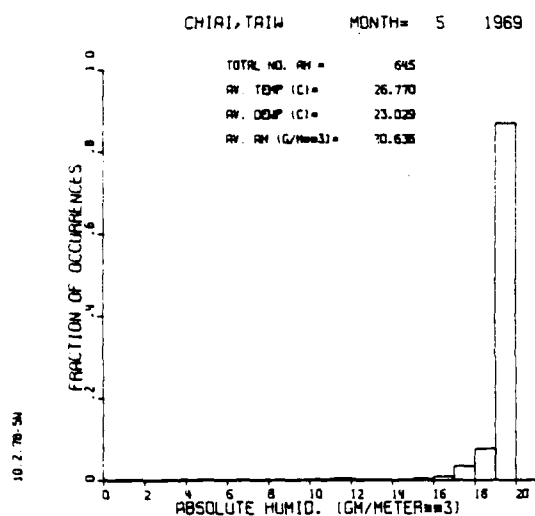
FIGURE 50. Visibility statistics, Cairo, Egypt, September-December 1969.

CHIAI, TAIWAN



10-4-78-81

FIGURE 51. Absolute humidity statistics, Chiai, Taiwan, January-April 1969.



10-4-78-82

FIGURE 52. Absolute humidity statistics, Chiai, Taiwan, May-August 1969.

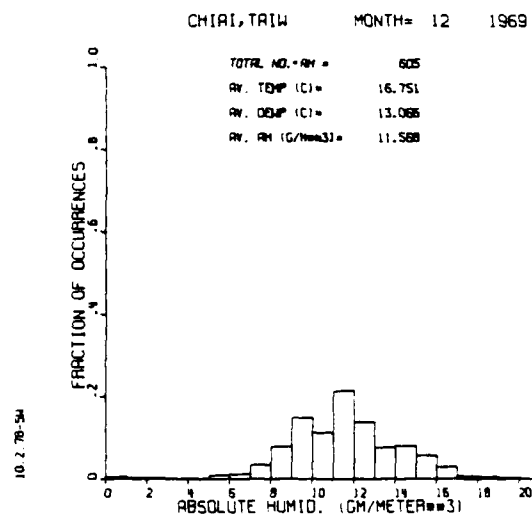
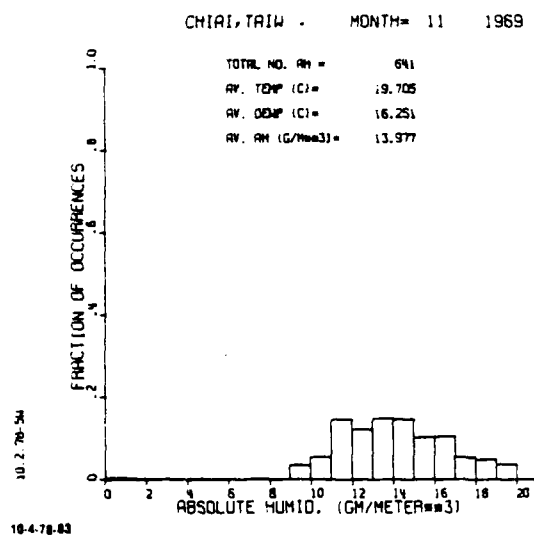
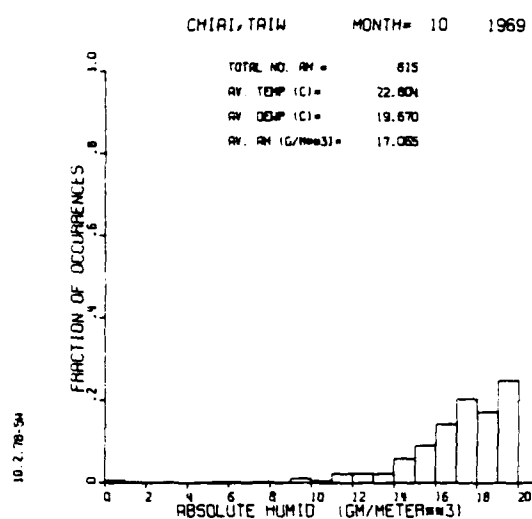
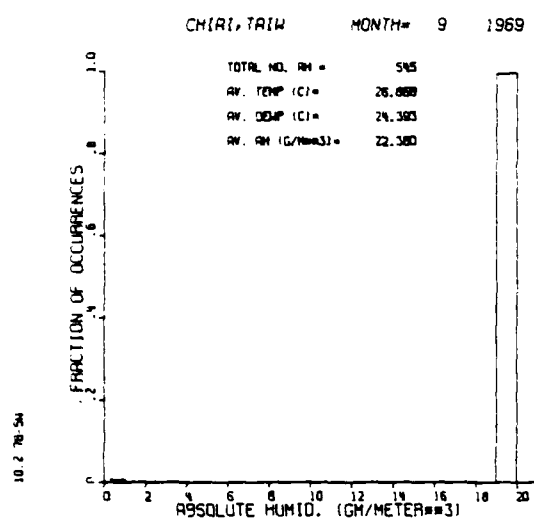


FIGURE 53. Absolute humidity statistics, Chiai, Taiwan, September-December 1969.

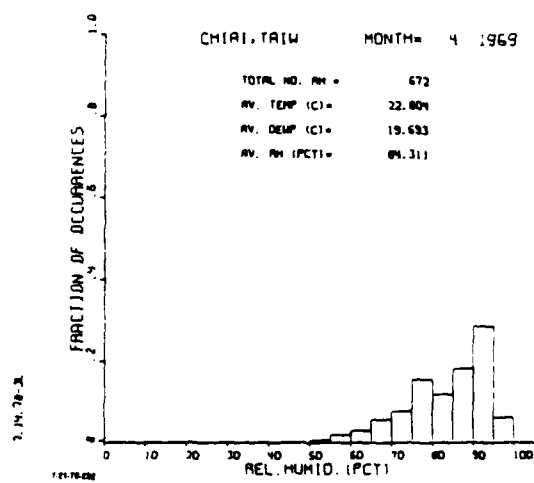
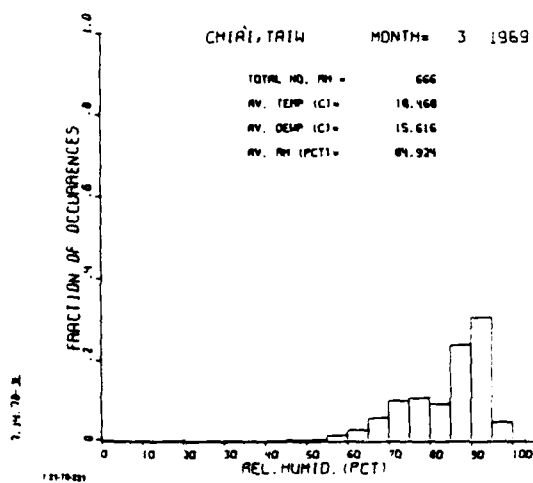
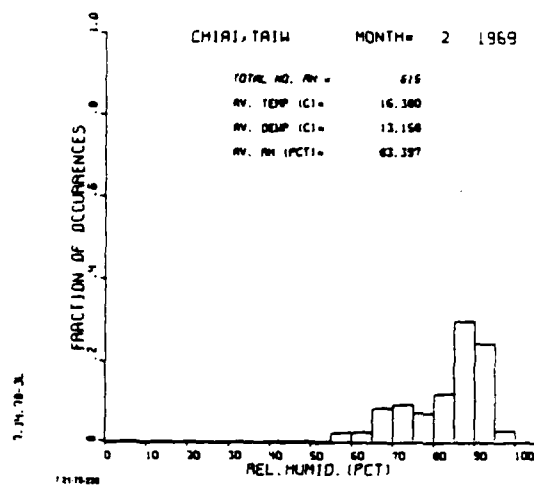
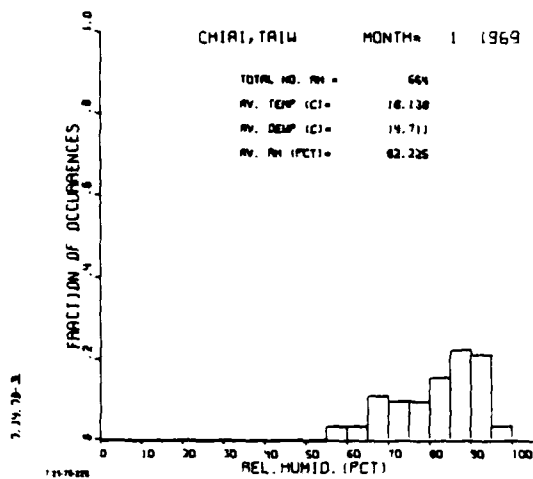


FIGURE 54. Relative humidity statistics, Chiai, Taiwan, January-April 1969.

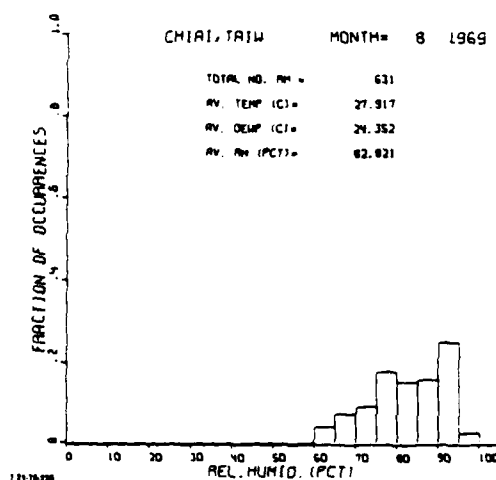
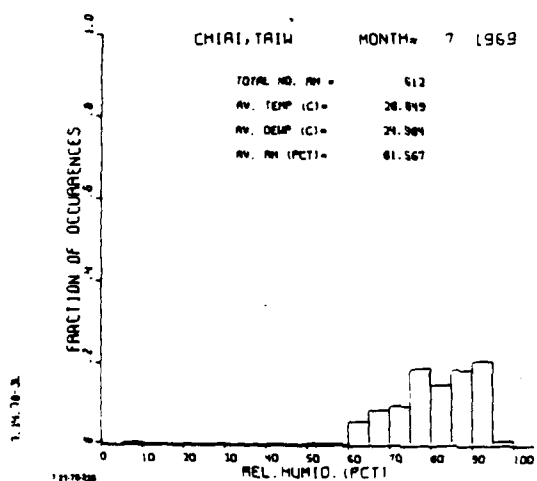
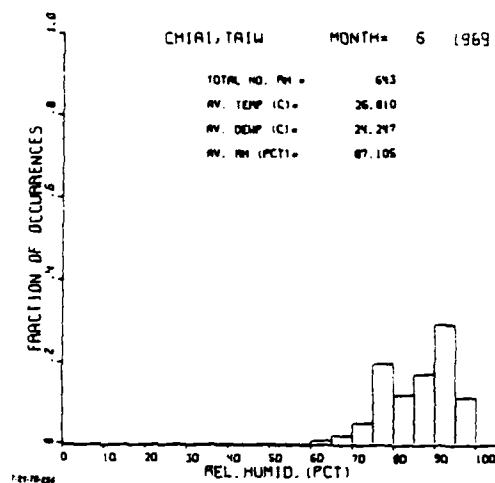
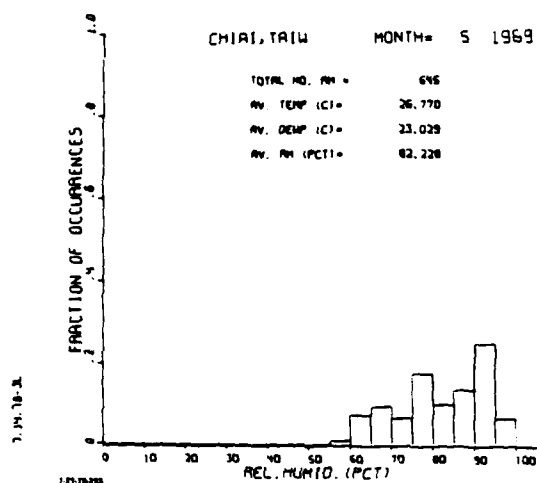


FIGURE 55. Relative humidity statistics, Chiai, Taiwan, May-August 1969.

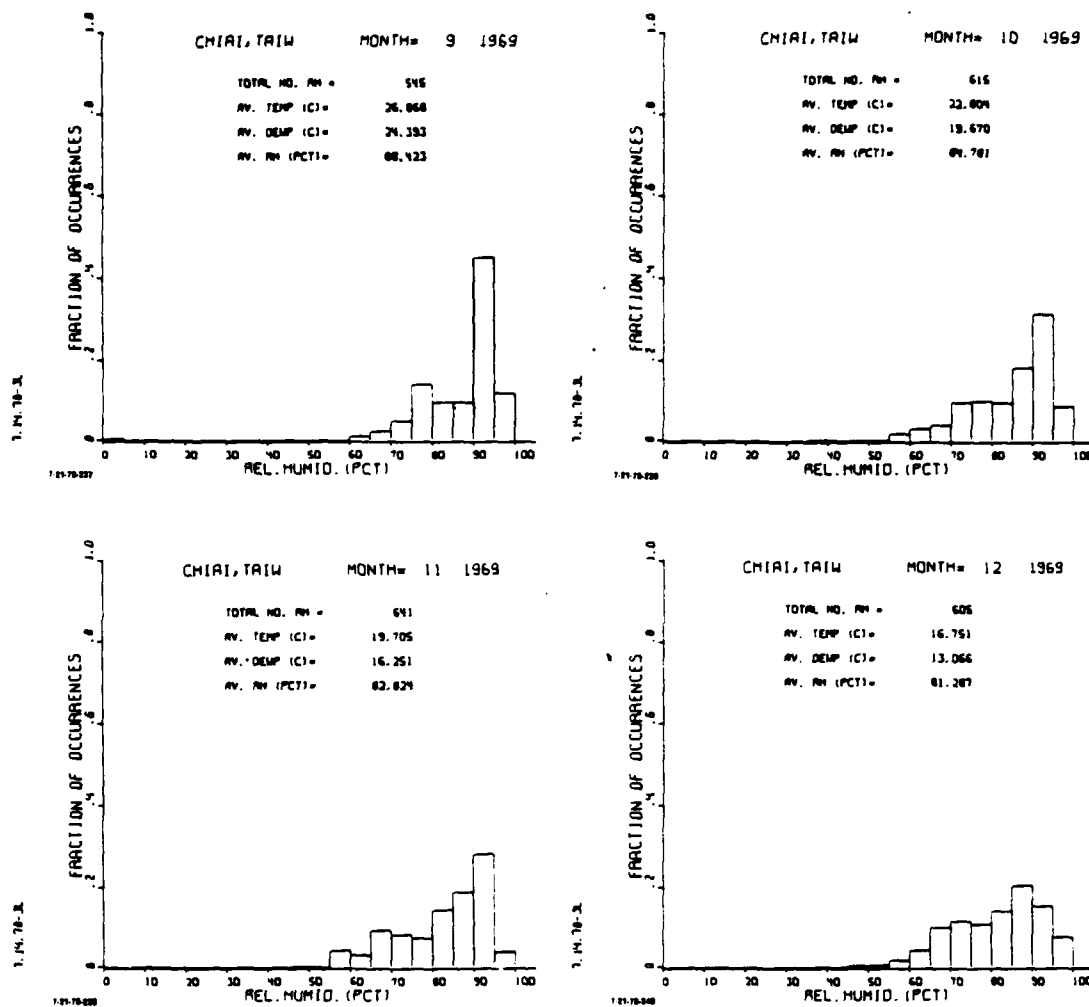


FIGURE 56. Relative humidity statistics, Chiai, Taiwan, September-December 1969.

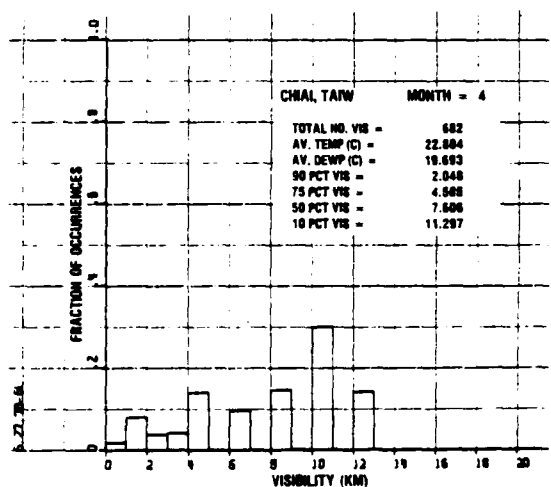
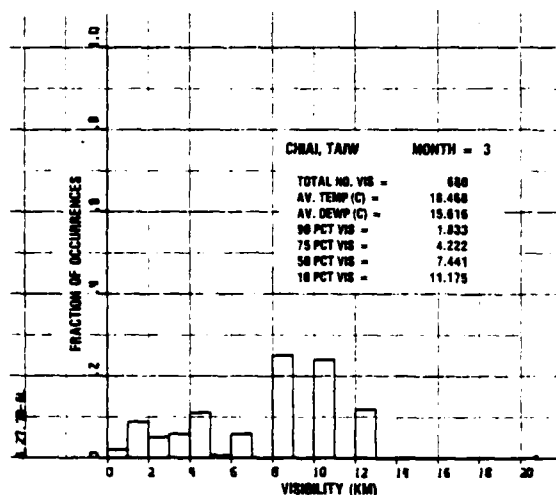
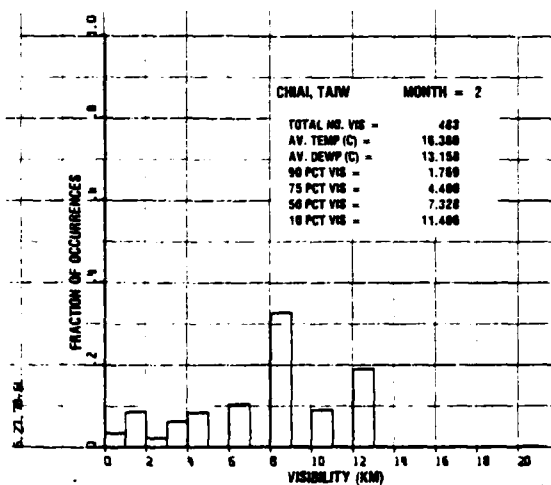
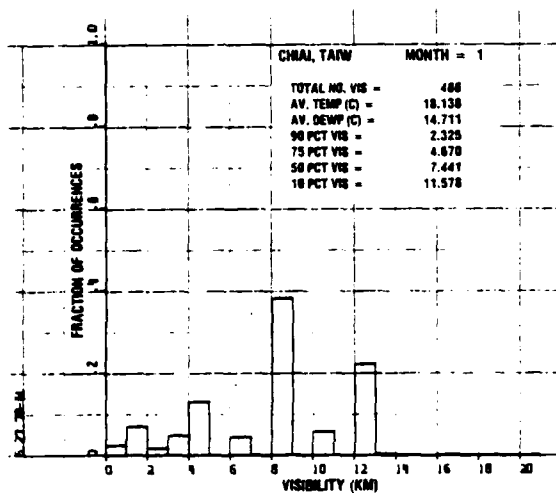


FIGURE 57. Visibility statistics, Chiai, Taiwan, January-April 1969.

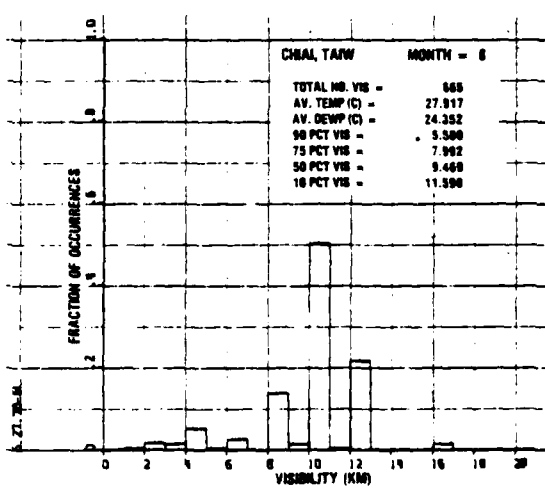
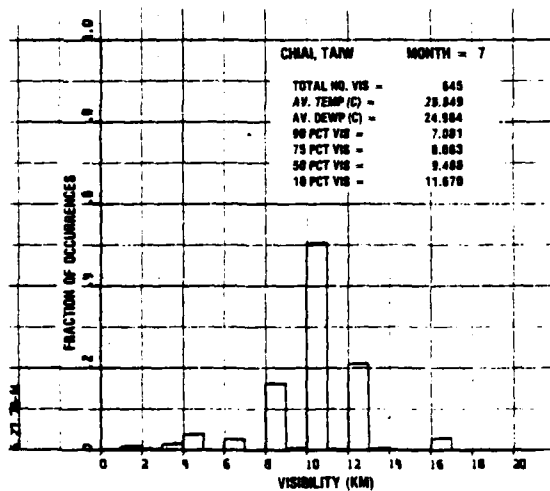
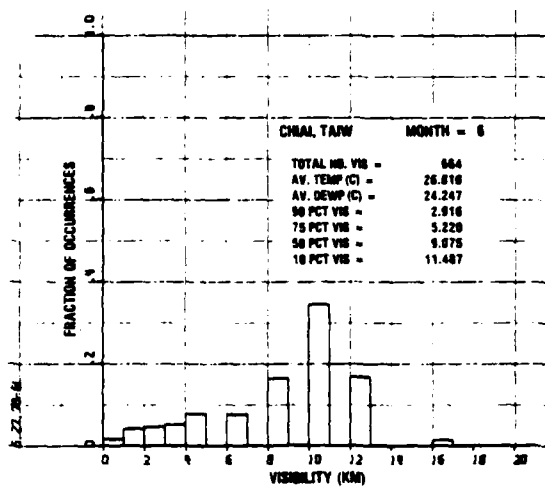
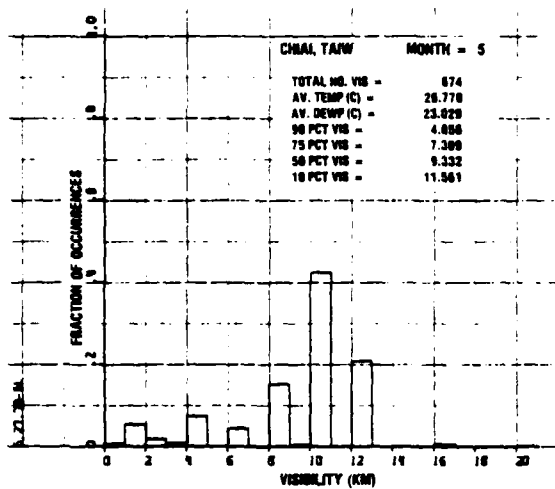
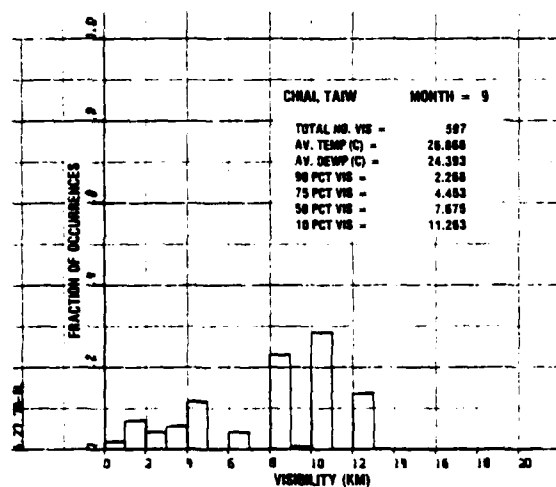
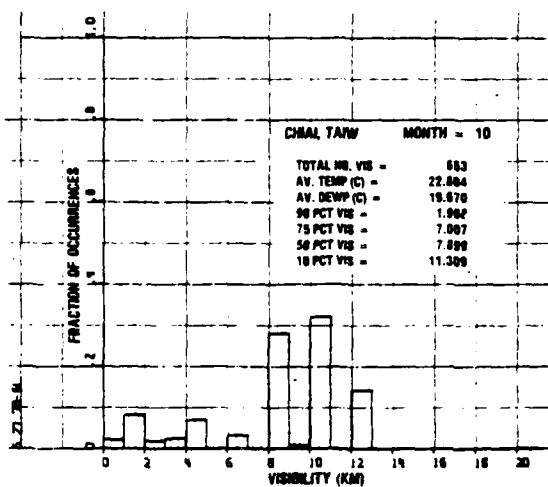


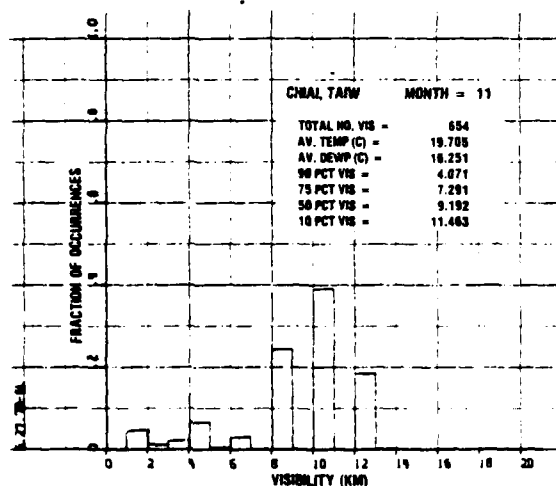
FIGURE 58. Visibility statistics, Chiai, Taiwan, May-August 1969.



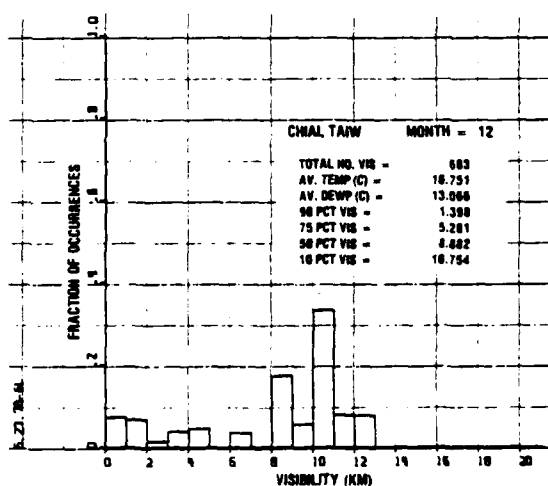
5 20 75 240



5 20 75 240



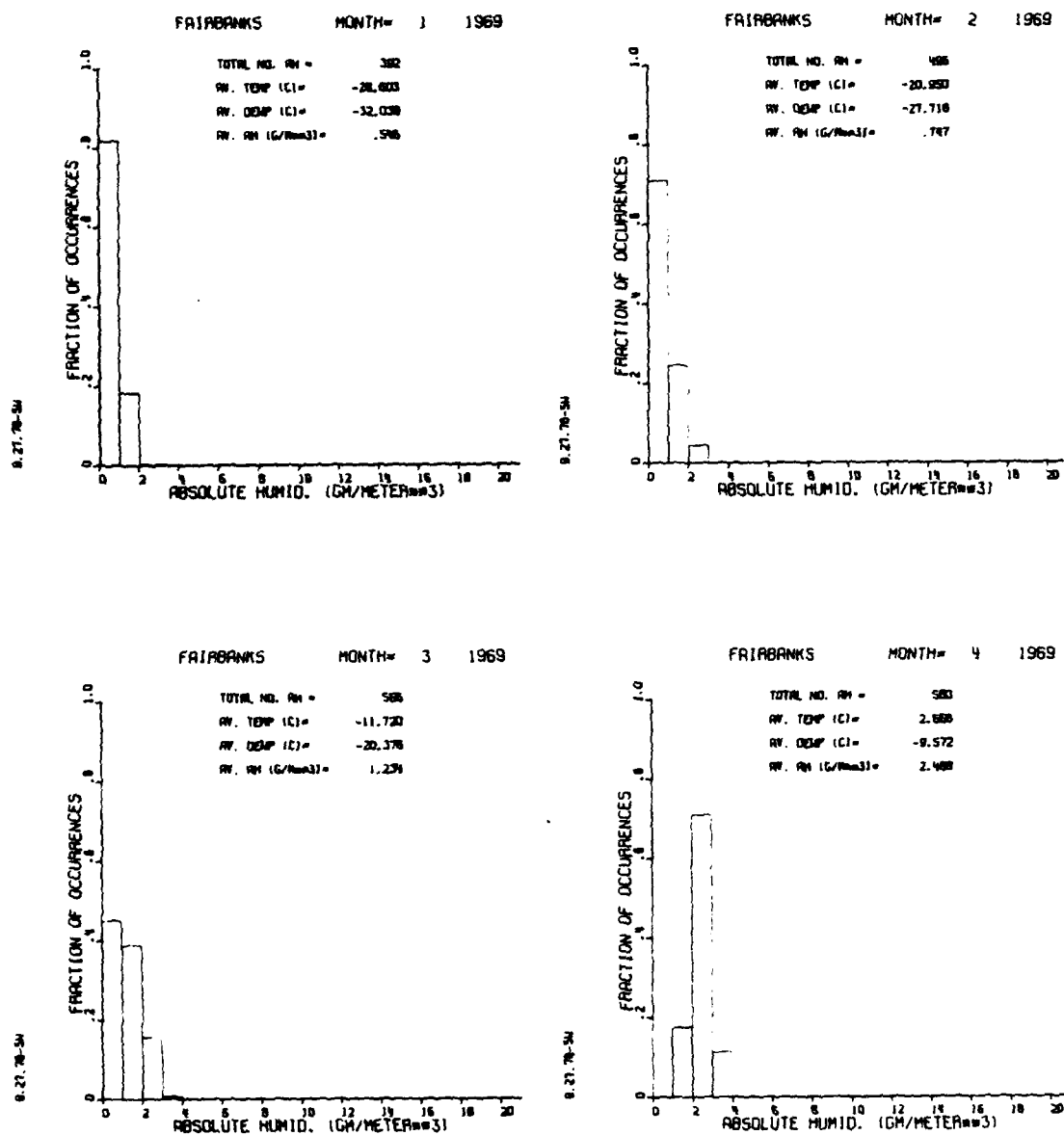
5 20 75 240



5 20 75 240

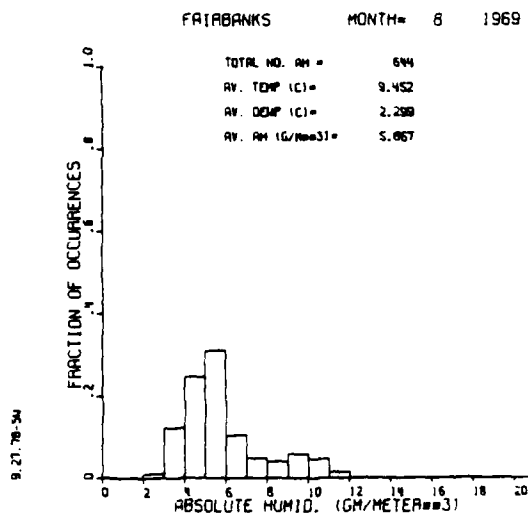
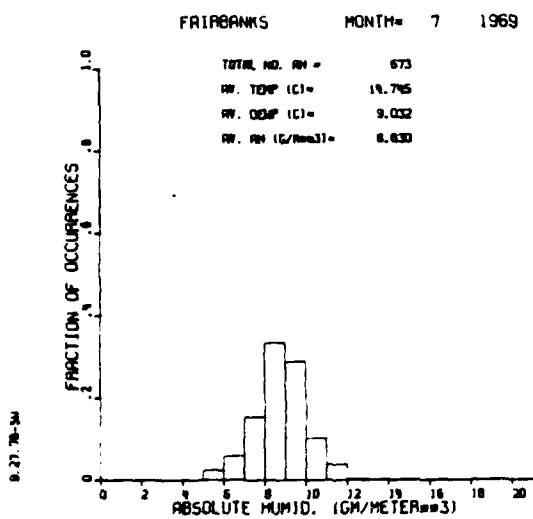
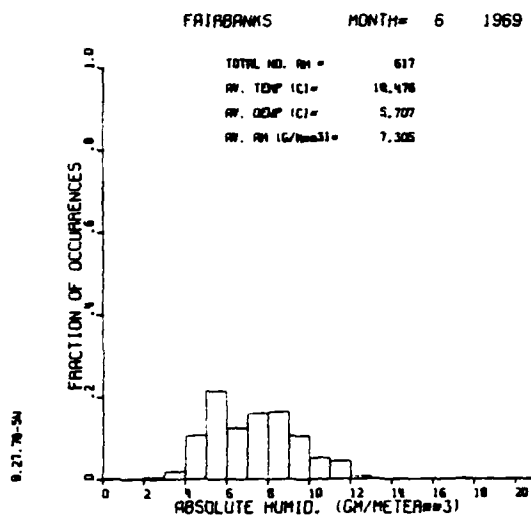
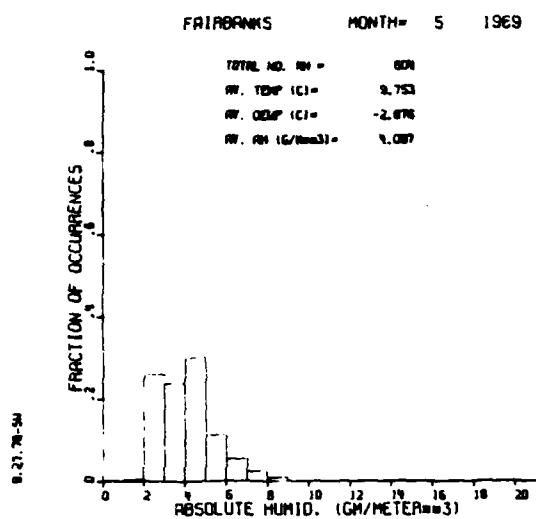
FIGURE 59. Visibility statistics, Chiai, Taiwan, September-December 1969.

FAIRBANKS, ALASKA



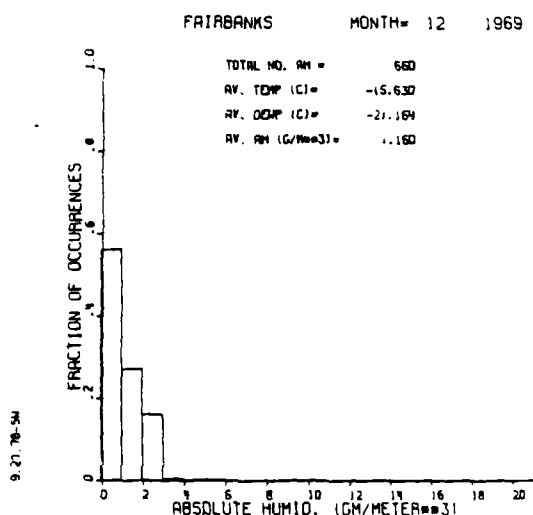
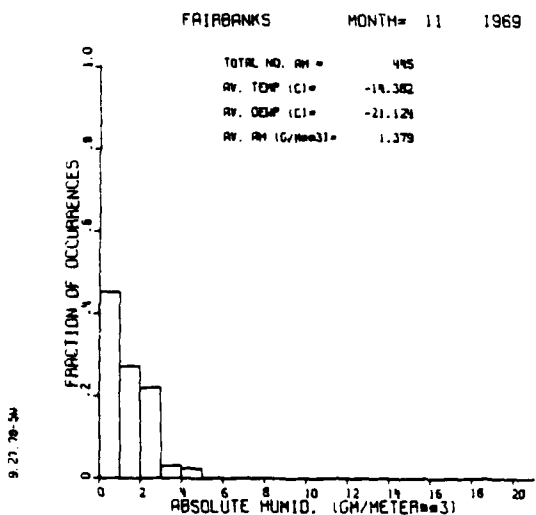
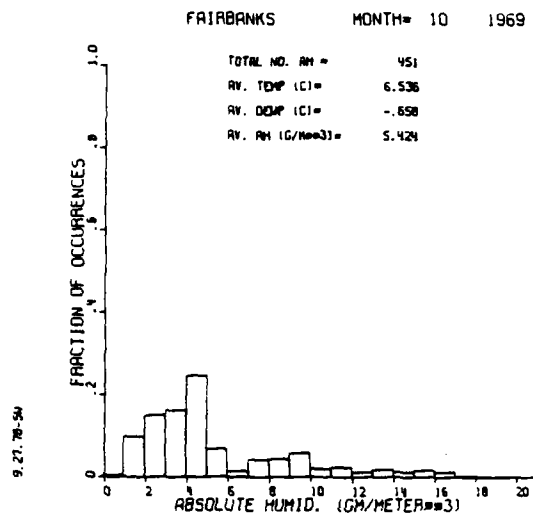
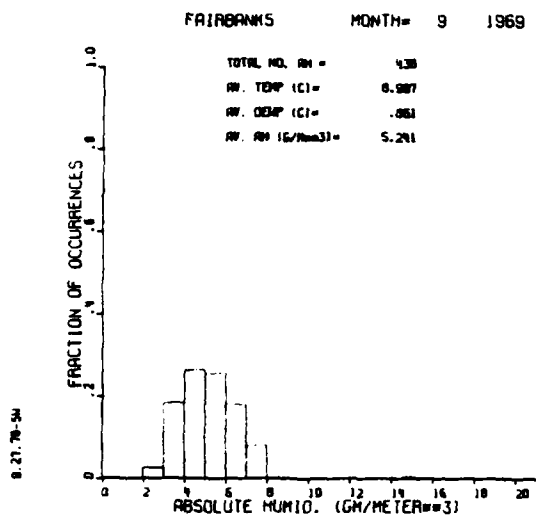
18-4-78-78

FIGURE 60. Absolute humidity statistics, Fairbanks, Alaska, January-April 1969.



10-4-78-79

FIGURE 61. Absolute humidity statistics, Fairbanks, Alaska, May-August 1969.



10.4.78-88

FIGURE 62. Absolute humidity statistics, Fairbanks, Alaska, September-December 1969.

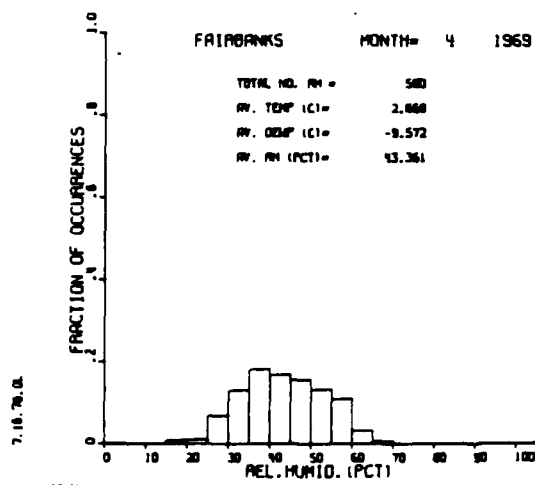
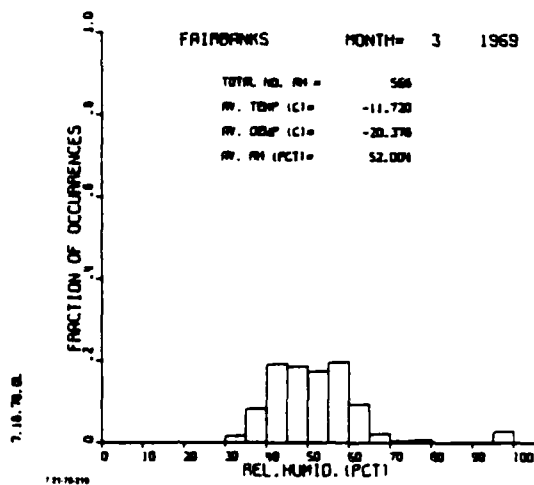
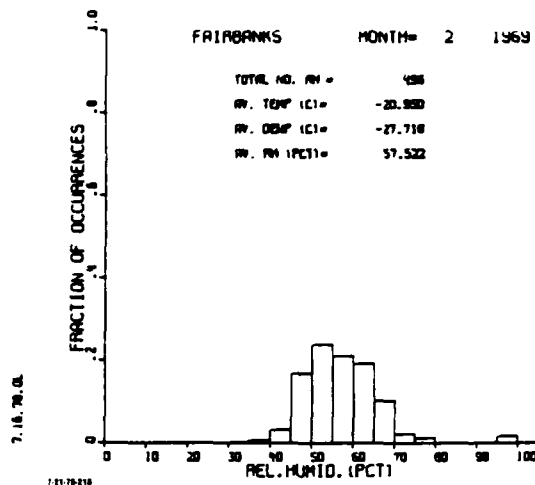
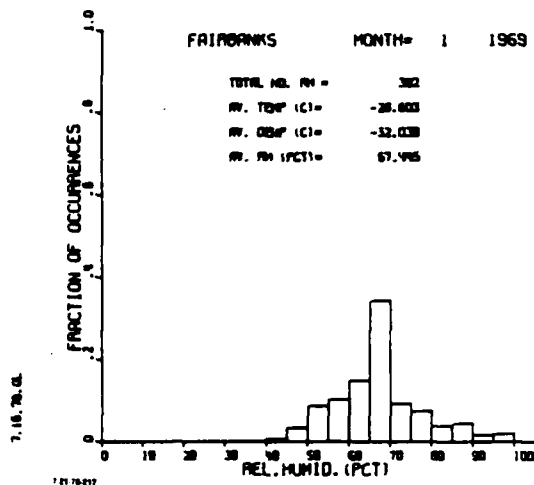


FIGURE 63. Relative humidity statistics, Fairbanks, Alaska, January-April 1969.

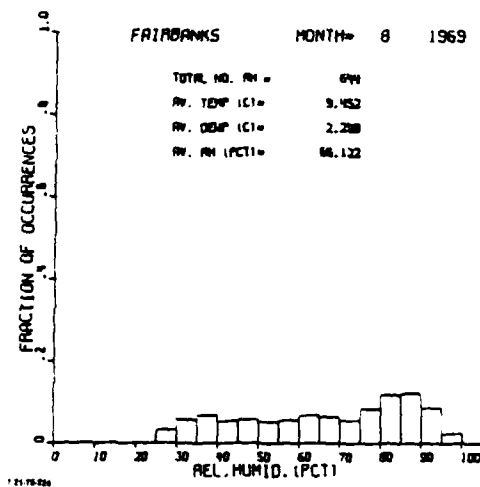
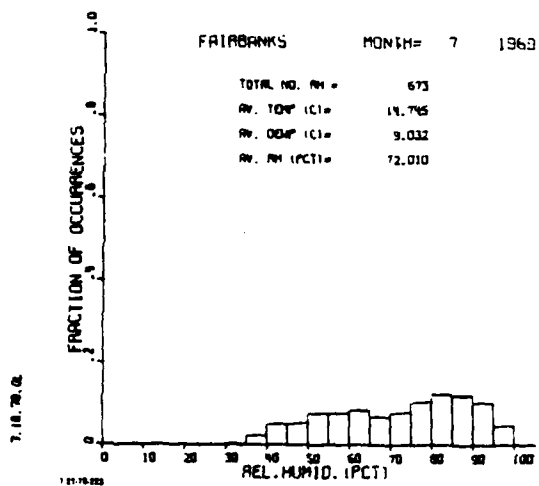
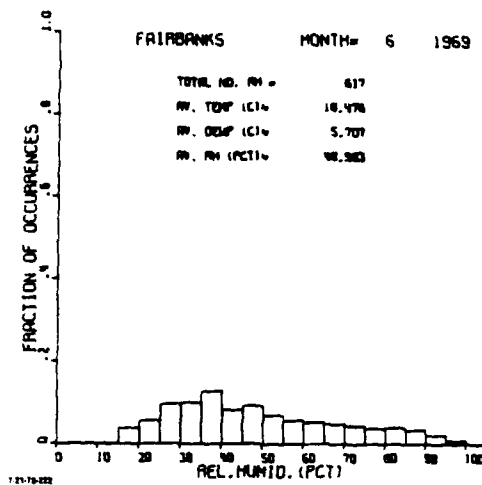
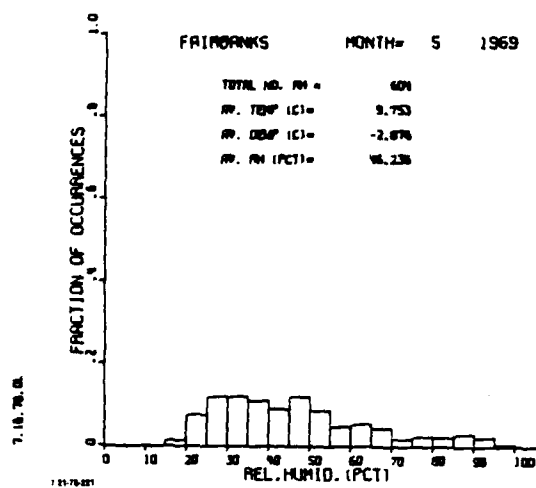


FIGURE 64. Relative humidity statistics, Fairbanks, Alaska, May-August 1969.

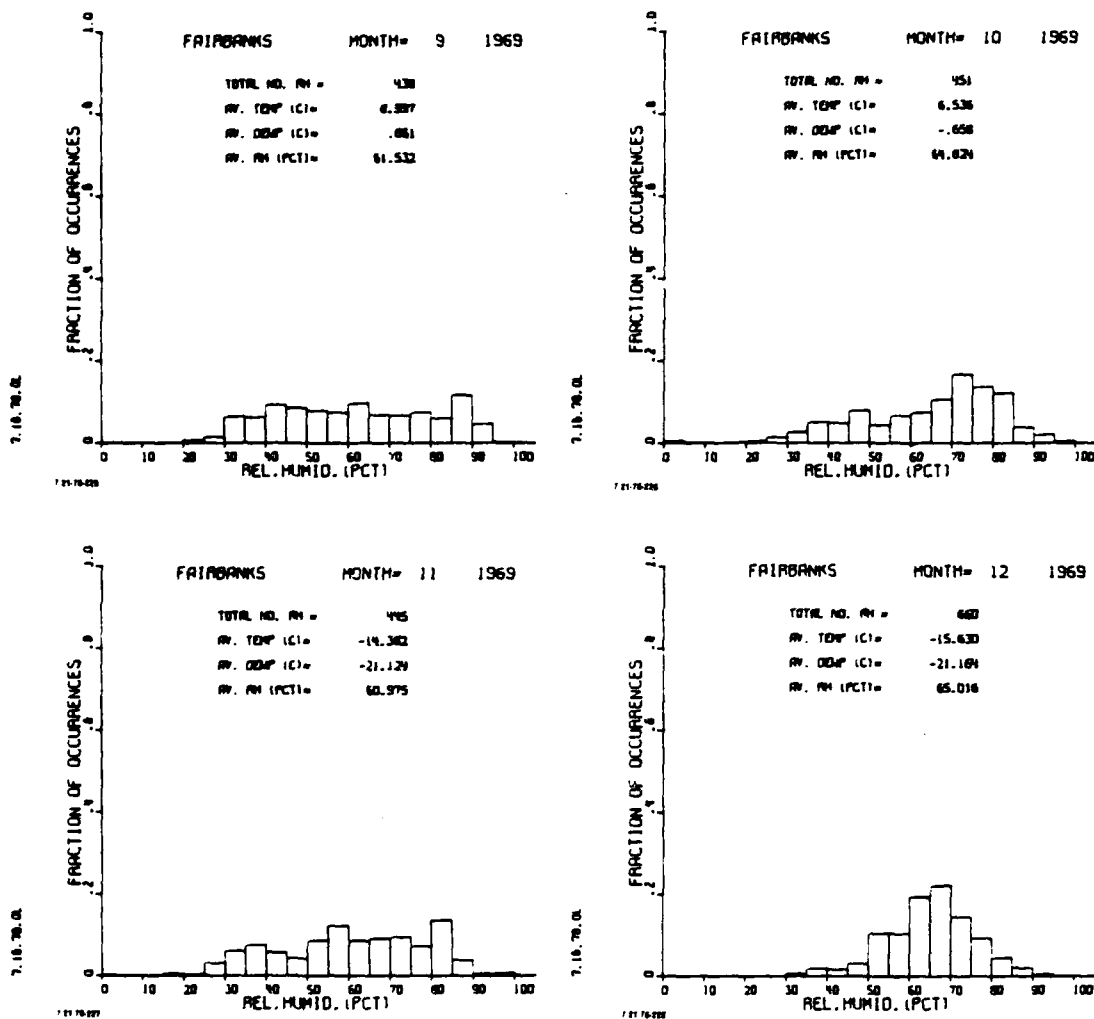


FIGURE 65. Relative humidity statistics, Fairbanks, Alaska, September-December 1969.

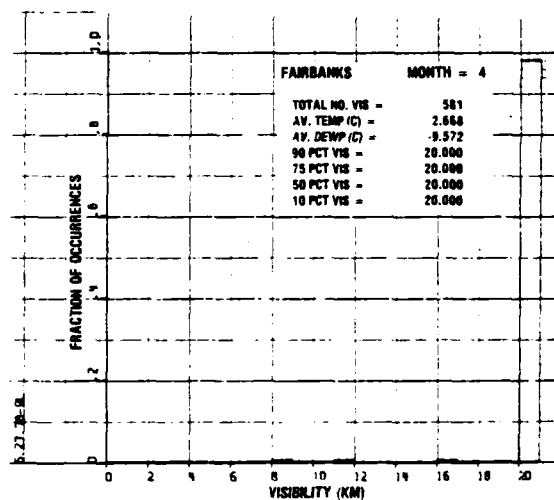
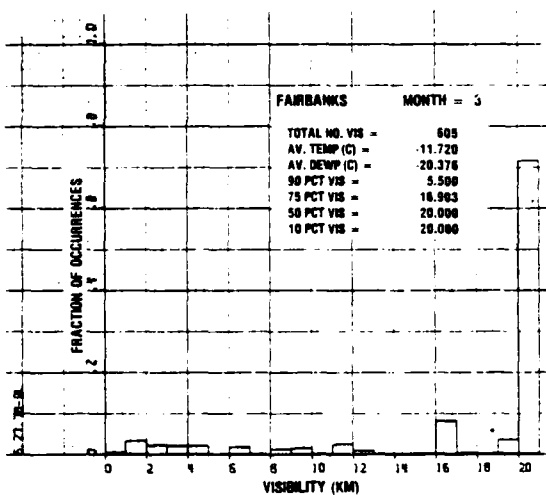
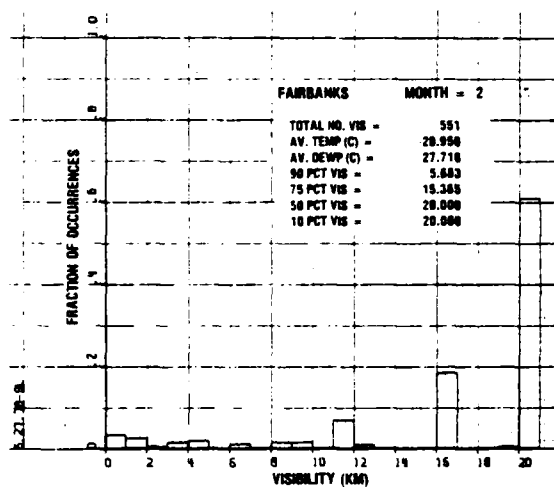
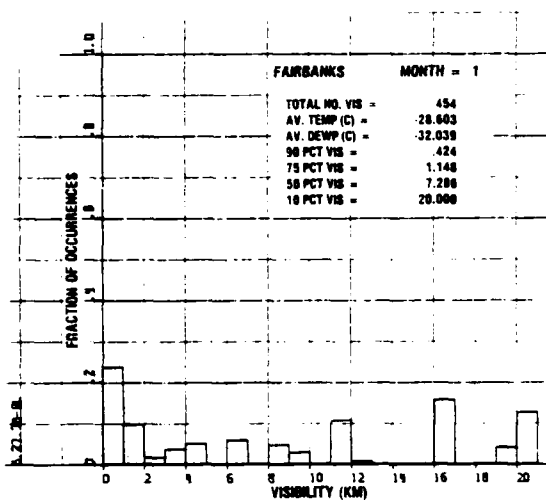
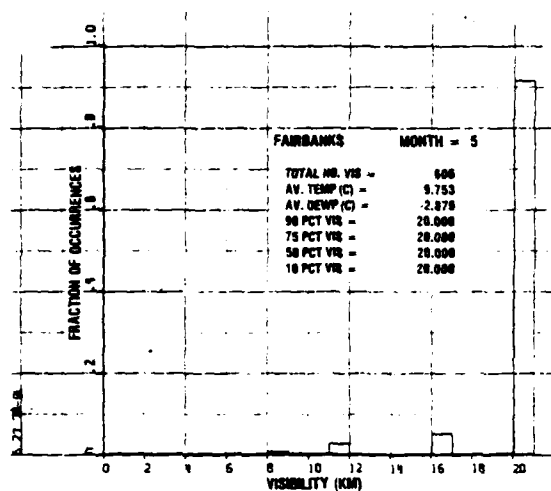
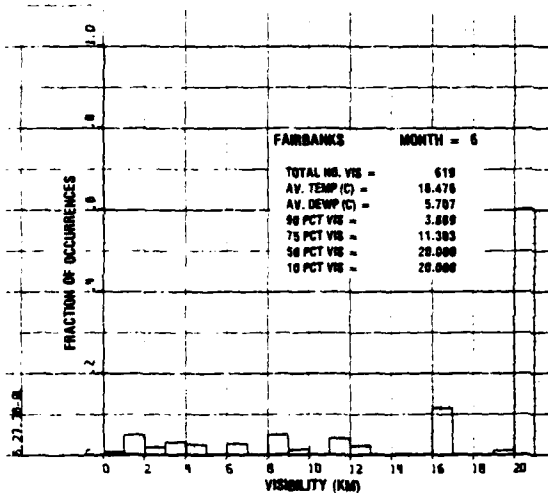


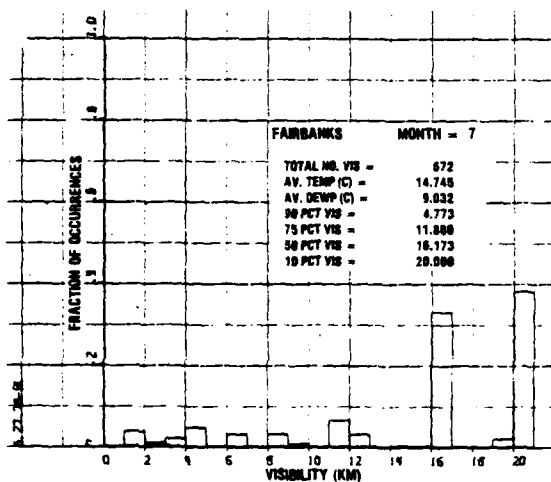
FIGURE 66. Visibility statistics, Fairbanks, Alaska, January-April 1969.



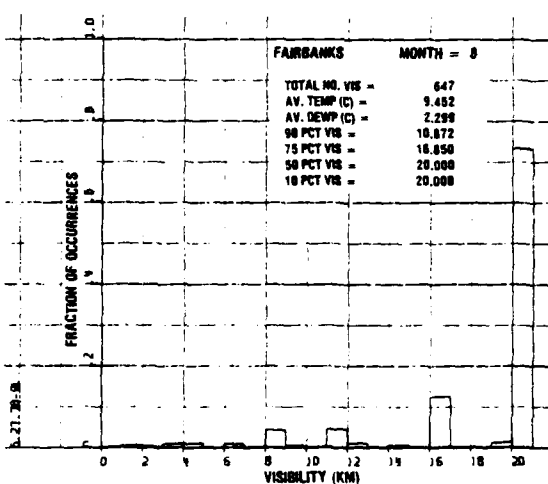
6-30-76-220



6-30-76-220



6-30-76-221



6-30-76-232

FIGURE 67. Visibility statistics, Fairbanks, Alaska, May-August 1969.

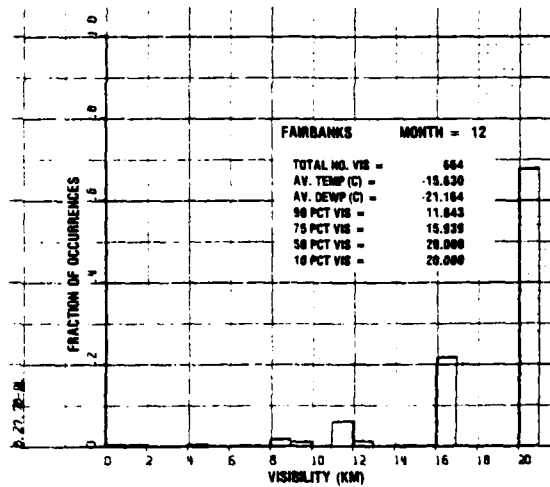
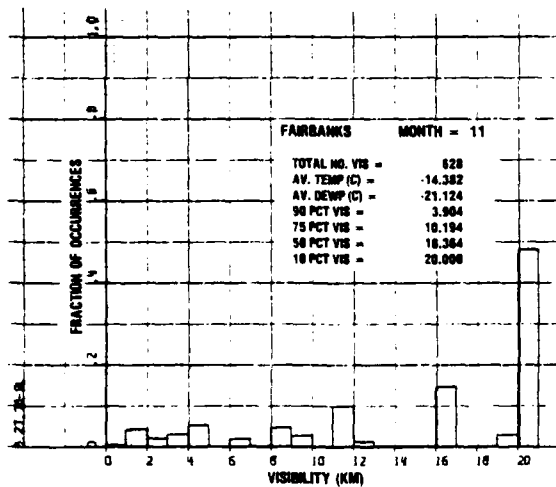
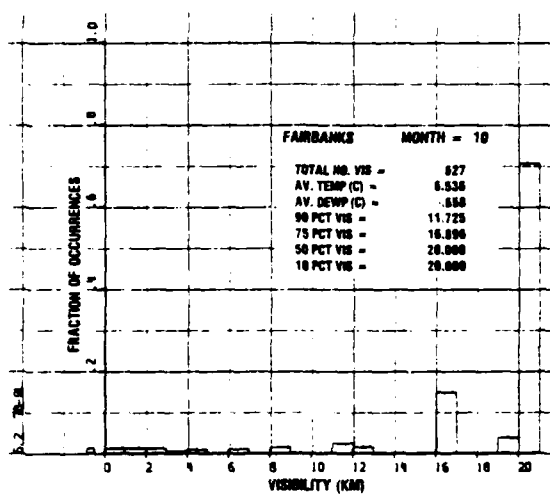
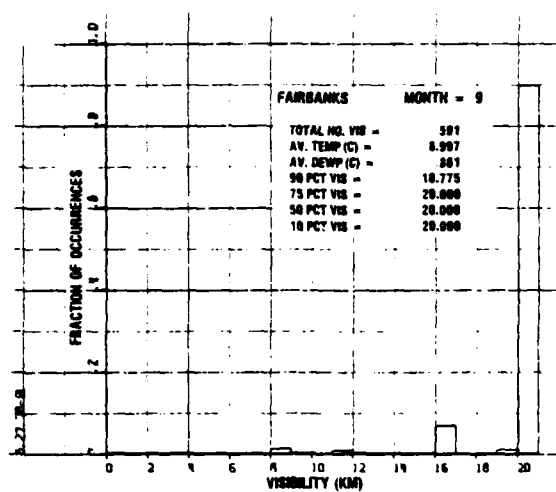
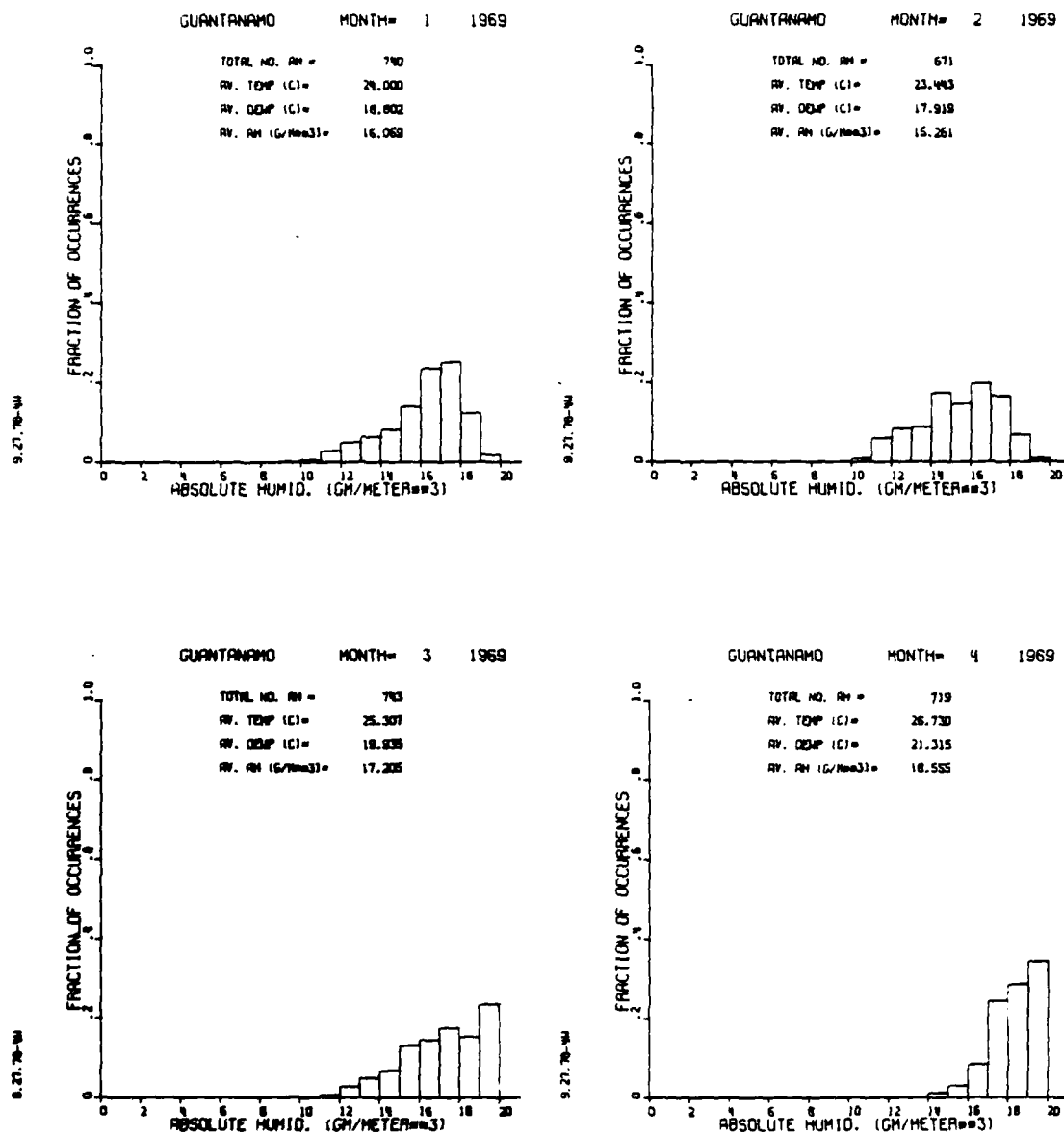


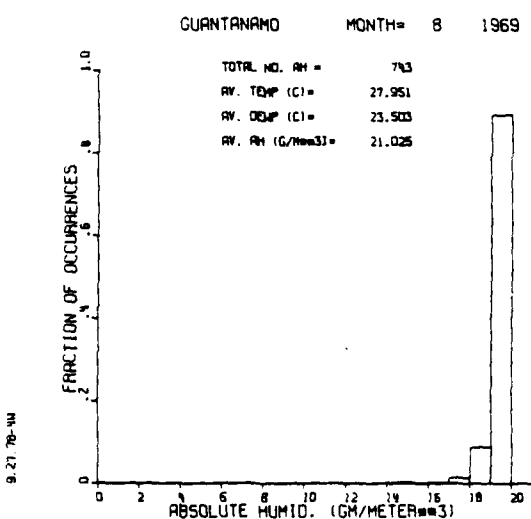
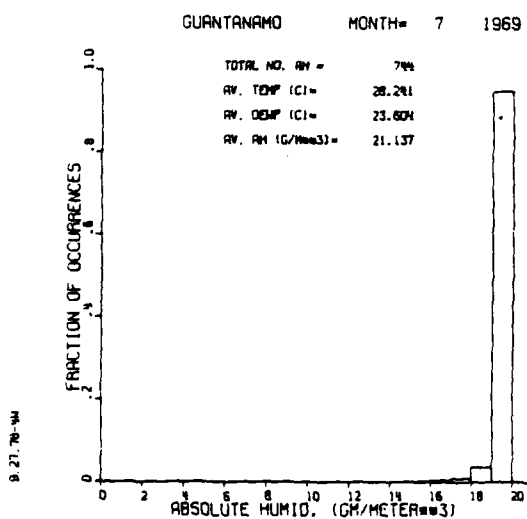
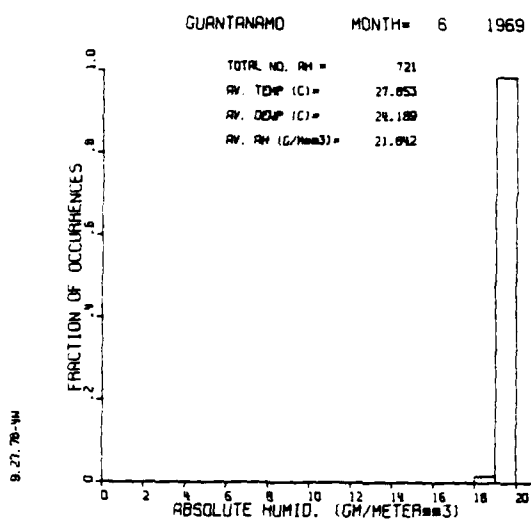
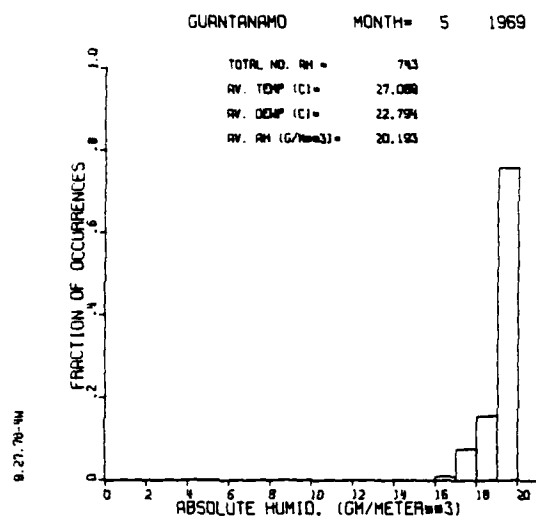
FIGURE 68. Visibility statistics, Fairbanks, Alaska, September-December 1969.

GUANTANAMO, CUBA



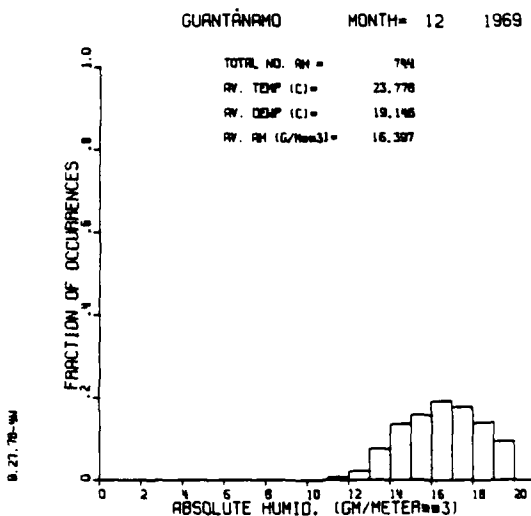
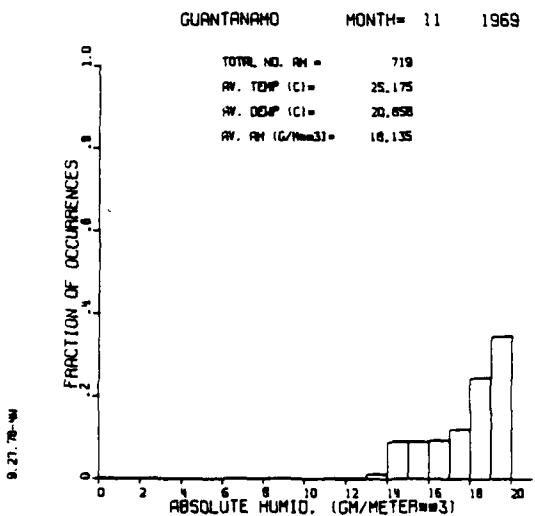
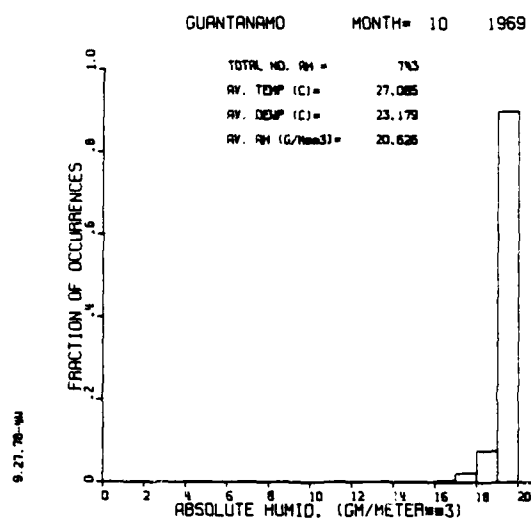
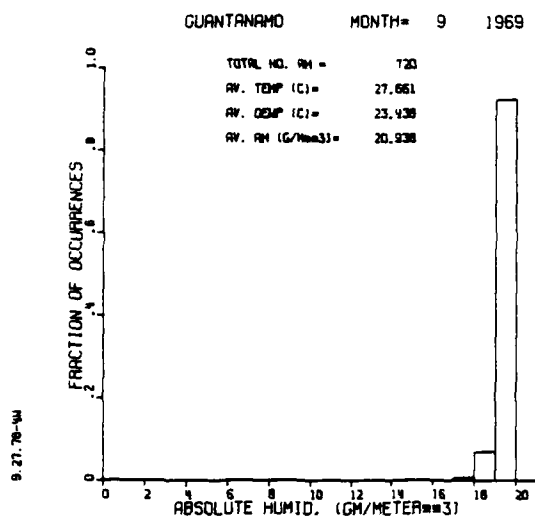
18-4-78-24

FIGURE 69. Absolute humidity statistics, Guantanamo, Cuba, January-April 1969.



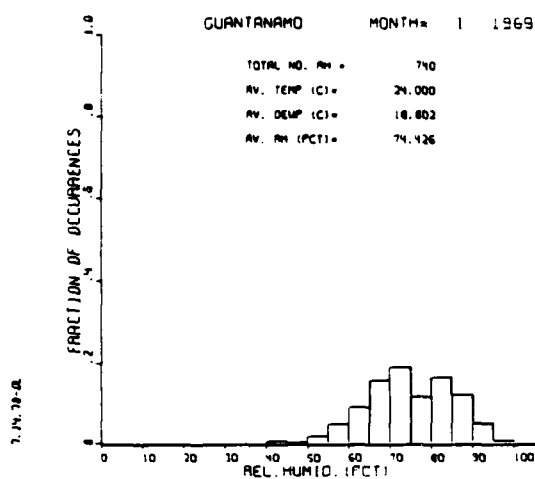
10-4-70-23

FIGURE 70. Absolute humidity statistics, Guantanamo, Cuba, May-August 1969.

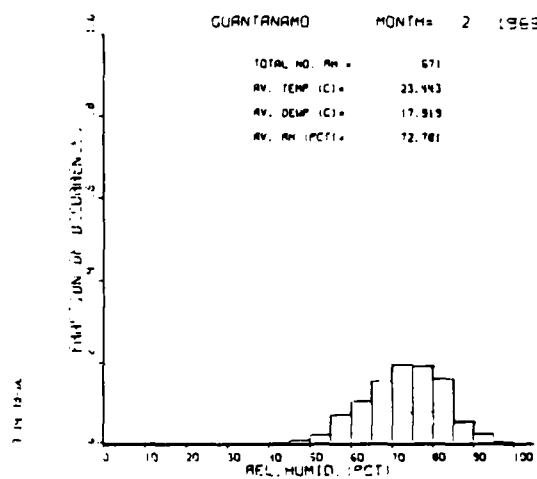


18-4-78-28

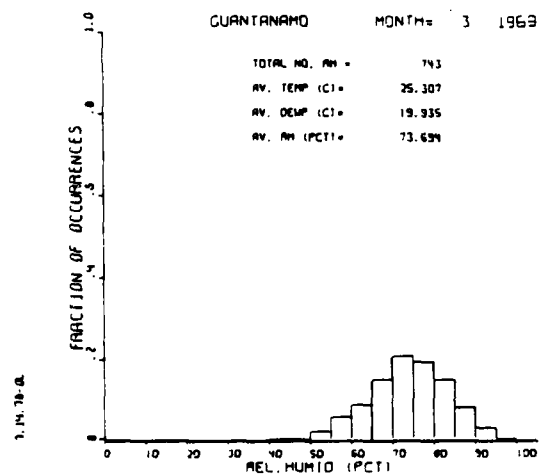
FIGURE 71. Absolute humidity statistics, Guantanamo, Cuba, September-December 1969.



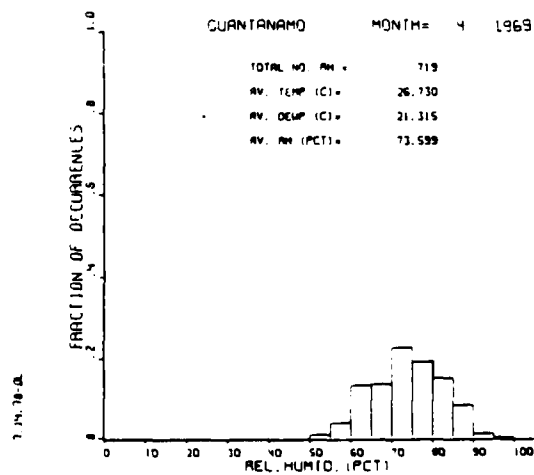
7 21 78-1



7 21 78-2

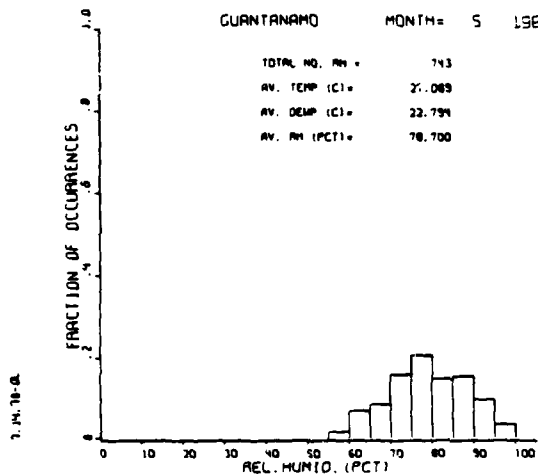


7 21 78-3

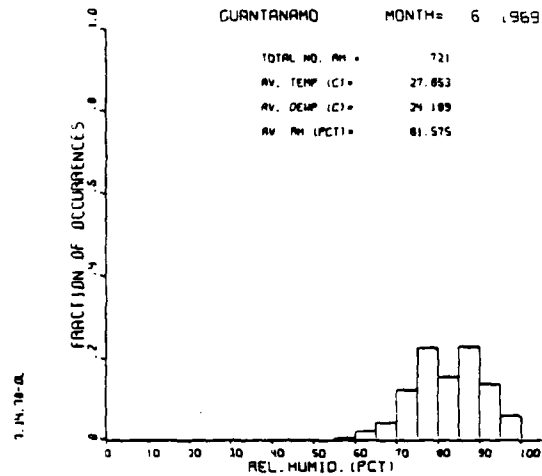


7 21 78-4

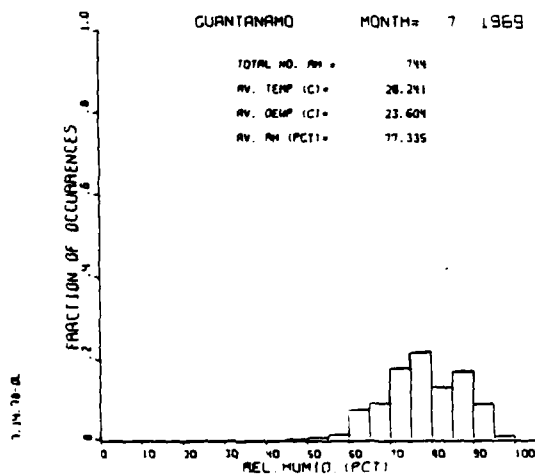
FIGURE 72. Relative humidity statistics, Guantanamo, Cuba, January-April 1969.



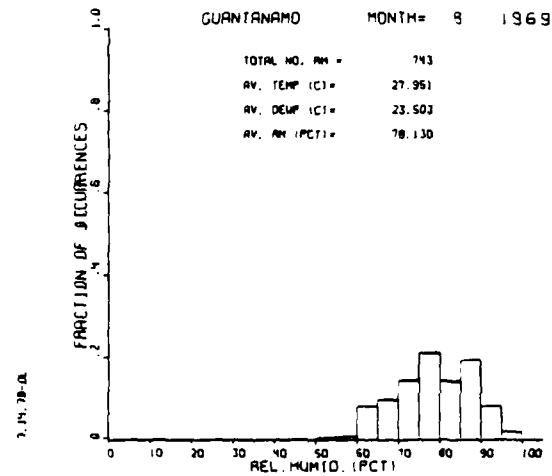
7.71.78.6



7.71.78.6



7.71.78.7



7.71.78.8

FIGURE 73. Relative humidity statistics, Guantanamo, Cuba, May-August 1969.

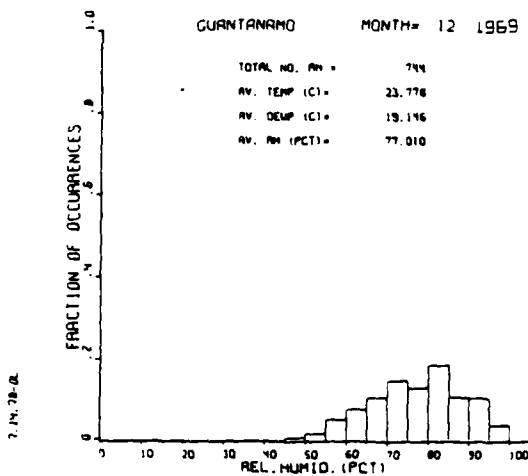
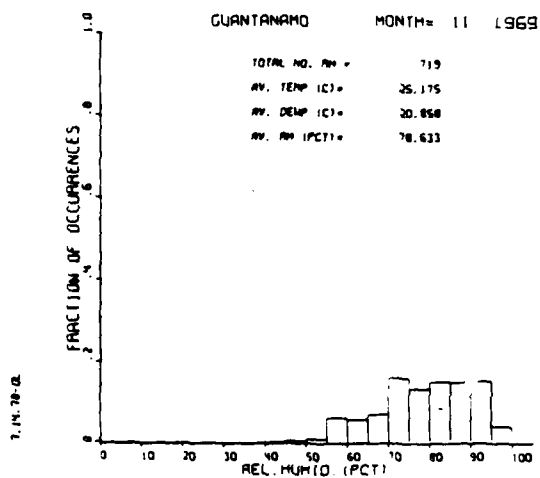
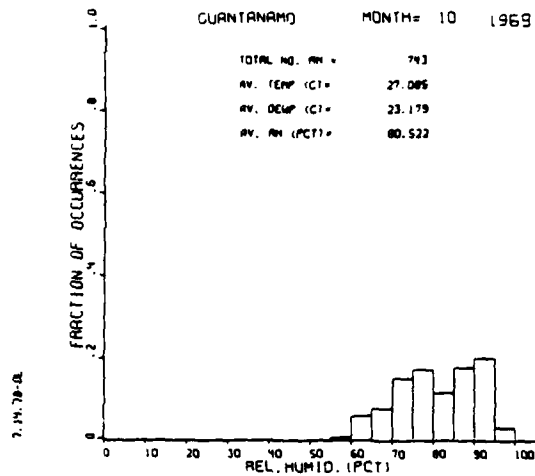
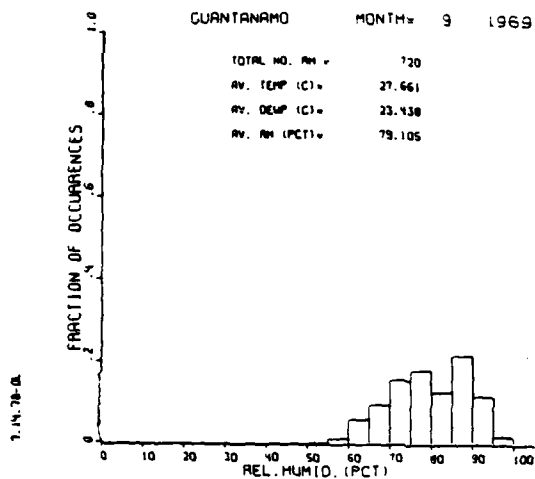
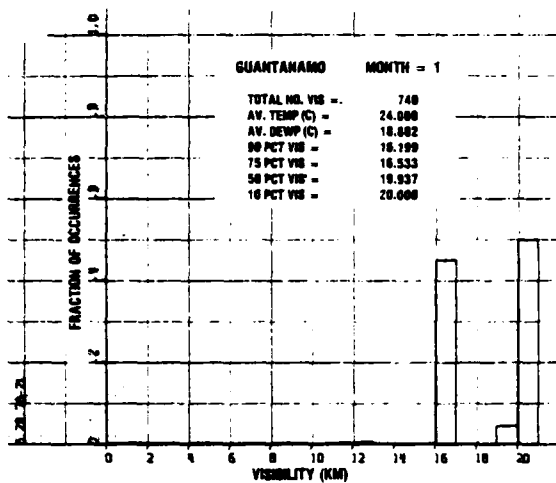
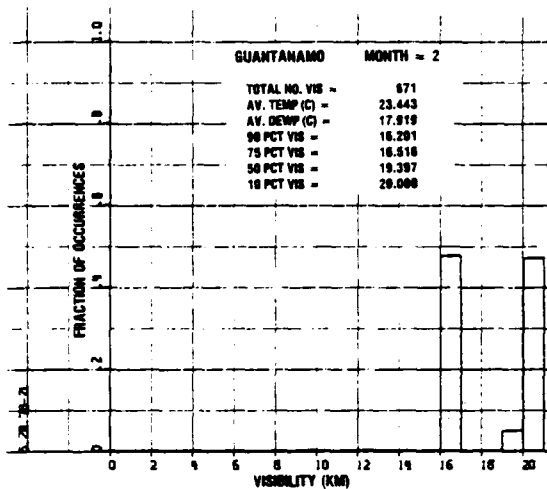


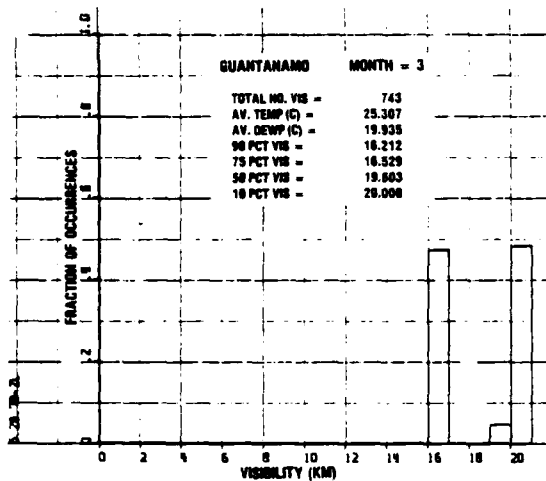
FIGURE 74. Relative humidity statistics, Guantanamo, Cuba, September-December 1969.



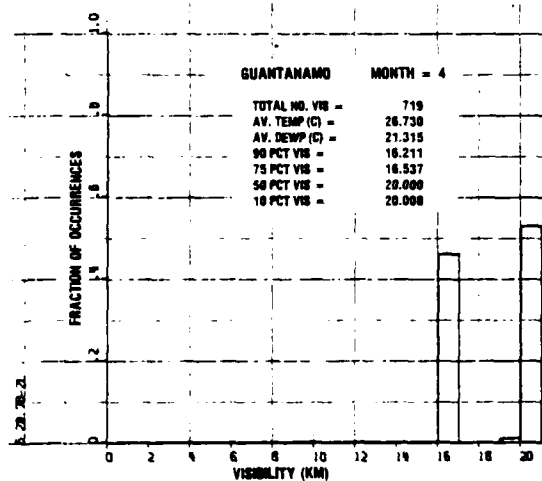
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6-20-75-10



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6-20-75-12

FIGURE 75. Visibility statistics, Guantanamo, Cuba, January-April 1969.

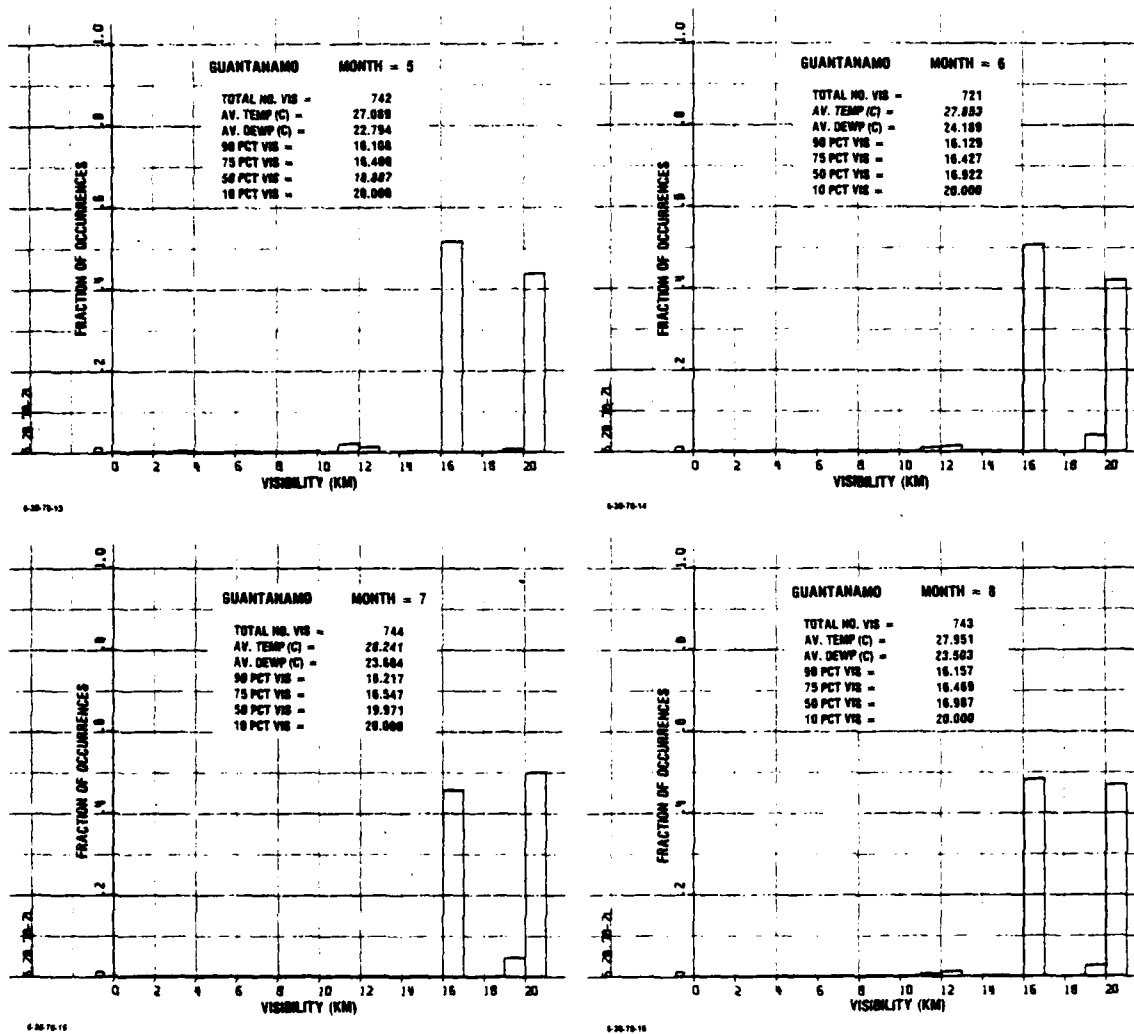


FIGURE 76. Visibility statistics, Guantanamo, Cuba, May-August 1969.

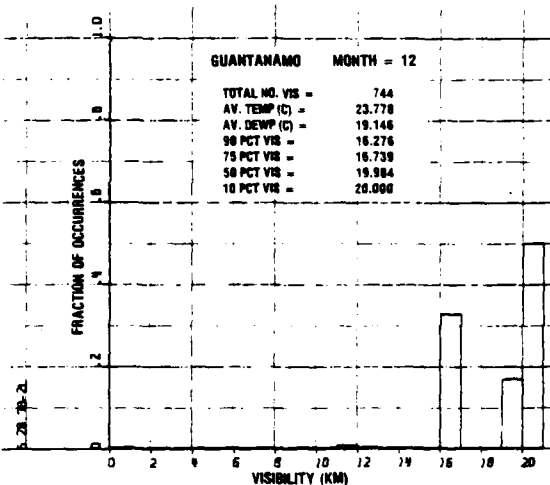
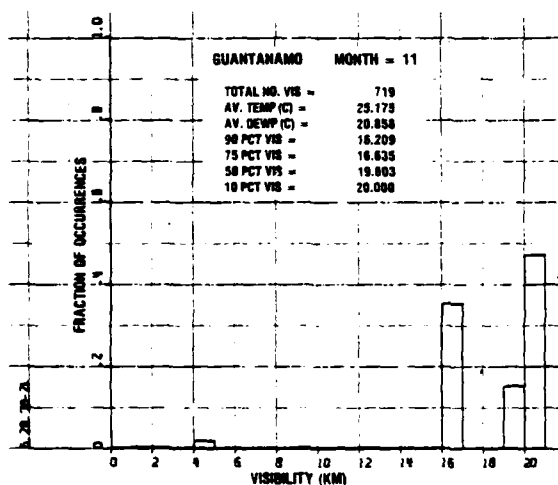
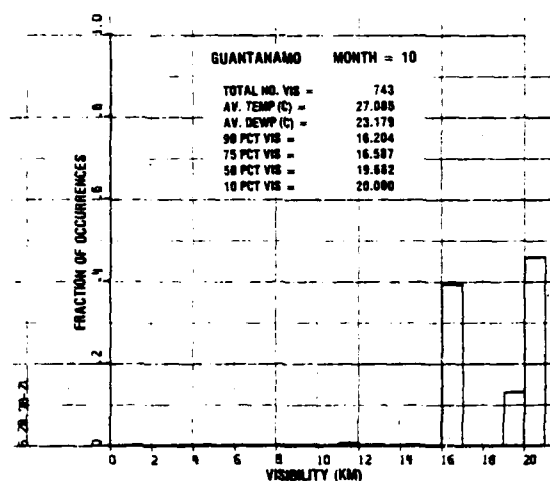
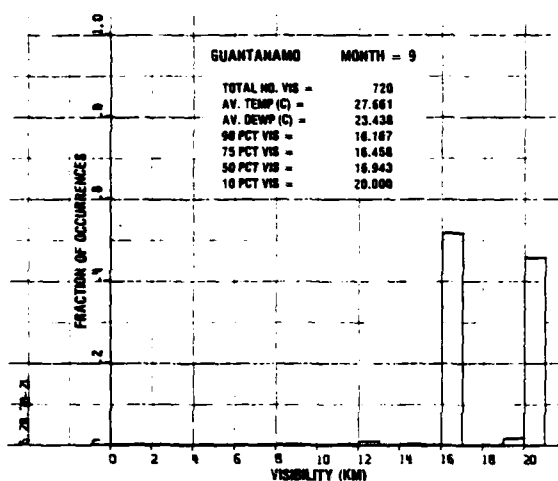


FIGURE 77. Visibility statistics, Guantanamo, Cuba, September-December 1969.

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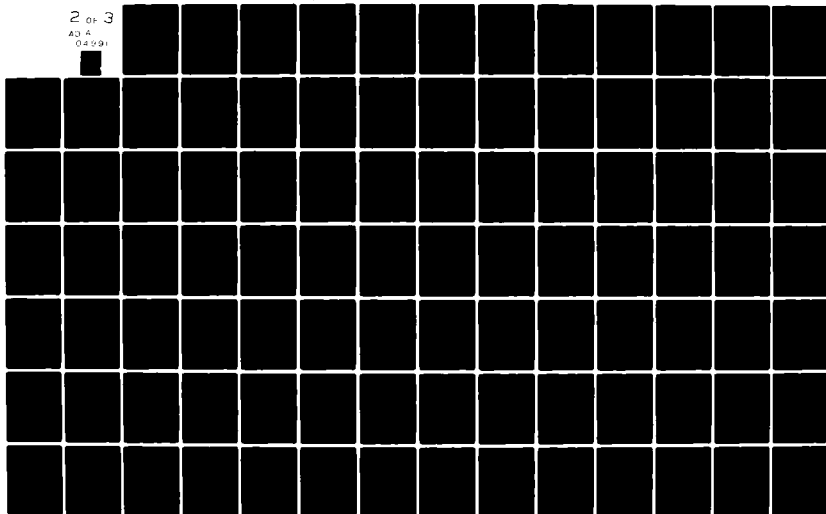
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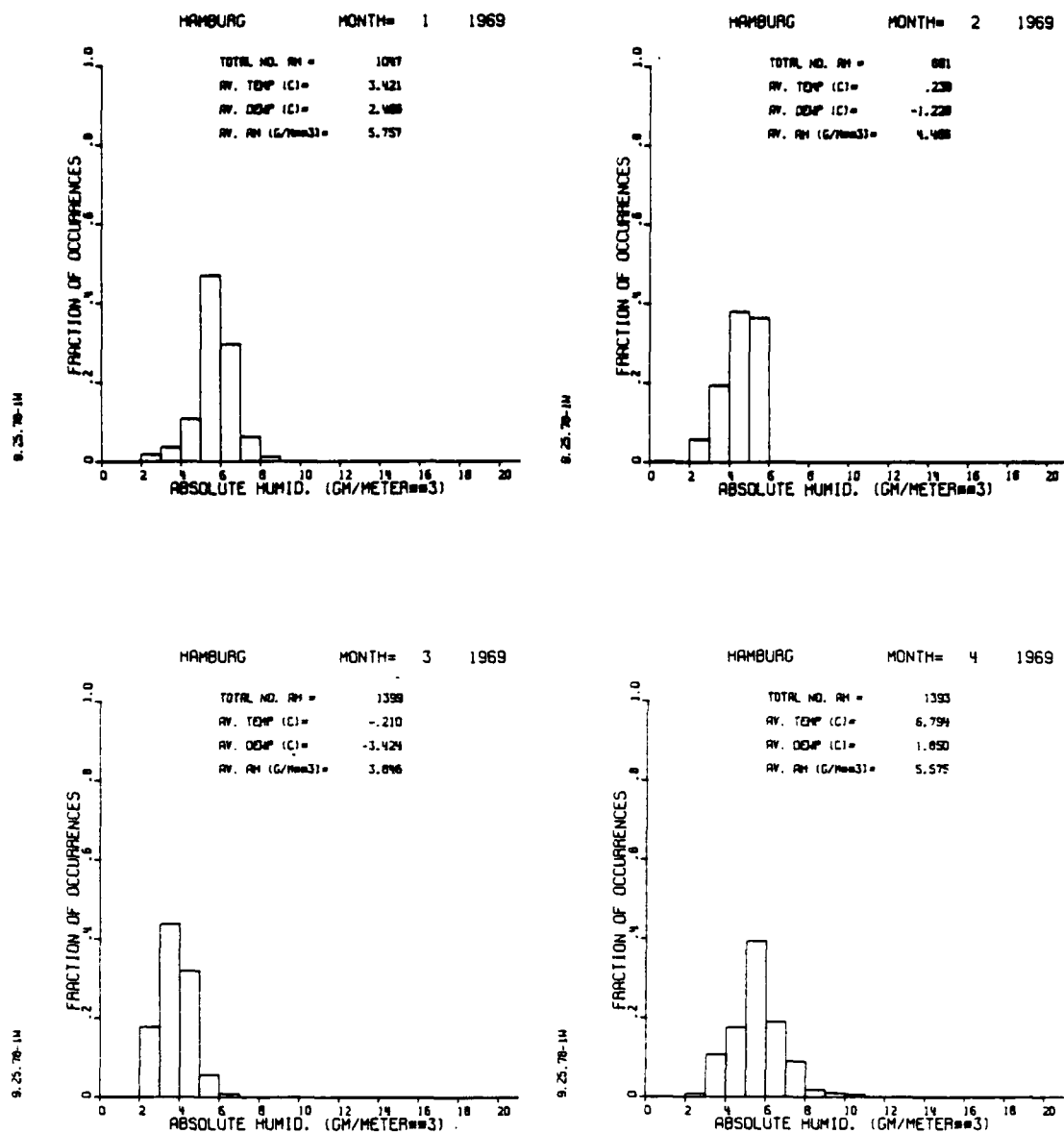
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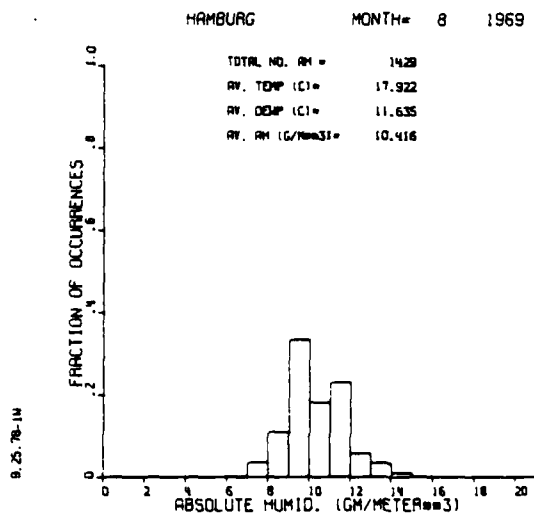
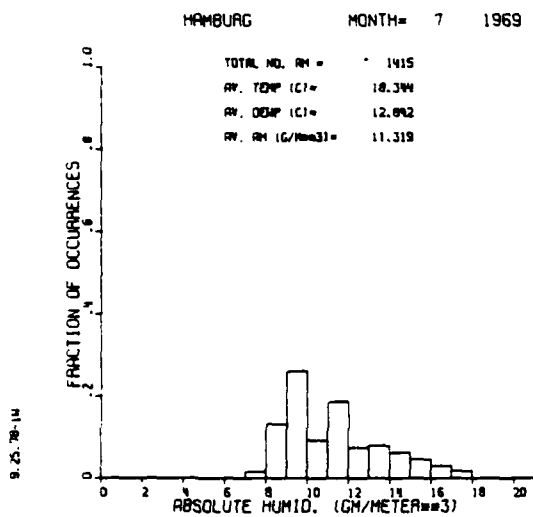
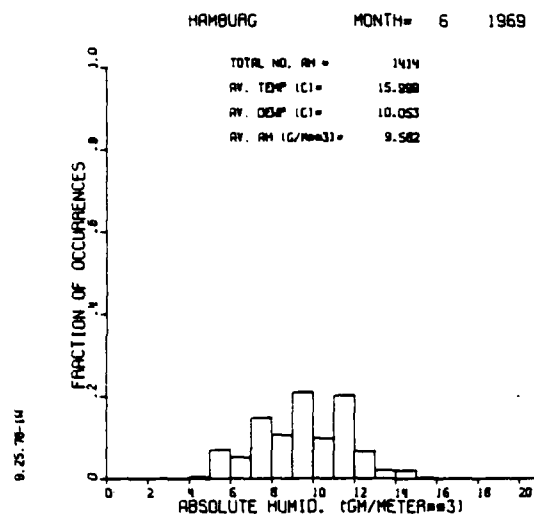
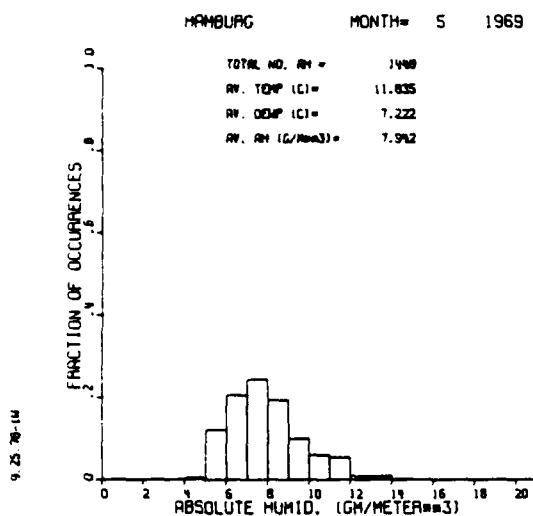
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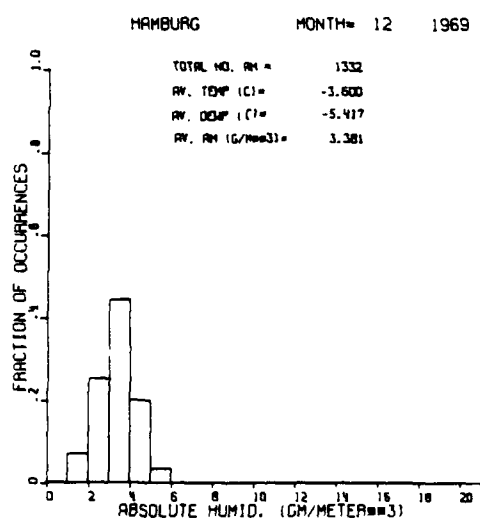
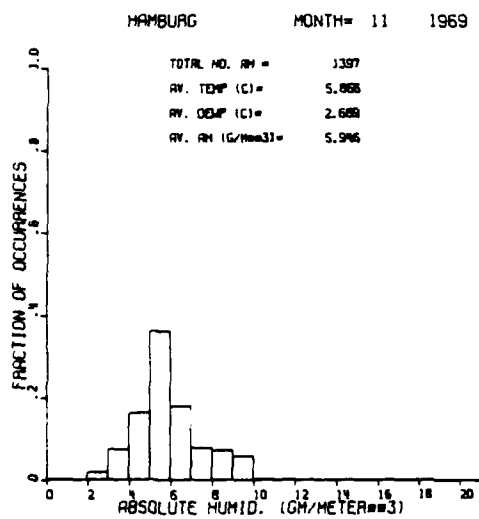
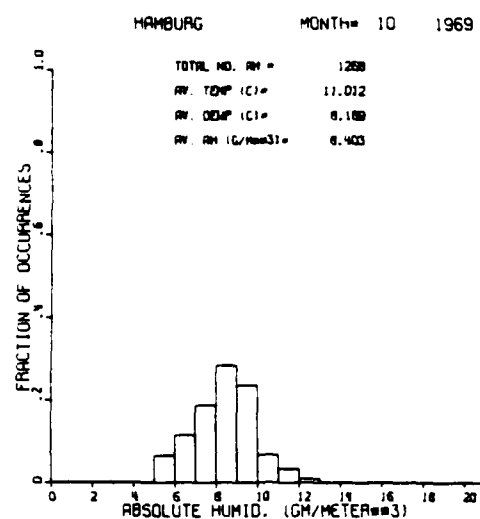
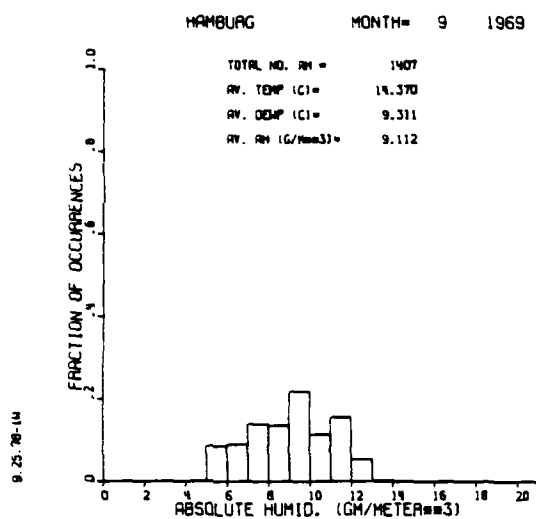
18-4-78-42

FIGURE 78. Absolute humidity statistics, Hamburg, West Germany, January-April 1969.



18-4-78-43

FIGURE 79. Absolute humidity statistics, Hamburg, West Germany, May-August 1969.



18-4-78-44

FIGURE 80. Absolute humidity statistics, Hamburg, West Germany, September-December 1969.

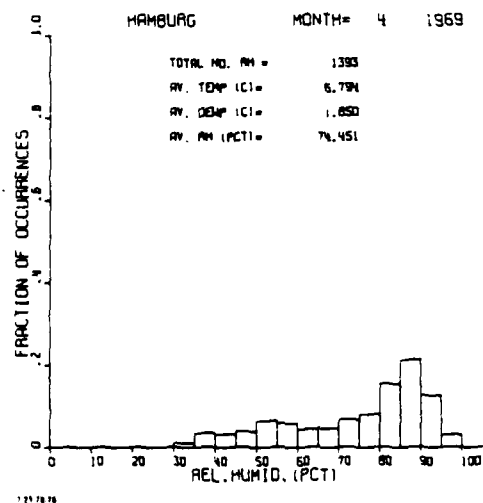
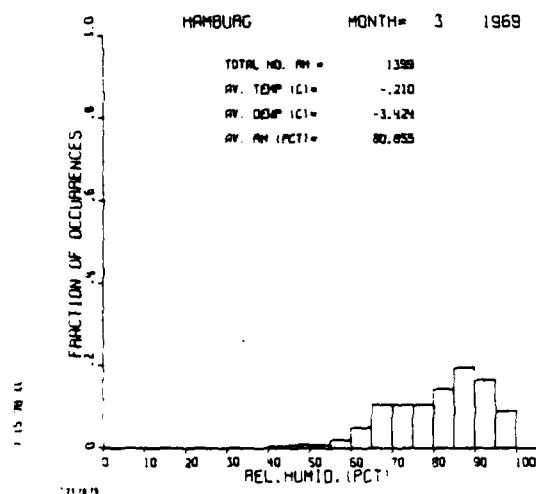
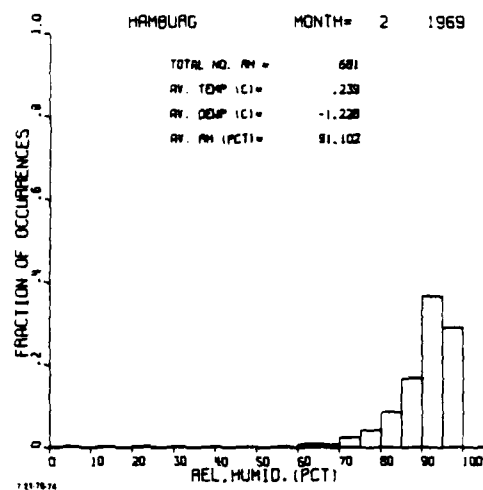
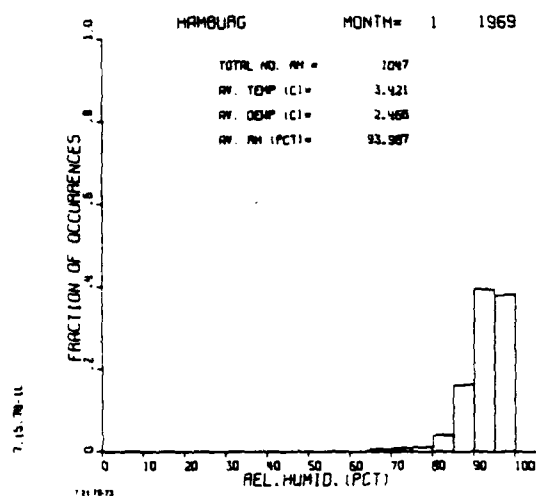


FIGURE 81. Relative humidity statistics, Hamburg, West Germany, January-April 1969.

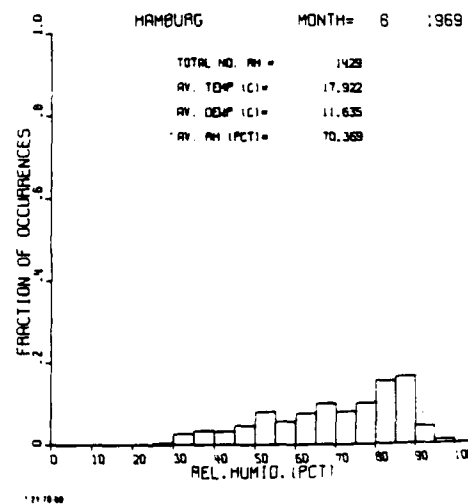
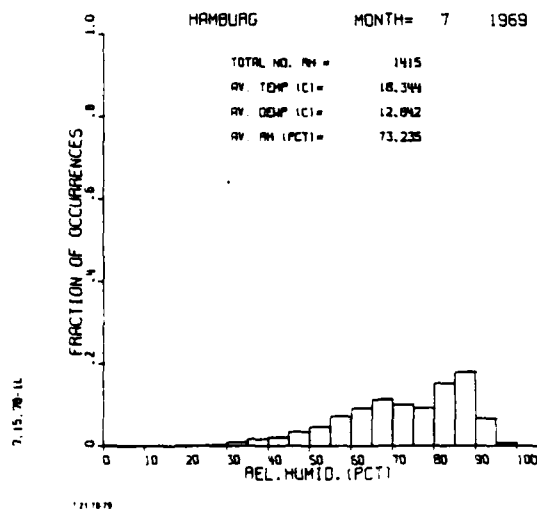
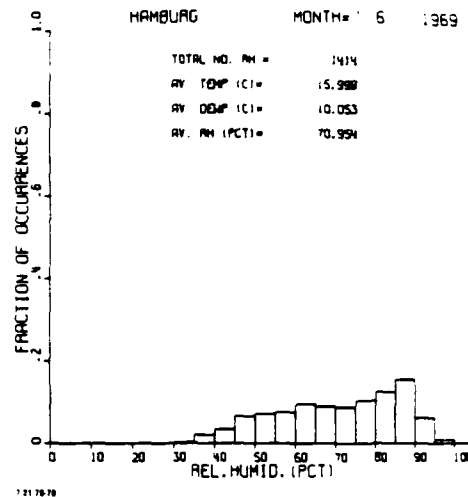
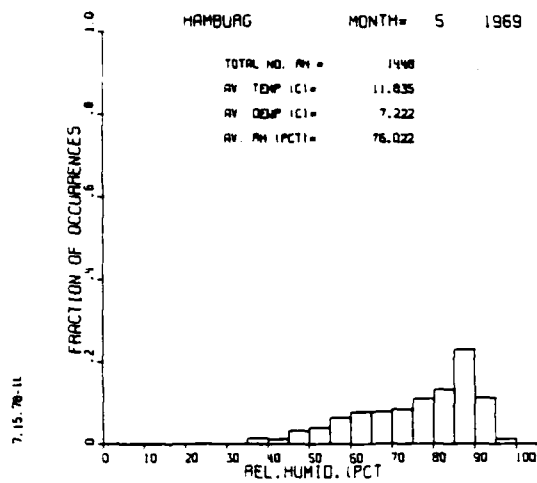


FIGURE 82. Relative humidity statistics, Hamburg, West Germany, May-August 1969.

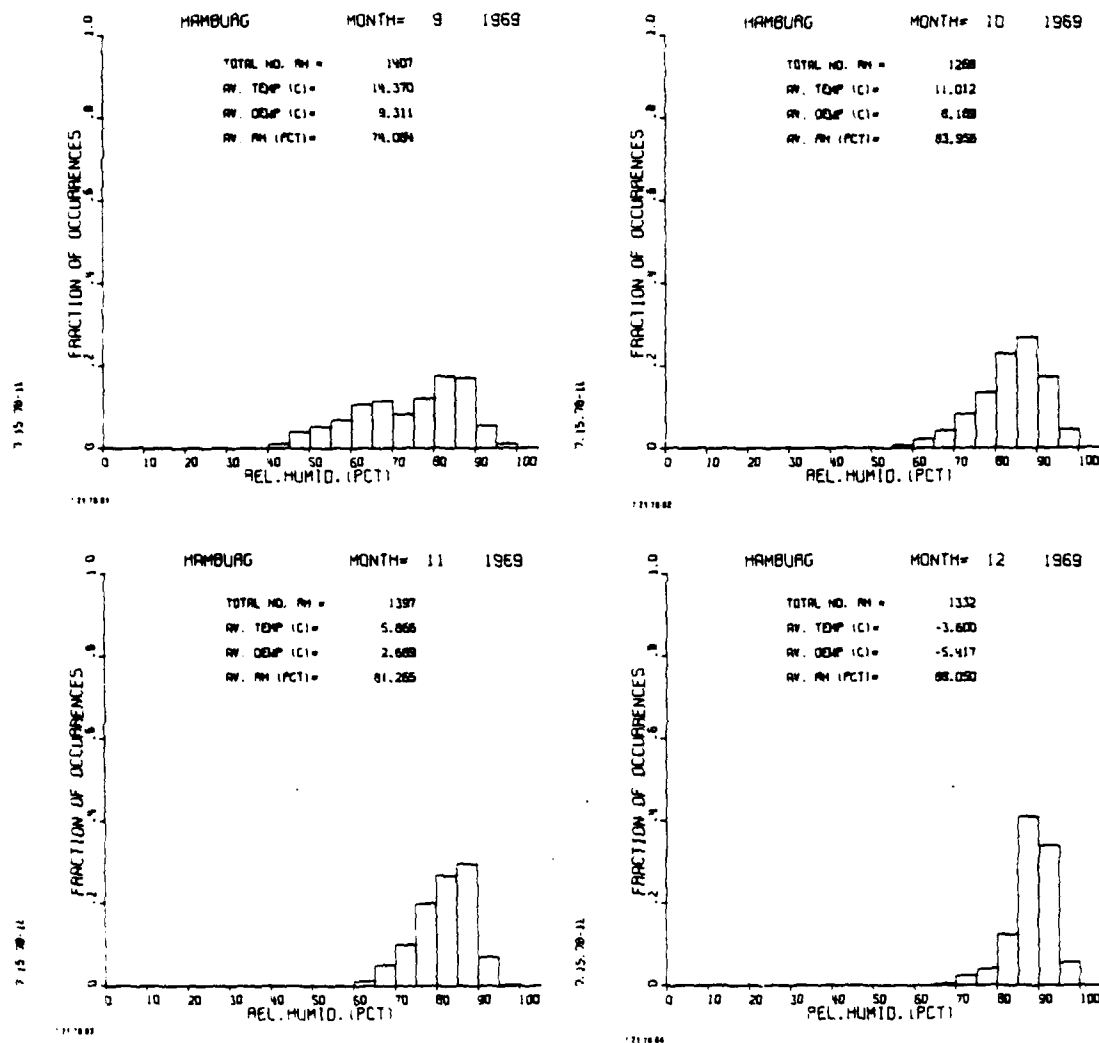


FIGURE 83. Relative humidity statistics, Hamburg, West Germany, September-December 1969.

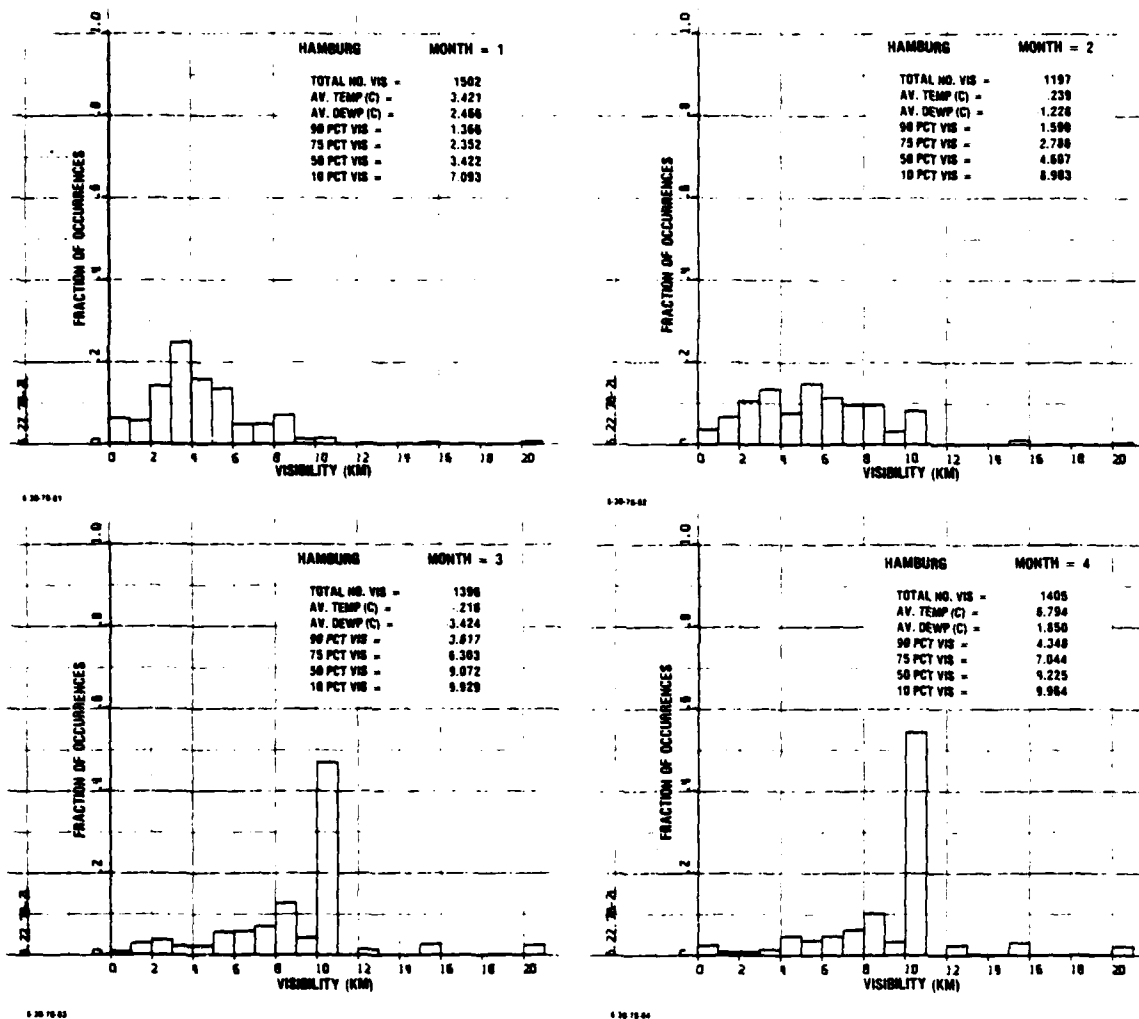


FIGURE 84. Visibility statistics, Hamburg, West Germany, January-April 1969.

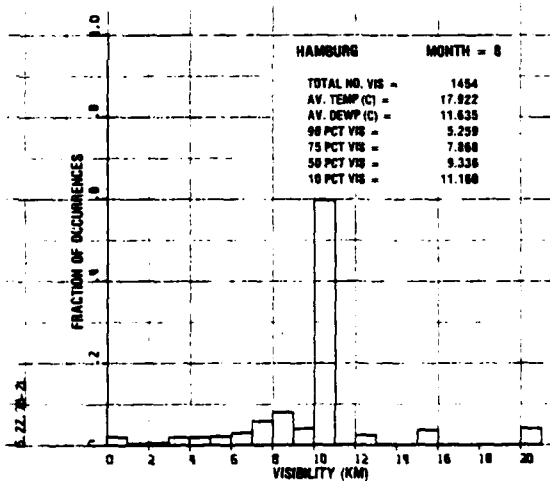
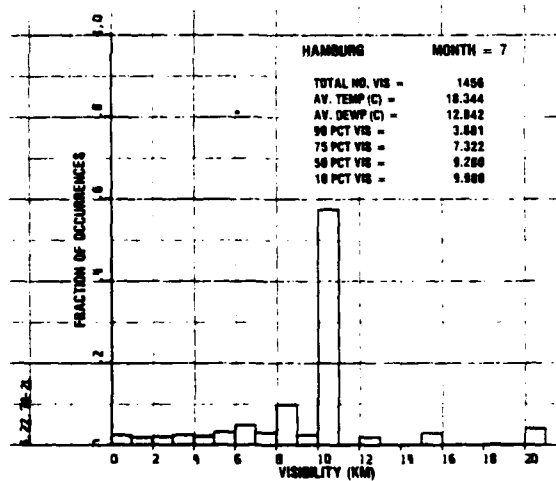
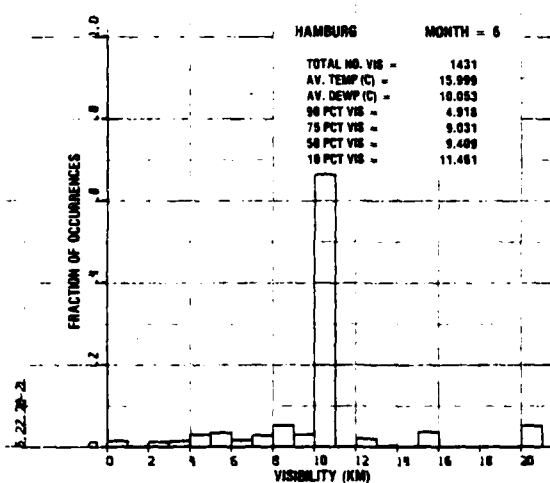
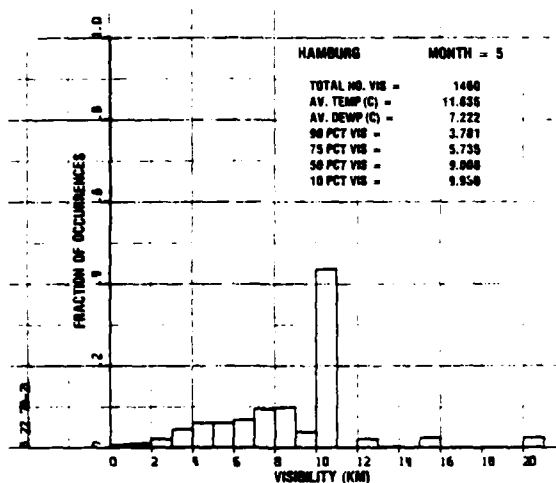


FIGURE 85. Visibility statistics, Hamburg, West Germany, May-August 1969.

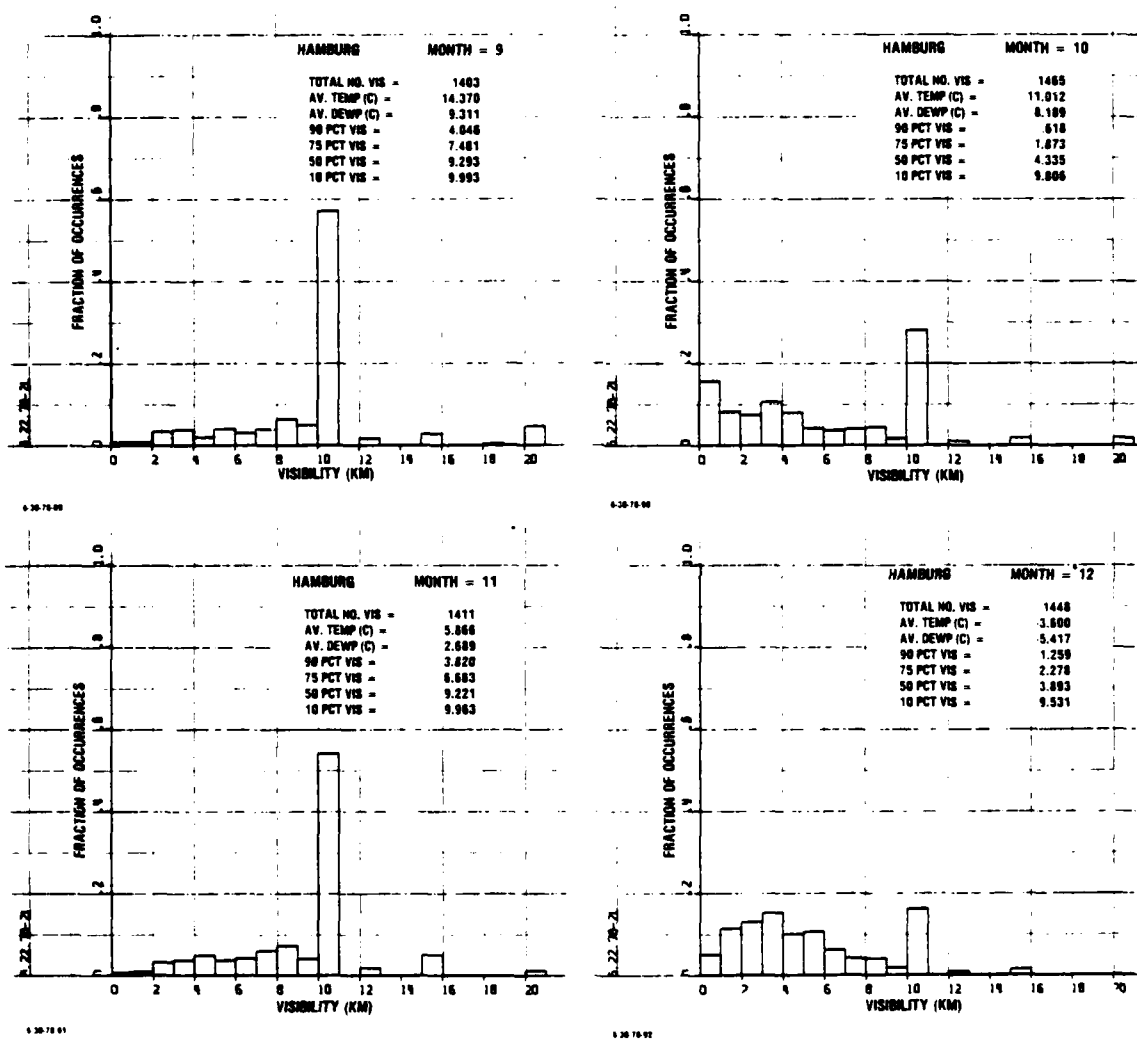


FIGURE 86. Visibility statistics, Hamburg, West Germany, September-December 1969.

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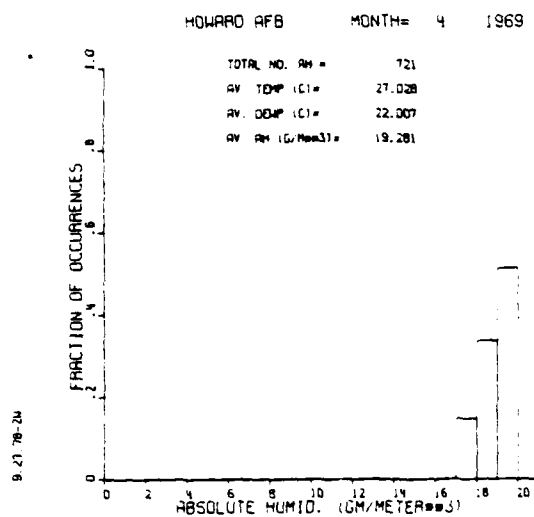
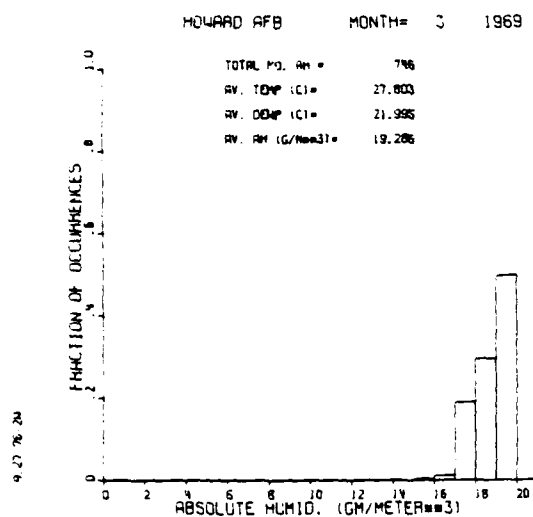
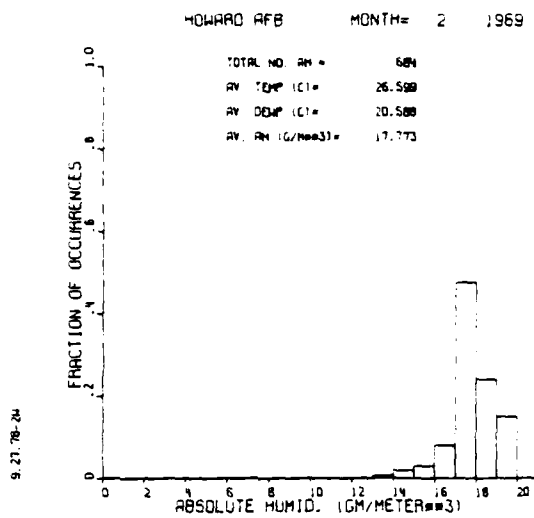
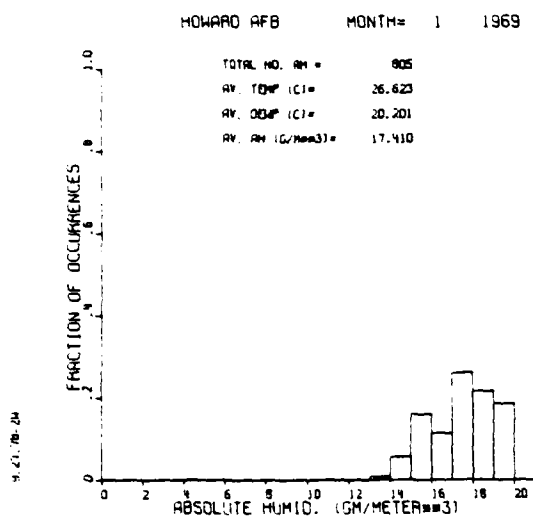
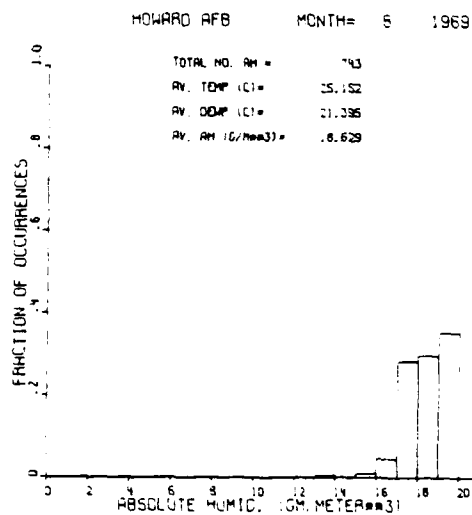
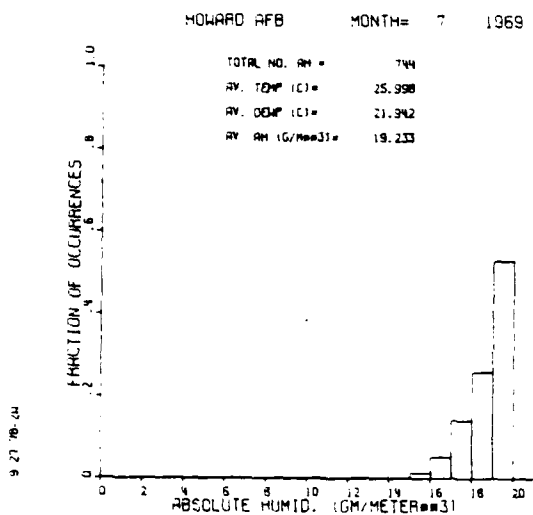
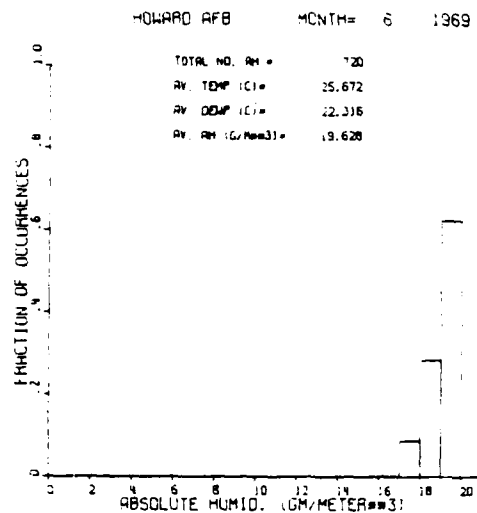
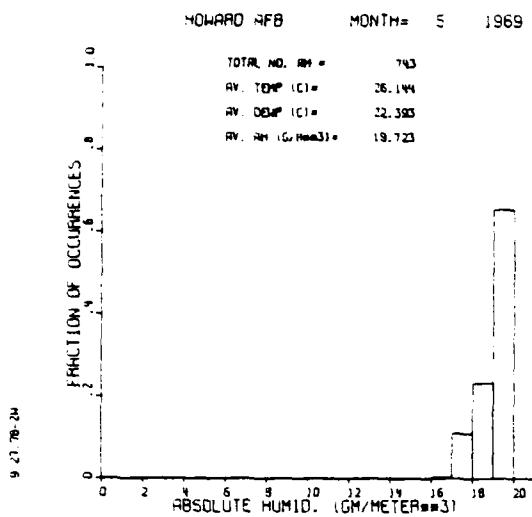
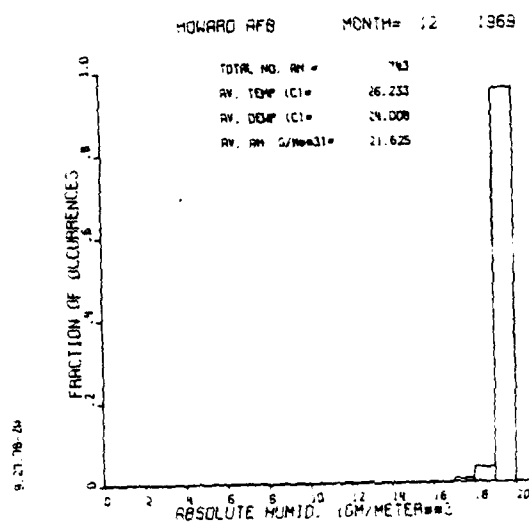
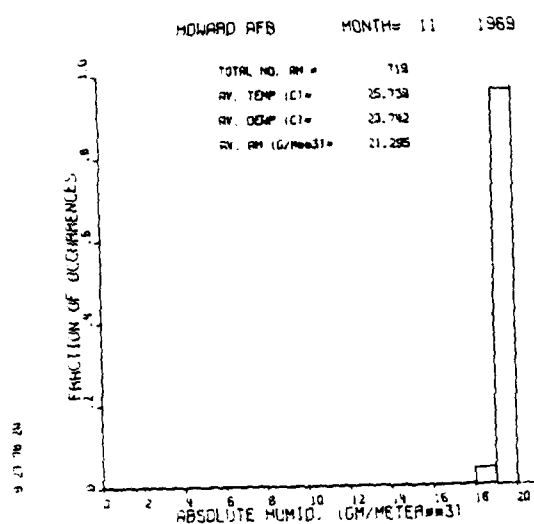
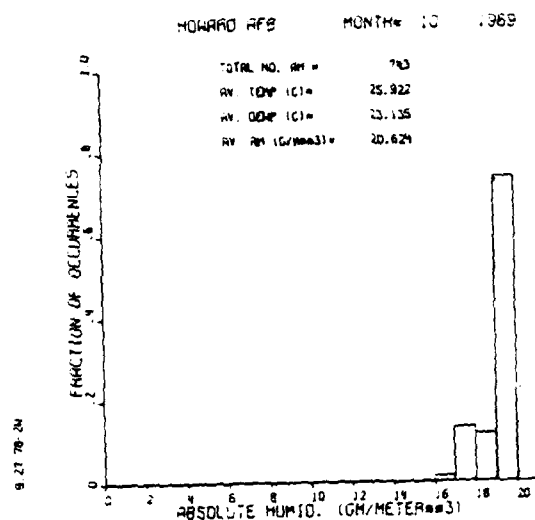
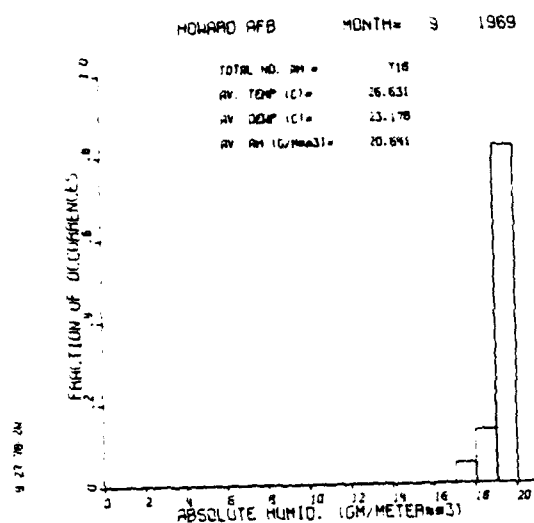


FIGURE 87. Absolute humidity statistics, Howard AFB, Panama, January-April 1969.



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FIGURE 88. Absolute humidity statistics, Howard AFB, Panama, May-August 1969.



18-478-47

FIGURE 89. Absolute humidity statistics, Howard AFB, Panama, September-December 1969.

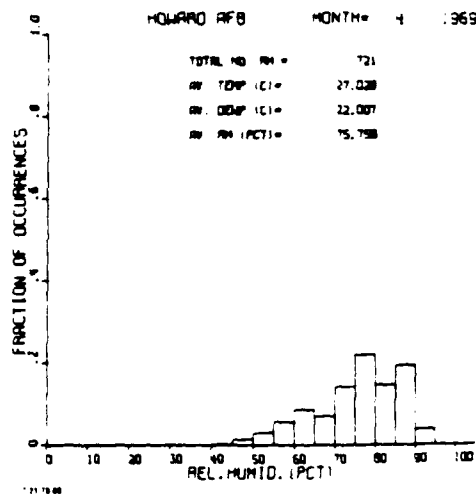
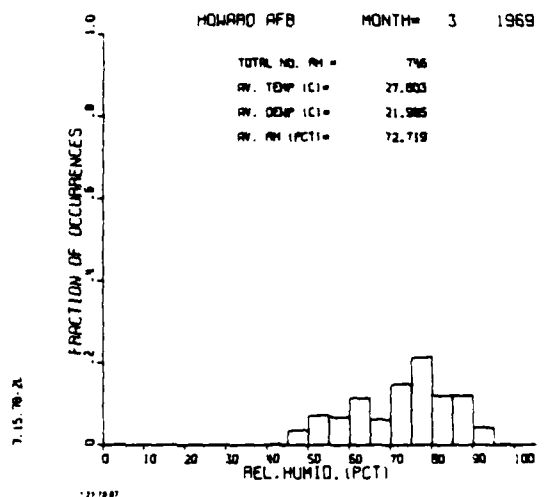
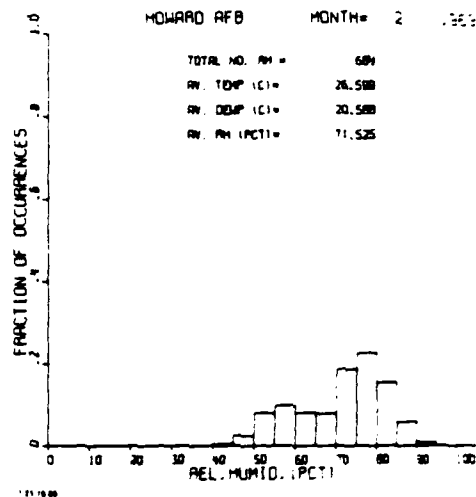
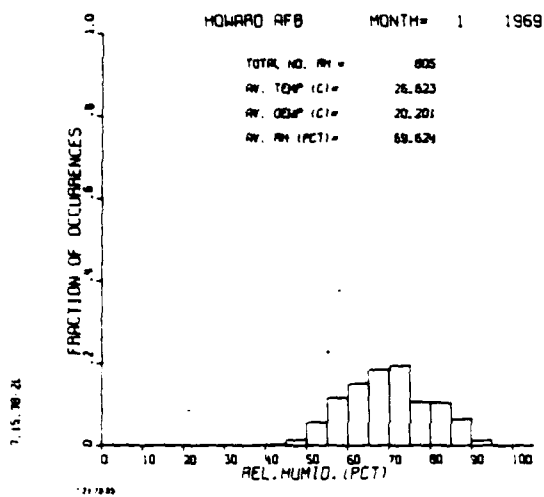


FIGURE 90. Relative humidity statistics, Howard AFB, Panama, January-April 1969.

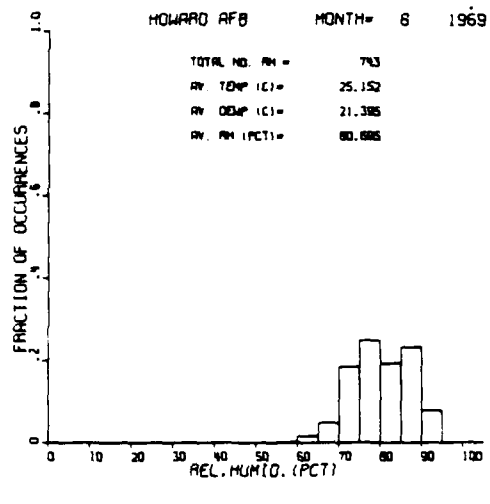
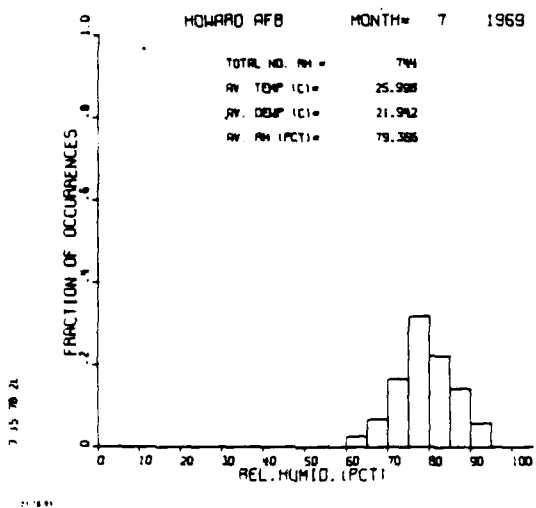
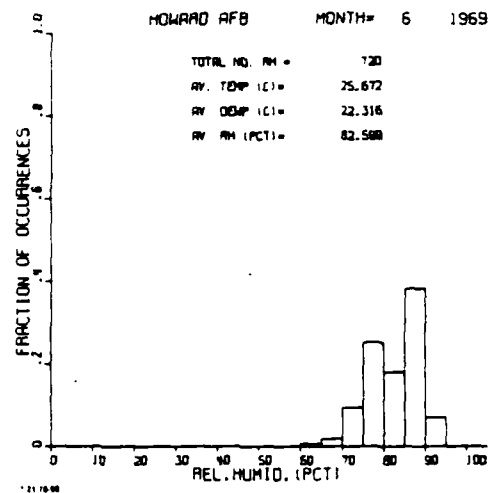
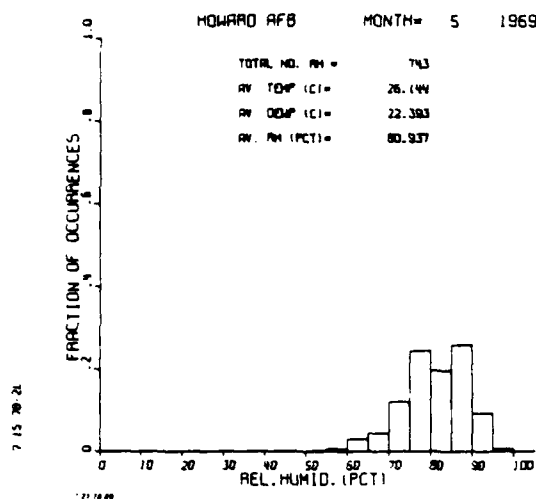


FIGURE 91. Relative humidity statistics, Howard AFB, Panama, May-August 1969.

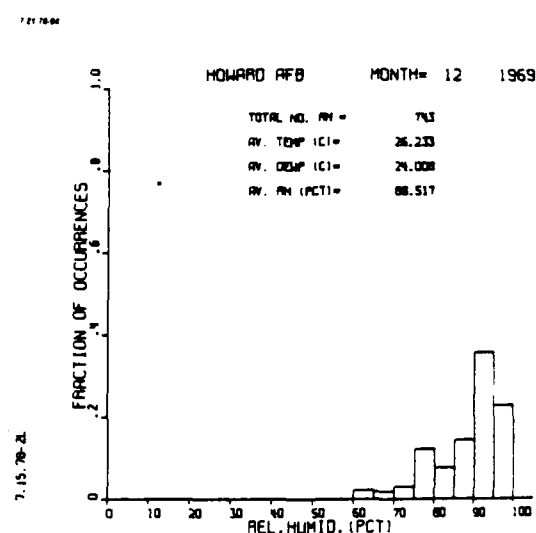
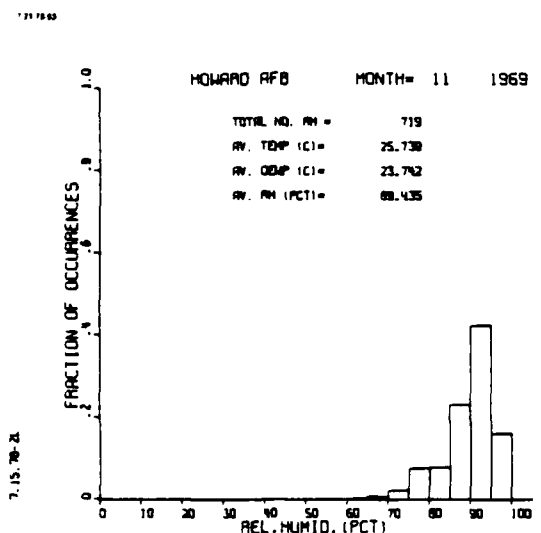
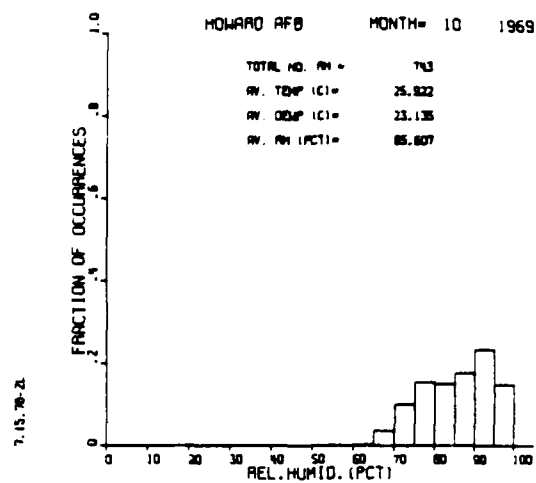
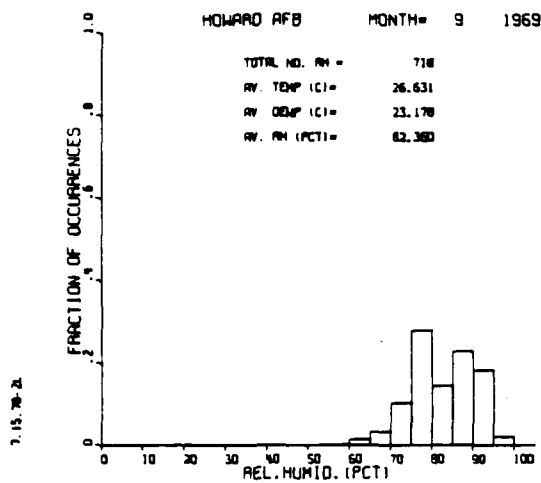
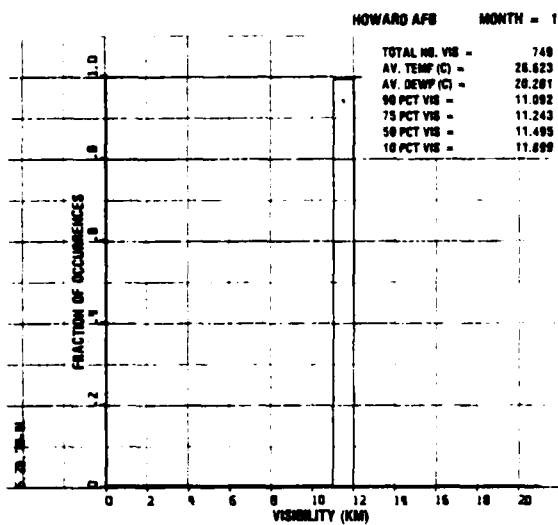
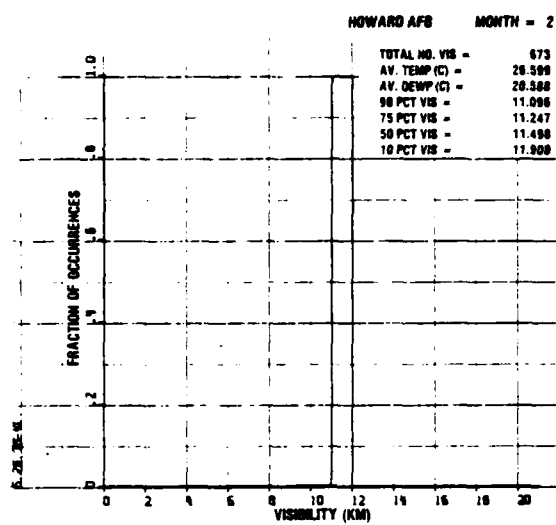


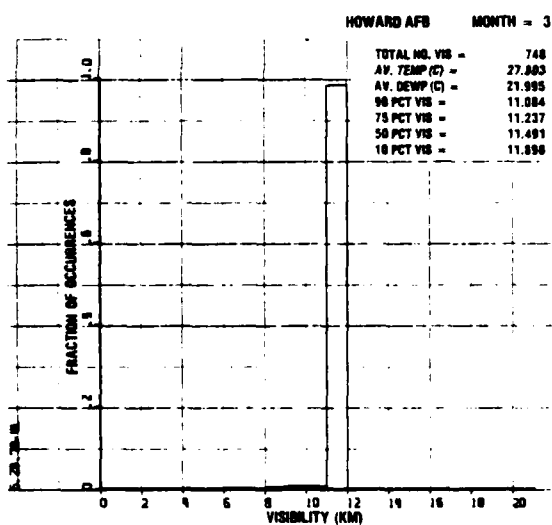
FIGURE 92. Relative humidity statistics, Howard AFB, Panama, September-December 1969.



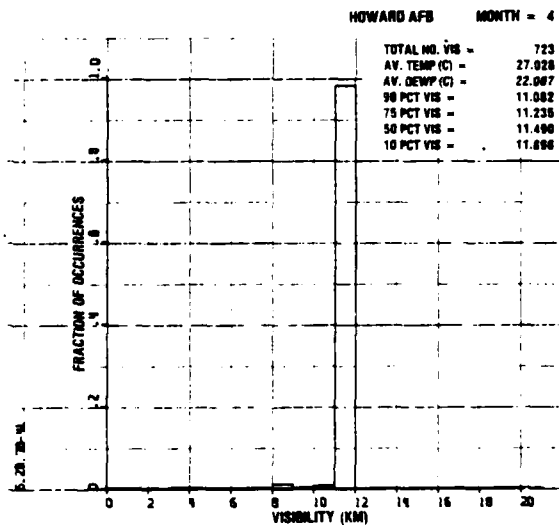
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6-20-75-04



6-20-75-05



6-20-75-06

FIGURE 93. Visibility statistics, Howard AFB, Panama, January-April 1969.

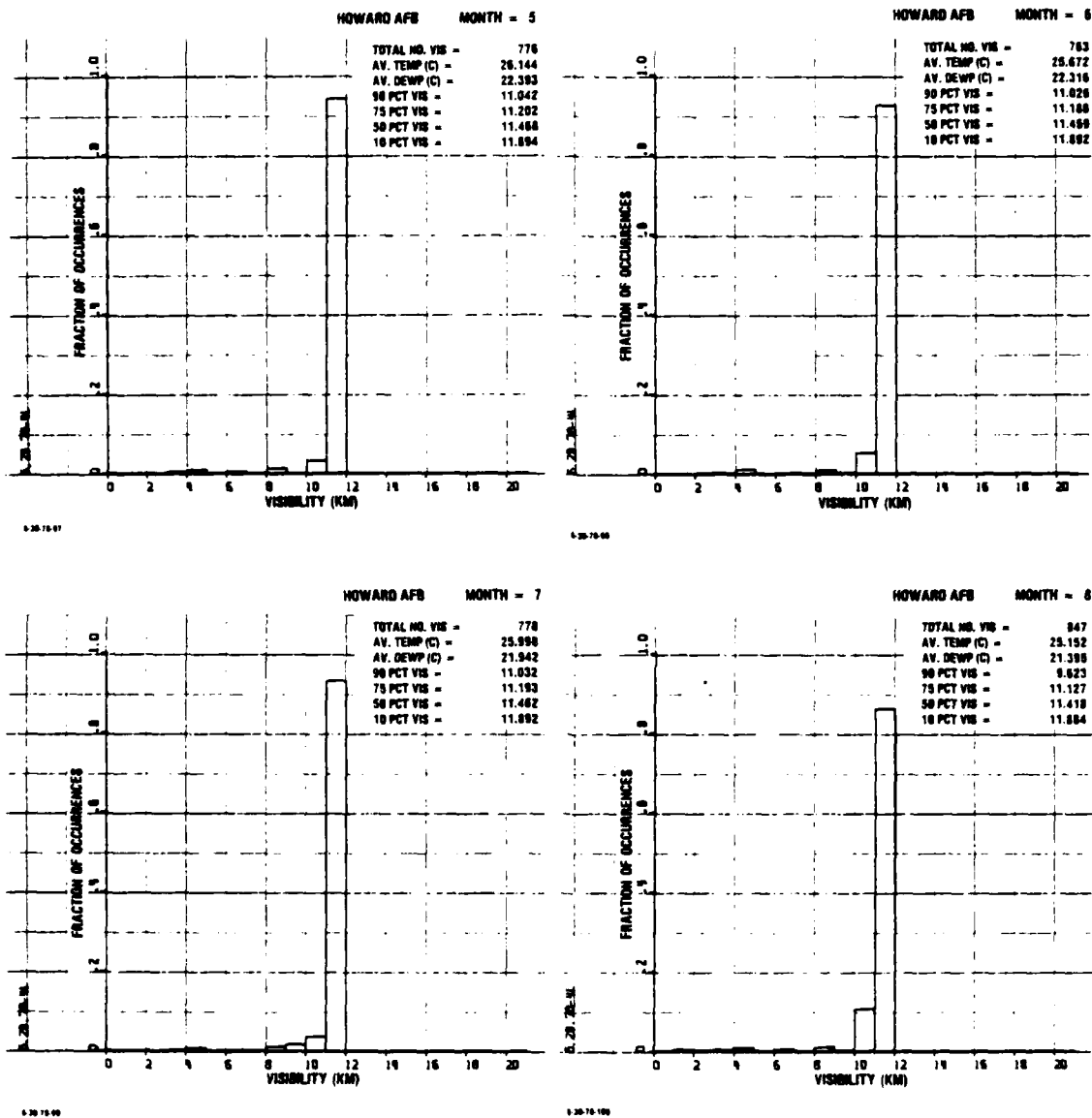


FIGURE 94. Visibility statistics, Howard AFB, Panama, May-August 1969.

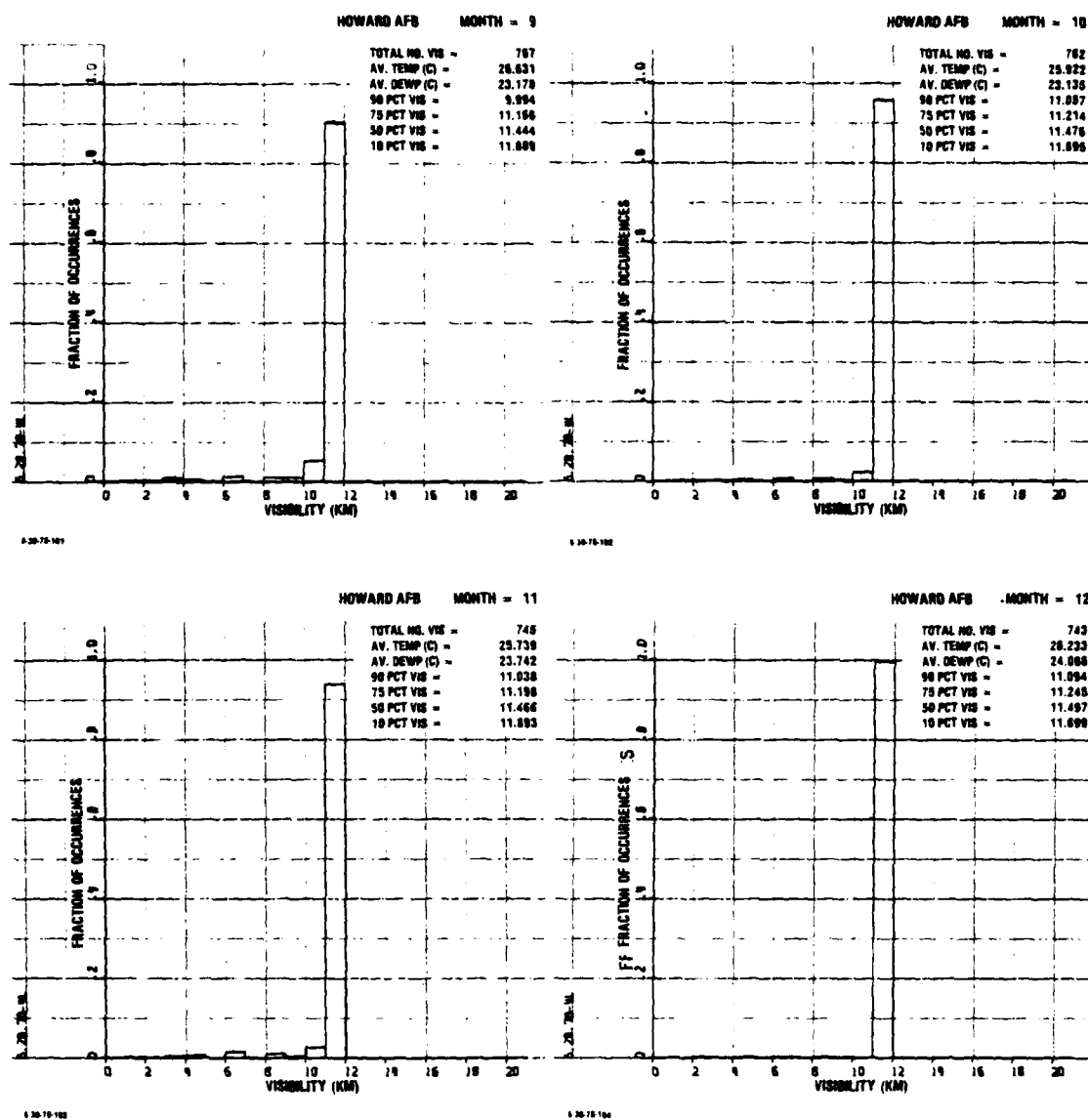


FIGURE 95. Visibility statistics, Howard AFB, Panama, September-December 1969.

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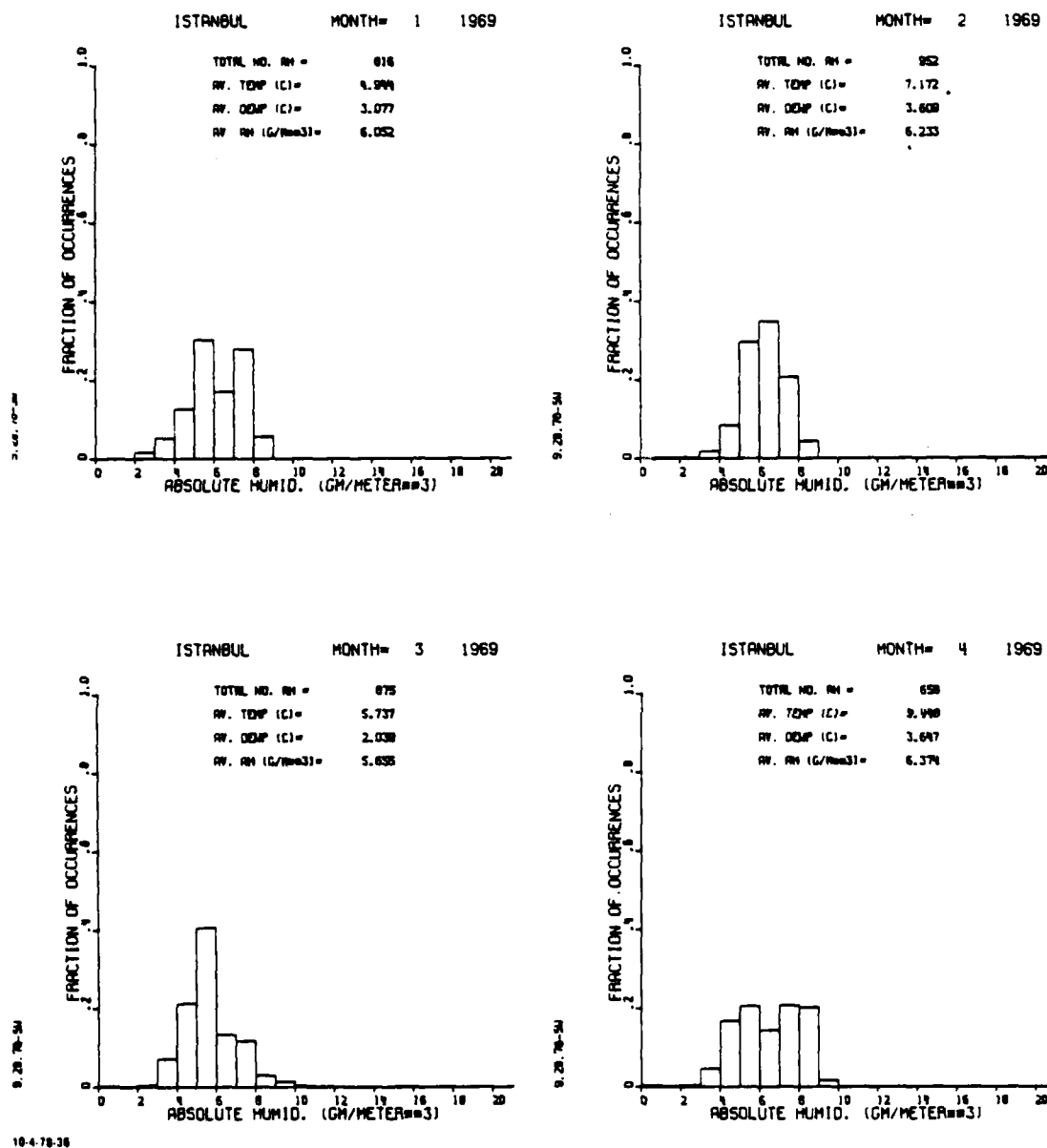


FIGURE 96. Absolute humidity statistics, Istanbul, Turkey, January-April 1969.

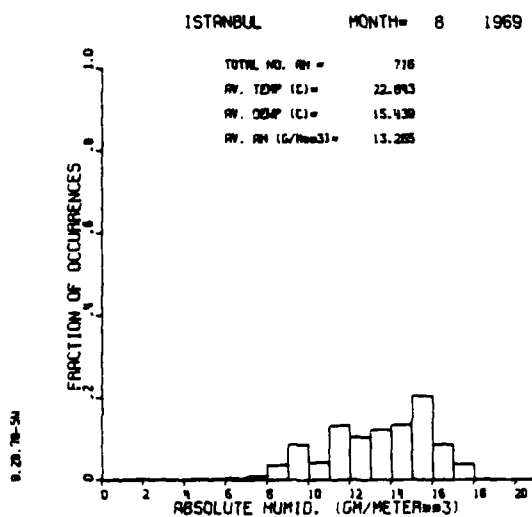
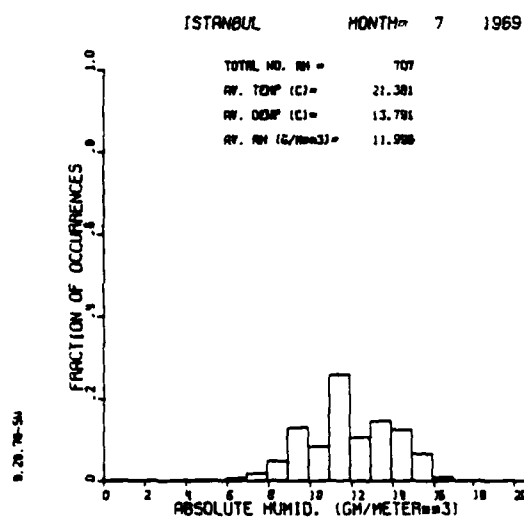
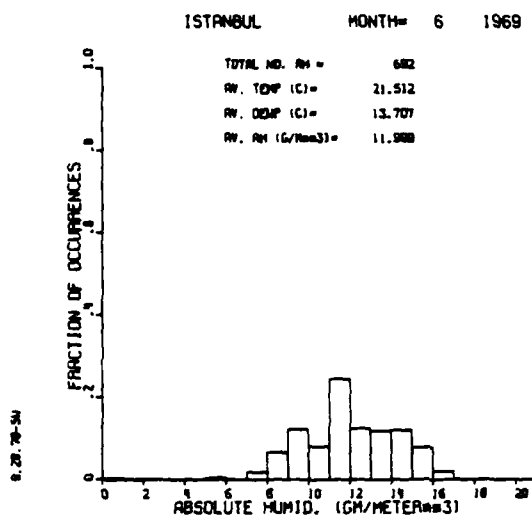
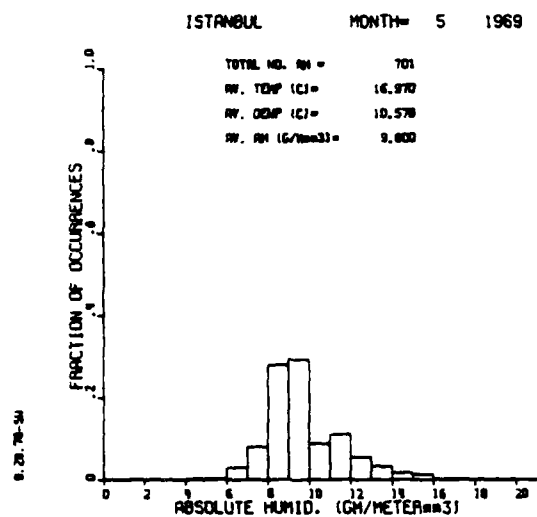
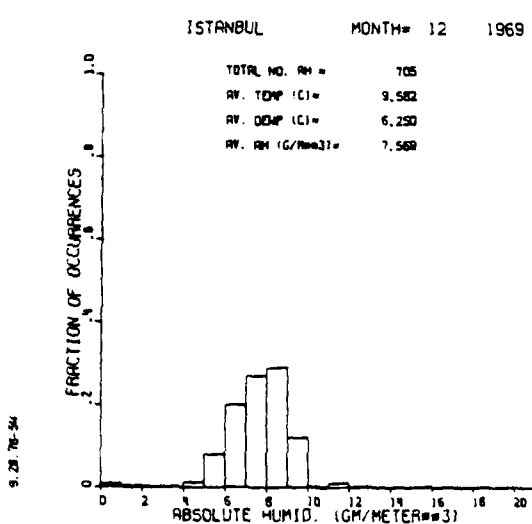
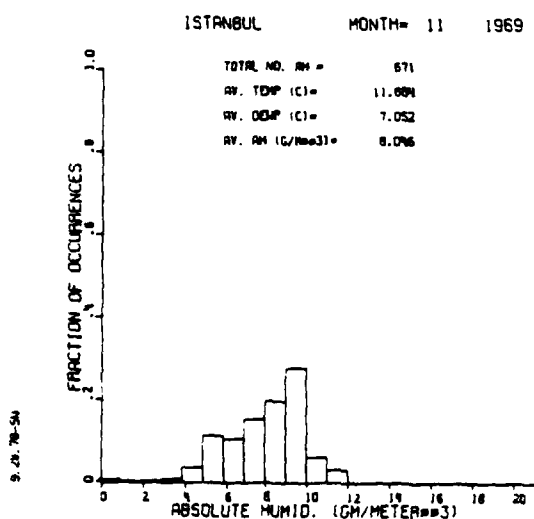
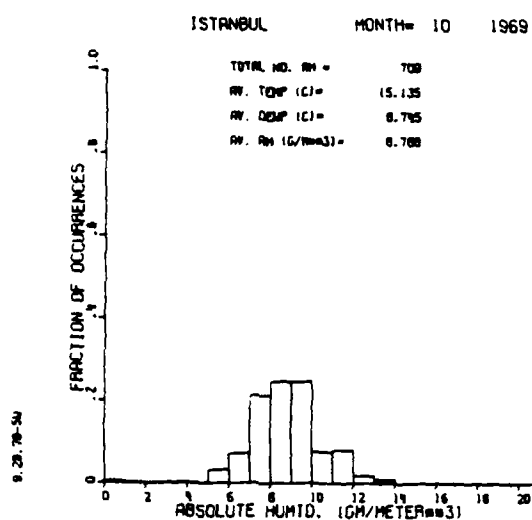
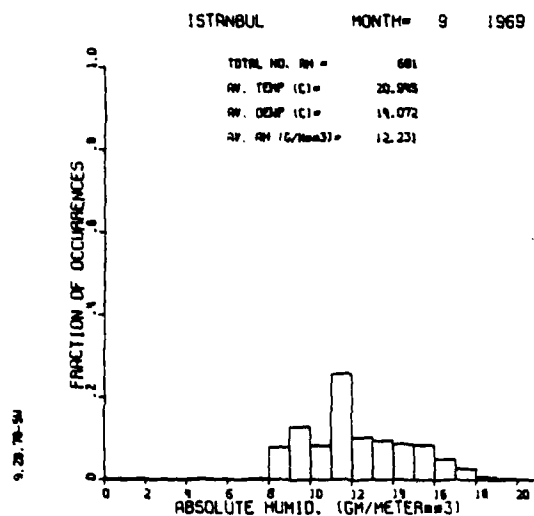


FIGURE 97. Absolute humidity statistics, Istanbul, Turkey, May-August 1969.



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FIGURE 98. Absolute humidity statistics, Istanbul, Turkey, September-December 1969.

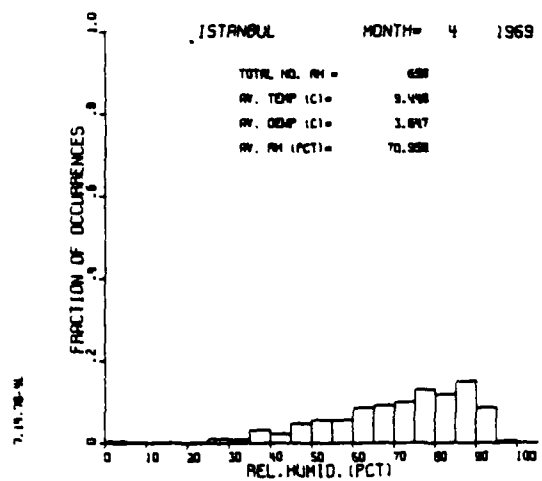
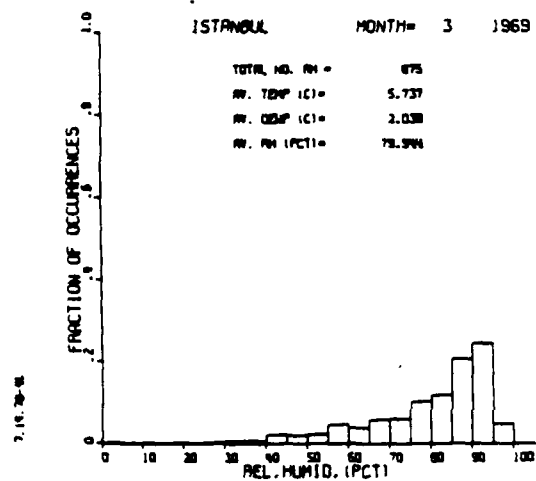
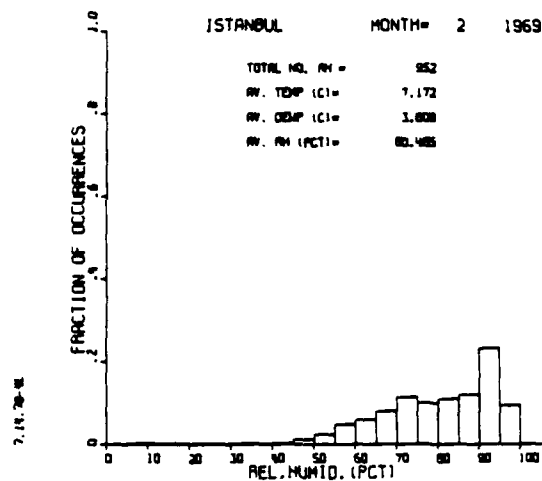
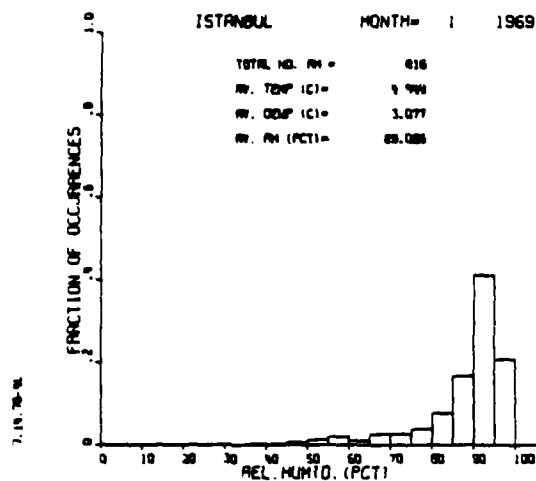


FIGURE 99. Relative humidity statistics, Istanbul, Turkey, January-April 1969.

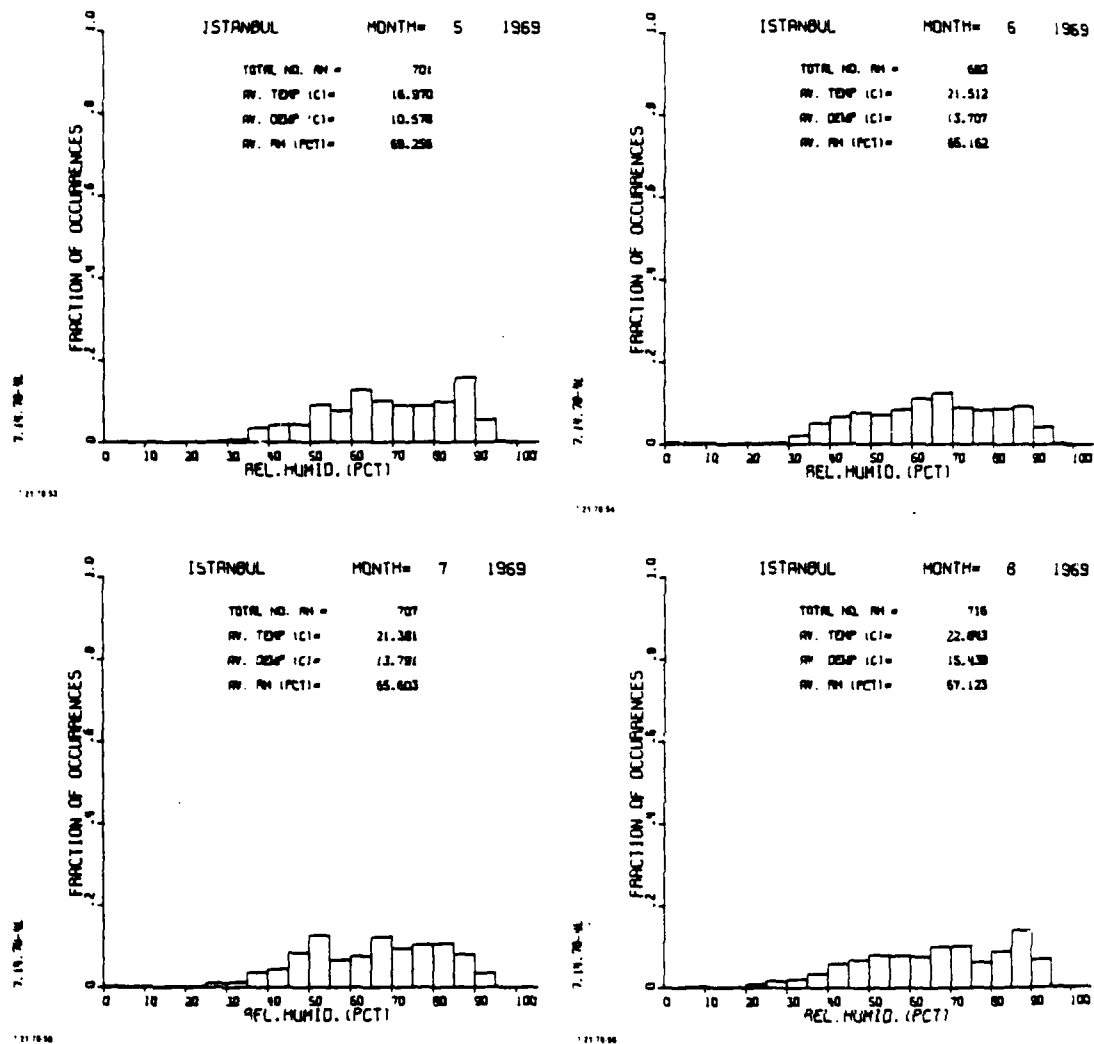


FIGURE 100. Relative humidity statistics, Istanbul, Turkey, May-August 1969.

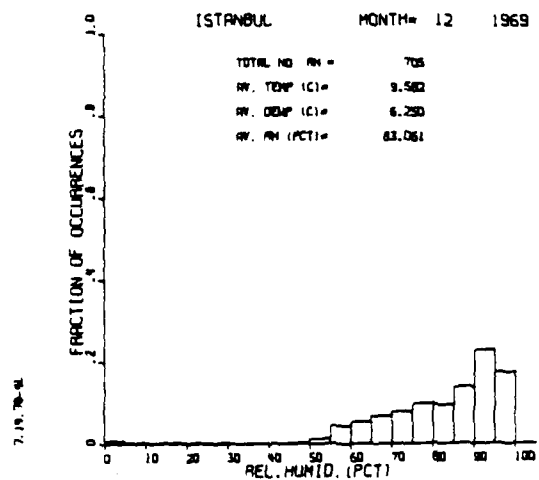
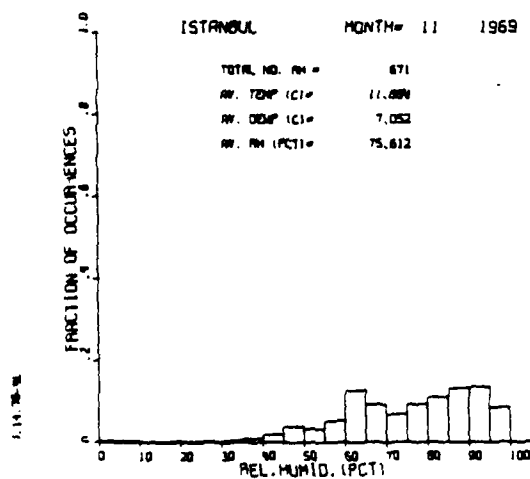
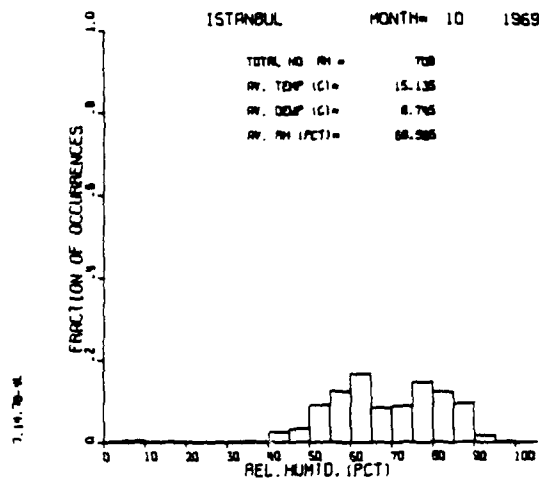
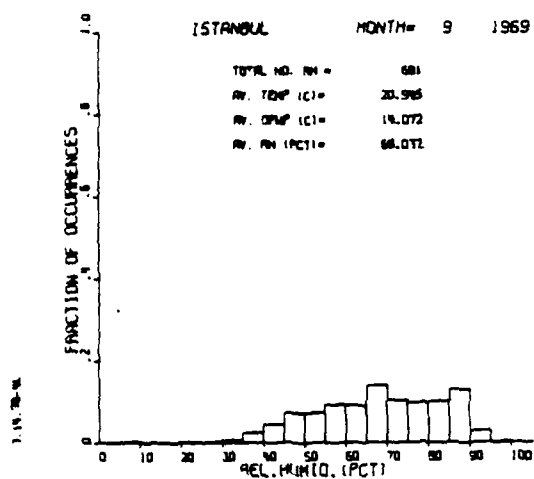


FIGURE 101. Relative humidity statistics, Istanbul, Turkey, September-December 1969.

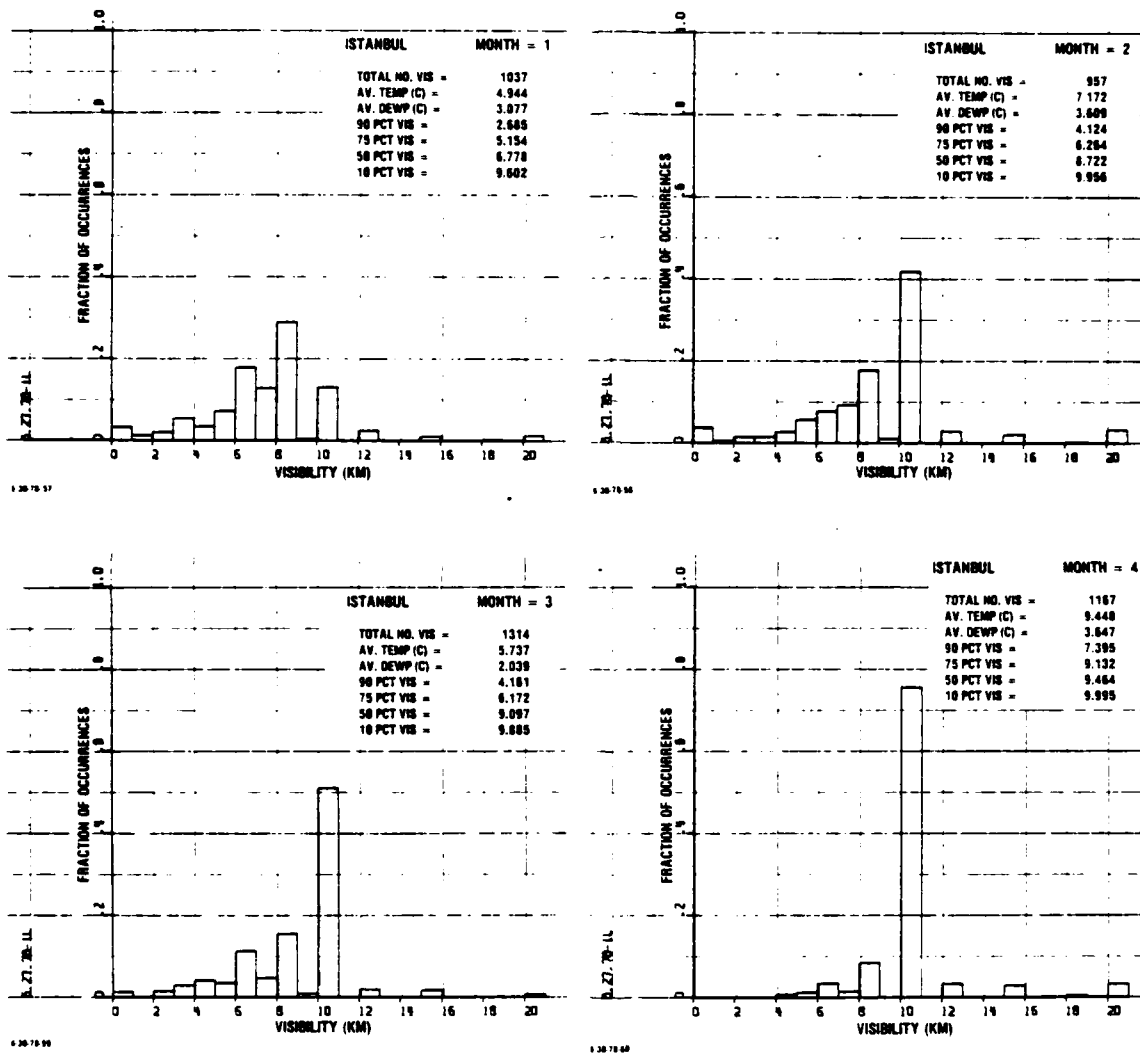


FIGURE 102. Visibility statistics, Istanbul, Turkey, January-April 1969.

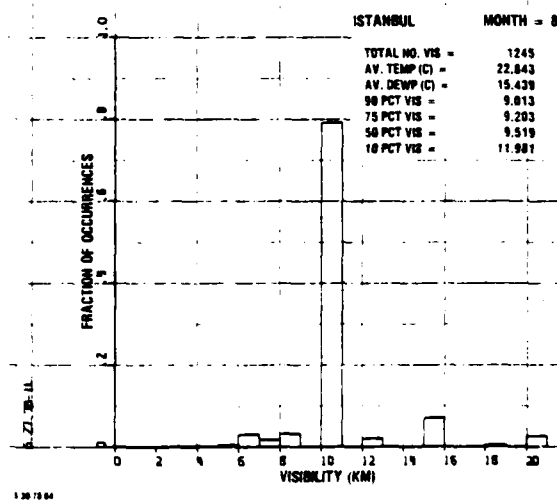
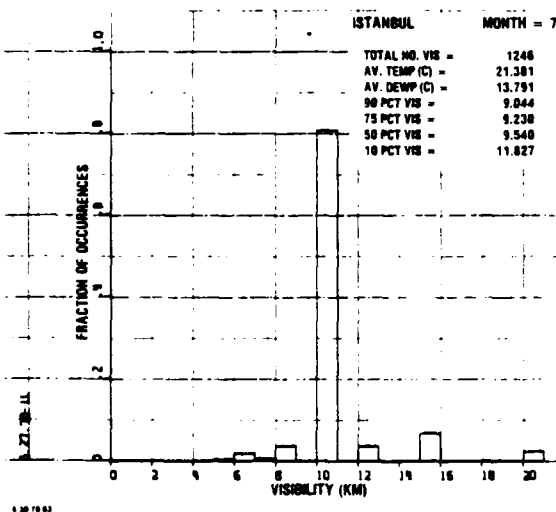
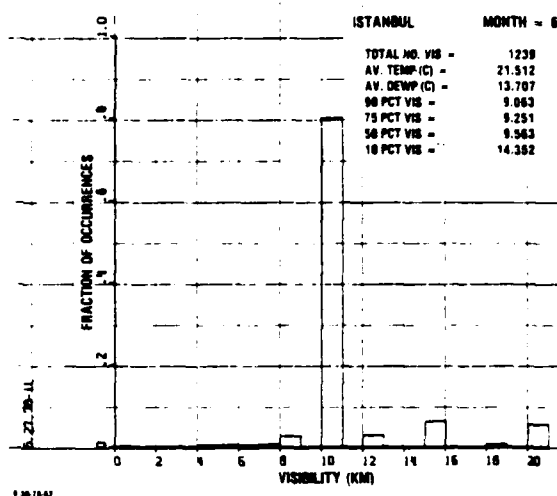
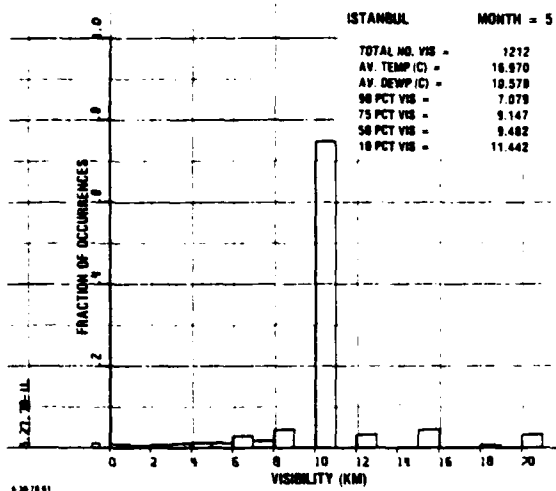


FIGURE 103. Visibility statistics, Istanbul, Turkey, May-August 1969.

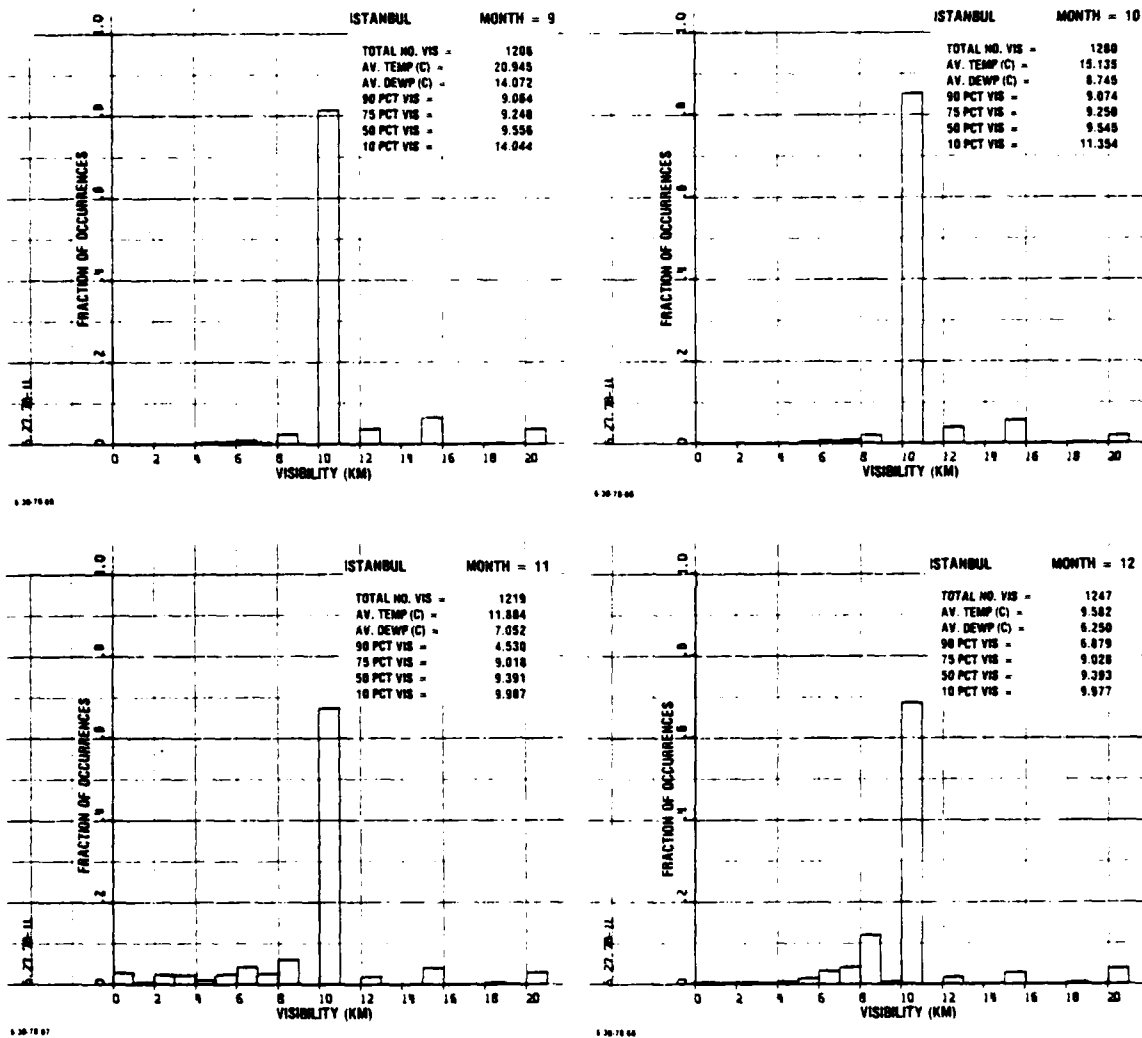
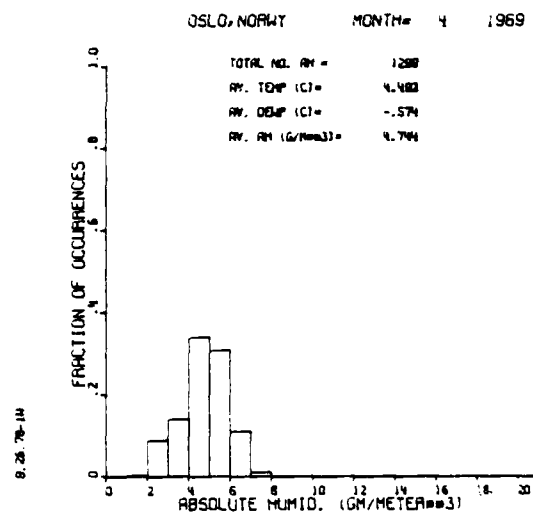
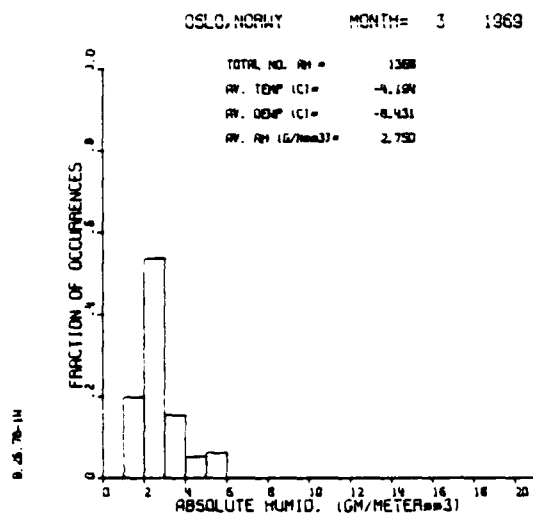
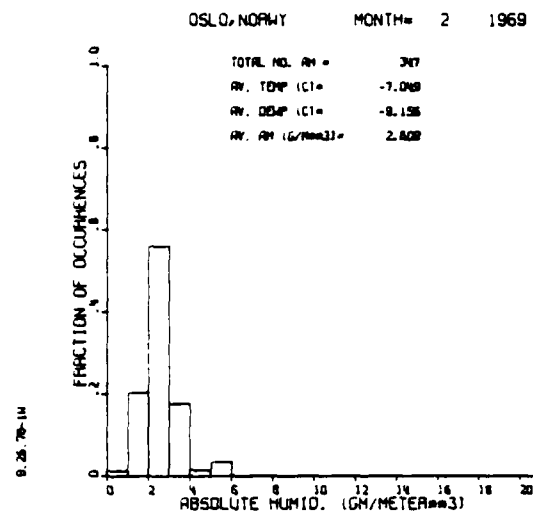
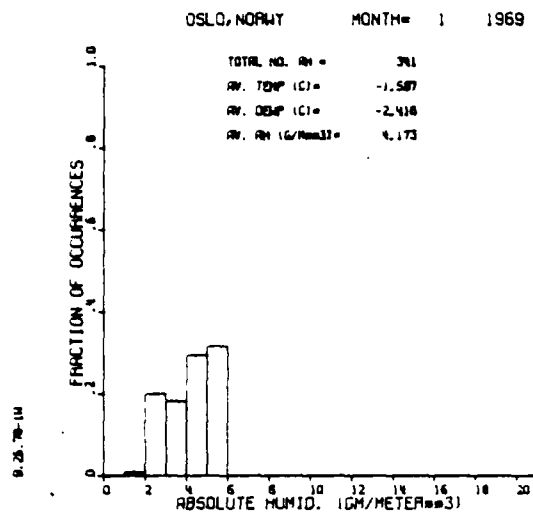


FIGURE 104. Visibility statistics, Istanbul, Turkey, September-December 1969.

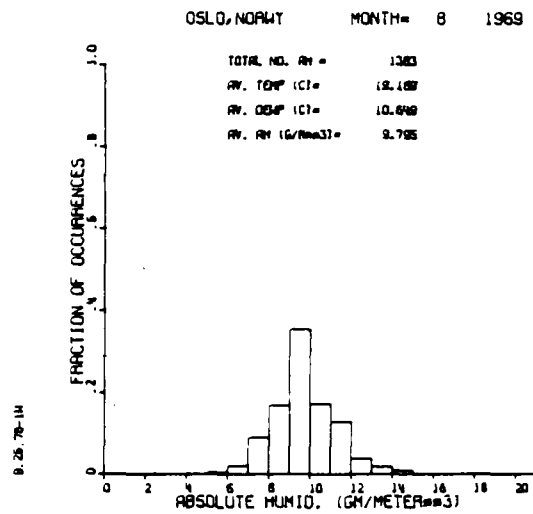
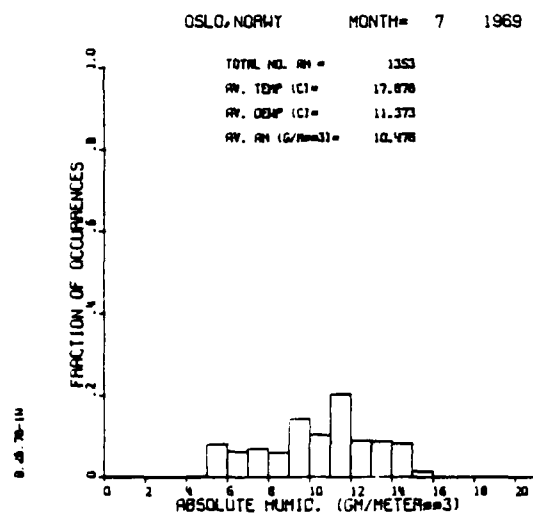
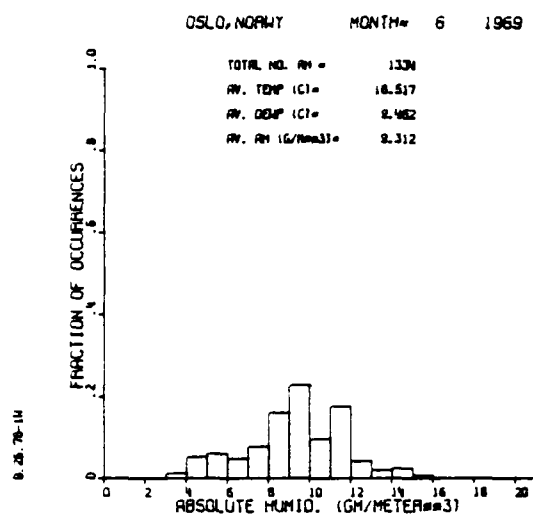
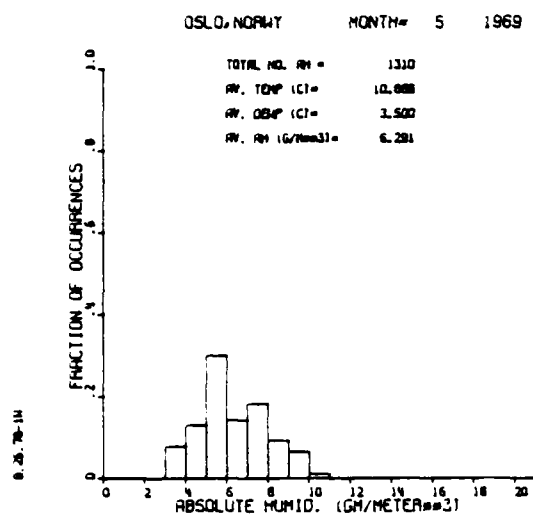
OSLO, NORWAY

A-121.



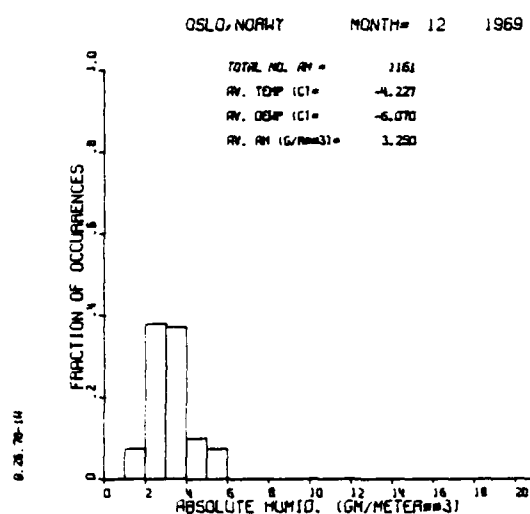
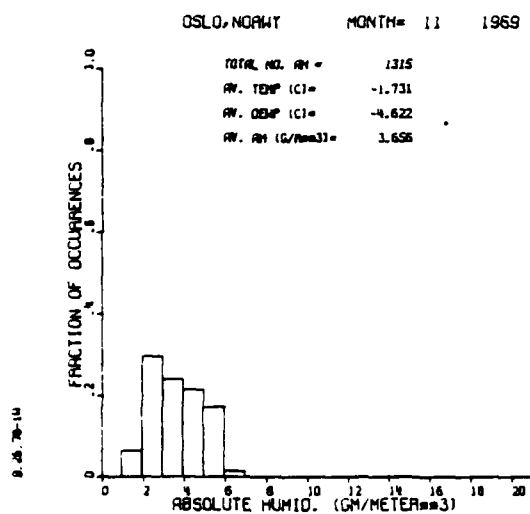
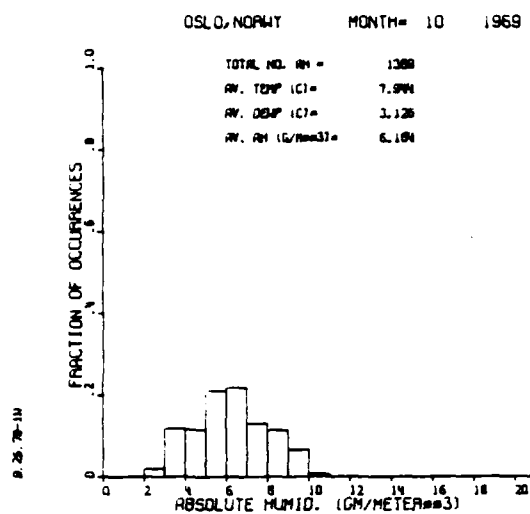
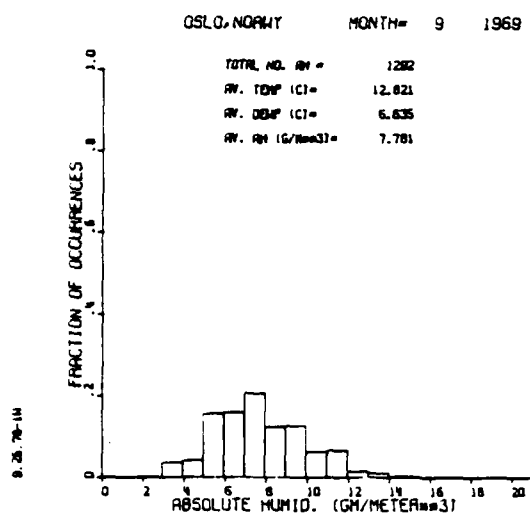
18-4-78-33

FIGURE 105. Absolute humidity statistics, Oslo, Norway, January-April 1969.



18-4-78-34

FIGURE 106. Absolute humidity statistics, Oslo, Norway, May-August 1969.



18-4-78-35

FIGURE 107. Absolute humidity statistics, Oslo, Norway, September-December 1969.

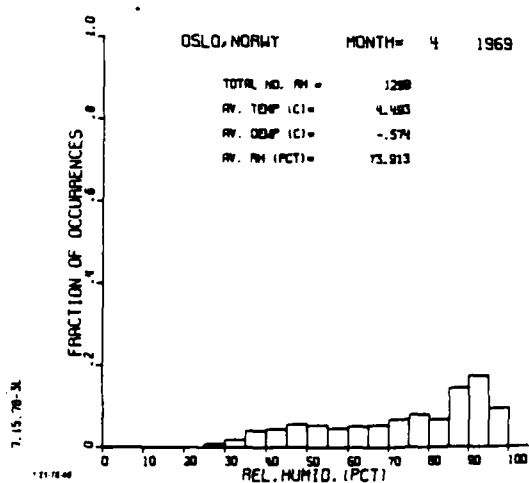
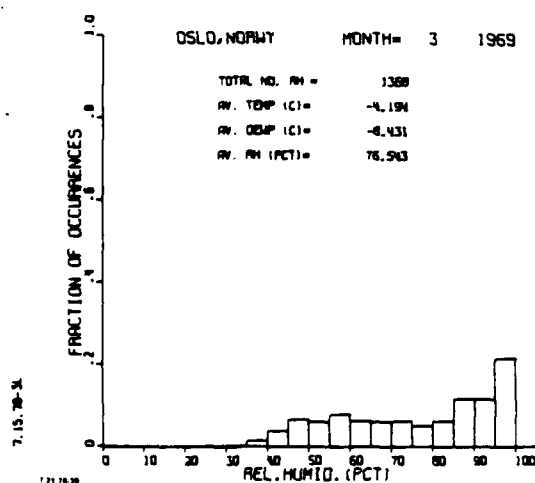
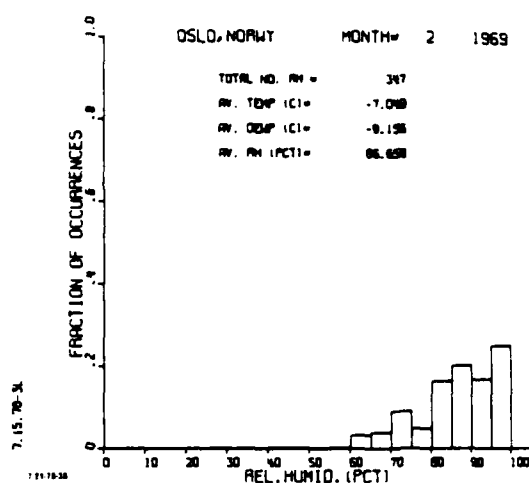
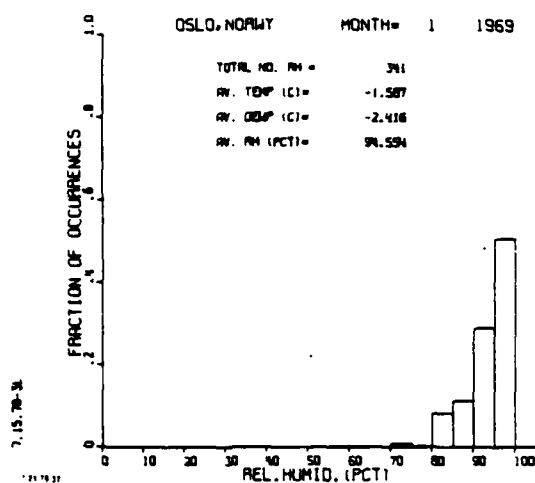


FIGURE 108. Relative humidity statistics, Oslo, Norway, January-April 1969.

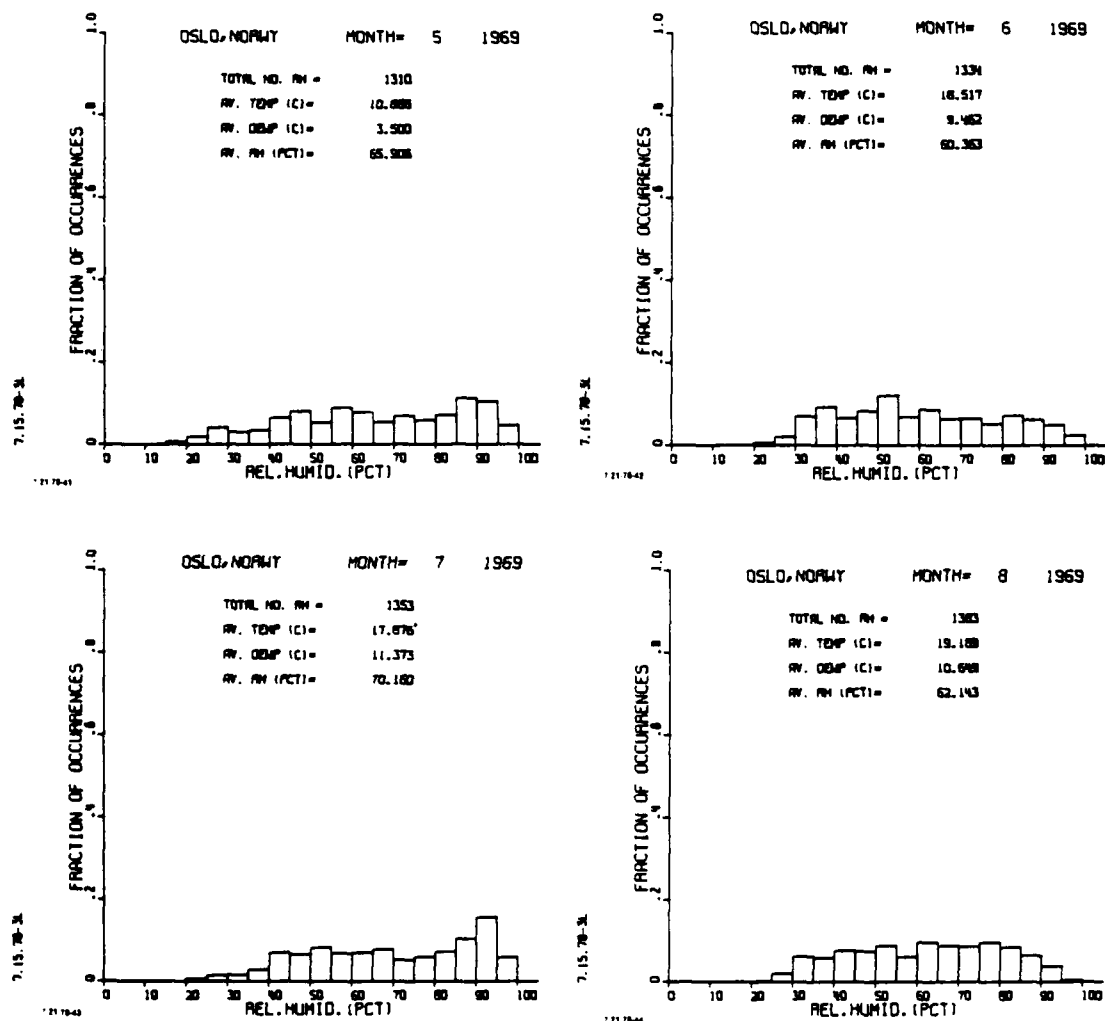


FIGURE 109. Relative humidity statistics, Oslo, Norway, May-August 1969.

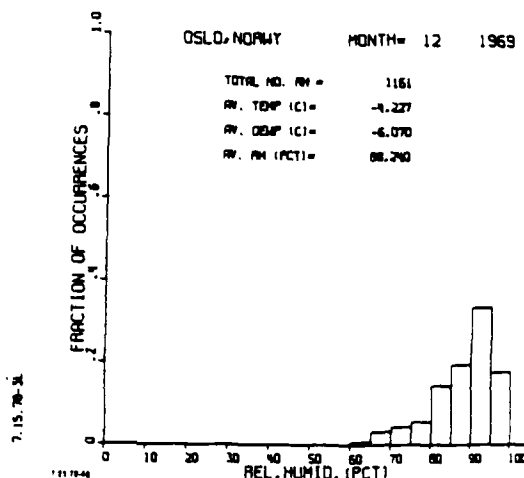
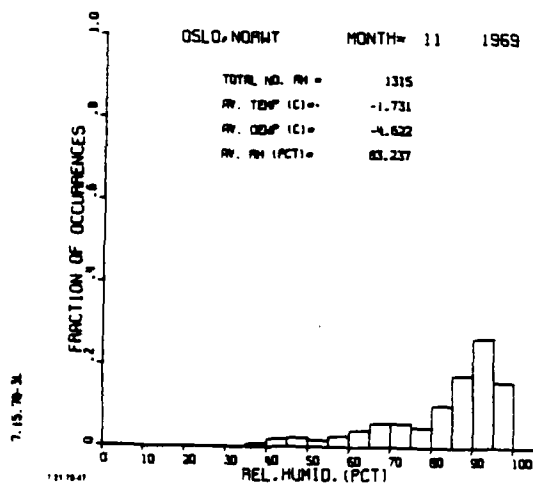
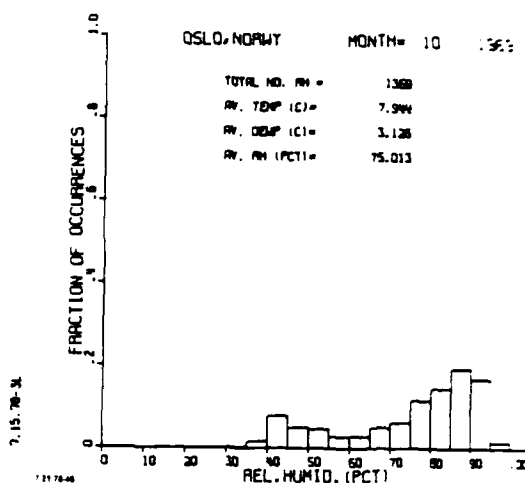
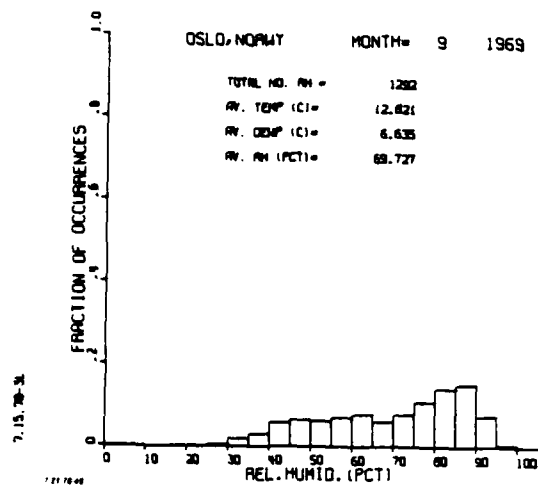
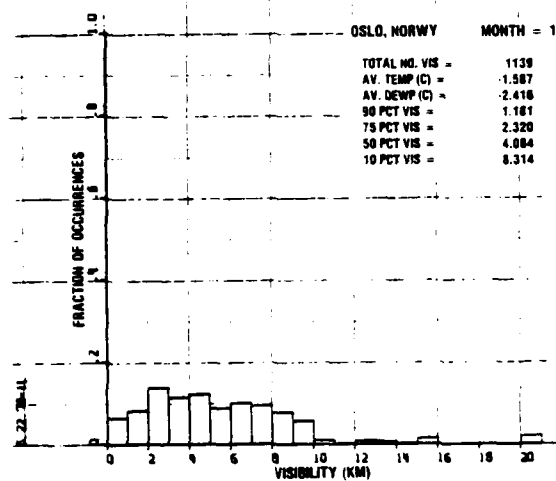
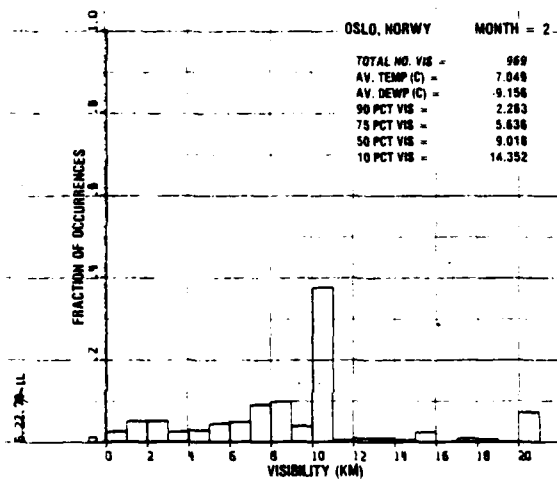


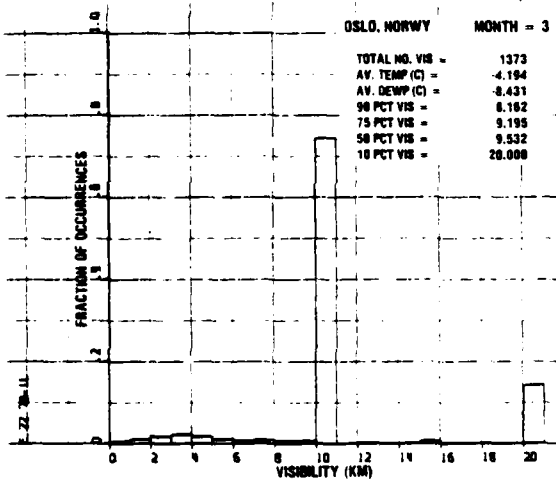
FIGURE 110. Relative humidity statistics, Oslo, Norway, September-December 1969.



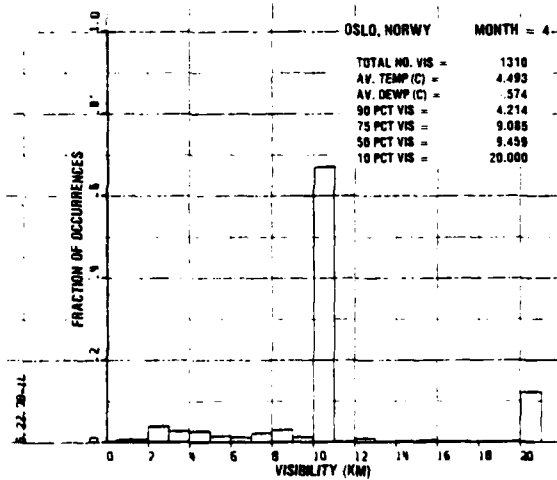
6 22 78-11



6 22 78-11



6 22 78-11



6 22 78-11

FIGURE 111. Visibility statistics, Oslo, Norway, January-April 1969.

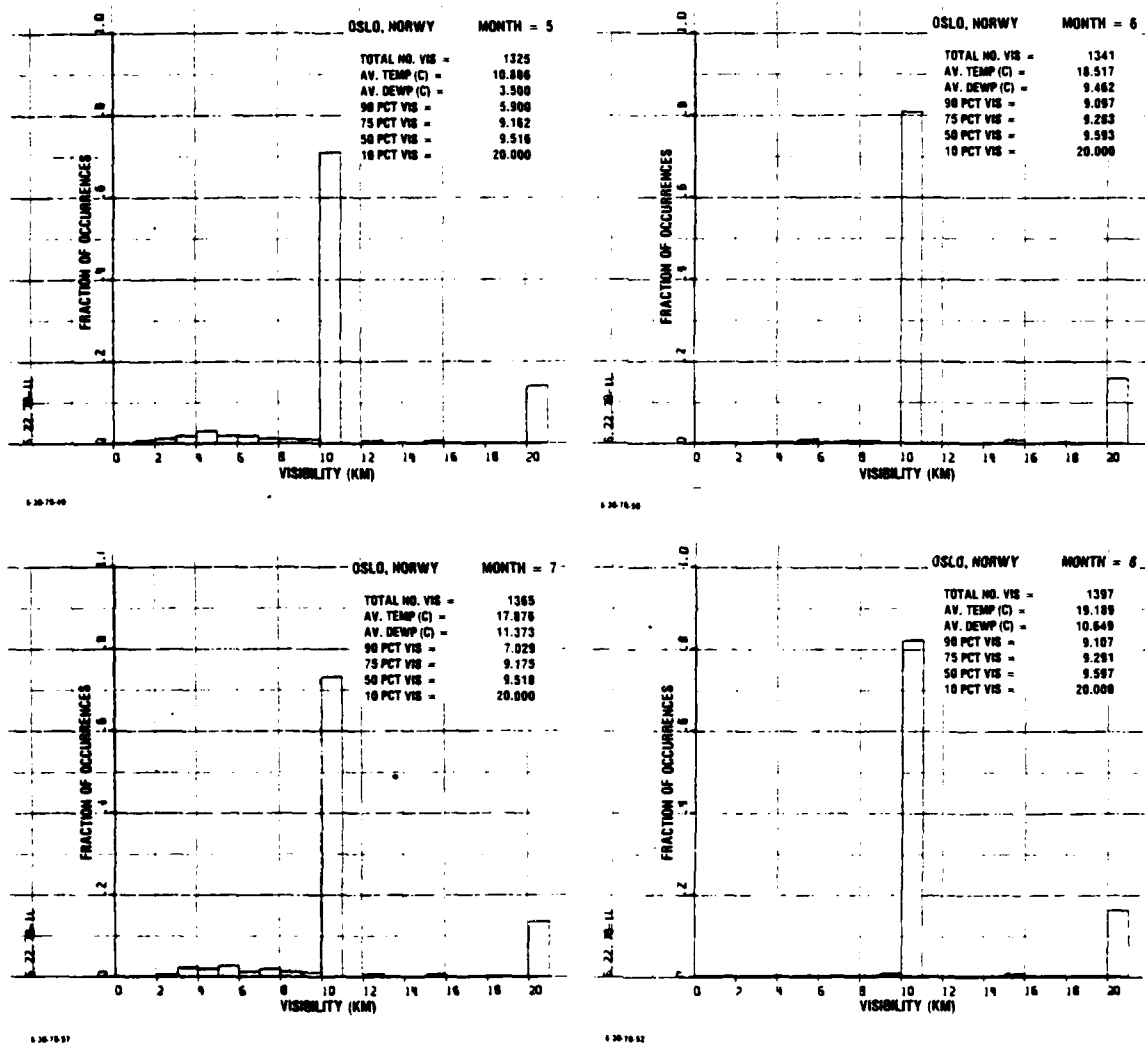


FIGURE 112. Visibility statistics, Oslo, Norway, May-August 1969.

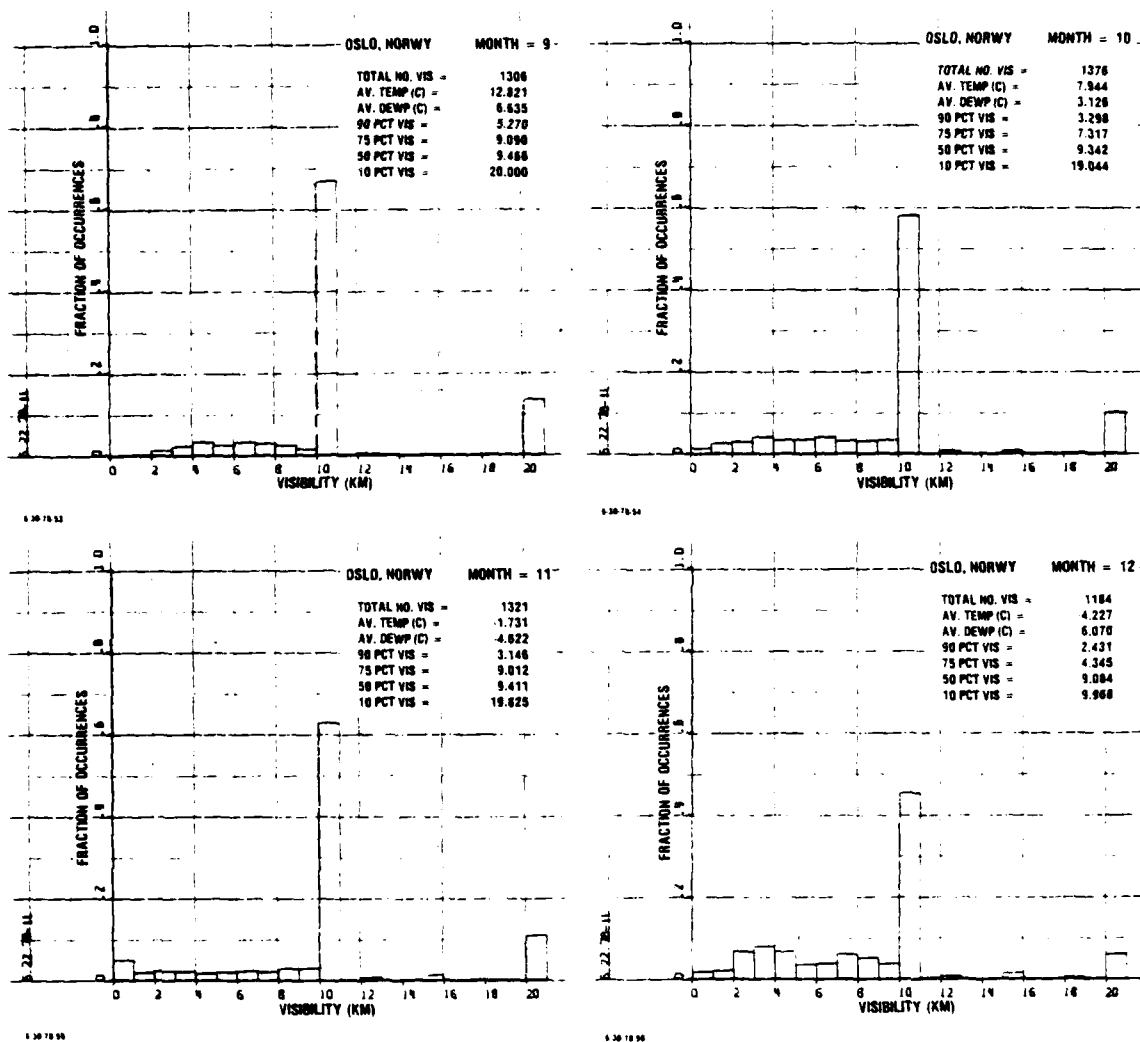
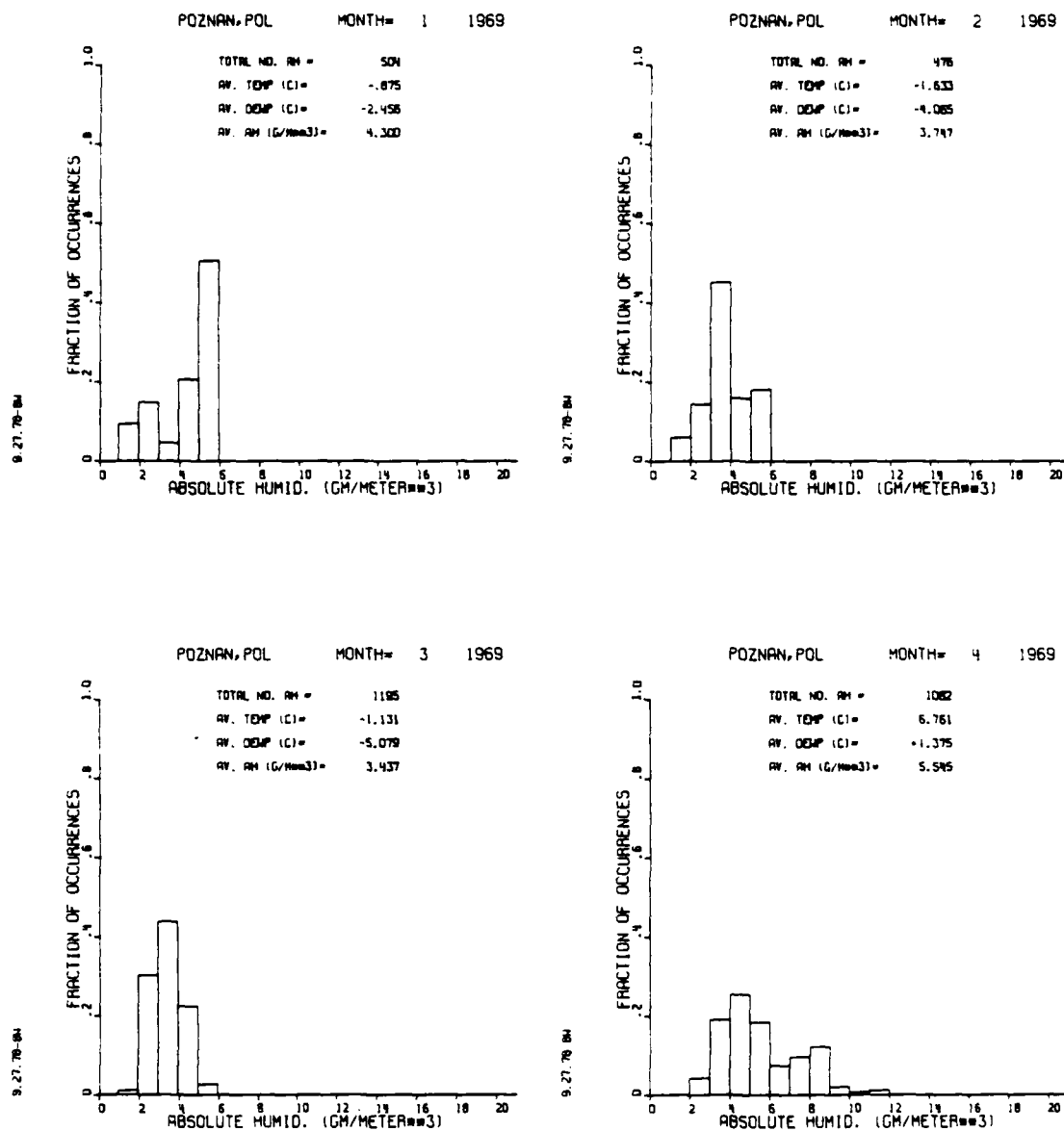


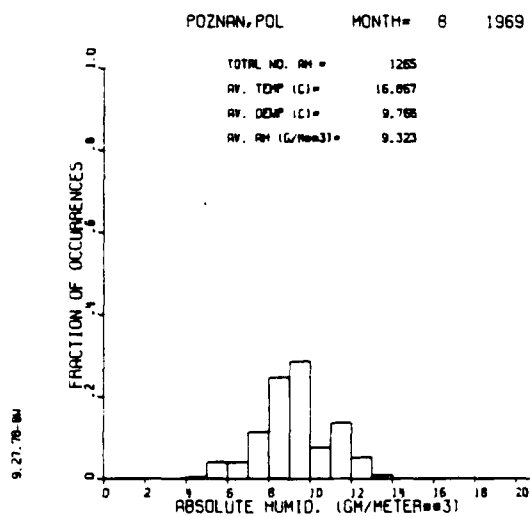
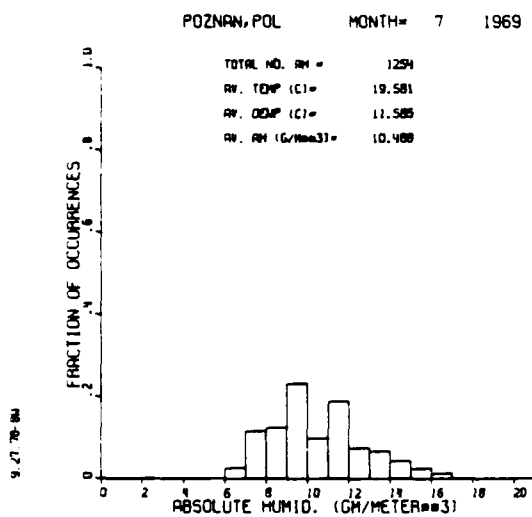
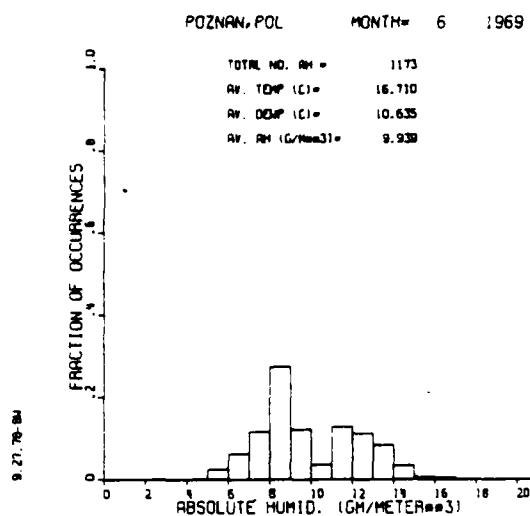
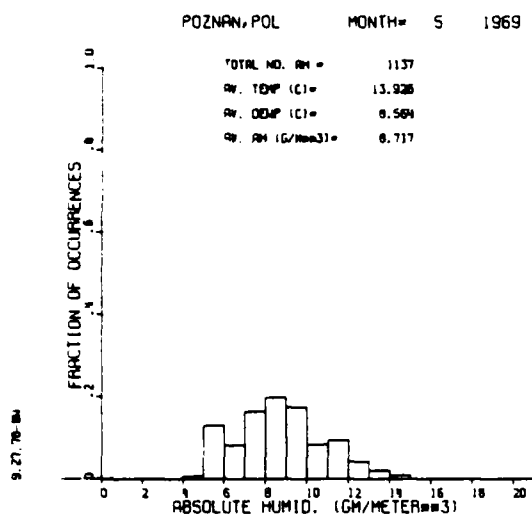
FIGURE 113. Visibility statistics, Oslo, Norway, September-December 1969.

POZNAN, POLAND



10-4-78-63

FIGURE 114. Absolute humidity statistics, Poznan, Poland, January-April 1969.



10-4-70-84

FIGURE 115. Absolute humidity statistics, Poznan, Poland, May-August 1969.

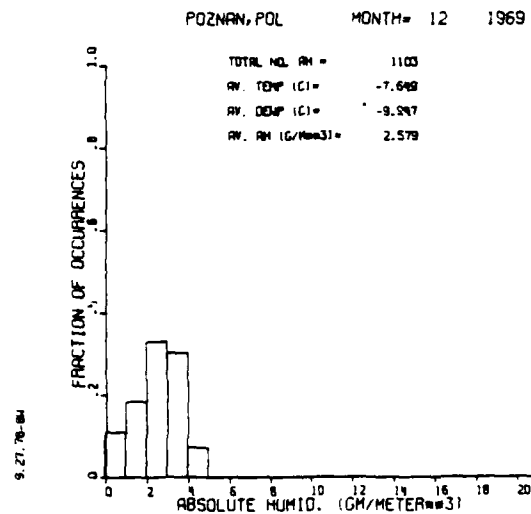
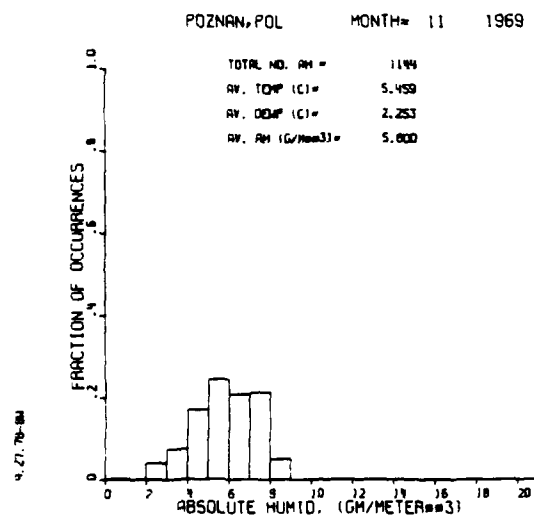
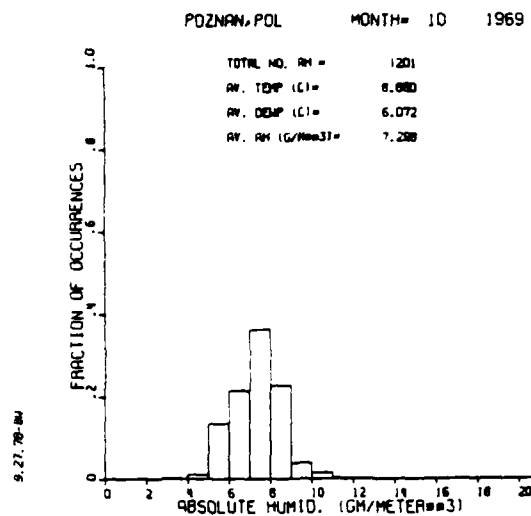
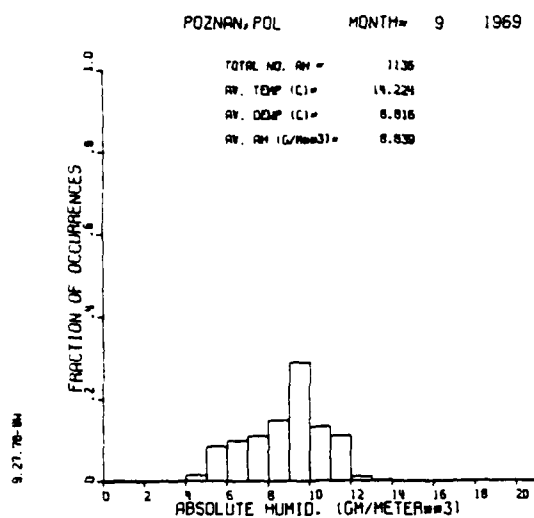


FIGURE 116. Absolute humidity statistics, Poznan, Poland, September-December 1969.

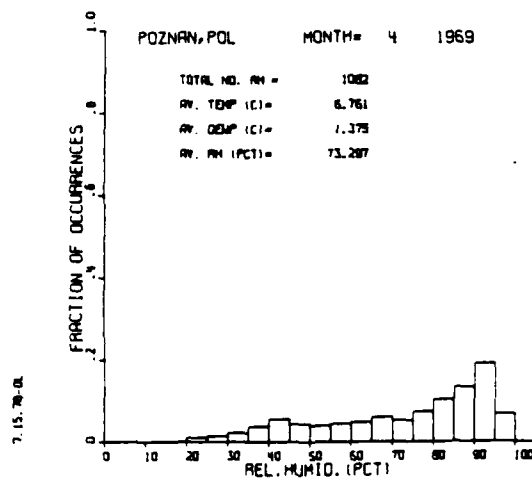
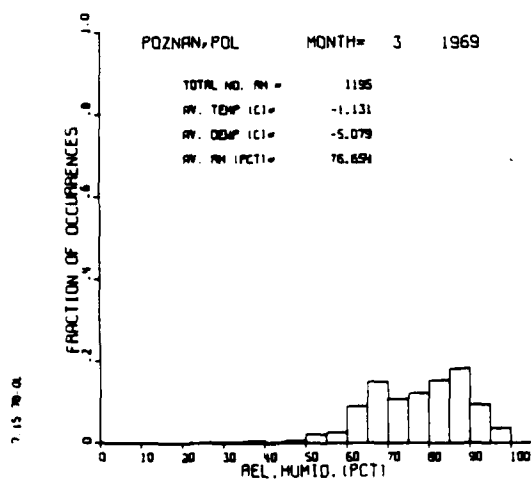
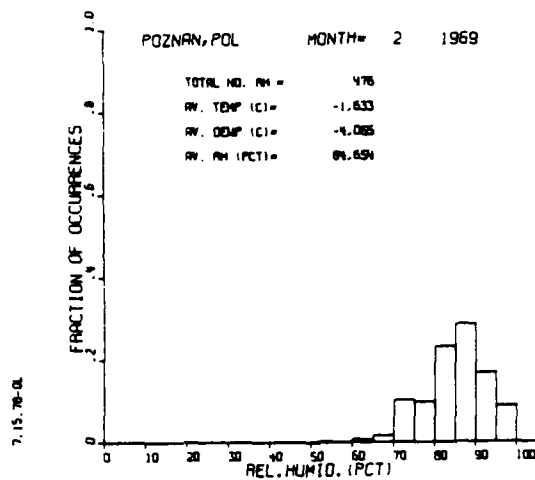
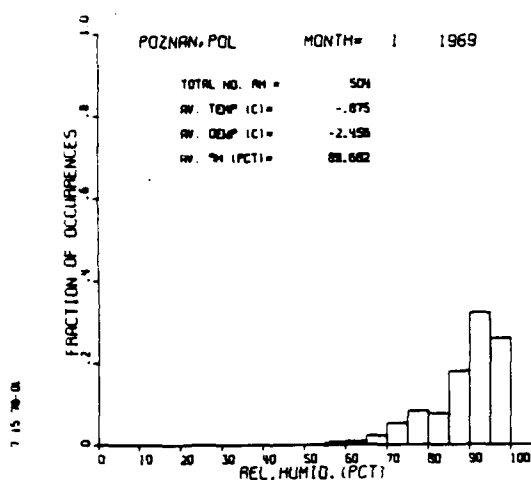


FIGURE 117. Relative humidity statistics, Poznan, Poland, January-April 1969.

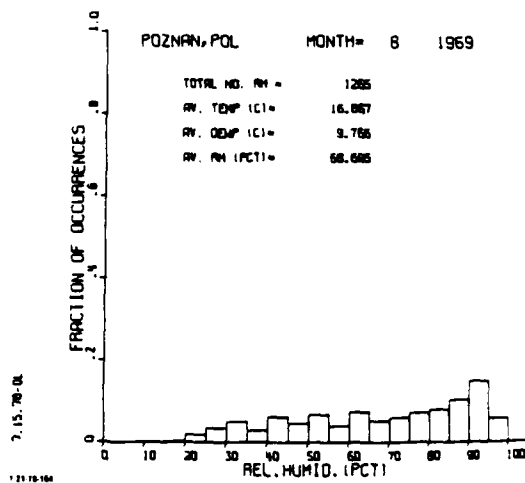
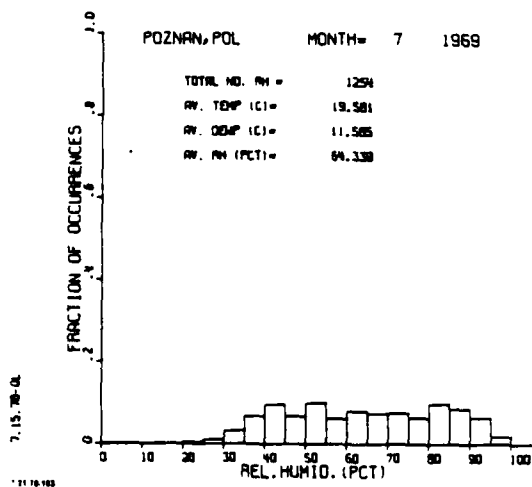
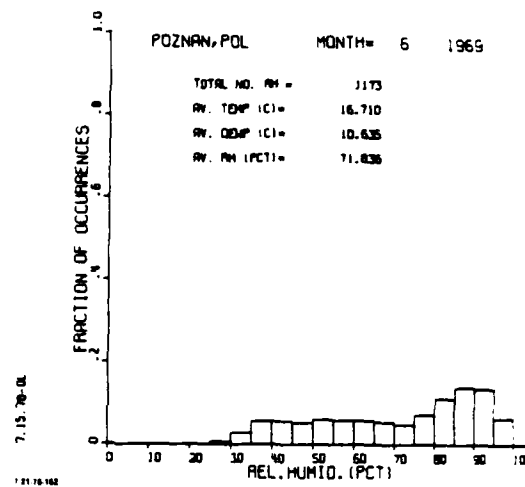
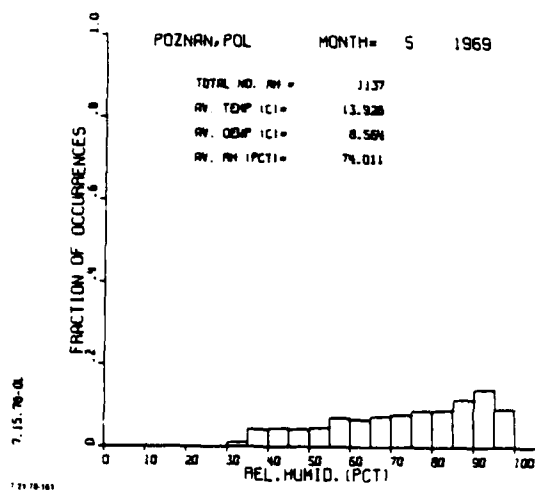


FIGURE 118. Relative humidity statistics, Poznan, Poland, May-August 1969.

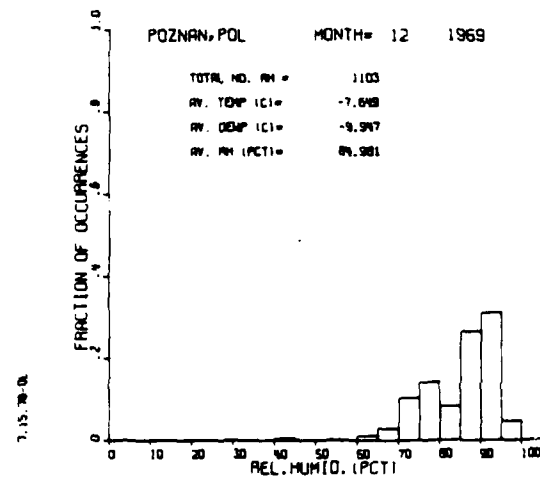
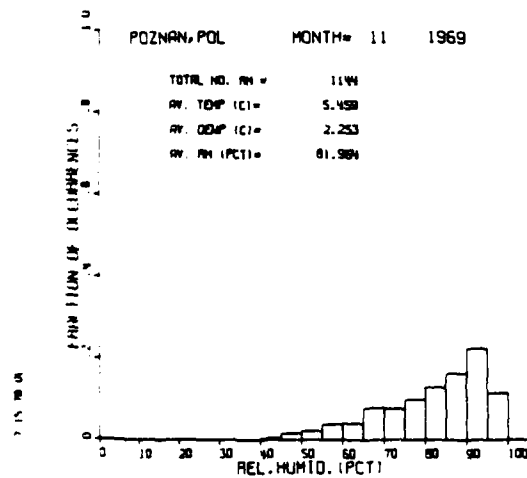
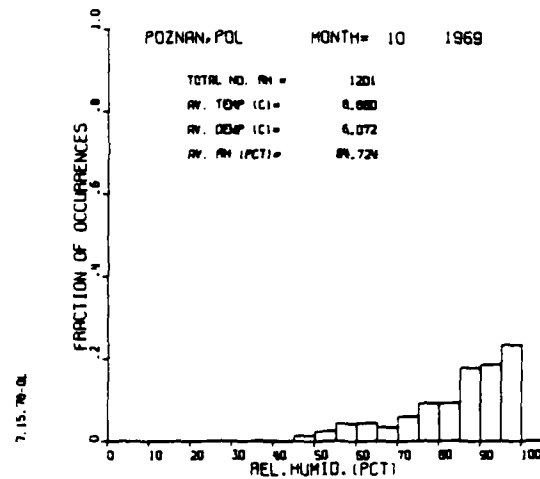
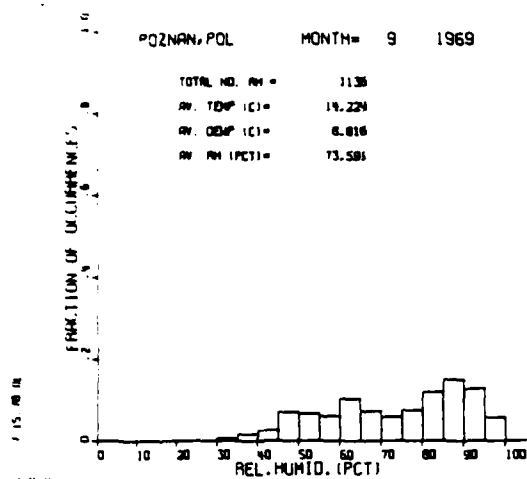


FIGURE 119. Relative humidity statistics, Poznan, Poland, September-December 1969.

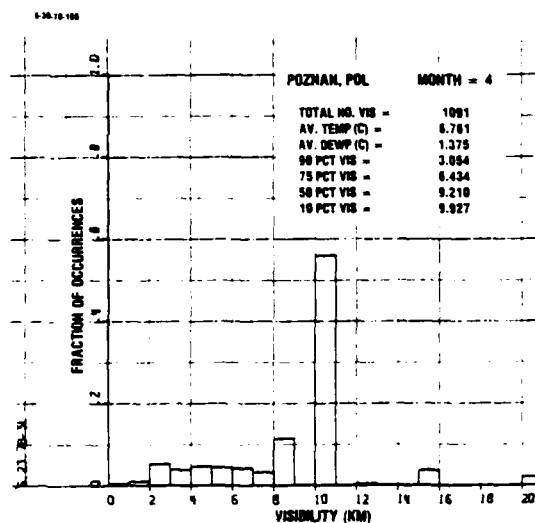
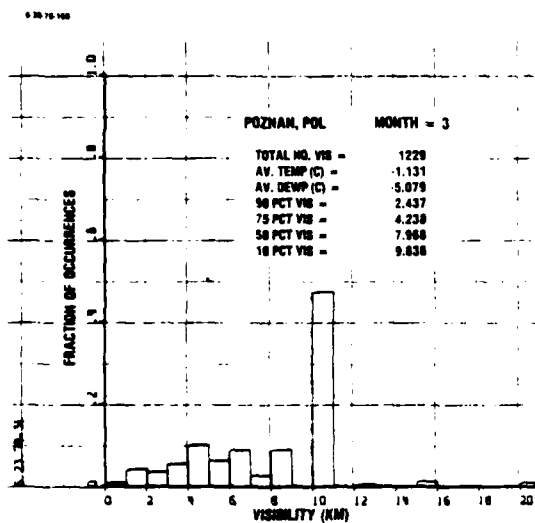
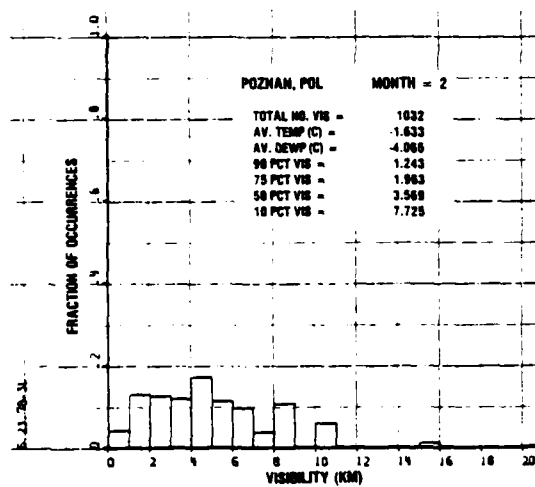
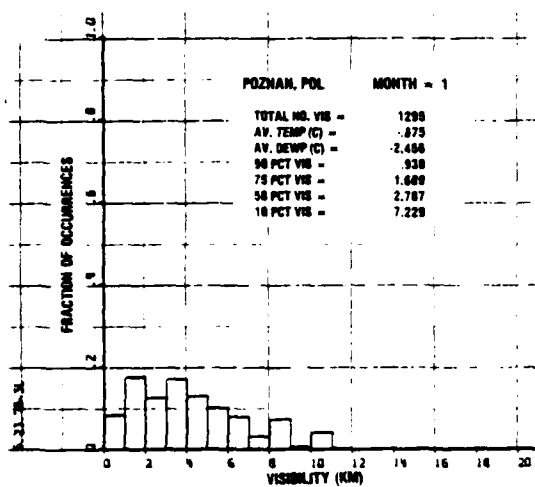


FIGURE 120. Visibility statistics, Poznan, Poland, January-April 1969.

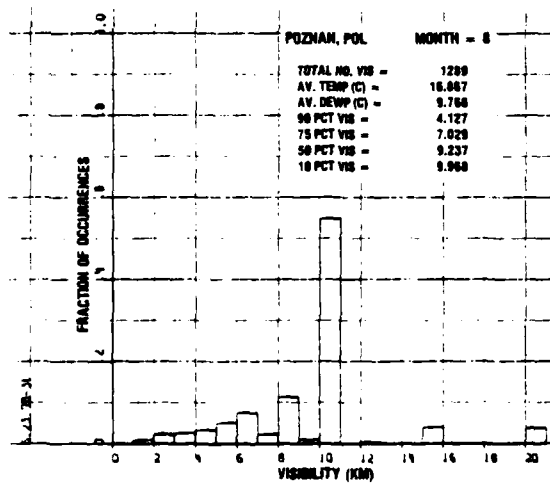
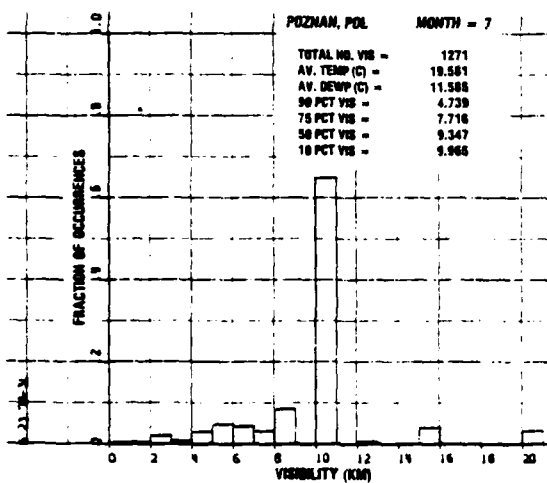
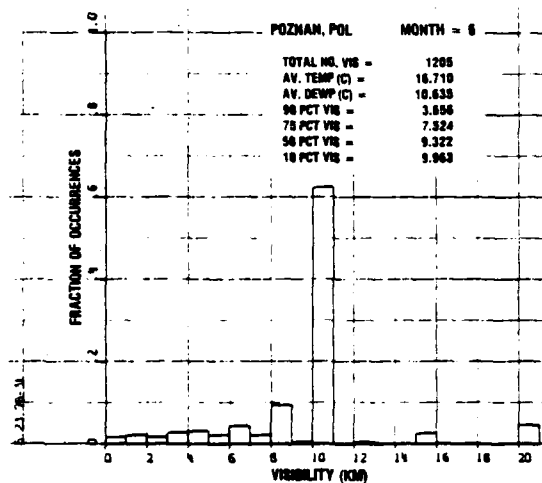
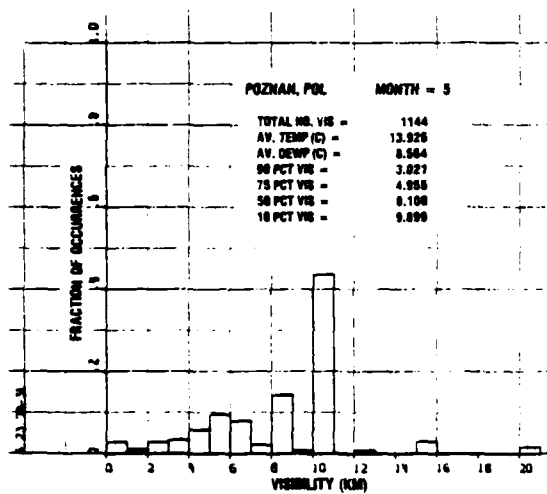
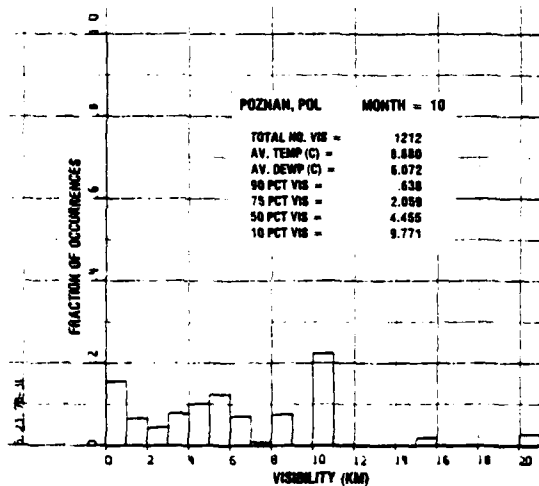
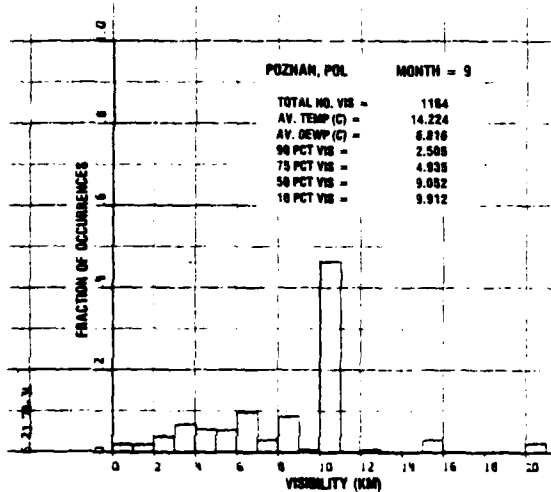
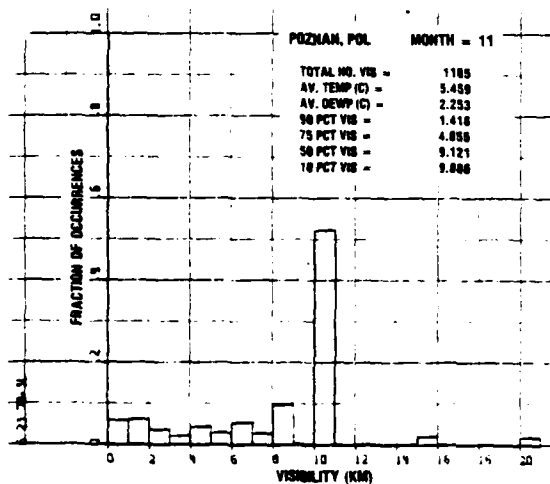


FIGURE 121. Visibility statistics, Poznan, Poland, May-August 1969.

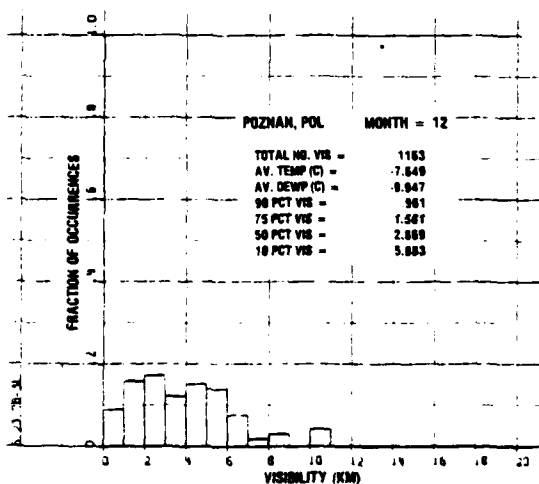


6-30-70-172

6-30-70-174



6-30-70-175

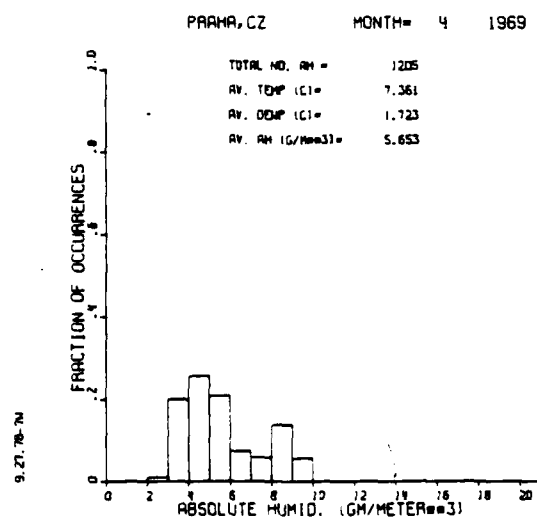
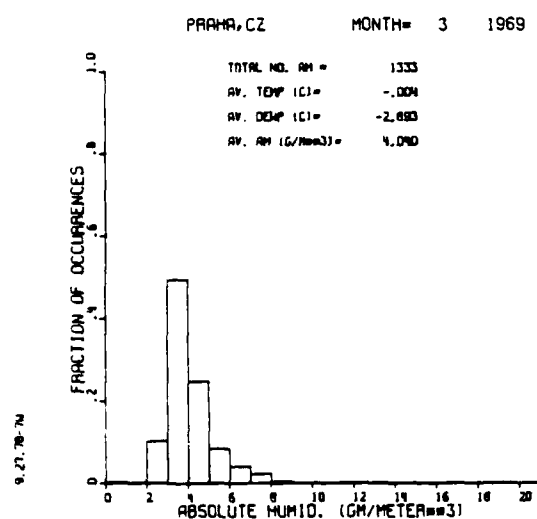
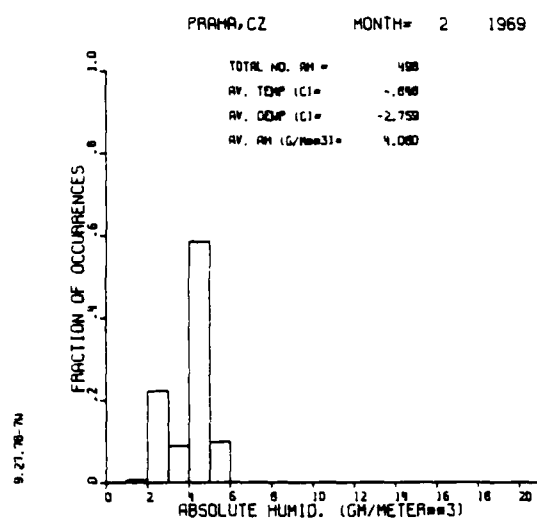
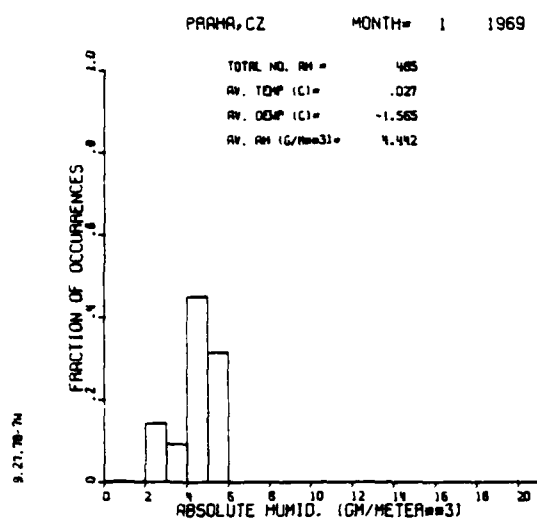


6-30-70-176

FIGURE 122. Visibility statistics, Poznan, Poland, September-December 1969.

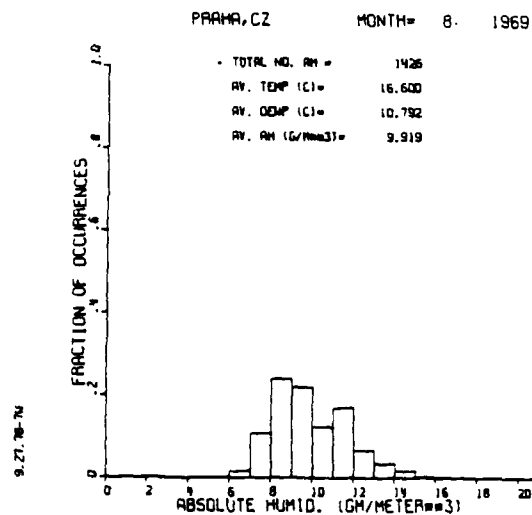
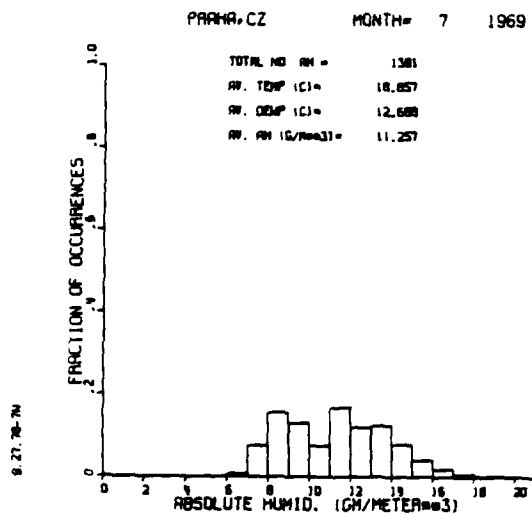
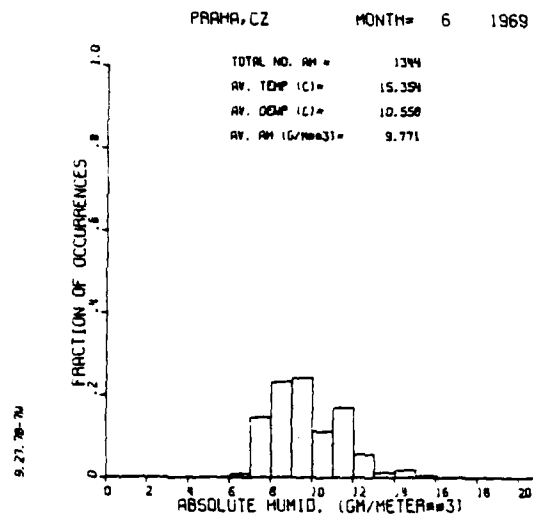
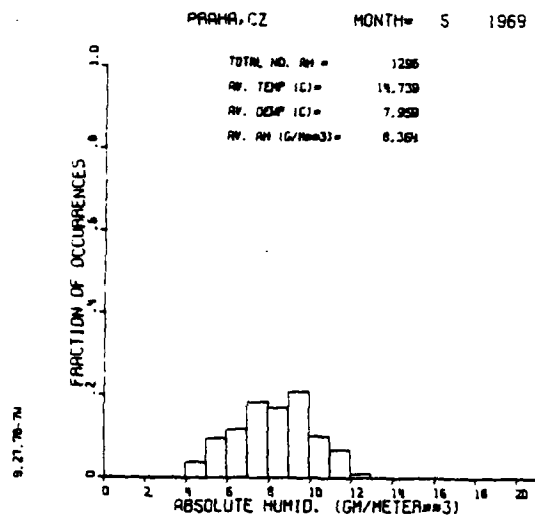
PRAHA, CZECHOSLOVAKIA

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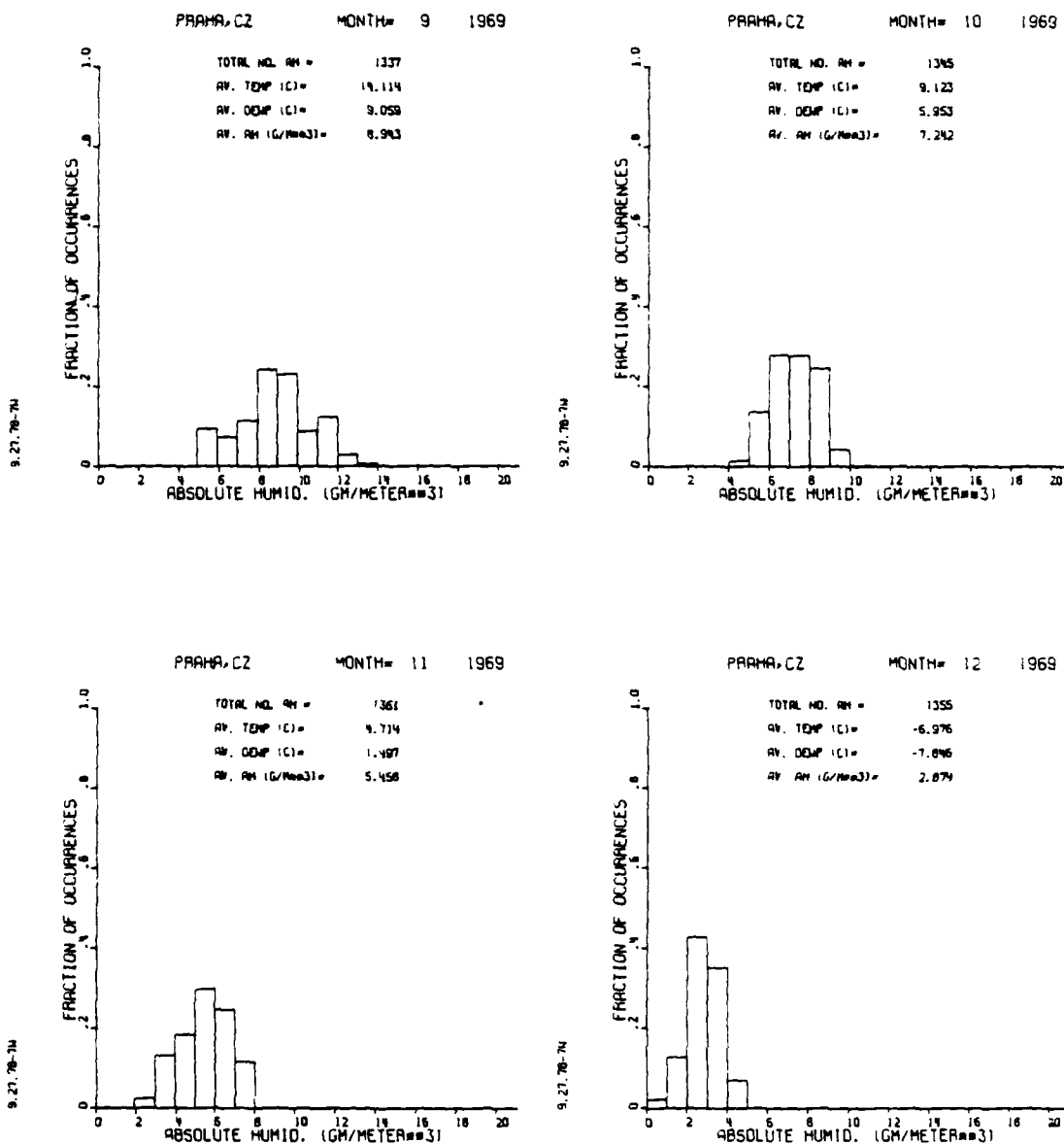
18-4-78-88

FIGURE 123. Absolute humidity statistics, Praha, Czechoslovakia, January-April 1969.



18-4-78-81

FIGURE 124. Absolute humidity statistics, Praha, Czechoslovakia, May-August 1969.



10-4-78-82

FIGURE 125. Absolute humidity statistics, Praha, Czechoslovakia, September-December 1969.

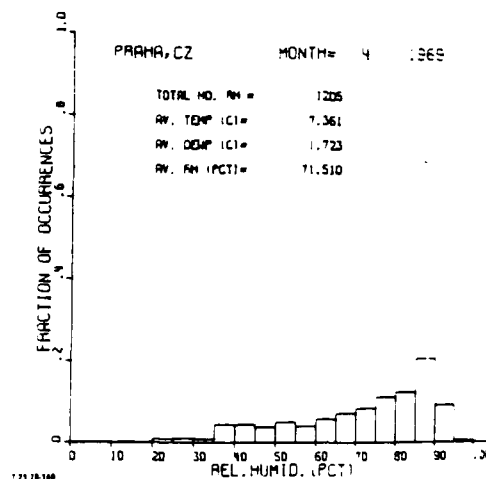
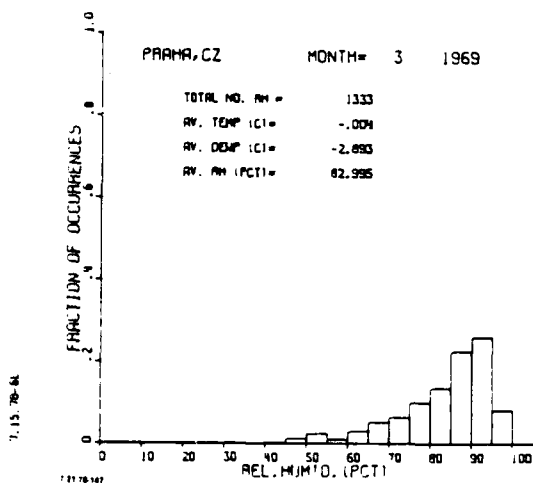
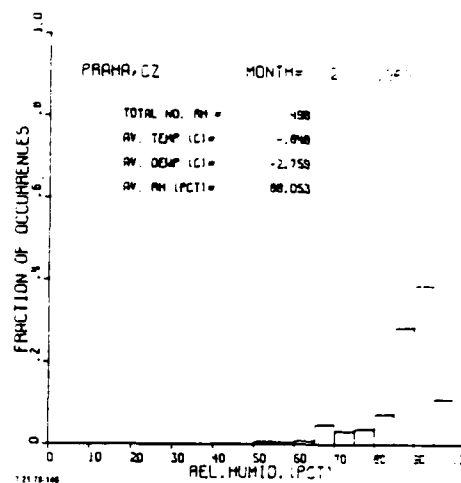
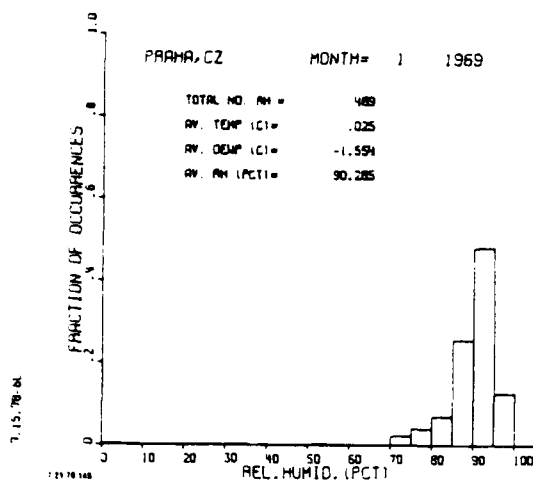


FIGURE 126. Relative humidity statistics, Praha, Czechoslovakia, January-April 1969.

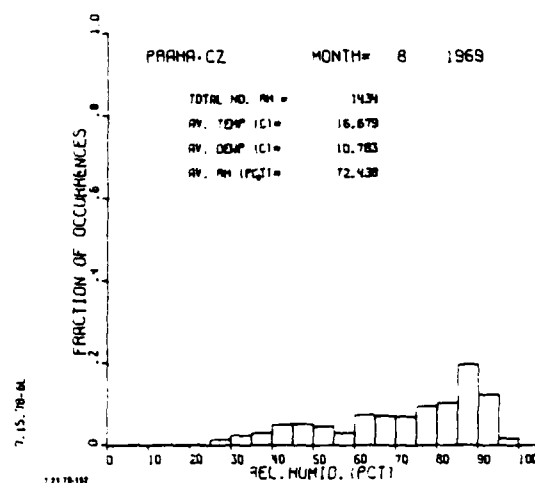
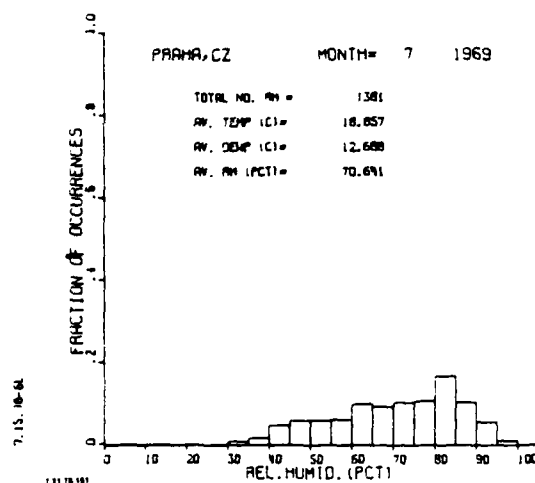
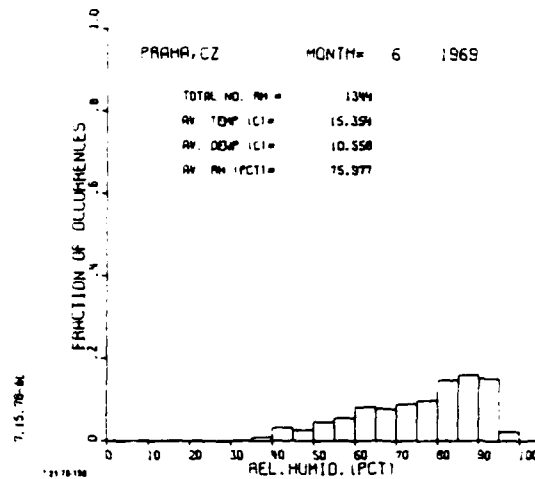
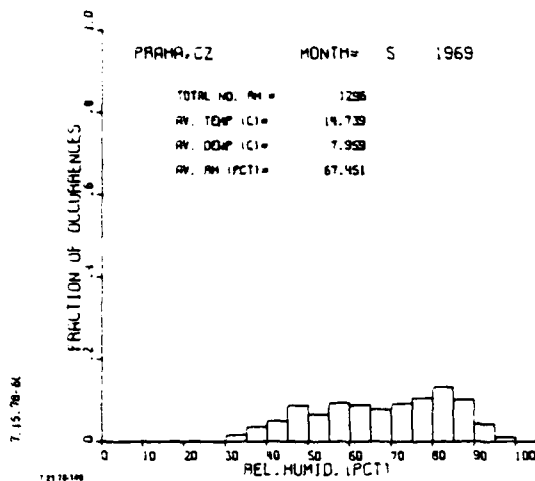


FIGURE 127. Relative humidity statistics, Praha, Czechoslovakia, May-August 1969.

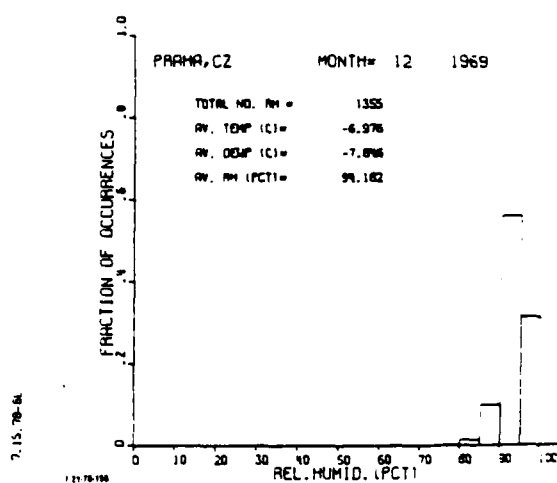
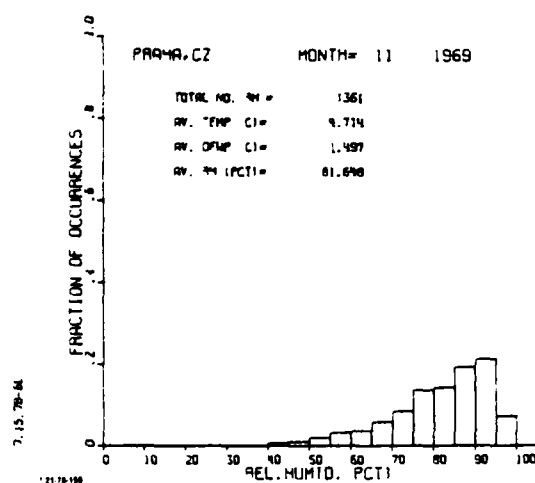
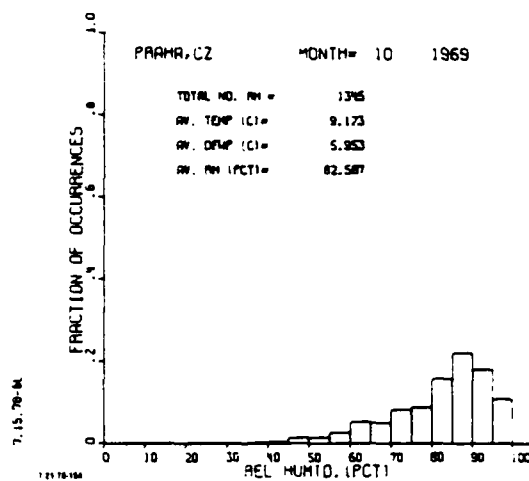
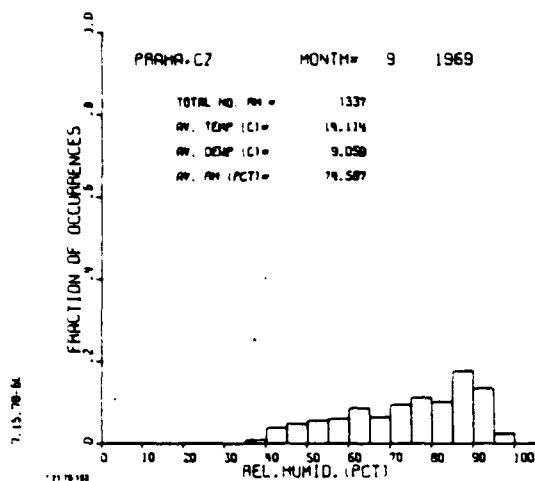


FIGURE 128. Relative humidity statistics, Praha, Czechoslovakia, September-December 1969.

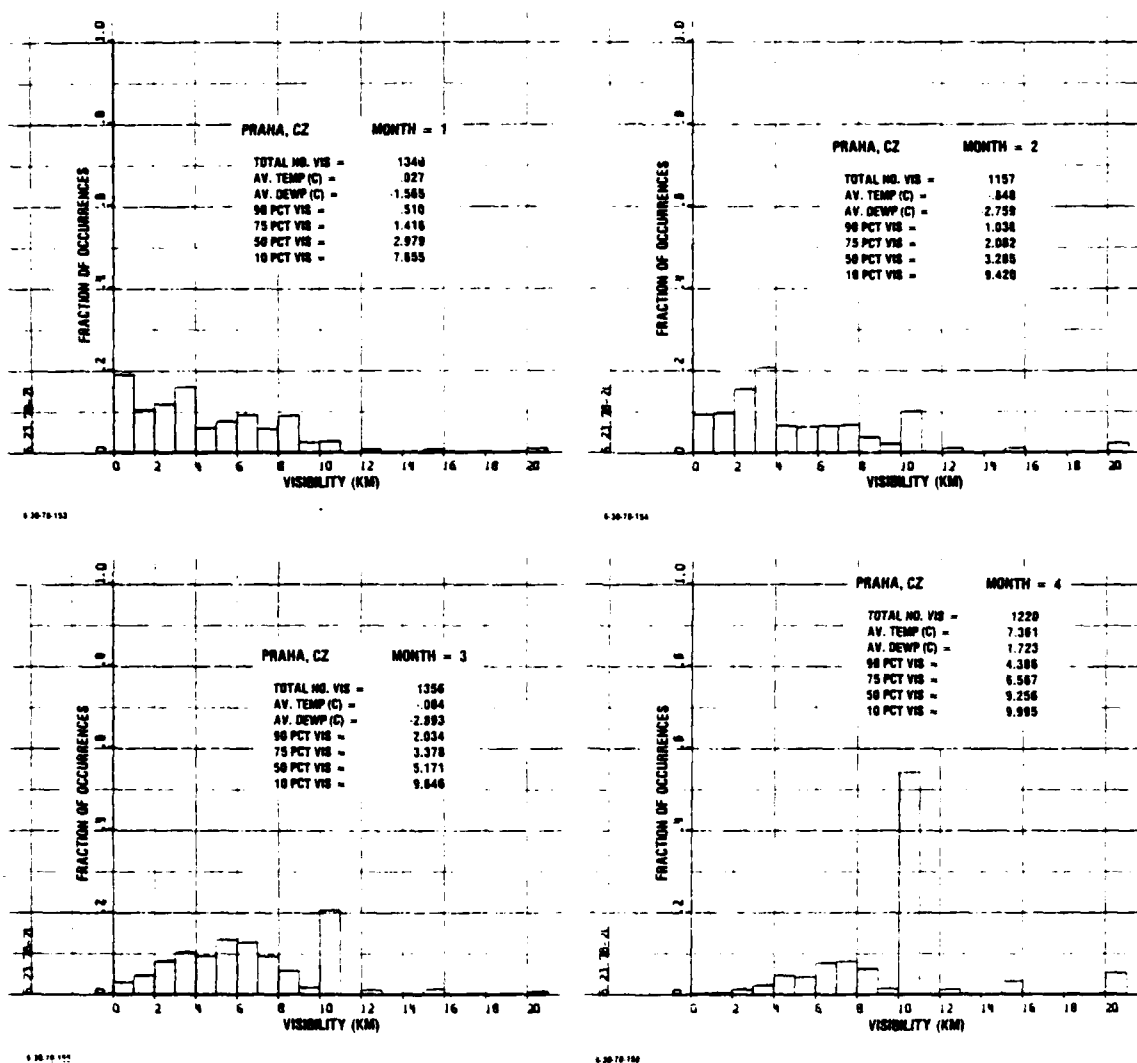


FIGURE 129. Visibility statistics, Praha, Czechoslovakia, January-April 1969.

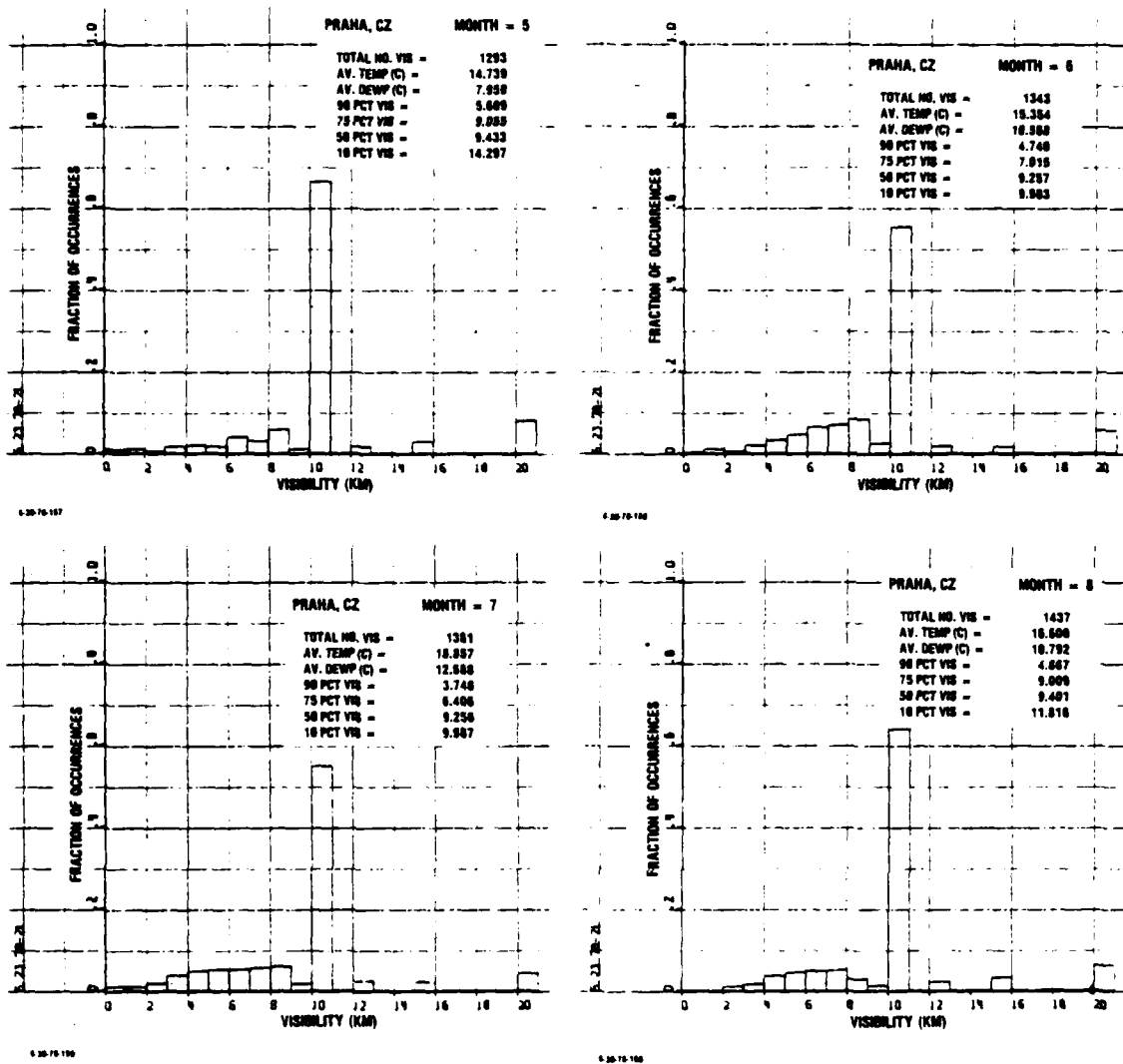


FIGURE 130. Visibility statistics, Praha, Czechoslovakia, May-August 1969.

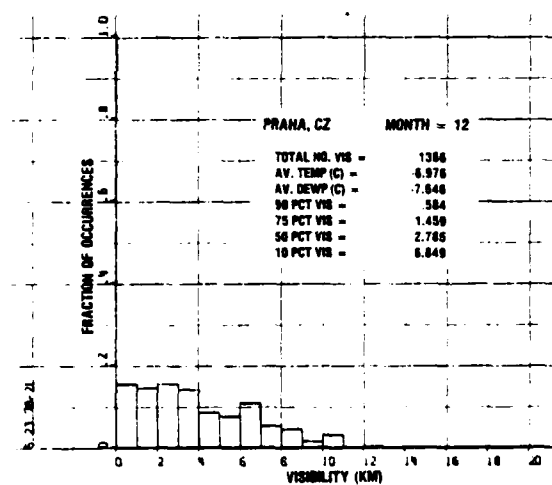
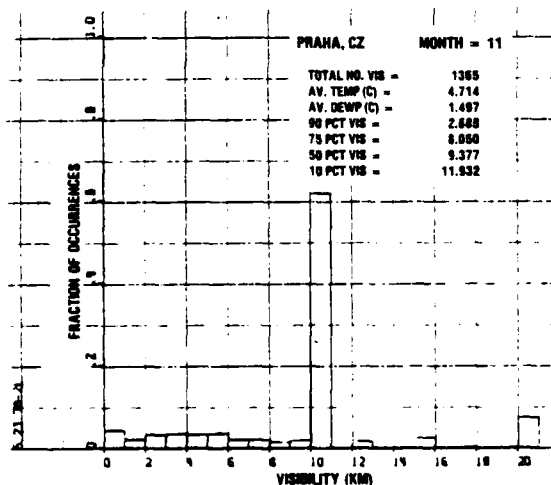
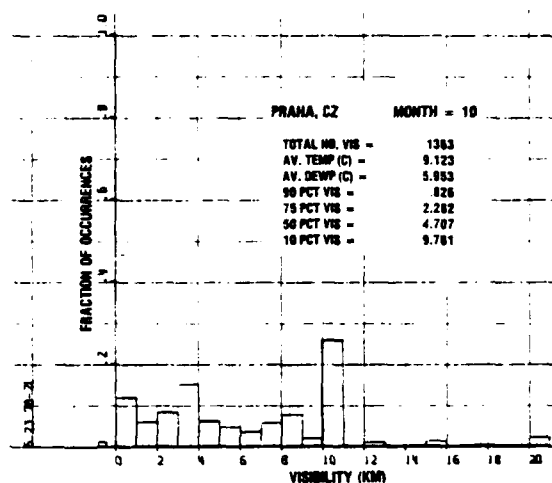
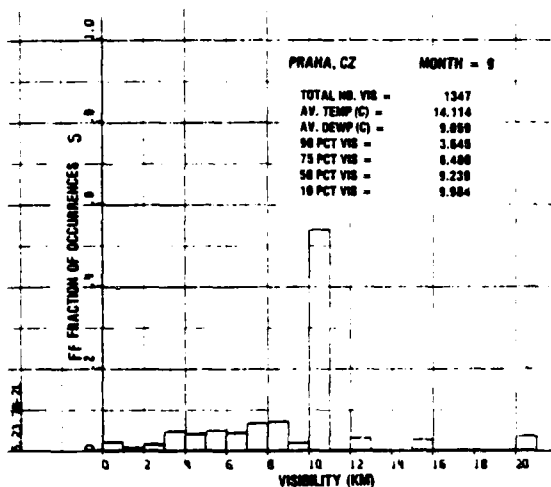
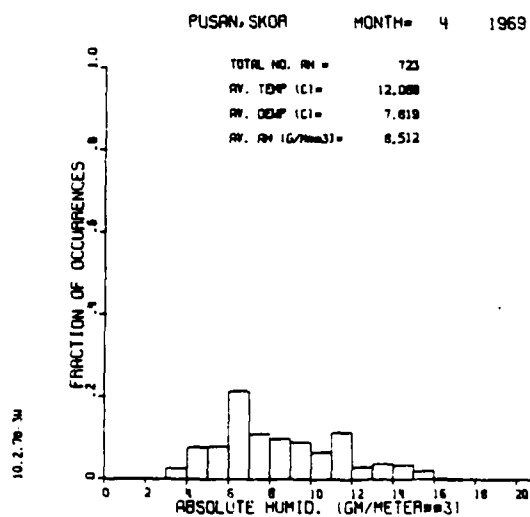
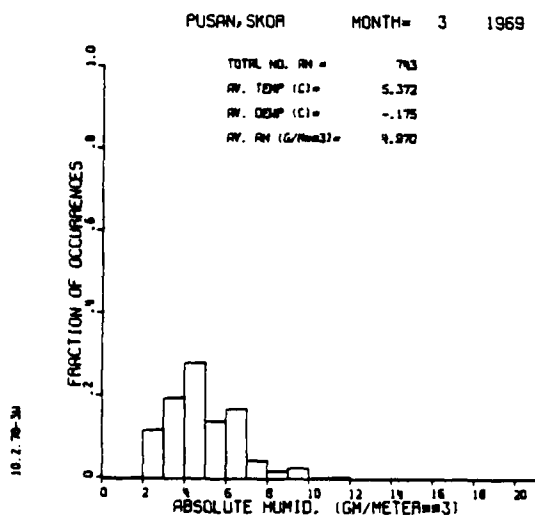
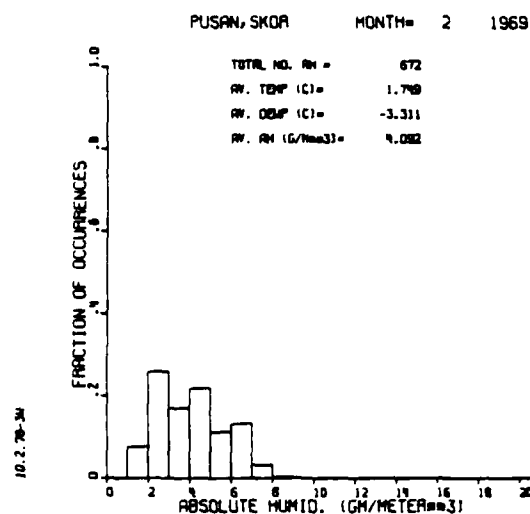
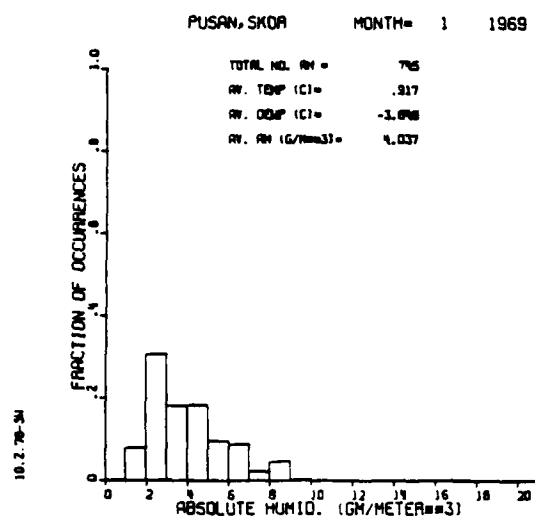


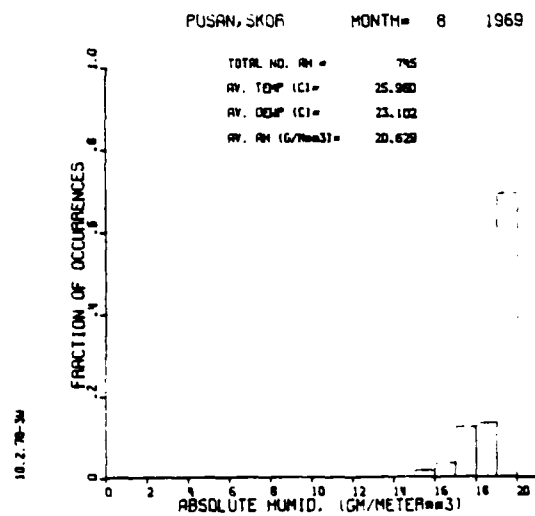
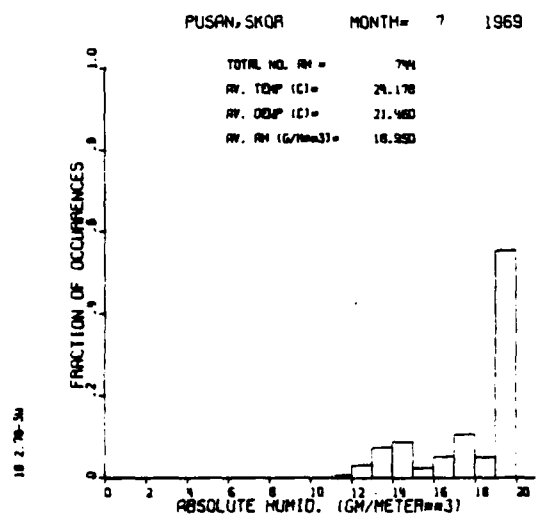
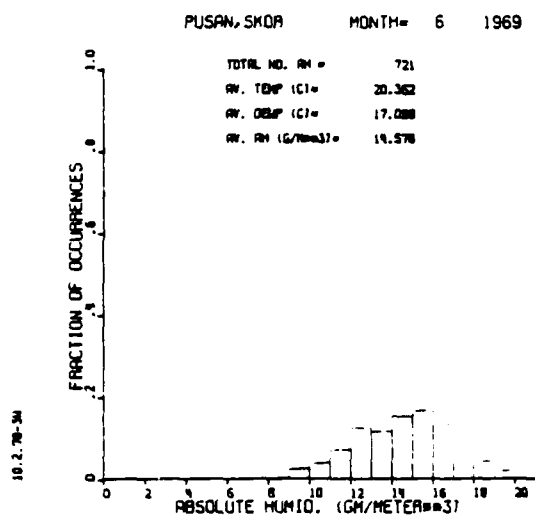
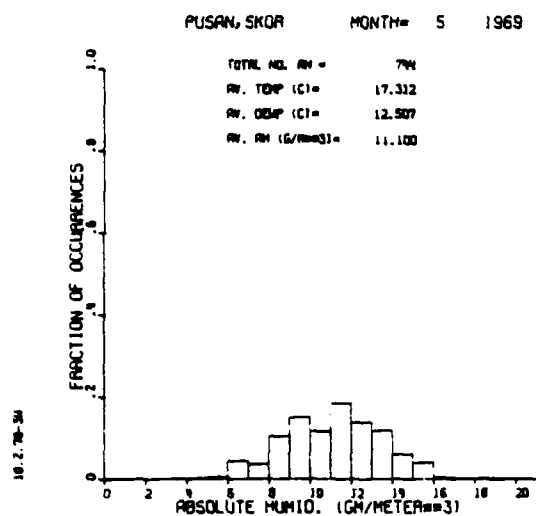
FIGURE 131. Visibility statistics, Praha, Czechoslovakia, September-December 1969.

PUSAN, SOUTH KOREA



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FIGURE 132. Absolute humidity statistics, Pusan, South Korea, January-April 1969.



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FIGURE 133. Absolute humidity statistics, Pusan, South Korea, May-August 1969.

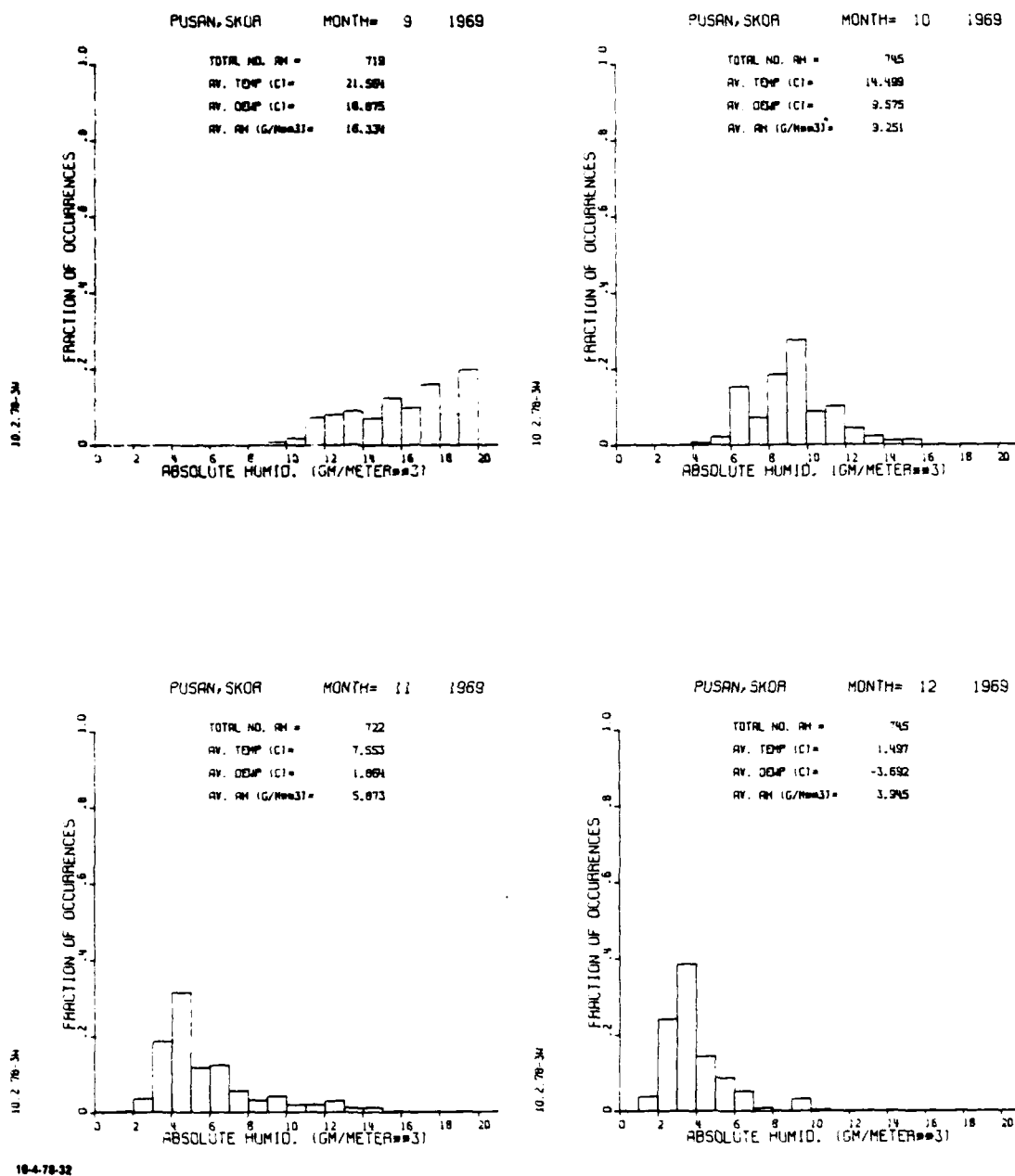


FIGURE 134. Absolute humidity statistics, Pusan, South Korea, September-December 1969.

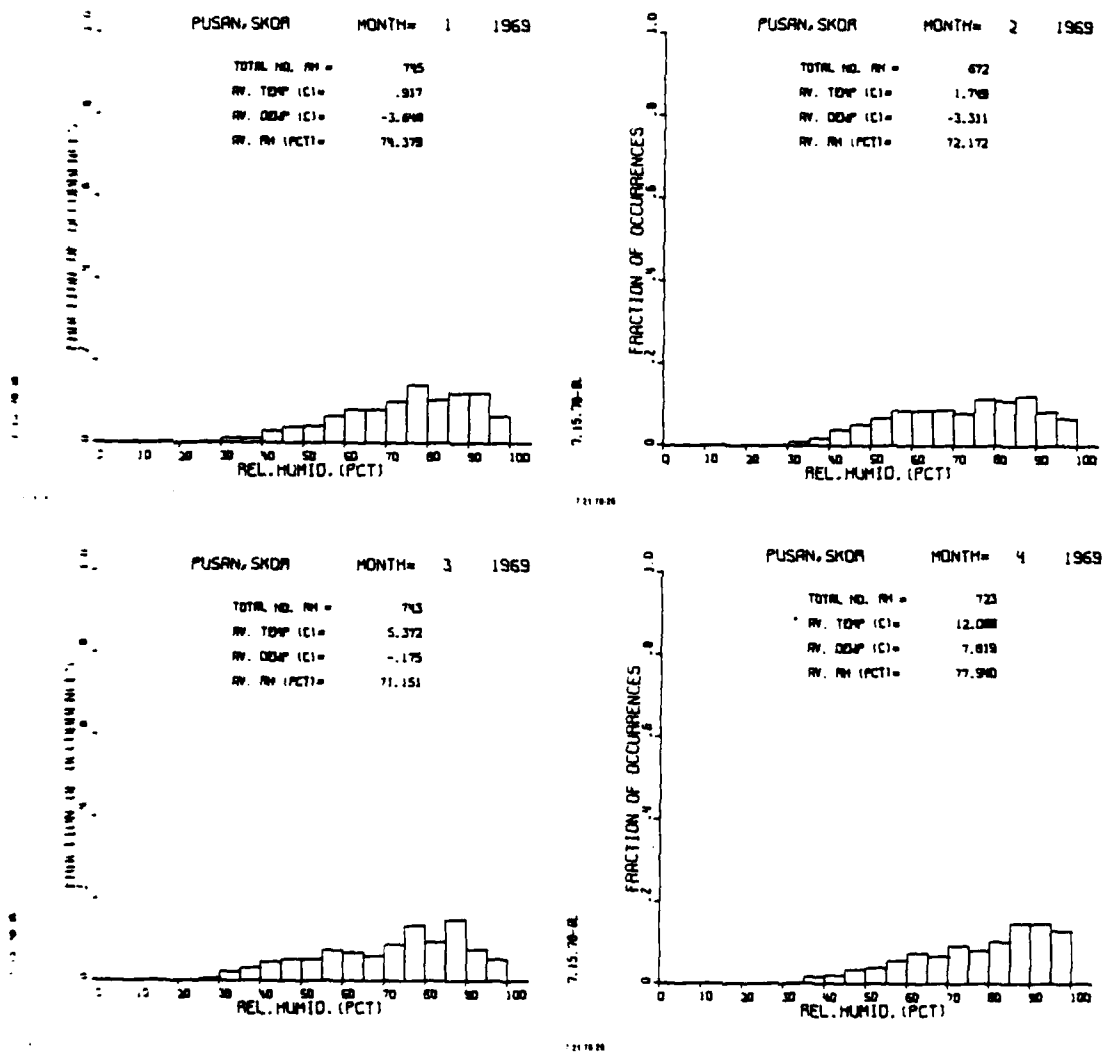


FIGURE 135. Relative humidity statistics, Pusan, South Korea, January-April 1969.

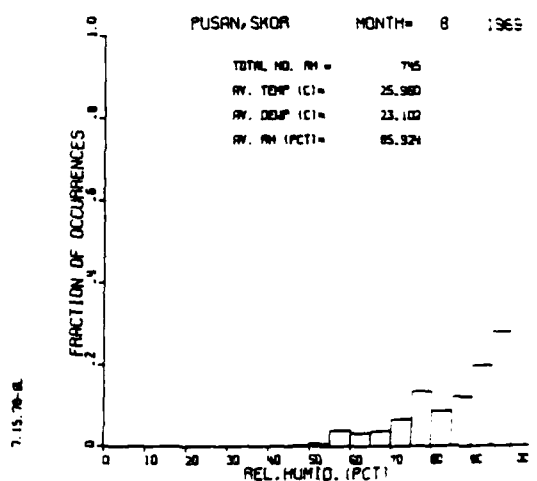
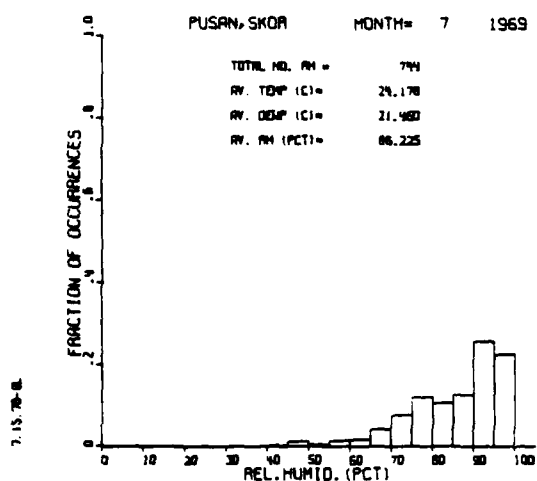
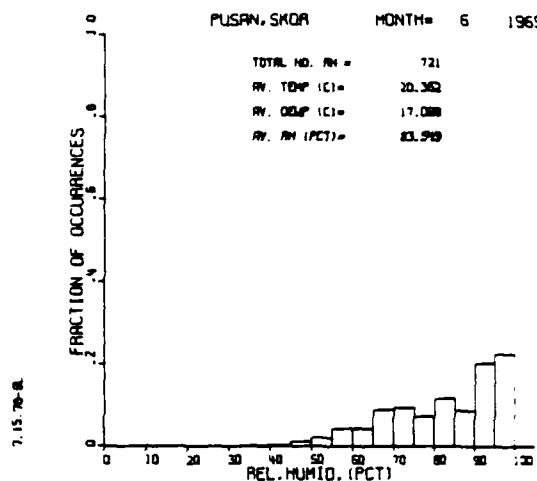
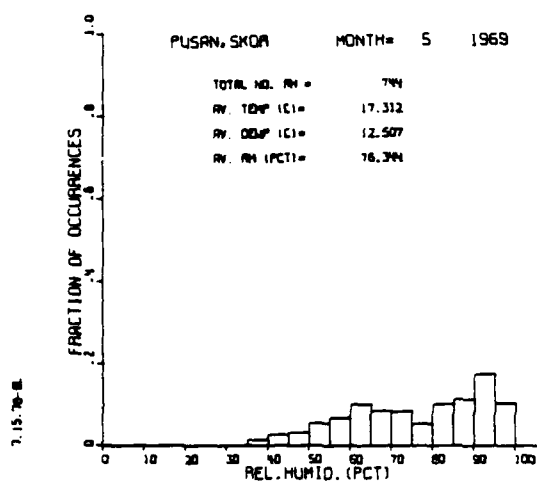


FIGURE 136. Relative humidity statistics, Pusan, South Korea, May-August 1969.

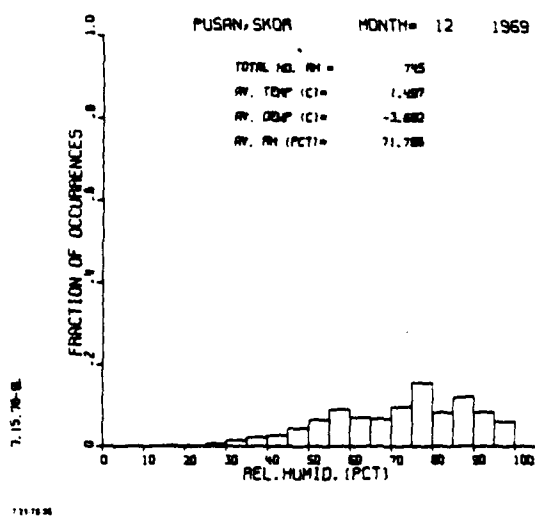
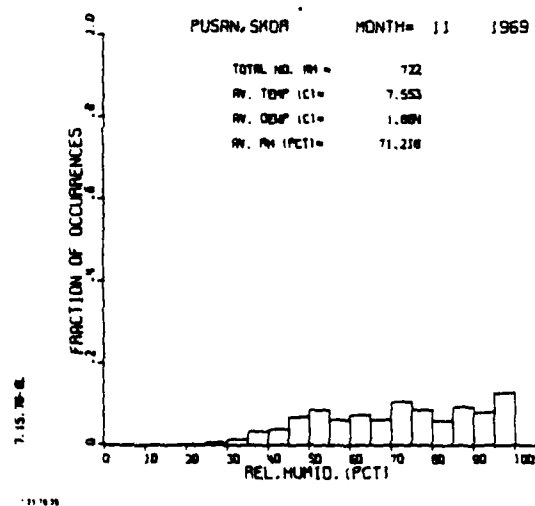
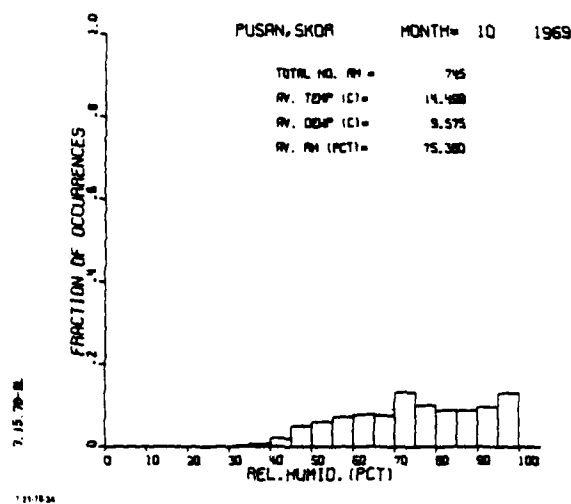
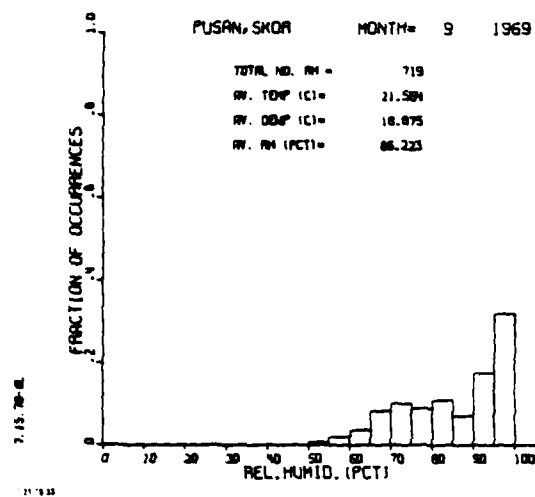


FIGURE 137. Relative humidity statistics, Pusan, South Korea, September-December 1969.

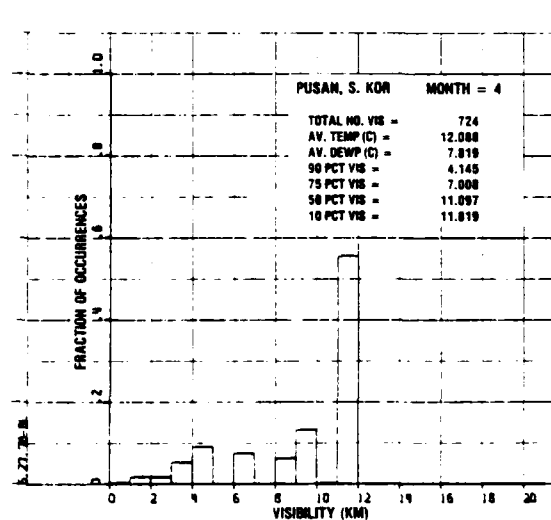
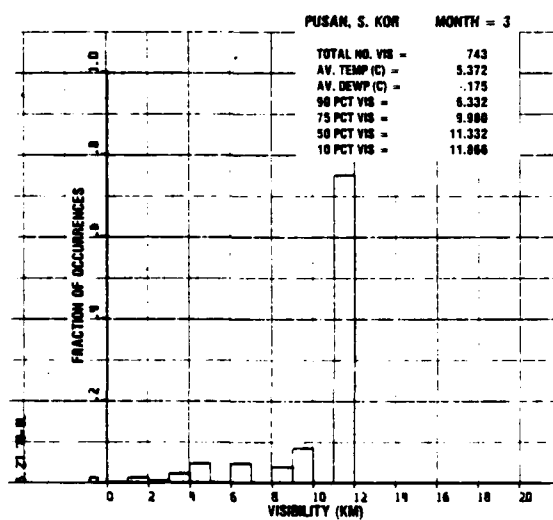
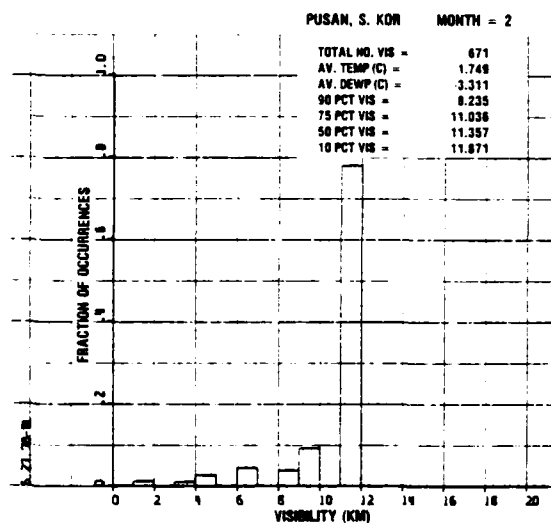
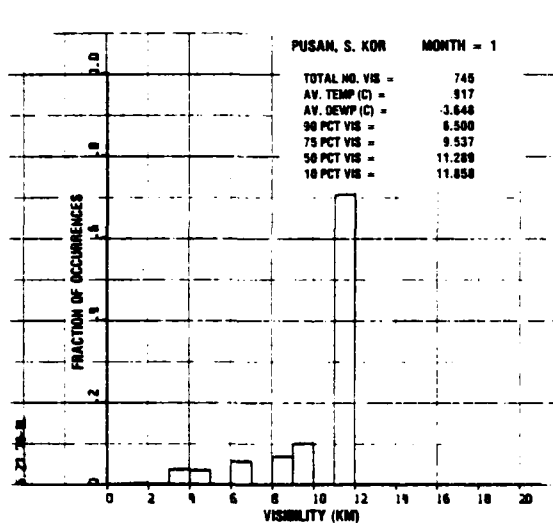
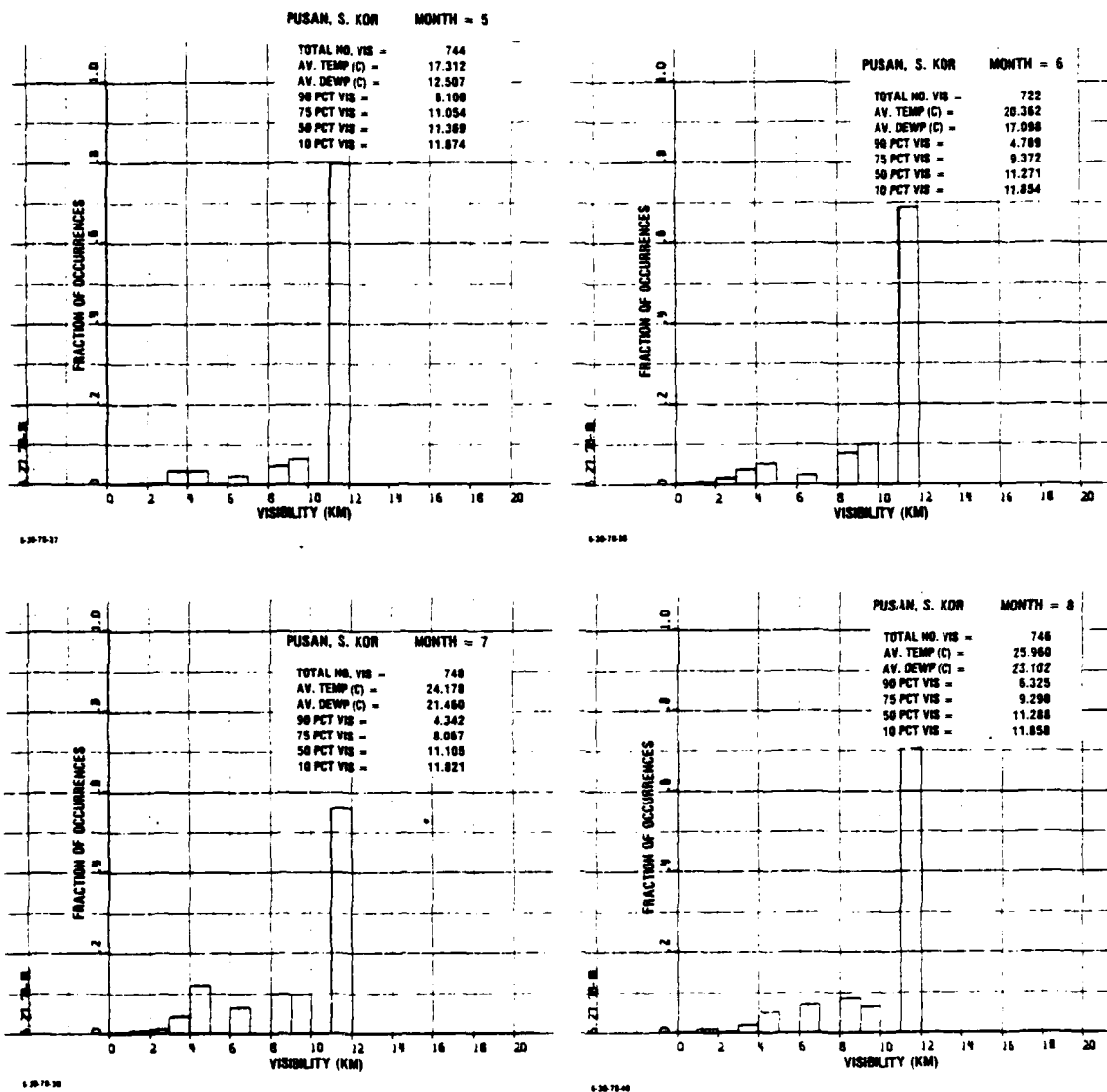


FIGURE 138. Visibility statistics, Pusan, South Korea, January-April 1969.



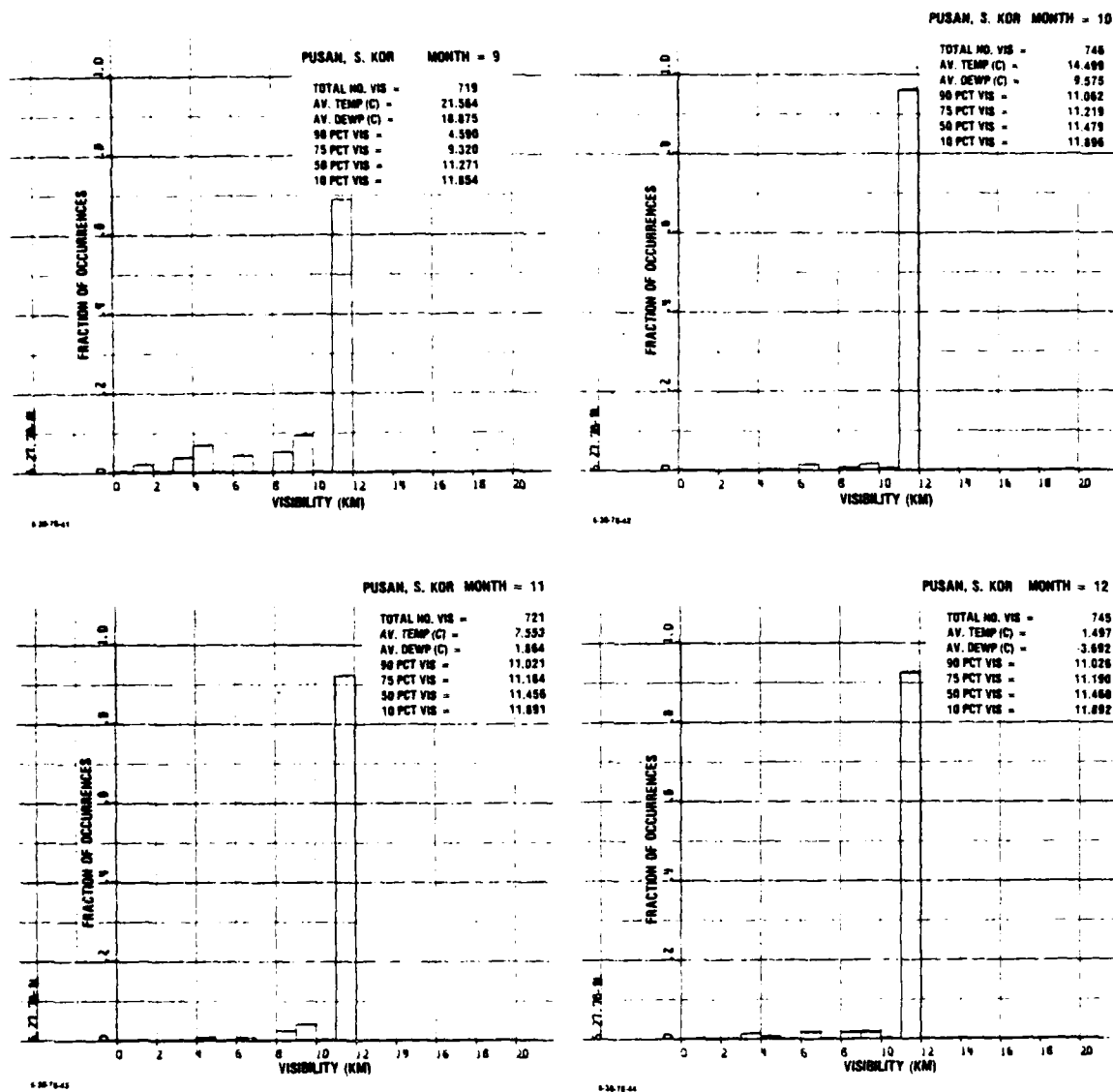


FIGURE 140. Visibility statistics, Pusan, South Korea, September-December 1969.

SEOUL, SOUTH KOREA

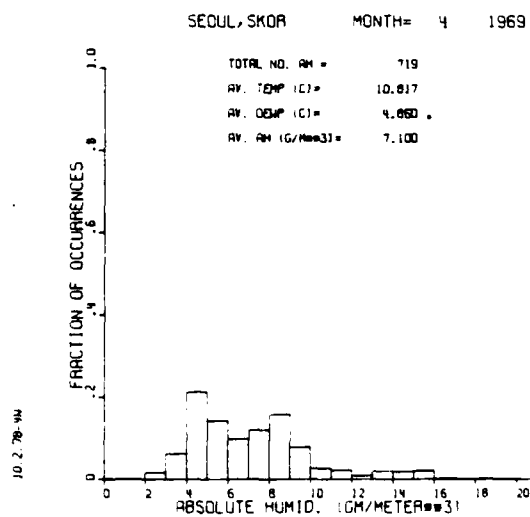
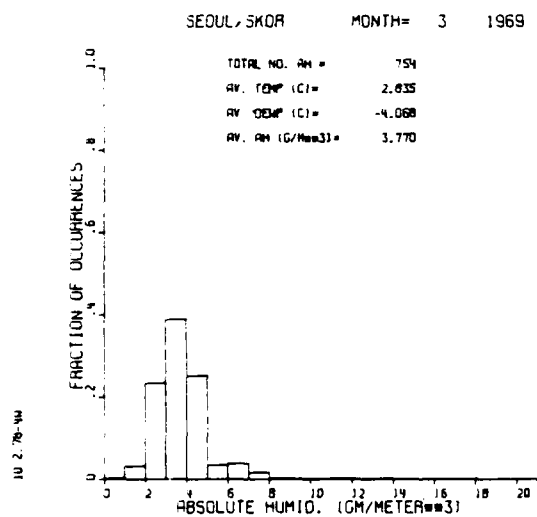
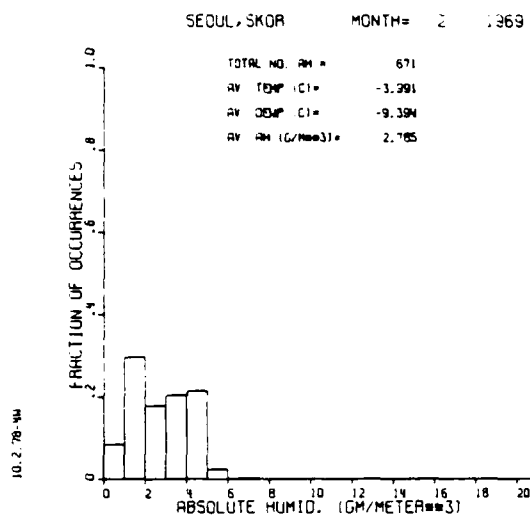
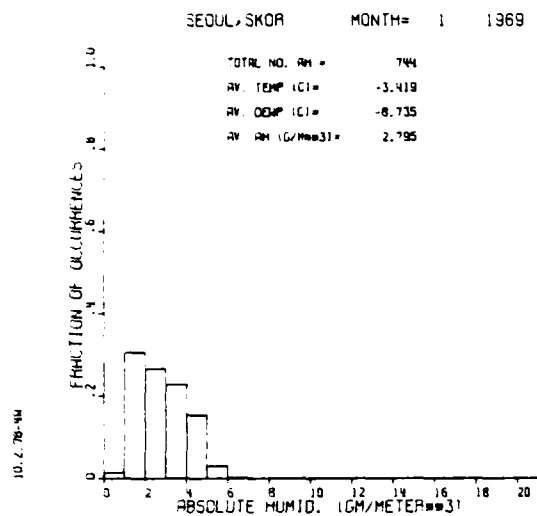


FIGURE 141. Absolute humidity statistics, Seoul, South Korea, January-April 1969.

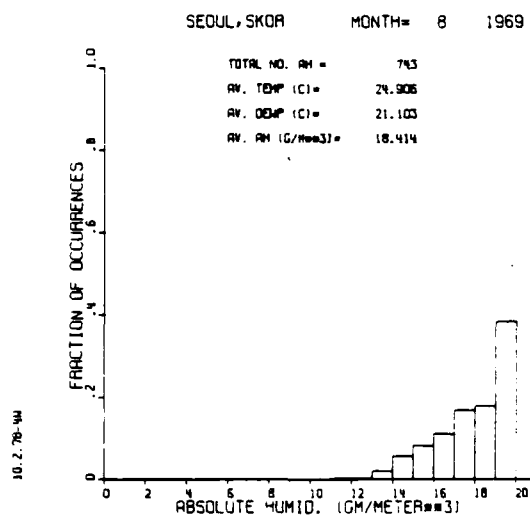
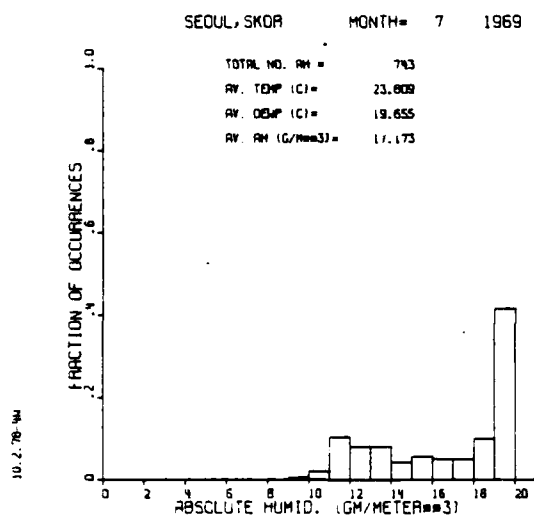
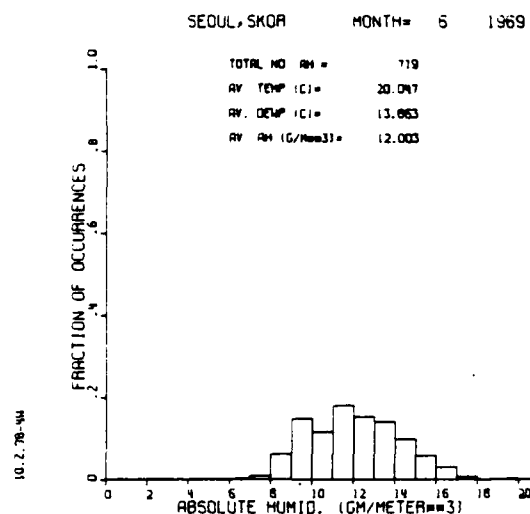
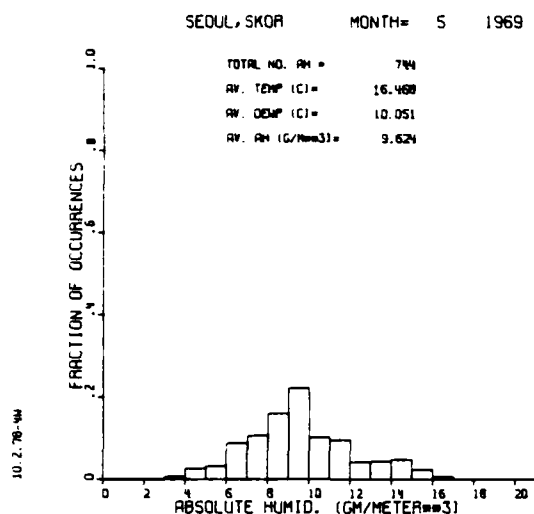


FIGURE 142. Absolute humidity statistics, Seoul, South Korea, May-August 1969.

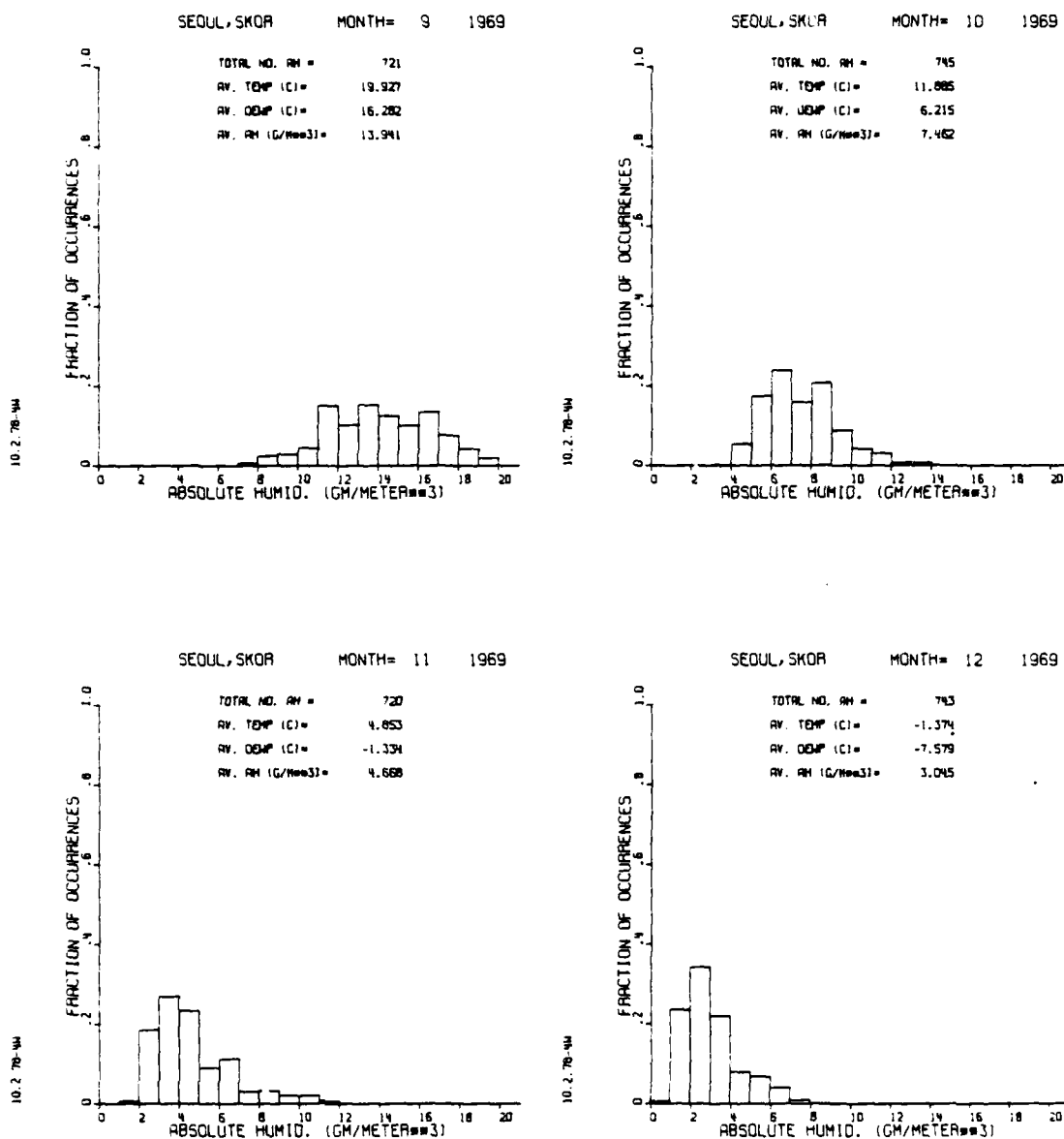


FIGURE 143. Absolute humidity statistics, Seoul, South Korea, September-December 1969.

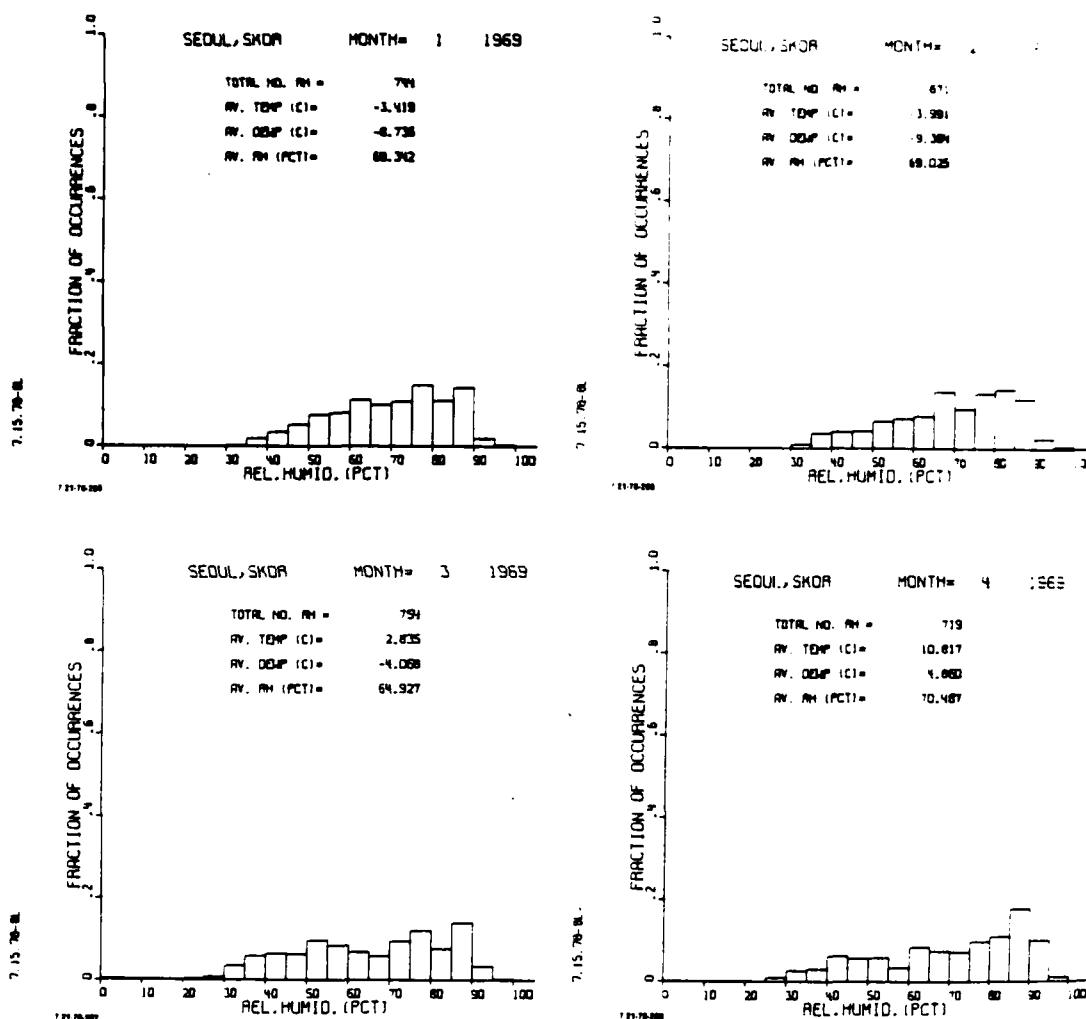


FIGURE 144. Relative humidity statistics, Seoul, South Korea, January-April 1969.

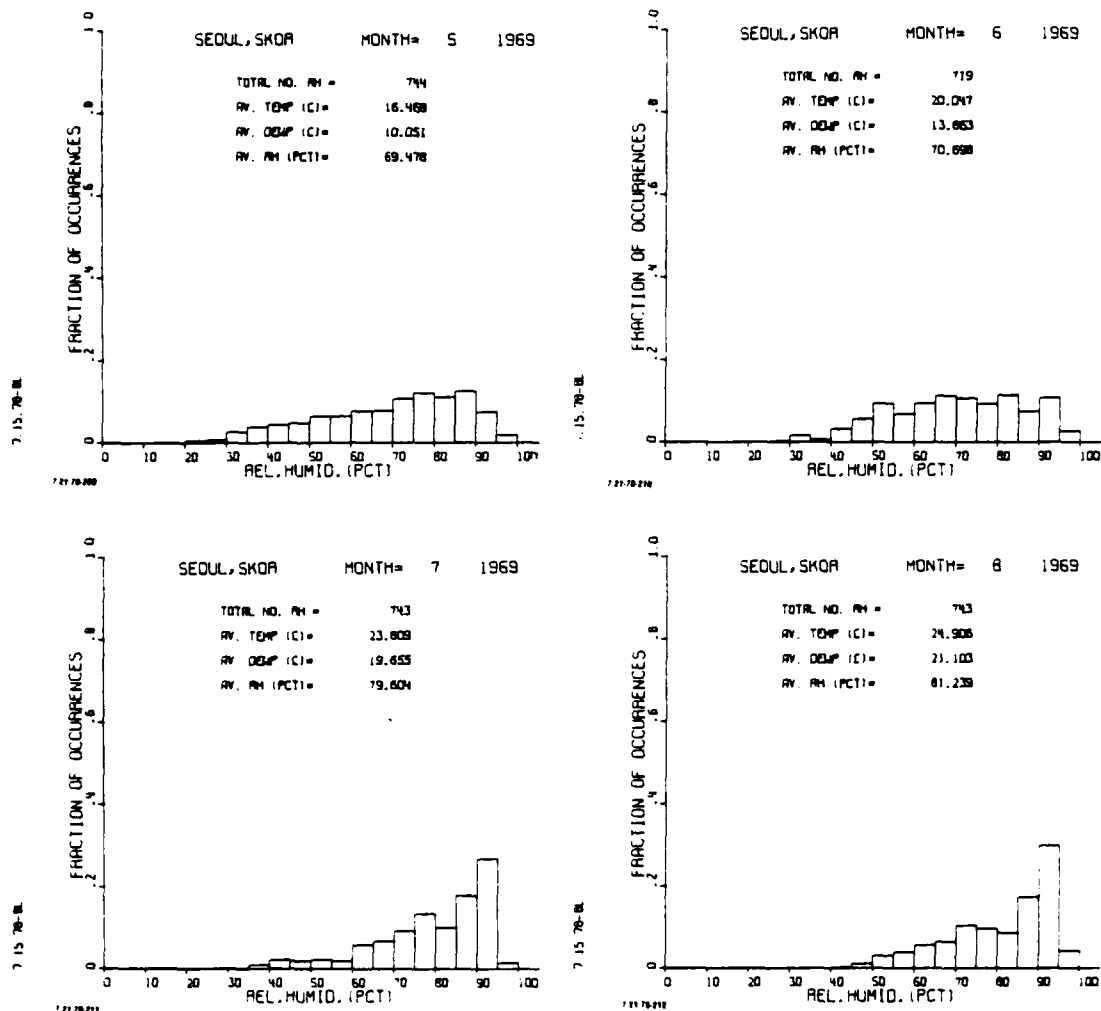


FIGURE 145. Relative humidity statistics, Seoul, South Korea, May-August 1969.

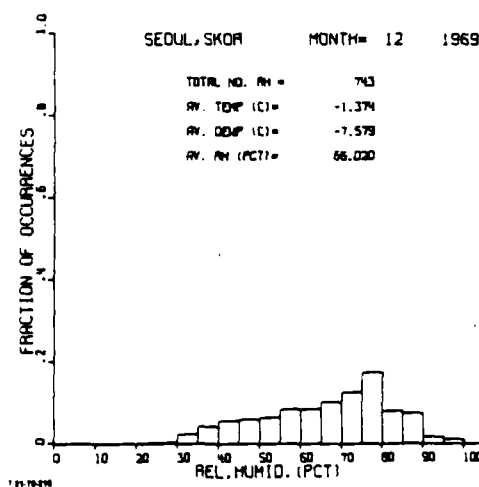
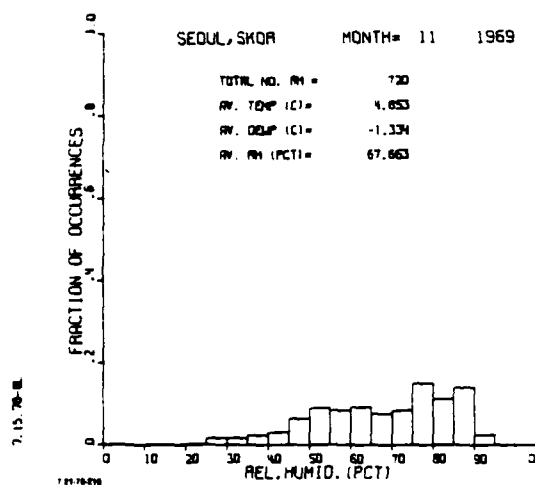
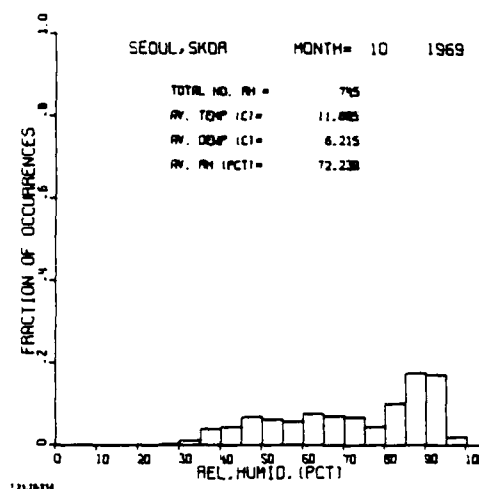
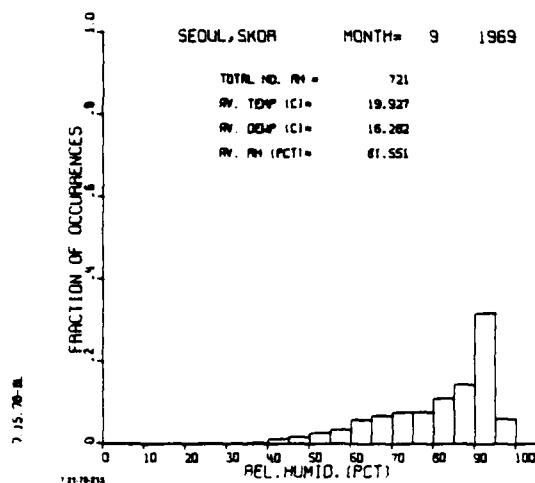


FIGURE 146. Relative humidity statistics, Seoul, South Korea, September-December 1969.

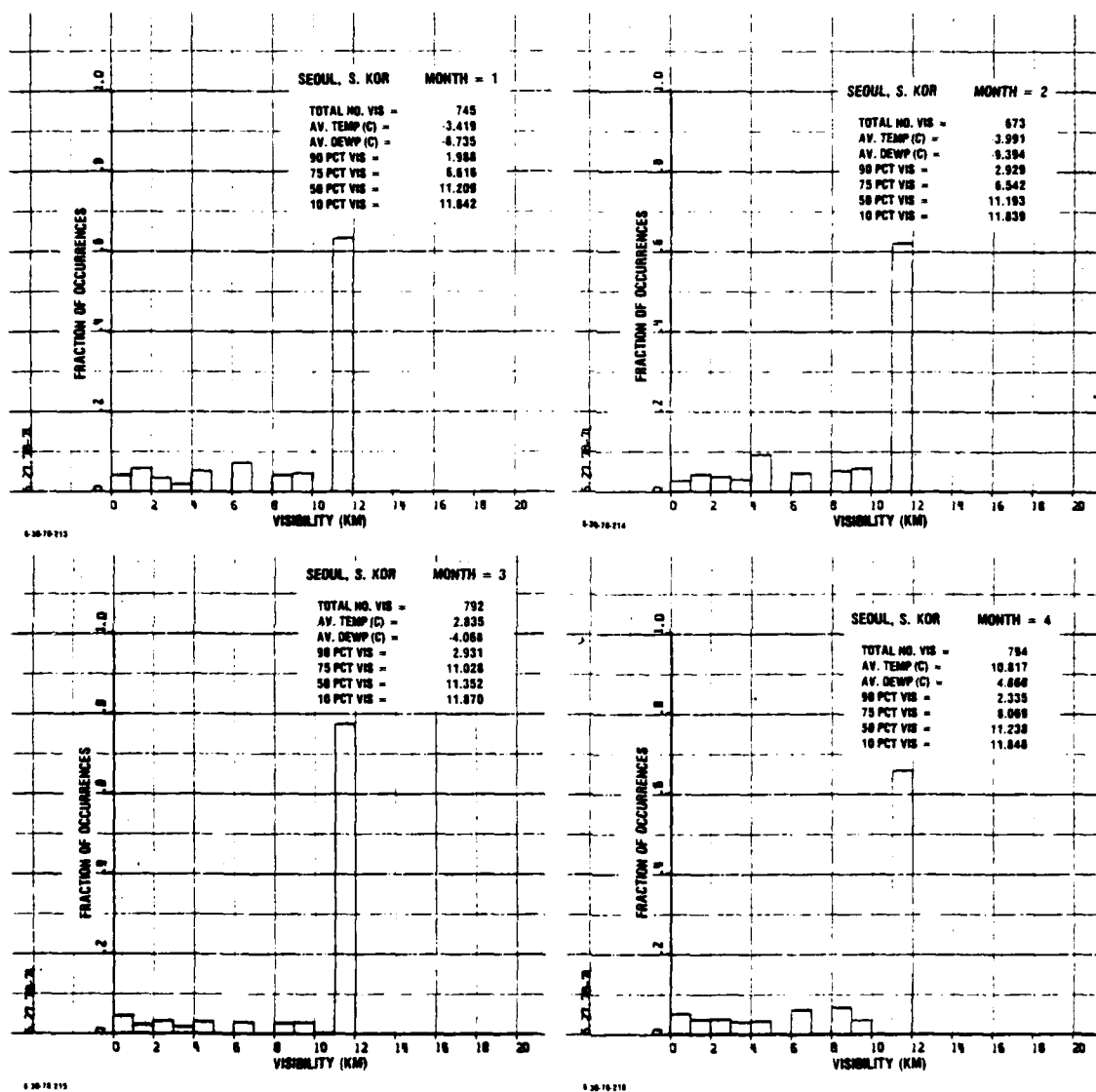


FIGURE 147. Visibility statistics, Seoul, South Korea, January-April 1969.

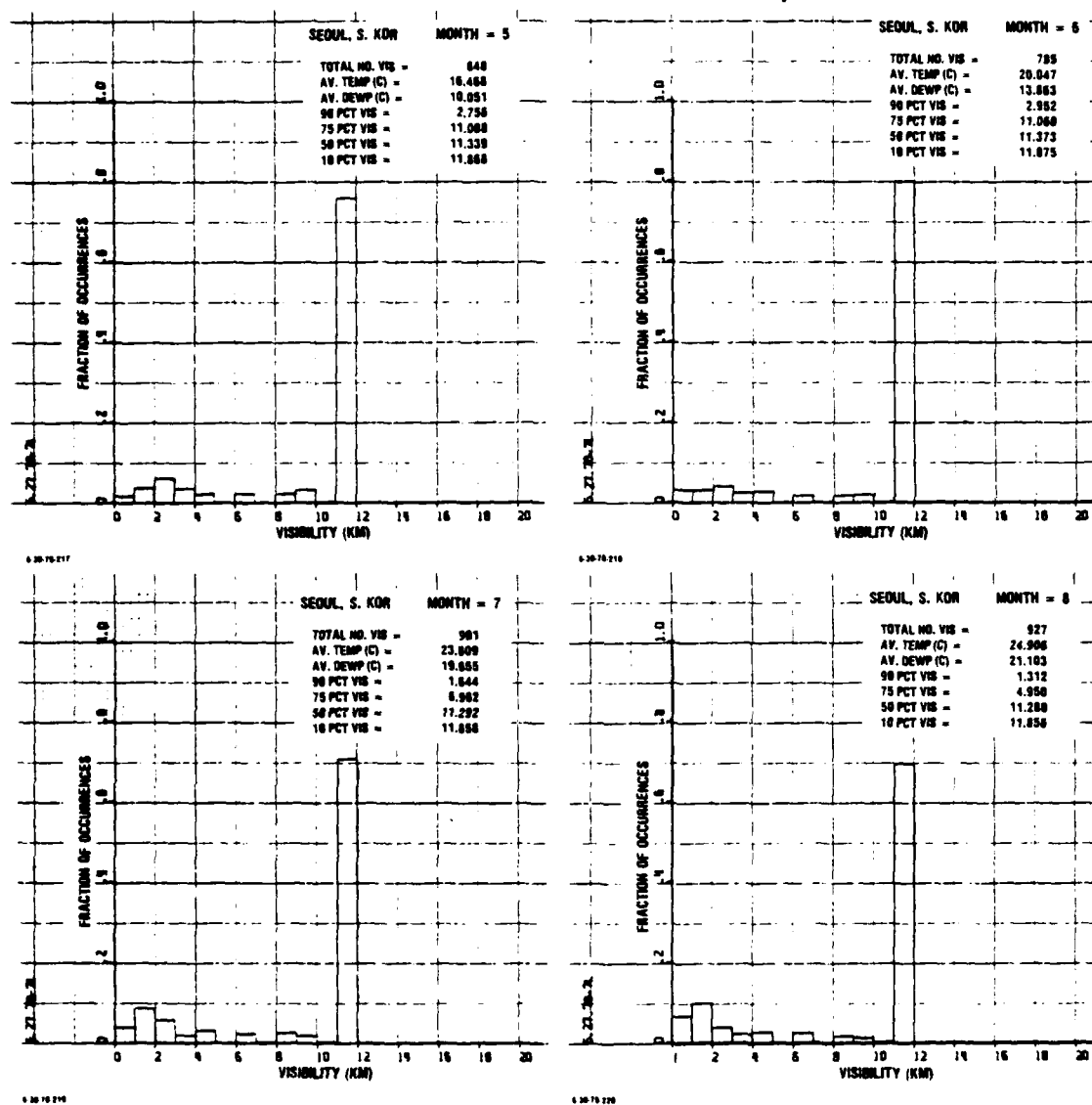


FIGURE 148. Visibility statistics, Seoul, South Korea, May-August 1969.

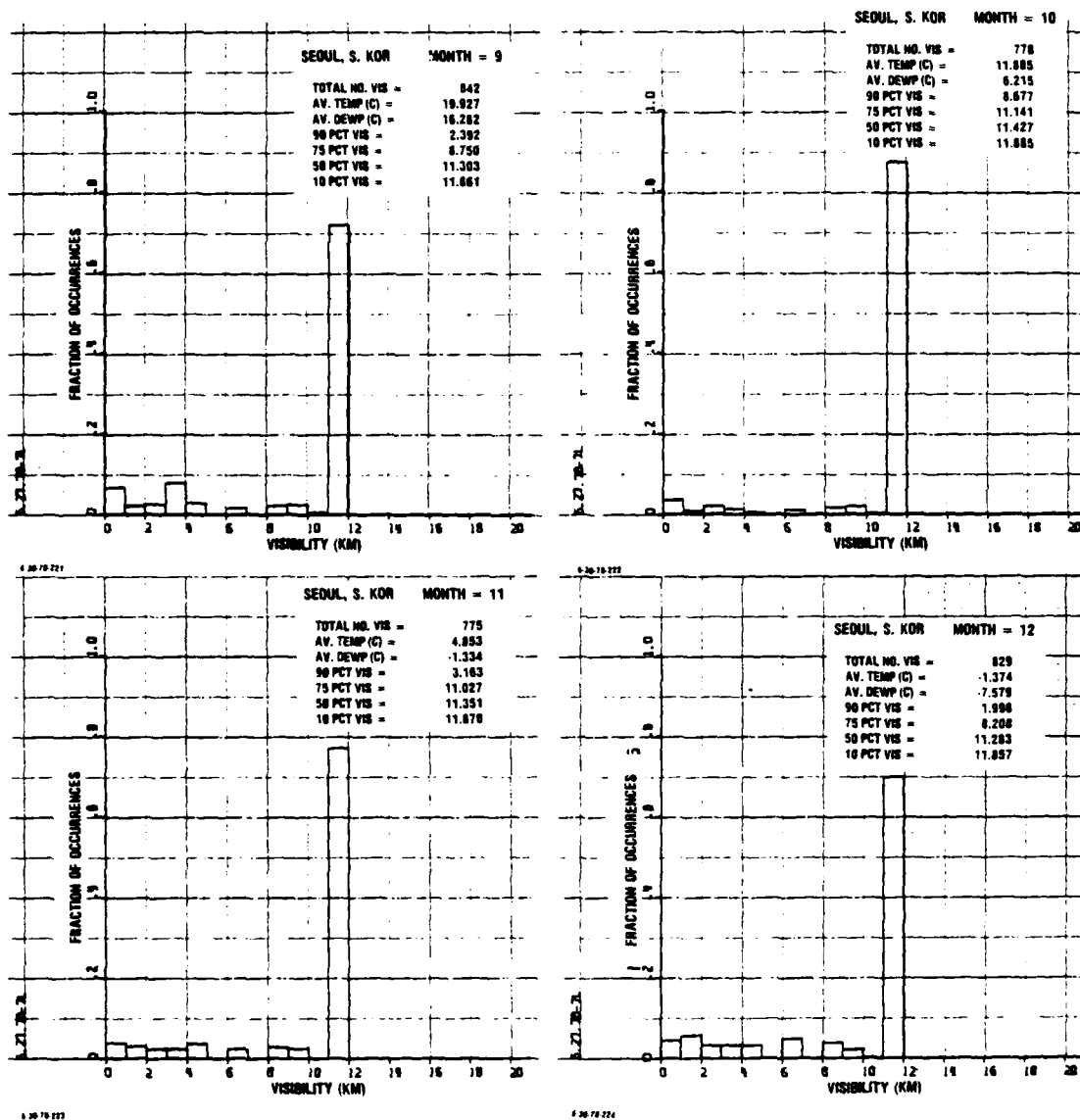
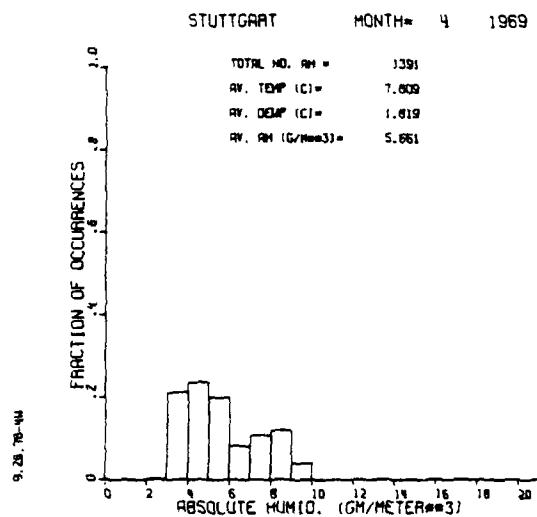
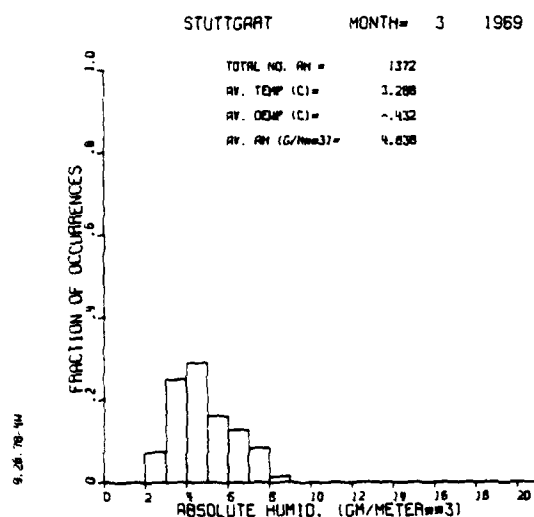
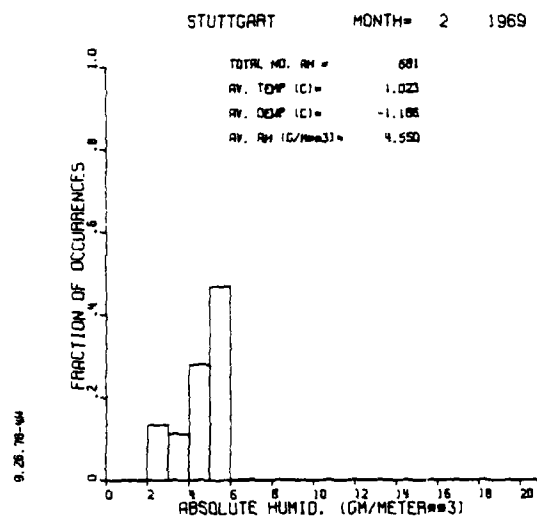
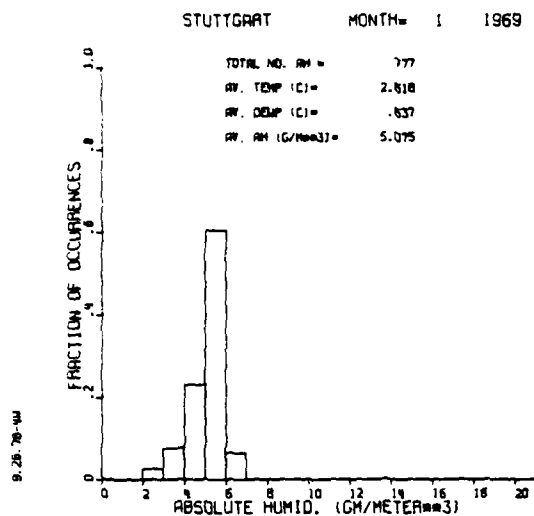


FIGURE 149. Visibility statistics, Seoul, South Korea, September-December 1969.

STUTTGART, WEST GERMANY



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FIGURE 150. Absolute humidity statistics, Stuttgart, West Germany, January-April 1969.

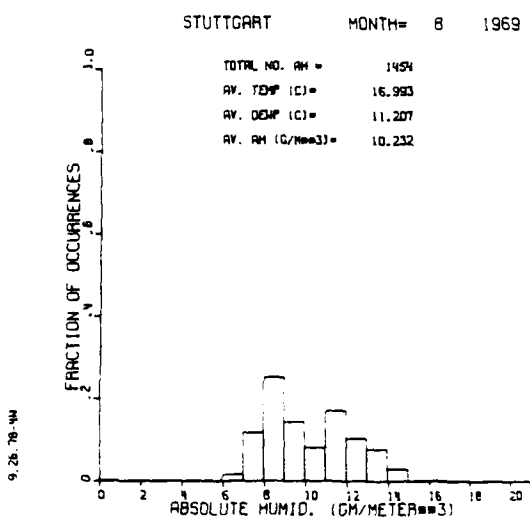
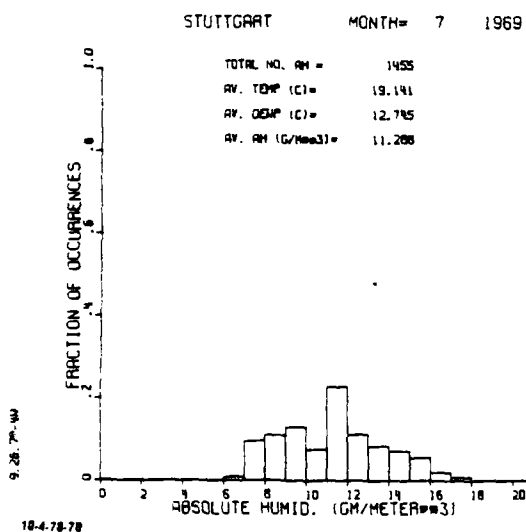
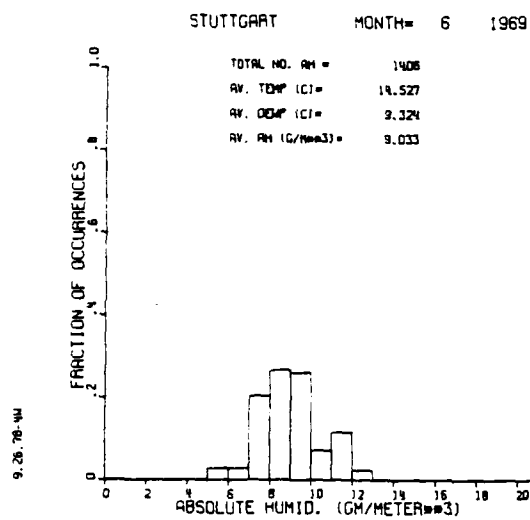
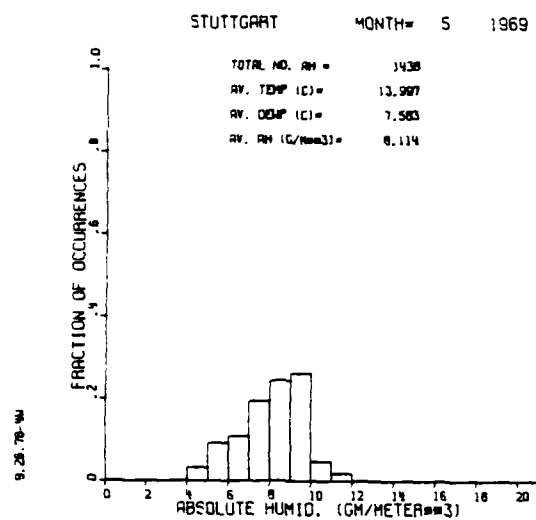


FIGURE 151. Absolute humidity statistics, Stuttgart, West Germany, May-August 1969.

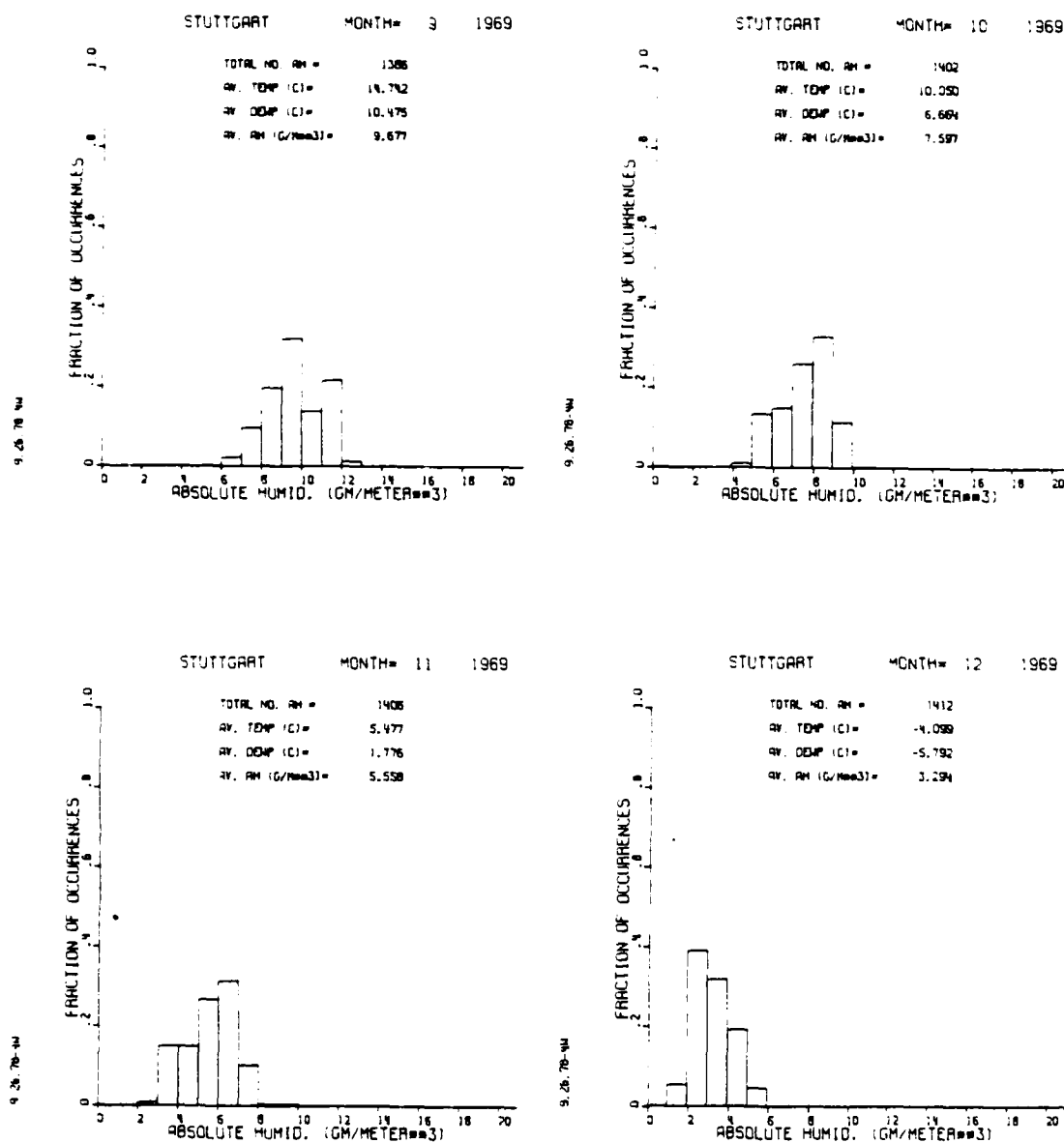


FIGURE 152. Absolute humidity statistics, Stuttgart, West Germany, September-December 1969.

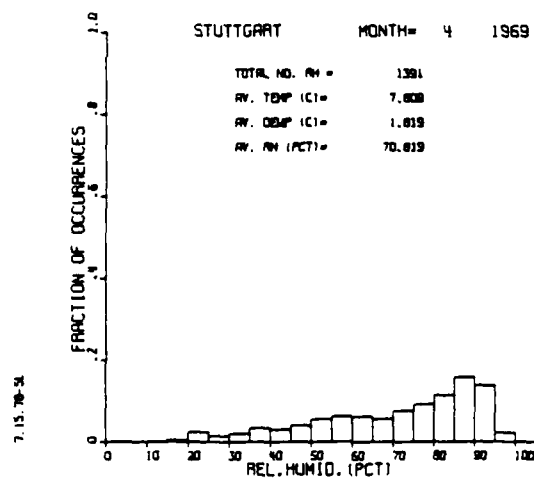
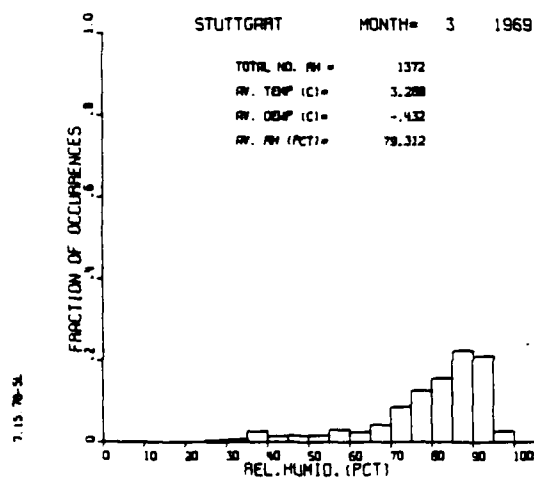
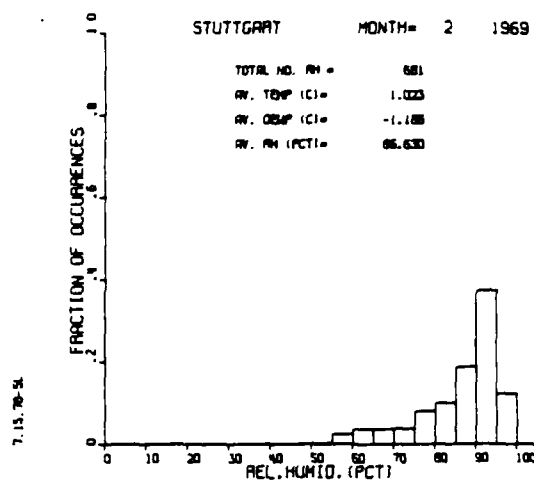
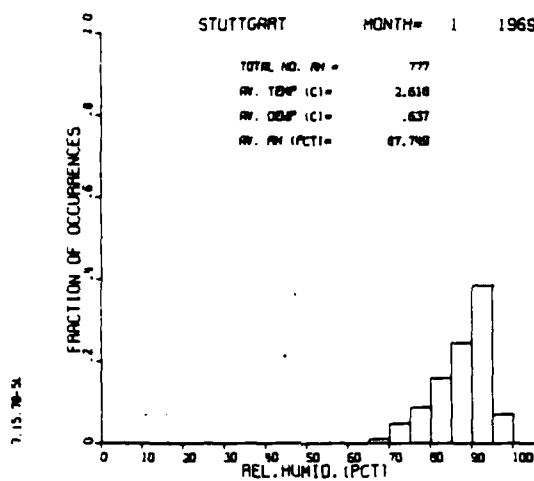


FIGURE 153. Relative humidity statistics, Stuttgart, West Germany, January-April 1969.

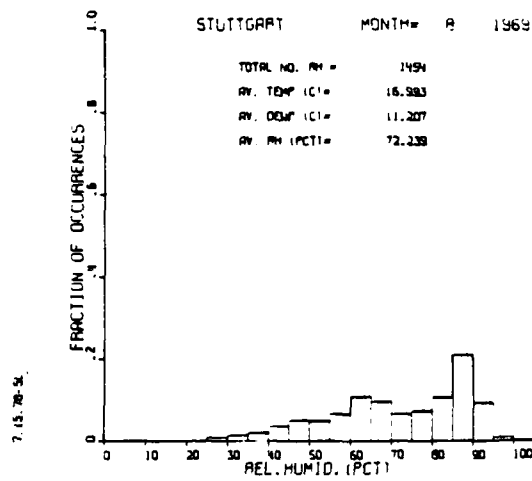
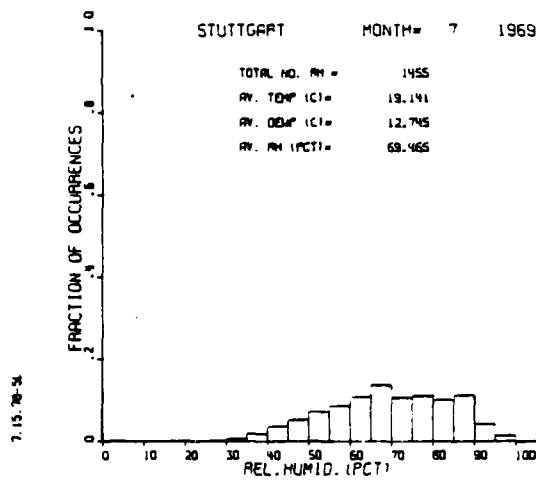
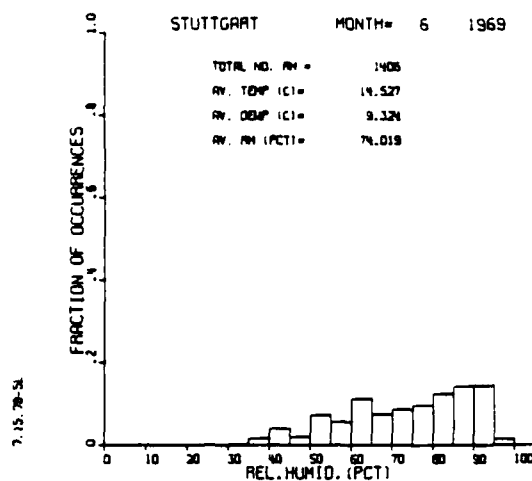
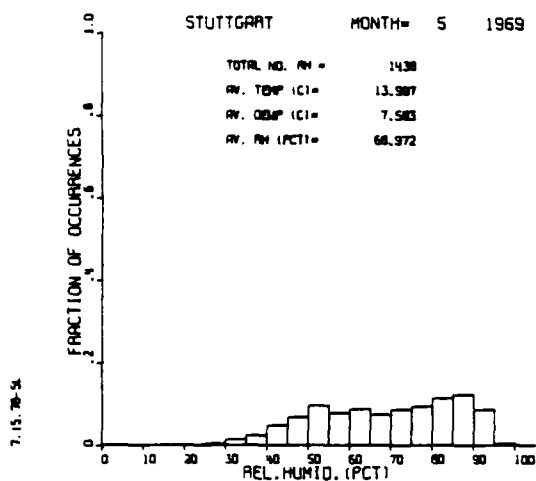


FIGURE 154. Relative humidity statistics, Stuttgart, West Germany, May-August 1969.

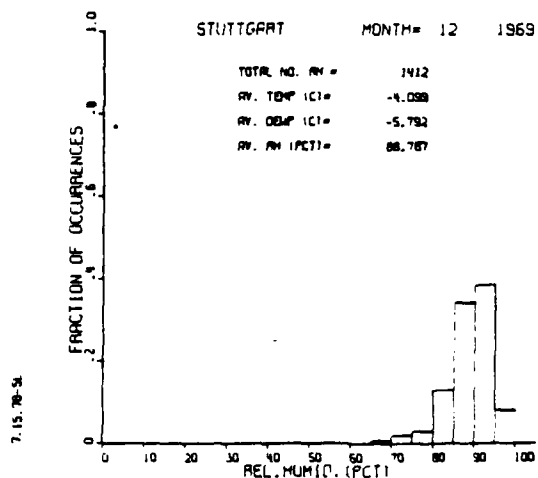
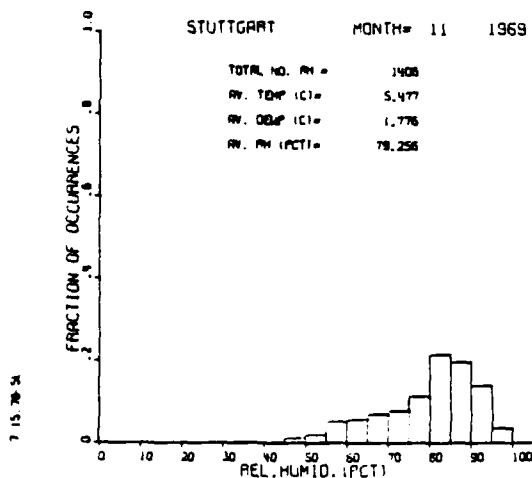
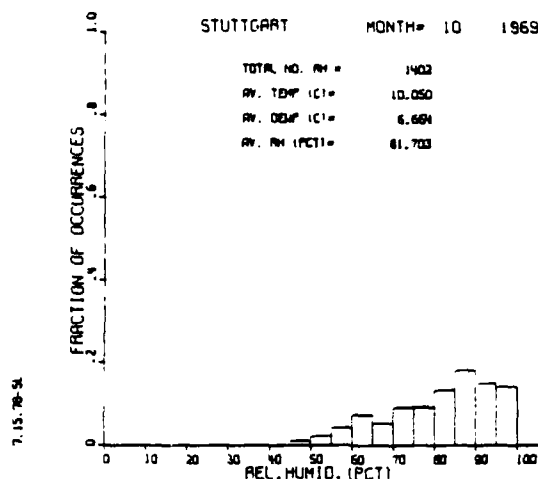
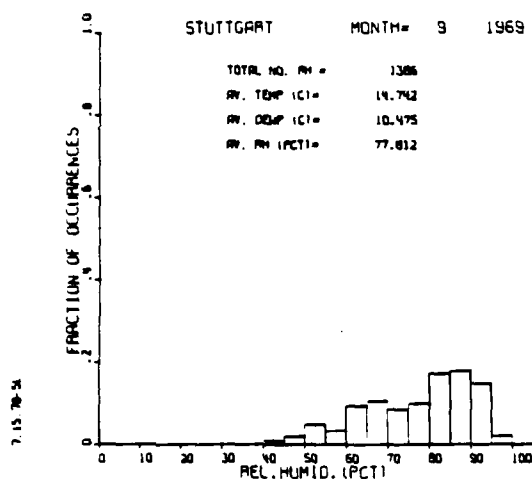


FIGURE 155. Relative humidity statistics, Stuttgart, West Germany, September-December 1969.

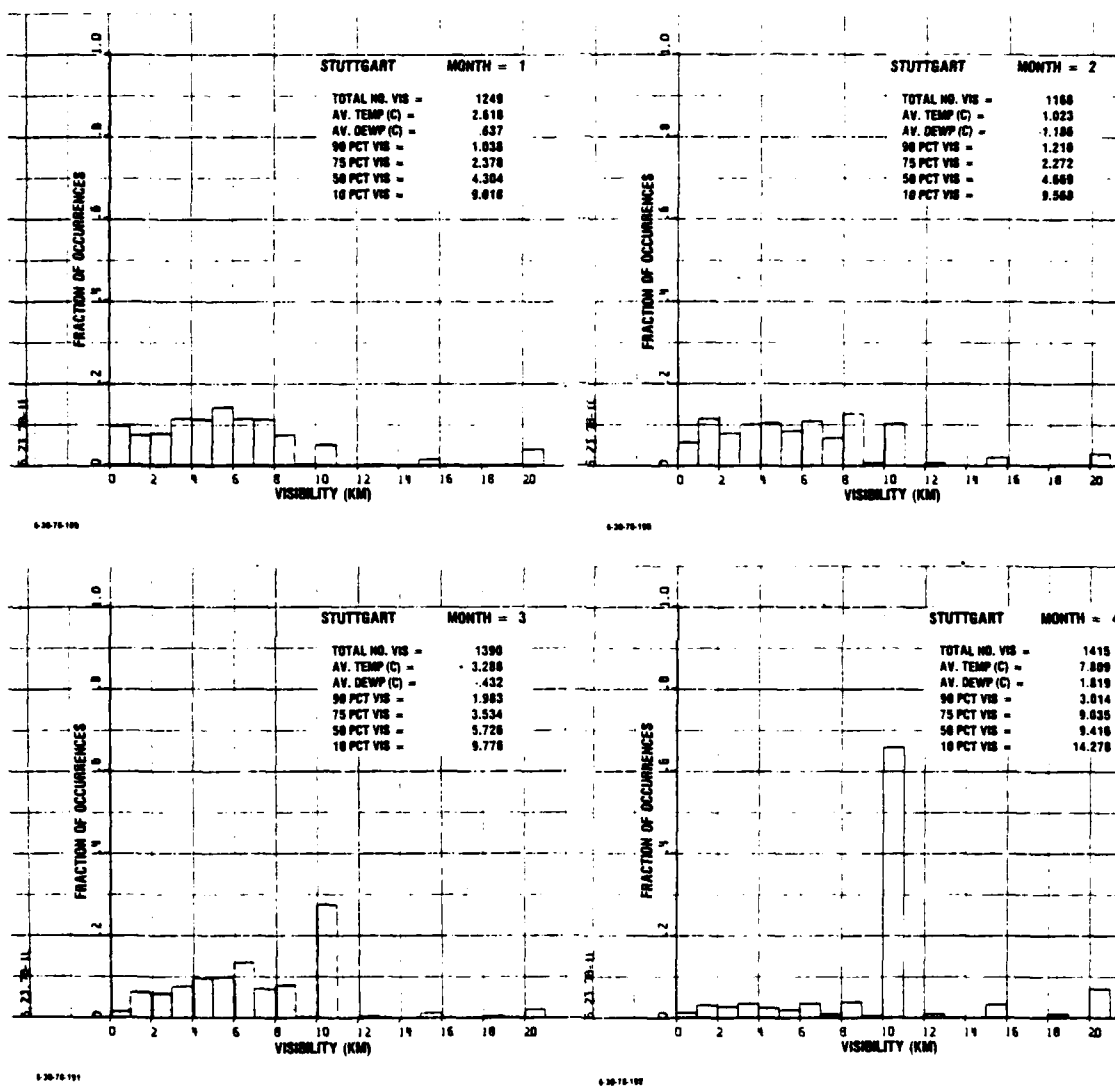


FIGURE 156. Visibility statistics, Stuttgart, West Germany, January-April 1969.

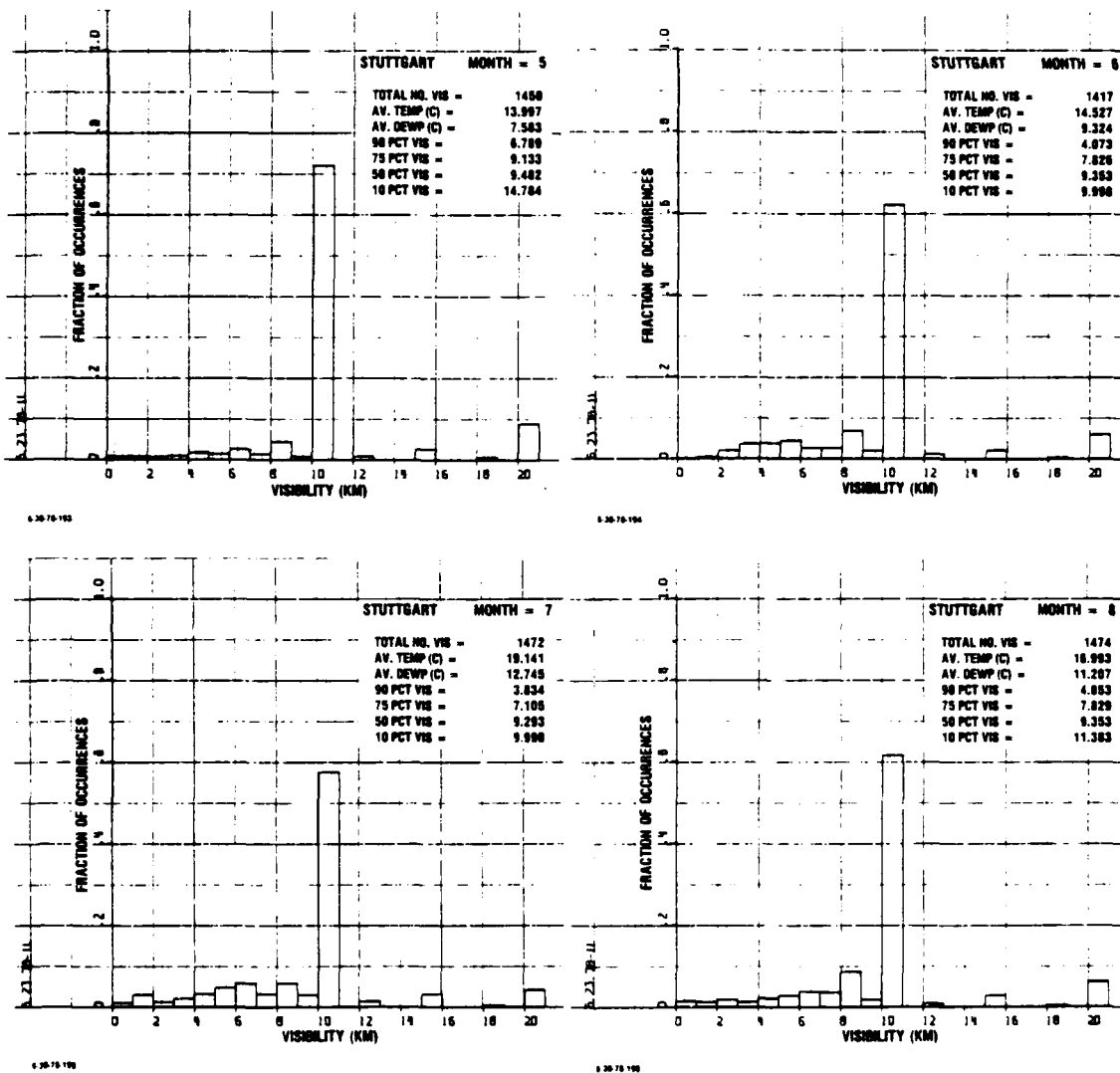


FIGURE 157. Visibility statistics, Stuttgart, West Germany, May-August 1969.

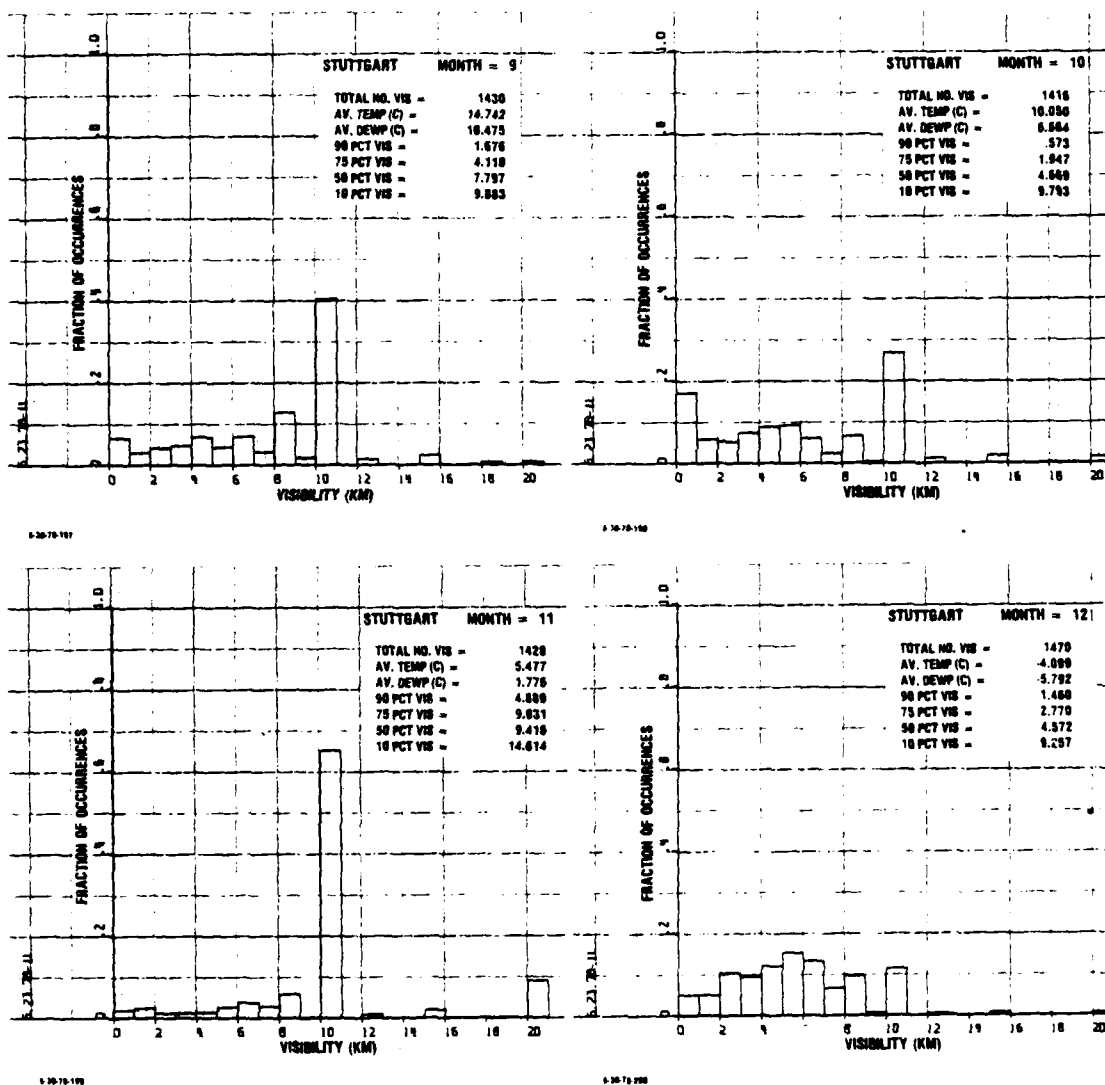
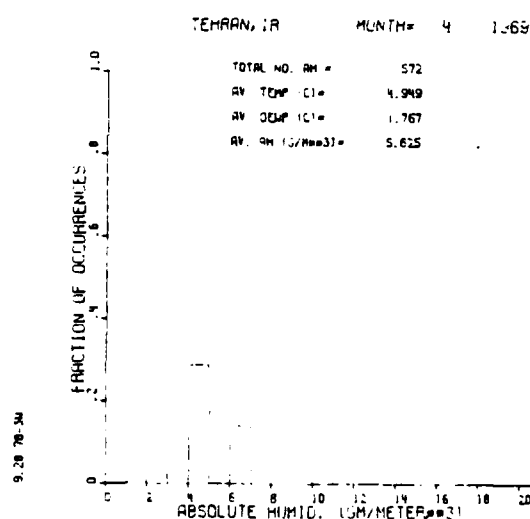
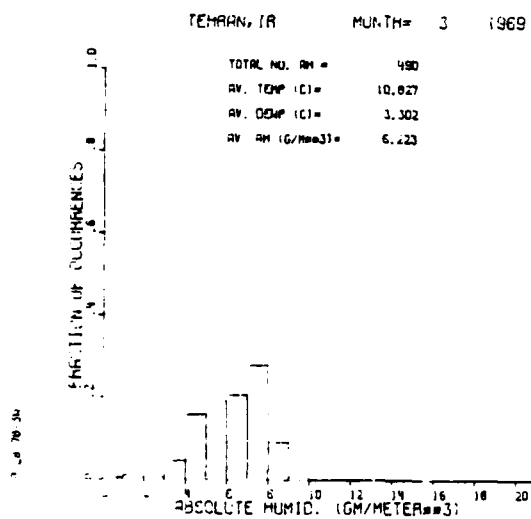
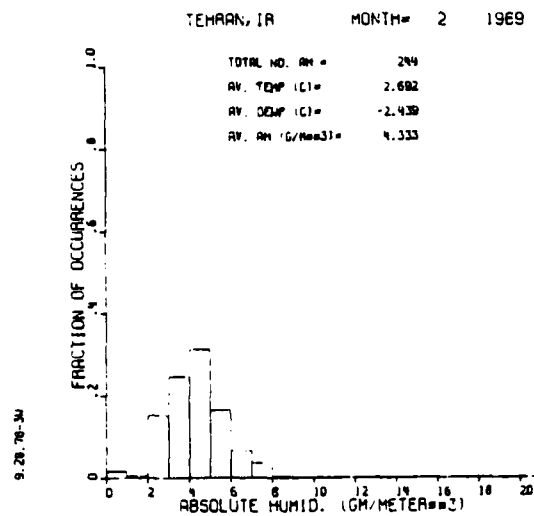
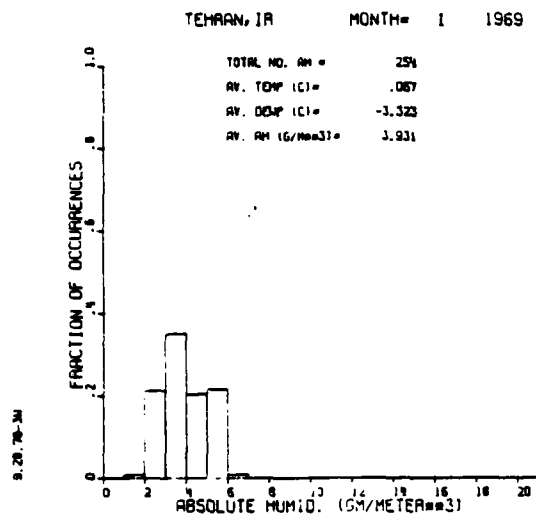


FIGURE 158. Visibility statistics, Stuttgart, West Germany, September-December 1969.

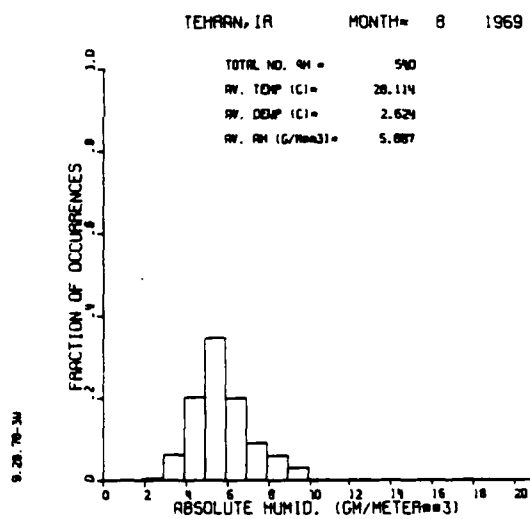
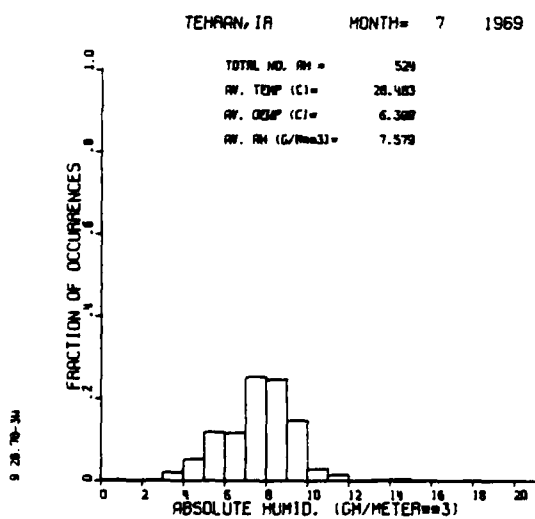
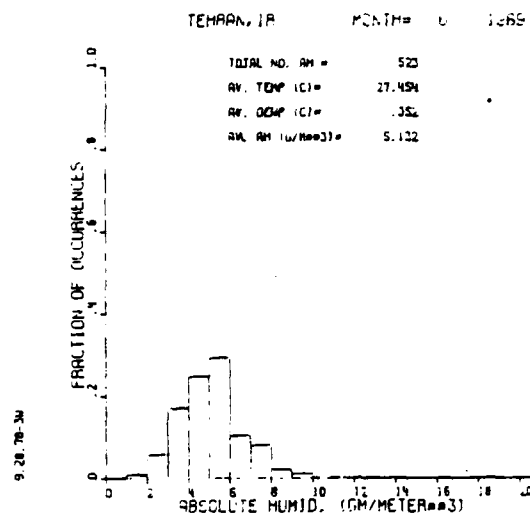
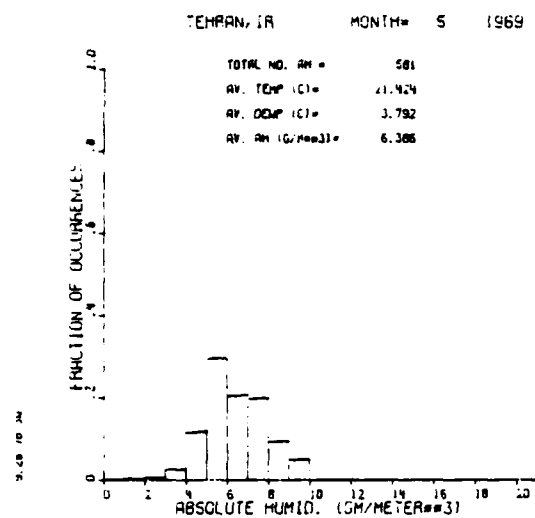
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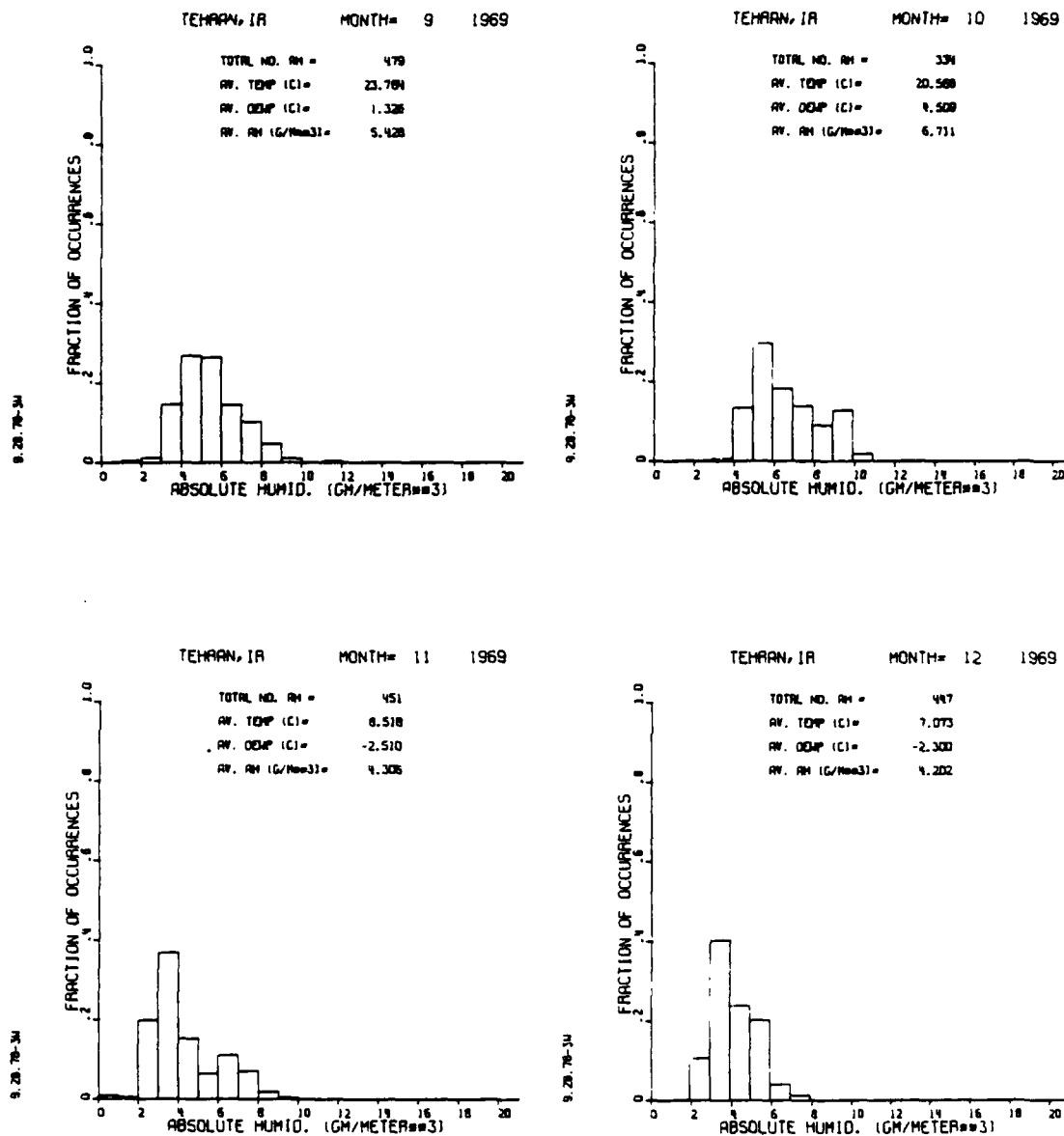
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FIGURE 159. Absolute humidity statistics, Tehran, Iran, January-April 1969.



18-4-78-55

FIGURE 160. Absolute humidity statistics, Tehran, Iran, May-August 1969.



10-4-78-56

FIGURE 161. Absolute humidity statistics, Tehran, Iran, September-December 1969.

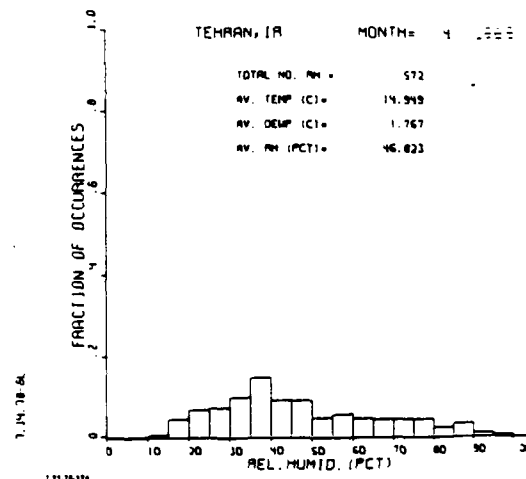
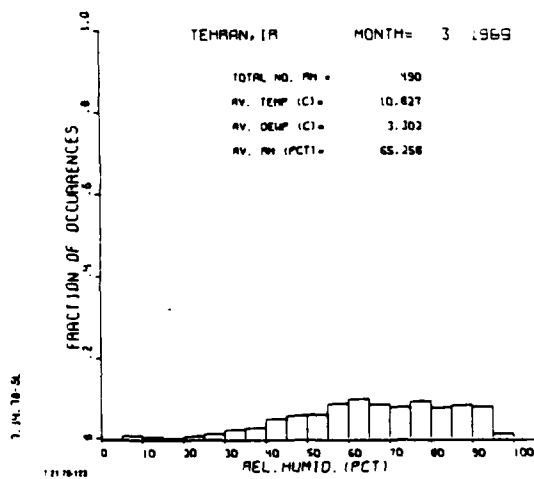
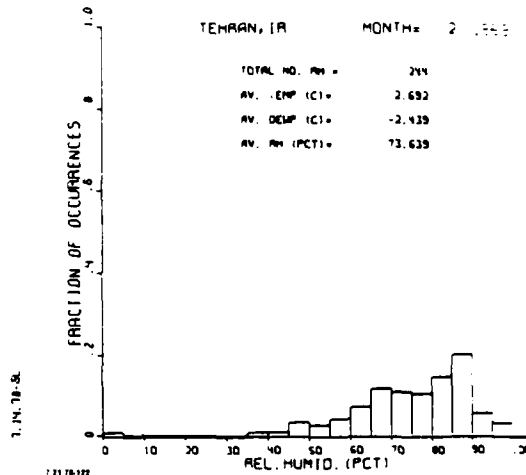
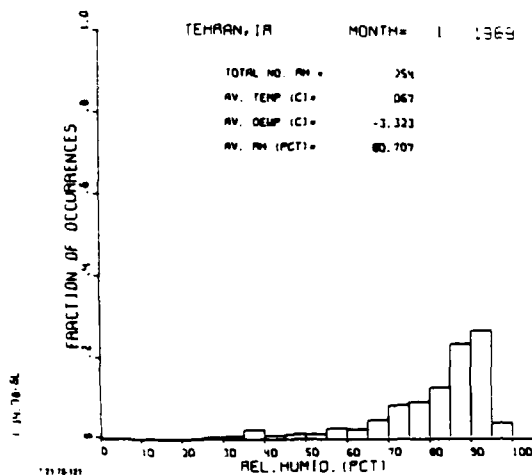


FIGURE 162. Relative humidity statistics, Tehran, Iran, January-April 1969.

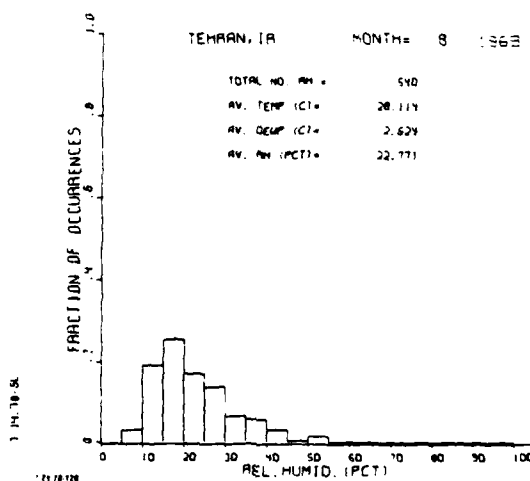
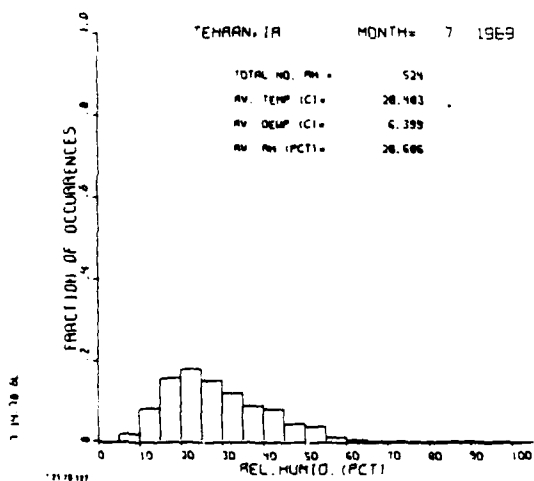
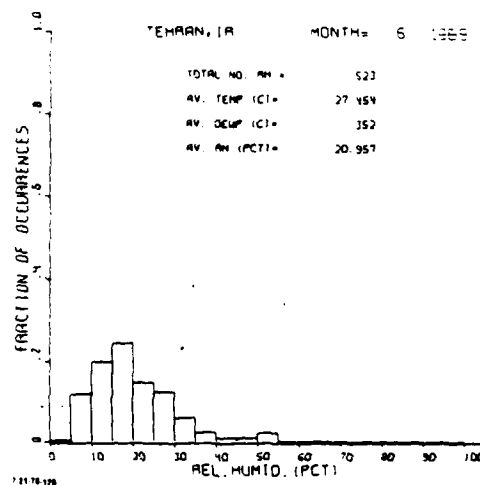
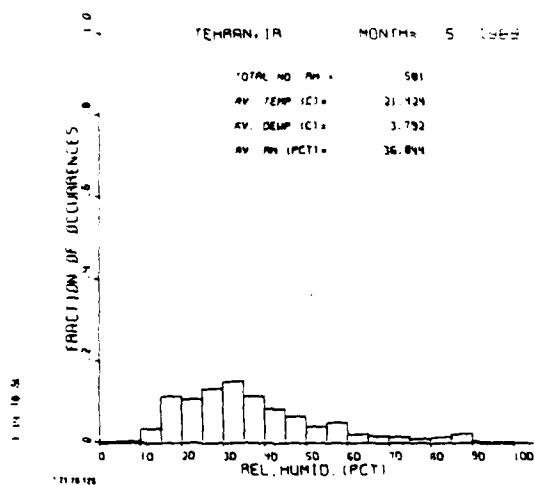


FIGURE 163. Relative humidity statistics, Tehran, Iran, May-August 1969.

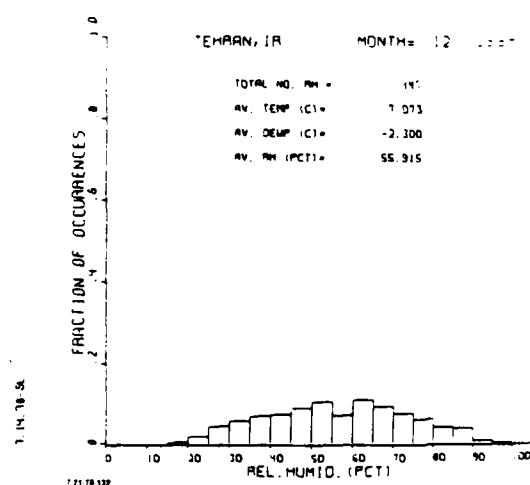
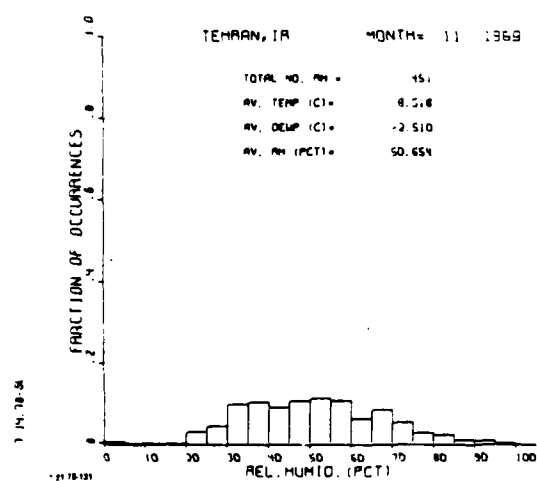
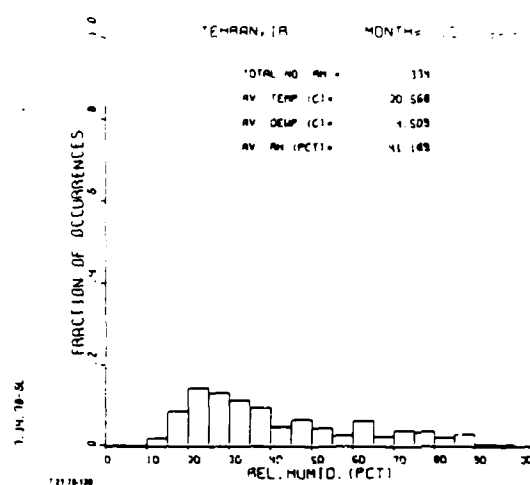
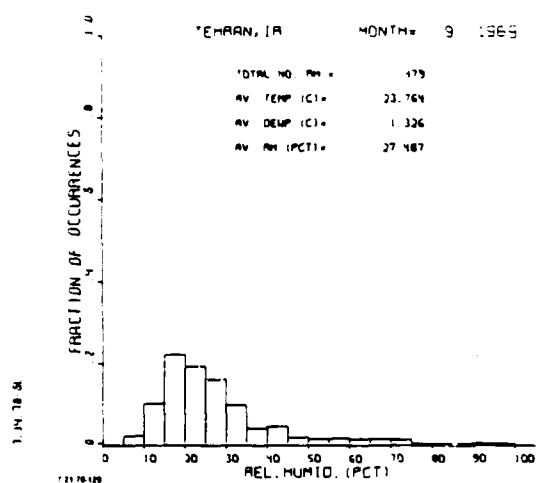


FIGURE 164. Relative humidity statistics, Tehran, Iran, September-December 1969.

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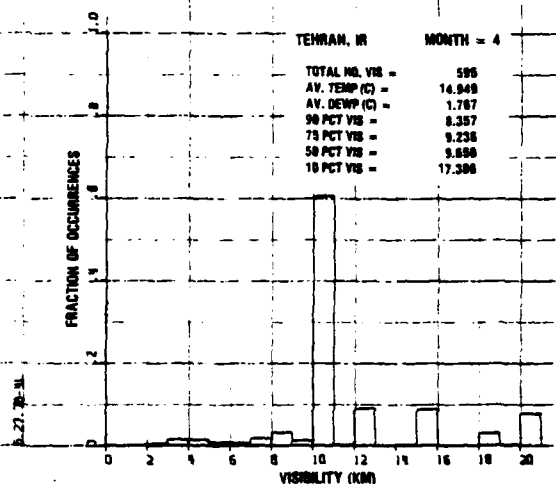
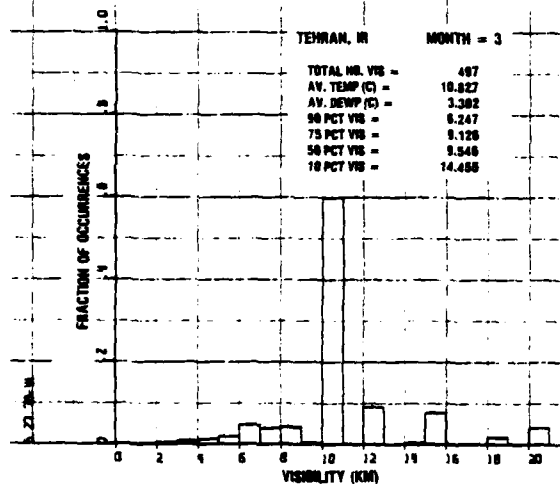
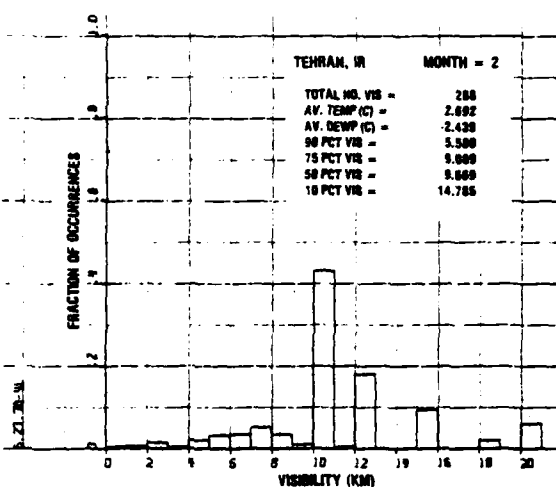
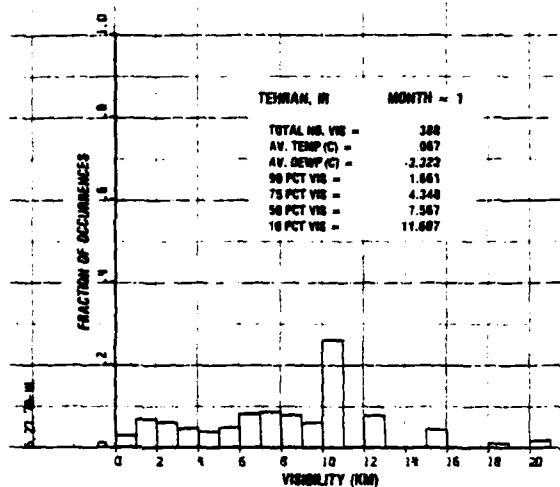


FIGURE 165. Visibility statistics, Tehran, Iran, January-April 1969.

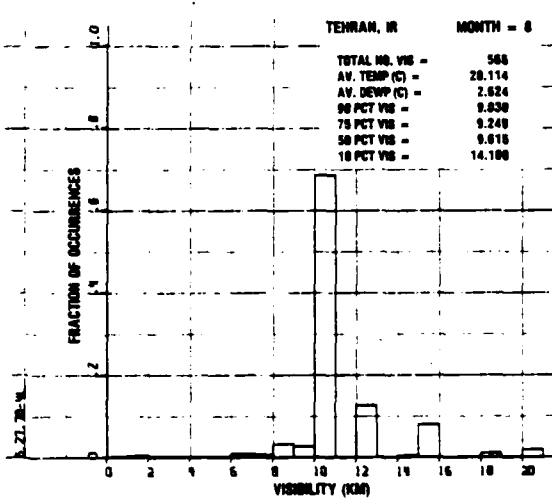
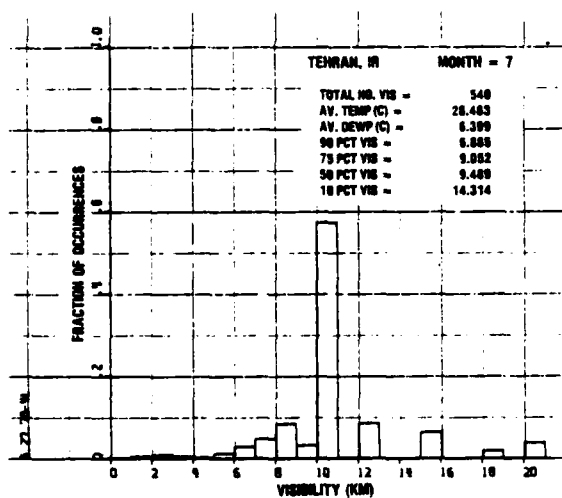
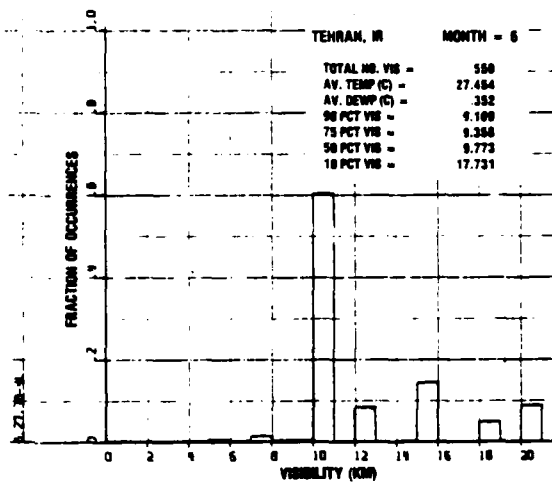
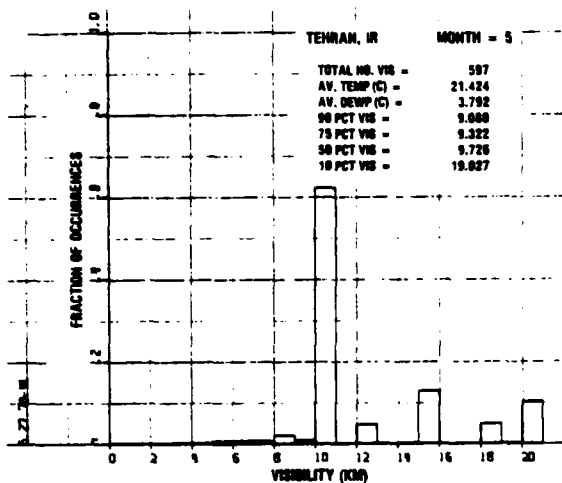


FIGURE 166. Visibility statistics, Tehran, Iran, May-August 1969.

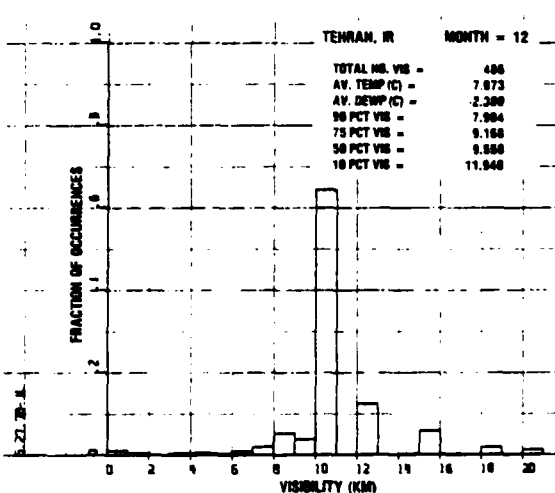
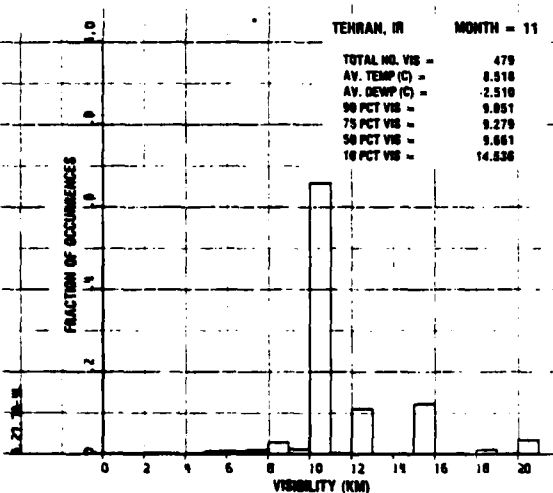
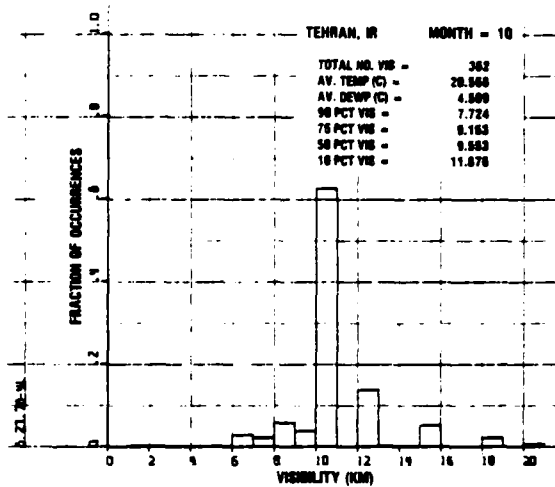
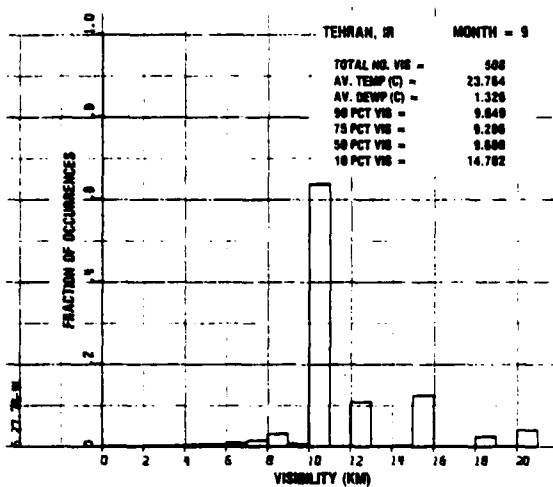
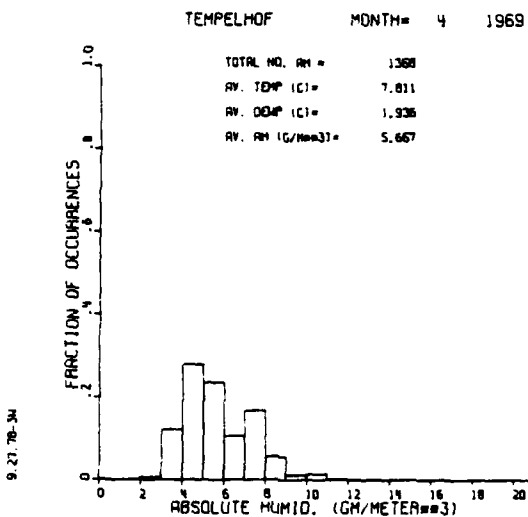
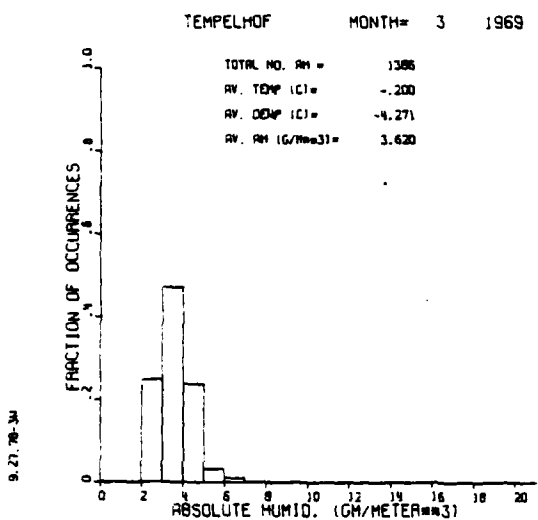
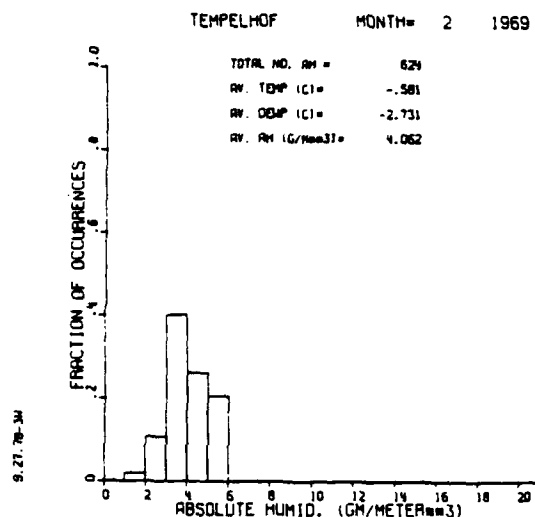
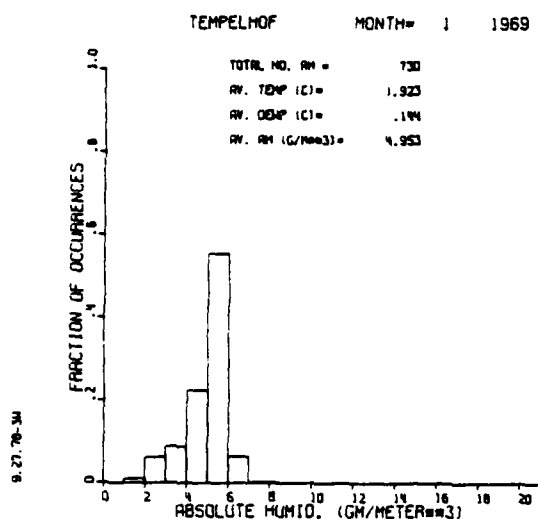


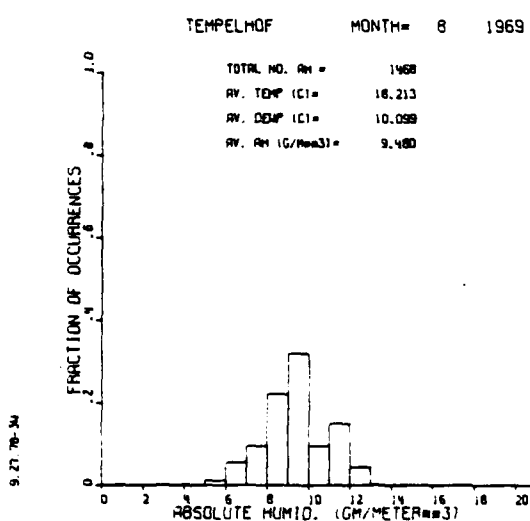
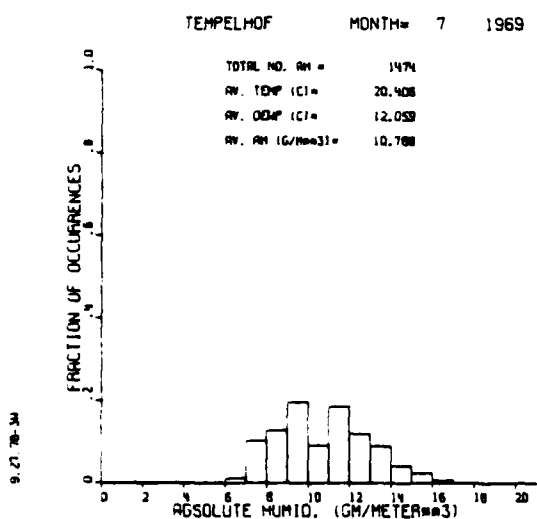
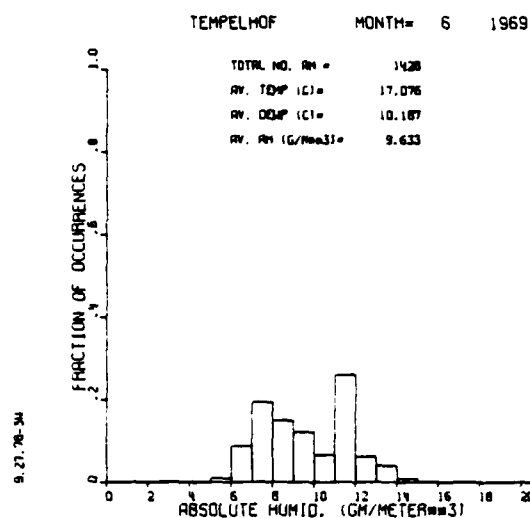
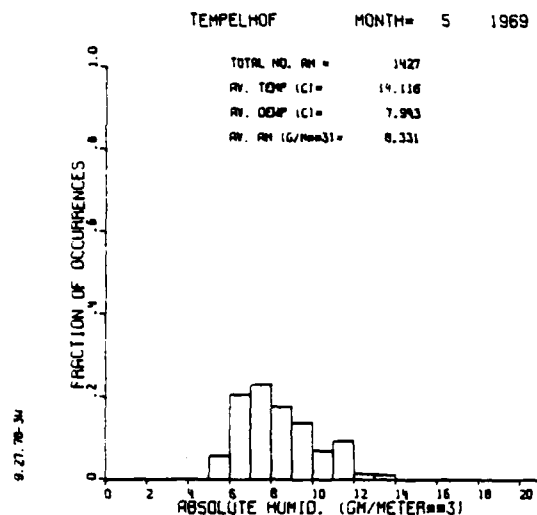
FIGURE 167. Visibility statistics, Tehran, Iran, September-December 1969.

TEMPELHOF (WEST BERLIN), GERMANY



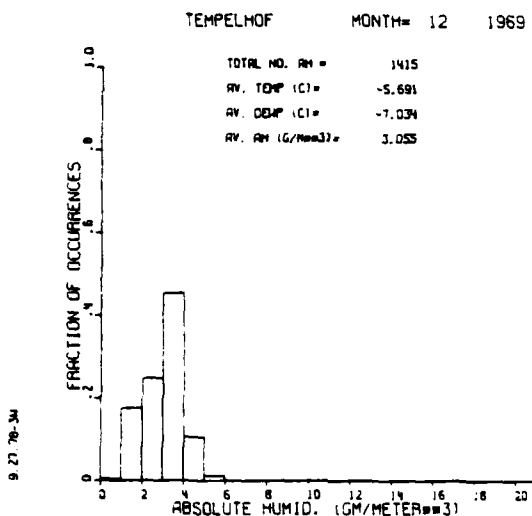
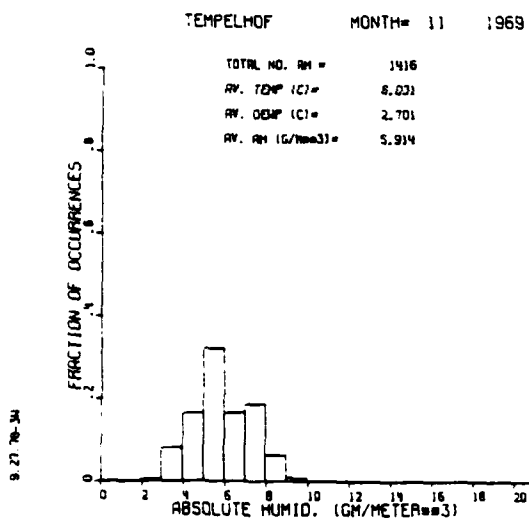
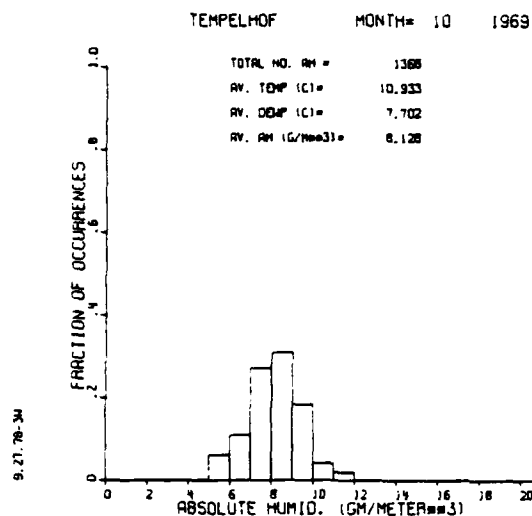
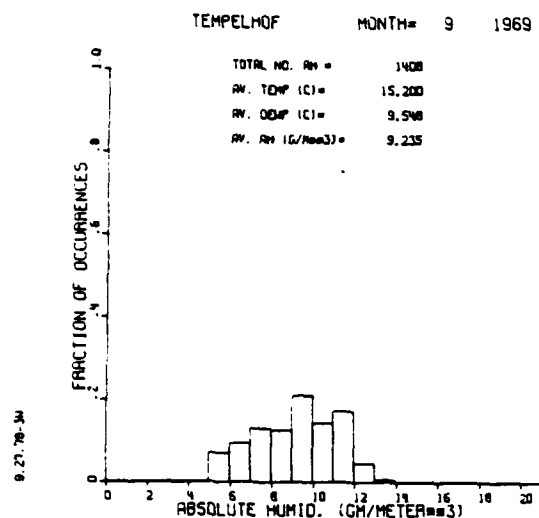
10-4-70-66

FIGURE 168. Absolute humidity statistics, Tempelhof (West Berlin), Germany, January-April 1969.



16-4-76-67

FIGURE 169. Absolute humidity statistics, Tempelhof (West Berlin), Germany, May-August 1969.



10-4-78-66

FIGURE 170. Absolute humidity statistics, Tempelhof (West Berlin), Germany, September-December 1969.

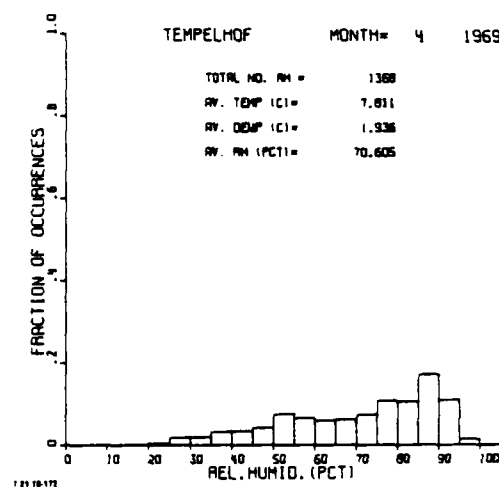
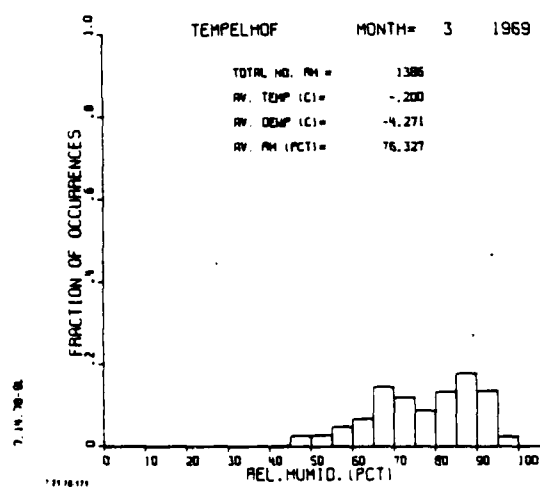
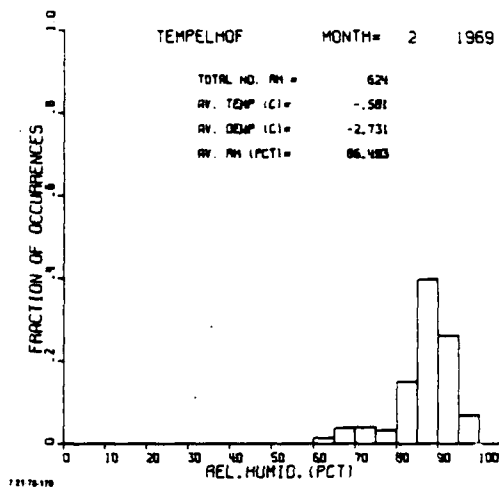
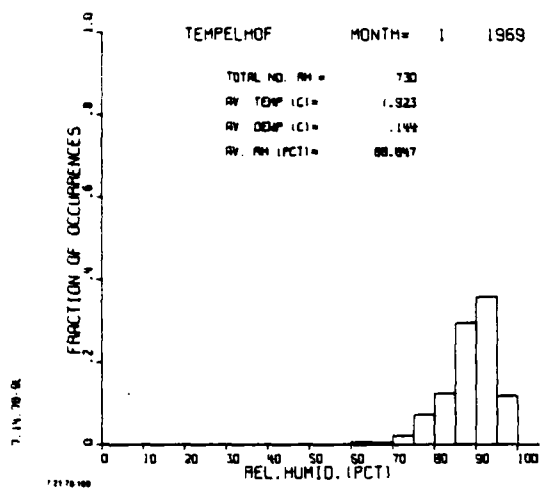


FIGURE 171. Relative humidity statistics, Tempelhof (West Berlin), Germany, January-April 1969.

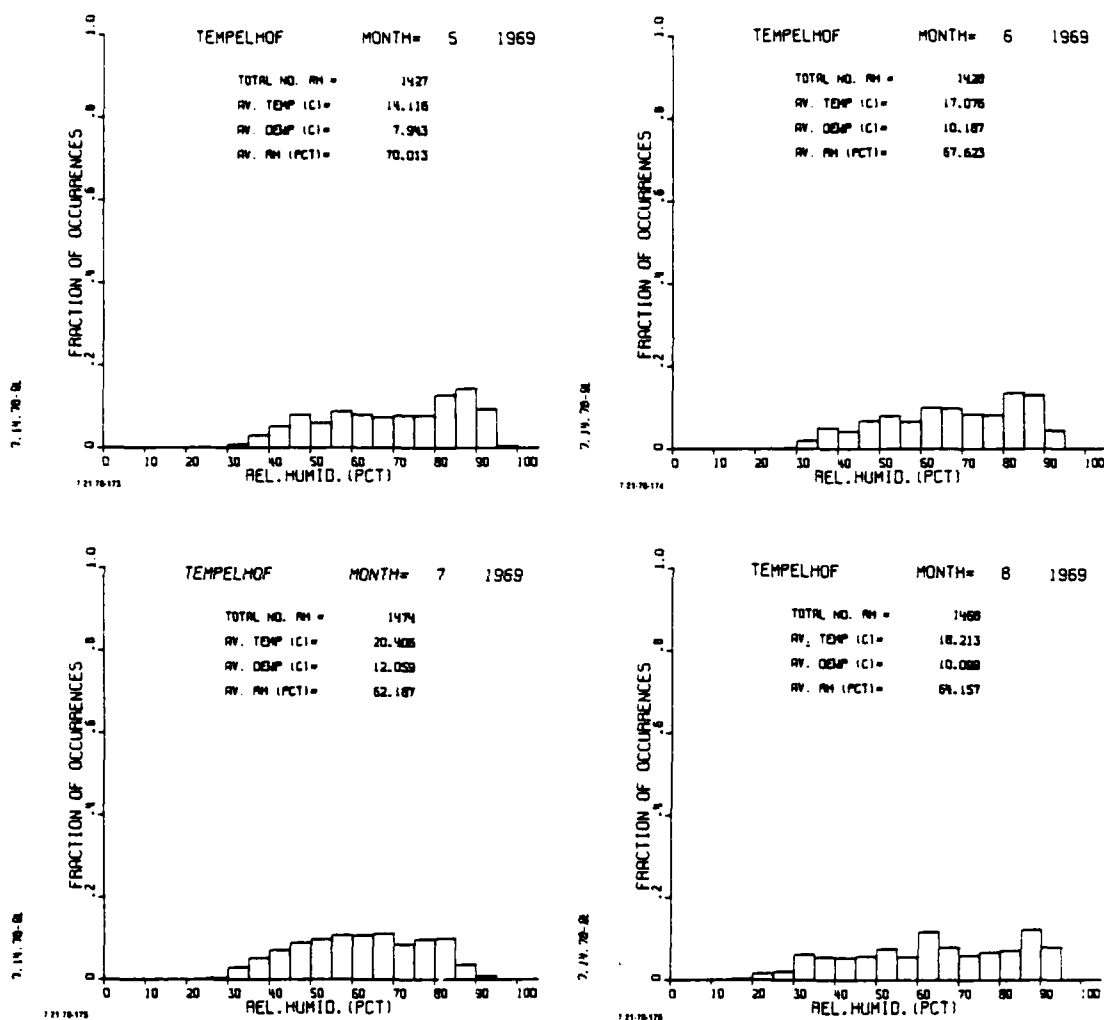


FIGURE 172. Relative humidity statistics, Tempelhof (West Berlin), Germany, May-August 1969.

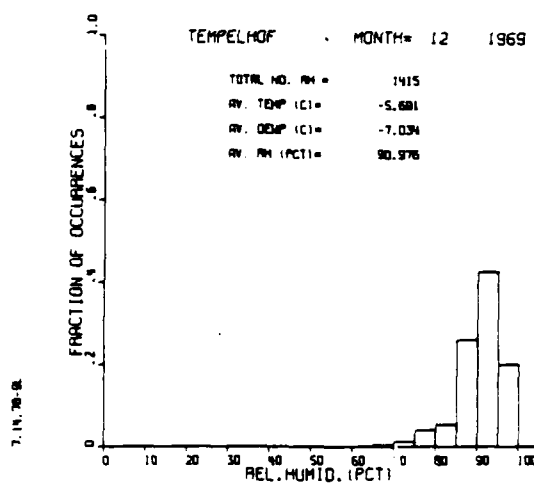
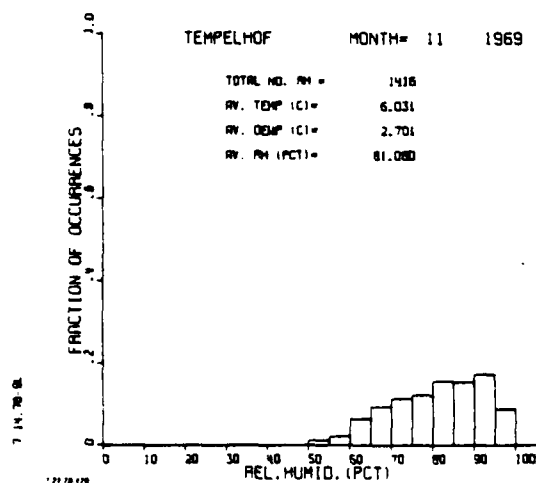
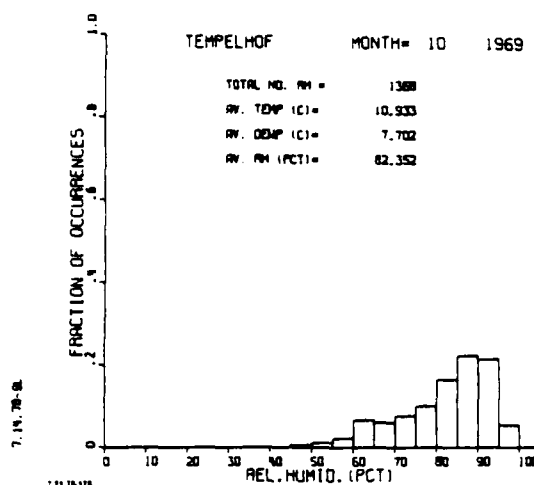
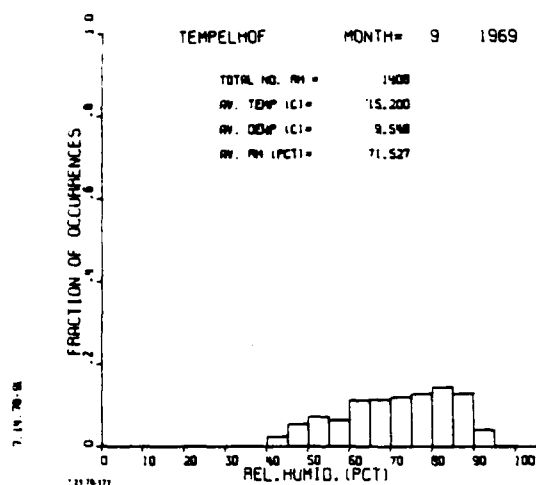


FIGURE 173. Relative humidity statistics, Tempelhof (West Berlin), Germany, September-December 1969.

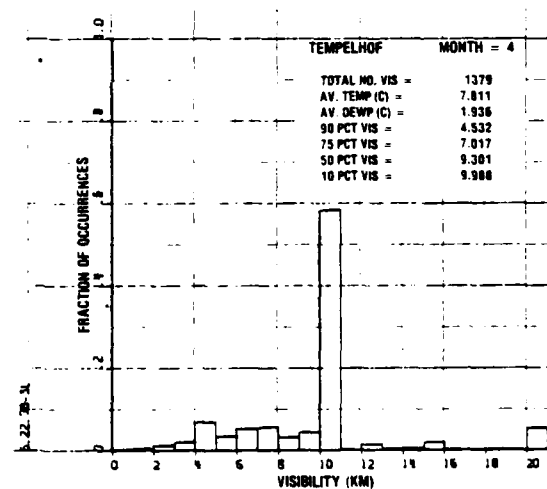
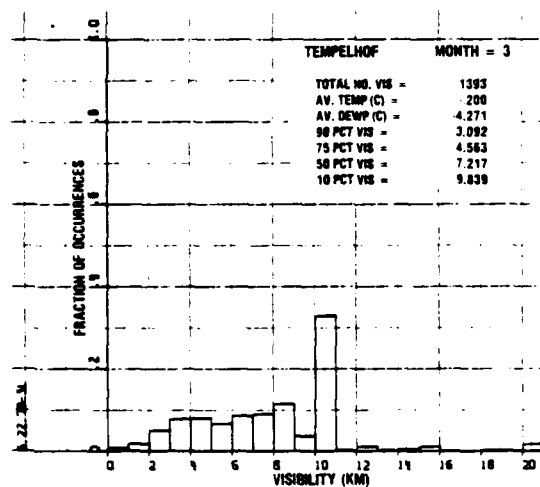
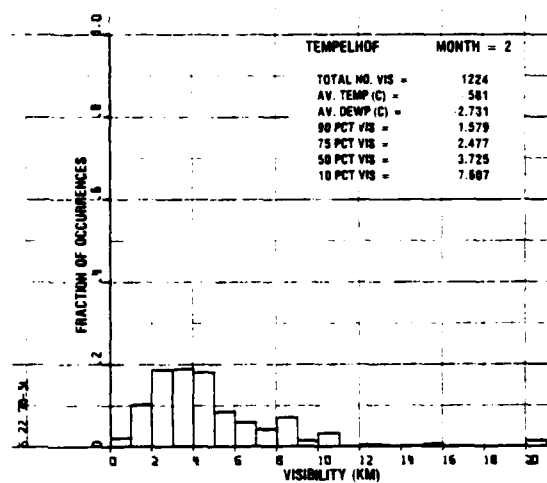
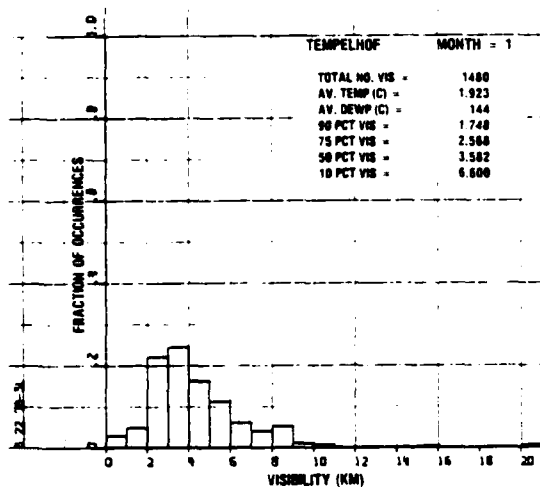


FIGURE 174. Visibility statistics, Tempelhof (West Berlin), Germany, January-April 1969.

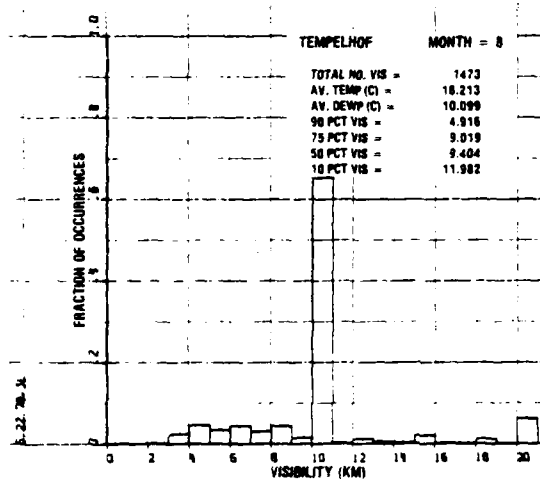
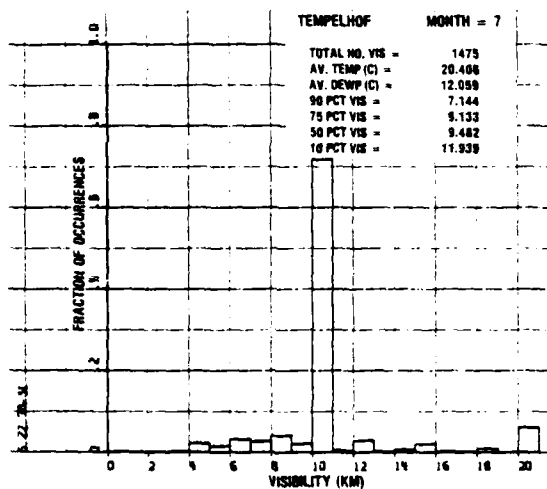
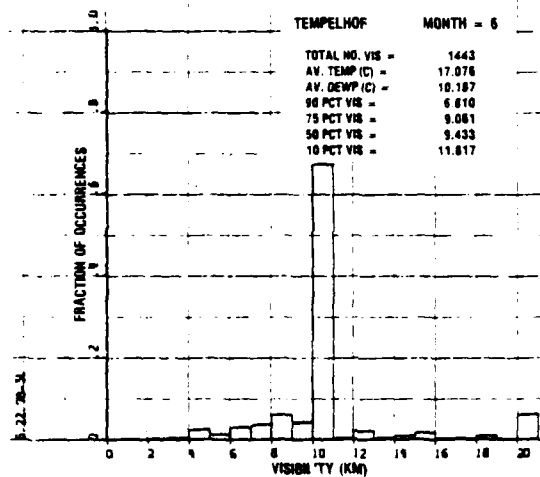
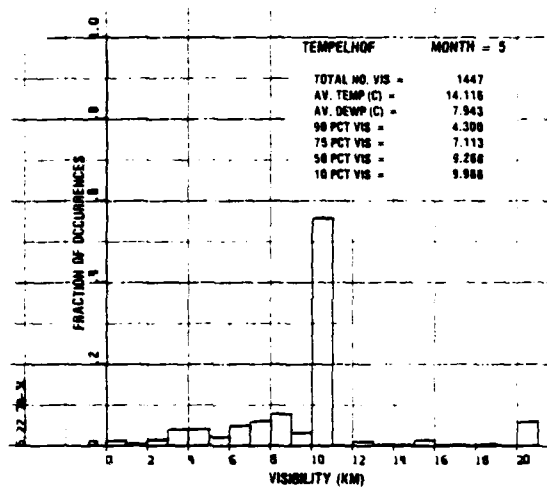
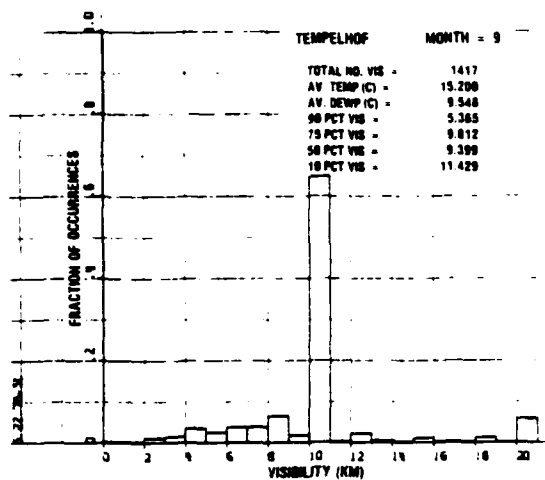
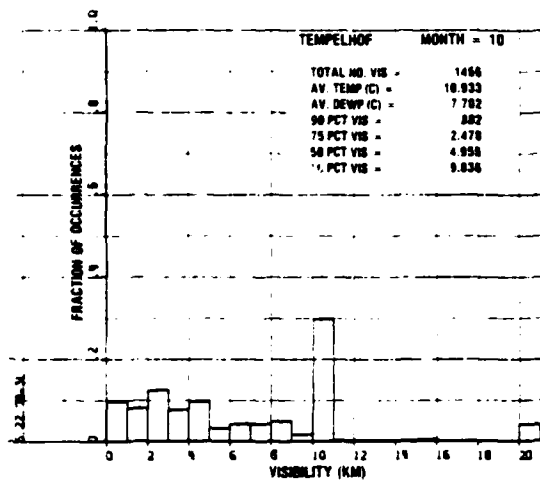


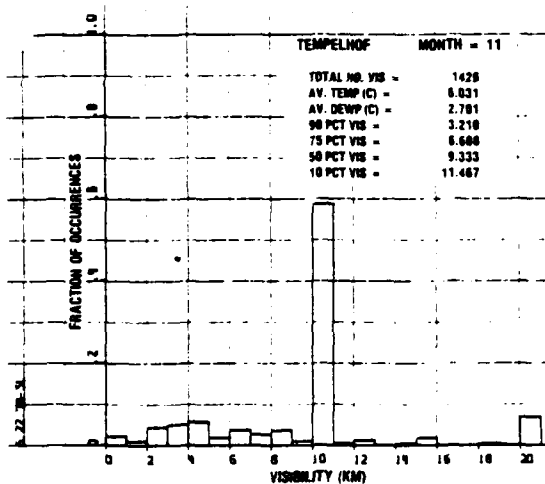
FIGURE 175. Visibility statistics, Tempelhof (West Berlin), Germany, May-August 1969.



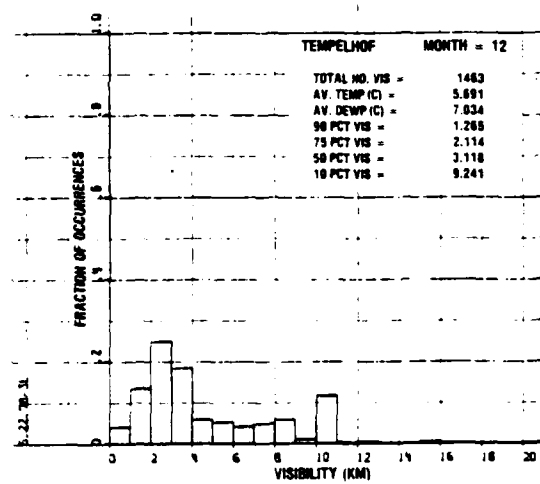
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6-20-75-100



6-20-75-101



6-20-75-100

FIGURE 176. Visibility statistics, Tempelhof (West Berlin), Germany, September-December 1969.

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