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Effects of Rain Attenuation on Satellite EHF Communications in the United States

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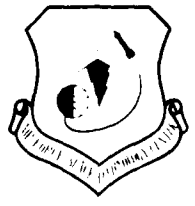

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One-minute rain rate data over a 10-year period-of-record at each of 41 locations in the contiguous U.S., and for a 6 1/2-year period-of-record at 1 location in Puerto Rico, were extracted from original weighing raingage recordings. The data were analyzed to determine monthly, seasonal, and annual rain-rate frequencies, durations, and probabilities at locations representing a large variety of climatic rainfall regimes. These analyses are particularly useful for estimating EHF (Extremely High Frequency) communication outages due to the increasing effects of attenuation caused by rain at frequencies above 10 GHz. An attenuation model was used to estimate the effects of rain attenuation at all 42 locations. Analyses of the 1-min rain rates, and outage estimates for various frequencies and propagation-path elevation angles are presented.

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Preface

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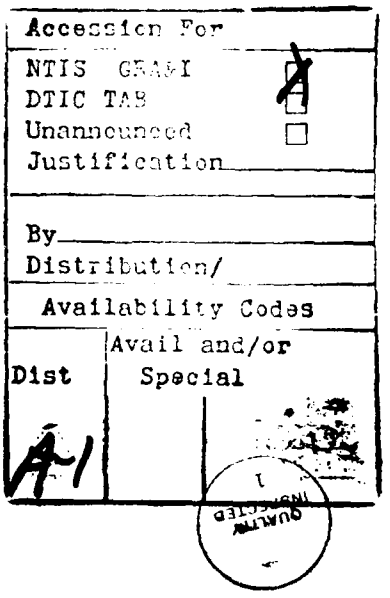

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1. INTRODUCTION

Attenuation due to rain is the major environmental cause of outages to satellite communication systems employing EHF (Extremely High Frequencies). Attenuation models have been developed to calculate the impact of rain on these systems based on rain rate distributions (for example, Crane[1]). One-minute rain rates are recognized as most practical for these path attenuation calculations, but data on 1-min rates are scarce. This has prompted the development of models for estimating 1-min rain-rate distributions (Tattelman and Scharr[2], Tattelman and Grantham[3]).

Attenuation of EHF signals can be significant at relatively low rain rates that occur with varying probabilities just about anywhere in the world. Therefore, more precise rain-rate data are required for locations representing many climatic rainfall regimes. With this in mind, Tattelman and Knight[4] describe a method for extracting and digitizing 1-min rain rates from original analog rain gage recordings. The method employs modern digitizing and filtering techniques to obtain the 1-min data

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1. Crane, R.K. (1980) Prediction of attenuation by rain, *IEEE Trans. Comm.* **COM-28** (No. 9): 1717-1733.
2. Tattelman, P. and Scharr, K.G. (1983) A model for estimating one-minute rainfall rates, *J. Clim. and Appl. Meteor.* **22** (No. 9):1575-1580.
3. Tattelman, P. and Grantham, D.D. (1985) A review of models for estimating 1-min rainfall rates for microwave attenuation calculations, *IEEE Trans. Comm.* **COM-33** (No. 4):361-372.
4. Tattelman, P. and Knight, R.W. (1988) Analyses of 1-min rain rates extracted from weighing rain gage recordings, *J. Appl. Meteorol.* **27** (No. 8):928-938.

that are ordinarily unreadable by eye. This method was used to extract the rain data analyzed in this report. Statistics on rainfall rates and outages are presented in the form of probabilities and frequencies-of-occurrence. Preliminary analyses were provided by Tattelman et al.[5]

2. DATA

Weighing rain gage recordings for approximately 300 U.S. weather stations are archived on microfiche at the National Climatic Data Center (NCDC), Asheville, North Carolina. Ten years of 1-min rain-rate data for 42 locations chosen to represent a variety of climatic rainfall regimes were analyzed for this report (rain rates for solid precipitation represent melted values). The locations, the percent of time it rained at each, and the percent of the rain data that was missing over the 10 years is provided in Table 1 (note: only 6 1/2 years of data were available at San Sebastian, PR). Missing data represent periods of rain when chart records were unavailable for digitizing. However, hourly totals were available, so it was possible to estimate the percent of total rain data that was missing at each location. This information was used to adjust the rain-rate analyses by using the correction factor

$$\text{Correction Factor} = \frac{T_{CH}}{T_{CH} - T_M}$$

where T_{CH} is the total number of clock hours of rain and T_M is the number of clock hours of rain that was missing (that is, not available for digitization). This correction factor is based on the premise that 1-min rain rates during the missing clock hours are distributed the same as the available 1-min data. This is reasonable since missing hours are associated with equipment problems and are not correlated with rain-rate intensity.

The data at all locations except Urbana were obtained from rain gage recordings stored in NCDC, and are for the period 1 January 1970 to 31 December 1979 (except San Sebastian). The data for Urbana were obtained from the Illinois State Water Survey, Champaign, Illinois as part of a USAF contract (Jones and Wendland[6]). The Urbana data cover a period of 10.25 years from 1 June 1969 to 31 August 1979. They were obtained using a high-speed weighing rain gage recorder described in the reference. The data for San Sebastian cover a total of 6 1/2 years from two time periods, 1 February 1973 to 30 September 1973 and 1 February 1974 to 30 November 1979.

3. ANALYSES OF ONE-MINUTE RATES

The analyses of 1-min rates presented here are intended primarily to assess the impact of rain on EHF satellite communications. Most previous studies of short-duration rain rates for use in attenuation models provide data in the form of annual rain-rate frequencies-of-occurrence

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5. Tattelman, P., Knight, R.W. and Scharr, K.G. (1987) *Esttmates of Satellite Communication Outages Due to Attenuation by Rain*, AFGL-TR-87-0081, ADA183969.
6. Jones, D.M.A. and Wendland, W.M. (1984) Some statistics of instantaneous precipitation, *J. Clim. and Appl. Meteorol.* **23**:1273-1285.

(Tattelman and Grantham[3]). However, annual statistics can be very misleading because occurrences of rain rates higher than critical rates (rain rates that would cause an outage) are concentrated in only a few months of the year at most locations. A low annual frequency-of-occurrence of rain outages can be intolerably high in these months. Although annual rain-rate frequencies-of-occurrence are presented for each location studied, monthly or seasonal rain-rate statistics are preferable for assessing the impact of attenuation caused by rain.

3.1 Rain-Rate Duration Frequencies-of-Occurrence

The annual average number of occurrences versus rain rate for six duration times are provided for each location in Figure 1. Rain rates are equalled or exceeded during each minute of the specified duration. Actual annual average occurrences are plotted for every 0.05 mm/min rate up to 1.00 mm/min and for every 0.10 mm/min thereafter. Values plotted for an occurrence of 10^{-2} represent the highest rate that was equalled or exceeded for the specified duration.

Monthly average number of occurrences vs. rain rate for six different duration times are provided for the worst (most extreme) month at each location in Figure 2. Values are plotted in the same manner as Figure 1. The worst month at each location was chosen from all the monthly plots to generally represent the highest number of occurrences of rain rates for all durations. Occurrences for some rates and durations may be higher in other months, but showing all these would add to an already large number of plots. (In Section 3.2, data on rain-rate probabilities are provided for up to 3 most-extreme months). Figure 3 shows average occurrences of 1-min rates for mid-season months to provide an appreciation of seasonal variations.

3.2 Rain-Rate Duration Probabilities

For many design considerations it is more practical to express the likelihood of events in terms of their probability. The Poisson distribution is an appropriate tool for quantifying random events, such as rainfall occurrences, if the events in any time interval are statistically independent of events in another time interval. In this case, rain events of 5-, 10-, 15-, 20-, and 30-min durations have been chosen and the time interval is a specified month of the year (for example July). Since these rain events are independent from year-to-year, the probability, P, of y rain events in a month can be calculated using the Poisson equation

$$P(y) = \frac{e^{-\lambda}\ \lambda y}{y!} \tag{1}$$

where λ is the mean number of events per month. Therefore, the probability of <u>at least</u> y occurrences of an event is

$$P(\text{at least } y) = 1 - \sum_{z=0}^{y-1} P(z). \tag{2}$$

One-min rainfall rate vs. duration and the probability of at least one occurrence during the worst months (up to 3) are provided in Table 2, and for all months at Boston and New Orleans in Table 3 (these 2 locations were chosen for more detailed analysis of monthly variations of rain rates and

outages). Rates corresponding to the probability of at least three occurrences during the worst months are provided for all locations in Table 4, and for all months at Boston and New Orleans in Table 5. The worst months were chosen to represent the highest rain rates for each probability and duration. The 0.1 and 0.9 probabilities in the tables can be used to evaluate the variability of rain rates over the 10-year period. Figure 4 shows an analysis of rain rates for a 5-min duration with a 0.1 probability of at least 3 occurrences during the worst month. An examination of Tables 2 and 4 reveals some interesting, but not surprising, geographical rainfall characteristics. At the 0.1 probability level in Table 2, the highest rain rates occur at continental locations where relatively infrequent, but very intense thunderstorms occur. For example, Newark and Chicago have the highest rates for the 5-min duration (probability of at least one occurrence). For longer duration events, Asheville, Topeka and Oklahoma City have some of the highest rain rates. In general, as we go to higher probability events in Table 2, the highest rates shift to the more tropical or semi-tropical locations, such as San Sebastian, New Orleans, Miami, and Tallahassee. This is also true as we shift upward to the longer duration events. In Table 4, which provides rates corresponding to a probability of at least 3 occurrences, highest intensities for all event probabilities are at San Sebastian and locations in the southeastern U.S. (for example, see Figure 4)

Tables 3 and 5 indicate that the highest rates at Boston and New Orleans occur during the summer months when convective activity is most intense. Variation between warm and cold season months is much greater at Boston than New Orleans. It is interesting to note, however, that as we go to higher rain event probabilities and increasing event durations at Boston, the monthly variations decrease. The monthly variations become quite small for an event duration of 20 min, event probability 0.9, and at an event duration of 30 min, event probability 0.9, the rates are slightly higher during the winter months than the summer months. This is due to the more prolonged nature of winter rain events.

Table 6 presents the longest duration at or above specified threshold rain rates and the month of the year that it occurred (San Sebastian is not included). Since these are the most extreme occurrences in 10 years (10.25 years at Urbana) the probability that they would occur in that month in any one year is approximately 0.1.

4. OUTAGE ESTIMATES

Ordinarily, attenuation models are used to determine path attenuation given the point rain rate. For this exercise, we reversed the order of calculation by determining critical rain rates that would cause an outage for a specified total path attenuation of 15 dB at 15, 30, and 45 GHz. The USAF Environmental Technical Applications Center (USAFETAC), Systems Support Section, provided critical rain rates based on the model developed by Crane.[1] Path length through the rain was determined using long-term average monthly freezing levels derived by USAFETAC. Attenuation due to ice and snow above the freezing level is minimal.

Table 7 specifies the critical rain rates during the worst months for the indicated path elevation angles at each location. The propagation path length through the rain was determined using mean monthly freezing levels above the ground (provided in the table). Rain intensities are generally highest during the summer months when freezing levels are also at their highest; thus, the number of

outages is greatest during these months. The highest critical rain rates are at locations with the lowest freezing levels above the ground (other factors being equal). Freezing levels generally decrease with increasing latitude and station elevation.

Tables 8, 9 and 10 provide critical rates causing an outage during all months at Boston and New Orleans (based on frequencies of 15, 30 and 45 GHz) for fade margins of 15 dB, 20 dB, and 25 dB, respectively. These sites were chosen for more detailed study of monthly variability of rain-rate intensity and outages. New Orleans has one of the heaviest rainfall regimes of all the locations studied, and rain intensities are quite high during all the mid-season months (see Figure 3). Boston has large seasonal variations in rainfall intensities (Figure 3) despite the fact that monthly average rainfall varies very little during the year. An examination of Tables 8 through 10 shows much higher critical rain rates during the winter months at Boston due to the lower freezing levels. At New Orleans, freezing levels remain relatively high during the winter months, so the variation in critical rates is not nearly as great as at Boston. These climatic factors have some very interesting impacts on outages that will be discussed later.

4.1 Outage Occurrences

The mean percent of time in the worst months with system outages due to rain is provided in Table 11. The mean percent of time with system outages due to rain for all months at Boston and New Orleans is provided in Tables 12 and 13, respectively. Values were estimated using the rain-rate data at each location and the critical rain rates in Tables 7 through 10.

An examination of Table 11 indicates that outages due to rain at 15 GHz occur most frequently at San Sebastian and locations along coastal areas of the southeastern U.S., such as New Orleans, Tallahassee, Miami, and Charleston. It takes a fairly high rain rate to cause an outage at 15 GHz, so attenuation outages are most common where very heavy convective rains are most frequent. At 30 GHz, critical rain rates are much lower and attenuation outages are much more frequent. At a 10° elevation angle, outages are most frequent at locations with the most moderate to heavy convective rain; thus, the percentage of the time it rains becomes an increasingly important factor. At higher elevation angles, outages are again most prevalent at locations with the heaviest convective rain. At 45 GHz outages are most frequent where the percentage of time that it rains is greatest, but as we move to higher elevation angles the intensity of the rainfall regime becomes increasingly important. A good example is the data for Seattle. At 45 GHz and an elevation angle of 10°, only a few locations exceed the mean percent of time with attenuation outages of 4.71 percent. At an elevation angle of 70°, the outage time falls to 0.02 percent, one of the lowest.

It is important to reiterate that the worst months are defined as those with the highest observed rain-rates, not the months with the most frequent attenuation outages. This difference leads to some interesting and informative results in Table 11. The month with the heaviest rain-rate regime may not produce the most attenuation outage time due to the importance of the freezing level and, hence, the length of the propagation path. A good example is the data for Tallahassee. In Table 2, the 0.1 probability rain rates in November equal or exceed those in August. However, in Table 11 all the outage times are much greater in August due primarily to the higher freezing level in that month. At all locations, at least one of the worst months represents the month with the most frequent outages.

Table 12 shows that outages due to rain at Boston occur predominantly during the summer or early fall. Most mid-latitude locations can expect outages to be similarly confined to about 3 to 5 months of the year. At New Orleans, Table 13 shows that, although outages are most frequent from late spring to early fall, relative differences between winter and summer months are much smaller than Boston. At 45 GHz for a 10° elevation angle, critical rates are so low that the rainiest month of the year (January) has the highest percent of time with attenuation outages.

4.2 Outage Durations

An examination of Tables 11 through 13 reveals that outages due to rain are relatively infrequent on a percentage of time basis. At 45 GHz, availabilities are at least 94.3 percent at all locations studied. This increases to 96.3 percent at 30 GHz and 99.5 percent at 15 GHz. To put the true impact of rain attenuation into perspective, it should be noted that each minute of rain is not randomly distributed in a month. When it is raining hard enough to cause an outage, it is likely to persist for a period of time. The duration of precipitation events causing outages deserves special attention for EHF satellite communications.

Tables 14, 15, and 16 provide the mean number of system outages due to rain with durations of at least 5, 10, 20 and 30 min in the worst months at all locations for frequencies of 15, 30, and 45 GHz, respectively (based on a fade margin of 15 dB). Tables 17, 18 and 19 provide outage estimates for all months at Boston for frequencies of 15, 30, and 45 GHz, respectively (based on fade margins of 15, 20, and 25 dB). Tables 20, 21 and 22 provide outage estimates for New Orleans. As noted earlier, worst months reflect the highest rainfall rates. However, at least one of the worst months at each location generally represents the month with the most frequent outages.

An examination of Tables 14, 15, and 16 reveals the large number of attenuation outages for extended periods that can be expected at most locations. The number of outages increases markedly with increasing radio frequency and decreasing elevation angle. Tables 17, 18, and 19 show the seasonal nature of outages at Boston, with a peak in August. Although outages are minimal at 15 GHz (Table 17), they are very substantial, especially at a 10° elevation angle, at 30 and 45 GHz (Tables 18 and 19). Tables 21, and 22 show the extensive quantity of outages throughout the year at New Orleans, even at a 25 dB fade margin. At 15 GHz, the number of outages at New Orleans is considerably less (Table 20).

4.3 Outage Probabilities

Tables 23, 24, and 25 provide probabilities of at least 3 system outage events of 10-, 20-, and 30-min duration during the worst months for radio frequencies of 15, 30, and 45 GHz. At 15 GHz, the probability of a 30-min outage is minimal at all locations, but increases rapidly with decreasing outage duration and decreasing elevation angle (Table 23). At 30 and 45 GHz, the probability of 3 outages is quite high at all but the driest locations (Table 24 and 25). The profound influence of the elevation angle on the probability of an outage is most evident at 15 and 30 GHz. At 45 GHz, most locations retain a high probability of 3 outages even at a 70° elevation angle.

The probability of at least 3 attenuation outages for all months at Boston is provided in Tables 26, 27, and 28. Outages are minimal at 15 GHz (Table 26). At 30 GHz, the clustering of higher

probabilities during the summer months is readily apparent (Table 27). At 45 GHz there is a substantial spreading of high probabilities into the winter months at an elevation angle of 10°.

The probability of at least 3 attenuation outages for all months at New Orleans is provided in Tables 29, 30, and 31. At 15 GHz (Table 29), highest probabilities are centered in August and decrease rapidly with increasing elevation and increasing event duration. At 30 GHz (Table 30) probabilities remain quite high at all elevation angles for a 10-min event duration and gradually decrease with increasing event duration and elevation angle. At 45 GHz (Table 31), probabilities are high at all event durations, fade margins and elevation angles, especially during the summer months.

5. CONCLUSIONS

Analyses of 1-min rain data are presented for 42 U.S. locations. These are used to estimate outage occurrences, durations, and probabilities based on critical rain rates that cause an outage. The critical rain rates used in this study were determined using an attenuation model developed by Crane.[1] Outage estimates were determined for the worst month at all locations, and for all months at Boston and New Orleans. Results are provided for propagation path elevation angles of 10°, 30°, 50°, and 70° and radio frequencies of 15, 30, and 45 GHz (based on a fade margin of 15 db at all locations, and fade margins of 15, 20, and 25 dB at Boston and New Orleans).

This study shows the profound influence of propagation path elevation angle on the quantity and duration of outages. Low elevation angles greatly increase the path length through the rain with outages resulting at rain (or drizzle) rates as low as 0.001 mm/min (at 45 GHz) at some locations. Total path attenuation is also greatly influenced by the height of the freezing level, above which the attenuation from ice and snow is negligible. Rain rates and freezing levels are generally much lower during the winter months, thereby minimizing the likelihood of an outage. Design of satellite EHF communications should be based on conditions during the month of the year when the probability and duration of outages is greatest. This is usually a summer month when rain rates and freezing levels are usually highest. Annual statistics that include the very low outage-probability winter months conceal the real impact of rain attenuation on operations.

The data presented in this study and the conclusions above can be used to develop a general strategy for minimizing the impact of attenuation due to rain. Since rain attenuation is minimal at most middle and northern latitude locations during the coldest half of the year, a satellite should be positioned to keep propagation path elevation angles highest in the subtropics and tropics.

During the summer months when attenuation due to rain at mid and high latitudes is generally greatest, a switch to lower frequencies and/or higher power levels may be needed to increase system availability. Rain outages during the summer months are least likely at dry locations in the western U.S., high altitude locations where freezing levels are lowest (generally in or around the Rocky Mountain states), or along the Pacific coast. Therefore, a satellite should be positioned to keep propagation paths highest in the eastern U. S.

The new rain-rate data analyzed for this report enabled a more detailed assessment of the probabilities and durations of satellite EHF communication outages due to attenuation by rain than has previously been available. Although only 42 locations were studied, they represent a variety of climatic regimes. The results at one location may provide a reasonable indication of rain-event

characteristics at another location with similar climatic rainfall regimes. Further study of rainfall attenuation is planned at AFGL to determine spatial correlations and ultimately an empirical model that can be used to estimate outages at most locations in the world.

References

1. Crane, R.K. (1980) Prediction of attenuation by rain, *IEEE Trans. Comm.* **COM-28** (No. 9): 1717-1733.
2. Tattelman, P. and Scharr, K.G. (1983) A model for estimating one-minute rainfall rates, *J. Clim. and Appl. Meteor.* **22** (No. 9):1575-1580.
3. Tattelman, P. and Grantham, D.D. (1985) A review of models for estimating 1-min rainfall rates for microwave attenuation calculations, *IEEE Trans. Comm.* **COM-33** (No. 4):361-372.
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6. Jones, D.M.A. and Wendland, W.M. (1984) Some statistics of instantaneous precipitation, *J. Clim. and Appl. Meteorol.* **23**:1273-1285.

Table 1. Locations for which 1-min rain rate data were studied. The percent of time it rained, and the percent of the rain data that were missing is provided.

Location	Elevation (m)	Percent of Time it Rains Jan	Apr	Jul	Oct	Ann	Percent of Rain Data Missing
Aberdeen, SD	395	2.0	5.0	2.1	3.2	2.9	1.1
Albuquerque, NM	1619	1.9	0.9	1.9	2.0	1.5	1.6
Allentown, PA	118	9.5	6.6	4.0	5.9	6.8	1.4
Asheville, NC	652	7.2	4.4	4.1	5.6	5.9	2.1
Bakersfield, CA	145	2.1	1.2	<.1	0.6	1.4	2.0
Billings, MT	1087	5.4	6.4	1.6	4.4	4.0	1.9
Boise, ID	865	6.8	3.3	0.8	2.8	3.2	2.2
Boston, MA	5	8.7	6.6	3.1	5.4	6.3	2.0
Cape Hatteras, NC	2	6.4	3.5	4.3	4.9	5.0	3.1
Charleston, SC	12	6.1	2.7	4.1	2.4	4.3	2.8
Cheyenne, WY	1867	1.6	4.2	2.3	2.1	2.6	10.8
Chicago, IL	185	6.0	6.6	2.8	4.5	5.2	6.8
Denver, CO	1610	1.7	4.6	1.9	2.6	2.8	2.7
Ely, NV	1906	2.2	3.3	1.6	2.6	2.3	13.7
Grand Junction, CO	1475	2.8	2.1	0.8	2.2	1.8	2.6
Houston, TX	29	6.3	3.3	2.5	3.3	3.7	3.3
Huntsville, AL	190	8.1	4.5	3.3	4.0	5.0	2.2
Internat'l Falls,MN	359	4.1	4.3	3.8	5.0	4.3	2.2
Key West, FL	3	1.8	1.0	2.6	2.8	2.3	3.7
Lexington, KY	294	9.4	6.9	4.2	5.7	6.4	7.3
Miami, FL	2	1.9	1.6	3.3	3.9	3.1	2.9
Newark, NJ	2	8.8	5.7	3.6	5.2	6.1	2.9
New Orleans, LA	1	5.8	3.3	4.5	2.2	4.1	2.2
New York, NY	4	8.0	6.1	3.1	5.0	5.9	5.1
Oklahoma City, OK	1285	2.3	3.1	2.5	3.9	3.0	7.7
Omaha, NE	300	2.8	5.4	2.8	4.2	3.7	11.7
Philadelphia, PA	2	8.7	6.3	3.3	5.2	5.7	3.8
Phoenix, AZ	340	1.5	0.4	0.6	1.6	1.0	6.0
Pittsburg, PA	228	8.6	5.4	3.6	5.5	5.6	7.8

Table 1. Locations for which 1-min rain rate data were studied. The percent of time it rained, and the percent of the rain data that were missing is provided. (Cont.)

Raleigh, NC	132	7.1	4.1	3.6	4.5	5.0	1.5
Rapid City, SD	965	2.1	5.8	2.6	2.6	3.0	6.2
San Angelo, TX	580	1.6	1.8	1.6	3.0	1.9	3.2
St. Louis, MO	163	5.0	4.8	2.4	3.7	4.3	3.6
San Sebastian, PR	260	0.9	1.6	1.5	2.0	1.8	0.0
Santa Maria, CA	72	4.2	1.4	<.1	0.8	1.8	1.2
Seattle, WA	120	14.0	6.5	2.3	7.3	8.1	2.3
Shreveport, LA	77	7.4	3.7	3.3	3.5	3.9	3.3
Spokane, WA	718	8.5	3.2	1.4	2.7	4.4	2.0
Tallahassee, FL	17	6.7	3.0	5.2	2.5	4.3	1.3
Topeka, KS	267	3.0	4.7	2.8	4.0	3.8	6.3
Urbana, IL	175	4.7	4.1	2.7	3.6	4.1	1.2*
Yuma, AZ	59	1.0	0.2	0.1	0.7	0.4	13.8

*This value represents percent of full operational time.

Table 2. One-min rainfall rate vs. duration and probability of at least 1 occurrence during the worst months.

Location	Worst Month(s)	Rainfall Rate (mm/min) Duration (min) 5 Probability			10 Probability			15 Probability			20 Probability			30 Probability		
		0.1	0.5	0.9	0.1	0.5	0.9	0.1	0.5	0.9	0.1	0.5	0.9	0.1	0.5	0.9
Aberdeen, SD	JUN	1.44	1.01	0.66	1.19	0.68	0.39	1.18	0.52	0.26	0.93	0.38	0.16	0.74	0.18	0.09
Aberdeen, SD	JUL	1.49	0.98	0.59	1.08	0.58	0.35	0.70	0.50	0.20	0.60	0.35	0.14	0.45	0.22	0.09
Albuquerque, NM	AUG	1.38	0.75	0.50	0.98	0.45	0.20	0.57	0.28	0.10	0.52	0.20	0.08	0.22	0.09	0.05
Allentown, PA	JUL	1.54	1.13	0.73	1.47	0.75	0.39	1.27	0.50	0.25	0.94	0.32	0.18	0.79	0.22	0.12
Allentown, PA	AUG	1.14	0.90	0.69	0.99	0.62	0.44	0.84	0.50	0.29	0.79	0.40	0.21	0.64	0.23	0.14
Asheville, NC	JUL	1.64	1.21	0.73	1.30	0.78	0.45	1.19	0.60	0.30	1.18	0.46	0.21	0.52	0.28	0.13
Asheville, NC	SEP	2.39	1.02	0.54	2.16	0.58	0.34	0.95	0.39	0.25	0.72	0.34	0.20	0.45	0.28	0.14
Bakersfield, CA	MAR	0.30	0.16	0.10	0.20	0.12	0.09	0.17	0.10	0.08	0.15	0.09	0.07	0.10	0.08	0.05
Bakersfield, CA	MAY	0.60	0.33	0.13	0.50	0.19	0.05	0.50	0.11	0.04	0.44	0.07	0.04	0.25	0.05	0.03
Billings, MT	JUL	0.89	0.51	0.23	0.59	0.30	0.11	0.44	0.17	0.08	0.39	0.13	0.06	0.34	0.09	0.04
Boise, ID	SEP	0.72	0.30	0.13	0.67	0.14	0.09	0.40	0.12	0.07	0.40	0.09	0.05	0.25	0.10	0.04
Boston, MA	AUG	1.19	0.86	0.48	0.90	0.47	0.26	0.60	0.33	0.16	0.36	0.22	0.13	0.30	0.15	0.09
Cape Hatteras, NC	SEP	1.70	1.14	0.84	1.30	0.82	0.59	1.00	0.66	0.42	0.95	0.53	0.33	0.65	0.36	0.18
Charleston, SC	JUN	2.09	1.62	1.06	1.66	1.01	0.64	1.29	0.91	0.45	1.29	0.62	0.34	1.08	0.38	0.19
Cheyenne, WY	JUL	1.14	0.79	0.47	0.75	0.48	0.24	0.75	0.31	0.15	0.50	0.19	0.11	0.30	0.10	0.06
Cheyenne, WY	SEP	1.75	0.56	0.16	0.75	0.21	0.09	0.70	0.16	0.08	0.68	0.10	0.06	0.62	0.07	0.04
Chicago, IL	JUL	2.50	1.37	0.71	1.80	0.85	0.42	1.04	0.60	0.29	0.75	0.39	0.24	0.57	0.27	0.11
Chicago, IL	AUG	1.60	1.24	0.86	1.39	0.71	0.44	0.85	0.48	0.29	0.67	0.38	0.23	0.47	0.25	0.12
Denver, CO	AUG	1.49	0.73	0.38	1.18	0.38	0.22	0.64	0.28	0.13	0.44	0.22	0.09	0.29	0.12	0.07
Ely, NV	AUG	1.19	0.41	0.16	0.47	0.19	0.09	0.40	0.12	0.07	0.35	0.09	0.05	0.15	0.07	0.04
Grand Junction, CO	JUL	1.39	0.37	0.10	0.97	0.10	0.06	0.92	0.08	0.04	0.34	0.06	0.04	0.15	0.04	0.03
Houston, TX	MAY	2.47	1.15	0.86	1.88	0.85	0.57	1.00	0.60	0.38	0.94	0.48	0.28	0.60	0.35	0.18
Houston, TX	JUN	1.60	1.32	0.97	1.49	0.96	0.59	1.00	0.65	0.41	0.89	0.57	0.29	0.89	0.36	0.15
Huntsville, AL	MAY	2.37	1.45	0.82	1.40	0.85	0.42	1.04	0.52	0.27	0.85	0.33	0.17	0.42	0.20	0.11
Huntsville, AL	JUL	1.50	1.34	0.93	1.29	0.88	0.57	1.29	0.66	0.41	0.89	0.48	0.30	0.84	0.28	0.14
Internat'l Falls, MN	JUL	1.78	0.97	0.65	0.99	0.72	0.32	0.99	0.56	0.18	0.84	0.34	0.14	0.64	0.15	0.09
Internat'l Falls, MN	SEP	1.79	0.81	0.50	1.57	0.56	0.32	1.17	0.43	0.23	0.97	0.32	0.16	0.68	0.22	0.09
Key West, FL	JUL	2.30	1.32	0.80	1.40	0.72	0.48	0.85	0.48	0.30	0.66	0.34	0.20	0.50	0.22	0.09
Key West, FL	AUG	1.70	1.50	1.03	1.59	1.00	0.59	1.01	0.68	0.40	1.00	0.52	0.24	0.79	0.31	0.10
Lexington, KY	JUN	1.49	1.13	0.77	1.24	0.81	0.38	1.20	0.58	0.23	0.99	0.34	0.15	0.99	0.14	0.10
Lexington, KY	JUL	1.74	1.24	0.94	1.39	0.92	0.58	1.39	0.67	0.44	0.95	0.57	0.33	0.54	0.41	0.18
Miami, FL	JUN	2.49	1.82	1.19	1.99	1.11	0.74	1.39	0.82	0.45	1.38	0.66	0.35	0.94	0.42	0.18
Newark, NJ	AUG	2.56	1.48	0.77	2.09	0.64	0.36	1.29	0.41	0.25	0.79	0.34	0.17	0.35	0.19	0.10
New Orleans, LA	JUL	2.49	1.71	0.96	1.99	1.13	0.63	1.49	0.68	0.43	1.47	0.46	0.30	1.26	0.28	0.16
New Orleans, LA	AUG	2.38	1.78	1.23	1.76	1.32	0.73	1.64	0.87	0.50	1.54	0.71	0.37	1.45	0.36	0.19
NYC (Kennedy), NY	JUN	2.00	0.92	0.50	1.19	0.48	0.30	0.80	0.37	0.20	0.80	0.24	0.15	0.45	0.16	0.10
NYC (Kennedy), NY	AUG	1.45	1.09	0.59	1.10	0.59	0.31	0.75	0.33	0.20	0.75	0.29	0.14	0.27	0.17	0.09

Table 2. One-min rainfall rate vs. duration and probability of at least 1 occurrence during the worst months. (Cont.)

Location	Worst Month(s)	Rainfall Rate (mm/min) Duration (min) 5 Probability			10 Probability			15 Probability			20 Probability			30 Probability		
		0.1	0.5	0.9	0.1	0.5	0.9	0.1	0.5	0.9	0.1	0.5	0.9	0.1	0.5	0.9
Oklahoma City, OK	MAY	1.91	1.09	0.84	1.07	0.82	0.55	0.91	0.62	0.41	0.86	0.56	0.30	0.51	0.40	0.20
Oklahoma City, OK	JUN	2.49	1.22	0.80	1.87	0.86	0.51	1.87	0.61	0.36	0.90	0.54	0.25	0.69	0.36	0.15
Omaha, NE	JUL	1.60	1.09	0.68	1.00	0.69	0.39	0.90	0.45	0.24	0.65	0.39	0.15	0.65	0.20	0.09
Omaha, NE	AUG	1.60	1.05	0.66	1.10	0.62	0.34	0.66	0.52	0.22	0.60	0.38	0.16	0.40	0.16	0.10
Philadelphia, PA	JUN	1.99	0.93	0.68	0.90	0.66	0.37	0.70	0.41	0.25	0.69	0.29	0.18	0.45	0.18	0.10
Philadelphia, PA	JUL	1.30	0.96	0.63	1.09	0.59	0.36	1.08	0.41	0.24	0.64	0.29	0.20	0.39	0.18	0.12
Philadelphia, PA	AUG	1.49	0.97	0.67	0.77	0.61	0.41	0.65	0.41	0.27	0.47	0.33	0.20	0.40	0.21	0.11
Phoenix, AZ	JUL	1.68	0.36	0.25	0.35	0.21	0.10	0.30	0.12	0.05	0.20	0.08	0.04	0.15	0.05	0.02
Phoenix, AZ	AUG	1.49	0.54	0.25	1.09	0.22	0.09	0.50	0.16	0.06	0.49	0.09	0.05	0.20	0.05	0.03
Pittsburgh, PA	JUL	1.80	1.02	0.59	0.99	0.52	0.28	0.98	0.29	0.16	0.74	0.20	0.12	0.35	0.14	0.09
Raleigh, NC	JUN	1.88	1.10	0.65	1.14	0.71	0.39	1.09	0.50	0.31	0.94	0.34	0.21	0.78	0.25	0.11
Raleigh, NC	JUL	1.39	0.93	0.64	0.94	0.60	0.42	0.79	0.50	0.28	0.79	0.30	0.20	0.49	0.23	0.11
Raleigh, NC	AUG	2.21	0.86	0.62	0.85	0.65	0.37	0.75	0.50	0.29	0.69	0.34	0.21	0.54	0.20	0.12
Rapid City, SD	JUN	1.30	0.77	0.50	0.75	0.49	0.24	0.65	0.29	0.18	0.60	0.20	0.14	0.25	0.16	0.11
Rapid City, SD	JUL	2.37	0.86	0.51	1.00	0.51	0.19	0.80	0.22	0.13	0.55	0.15	0.09	0.17	0.10	0.05
St. Louis, MO	JUN	1.69	0.87	0.64	1.28	0.56	0.33	0.70	0.40	0.22	0.55	0.30	0.15	0.28	0.17	0.09
St. Louis, MO	JUL	1.80	1.12	0.64	1.48	0.56	0.31	0.79	0.38	0.19	0.55	0.23	0.09	0.37	0.10	0.05
San Angelo, TX	MAY	1.97	0.96	0.65	0.99	0.65	0.27	0.77	0.38	0.14	0.64	0.26	0.12	0.34	0.12	0.08
San Sebastian, PR	SEP	2.41	1.93	1.30	1.91	1.40	0.80	1.41	0.98	0.61	1.31	0.76	0.45	0.91	0.45	0.26
San Sebastian, PR	OCT	1.72	1.28	0.98	1.32	0.97	0.68	1.12	0.77	0.57	1.02	0.67	0.44	0.96	0.49	0.25
Santa Maria, CA	JAN	0.78	0.32	0.22	0.54	0.22	0.15	0.24	0.17	0.13	0.22	0.15	0.11	0.20	0.12	0.09
Santa Maria, CA	DEC	0.57	0.38	0.26	0.44	0.27	0.18	0.39	0.19	0.14	0.30	0.18	0.12	0.20	0.13	0.09
Seattle, WA	AUG	0.51	0.23	0.14	0.30	0.14	0.10	0.16	0.12	0.09	0.12	0.10	0.08	0.11	0.09	0.06
Seattle, WA	SEP	0.45	0.26	0.16	0.39	0.17	0.12	0.35	0.13	0.10	0.20	0.12	0.09	0.11	0.09	0.07
Shreveport, LA	MAY	1.80	1.18	0.84	1.40	0.89	0.60	1.20	0.67	0.44	0.80	0.56	0.35	0.70	0.44	0.22
Shreveport, LA	SEP	2.19	0.86	0.54	1.89	0.59	0.33	1.38	0.44	0.21	1.38	0.32	0.16	0.84	0.18	0.11
Spokane, WA	MAY	0.45	0.31	0.16	0.35	0.18	0.10	0.24	0.11	0.08	0.15	0.09	0.06	0.10	0.07	0.04
Spokane, WA	JUN	0.62	0.41	0.22	0.38	0.23	0.11	0.37	0.14	0.08	0.29	0.11	0.07	0.15	0.08	0.05
Tallahassee, FL	AUG	2.14	1.71	1.27	1.59	1.08	0.81	1.20	0.84	0.60	0.90	0.67	0.38	0.69	0.38	0.21
Tallahassee, FL	NOV	2.50	1.51	0.72	2.18	0.91	0.44	1.20	0.61	0.29	0.90	0.41	0.21	0.84	0.31	0.13
Topeka, KS	JUN	1.80	1.06	0.79	1.14	0.76	0.42	0.90	0.54	0.30	0.90	0.40	0.23	0.74	0.28	0.14
Topeka, KS	JUL	2.14	1.09	0.57	2.10	0.59	0.33	1.60	0.47	0.24	0.70	0.29	0.15	0.42	0.17	0.08
Topeka, KS	OCT	2.38	0.87	0.37	1.39	0.41	0.22	1.19	0.27	0.17	0.99	0.20	0.14	0.35	0.16	0.11
Urbana, IL	JUL	1.96	1.38	1.00	1.63	0.87	0.41	0.84	0.51	0.22	0.82	0.28	0.14	0.24	0.11	0.08
Yuma, AZ	AUG	0.70	0.46	0.22	0.60	0.28	0.10	0.60	0.17	0.06	0.45	0.14	0.05	0.40	0.05	0.03
Yuma, AZ	SEP	0.54	0.22	0.13	0.30	0.16	0.08	0.22	0.14	0.05	0.18	0.09	0.04	0.17	0.05	0.02

Table 3. One-min rainfall rate vs. duration and probability of at least 1 occurrence for all months at Boston and New Orleans.

Location	Month	Rainfall Rate (mm/min)														
		Duration (min)														
		5			10			15			20			30		
		Probability			Probability			Probability			Probability			Probability		
		0.1	0.5	0.9	0.1	0.5	0.9	0.1	0.5	0.9	0.1	0.5	0.9	0.1	0.5	0.9
Boston, MA	JAN	0.31	0.24	0.19	0.25	0.19	0.15	0.17	0.16	0.14	0.17	0.15	0.12	0.16	0.13	0.10
Boston, MA	FEB	0.35	0.26	0.20	0.30	0.22	0.16	0.25	0.18	0.13	0.25	0.17	0.12	0.20	0.14	0.09
Boston, MA	MAR	0.40	0.26	0.18	0.26	0.19	0.14	0.25	0.16	0.11	0.20	0.14	0.10	0.20	0.11	0.08
Boston, MA	APR	0.58	0.22	0.16	0.25	0.16	0.13	0.20	0.14	0.11	0.20	0.13	0.10	0.15	0.12	0.09
Boston, MA	MAY	0.35	0.27	0.23	0.30	0.23	0.18	0.22	0.20	0.14	0.21	0.17	0.12	0.16	0.14	0.09
Boston, MA	JUN	0.94	0.60	0.37	0.45	0.36	0.22	0.35	0.23	0.14	0.35	0.19	0.12	0.29	0.13	0.09
Boston, MA	JUL	1.28	0.75	0.45	0.75	0.42	0.24	0.45	0.27	0.16	0.31	0.20	0.12	0.21	0.13	0.08
Boston, MA	AUG	1.19	0.86	0.48	0.90	0.47	0.26	0.60	0.33	0.16	0.36	0.22	0.13	0.30	0.15	0.09
Boston, MA	SEP	0.99	0.60	0.42	0.79	0.40	0.23	0.59	0.24	0.18	0.45	0.25	0.15	0.30	0.17	0.11
Boston, MA	OCT	1.37	0.40	0.25	0.73	0.28	0.19	0.49	0.22	0.15	0.34	0.19	0.13	0.20	0.15	0.10
Boston, MA	NOV	0.35	0.24	0.19	0.26	0.20	0.16	0.21	0.18	0.14	0.20	0.16	0.13	0.20	0.14	0.10
Boston, MA	DEC	0.82	0.22	0.18	0.40	0.19	0.15	0.21	0.17	0.13	0.21	0.15	0.11	0.16	0.13	0.10
New Orleans, LA	JAN	1.30	0.91	0.60	1.10	0.57	0.34	0.80	0.41	0.24	0.80	0.29	0.20	0.45	0.22	0.14
New Orleans, LA	FEB	1.77	0.94	0.72	0.90	0.60	0.38	0.72	0.43	0.25	0.64	0.30	0.20	0.49	0.24	0.13
New Orleans, LA	MAR	1.04	0.88	0.65	0.85	0.62	0.43	0.74	0.39	0.30	0.65	0.33	0.22	0.35	0.21	0.14
New Orleans, LA	APR	2.47	1.14	0.72	1.04	0.68	0.41	0.95	0.48	0.27	0.75	0.32	0.22	0.44	0.23	0.15
New Orleans, LA	MAY	1.50	1.20	0.87	1.04	0.76	0.54	0.80	0.58	0.38	0.80	0.45	0.25	0.69	0.32	0.15
New Orleans, LA	JUN	1.60	1.28	0.99	1.20	0.99	0.64	1.10	0.79	0.47	1.10	0.66	0.34	0.70	0.36	0.20
New Orleans, LA	JUL	2.49	1.71	0.96	1.99	1.13	0.63	1.49	0.68	0.43	1.47	0.46	0.30	1.26	0.28	0.16
New Orleans, LA	AUG	2.38	1.78	1.23	1.76	1.32	0.73	1.64	0.87	0.50	1.54	0.71	0.37	1.45	0.36	0.19
New Orleans, LA	SEP	1.74	1.31	1.03	1.30	0.89	0.62	1.14	0.75	0.41	0.84	0.51	0.34	0.59	0.30	0.17
New Orleans, LA	OCT	2.09	0.98	0.64	1.29	0.71	0.34	0.80	0.42	0.21	0.75	0.36	0.15	0.33	0.17	0.11
New Orleans, LA	NOV	2.39	1.22	0.54	1.89	0.48	0.33	1.86	0.44	0.26	1.56	0.29	0.20	0.97	0.23	0.15
New Orleans, LA	DEC	1.34	1.05	0.69	1.00	0.75	0.39	0.65	0.46	0.27	0.59	0.33	0.22	0.44	0.23	0.15

Table 4. One-min rainfall rate vs. duration and probability of at least 3 occurrences during the worst months.

Location	Worst Month(s)	Rainfall Rate (mm/min) Duration (min) 5 Probability			10 Probability			15 Probability			20 Probability			30 Probability		
		0.1	0.5	0.9	0.1	0.5	0.9	0.1	0.5	0.9	0.1	0.5	0.9	0.1	0.5	0.9
Aberdeen, SD	JUN	0.90	0.63	0.44	0.59	0.36	0.19	0.45	0.23	0.12	0.30	0.14	0.09	0.13	0.09	0.05
Aberdeen, SD	JUL	0.82	0.56	0.38	0.52	0.28	0.17	0.40	0.18	0.10	0.20	0.13	0.07	0.14	0.08	0.04
Albuquerque, NM	AUG	0.64	0.43	0.21	0.32	0.17	0.09	0.19	0.09	0.07	0.12	0.07	0.05	0.08	0.05	0.04
Allentown, PA	JUL	1.00	0.66	0.46	0.55	0.35	0.23	0.37	0.23	0.15	0.27	0.17	0.13	0.15	0.11	0.08
Allentown, PA	AUG	0.86	0.66	0.53	0.57	0.42	0.30	0.44	0.26	0.20	0.35	0.20	0.14	0.19	0.13	0.09
Asheville, NC	JUL	1.00	0.70	0.49	0.67	0.43	0.25	0.47	0.26	0.16	0.38	0.19	0.12	0.21	0.11	0.08
Asheville, NC	SEP	0.73	0.50	0.35	0.49	0.32	0.22	0.35	0.23	0.16	0.29	0.19	0.13	0.22	0.13	0.09
Bakersfield, CA	MAR	0.14	0.10	0.09	0.10	0.08	0.07	0.09	0.07	0.06	0.08	0.06	0.05	0.07	0.05	0.04
Bakersfield, CA	MAY	0.23	0.10	0.04	0.12	0.05	0.03	0.06	0.04	0.03	0.05	0.03	0.02	0.04	0.02	0.01
Billings, MT	JUL	0.38	0.20	0.11	0.21	0.10	0.07	0.13	0.08	0.05	0.10	0.05	0.04	0.06	0.04	0.03
Boise, ID	SEP	0.19	0.12	0.09	0.12	0.08	0.06	0.09	0.06	0.04	0.08	0.05	0.04	0.05	0.04	0.03
Boston, MA	AUG	0.71	0.44	0.33	0.37	0.24	0.17	0.23	0.15	0.12	0.18	0.13	0.09	0.13	0.09	0.06
Cape Hatteras, NC	SEP	0.99	0.80	0.61	0.74	0.56	0.37	0.57	0.39	0.23	0.44	0.30	0.16	0.28	0.16	0.09
Charleston, SC	JUN	1.36	1.01	0.75	0.91	0.60	0.45	0.61	0.41	0.28	0.53	0.30	0.18	0.32	0.17	0.10
Cheyenne, WY	JUL	0.68	0.43	0.27	0.36	0.22	0.14	0.23	0.14	0.09	0.17	0.10	0.06	0.09	0.05	0.04
Cheyenne, WY	SEP	0.31	0.14	0.09	0.15	0.09	0.06	0.10	0.07	0.05	0.09	0.05	0.04	0.06	0.04	0.03
Chicago, IL	JUL	1.09	0.64	0.44	0.58	0.40	0.28	0.40	0.27	0.16	0.35	0.20	0.10	0.20	0.10	0.06
Chicago, IL	AUG	1.11	0.77	0.49	0.62	0.42	0.27	0.42	0.26	0.15	0.33	0.21	0.12	0.21	0.11	0.07
Denver, CO	AUG	0.53	0.35	0.23	0.32	0.19	0.10	0.22	0.11	0.07	0.14	0.08	0.05	0.09	0.06	0.04
Ely, NV	AUG	0.31	0.14	0.09	0.14	0.08	0.05	0.09	0.06	0.04	0.07	0.05	0.04	0.05	0.04	0.03
Grand Junction, CO	JUL	0.26	0.09	0.06	0.09	0.05	0.03	0.06	0.04	0.03	0.05	0.03	0.02	0.04	0.02	0.01
Houston, TX	MAY	1.02	0.83	0.63	0.75	0.51	0.36	0.55	0.35	0.24	0.43	0.27	0.17	0.27	0.16	0.10
Houston, TX	JUN	1.19	0.93	0.65	0.86	0.56	0.36	0.60	0.37	0.20	0.44	0.26	0.15	0.25	0.13	0.07
Huntsville, AL	MAY	1.12	0.76	0.51	0.71	0.38	0.24	0.42	0.25	0.15	0.25	0.16	0.12	0.15	0.10	0.08
Huntsville, AL	JUL	1.20	0.90	0.68	0.77	0.55	0.37	0.55	0.39	0.23	0.42	0.26	0.15	0.23	0.13	0.09
Internat'l Falls, MN	JUL	0.87	0.61	0.36	0.60	0.30	0.17	0.35	0.17	0.12	0.25	0.13	0.09	0.12	0.09	0.06
Internat'l Falls, MN	SEP	0.71	0.46	0.34	0.45	0.30	0.19	0.30	0.20	0.12	0.26	0.14	0.09	0.15	0.09	0.06
Key West, FL	JUL	0.99	0.77	0.56	0.59	0.44	0.27	0.39	0.28	0.16	0.29	0.17	0.10	0.17	0.08	0.05
Key West, FL	AUG	1.32	1.00	0.75	0.84	0.57	0.37	0.57	0.37	0.19	0.42	0.22	0.13	0.23	0.09	0.06
Lexington, KY	JUN	1.04	0.67	0.45	0.61	0.36	0.22	0.36	0.21	0.13	0.23	0.14	0.10	0.13	0.09	0.07
Lexington, KY	JUL	1.13	0.89	0.68	0.82	0.54	0.41	0.58	0.41	0.24	0.46	0.30	0.16	0.32	0.15	0.09
Miami, FL	JUN	1.46	1.15	0.90	0.97	0.70	0.44	0.73	0.42	0.29	0.54	0.32	0.19	0.34	0.16	0.09
Newark, NJ	AUG	1.21	0.65	0.43	0.49	0.34	0.22	0.34	0.23	0.13	0.28	0.15	0.10	0.16	0.10	0.07
New Orleans, LA	JUL	1.51	0.89	0.68	0.75	0.58	0.39	0.55	0.41	0.25	0.42	0.28	0.17	0.24	0.15	0.09
New Orleans, LA	AUG	1.70	1.15	0.81	1.10	0.70	0.49	0.72	0.46	0.29	0.50	0.31	0.20	0.29	0.17	0.10
NYC (Kennedy), NY	JUN	0.72	0.45	0.32	0.40	0.26	0.19	0.29	0.18	0.13	0.21	0.14	0.10	0.14	0.10	0.07
NYC (Kennedy), NY	AUG	0.92	0.51	0.34	0.42	0.29	0.18	0.28	0.18	0.11	0.19	0.13	0.09	0.12	0.08	0.05

Table 4. One-min rainfall rate vs. duration and probability of at least 3 occurrences during the worst months. (Cont.)

Location	Worst Month(s)	Rainfall Rate (mm/min)														
		Duration (min)														
		5			10			15			20			30		
		Probability			Probability			Probability			Probability			Probability		
		0.1	0.5	0.9	0.1	0.5	0.9	0.1	0.5	0.9	0.1	0.5	0.9	0.1	0.5	0.9
Oklahoma City, OK	MAY	1.04	0.79	0.57	0.75	0.51	0.34	0.54	0.37	0.24	0.45	0.27	0.17	0.30	0.18	0.12
Oklahoma City, OK	JUN	1.07	0.69	0.54	0.64	0.49	0.31	0.51	0.33	0.19	0.46	0.23	0.14	0.24	0.13	0.08
Omaha, NE	JUL	0.96	0.65	0.44	0.56	0.36	0.20	0.38	0.22	0.11	0.26	0.13	0.08	0.14	0.08	0.05
Omaha, NE	AUG	0.87	0.60	0.39	0.53	0.31	0.19	0.33	0.20	0.13	0.23	0.14	0.10	0.14	0.10	0.06
Philadelphia, PA	JUN	0.81	0.65	0.47	0.56	0.34	0.24	0.34	0.23	0.15	0.25	0.16	0.11	0.15	0.09	0.07
Philadelphia, PA	JUL	0.77	0.61	0.43	0.53	0.34	0.23	0.34	0.22	0.16	0.25	0.18	0.11	0.16	0.10	0.07
Philadelphia, PA	AUG	0.84	0.64	0.50	0.52	0.39	0.28	0.34	0.25	0.17	0.28	0.18	0.10	0.15	0.10	0.07
Phoenix, AZ	JUL	0.33	0.21	0.11	0.15	0.09	0.04	0.09	0.05	0.03	0.06	0.04	0.02	0.04	0.02	0.00
Phoenix, AZ	AUG	0.42	0.22	0.10	0.17	0.08	0.05	0.10	0.05	0.04	0.07	0.04	0.03	0.04	0.02	0.01
Pittsburgh, PA	JUL	0.86	0.56	0.39	0.46	0.27	0.16	0.26	0.15	0.11	0.14	0.11	0.09	0.11	0.08	0.06
Raleigh, NC	JUN	0.92	0.58	0.41	0.56	0.36	0.26	0.42	0.28	0.14	0.31	0.18	0.09	0.19	0.10	0.07
Raleigh, NC	JUL	0.83	0.60	0.48	0.53	0.39	0.25	0.38	0.26	0.17	0.26	0.19	0.12	0.18	0.10	0.06
Raleigh, NC	AUG	0.77	0.60	0.42	0.57	0.35	0.24	0.41	0.26	0.16	0.30	0.19	0.12	0.17	0.11	0.07
Rapid City, SD	JUN	0.67	0.46	0.27	0.41	0.22	0.16	0.24	0.17	0.13	0.18	0.13	0.10	0.14	0.10	0.07
Rapid City, SD	JUL	0.78	0.42	0.21	0.38	0.17	0.11	0.18	0.12	0.07	0.13	0.09	0.05	0.08	0.05	0.04
St. Louis, MO	JUN	0.75	0.58	0.41	0.46	0.30	0.20	0.30	0.21	0.12	0.22	0.14	0.09	0.13	0.08	0.05
St. Louis, MO	JUL	0.96	0.59	0.43	0.51	0.27	0.16	0.30	0.16	0.09	0.17	0.09	0.05	0.08	0.05	0.04
San Angelo, TX	MAY	0.81	0.56	0.32	0.42	0.24	0.14	0.26	0.14	0.10	0.15	0.11	0.07	0.10	0.07	0.04
San Sebastian, PR	SEP	1.57	1.24	0.89	1.08	0.77	0.54	0.81	0.56	0.39	0.66	0.43	0.28	0.38	0.25	0.15
San Sebastian, PR	OCT	1.16	0.96	0.76	0.91	0.66	0.49	0.71	0.52	0.35	0.62	0.40	0.25	0.41	0.24	0.15
Santa Maria, CA	JAN	0.29	0.20	0.15	0.19	0.14	0.12	0.15	0.12	0.09	0.14	0.11	0.08	0.11	0.08	0.05
Santa Maria, CA	DEC	0.33	0.25	0.18	0.23	0.17	0.13	0.17	0.13	0.10	0.15	0.12	0.09	0.12	0.09	0.06
Seattle, WA	AUG	0.19	0.13	0.10	0.13	0.10	0.08	0.10	0.08	0.07	0.09	0.07	0.05	0.08	0.06	0.04
Seattle, WA	SEP	0.20	0.15	0.12	0.15	0.12	0.09	0.12	0.09	0.08	0.11	0.09	0.07	0.08	0.07	0.05
Shreveport, LA	MAY	1.11	0.80	0.64	0.74	0.58	0.39	0.58	0.42	0.29	0.50	0.33	0.19	0.34	0.20	0.11
Shreveport, LA	SEP	0.71	0.49	0.34	0.47	0.30	0.18	0.36	0.19	0.13	0.25	0.15	0.10	0.15	0.10	0.06
Spokane, WA	MAY	0.27	0.14	0.10	0.14	0.09	0.07	0.09	0.07	0.05	0.08	0.06	0.04	0.06	0.04	0.03
Spokane, WA	JUN	0.37	0.19	0.11	0.18	0.10	0.08	0.11	0.08	0.06	0.09	0.07	0.05	0.07	0.05	0.04
Tallahassee, FL	AUG	1.54	1.22	0.95	1.02	0.77	0.60	0.78	0.55	0.34	0.55	0.35	0.23	0.30	0.18	0.11
Tallahassee, FL	NOV	1.12	0.66	0.47	0.64	0.40	0.24	0.45	0.26	0.15	0.35	0.18	0.12	0.22	0.12	0.08
Topeka, KS	JUN	0.96	0.74	0.50	0.67	0.40	0.27	0.47	0.28	0.17	0.35	0.21	0.12	0.21	0.12	0.08
Topeka, KS	JUL	0.83	0.54	0.38	0.51	0.30	0.18	0.41	0.19	0.11	0.25	0.13	0.08	0.12	0.08	0.05
Topeka, KS	OCT	0.54	0.34	0.24	0.32	0.20	0.16	0.23	0.16	0.12	0.18	0.13	0.10	0.14	0.11	0.08
Urbana, IL	JUL	1.27	0.91	0.63	0.80	0.38	0.23	0.37	0.20	0.12	0.22	0.13	0.08	0.09	0.07	0.05
Yuma, AZ	AUG	0.34	0.20	0.10	0.20	0.09	0.05	0.13	0.05	0.03	0.09	0.04	0.02	0.04	0.02	0.00
Yuma, AZ	SEP	0.19	0.12	0.07	0.13	0.06	0.04	0.09	0.04	0.02	0.07	0.03	0.01	0.04	0.02	0.00

Table 5. One-min rainfall rate vs. duration and probability of at least 3 occurrences for all months at Boston and New Orleans.

		Rainfall Rate (mm/min)														
		Duration (min)														
Location	Month	5			10			15			20			30		
		Probability			Probability			Probability			Probability			Probability		
		0.1	0.5	0.9	0.1	0.5	0.9	0.1	0.5	0.9	0.1	0.5	0.9	0.1	0.5	0.9
Boston, MA	JAN	0.22	0.18	0.15	0.17	0.15	0.13	0.15	0.13	0.11	0.14	0.12	0.10	0.12	0.10	0.08
Boston, MA	FEB	0.24	0.19	0.16	0.19	0.15	0.12	0.16	0.12	0.09	0.14	0.11	0.09	0.12	0.09	0.07
Boston, MA	MAR	0.23	0.18	0.14	0.17	0.13	0.10	0.14	0.10	0.08	0.12	0.09	0.08	0.10	0.08	0.06
Boston, MA	APR	0.19	0.15	0.13	0.15	0.13	0.10	0.13	0.11	0.09	0.12	0.09	0.08	0.11	0.09	0.07
Boston, MA	MAY	0.25	0.22	0.18	0.21	0.17	0.13	0.18	0.13	0.10	0.16	0.11	0.09	0.12	0.09	0.07
Boston, MA	JUN	0.48	0.35	0.23	0.30	0.20	0.13	0.21	0.14	0.10	0.15	0.11	0.08	0.11	0.08	0.06
Boston, MA	JUL	0.65	0.39	0.27	0.32	0.22	0.14	0.23	0.14	0.10	0.16	0.11	0.08	0.11	0.08	0.05
Boston, MA	AUG	0.71	0.44	0.33	0.37	0.24	0.17	0.23	0.15	0.12	0.18	0.13	0.09	0.13	0.09	0.06
Boston, MA	SEP	0.52	0.38	0.24	0.30	0.22	0.17	0.22	0.17	0.13	0.19	0.14	0.10	0.15	0.11	0.08
Boston, MA	OCT	0.34	0.24	0.19	0.24	0.18	0.14	0.19	0.15	0.11	0.16	0.12	0.09	0.13	0.10	0.08
Boston, MA	NOV	0.22	0.18	0.16	0.18	0.15	0.13	0.16	0.13	0.11	0.15	0.12	0.09	0.13	0.10	0.08
Boston, MA	DEC	0.20	0.17	0.15	0.17	0.14	0.12	0.15	0.12	0.10	0.14	0.11	0.09	0.12	0.09	0.08
New Orleans, LA	JAN	0.79	0.54	0.42	0.46	0.32	0.23	0.36	0.22	0.17	0.25	0.19	0.14	0.18	0.13	0.09
New Orleans, LA	FEB	0.88	0.70	0.43	0.50	0.36	0.24	0.36	0.23	0.17	0.24	0.18	0.13	0.19	0.12	0.09
New Orleans, LA	MAR	0.77	0.63	0.49	0.54	0.41	0.29	0.36	0.28	0.19	0.29	0.21	0.15	0.18	0.14	0.10
New Orleans, LA	APR	1.03	0.68	0.47	0.57	0.38	0.25	0.36	0.25	0.18	0.28	0.20	0.13	0.20	0.14	0.08
New Orleans, LA	MAY	1.06	0.83	0.62	0.67	0.51	0.34	0.52	0.34	0.22	0.37	0.23	0.15	0.27	0.14	0.09
New Orleans, LA	JUN	1.19	0.96	0.75	0.89	0.59	0.44	0.62	0.43	0.26	0.56	0.31	0.17	0.31	0.17	0.08
New Orleans, LA	JUL	1.51	0.89	0.68	0.75	0.58	0.39	0.55	0.41	0.25	0.42	0.28	0.17	0.24	0.15	0.09
New Orleans, LA	AUG	1.70	1.15	0.81	1.10	0.70	0.49	0.72	0.46	0.29	0.50	0.31	0.20	0.29	0.17	0.10
New Orleans, LA	SEP	1.20	0.97	0.75	0.79	0.59	0.42	0.63	0.38	0.24	0.44	0.32	0.17	0.24	0.15	0.09
New Orleans, LA	OCT	0.89	0.60	0.38	0.51	0.31	0.19	0.33	0.19	0.14	0.25	0.14	0.11	0.14	0.10	0.07
New Orleans, LA	NOV	0.91	0.49	0.37	0.41	0.31	0.24	0.32	0.25	0.18	0.26	0.19	0.14	0.19	0.14	0.10
New Orleans, LA	DEC	0.93	0.63	0.44	0.51	0.36	0.26	0.37	0.25	0.19	0.27	0.21	0.15	0.20	0.14	0.09

Table 6. Longest duration of 1-min rain rates at or above specified threshold rates and the month of occurrence.

Location	Duration (min) and Month								
	Threshold Rate (mm/min)								
	0.1	0.2	0.4	0.7	1.0	1.3	1.6	2.0	2.5
Aberdeen, SD	152 Jun	118 Jun	70 Jun	31 Jun	18 Jun	8 Jun	4 Jun*	3 Sep*	3 Sep
Albuquerque, NM	63 Oct	35 May	27 Aug	16 Jun	10 Aug	5 Aug	4 Aug	4 Aug	1 Aug
Allentown, PA	244 Nov	120 Sep	44 Aug	32 Jul	19 Jul	16 Jul	5 Jun	3 Jun	2 Jun
Asheville, NC	235 Nov	119 May	84 Aug	56 Aug	29 Aug	14 Sep	12 Sep	11 Sep	5 May
Bakersfield, CA	109 Aug	53 Jun	25 May	7 Jun	2 Jun	0 —	0 —	0 —	0 —
Billings, MT	121 Aug	49 Jul	27 Jul	7 Jul*	5 Jun	4 Jun	3 Jul	2 Jul	2 Jul
Boise, ID	53 Jun	35 Sep	25 Sep	6 Sep	3 Sep	3 Sep	2 Sep	1 Sep	0 —
Boston, MA	275 Jan	52 Sep	23 Sep	13 Sep*	7 Jul*	7 Jul	3 Oct	3 Oct	1 Oct*
Cape Hatteras, NC	215 Feb	162 Nov	93 Nov	39 Nov	16 Jul*	11 Jul	6 Nov	4 Sep*	3 Sep
Charleston, SC	300 Sep	127 Jun	71 Aug	51 Jun	48 Jun	24 Jun	11 Jun	5 Jun*	4 Jun*
Cheyenne, WY	122 May	46 Sep	37 Sep	28 Sep	7 Sep	6 Sep	6 Sep	4 Sep	3 Sep
Chicago, IL	144 Jun	121 Jun	82 Sep	40 Jun	19 Jun	13 Jun*	13 Jun	8 Jul	6 Jul
Denver, CO	162 Jun	47 Aug	20 Aug	13 Aug	12 Aug	6 Aug	4 Aug*	4 Jul	3 Jul
Ely, NV	48 May	27 Aug	17 Aug	8 Aug	6 Aug	4 Aug	2 Aug	1 Aug	0 —
Grand Junction, CO	40 Jul	24 Jul	19 Jul	17 Jul	10 Jul	8 Jul	4 Jul	2 Jul	1 Jul
Houston, TX	195 Sep	92 Jul	74 Jul	40 Jun	25 Aug	18 Aug	11 Apr	10 Apr	9 Apr
Huntsville, AL	284 Mar	89 Jul	64 Jul	36 Jul	19 Jul	16 Jul	7 May	6 May	4 May
Internat'l Falls,MN	112 Jun	99 Jun	59 Jun	30 Sep	20 Sep	10 Sep*	10 Sep	3 May	2 May*
Key West, Fl	156 May	74 Aug	61 Apr	39 Apr*	22 Aug	12 Aug*	10 Aug	7 Jul*	4 Jul*
Lexington, KY	191 Oct	83 Apr	49 Jul	32 Jun	31 Jun	15 Jul	6 Jul	4 Jul	3 Jul*
Miami, FL	285 Apr	123 May	109 May	46 Aug	25 Jun	23 Jun	13 Sep	10 Jun*	9 Jun
Newark, NJ	204 Jan	118 Nov	64 Nov	20 Aug	16 Aug	15 Aug	13 Aug	11 Aug	7 Aug
New Orleans, LA	205 Feb	96 May*	86 Aug	61 Aug	53 Aug	44 Aug	24 Nov	10 Jul	6 Apr
New York, NY	219 Jan	61 Jun	32 Jun	25 Aug	13 Aug	11 Sep	11 Sep	6 Sep*	3 Sep*
Oklahoma City, OK	250 Sep	107 Jul	59 Sep	32 Sep*	27 Sep	15 Jun	15 Jun	8 Jun	6 Jun
Omaha, NE	142 May	67 Jul	42 Jul	18 Jul	12 Jul*	9 Jul	5 Jul*	3 Jul*	3 Aug*
Philadelphia, PA	160 Jul	61 May*	32 Jun	24 Jun	18 Jul	8 Jun	6 Jun	5 Jun	2 Jun*
Phoenix, AZ	84 Oct	35 Aug	21 Aug	12 Aug	11 Aug	6 Jul*	5 Jul	4 Jul	3 Jul*
Pittsburg, PA	150 May	58 Apr	27 Jul	23 Jul	17 Jul	7 Jul*	6 Jul*	5 Oct	4 Oct
Raleigh, NC	200 Apr	72 Jun	51 Sep	44 Jun	17 Jun	8 Aug	7 Aug	6 Aug	4 Sep
Rapid City, SD	149 Jun	55 Jun	28 Jul	16 Jul	11 Jul	8 Jul	8 Jul	6 Jul	4 Jul
St. Louis, MO	214 Mar	60 Apr	32 Aug	19 Jun	13 May	11 Jun	6 Jul	4 Jul	2 Apr*
San Angelo, TX	161 Apr	69 Apr	35 Apr	19 May	10 May	8 May	7 May	6 May	3 Jun
Santa Maria, CA	132 Jan	46 Jan	19 Sep	5 Jan*	3 Jan*	2 Nov*	2 Nov*	1 Nov	0 —
Seattle, WA	82 Feb	59 Oct	13 Sep	2 Aug*	0 —	0 —	0 —	0 —	0 —
Shreveport, LA	263 Aug	154 May	110 May	35 Sep	26 Sep	23 Sep	11 Sep	9 Sep	3 Sep
Spokane, WA	100 Jul	35 Jul	12 Sep	4 Jun	3 May*	2 May	2 May	1 May*	0 —
Tallahassee, FL	223 Feb	113 Jan*	61 Nov	46 Jul	27 May	24 May	15 May	10 Nov	8 May
Topeka, KS	180 Nov	89 May	56 May	33 Jun	20 Oct	17 Jul	15 Jul	10 Jul	4 Jun
Urbana, IL	91 Oct	45 May	37 May	25 Jun	20 Jun	14 Jun	10 Jul*	5 Jul*	4 May
Yuma, AZ	91 Sep	44 Aug	32 Aug	5 Aug	3 Mar	2 Mar	2 Mar	1 Mar	0 —

*Also occurred in at least 1 other month.

Table 7. Critical rainfall rates causing an outage during the worst months for stated frequencies and elevation angles (based on a 15 dB fade margin).

			CRITICAL RAINRATES (mm/hr) FOR A 15db FADE MARGIN											
			15 GHz				30 GHz				45 GHz (mm/min)			
	Month	FRZ LVLS	ELEVATION ANGLE				ELEVATION ANGLE				ELEVATION ANGLE			
		AVG (km)	10	30	50	70	10	30	50	70	10	30	50	70
Aberdeen SD	Jun	3.39	0.35	0.75	1.04	1.21	0.04	0.15	0.25	0.35	0.008	0.067	0.13	0.20
	Jul	4.02	0.31	0.64	0.89	1.03	0.03	0.13	0.21	0.29	0.004	0.053	0.10	0.16
Albuquerque NM	Aug	3.17	0.37	0.79	1.11	1.29	0.04	0.17	0.27	0.38	0.010	0.074	0.14	0.22
Allentown PA	Jul	4.37	0.30	0.60	0.82	0.95	0.02	0.11	0.19	0.26	0.003	0.046	0.09	0.14
	Aug	4.25	0.30	0.61	0.84	0.98	0.02	0.12	0.19	0.27	0.003	0.048	0.09	0.15
Asheville NC	Jul	4.45	0.30	0.59	0.81	0.93	0.02	0.11	0.18	0.25	0.002	0.045	0.09	0.14
	Sep	4.28	0.30	0.61	0.84	0.97	0.02	0.12	0.19	0.27	0.003	0.048	0.09	0.15
Bakersfield CA	Mar	2.49	0.43	0.98	1.39	1.63	0.06	0.22	0.35	0.49	0.019	0.104	0.19	0.30
	May	3.53	0.34	0.72	1.00	1.17	0.03	0.15	0.24	0.33	0.007	0.064	0.12	0.19
Billings MT	Jul	2.95	0.38	0.84	1.18	1.39	0.05	0.18	0.29	0.41	0.013	0.082	0.16	0.24
Boise ID	Sep	2.70	0.41	0.91	1.29	1.51	0.05	0.20	0.32	0.44	0.016	0.093	0.17	0.27
Boston	Aug	4.18	0.31	0.62	0.86	0.99	0.02	0.12	0.20	0.27	0.003	0.050	0.10	0.15
Cape Hatteras NC	Sep	4.48	0.30	0.59	0.80	0.93	0.02	0.11	0.18	0.25	0.002	0.045	0.09	0.14
Charleston SC	Jun	4.40	0.30	0.60	0.81	0.94	0.02	0.11	0.19	0.26	0.003	0.046	0.09	0.14
Cheyenne WY	Jul	3.00	0.38	0.83	1.16	1.36	0.05	0.18	0.29	0.40	0.012	0.080	0.15	0.24
	Sep	2.37	0.44	1.02	1.45	1.70	0.07	0.23	0.37	0.52	0.021	0.112	0.21	0.32
Chicago IL	Jul	4.36	0.30	0.60	0.82	0.95	0.02	0.11	0.19	0.26	0.003	0.047	0.09	0.14
	Aug	4.24	0.31	0.62	0.84	0.98	0.02	0.12	0.19	0.27	0.003	0.049	0.09	0.15
Denver CO	Aug	3.13	0.37	0.80	1.12	1.31	0.04	0.17	0.27	0.38	0.011	0.076	0.14	0.23
Ely NV	Aug	2.78	0.40	0.89	1.25	1.47	0.05	0.19	0.31	0.43	0.015	0.089	0.17	0.26
Grand Junction CO	Jul	3.45	0.35	0.73	1.02	1.19	0.04	0.15	0.25	0.34	0.008	0.066	0.12	0.20
Houston TX	May	4.33	0.30	0.60	0.83	0.96	0.02	0.12	0.19	0.26	0.003	0.047	0.09	0.15
	Jun	4.72	0.29	0.56	0.76	0.88	0.02	0.10	0.17	0.24	0.001	0.041	0.08	0.13
Huntsville AL	May	3.69	0.33	0.69	0.96	1.12	0.03	0.14	0.23	0.32	0.006	0.060	0.11	0.18
	Jul	4.49	0.29	0.59	0.80	0.93	0.02	0.11	0.18	0.25	0.002	0.044	0.09	0.14
Internat'l Falls MN	Jul	3.50	0.34	0.73	1.01	1.18	0.03	0.15	0.24	0.34	0.008	0.065	0.12	0.19
	Sep	2.56	0.42	0.96	1.35	1.58	0.06	0.21	0.34	0.47	0.018	0.100	0.19	0.29
Key West FL	Jul	4.64	0.29	0.57	0.78	0.90	0.02	0.11	0.18	0.24	0.002	0.042	0.08	0.13
	Aug	4.69	0.29	0.57	0.77	0.89	0.02	0.10	0.17	0.24	0.001	0.042	0.08	0.13
Lexington KY	Jun	3.79	0.33	0.68	0.94	1.09	0.03	0.13	0.22	0.31	0.006	0.057	0.11	0.17
	Jul	4.24	0.30	0.62	0.84	0.98	0.02	0.12	0.19	0.27	0.003	0.049	0.09	0.15
Miami FL	Jun	4.63	0.29	0.57	0.78	0.90	0.02	0.11	0.18	0.24	0.002	0.042	0.08	0.13
Newark NJ	Aug	4.36	0.30	0.60	0.82	0.95	0.02	0.11	0.19	0.26	0.003	0.046	0.09	0.14
New Orleans LA	Jul	4.73	0.29	0.56	0.76	0.88	0.02	0.10	0.17	0.24	0.001	0.041	0.08	0.13
	Aug	4.73	0.29	0.56	0.76	0.88	0.02	0.10	0.17	0.24	0.001	0.041	0.08	0.13

Table 7. Critical rainfall rates causing an outage during the worst months for stated frequencies and elevation angles (based on a 15 dB fade margin). (Cont.)

			CRITICAL RAINRATES (mm/hr) FOR A 15db FADE MARGIN											
			15 GHz				30 GHz				45 GHz (mm/min)			
	Month	FRZ LVLS	ELEVATION ANGLE				ELEVATION ANGLE				ELEVATION ANGLE			
		AVG (km)	10	30	50	70	10	30	50	70	10	30	50	70
New York NY	Jun	4.00	0.32	0.65	0.89	1.04	0.03	0.13	0.21	0.29	0.004	0.053	0.10	0.16
	Aug	4.36	0.30	0.60	0.82	0.95	0.02	0.11	0.19	0.26	0.003	0.046	0.09	0.14
Oklahoma City OK	May	3.41	0.35	0.74	1.03	1.21	0.04	0.15	0.25	0.35	0.008	0.067	0.13	0.20
	Jun	4.10	0.31	0.63	0.87	1.01	0.02	0.12	0.20	0.28	0.004	0.051	0.10	0.16
Omaha NE	Jul	4.31	0.30	0.61	0.83	0.96	0.02	0.12	0.19	0.26	0.003	0.047	0.09	0.15
	Aug	4.08	0.31	0.64	0.87	1.02	0.03	0.12	0.20	0.28	0.004	0.051	0.10	0.16
Philadelphia PA	Jun	4.00	0.32	0.65	0.89	1.04	0.03	0.13	0.21	0.29	0.004	0.053	0.10	0.16
	Jul	4.48	0.30	0.59	0.80	0.93	0.02	0.11	0.18	0.25	0.002	0.045	0.09	0.14
	Aug	4.36	0.30	0.60	0.82	0.95	0.02	0.11	0.19	0.26	0.003	0.046	0.09	0.14
Phoenix AZ	Jul	4.53	0.29	0.58	0.79	0.92	0.02	0.11	0.18	0.25	0.002	0.044	0.09	0.14
	Aug	4.48	0.30	0.59	0.80	0.93	0.02	0.11	0.18	0.25	0.002	0.045	0.09	0.14
Pittsburgh PA	Jul	4.00	0.32	0.65	0.89	1.04	0.03	0.13	0.21	0.29	0.004	0.053	0.10	0.16
Raleigh NC	Jun	4.09	0.31	0.63	0.87	1.01	0.02	0.12	0.20	0.28	0.004	0.051	0.10	0.16
	Jul	4.49	0.29	0.59	0.80	0.93	0.02	0.11	0.18	0.25	0.002	0.044	0.09	0.14
	Aug	4.46	0.30	0.59	0.80	0.93	0.02	0.11	0.18	0.25	0.002	0.045	0.09	0.14
Rapid City SD	Jun	2.89	0.39	0.86	1.21	1.41	0.05	0.18	0.16	0.42	0.013	0.085	0.16	0.25
	Jul	3.54	0.34	0.72	1.00	1.16	0.03	0.15	0.24	0.33	0.007	0.063	0.12	0.19
St. Louis MO	Jun	4.05	0.31	0.64	0.88	1.02	0.03	0.12	0.20	0.28	0.004	0.052	0.10	0.16
	Jul	4.49	0.29	0.59	0.80	0.93	0.02	0.11	0.18	0.25	0.002	0.044	0.09	0.14
San Angelo TX	May	3.53	0.34	0.72	1.00	1.17	0.03	0.15	0.24	0.33	0.007	0.064	0.12	0.19
San Sebastian PR	Sep	4.58	0.29	0.58	0.78	0.91	0.02	0.11	0.18	0.25	0.002	0.043	0.08	0.13
	Oct	4.62	0.29	0.57	0.78	0.90	0.02	0.11	0.18	0.24	0.002	0.042	0.08	0.13
Santa Maria CA	Jan	2.98	0.38	0.84	1.17	1.37	0.05	0.18	0.29	0.40	0.012	0.081	0.15	0.24
	Dec	3.26	0.36	0.77	1.08	1.26	0.04	0.16	0.26	0.36	0.010	0.071	0.13	0.21
Seattle WA	Aug	3.50	0.34	0.73	1.01	1.18	0.03	0.15	0.24	0.34	0.008	0.065	0.12	0.19
	Sep	3.31	0.36	0.76	1.06	1.24	0.04	0.16	0.26	0.36	0.009	0.070	0.13	0.21
Sheveport LA	May	3.97	0.32	0.65	0.90	1.04	0.03	0.13	0.21	0.24	0.005	0.054	0.10	0.16
	Sep	4.54	0.29	0.58	0.79	0.92	0.02	0.11	0.18	0.25	0.002	0.044	0.09	0.14
Spokane WA	May	1.83	0.54	1.29	1.85	2.16	0.09	0.31	0.50	0.70	0.034	0.158	0.29	0.44
	Jun	2.48	0.43	0.98	1.39	1.63	0.06	0.22	0.36	0.49	0.019	0.105	0.19	0.31
Tallahasse FL	Aug	4.74	0.29	0.56	0.76	0.88	0.02	0.10	0.17	0.24	0.001	0.041	0.08	0.13
	Nov	4.09	0.31	0.63	0.87	1.01	0.02	0.12	0.20	0.28	0.004	0.051	0.10	0.16
Topeka KS	Jun	3.98	0.32	0.65	0.89	1.04	0.03	0.13	0.21	0.29	0.005	0.053	0.10	0.16
	Jul	4.48	0.30	0.59	0.80	0.93	0.02	0.11	0.18	0.25	0.002	0.045	0.09	0.14
	Oct	3.09	0.37	0.81	1.13	1.33	0.04	0.17	0.28	0.39	0.011	0.077	0.15	0.23
Urbana IL	Jul	4.46	0.30	0.59	0.80	0.93	0.02	0.11	0.18	0.25	0.002	0.045	0.09	0.14
Yuma AZ	Aug	4.80	0.28	0.55	0.75	0.87	0.02	0.10	0.17	0.23	0.001	0.040	0.08	0.13
	Sep	4.56	0.29	0.58	0.79	0.91	0.02	0.11	0.18	0.25	0.002	0.043	0.08	0.14

Table 8. Critical rainfall rates causing an outage during all months at Boston and New Orleans for stated frequencies and elevation angles (based on a 15 dB fade margin).

			CRITICAL RAINRATES (in mm/min) FOR A 15dB FADE MARGIN											
			15 GHz				30 GHz				45 GHz			
LOCATION	MONTH	FRZ LVLS AVG (km)	ELEVATION ANGLE				ELEVATION ANGLE				ELEVATION ANGLE			
			10	30	50	70	10	30	50	70	10	30	50	70
Boston MA	Jan	0.76	1.13	2.92	4.23	4.23	0.25	0.83	1.34	1.70	0.122	0.483	0.87	1.23
	Feb	0.76	1.13	2.92	4.23	4.23	0.25	0.83	1.34	1.70	0.122	0.483	0.87	1.23
	Mar	1.28	0.72	1.79	2.59	2.99	0.14	0.45	0.75	1.02	0.059	0.251	0.45	0.68
	Apr	1.99	0.51	1.20	1.71	2.00	0.08	0.28	0.45	0.63	0.029	0.141	0.26	0.40
	May	2.92	0.39	0.85	1.19	1.40	0.05	0.18	0.30	0.41	0.013	0.083	0.16	0.25
	Jun	3.71	0.33	0.69	0.95	1.11	0.03	0.14	0.23	0.31	0.006	0.059	0.11	0.18
	Jul	4.16	0.31	0.63	0.86	1.00	0.02	0.12	0.20	0.28	0.004	0.050	0.10	0.15
	Aug	4.18	0.31	0.62	0.86	0.99	0.02	0.12	0.20	0.27	0.004	0.050	0.10	0.15
	Sep	3.85	0.32	0.67	0.92	1.07	0.03	0.13	0.22	0.30	0.005	0.056	0.11	0.17
	Oct	2.94	0.39	0.85	1.19	1.39	0.05	0.18	0.29	0.41	0.013	0.083	0.16	0.25
	Nov	2.24	0.46	1.09	1.53	1.79	0.07	0.25	0.40	0.55	0.023	0.120	0.22	0.35
	Dec	1.13	0.80	2.01	2.92	3.35	0.16	0.52	0.87	1.16	0.071	0.294	0.53	0.79
New Orleans LA	Jan	3.39	0.35	0.75	1.04	1.21	0.04	0.15	0.25	0.35	0.009	0.067	0.13	0.20
	Feb	3.37	0.35	0.75	1.04	1.22	0.04	0.15	0.25	0.35	0.009	0.068	0.13	0.20
	Mar	3.75	0.33	0.68	0.95	1.10	0.03	0.14	0.22	0.31	0.006	0.058	0.11	0.18
	Apr	3.97	0.32	0.65	0.90	1.04	0.03	0.13	0.21	0.29	0.005	0.054	0.10	0.16
	May	4.26	0.30	0.61	0.84	0.97	0.02	0.12	0.19	0.27	0.003	0.048	0.09	0.15
	Jun	4.61	0.29	0.57	0.78	0.90	0.02	0.11	0.18	0.24	0.002	0.043	0.08	0.13
	Jul	4.73	0.29	0.56	0.76	0.88	0.02	0.10	0.17	0.24	0.001	0.041	0.08	0.13
	Aug	4.73	0.29	0.56	0.76	0.88	0.02	0.10	0.17	0.24	0.001	0.041	0.08	0.13
	Sep	4.69	0.29	0.57	0.77	0.89	0.02	0.10	0.17	0.24	0.001	0.042	0.08	0.13
	Oct	4.40	0.30	0.60	0.81	0.94	0.02	0.11	0.19	0.26	0.003	0.046	0.09	0.14
	Nov	4.07	0.31	0.64	0.88	1.02	0.03	0.12	0.20	0.28	0.004	0.052	0.10	0.16
	Dec	3.73	0.33	0.69	0.95	1.11	0.03	0.14	0.23	0.31	0.006	0.059	0.11	0.18

Table 9. Critical rainfall rates causing an outage during all months at Boston and New Orleans for stated frequencies and elevation angles (based on a 20 dB fade margin).

			CRITICAL RAINRATES (in mm/min) FOR A 20dB FADE MARGIN											
			15 GHz				30 GHz				45 GHz			
LOCATION	MONTH	FRZ LVLS AVG (km)	ELEVATION ANGLE				ELEVATION ANGLE				ELEVATION ANGLE			
			10	30	50	70	10	30	50	70	10	30	50	70
Boston MA	Jan	0.76	1.55	3.97	4.23	4.23	0.35	1.14	1.81	2.21	0.176	0.687	1.21	1.60
	Feb	0.76	1.55	3.97	4.23	4.23	0.35	1.14	1.81	2.21	0.176	0.687	1.21	1.60
	Mar	1.28	1.01	2.44	3.50	4.00	0.20	0.63	1.03	1.33	0.088	0.349	0.62	0.90
	Apr	1.99	0.73	1.64	2.31	2.65	0.12	0.38	0.62	0.83	0.045	0.200	0.35	0.52
	May	2.92	0.57	1.17	1.62	1.85	0.08	0.25	0.40	0.54	0.022	0.121	0.22	0.32
	Jun	3.71	0.49	0.96	1.30	1.48	0.05	0.20	0.31	0.41	0.012	0.087	0.16	0.24
	Jul	4.16	0.47	0.88	1.17	1.33	0.04	0.17	0.27	0.36	0.008	0.074	0.14	0.21
	Aug	4.18	0.47	0.87	1.17	1.32	0.04	0.17	0.27	0.36	0.008	0.074	0.14	0.20
	Sep	3.85	0.48	0.93	1.26	1.43	0.05	0.19	0.30	0.39	0.010	0.083	0.15	0.23
	Oct	2.94	0.56	1.17	1.61	1.84	0.07	0.25	0.40	0.53	0.022	0.120	0.22	0.32
	Nov	2.24	0.67	1.48	2.07	2.37	0.11	0.34	0.54	0.73	0.037	0.172	0.31	0.44
	Dec	1.13	1.12	2.74	3.94	4.23	0.23	0.73	1.18	1.51	0.104	0.407	0.73	1.04
New Orleans LA	Jan	3.39	0.52	1.04	1.41	1.61	0.06	0.22	0.34	0.45	0.015	0.099	0.18	0.27
	Feb	3.37	0.52	1.04	1.42	1.62	0.06	0.22	0.34	0.45	0.016	0.100	0.18	0.27
	Mar	3.75	0.49	0.95	1.29	1.46	0.05	0.19	0.31	0.41	0.011	0.086	0.16	0.24
	Apr	3.97	0.48	0.91	1.22	1.39	0.05	0.18	0.29	0.38	0.009	0.079	0.15	0.22
	May	4.26	0.46	0.86	1.15	1.30	0.04	0.17	0.27	0.35	0.007	0.072	0.13	0.20
	Jun	4.61	0.44	0.81	1.07	1.20	0.03	0.15	0.24	0.32	0.004	0.064	0.12	0.18
	Jul	4.73	0.44	0.79	1.04	1.17	0.03	0.15	0.24	0.31	0.004	0.062	0.12	0.17
	Aug	4.73	0.44	0.79	1.04	1.17	0.03	0.15	0.24	0.31	0.004	0.062	0.12	0.17
	Sep	4.69	0.44	0.80	1.05	1.18	0.03	0.15	0.24	0.32	0.004	0.062	0.12	0.17
	Oct	4.40	0.45	0.84	1.11	1.26	0.04	0.16	0.26	0.34	0.006	0.068	0.13	0.19
	Nov	4.07	0.47	0.89	1.19	1.35	0.04	0.18	0.28	0.37	0.008	0.077	0.14	0.21
	Dec	3.73	0.49	0.96	1.29	1.47	0.05	0.19	0.31	0.41	0.012	0.087	0.16	0.24

Table 10. Critical rainfall rates causing an outage during all months at Boston and New Orleans for stated frequencies and elevation angles (based on a 25 dB fade margin).

			CRITICAL RAINRATES (in mm/min) FOR A 25dB FADE MARGIN											
			15 GHz				30 GHz				45 GHz			
LOCATION	MONTH	FRZ LVLS AVG (km)	ELEVATION ANGLE				ELEVATION ANGLE				ELEVATION ANGLE			
			10	30	50	70	10	30	50	70	10	30	50	70
Boston MA	Jan	0.76	2.00	4.23	4.23	4.23	0.45	1.47	2.31	2.76	0.234	0.910	1.57	2.00
	Feb	0.76	2.00	4.23	4.23	4.23	0.45	1.47	2.31	2.76	0.234	0.910	1.57	2.00
	Mar	1.28	1.32	3.11	4.23	4.23	0.26	0.82	1.31	1.65	0.119	0.456	0.82	1.12
	Apr	1.99	0.96	2.09	2.93	3.32	0.16	0.49	0.80	1.03	0.064	0.263	0.46	0.66
	May	2.92	0.77	1.51	2.05	2.32	0.11	0.33	0.51	0.67	0.033	0.162	0.28	0.40
	Jun	3.71	0.68	1.25	1.65	1.85	0.08	0.26	0.39	0.51	0.019	0.118	0.21	0.30
	Jul	4.16	0.65	1.14	1.49	1.66	0.07	0.23	0.35	0.45	0.013	0.101	0.18	0.26
	Aug	4.18	0.65	1.14	1.49	1.66	0.06	0.23	0.35	0.44	0.013	0.101	0.18	0.26
	Sep	3.85	0.67	1.21	1.60	1.79	0.07	0.25	0.38	0.49	0.017	0.112	0.20	0.29
	Oct	2.94	0.76	1.50	2.04	2.30	0.11	0.33	0.51	0.67	0.033	0.160	0.28	0.40
	Nov	2.24	0.89	1.89	2.62	2.97	0.14	0.43	0.70	0.91	0.053	0.227	0.39	0.56
	Dec	1.13	1.45	3.48	4.23	4.23	0.30	0.94	1.50	1.87	0.141	0.540	0.96	1.30
New Orleans LA	Jan	3.39	0.71	1.34	1.79	2.01	0.09	0.28	0.43	0.57	0.024	0.133	0.23	0.34
	Feb	3.37	0.71	1.34	1.80	2.03	0.09	0.28	0.43	0.57	0.024	0.134	0.24	0.34
	Mar	3.75	0.68	1.23	1.64	1.83	0.08	0.25	0.39	0.50	0.019	0.116	0.21	0.30
	Apr	3.97	0.66	1.18	1.56	1.74	0.07	0.24	0.37	0.47	0.016	0.108	0.19	0.27
	May	4.26	0.64	1.12	1.46	1.62	0.06	0.22	0.34	0.43	0.012	0.098	0.17	0.25
	Jun	4.61	0.62	1.05	1.36	1.51	0.05	0.20	0.31	0.40	0.009	0.087	0.16	0.23
	Jul	4.73	0.62	1.03	1.33	1.47	0.05	0.20	0.30	0.39	0.008	0.085	0.15	0.22
	Aug	4.73	0.62	1.03	1.33	1.47	0.05	0.20	0.30	0.39	0.008	0.085	0.15	0.22
	Sep	4.69	0.62	1.04	1.34	1.48	0.05	0.20	0.31	0.39	0.008	0.085	0.15	0.22
	Oct	4.40	0.63	1.09	1.42	1.58	0.06	0.21	0.33	0.42	0.011	0.094	0.17	0.24
	Nov	4.07	0.65	1.16	1.52	1.70	0.07	0.23	0.36	0.46	0.014	0.104	0.18	0.27
	Dec	3.73	0.68	1.24	1.65	1.84	0.08	0.25	0.39	0.51	0.019	0.117	0.21	0.30

Table 11. Estimated mean percent of time with system outages due to rain in the worst months for stated elevation angles, frequencies and fade margins.

Location	Month(s)	Percent of time in the Month: 15 GHz 15 dB Elevation Angle (in degrees) 10	30	50	70	30 GHz 15 dB Elevation Angle (in degrees) 10	30	50	70	45 GHz 15 dB Elevation Angle (in degrees) 10	30	50	70
Aberdeen, SD	JUN	0.10	0.03	0.01	0.01	1.23	0.21	0.14	0.10	2.92	0.58	0.26	0.17
Aberdeen, SD	JUL	0.09	0.04	0.02	0.02	1.14	0.21	0.12	0.09	2.04	0.43	0.26	0.17
Albuquerque, NM	AUG	0.04	0.01	0.01	0.00	0.70	0.09	0.06	0.04	1.79	0.23	0.10	0.07
Allentown, PA	JUL	0.13	0.05	0.03	0.02	2.84	0.46	0.23	0.15	3.90	1.21	0.59	0.34
Allentown, PA	AUG	0.19	0.07	0.03	0.01	3.34	0.52	0.32	0.21	4.52	1.40	0.74	0.40
Asheville, NC	JUL	0.13	0.05	0.03	0.02	2.83	0.40	0.23	0.16	4.01	1.19	0.52	0.31
Asheville, NC	SEP	0.09	0.03	0.01	0.01	4.09	0.43	0.19	0.10	5.69	1.46	0.69	0.27
Bakersfield, CA	MAR	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.00	1.69	0.03	0.01	0.00
Bakersfield, CA	MAY	0.01	0.00	0.00	0.00	0.29	0.02	0.01	0.01	0.56	0.04	0.03	0.02
Billings, MT	JUL	0.02	0.00	0.00	0.00	0.20	0.04	0.02	0.01	1.24	0.11	0.04	0.03
Boise, ID	SEP	0.01	0.00	0.00	0.00	0.18	0.01	0.01	0.01	1.28	0.07	0.02	0.01
Boston, MA	AUG	0.09	0.03	0.02	0.01	3.30	0.33	0.15	0.10	4.59	1.02	0.40	0.22
Cape Hatteras, NC	SEP	0.21	0.08	0.04	0.03	3.14	0.53	0.36	0.26	4.39	1.39	0.65	0.44
Charleston, SC	JUN	0.33	0.13	0.08	0.06	3.07	0.73	0.48	0.37	4.10	1.49	0.87	0.62
Cheyenne, WY	JUL	0.05	0.01	0.00	0.00	0.48	0.12	0.07	0.05	1.90	0.34	0.15	0.09
Cheyenne, WY	SEP	0.01	0.00	0.00	0.00	0.14	0.02	0.01	0.01	1.36	0.05	0.02	0.01
Chicago, IL	JUL	0.15	0.05	0.03	0.02	2.04	0.37	0.22	0.17	2.75	0.89	0.47	0.29
Chicago, IL	AUG	0.15	0.06	0.04	0.03	2.56	0.38	0.24	0.17	3.52	0.92	0.53	0.29
Denver, CO	AUG	0.04	0.01	0.01	0.01	0.67	0.10	0.06	0.04	1.50	0.28	0.12	0.07
Ely, NV	AUG	0.01	0.00	0.00	0.00	0.15	0.02	0.01	0.01	1.09	0.07	0.03	0.02
Grand Junction, CO	JUL	0.01	0.01	0.01	0.00	0.23	0.02	0.02	0.01	0.68	0.07	0.03	0.02
Houston, TX	MAY	0.24	0.09	0.05	0.04	2.56	0.62	0.39	0.28	3.24	1.47	0.84	0.49
Houston, TX	JUN	0.21	0.10	0.07	0.05	1.80	0.47	0.33	0.25	2.47	1.07	0.59	0.41
Huntsville, AL	MAY	0.14	0.05	0.03	0.02	2.64	0.38	0.22	0.14	4.33	1.11	0.52	0.28
Huntsville, AL	JUL	0.27	0.11	0.07	0.05	2.46	0.62	0.41	0.31	3.27	1.37	0.74	0.51
Internat'l Falls, MN	JUL	0.08	0.03	0.01	0.01	2.01	0.19	0.12	0.08	3.35	0.65	0.27	0.15
Internat'l Falls, MN	SEP	0.05	0.01	0.00	0.00	0.63	0.14	0.07	0.04	3.52	0.30	0.16	0.10
Key West, FL	JUL	0.20	0.09	0.05	0.04	1.90	0.44	0.31	0.24	2.60	1.05	0.57	0.39
Key West, FL	AUG	0.27	0.14	0.09	0.07	2.55	0.61	0.41	0.32	3.56	1.38	0.75	0.51
Lexington, KY	JUN	0.12	0.04	0.03	0.02	2.65	0.36	0.20	0.14	4.50	1.02	0.43	0.26
Lexington, KY	JUL	0.24	0.11	0.06	0.04	3.04	0.53	0.37	0.27	4.12	1.20	0.70	0.43
Miami, FL	JUN	0.38	0.18	0.12	0.10	3.41	0.79	0.57	0.45	4.62	1.92	1.05	0.71
Newark, NJ	AUG	0.15	0.06	0.03	0.03	2.96	0.44	0.23	0.17	4.02	1.33	0.60	0.31
New Orleans, LA	JUL	0.27	0.12	0.07	0.05	3.24	0.71	0.46	0.34	4.52	1.82	0.91	0.59
New Orleans, LA	AUG	0.38	0.19	0.11	0.08	3.25	0.85	0.60	0.45	4.43	1.95	1.07	0.73
NYC (Kennedy), NY	JUN	0.08	0.03	0.02	0.02	2.64	0.30	0.15	0.10	4.82	0.93	0.39	0.22
NYC (Kennedy), NY	AUG	0.11	0.04	0.03	0.02	2.56	0.32	0.18	0.13	3.56	1.03	0.43	0.25

Table 11. Estimated mean percent of time with system outages due to rain in the worst months for stated elevation angles, frequencies and fade margins. (Cont.)

Location	Month(s)	Percent of time in the Month: 15 GHz 15 dB Elevation Angle (in degrees) 10	30	50	70	30 GHz 15 dB Elevation Angle (in degrees) 10	30	50	70	45 GHz 15 dB Elevation Angle (in degrees) 10	30	50	70
Oklahoma City, OK	MAY	0.15	0.04	0.02	0.01	2.12	0.45	0.24	0.15	3.85	1.30	0.57	0.32
Oklahoma City, OK	JUN	0.17	0.06	0.03	0.02	2.18	0.42	0.27	0.19	2.90	0.81	0.47	0.34
Omaha, NE	JUL	0.12	0.05	0.03	0.02	2.01	0.30	0.19	0.14	2.74	0.87	0.43	0.22
Omaha, NE	AUG	0.10	0.04	0.02	0.02	1.46	0.30	0.17	0.11	2.46	0.69	0.36	0.21
Philadelphia, PA	JUN	0.16	0.05	0.03	0.02	2.54	0.43	0.26	0.18	4.54	0.97	0.52	0.35
Philadelphia, PA	JUL	0.14	0.05	0.03	0.02	2.35	0.41	0.26	0.18	3.27	1.08	0.51	0.34
Philadelphia, PA	AUG	0.19	0.07	0.04	0.02	2.60	0.50	0.31	0.24	3.48	1.25	0.63	0.40
Phoenix, AZ	JUL	0.03	0.01	0.01	0.01	0.39	0.07	0.05	0.03	0.55	0.19	0.09	0.06
Phoenix, AZ	AUG	0.03	0.01	0.01	0.01	0.47	0.06	0.04	0.03	0.66	0.20	0.08	0.05
Pittsburgh, PA	JUL	0.11	0.04	0.03	0.02	2.02	0.30	0.16	0.12	3.44	0.90	0.40	0.22
Raleigh, NC	JUN	0.13	0.03	0.02	0.01	2.23	0.33	0.21	0.15	2.99	0.78	0.37	0.25
Raleigh, NC	JUL	0.16	0.05	0.02	0.01	2.54	0.47	0.29	0.19	3.55	1.21	0.57	0.37
Raleigh, NC	AUG	0.12	0.04	0.02	0.01	2.40	0.40	0.24	0.16	3.39	1.03	0.49	0.32
Rapid City, SD	JUN	0.05	0.01	0.01	0.00	0.91	0.14	0.17	0.05	2.64	0.57	0.17	0.08
Rapid City, SD	JUL	0.05	0.02	0.01	0.01	1.28	0.12	0.07	0.05	2.33	0.32	0.16	0.09
St. Louis, MO	JUN	0.13	0.05	0.03	0.02	1.53	0.33	0.19	0.14	2.53	0.74	0.38	0.24
St. Louis, MO	JUL	0.12	0.05	0.03	0.03	1.67	0.25	0.18	0.14	2.36	0.75	0.32	0.21
San Angelo, TX	MAY	0.07	0.03	0.02	0.01	1.11	0.14	0.10	0.07	1.77	0.46	0.21	0.12
San Sebastian, PR	SEP	0.43	0.18	0.12	0.09	2.85	0.87	0.63	0.49	3.77	1.67	1.07	0.78
San Sebastian, PR	OCT	0.37	0.15	0.08	0.06	2.60	0.90	0.61	0.46	3.36	1.68	1.10	0.80
Santa Maria, CA	JAN	0.01	0.00	0.00	0.00	0.65	0.05	0.02	0.01	3.42	0.38	0.07	0.03
Santa Maria, CA	DEC	0.02	0.00	0.00	0.00	1.28	0.10	0.04	0.02	3.13	0.49	0.17	0.06
Seattle, WA	AUG	0.01	0.00	0.00	0.00	1.68	0.02	0.01	0.01	3.11	0.29	0.05	0.01
Seattle, WA	SEP	0.01	0.00	0.00	0.00	1.60	0.03	0.01	0.01	4.71	0.41	0.07	0.02
Shreveport, LA	MAY	0.21	0.07	0.03	0.02	2.07	0.55	0.34	0.30	3.19	1.13	0.68	0.44
Shreveport, LA	SEP	0.08	0.03	0.01	0.01	2.25	0.31	0.17	0.09	3.18	1.02	0.41	0.23
Spokane, WA	MAY	0.00	0.00	0.00	0.00	0.11	0.01	0.00	0.00	1.42	0.03	0.02	0.01
Spokane, WA	JUN	0.02	0.00	0.00	0.00	0.26	0.03	0.02	0.01	1.65	0.08	0.04	0.03
Tallahassee, FL	AUG	0.44	0.23	0.15	0.11	3.65	0.92	0.65	0.51	4.99	2.17	1.17	0.78
Tallahassee, FL	NOV	0.13	0.05	0.03	0.02	2.62	0.41	0.21	0.15	3.49	0.97	0.50	0.27
Topeka, KS	JUN	0.15	0.06	0.03	0.02	2.22	0.37	0.22	0.16	3.70	1.01	0.47	0.29
Topeka, KS	JUL	0.10	0.03	0.02	0.02	1.93	0.27	0.17	0.13	2.72	0.84	0.35	0.21
Topeka, KS	OCT	0.03	0.01	0.01	0.00	1.51	0.14	0.05	0.03	3.36	0.59	0.17	0.08
Urbana, IL	JUL	0.25	0.12	0.08	0.06	1.92	0.52	0.36	0.28	2.48	1.13	0.63	0.43
Yuma, AZ	AUG	0.02	0.01	0.00	0.00	0.35	0.07	0.04	0.03	0.48	0.20	0.09	0.06
Yuma, AZ	SEP	0.01	0.00	0.00	0.00	0.28	0.04	0.02	0.01	0.40	0.13	0.06	0.03

Table 12. Estimated mean percent of time with system outages due to rain for all months at Boston for stated elevation angles, frequencies, and fade margins.

Percent of time in the Month

Month	Elevation Angle (in degrees) 10	30	50	70	Elevation Angle (in degrees) 10	30	50	70	Elevation Angle (in degrees) 10	30	50	70
	15 GHz 15 dB				30 GHz 15 dB				45 GHz 15 dB			
JAN	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.20	0.00	0.00	0.00
FEB	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.15	0.00	0.00	0.00
MAR	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.71	0.01	0.00	0.00
APR	0.00	0.00	0.00	0.00	0.49	0.01	0.00	0.00	3.45	0.07	0.01	0.00
MAY	0.00	0.00	0.00	0.00	1.01	0.07	0.00	0.00	5.39	0.51	0.09	0.02
JUN	0.04	0.01	0.00	0.00	2.21	0.15	0.07	0.05	3.95	0.68	0.24	0.10
JUL	0.06	0.02	0.01	0.01	2.11	0.23	0.11	0.07	2.90	0.63	0.27	0.16
AUG	0.09	0.03	0.02	0.01	3.30	0.33	0.15	0.10	4.51	1.02	0.40	0.22
SEP	0.05	0.01	0.00	0.00	2.67	0.29	0.10	0.06	4.67	0.99	0.37	0.18
OCT	0.01	0.00	0.00	0.00	1.04	0.09	0.02	0.01	4.35	0.56	0.12	0.03
NOV	0.00	0.00	0.00	0.00	0.77	0.01	0.00	0.00	4.26	0.20	0.02	0.00
DEC	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.81	0.00	0.00	0.00
	15 GHz 20 dB				30 GHz 20 dB				45 GHz 20 dB			
JAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00
FEB	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00
MAR	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.31	0.00	0.00	0.00
APR	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	1.56	0.01	0.00	0.00
MAY	0.00	0.00	0.00	0.00	0.55	0.02	0.00	0.00	4.32	0.19	0.04	0.00
JUN	0.02	0.00	0.00	0.00	0.77	0.09	0.05	0.03	3.52	0.40	0.12	0.07
JUL	0.04	0.01	0.01	0.00	1.13	0.14	0.08	0.05	2.71	0.46	0.18	0.11
AUG	0.05	0.02	0.01	0.00	1.78	0.19	0.10	0.07	4.21	0.72	0.26	0.15
SEP	0.03	0.00	0.00	0.00	1.06	0.14	0.06	0.04	4.27	0.63	0.21	0.09
OCT	0.01	0.00	0.00	0.00	0.75	0.03	0.01	0.01	3.55	0.24	0.05	0.02
NOV	0.00	0.00	0.00	0.00	0.24	0.00	0.00	0.00	2.62	0.06	0.01	0.00
DEC	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.21	0.00	0.00	0.00
	15 GHz 25 dB				30 GHz 25 dB				45 GHz 25 dB			
JAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00
FEB	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00
MAR	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.31	0.00	0.00	0.00
APR	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	1.56	0.01	0.00	0.00
MAY	0.00	0.00	0.00	0.00	0.55	0.02	0.00	0.00	4.32	0.19	0.04	0.00
JUN	0.02	0.00	0.00	0.00	0.77	0.09	0.05	0.03	3.52	0.40	0.12	0.07
JUL	0.04	0.01	0.01	0.00	1.13	0.14	0.08	0.05	2.71	0.46	0.18	0.11
AUG	0.05	0.02	0.01	0.00	1.78	0.19	0.10	0.07	4.21	0.72	0.26	0.15
SEP	0.03	0.00	0.00	0.00	1.06	0.14	0.06	0.04	4.27	0.63	0.21	0.09
OCT	0.01	0.00	0.00	0.00	0.75	0.03	0.01	0.01	3.55	0.24	0.05	0.02
NOV	0.00	0.00	0.00	0.00	0.24	0.00	0.00	0.00	2.62	0.06	0.01	0.00
DEC	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.21	0.00	0.00	0.00

Table 13. Estimated mean percent of time with system outages due to rain for all months at New Orleans for stated elevation angles, frequencies and fade margins.

	Percent of time in the Month											
	Elevation Angle (in degrees)				Elevation Angle (in degrees)				Elevation Angle (in degrees)			
Month	10	30	50	70	10	30	50	70	10	30	50	70
	15 GHz 15 dB				30 GHz 15 dB				45 GHz 15 dB			
JAN	0.11	0.03	0.01	0.01	2.40	0.38	0.17	0.11	5.12	1.24	0.51	0.24
FEB	0.12	0.03	0.01	0.01	1.96	0.39	0.19	0.12	3.94	1.08	0.49	0.26
MAR	0.17	0.05	0.02	0.01	2.67	0.49	0.27	0.18	4.11	1.35	0.67	0.35
APR	0.13	0.05	0.03	0.02	1.99	0.41	0.23	0.15	3.26	0.95	0.50	0.32
MAY	0.22	0.09	0.05	0.04	2.85	0.57	0.35	0.24	3.74	1.38	0.79	0.43
JUN	0.29	0.14	0.08	0.06	1.96	0.56	0.40	0.34	2.57	1.18	0.73	0.50
JUL	0.27	0.12	0.07	0.05	3.24	0.71	0.46	0.34	4.52	1.82	0.91	0.59
AUG	0.38	0.19	0.11	0.08	3.25	0.85	0.60	0.45	4.43	1.95	1.07	0.73
SEP	0.33	0.14	0.10	0.08	3.45	0.82	0.54	0.40	4.73	1.97	1.07	0.68
OCT	0.10	0.05	0.03	0.02	1.68	0.40	0.19	0.12	2.16	0.93	0.51	0.29
NOV	0.12	0.03	0.02	0.02	2.87	0.57	0.26	0.15	4.70	1.43	0.69	0.37
DEC	0.15	0.04	0.03	0.02	2.86	0.52	0.26	0.17	4.42	1.42	0.72	0.37
	15 GHz 20 dB				30 GHz 20 dB				45 GHz 20 dB			
JAN	0.05	0.01	0.00	0.00	1.36	0.21	0.11	0.07	4.60	0.71	0.29	0.16
FEB	0.07	0.01	0.01	0.00	1.19	0.23	0.13	0.09	3.49	0.66	0.31	0.17
MAR	0.09	0.02	0.01	0.00	1.47	0.33	0.18	0.12	3.81	0.94	0.41	0.24
APR	0.08	0.03	0.02	0.01	0.98	0.28	0.15	0.11	3.05	0.71	0.34	0.22
MAY	0.14	0.05	0.02	0.02	1.80	0.39	0.24	0.19	3.53	1.01	0.52	0.33
JUN	0.20	0.08	0.04	0.03	1.63	0.45	0.34	0.27	2.51	0.85	0.53	0.40
JUL	0.17	0.06	0.04	0.03	2.56	0.50	0.34	0.25	4.32	1.09	0.63	0.46
AUG	0.26	0.11	0.06	0.05	2.63	0.65	0.45	0.36	4.24	1.26	0.77	0.60
SEP	0.21	0.09	0.05	0.04	2.78	0.59	0.40	0.30	4.53	1.29	0.73	0.54
OCT	0.07	0.03	0.02	0.01	1.10	0.24	0.12	0.09	2.08	0.68	0.33	0.19
NOV	0.05	0.02	0.01	0.01	2.16	0.32	0.15	0.08	4.42	1.04	0.46	0.24
DEC	0.08	0.03	0.01	0.01	1.56	0.34	0.17	0.10	4.03	0.98	0.43	0.25
	15 GHz 25 dB				30 GHz 25 dB				45 GHz 25 dB			
JAN	0.03	0.00	0.00	0.00	0.86	0.15	0.08	0.04	3.81	0.49	0.20	0.11
FEB	0.04	0.01	0.00	0.00	0.79	0.17	0.09	0.06	2.98	0.47	0.20	0.13
MAR	0.05	0.01	0.00	0.00	1.03	0.23	0.13	0.09	3.33	0.63	0.29	0.19
APR	0.05	0.02	0.01	0.01	0.79	0.19	0.11	0.08	2.70	0.48	0.26	0.17
MAY	0.08	0.02	0.01	0.01	1.16	0.30	0.20	0.16	3.27	0.69	0.39	0.26
JUN	0.12	0.05	0.02	0.02	0.95	0.37	0.27	0.22	2.34	0.68	0.43	0.34
JUL	0.10	0.04	0.02	0.02	1.21	0.39	0.26	0.20	4.05	0.86	0.50	0.37
AUG	0.17	0.06	0.04	0.03	1.39	0.53	0.37	0.29	3.99	1.01	0.65	0.49
SEP	0.13	0.05	0.02	0.02	1.44	0.46	0.31	0.25	4.26	1.01	0.59	0.43
OCT	0.04	0.02	0.01	0.01	0.74	0.16	0.09	0.07	1.93	0.48	0.22	0.14
NOV	0.03	0.01	0.01	0.01	1.15	0.21	0.09	0.06	3.99	0.66	0.32	0.16
DEC	0.04	0.02	0.01	0.00	1.09	0.23	0.12	0.07	3.58	0.67	0.29	0.17

Table 14. Estimated mean number or system outages due to rain in the worst months for the indicated durations (based on a frequency of 15 GHz and a fade margin of 15dB).

NUMBER OF OUTAGES

Location		5-min Duration				10-min Duration				20-min Duration				30-min Duration			
		Elevation Angle (in degrees)				Elevation Angle (in degrees)				Elevation Angle (in degrees)				Elevation Angle (in degrees)			
		10	30	50	70	10	30	50	70	10	30	50	70	10	30	50	70
Aberdeen	JUN	7.3	1.7	0.7	0.5	2.8	0.5	0.3	0.1	0.8	0.1	0.0	0.0	0.3	0.1	0.0	0.0
Aberdeen	JUL	6.4	1.8	0.8	0.5	2.5	0.4	0.1	0.1	0.8	0.0	0.0	0.0	0.3	0.0	0.0	0.0
Albuquerque	AUG	3.2	0.6	0.1	0.1	0.9	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Allentown	JUL	9.4	3.2	1.7	1.2	3.3	0.8	0.6	0.3	0.5	0.2	0.2	0.1	0.4	0.1	0.1	0.0
Allentown	AUG	13.7	3.5	1.3	0.4	5.3	0.8	0.2	0.1	1.2	0.2	0.0	0.0	0.4	0.1	0.0	0.0
Asheville	JUL	10.1	3.9	1.8	1.1	4.0	1.5	0.6	0.3	1.4	0.4	0.2	0.1	0.6	0.0	0.0	0.0
Asheville	SEP	7.0	1.8	0.9	0.8	3.2	0.6	0.3	0.3	1.0	0.2	0.0	0.0	0.6	0.0	0.0	0.0
Bakersfield	MAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bakersfield	MAY	0.5	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Billings	JUL	1.1	0.1	0.0	0.0	0.4	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Boise	SEP	0.6	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Boston	AUG	5.9	1.4	0.7	0.3	1.7	0.5	0.2	0.0	0.4	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Cape Hatteras	SEP	16.4	5.9	2.7	1.6	6.9	2.3	0.7	0.4	2.6	0.4	0.2	0.1	0.9	0.1	0.0	0.0
Charleston	JUN	24.2	8.4	4.6	3.3	9.7	2.7	1.6	1.0	2.7	0.7	0.4	0.2	1.3	0.1	0.1	0.1
Cheyenne	JUL	3.2	0.4	0.1	0.0	0.9	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cheyenne	SEP	0.8	0.1	0.1	0.1	0.3	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Chicago	JUL	11.7	3.1	1.7	1.7	4.9	1.0	0.6	0.6	1.6	0.1	0.0	0.0	0.4	0.0	0.0	0.0
Chicago	AUG	11.0	3.9	2.4	1.3	4.4	1.1	0.4	0.2	1.4	0.2	0.0	0.0	0.4	0.0	0.0	0.0
Denver	AUG	2.4	0.6	0.4	0.2	0.8	0.1	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ely	AUG	0.7	0.1	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Grand Junction	JUL	0.8	0.3	0.3	0.1	0.2	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Houston	MAY	17.4	6.2	2.7	1.5	6.5	2.1	0.8	0.3	1.9	0.3	0.1	0.1	0.9	0.1	0.0	0.0
Houston	JUN	15.8	7.0	3.7	2.9	6.5	2.7	1.3	1.1	2.3	0.8	0.2	0.1	0.8	0.2	0.1	0.1
Huntsville	MAY	10.2	3.4	1.4	1.1	3.4	1.1	0.4	0.3	0.7	0.3	0.0	0.0	0.2	0.0	0.0	0.0
Huntsville	JUL	20.0	7.1	4.0	2.3	7.5	2.1	1.0	0.5	2.4	0.3	0.2	0.0	0.7	0.2	0.1	0.0
Internat'l Falls	JUL	5.7	1.9	0.6	0.2	2.0	0.6	0.1	0.0	0.5	0.1	0.0	0.0	0.2	0.0	0.0	0.0
Internat'l Falls	SEP	3.3	0.4	0.2	0.2	1.2	0.2	0.1	0.1	0.4	0.1	0.0	0.0	0.1	0.0	0.0	0.0
Key West, FL	JUL	13.7	5.1	2.5	1.7	4.5	1.3	0.6	0.4	0.8	0.2	0.0	0.0	0.4	0.0	0.0	0.0
Key West, FL	AUG	20.8	8.7	5.0	3.5	7.3	2.6	1.3	0.9	1.8	0.5	0.2	0.2	0.8	0.2	0.1	0.0
Lexington, KY	JUN	8.6	2.6	1.6	0.8	3.2	0.9	0.5	0.2	0.7	0.2	0.1	0.0	0.3	0.1	0.1	0.0
Lexington, KY	JUL	19.0	6.8	3.2	1.8	7.9	2.0	1.0	0.4	2.7	0.3	0.2	0.0	1.2	0.0	0.0	0.0
Miami, FL	JUN	28.0	10.8	6.7	5.3	10.9	3.6	2.1	1.6	3.1	1.0	0.4	0.4	1.4	0.4	0.2	0.1
Newark, NJ	AUG	10.1	3.2	2.0	1.4	3.2	0.7	0.5	0.3	0.9	0.1	0.1	0.0	0.1	0.0	0.0	0.0
New Orleans	JUL	21.1	7.8	3.8	2.8	8.1	2.8	1.0	0.9	2.5	0.5	0.3	0.3	0.6	0.2	0.1	0.1
New Orleans	AUG	28.4	12.8	6.7	4.4	11.0	4.2	1.9	1.4	2.9	0.9	0.4	0.4	1.1	0.4	0.2	0.1
NYC (Kennedy)	JUN	5.5	1.6	0.7	0.5	2.0	0.5	0.1	0.1	0.3	0.2	0.0	0.0	0.2	0.0	0.0	0.0
NYC (Kennedy)	AUG	6.8	2.2	1.1	1.0	2.5	0.6	0.3	0.2	0.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0

Table 14. Estimated mean number or system outages due to rain in the worst months for the indicated durations (based on a frequency of 15 GHz and a fade margin of 15dB). (Cont.)

NUMBER OF OUTAGES

Location		5-min Duration				10-min Duration				20-min Duration				30-min Duration			
		Elevation Angle (in degrees)				Elevation Angle (in degrees)				Elevation Angle (in degrees)				Elevation Angle (in degrees)			
		10	30	50	70	10	30	50	70	10	30	50	70	10	30	50	70
Oklahoma City	MAY	11.8	3.1	1.3	0.3	5.1	1.1	0.3	0.0	1.9	0.2	0.0	0.0	1.0	0.0	0.0	0.0
Oklahoma City	JUN	13.0	3.5	2.1	1.3	5.2	1.2	0.7	0.2	1.7	0.4	0.2	0.0	0.9	0.1	0.0	0.0
Omaha	JUL	8.7	3.2	1.5	1.1	3.3	0.8	0.3	0.1	1.0	0.1	0.0	0.0	0.3	0.1	0.0	0.0
Omaha	AUG	7.2	2.5	1.0	0.7	2.6	0.5	0.3	0.1	0.8	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Philadelphia	JUN	9.8	2.7	0.8	0.4	3.2	0.7	0.1	0.0	0.5	0.1	0.0	0.0	0.2	0.0	0.0	0.0
Philadelphia	JUL	9.9	2.9	0.9	0.7	3.4	0.7	0.2	0.1	0.6	0.1	0.0	0.0	0.1	0.0	0.0	0.0
Philadelphia	AUG	12.7	3.4	1.2	0.6	4.3	0.7	0.0	0.0	0.8	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Phoenix	JUL	1.8	0.3	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Phoenix	AUG	1.6	0.5	0.2	0.2	0.5	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pittsburgh	JUL	6.8	2.0	0.9	0.7	1.8	0.4	0.1	0.1	0.3	0.1	0.0	0.0	0.1	0.0	0.0	0.0
Raleigh	JUN	9.8	2.4	1.3	0.8	4.0	1.0	0.4	0.2	1.1	0.2	0.1	0.0	0.4	0.1	0.0	0.0
Raleigh	JUL	11.3	2.8	1.4	0.7	4.1	0.7	0.3	0.1	0.8	0.2	0.1	0.0	0.3	0.0	0.0	0.0
Raleigh	AUG	9.5	2.8	0.9	0.3	4.0	1.0	0.2	0.0	1.1	0.1	0.0	0.0	0.3	0.0	0.0	0.0
Rapid City	JUN	3.3	0.4	0.1	0.0	1.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rapid City	JUL	3.2	1.3	0.3	0.1	1.3	0.3	0.1	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
St. Louis	JUN	8.3	2.3	0.7	0.5	2.6	0.5	0.1	0.1	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
St. Louis	JUL	7.9	2.7	1.7	1.2	2.5	0.5	0.3	0.2	0.5	0.0	0.0	0.0	0.3	0.0	0.0	0.0
San Angelo	MAY	5.1	1.6	0.6	0.2	1.8	0.2	0.1	0.0	0.4	0.0	0.0	0.0	0.1	0.0	0.0	0.0
San Sebastian	SEP	33.2	12.3	7.8	5.1	13.9	4.5	2.5	1.7	5.1	1.3	0.6	0.4	1.8	0.2	0.1	0.1
San Sebastian	OCT	29.9	10.3	5.0	3.5	12.5	4.1	1.7	1.2	4.7	1.3	0.2	0.2	1.8	0.4	0.2	0.2
Santa Maria	JAN	0.4	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Santa Maria	DEC	0.8	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Seattle	AUG	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Seattle	SEP	0.4	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shreveport	MAY	17.0	5.1	1.9	1.3	7.5	1.9	0.4	0.4	2.9	0.4	0.0	0.0	1.5	0.2	0.0	0.0
Shreveport	SEP	6.2	1.9	0.8	0.6	2.7	0.7	0.3	0.2	0.8	0.2	0.1	0.1	0.2	0.1	0.1	0.0
Spokane	MAY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Spokane	JUN	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tallahassee	AUG	33.6	15.6	9.6	6.7	13.5	5.8	2.7	1.9	3.7	1.1	0.4	0.1	1.2	0.2	0.0	0.0
Tallahassee	NOV	9.6	3.1	1.8	1.5	3.9	1.1	0.7	0.5	1.4	0.3	0.1	0.0	0.7	0.2	0.1	0.0
Topeka	JUN	10.5	3.5	1.4	0.7	4.3	1.2	0.2	0.2	1.4	0.2	0.1	0.0	0.5	0.1	0.0	0.0
Topeka	JUL	7.2	2.1	1.1	1.0	2.6	0.7	0.2	0.1	0.6	0.2	0.0	0.0	0.4	0.0	0.0	0.0
Topeka	OCT	2.3	0.7	0.4	0.2	0.9	0.3	0.1	0.1	0.3	0.1	0.0	0.0	0.1	0.0	0.0	0.0
Urbana	JUL	14.5	5.7	4.1	2.6	3.8	1.6	1.1	0.4	0.6	0.3	0.1	0.0	0.0	0.0	0.0	0.0
Yuma	AUG	1.7	0.5	0.0	0.0	0.6	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Yuma	SEP	0.3	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 15. Estimated mean number or system outages due to rain in the worst months for the indicated durations (based on a frequency of 30 GHz and a fade margin of 15dB).

NUMBER OF OUTAGES

Location		5-min Duration				10-min Duration				20-min Duration				30-min Duration			
		Elevation Angle (in degrees)				Elevation Angle (in degrees)				Elevation Angle (in degrees)				Elevation Angle (in degrees)			
		10	30	50	70	10	30	50	70	10	30	50	70	10	30	50	70
Aberdeen	JUN	101.2	16.7	10.6	7.3	47.9	7.1	4.2	2.8	21.7	2.4	1.2	0.8	12.1	0.8	0.5	0.3
Aberdeen	JUL	95.7	17.3	9.7	6.9	45.0	7.6	3.9	2.6	20.3	2.7	1.1	0.8	11.9	1.4	0.7	0.3
Albuquerque	AUG	58.4	6.5	4.6	3.1	26.8	2.7	1.6	0.8	11.7	0.8	0.6	0.2	6.5	0.3	0.0	0.0
Allentown	JUL	242.6	37.7	17.8	11.5	116.8	17.1	7.3	4.5	54.0	6.9	2.2	1.1	32.8	2.9	0.9	0.5
Allentown	AUG	286.6	42.2	24.7	15.7	137.4	18.7	9.8	6.3	63.3	6.9	2.9	1.6	38.5	3.2	1.2	0.5
Asheville	JUL	241.8	33.2	18.4	12.4	115.8	14.9	8.0	5.2	52.5	5.9	2.9	1.9	32.3	2.9	1.1	0.8
Asheville	SEP	344.2	34.6	15.0	8.1	166.9	15.8	6.7	3.6	78.6	6.5	2.6	1.4	49.2	3.4	1.3	0.6
Bakersfield	MAR	17.7	0.3	0.0	0.0	8.4	0.1	0.0	0.0	3.6	0.0	0.0	0.0	2.2	0.0	0.0	0.0
Bakersfield	MAY	24.8	2.1	1.1	0.5	11.8	0.9	0.5	0.2	5.6	0.3	0.1	0.1	3.5	0.3	0.1	0.0
Billings	JUL	16.2	3.1	1.6	1.0	7.2	1.4	0.7	0.3	2.8	0.4	0.2	0.1	1.2	0.2	0.1	0.0
Boise	SEP	14.5	1.0	0.6	0.5	6.4	0.4	0.2	0.2	2.5	0.1	0.1	0.0	1.0	0.1	0.0	0.0
Boston	AUG	273.7	24.8	10.5	6.9	132.6	10.7	3.8	2.2	60.0	3.3	0.8	0.5	36.0	1.4	0.2	0.1
Cape Hatteras	SEP	262.1	42.7	27.9	20.3	125.9	19.7	12.7	8.7	58.1	8.4	4.8	3.3	35.8	4.3	2.3	1.5
Charleston	JUN	250.2	57.6	36.1	27.2	118.8	25.1	14.9	10.9	53.5	9.6	4.8	3.4	32.0	4.5	2.3	1.6
Cheyenne	JUL	38.5	8.9	5.0	3.0	16.9	3.6	1.6	0.9	6.7	1.0	0.2	0.1	2.8	0.2	0.1	0.0
Cheyenne	SEP	11.3	1.6	0.9	0.6	5.0	0.7	0.3	0.3	2.1	0.2	0.1	0.1	1.0	0.1	0.1	0.1
Chicago	JUL	173.3	29.8	17.6	13.5	82.6	13.4	7.7	5.9	37.2	5.1	2.8	2.1	22.7	2.4	1.2	0.8
Chicago	AUG	216.9	30.8	18.7	13.0	103.6	13.8	8.0	5.2	47.1	5.2	3.0	1.9	28.4	2.6	1.3	0.6
Denver	AUG	55.8	7.7	4.4	2.3	25.9	3.1	1.5	0.7	11.1	0.9	0.4	0.1	6.5	0.4	0.1	0.0
Ely	AUG	12.0	1.8	1.1	0.6	5.5	0.7	0.4	0.2	2.1	0.2	0.1	0.0	1.1	0.0	0.0	0.0
Grand Junction	JUL	17.9	1.6	1.1	0.9	8.0	0.5	0.2	0.2	3.2	0.1	0.1	0.1	1.7	0.1	0.0	0.0
Houston	MAY	219.5	50.5	30.9	21.6	105.7	22.4	13.2	9.0	49.2	8.8	4.8	2.9	29.9	4.4	2.0	1.2
Houston	JUN	147.4	37.3	26.1	18.7	69.6	17.2	11.8	8.0	31.0	6.6	4.6	3.0	18.8	3.7	1.8	1.1
Huntsville	MAY	224.1	29.7	15.7	10.6	105.9	12.3	5.8	3.6	47.6	3.8	1.3	0.8	27.7	1.4	0.5	0.3
Huntsville	JUL	206.2	49.5	32.3	23.4	96.4	21.6	13.6	9.3	42.8	8.1	4.4	2.8	25.8	3.6	1.7	0.9
Internat'l Falls	JUL	170.3	15.0	8.7	5.7	80.5	6.1	3.5	2.0	36.3	1.9	1.2	0.5	21.5	0.7	0.4	0.2
Internat'l Falls	SEP	51.3	11.0	5.2	2.6	23.5	4.6	1.9	1.0	9.8	1.5	0.6	0.3	5.6	0.8	0.1	0.1
Key West, FL	JUL	156.1	34.7	23.8	18.0	71.7	15.0	9.4	6.6	31.0	4.8	2.6	1.7	17.0	1.8	1.0	0.6
Key West, FL	AUG	209.8	48.2	31.5	24.0	96.6	20.8	12.5	9.0	41.2	6.9	3.7	2.3	22.9	2.2	1.3	1.1
Lexington, KY	JUN	218.1	27.3	14.4	9.4	103.8	11.2	5.2	3.5	47.3	3.2	1.2	0.7	28.2	1.2	0.3	0.3
Lexington, KY	JUL	258.2	43.0	29.2	20.9	123.6	19.2	12.7	8.6	56.9	7.3	4.1	2.9	34.3	3.3	2.2	1.4
Miami, FL	JUN	276.0	61.0	42.6	33.1	128.7	26.2	17.8	12.9	55.7	9.6	5.9	3.9	33.1	4.1	2.4	1.6
Newark, NJ	AUG	247.9	34.5	17.0	12.1	117.9	14.4	6.4	4.1	54.1	4.7	1.9	1.3	32.7	2.0	0.6	0.3
New Orleans	JUL	272.7	57.9	36.4	26.4	127.1	25.7	15.7	11.0	55.6	9.3	5.3	3.4	32.8	4.8	2.2	1.1
New Orleans	AUG	273.3	69.4	47.4	34.0	128.0	31.2	19.9	13.5	56.5	11.7	6.5	4.0	33.0	5.4	2.7	1.5
NYC (Kennedy)	JUN	217.0	22.8	10.8	6.6	103.9	9.6	4.3	2.4	47.7	3.2	1.3	0.4	29.3	1.4	0.5	0.2
NYC (Kennedy)	AUG	215.9	24.7	13.5	8.9	103.0	10.4	4.9	3.1	46.8	3.5	1.2	0.9	28.0	1.2	0.6	0.2

Table 15. Estimated mean number or system outages due to rain in the worst months for the indicated durations (based on a frequency of 30 GHz and a fade margin of 15dB). (Cont.)

NUMBER OF OUTAGES

Location		5-min Duration, Elevation Angle (in degrees) 10	30	50	70	10-min Duration, Elevation Angle (in degrees) 10	30	50	70	20-min Duration, Elevation Angle (in degrees) 10	30	50	70	30-min Duration, Elevation Angle (in degrees) 10	30	50	70
Oklahoma City	MAY	182.6	36.9	19.3	11.8	87.8	16.0	8.3	5.1	40.9	6.4	2.8	1.9	24.6	3.1	1.6	1.0
Oklahoma City	JUN	180.1	33.5	20.5	14.6	86.6	15.3	8.8	6.0	40.4	6.4	3.2	2.0	24.6	3.3	1.3	1.0
Omaha	JUL	169.8	23.2	14.0	10.1	79.5	9.7	5.7	3.9	35.0	3.0	1.7	1.1	21.0	1.4	0.7	0.5
Omaha	AUG	123.2	24.6	12.6	8.1	57.7	11.1	4.7	3.0	25.0	4.0	1.6	0.8	15.5	1.8	0.4	0.3
Philadelphia	JUN	207.2	31.9	18.3	11.7	97.9	13.3	6.5	3.9	43.5	4.0	1.8	0.7	25.9	1.6	0.4	0.2
Philadelphia	JUL	197.4	32.8	20.2	12.9	93.9	14.0	8.4	4.7	42.8	5.3	2.9	1.1	26.0	2.5	0.8	0.2
Philadelphia	AUG	215.8	38.7	23.2	16.5	102.3	16.1	9.1	6.3	46.2	5.1	2.5	1.6	27.8	2.3	0.9	0.3
Phoenix	JUL	30.0	5.2	3.2	2.3	13.9	2.1	0.9	0.4	6.0	0.4	0.1	0.0	3.3	0.2	0.0	0.0
Phoenix	AUG	38.2	4.9	3.3	2.4	17.5	1.8	1.0	0.6	7.8	0.5	0.3	0.1	4.2	0.3	0.1	0.0
Pittsburgh	JUL	166.9	22.0	11.3	7.6	77.7	8.4	3.8	2.1	33.2	2.0	0.7	0.3	19.4	0.8	0.4	0.1
Raleigh	JUN	184.3	25.8	16.4	11.6	88.4	11.5	7.1	4.7	40.7	4.1	2.4	1.5	24.8	2.1	1.0	0.5
Raleigh	JUL	215.1	37.3	22.2	14.5	101.7	16.4	9.1	5.4	46.2	5.8	3.0	1.3	27.7	2.4	1.1	0.5
Raleigh	AUG	204.5	32.3	19.1	12.3	98.3	14.5	8.2	5.0	45.8	6.0	2.9	1.7	28.5	2.8	1.0	0.3
Rapid City	JUN	74.2	10.5	12.8	3.0	34.7	4.1	5.2	1.0	15.6	1.1	1.5	0.3	8.5	0.5	0.8	0.0
Rapid City	JUL	107.0	9.0	4.5	3.3	50.3	3.3	1.5	1.3	23.0	0.7	0.3	0.3	13.3	0.2	0.0	0.0
St. Louis	JUN	120.7	24.5	13.7	9.5	56.0	10.2	5.5	3.2	24.1	3.2	1.2	0.7	13.5	1.4	0.5	0.1
St. Louis	JUL	133.1	19.2	13.2	9.1	61.1	7.5	4.7	3.0	25.9	1.8	1.0	0.6	15.0	0.6	0.4	0.4
San Angelo	MAY	93.1	10.3	6.9	5.2	43.5	4.3	2.7	1.8	19.1	1.1	0.8	0.5	11.3	0.3	0.2	0.1
San Sebastian	SEP	233.2	69.9	49.7	37.9	111.6	31.8	22.0	16.4	51.7	12.8	8.6	6.1	31.4	7.1	4.4	2.6
San Sebastian	OCT	219.8	74.4	49.0	36.4	106.1	33.5	21.6	15.6	49.1	13.1	7.8	5.6	30.5	7.3	4.4	2.6
Santa Maria	JAN	54.4	3.9	1.1	0.3	25.1	1.5	0.2	0.1	10.7	0.4	0.0	0.0	5.9	0.1	0.0	0.0
Santa Maria	DEC	109.7	7.6	2.4	0.8	52.4	3.0	0.8	0.2	24.1	1.0	0.1	0.0	14.3	0.3	0.0	0.0
Seattle	AUG	144.8	1.6	0.5	0.2	69.2	0.5	0.1	0.0	31.2	0.0	0.0	0.0	19.1	0.0	0.0	0.0
Seattle	SEP	132.7	2.3	0.7	0.4	63.2	0.9	0.2	0.1	28.6	0.2	0.0	0.0	17.0	0.0	0.0	0.0
Shreveport	MAY	178.1	46.1	27.8	24.3	85.2	21.4	12.4	10.4	39.7	9.0	4.8	4.1	24.4	4.7	2.5	2.0
Shreveport	SEP	188.9	25.0	12.6	6.9	91.3	11.1	5.3	2.8	42.6	4.4	1.9	0.8	26.2	2.4	0.8	0.2
Spokane	MAY	8.2	0.7	0.0	0.0	3.6	0.1	0.0	0.0	1.1	0.0	0.0	0.0	0.4	0.0	0.0	0.0
Spokane	JUN	20.4	2.3	1.2	0.5	9.0	0.8	0.2	0.0	3.7	0.1	0.0	0.0	1.7	0.0	0.0	0.0
Tallahassee	AUG	301.8	74.9	51.1	39.9	142.3	32.8	21.5	16.8	64.2	11.9	7.4	5.1	38.2	5.7	2.8	1.9
Tallahassee	NOV	218.6	32.4	16.0	11.0	105.9	14.3	6.7	4.5	49.4	5.5	2.4	1.6	31.0	2.9	1.3	0.8
Topeka	JUN	184.2	29.0	17.3	11.9	88.0	12.8	7.2	5.0	40.8	4.7	2.6	1.6	24.1	2.5	1.1	0.7
Topeka	JUL	165.4	20.9	13.2	9.5	78.9	9.0	5.4	3.7	36.4	3.3	1.9	1.1	22.0	1.2	0.6	0.4
Topeka	OCT	130.5	10.7	3.8	2.0	62.7	4.5	1.4	0.8	29.5	1.4	0.3	0.2	17.6	0.6	0.2	0.0
Urbana	JUL	159.6	34.5	23.1	16.6	73.1	12.4	7.3	4.9	31.0	3.2	1.6	0.8	17.6	0.7	0.2	0.1
Yuma	AUG	29.1	5.3	3.3	2.2	13.4	2.4	1.3	0.8	6.0	1.0	0.5	0.2	3.7	0.4	0.1	0.1
Yuma	SEP	23.0	3.0	1.3	0.4	11.1	1.4	0.4	0.2	5.0	0.5	0.1	0.0	3.1	0.4	0.1	0.0

Table 16. Estimated mean number or system outages due to rain in the worst months for the indicated durations (based on a frequency of 45GHz and a fade margin of 15dB).

NUMBER OF OUTAGES

Location		5-min Duration				10-min Duration				20-min Duration				30-min Duration			
		Elevation Angle (in degrees)				Elevation Angle (in degrees)				Elevation Angle (in degrees)				Elevation Angle (in degrees)			
		10	30	50	70	10	30	50	70	10	30	50	70	10	30	50	70
Aberdeen	JUN	242.2	46.7	20.6	13.0	116.5	21.6	9.0	5.1	53.9	9.2	3.2	1.5	33.2	4.3	1.3	0.6
Aberdeen	JUL	172.4	35.7	21.7	13.5	81.9	16.3	10.0	5.6	37.2	7.0	3.7	1.9	22.8	3.5	2.0	1.0
Albuquerque	AUG	149.5	19.2	7.7	5.2	70.4	8.3	3.2	2.1	31.7	3.2	1.0	0.7	18.7	1.5	0.3	0.1
Allentown	JUL	334.4	102.3	49.0	27.3	161.7	48.2	22.6	12.0	75.6	21.1	9.4	4.4	46.2	12.3	4.5	1.5
Allentown	AUG	388.8	118.1	60.7	31.6	187.7	54.7	27.6	13.1	87.3	23.7	11.0	4.6	54.0	13.0	5.5	1.8
Asheville	JUL	343.5	100.6	43.1	25.1	164.9	47.5	19.7	11.2	75.6	20.5	8.0	4.2	46.7	12.2	4.2	1.9
Asheville	SEP	479.9	120.9	55.9	21.1	233.4	57.2	25.9	9.5	110.7	25.6	11.0	3.9	69.5	15.9	6.3	1.8
Bakersfield	MAR	146.0	2.3	0.4	0.1	70.7	1.0	0.1	0.0	33.1	0.3	0.0	0.0	20.9	0.1	0.0	0.0
Bakersfield	MAY	48.5	3.8	2.4	1.7	23.3	1.7	1.1	0.7	11.1	0.7	0.4	0.2	6.9	0.5	0.3	0.1
Billings	JUL	105.4	9.5	3.5	2.1	49.8	4.2	1.5	0.9	22.6	1.7	0.5	0.2	13.7	0.8	0.2	0.1
Boise	SEP	106.0	5.7	1.2	0.7	50.2	2.2	0.5	0.3	23.2	0.7	0.1	0.1	13.4	0.2	0.1	0.1
Boston	AUG	382.2	82.4	30.9	15.7	186.4	37.7	13.6	6.4	85.3	15.5	4.4	1.6	52.1	7.5	1.9	0.6
Cape Hatteras	SEP	368.7	114.2	53.1	35.2	177.9	53.7	24.6	15.9	82.8	23.7	10.7	6.4	51.7	13.6	5.5	3.2
Charleston	JUN	336.1	118.7	68.4	47.6	160.4	55.2	30.4	20.6	73.0	23.5	12.0	7.5	44.3	13.1	6.0	3.4
Cheyenne	JUL	158.3	26.7	10.9	6.2	73.8	11.4	4.5	2.3	32.5	4.2	1.6	0.4	19.2	1.6	0.2	0.1
Cheyenne	SEP	112.1	3.7	1.7	1.0	53.3	1.6	0.7	0.4	23.7	0.6	0.2	0.2	14.2	0.2	0.1	0.1
Chicago	JUL	235.6	74.4	38.2	23.3	112.8	34.6	17.4	10.3	51.3	14.8	6.9	3.6	32.0	7.8	3.3	1.9
Chicago	AUG	299.2	76.6	43.2	22.9	143.3	35.8	19.6	10.2	65.8	15.3	7.7	3.7	40.1	8.5	4.1	1.6
Denver	AUG	124.8	22.0	9.4	5.4	58.5	9.7	3.8	2.1	26.1	3.7	1.1	0.6	15.6	2.0	0.6	0.1
Ely	AUG	92.4	5.7	2.2	1.3	43.5	2.5	0.8	0.5	19.5	0.8	0.3	0.1	11.3	0.4	0.1	0.0
Grand Junction	JUL	55.1	5.0	2.0	1.3	25.1	2.0	0.6	0.4	10.6	0.7	0.2	0.1	5.9	0.3	0.1	0.0
Houston	MAY	279.5	124.3	69.2	39.3	134.9	59.2	31.9	16.6	63.3	26.8	13.3	6.2	38.7	16.0	7.2	2.9
Houston	JUN	202.0	87.1	46.8	32.1	96.0	40.5	21.5	14.7	42.9	17.8	8.8	5.8	26.3	10.4	4.9	2.8
Huntsville	MAY	368.9	91.5	40.6	21.3	176.5	41.5	17.4	8.4	80.7	17.4	6.0	2.2	48.6	8.7	2.4	0.8
Huntsville	JUL	275.2	114.1	60.2	40.6	129.1	52.9	26.8	17.5	58.1	22.5	10.5	6.0	35.3	13.2	5.2	2.5
Internat'l Falls	JUL	286.2	53.3	21.8	11.3	136.1	24.4	9.4	4.7	61.8	10.3	3.1	1.5	37.6	5.3	1.3	0.5
Internat'l Falls	SEP	293.1	23.5	12.4	7.1	140.4	10.3	5.2	2.9	64.3	3.8	1.8	0.9	39.6	1.9	1.0	0.2
Key West, FL	JUL	213.7	85.8	46.0	31.0	98.8	38.7	20.2	13.2	43.4	15.9	7.3	4.0	24.3	8.1	3.1	1.5
Key West, FL	AUG	294.3	112.0	59.5	39.8	136.3	50.6	26.1	16.5	59.0	20.6	9.4	5.2	33.6	10.4	3.7	1.8
Lexington, KY	JUN	373.4	81.3	33.1	19.3	179.3	37.3	13.7	7.5	83.8	15.2	4.1	1.9	51.2	8.1	1.8	0.4
Lexington, KY	JUL	350.8	100.3	57.8	34.7	168.3	47.3	26.4	15.3	77.7	21.4	10.9	5.5	47.6	11.6	5.1	2 7
Miami, FL	JUN	376.1	153.7	82.1	54.9	176.6	70.1	36.1	23.3	77.3	29.2	13.9	8.4	46.9	16.2	6.6	3.5
Newark, NJ	AUG	338.6	109.3	47.9	24.0	162.1	50.4	20.8	9.6	75.7	21.0	7.4	3.2	46.4	11.7	3.6	1.0
New Orleans	JUL	382.6	151.3	74.4	47.2	179.4	69.2	33.1	20.7	79.6	29.1	12.7	7.4	47.8	16.3	6.6	3.5
New Orleans	AUG	373.4	162.7	87.8	58.9	175.5	75.6	40.0	25.8	78.4	32.3	15.8	9.0	46.4	18.3	8.0	4.1
NYC (Kennedy)	JUN	398.5	74.5	30.1	16.7	192.2	34.6	13.1	6.7	89.9	14.6	4.7	2.1	56.5	8.1	2.5	0.7
NYC (Kennedy)	AUG	301.3	85.2	34.4	19.0	144.5	39.7	15.0	7.5	66.4	16.9	5.6	2.4	40.5	8.9	2.3	0.9

Table 16. Estimated mean number or system outages due to rain in the worst months for the indicated durations (based on a frequency of 45GHz and a fade margin of 15dB). (Cont.)

NUMBER OF OUTAGES

Location		5-min Duration				10-min Duration				20-min Duration				30-min Duration			
		Elevation Angle (in degrees)				Elevation Angle (in degrees)				Elevation Angle (in degrees)				Elevation Angle (in degrees)			
		10	30	50	70	10	30	50	70	10	30	50	70	10	30	50	70
Oklahoma City	MAY	335.9	110.2	47.2	25.9	162.8	52.3	21.2	11.5	77.4	23.6	8.7	4.3	48.8	13.6	4.6	2.4
Oklahoma City	JUN	240.7	66.0	37.5	26.1	116.0	31.2	17.4	11.6	54.6	13.8	7.4	4.5	33.4	7.8	4.0	2.0
Omaha	JUL	231.7	71.6	34.0	17.1	108.8	32.9	14.6	7.1	48.3	13.9	5.0	2.4	29.5	7.4	2.5	0.9
Omaha	AUG	208.8	56.8	29.8	16.1	98.7	25.9	13.8	6.6	44.0	10.3	5.0	2.3	27.4	6.3	2.5	0.7
Philadelphia	JUN	373.9	76.6	39.9	25.1	178.7	34.6	17.1	9.9	82.4	13.1	5.8	2.6	50.0	7.1	2.3	1.0
Philadelphia	JUL	274.2	90.7	41.7	27.0	131.0	42.3	18.3	11.5	60.2	18.5	7.2	4.3	37.2	10.5	3.7	1.7
Philadelphia	AUG	290.2	102.1	50.0	30.7	138.4	47.0	21.5	12.5	63.6	19.5	7.4	3.9	39.1	10.7	3.7	1.4
Phoenix	JUL	41.9	14.2	6.5	4.1	19.7	6.1	2.8	1.4	8.8	2.2	0.7	0.3	5.0	1.1	0.3	0.1
Phoenix	AUG	54.3	15.8	6.3	4.2	25.2	6.8	2.5	1.5	11.3	2.9	0.8	0.4	6.3	1.2	0.4	0.1
Pittsburgh	JUL	287.3	71.7	30.0	15.7	136.3	31.4	12.2	5.4	60.4	11.7	3.7	0.9	36.7	5.8	1.3	0.5
Raleigh	JUN	248.4	63.4	29.4	19.7	119.6	29.4	13.1	8.8	55.6	12.5	4.7	3.0	34.2	7.0	2.5	1.4
Raleigh	JUL	300.8	100.7	46.5	28.9	143.0	46.6	20.7	12.3	65.9	20.0	7.7	4.5	40.3	10.9	3.5	1.6
Raleigh	AUG	289.7	86.2	40.2	25.5	139.8	40.8	18.4	11.2	65.7	18.3	7.8	4.2	41.3	10.7	3.9	1.8
Rapid City	JUN	217.1	45.2	12.8	5.8	103.0	20.5	5.2	2.1	46.9	8.6	1.5	0.5	28.2	4.5	0.8	0.1
Rapid City	JUL	196.8	25.1	11.9	6.3	92.8	11.4	4.8	2.2	42.9	4.7	1.4	0.5	25.6	2.1	0.5	0.0
St. Louis	JUN	200.1	58.3	28.7	17.2	93.8	26.3	12.0	7.0	41.4	10.5	3.8	2.2	24.5	5.0	1.8	0.8
St. Louis	JUL	188.9	58.7	24.2	16.0	87.9	25.5	9.7	6.0	38.3	9.4	2.6	1.5	22.7	4.7	0.9	0.5
San Angelo	MAY	148.5	38.1	16.6	8.7	70.1	17.1	6.9	3.5	31.5	6.8	2.3	1.0	19.3	3.4	0.9	0.2
San Sebastian	SEP	309.9	135.2	86.3	62.4	149.1	63.8	39.9	28.3	69.8	28.5	16.7	11.2	43.1	16.4	9.3	6.1
San Sebastian	OCT	283.5	142.0	92.7	65.8	137.1	68.1	43.0	29.4	64.0	30.8	18.1	11.3	40.9	17.8	10.0	6.2
Santa Maria	JAN	294.9	31.4	5.6	1.9	143.0	14.5	2.2	0.4	67.1	5.9	0.7	0.0	41.7	3.2	0.2	0.0
Santa Maria	DEC	270.4	41.1	13.2	3.9	131.1	19.1	5.7	1.4	61.3	8.3	2.2	0.3	37.6	4.5	0.9	0.1
Seattle	AUG	269.0	23.9	3.9	0.7	129.3	11.0	1.7	0.2	58.8	4.5	0.5	0.0	36.4	2.4	0.2	0.0
Seattle	SEP	393.5	32.7	5.2	1.0	188.9	15.3	2.3	0.3	86.6	6.4	0.7	0.1	53.3	3.4	0.2	0.0
Shreveport	MAY	275.4	96.8	57.4	36.7	132.8	45.5	26.7	16.9	62.5	20.6	11.6	6.8	39.1	12.0	5.7	3.8
Shreveport	SEP	267.3	84.4	33.4	18.4	129.6	40.3	15.3	8.1	60.7	18.3	6.3	3.0	38.0	10.6	3.5	1.4
Spokane	MAY	121.5	2.3	0.9	0.1	57.7	0.8	0.1	0.0	26.1	0.1	0.0	0.0	15.7	0.0	0.0	0.0
Spokane	JUN	135.1	5.9	2.7	1.7	63.5	2.4	1.0	0.5	28.2	0.8	0.1	0.1	16.9	0.2	0.0	0.0
Tallahassee	AUG	413.1	178.8	95.4	62.8	195.4	83.7	43.1	26.9	89.7	36.0	16.7	9.6	54.1	20.6	8.6	4.1
Tallahassee	NOV	292.3	79.6	39.2	20.9	142.2	37.5	17.5	8.8	66.9	16.5	6.9	3.1	42.4	9.6	3.6	1.7
Topeka	JUN	307.9	82.3	37.0	22.6	147.8	38.7	16.8	9.6	69.2	17.4	6.7	3.2	42.1	9.3	3.5	1.7
Topeka	JUL	234.0	70.2	28.2	16.4	111.9	33.0	12.6	6.9	52.2	14.5	4.9	2.5	32.0	8.3	2.2	0.9
Topeka	OCT	290.9	50.4	13.1	5.7	141.1	23.6	5.7	2.1	67.0	10.3	1.9	0.4	41.6	5.9	0.7	0.3
Urbana	JUL	211.0	88.2	44.0	28.3	99.1	37.0	16.6	9.5	43.3	13.9	4.9	2.3	25.1	7.0	1.6	0.4
Yuma	AUG	40.9	16.6	7.3	4.3	19.1	7.4	3.2	1.8	8.5	3.3	1.3	0.7	5.5	1.7	0.5	0.2
Yuma	SEP	32.8	10.5	4.7	2.1	15.8	5.0	2.2	1.0	7.2	2.2	0.9	0.4	4.5	1.3	0.5	0.2

Table 17. Estimated mean number of system outages due to rain for all months at Boston, MA for the indicated durations and fade margins (based on a frequency of 15 GHz).

		NUMBER OF OUTAGES															
		5-min Duration				10-min Duration				20-min Duration				30-min Duration			
		Elevation Angle (in degrees)				Elevation Angle (in degrees)				Elevation Angle (in degrees)				Elevation Angle (in degrees)			
	Month	10	30	50	70	10	30	50	70	10	30	50	70	10	30	50	70
	JAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	FEB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	MAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	APR	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Freq = 15 GHz	MAY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	JUN	3.0	0.2	0.1	0.0	1.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fade = 15 dB	JUL	4.1	1.2	0.5	0.2	1.2	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	AUQ	5.9	1.4	0.7	0.3	1.7	0.5	0.2	0.0	0.4	0.0	0.0	0.0	0.1	0.0	0.0	0.0
	SEP	3.5	0.5	0.1	0.0	1.0	0.1	0.0	0.0	0.4	0.0	0.0	0.0	0.1	0.0	0.0	0.0
	OCT	0.8	0.2	0.1	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	NOV	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	DEC	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	JAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	FEB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	MAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	APR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Freq = 15 GHz	MAY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	JUN	1.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fade = 20 dB	JUL	2.2	0.4	0.1	0.1	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	AUG	2.4	0.7	0.1	0.0	0.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	SEP	1.5	0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	OCT	0.3	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	NOV	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	DEC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	JAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	FEB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	MAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	APR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Freq = 15 GHz	MAY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	JUN	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fade = 25 dB	JUL	1.1	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	AUG	1.2	0.1	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	SEP	0.5	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	OCT	0.3	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	NOV	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	DEC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 18. Estimated mean number of system outages due to rain for all months at Boston, MA for the indicated durations and fade margins (based on a frequency of 30 GHz).

NUMBER OF OUTAGES

		5-min Duration				10-min Duration				20-min Duration				30-min Duration			
		Elevation Angle (in degrees)				Elevation Angle (in degrees)				Elevation Angle (in degrees)				Elevation Angle (in degrees)			
	Month	10	30	50	70	10	30	50	70	10	30	50	70	10	30	50	70
	JAN	0.6	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	FEB	0.9	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	MAR	5.7	0.0	0.0	0.0	2.3	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.2	0.0	0.0	0.0
	APR	39.9	0.4	0.1	0.0	18.8	0.0	0.0	0.0	7.8	0.0	0.0	0.0	4.8	0.0	0.0	0.0
Freq = 30 GHz	MAY	83.3	5.6	0.2	0.0	38.5	2.3	0.1	0.0	16.5	0.7	0.0	0.0	9.7	0.2	0.0	0.0
	JUN	181.8	11.3	5.4	3.4	86.5	4.7	2.2	1.1	39.2	1.5	0.5	0.1	23.6	0.6	0.1	0.1
Fade = 15 dB	JUL	178.5	17.8	8.3	5.0	84.3	7.5	3.3	1.6	37.2	2.4	0.7	0.2	21.6	0.9	0.2	0.0
	AUG	273.7	24.8	10.5	6.9	132.6	10.7	3.8	2.2	60.0	3.3	0.8	0.5	36.0	1.4	0.2	0.1
	SEP	219.4	22.4	7.4	3.8	104.7	10.0	2.8	1.1	47.3	3.5	0.7	0.4	28.4	1.8	0.3	0.1
	OCT	87.5	7.0	1.6	0.6	41.4	2.9	0.7	0.2	17.8	0.8	0.1	0.0	10.2	0.3	0.0	0.0
	NOV	63.2	0.5	0.0	0.0	30.2	0.2	0.0	0.0	13.5	0.0	0.0	0.0	8.2	0.0	0.0	0.0
	DEC	4.3	0.1	0.1	0.0	1.6	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.2	0.0	0.0	0.0
	JAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	FEB	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	MAR	1.6	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0
	APR	9.4	0.1	0.1	0.0	4.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.9	0.0	0.0	0.0
Freq = 30 GHz	MAY	45.3	1.2	0.0	0.0	20.8	0.4	0.0	0.0	8.7	0.0	0.0	0.0	4.8	0.0	0.0	0.0
	JUN	61.1	6.4	3.4	1.8	27.8	2.6	1.1	0.3	11.8	0.6	0.1	0.0	6.9	0.2	0.1	0.0
Fade = 20 dB	JUL	94.4	10.2	5.3	3.1	43.9	4.0	1.7	0.8	18.8	1.0	0.2	0.0	10.5	0.3	0.0	0.0
	AUG	146.2	13.6	6.9	4.6	69.3	5.4	2.2	1.3	30.3	1.3	0.5	0.2	17.0	0.5	0.1	0.0
	SEP	86.5	10.6	3.8	2.6	40.7	4.3	1.1	0.7	17.4	1.2	0.4	0.2	10.0	0.5	0.1	0.0
	OCT	62.8	2.4	0.7	0.3	29.6	0.9	0.2	0.1	12.5	0.2	0.0	0.0	7.1	0.0	0.0	0.0
	NOV	19.5	0.1	0.0	0.0	9.0	0.0	0.0	0.0	3.7	0.0	0.0	0.0	2.0	0.0	0.0	0.0
	DEC	0.6	0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	JAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	FEB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	MAR	0.8	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	APR	2.4	0.1	0.0	0.0	0.8	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Freq = 30 GHz	MAY	17.5	0.1	0.0	0.0	7.8	0.0	0.0	0.0	3.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0
	JUN	36.5	4.4	2.1	1.0	16.2	1.8	0.4	0.0	6.6	0.3	0.0	0.0	3.5	0.1	0.0	0.0
Fade = 25 dB	JUL	40.2	6.9	3.3	2.3	18.0	2.5	0.9	0.6	7.0	0.4	0.0	0.0	3.5	0.1	0.0	0.0
	AUG	72.1	8.6	4.8	2.8	32.9	3.0	1.4	0.7	13.3	0.7	0.2	0.0	6.4	0.1	0.0	0.0
	SEP	64.6	4.5	2.7	1.3	30.2	1.4	0.8	0.2	12.6	0.4	0.3	0.0	7.2	0.2	0.0	0.0
	OCT	22.7	1.2	0.4	0.3	10.4	0.5	0.1	0.1	3.9	0.1	0.0	0.0	2.0	0.0	0.0	0.0
	NOV	9.3	0.0	0.0	0.0	4.2	0.0	0.0	0.0	1.8	0.0	0.0	0.0	0.9	0.0	0.0	0.0
	DEC	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 19. Estimated mean number of system outages due to rain for all months at Boston, MA for the indicated durations and fade margins (based on a frequency of 45 GHz).

NUMBER OF OUTAGES

		5-min Duration				10-min Duration				20-min Duration				30-min Duration			
		Elevation Angle (in degrees)				Elevation Angle (in degrees)				Elevation Angle (in degrees)				Elevation Angle (in degrees)			
	Month	10	30	50	70	10	30	50	70	10	30	50	70	10	30	50	70
	JAN	16.2	0.0	0.0	0.0	7.2	0.0	0.0	0.0	3.1	0.0	0.0	0.0	1.4	0.0	0.0	0.0
	FEB	11.5	0.0	0.0	0.0	5.3	0.0	0.0	0.0	2.2	0.0	0.0	0.0	1.2	0.0	0.0	0.0
	MAR	59.3	0.9	0.0	0.0	27.9	0.3	0.0	0.0	12.4	0.0	0.0	0.0	7.1	0.0	0.0	0.0
	APR	289.1	4.8	0.5	0.1	140.9	1.9	0.1	0.0	65.1	0.5	0.0	0.0	40.9	0.3	0.0	0.0
Freq = 45 GHz	MAY	461.7	41.5	7.0	1.2	224.0	19.0	3.0	0.4	103.3	7.9	1.1	0.0	63.6	4.4	0.4	0.0
	JUN	326.7	53.7	17.9	7.5	156.9	24.3	7.5	3.1	72.0	10.3	2.7	0.8	43.8	5.9	1.1	0.3
Fade = 15 dB	JUL	245.9	52.4	22.1	11.4	116.7	23.7	9.5	4.5	51.9	9.7	3.1	1.2	30.4	4.9	1.3	0.4
	AUG	375.8	82.4	30.9	15.7	183.2	37.7	13.6	6.4	83.8	15.5	4.4	1.6	51.2	7.5	1.9	0.6
	SEP	385.5	79.9	28.6	13.4	184.8	37.6	13.0	5.6	84.7	16.0	4.7	1.7	51.5	9.2	2.6	0.8
	OCT	376.7	46.7	9.5	2.4	182.1	21.9	4.0	0.9	84.6	9.1	1.1	0.2	52.5	5.0	0.5	0.0
	NOV	356.2	16.1	1.2	0.1	173.0	7.4	0.4	0.0	81.2	3.1	0.1	0.0	50.5	1.6	0.1	0.0
	DEC	68.5	0.2	0.1	0.1	32.4	0.1	0.0	0.0	14.3	0.0	0.0	0.0	8.4	0.0	0.0	0.0
	JAN	3.6	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.1	0.0	0.0	0.0
	FEB	4.1	0.0	0.0	0.0	1.8	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.3	0.0	0.0	0.0
	MAR	25.5	0.1	0.0	0.0	11.7	0.0	0.0	0.0	5.1	0.0	0.0	0.0	2.7	0.0	0.0	0.0
	APR	128.9	0.8	0.2	0.1	62.4	0.2	0.0	0.0	28.0	0.1	0.0	0.0	17.4	0.0	0.0	0.0
Freq = 45 GHz	MAY	369.7	14.8	3.0	0.2	178.9	6.6	1.1	0.1	82.2	2.6	0.2	0.0	50.5	1.2	0.0	0.0
	JUN	290.4	30.8	8.5	5.0	139.3	13.5	3.5	2.1	63.8	5.4	1.0	0.4	38.7	2.8	0.4	0.1
Fade = 20 dB	JUL	229.0	37.8	13.6	7.9	108.6	16.9	5.5	3.1	48.2	6.5	1.6	0.6	28.2	3.2	0.6	0.2
	AUG	350.3	57.7	18.7	10.5	170.6	26.1	7.9	3.8	77.9	10.2	2.1	0.8	47.4	4.8	0.9	0.2
	SEP	352.3	50.3	16.2	6.4	168.8	23.5	6.9	2.3	77.2	9.5	2.2	0.6	46.9	5.4	1.0	0.3
	OCT	306.4	19.8	3.6	1.2	147.9	8.9	1.4	0.5	68.4	3.2	0.4	0.1	42.2	1.6	0.1	0.0
	NOV	218.2	4.1	0.3	0.0	105.7	1.7	0.0	0.0	49.2	0.7	0.0	0.0	30.6	0.3	0.0	0.0
	DEC	16.6	0.2	0.1	0.0	7.6	0.1	0.0	0.0	3.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0
	JAN	0.9	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	FEB	1.3	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	MAR	8.7	0.0	0.0	0.0	3.7	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.5	0.0	0.0	0.0
	APR	60.7	0.5	0.1	0.0	29.0	0.1	0.0	0.0	12.4	0.0	0.0	0.0	7.6	0.0	0.0	0.0
Freq = 45 GHz	MAY	257.2	6.9	0.6	0.0	123.8	2.9	0.2	0.0	56.4	1.1	0.0	0.0	34.4	0.4	0.0	0.0
	JUN	248.2	16.1	6.1	3.5	118.8	6.8	2.5	1.1	54.2	2.4	0.6	0.1	32.9	1.0	0.2	0.1
Fade = 25 dB	JUL	208.0	21.9	9.6	5.7	98.5	9.4	3.8	1.9	43.6	3.1	0.9	0.2	25.4	1.3	0.3	0.0
	AUG	318.4	30.6	12.6	7.1	154.8	13.4	4.8	2.3	70.4	4.4	1.1	0.5	42.6	1.9	0.4	0.1
	SEP	305.8	28.0	9.3	4.0	146.3	12.7	3.6	1.2	66.8	4.6	0.9	0.4	40.4	2.6	0.4	0.1
	OCT	220.4	9.5	1.8	0.7	106.0	4.0	0.7	0.2	48.5	1.1	0.1	0.0	29.7	0.5	0.0	0.0
	NOV	86.0	1.1	0.0	0.0	41.3	0.4	0.0	0.0	18.6	0.0	0.0	0.0	11.5	0.0	0.0	0.0
	DEC	7.4	0.1	0.0	0.0	3.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.6	0.0	0.0	0.0

Table 20. Estimated mean number of system outages due to rain for all months at New Orleans for the indicated durations and fade margins (based on a frequency of 15 GHz).

		NUMBER OF OUTAGES															
		5-min Duration				10-min Duration				20-min Duration				30-min Duration			
		Elevation Angle (in degrees)				Elevation Angle (in degrees)				Elevation Angle (in degrees)				Elevation Angle (in degrees)			
	Month	10	30	50	70	10	30	50	70	10	30	50	70	10	30	50	70
	JAN	7.6	1.3	0.4	0.1	2.2	0.2	0.1	0.0	0.5	0.1	0.0	0.0	0.1	0.0	0.0	0.0
	FEB	8.0	1.5	0.3	0.2	2.8	0.1	0.0	0.0	0.5	0.0	0.0	0.0	0.2	0.0	0.0	0.0
	MAR	11.8	1.9	0.3	0.0	4.1	0.3	0.0	0.0	0.7	0.0	0.0	0.0	0.1	0.0	0.0	0.0
	APR	9.0	3.1	1.5	0.9	3.4	0.8	0.3	0.1	0.7	0.2	0.0	0.0	0.2	0.0	0.0	0.0
Freq = 15 GHz	MAY	16.6	5.6	2.6	1.7	6.4	1.6	0.5	0.3	1.7	0.2	0.0	0.0	0.9	0.2	0.0	0.0
	JUN	21.7	8.6	4.9	3.3	8.9	3.1	1.4	1.1	3.0	1.0	0.4	0.2	1.3	0.2	0.0	0.0
Fade = 15 dB	JUL	21.1	7.8	3.8	2.8	8.1	2.8	1.0	0.9	2.5	0.5	0.3	0.3	0.6	0.2	0.1	0.1
	AUG	28.4	12.8	6.7	4.4	11.0	4.2	1.9	1.4	2.9	0.9	0.4	0.4	1.1	0.4	0.2	0.1
	SEP	24.2	8.9	5.0	3.5	9.9	2.9	1.2	0.7	3.3	0.6	0.1	0.0	0.8	0.1	0.0	0.0
	OCT	7.5	2.7	1.5	0.9	2.9	0.8	0.4	0.2	0.8	0.2	0.0	0.0	0.3	0.0	0.0	0.0
	NOV	8.0	1.7	1.2	0.9	2.8	0.5	0.3	0.3	0.6	0.2	0.1	0.1	0.2	0.1	0.1	0.1
	DEC	10.0	2.3	1.0	0.5	3.2	0.7	0.2	0.0	0.7	0.0	0.0	0.0	0.1	0.0	0.0	0.0
	JAN	3.1	0.4	0.0	0.0	0.9	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	FEB	4.0	0.3	0.1	0.1	1.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0
	MAR	5.2	0.3	0.0	0.0	1.6	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	APR	5.2	1.5	0.5	0.4	1.7	0.3	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Freq = 15 GHz	MAY	9.6	2.4	0.7	0.5	3.5	0.5	0.0	0.0	0.6	0.0	0.0	0.0	0.2	0.0	0.0	0.0
	JUN	13.7	4.5	1.8	1.1	5.3	1.4	0.4	0.1	1.5	0.4	0.1	0.0	0.4	0.0	0.0	0.0
Fade = 20 dB	JUL	11.6	3.4	2.0	1.8	4.2	1.0	0.7	0.6	0.8	0.3	0.1	0.1	0.2	0.1	0.1	0.1
	AUG	18.3	5.8	3.3	2.6	6.6	1.7	1.1	0.8	1.6	0.4	0.4	0.3	0.4	0.1	0.1	0.1
	SEP	13.9	4.6	2.2	1.3	4.8	1.0	0.5	0.2	1.2	0.1	0.0	0.0	0.1	0.0	0.0	0.0
	OCT	4.2	1.4	0.5	0.4	1.2	0.4	0.1	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	NOV	3.2	1.1	0.7	0.5	0.7	0.3	0.2	0.2	0.3	0.1	0.1	0.1	0.1	0.1	0.0	0.0
	DEC	4.6	1.0	0.2	0.0	1.1	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	JAN	1.3	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	FEB	2.5	0.1	0.1	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	MAR	1.9	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	APR	2.9	0.5	0.2	0.2	0.8	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Freq = 15 GHz	MAY	4.7	0.8	0.2	0.0	1.4	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0
	JUN	7.5	1.9	0.6	0.2	2.4	0.5	0.0	0.0	0.8	0.1	0.0	0.0	0.1	0.0	0.0	0.0
Fade = 25 dB	JUL	6.9	2.1	1.4	1.1	2.4	0.7	0.5	0.4	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.0
	AUG	10.7	3.3	2.0	1.6	3.5	1.1	0.7	0.6	0.9	0.4	0.3	0.2	0.3	0.1	0.1	0.1
	SEP	7.9	2.2	0.6	0.3	2.3	0.5	0.1	0.0	0.4	0.0	0.0	0.0	0.1	0.0	0.0	0.0
	OCT	2.4	0.5	0.3	0.3	0.8	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	NOV	1.6	0.7	0.4	0.4	0.5	0.2	0.2	0.1	0.2	0.1	0.1	0.0	0.1	0.0	0.0	0.0
	DEC	2.4	0.3	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 21. Estimated mean number of system outages due to rain for all months at New Orleans for the indicated durations and fade margins (based on a frequency of 30 GHz).

		NUMBER OF OUTAGES															
		5-min Duration				10-min Duration				20-min Duration				30-min Duration			
		Elevation Angle (in degrees)				Elevation Angle (in degrees)				Elevation Angle (in degrees)				Elevation Angle (in degrees)			
	Month	10	30	50	70	10	30	50	70	10	30	50	70	10	30	50	70
	JAN	203.8	30.0	11.9	7.6	96.4	12.4	4.1	2.2	43.0	4.1	1.0	0.5	25.5	1.8	0.5	0.1
	FEB	161.4	28.7	13.1	8.0	76.2	11.7	5.0	2.8	34.0	3.8	1.0	0.5	20.4	1.7	0.6	0.2
	MAR	226.5	39.2	20.2	13.2	107.2	17.1	8.0	4.7	47.9	6.2	2.4	0.8	29.4	2.6	0.6	0.2
	APR	164.8	32.0	16.8	10.4	78.8	14.5	7.2	4.0	35.9	5.5	2.5	0.9	21.1	3.0	1.0	0.3
Freq = 30 GHz	MAY	242.2	45.7	27.0	18.6	115.4	20.4	11.3	7.4	52.5	7.9	3.7	2.1	32.2	3.6	1.8	1.1
	JUN	158.9	44.0	31.5	25.3	74.1	19.9	13.8	10.4	31.8	7.7	5.0	3.6	18.9	3.6	2.5	1.6
Fade = 15 dB	JUL	272.7	57.9	36.4	26.4	127.1	25.7	15.7	11.0	55.6	9.3	5.3	3.4	32.8	4.8	2.2	1.1
	AUG	273.3	69.4	47.4	34.0	128.0	31.2	19.9	13.5	56.5	11.7	6.5	4.0	33.0	5.4	2.7	1.5
	SEP	280.9	62.8	41.1	28.8	131.8	27.4	17.3	12.0	58.4	8.9	5.3	3.9	33.9	4.4	2.3	1.2
	OCT	142.9	32.3	13.8	9.1	68.0	14.3	5.6	3.6	30.7	5.5	1.6	0.8	18.6	2.5	0.6	0.4
	NOV	237.6	44.5	19.5	10.4	113.4	19.7	8.1	3.8	51.7	7.5	2.1	0.9	31.9	3.7	0.9	0.3
	DEC	243.9	39.9	19.0	11.0	115.6	17.5	7.2	3.6	51.9	6.3	2.0	0.8	31.4	2.8	0.8	0.2
	JAN	113.4	15.6	7.9	4.6	52.6	5.9	2.4	1.2	22.5	1.8	0.5	0.1	12.6	0.7	0.1	0.1
	FEB	96.5	16.6	8.4	4.9	44.3	6.5	2.9	1.4	18.8	1.7	0.5	0.2	10.8	0.8	0.2	0.1
	MAR	123.3	24.9	13.2	8.0	57.3	10.1	4.7	2.6	24.6	3.4	0.8	0.4	14.4	1.0	0.2	0.0
	APR	79.6	21.4	10.4	7.3	37.2	9.5	4.0	2.7	16.4	3.3	0.9	0.6	8.5	1.7	0.3	0.1
Freq = 30 GHz	MAY	151.6	30.4	18.6	13.7	71.8	12.9	7.4	5.2	31.8	4.3	2.1	1.3	18.9	2.1	1.1	0.4
	JUN	131.3	35.2	25.3	19.9	61.0	15.7	10.4	8.1	26.1	5.8	3.6	2.6	15.2	2.8	1.6	1.1
Fade = 20 dB	JUL	214.9	40.1	26.4	19.4	99.5	17.4	11.0	7.3	43.0	6.1	3.4	2.2	24.9	2.6	1.1	0.5
	AUG	220.7	51.9	34.0	26.6	103.1	22.2	13.5	10.2	45.0	7.1	4.0	2.7	26.0	3.2	1.5	0.9
	SEP	225.2	45.4	28.8	21.8	105.3	19.1	12.0	8.5	46.0	6.0	3.9	2.7	26.4	2.7	1.2	0.6
	OCT	93.0	18.2	9.1	6.3	43.7	7.6	3.6	2.3	19.3	2.2	0.8	0.7	11.5	0.8	0.4	0.1
	NOV	178.3	24.0	10.4	5.4	84.4	10.1	3.8	1.6	38.0	3.1	0.9	0.3	23.3	1.4	0.3	0.1
	DEC	130.4	25.6	11.0	6.4	60.2	10.5	3.6	2.0	25.5	3.4	0.8	0.3	14.5	1.4	0.2	0.1
	JAN	70.4	10.4	5.1	2.4	31.2	3.5	1.3	0.7	12.5	0.8	0.1	0.1	6.2	0.3	0.1	0.0
	FEB	62.3	11.2	5.5	3.5	27.3	4.1	1.6	0.7	10.6	0.8	0.2	0.1	5.5	0.4	0.1	0.0
	MAR	84.7	16.9	8.8	5.0	38.8	6.6	2.9	1.5	16.0	1.6	0.4	0.3	8.6	0.5	0.0	0.0
	APR	63.7	13.9	7.6	5.3	29.5	5.8	2.8	1.8	12.8	1.8	0.6	0.5	6.6	0.6	0.1	0.1
Freq = 30 GHz	MAY	95.8	23.1	14.3	10.7	44.8	9.5	5.4	4.0	19.1	3.0	1.4	0.7	10.7	1.5	0.5	0.2
	JUN	76.1	29.0	20.5	15.5	34.7	12.5	8.4	5.9	14.6	4.4	2.7	1.7	7.8	2.3	1.2	0.5
Fade = 25 dB	JUL	99.2	30.8	20.0	14.4	44.4	13.2	7.6	5.4	17.8	4.2	2.3	1.4	9.2	1.6	0.5	0.4
	AUG	115.3	40.7	27.5	21.2	53.1	16.4	10.6	8.2	21.9	5.5	2.7	2.2	12.0	2.0	1.0	0.6
	SEP	113.9	34.8	22.6	17.5	52.3	14.7	9.0	6.3	21.1	4.2	2.9	1.8	11.3	1.7	0.6	0.2
	OCT	61.6	11.7	6.6	4.6	28.5	4.7	2.4	1.5	12.1	1.3	0.7	0.5	6.9	0.5	0.1	0.0
	NOV	92.9	15.7	5.8	3.4	42.9	6.2	1.7	0.8	18.3	1.6	0.3	0.3	10.7	0.7	0.1	0.1
	DEC	89.0	16.2	7.2	4.3	40.4	5.7	2.3	1.1	16.3	1.3	0.4	0.1	8.5	0.5	0.1	0.0

Table 22. Estimated mean number of system outages due to rain for all months at New Orleans for the indicated durations and fade margins (based on a frequency of 45 GHz).

NUMBER OF OUTAGES

		5-min Duration				10-min Duration				20-min Duration				30-min Duration			
		Elevation Angle (in degrees)				Elevation Angle (in degrees)				Elevation Angle (in degrees)				Elevation Angle (in degrees)			
	Month	10	30	50	70	10	30	50	70	10	30	50	70	10	30	50	70
	JAN	439.4	103.4	40.4	18.0	210.1	47.6	17.1	7.0	96.1	20.1	6.1	2.3	58.9	11.1	2.7	0.8
	FEB	327.3	87.4	37.6	18.9	157.3	39.8	15.7	7.5	72.9	16.6	5.5	2.2	44.9	9.4	2.5	1.0
	MAR	350.4	113.0	54.0	27.2	166.9	52.4	24.2	11.3	75.9	22.3	9.2	3.8	47.4	12.8	4.2	1.3
	APR	271.3	76.5	39.9	25.0	130.8	35.6	18.1	11.3	60.3	15.7	7.4	4.0	36.9	8.1	3.8	2.2
Freq = 45 GHz	MAY	319.2	115.4	64.2	33.9	152.6	54.3	29.4	14.6	70.1	23.5	12.2	5.0	43.5	13.6	6.0	2.3
	JUN	208.6	95.4	58.2	39.6	97.8	43.9	26.5	17.8	42.2	18.6	10.7	6.7	25.5	10.4	5.4	3.2
Fade = 15 dB	JUL	382.6	151.3	74.4	47.2	179.4	69.2	33.1	20.7	79.6	29.1	12.7	7.4	47.8	16.3	6.6	3.5
	AUG	373.4	162.7	87.8	58.9	175.5	75.6	40.0	25.8	78.4	32.3	15.8	9.0	46.4	18.3	8.0	4.1
	SEP	386.6	158.5	83.3	52.4	182.2	73.5	37.4	22.4	82.0	31.1	13.8	7.2	48.1	17.3	7.2	3.3
	OCT	185.4	78.1	42.0	22.8	88.6	36.5	19.0	9.8	40.3	15.8	7.7	3.1	24.6	9.3	4.0	1.3
	NOV	391.6	116.5	53.6	28.6	188.7	54.2	24.1	12.1	87.5	23.7	9.4	4.1	54.3	14.3	4.7	2.0
	DEC	380.0	118.0	56.0	27.8	182.2	54.3	24.7	11.6	83.6	22.8	9.2	3.9	51.6	12.7	4.0	1.6
	JAN	393.8	57.6	22.8	10.9	188.1	24.8	9.2	3.7	85.8	9.5	3.0	0.9	52.4	4.3	1.2	0.4
	FEB	289.9	50.9	22.8	11.8	139.0	21.6	9.2	4.4	64.2	7.9	2.9	0.9	39.3	3.7	1.3	0.4
	MAR	324.5	77.0	32.0	18.0	154.5	35.1	13.6	7.0	70.1	14.3	4.7	1.9	43.7	7.4	1.8	0.6
	APR	254.2	56.6	26.7	15.8	122.5	26.1	12.1	6.7	56.4	11.2	4.3	2.2	34.4	5.7	2.5	0.9
Freq = 45 GHz	MAY	301.1	83.1	41.8	25.3	143.8	38.6	18.4	10.5	65.9	16.4	6.9	3.4	40.9	8.8	3.2	1.7
	JUN	203.1	67.7	41.8	31.5	95.2	30.9	18.9	13.8	41.0	12.8	7.2	5.0	24.8	6.7	3.4	2.5
Fade = 20 dB	JUL	365.2	89.3	50.8	36.4	171.2	39.9	22.3	15.7	75.8	15.7	8.0	5.3	45.4	8.2	4.0	2.2
	AUG	357.6	104.3	62.4	47.4	168.0	47.9	27.6	19.9	74.9	19.5	9.9	6.5	44.3	10.4	4.5	2.7
	SEP	369.9	101.7	55.9	41.1	174.2	46.4	24.1	17.3	78.3	18.2	7.7	5.3	45.9	9.7	3.7	2.3
	OCT	177.9	56.4	26.0	13.8	84.9	25.9	11.3	5.6	38.6	10.9	3.9	1.6	23.6	6.1	1.7	0.6
	NOV	367.9	83.8	35.4	18.2	177.2	38.5	15.3	7.4	82.0	16.2	5.5	2.0	50.9	9.3	2.7	0.8
	DEC	346.0	79.3	32.3	17.6	165.5	35.8	13.9	6.4	75.7	14.2	4.8	1.6	46.6	7.1	2.1	0.6
	JAN	325.4	38.9	14.3	7.9	155.1	16.4	5.3	2.4	70.4	5.8	1.6	0.5	42.7	2.6	0.7	0.1
	FEB	247.1	35.8	14.3	8.4	118.0	14.9	5.5	2.9	54.1	5.1	1.3	0.5	33.0	2.4	0.7	0.2
	MAR	283.3	51.1	21.4	13.9	134.6	22.8	8.5	4.9	60.8	8.6	2.7	0.9	37.7	3.9	0.7	0.2
	APR	224.4	37.8	19.6	11.7	107.9	17.1	8.6	4.7	49.6	6.9	3.0	1.3	29.9	3.6	1.4	0.4
Freq = 45 GHz	MAY	278.5	55.8	30.4	19.9	132.9	25.3	12.9	8.1	60.8	10.4	4.3	2.3	37.5	4.8	2.1	1.2
	JUN	189.3	54.0	34.0	26.2	88.6	24.6	15.1	10.9	38.1	9.8	5.5	3.8	22.9	4.8	2.7	1.8
Fade = 25 dB	JUL	342.1	70.3	40.1	28.6	160.1	31.3	17.4	12.1	70.8	11.8	6.1	3.8	42.3	6.2	2.6	1.4
	AUG	336.5	83.2	51.9	37.3	158.0	37.8	22.2	15.0	70.3	14.8	7.1	4.8	41.5	7.4	3.2	1.8
	SEP	347.6	78.2	45.4	31.8	163.6	34.9	19.1	13.3	73.3	12.5	6.0	4.0	42.9	6.5	2.7	1.4
	OCT	165.4	39.4	16.7	10.0	78.9	17.7	7.0	4.0	35.8	7.1	2.0	0.9	21.8	3.6	0.7	0.4
	NOV	332.3	51.8	24.0	11.3	159.8	23.2	10.1	4.2	73.7	9.0	3.1	1.0	45.7	4.5	1.4	0.4
	DEC	306.3	52.2	21.9	11.5	146.1	23.0	8.6	3.9	66.5	8.5	2.6	0.8	40.7	3.7	1.0	0.2

Table 23. Estimated probability of at least 3 system outages due to rain in the worst months for the indicated durations (based on a frequency of 15 GHz and a fade margin of 15 dB).

		PROBABILITY OF AT LEAST 3 OUTAGES											
		10-min Duration				20-min Duration				30-min Duration			
		Elevation Angle (in degrees)				Elevation Angle (in degrees)				Elevation Angle (in degrees)			
Location	Month(s)	10	30	50	70	10	30	50	70	10	30	50	70
Aberdeen, SD	JUN	.53	.01	*	*	.04	*	*	*	*	*	*	*
Aberdeen, SD	JUL	.44	*	*	*	.04	*	*	*	*	*	*	*
Albuquerque, NM	AUG	.05	*	*	*	*	*	*	*	*	*	*	*
Allentown, PA	JUL	.64	.04	.01	*	.01	*	*	*	*	*	*	*
Allentown, PA	AUG	.89	.04	*	*	.12	*	*	*	*	*	*	*
Asheville, NC	JUL	.76	.18	.01	*	.16	.01	*	*	.02	*	*	*
Asheville, NC	SEP	.60	.02	*	*	.08	*	*	*	.02	*	*	*
Bakersfield, CA	MAR	*	*	*	*	*	*	*	*	*	*	*	*
Bakersfield, CA	MAY	*	*	*	*	*	*	*	*	*	*	*	*
Billings, MT	JUL	*	*	*	*	*	*	*	*	*	*	*	*
Boise, ID	SEP	*	*	*	*	*	*	*	*	*	*	*	*
Boston, MA	AUG	.24	.01	*	*	*	*	*	*	*	*	*	*
Cape Hatteras, NC	SEP	.96	.40	.03	*	.48	.01	*	*	.07	*	*	*
Charleston, SC	JUN	.99	.49	.22	.07	.49	.03	*	*	.15	*	*	*
Cheyenne, WY	JUL	.05	*	*	*	*	*	*	*	*	*	*	*
Cheyenne, WY	SEP	*	*	*	*	*	*	*	*	*	*	*	*
Chicago, IL	JUL	.86	.07	.02	.02	.21	*	*	*	*	*	*	*
Chicago, IL	AUG	.81	.10	*	*	.16	*	*	*	*	*	*	*
Denver, CO	AUG	.04	*	*	*	*	*	*	*	*	*	*	*
Ely, NV	AUG	*	*	*	*	*	*	*	*	*	*	*	*
Grand Junction, CO	JUL	*	*	*	*	*	*	*	*	*	*	*	*
Houston, TX	MAY	.95	.35	.04	*	.30	*	*	*	.06	*	*	*
Houston, TX	JUN	.95	.49	.14	.09	.41	.04	*	*	.04	*	*	*
Huntsville, AL	MAY	.66	.10	*	*	.03	*	*	*	*	*	*	*
Huntsville, AL	JUL	.97	.33	.08	.01	.43	*	*	*	.02	*	*	*
Internat'l Falls, MN	JUL	.31	.02	*	*	.01	*	*	*	*	*	*	*
Internat'l Falls, MN	SEP	.11	*	*	*	*	*	*	*	*	*	*	*
Key West, FL	JUL	.81	.14	.02	*	.04	*	*	*	*	*	*	*
Key West, FL	AUG	.97	.48	.15	.06	.27	.01	*	*	.04	*	*	*
Lexington, KY	JUN	.60	.05	.01	*	.02	*	*	*	*	*	*	*
Lexington, KY	JUL	.98	.31	.07	*	.49	*	*	*	.12	*	*	*
Miami, FL	JUN	.99	.70	.34	.22	.59	.07	.01	*	.15	*	*	*
Newark, NJ	AUG	.61	.03	.01	*	.06	*	*	*	*	*	*	*
New Orleans, LA	JUL	.98	.54	.08	.06	.45	.01	*	*	.02	*	*	*
New Orleans, LA	AUG	.99	.78	.30	.16	.55	.06	*	*	.09	*	*	*
NYC (Kennedy), NY	JUN	.30	.01	*	*	*	*	*	*	*	*	*	*
NYC (Kennedy), NY	AUG	.44	.01	*	*	.03	*	*	*	*	*	*	*

* < .01

Table 23. Estimated probability of at least 3 system outages due to rain in the worst months for the indicated durations (based on a frequency of 15 GHz and a fade margin of 15 dB). (Cont.)

		PROBABILITY OF AT LEAST 3 OUTAGES											
		10-min Duration				20-min Duration				30-min Duration			
		Elevation Angle (in degrees)				Elevation Angle (in degrees)				Elevation Angle (in degrees)			
Location	Month(s)	10	30	50	70	10	30	50	70	10	30	50	70
Oklahoma City, OK	MAY	.88	.10	*	*	.28	*	*	*	.07	*	*	*
Oklahoma City, OK	JUN	.89	.12	.03	*	.24	*	*	*	.05	*	*	*
Omaha, NE	JUL	.63	.04	*	*	.08	*	*	*	*	*	*	*
Omaha, NE	AUG	.48	.01	*	*	.04	*	*	*	*	*	*	*
Philadelphia, PA	JUN	.61	.03	*	*	.01	*	*	*	*	*	*	*
Philadelphia, PA	JUL	.65	.03	*	*	.02	*	*	*	*	*	*	*
Philadelphia, PA	AUG	.80	.03	*	*	.05	*	*	*	*	*	*	*
Phoenix, AZ	JUL	*	*	*	*	*	*	*	*	*	*	*	*
Phoenix, AZ	AUG	.01	*	*	*	*	*	*	*	*	*	*	*
Pittsburgh, PA	JUL	.26	*	*	*	*	*	*	*	*	*	*	*
Raleigh, NC	JUN	.75	.08	*	*	.09	*	*	*	*	*	*	*
Raleigh, NC	JUL	.77	.03	*	*	.04	*	*	*	*	*	*	*
Raleigh, NC	AUG	.76	.08	*	*	.10	*	*	*	*	*	*	*
Rapid City, SD	JUN	.08	*	*	*	*	*	*	*	*	*	*	*
Rapid City, SD	JUL	.13	*	*	*	*	*	*	*	*	*	*	*
St. Louis, MO	JUN	.47	.01	*	*	.03	*	*	*	*	*	*	*
St. Louis, MO	JUL	.44	.01	*	*	.01	*	*	*	*	*	*	*
San Angelo, TX	MAY	.26	*	*	*	.01	*	*	*	*	*	*	*
San Sebastian, PR	SEP	.99	.82	.45	.23	.88	.14	.02	*	.25	*	*	*
San Sebastian, PR	OCT	.99	.77	.25	.11	.84	.15	*	*	.26	*	*	*
Santa Maria, CA	JAN	*	*	*	*	*	*	*	*	*	*	*	*
Santa Maria, CA	DEC	*	*	*	*	*	*	*	*	*	*	*	*
Seattle, WA	AUG	*	*	*	*	*	*	*	*	*	*	*	*
Seattle, WA	SEP	*	*	*	*	*	*	*	*	*	*	*	*
Shreveport, LA	MAY	.97	.28	*	*	.54	*	*	*	.17	*	*	*
Shreveport, LA	SEP	.50	.03	*	*	.05	*	*	*	*	*	*	*
Spokane, WA	MAY	*	*	*	*	*	*	*	*	*	*	*	*
Spokane, WA	JUN	*	*	*	*	*	*	*	*	*	*	*	*
Tallahassee, FL	AUG	.99	.92	.51	.29	.70	.09	*	*	.12	*	*	*
Tallahassee, FL	NOV	.75	.10	.03	.01	.15	*	*	*	.02	*	*	*
Topeka, KS	JUN	.80	.13	*	*	.16	*	*	*	*	*	*	*
Topeka, KS	JUL	.49	.03	*	*	.02	*	*	*	*	*	*	*
Topeka, KS	OCT	.06	*	*	*	*	*	*	*	*	*	*	*
Urbana, IL	JUL	.73	.21	.09	*	.02	*	*	*	*	*	*	*
Yuma, AZ	AUG	.02	*	*	*	*	*	*	*	*	*	*	*
Yuma, AZ	SEP	*	*	*	*	*	*	*	*	*	*	*	*

* < .01

Table 24. Estimated probability of at least 3 system outages due to rain in the worst months for the indicated durations (based on a frequency of 30 GHz and a fade margin of 15 dB).

PROBABILITY OF AT LEAST 3 OUTAGES

Location	Month(s)	10-min Duration, Elevation Angle (in degrees) 10	30	50	70	20-min Duration, Elevation Angle (in degrees) 10	30	50	70	30-min Duration, Elevation Angle (in degrees) 10	30	50	70
Aberdeen, SD	JUN	.99	.97	.78	.53	.99	.43	.12	.04	.96	.04	.01	*
Aberdeen, SD	JUL	.99	.97	.74	.48	.99	.49	.09	.05	.96	.15	.03	*
Albuquerque, NM	AUG	.99	.49	.21	.05	.95	.05	.01	*	.72	*	*	*
Allentown, PA	JUL	.99	.99	.97	.82	.99	.96	.35	.09	.99	.51	.07	.01
Allentown, PA	AUG	.99	.99	.99	.94	.99	.96	.54	.20	.99	.57	.10	.01
Asheville, NC	JUL	.99	.99	.98	.89	.99	.92	.54	.29	.99	.53	.09	.04
Asheville, NC	SEP	.99	.99	.96	.70	.99	.94	.48	.15	.99	.62	.14	.02
Bakersfield, CA	MAR	.97	*	*	*	.57	*	*	*	.24	*	*	*
Bakersfield, CA	MAY	.87	.06	.01	*	.64	*	*	*	.32	*	*	*
Billings, MT	JUL	.97	.15	.03	*	.53	*	*	*	.12	*	*	*
Boise, ID	SEP	.95	*	*	*	.45	*	*	*	.08	*	*	*
Boston, MA	AUG	.99	.99	.72	.36	.99	.58	.05	.01	.99	.13	*	*
Cape Hatteras, NC	SEP	.99	.99	.99	.99	.99	.98	.85	.63	.99	.79	.40	.18
Charleston, SC	JUN	.99	.99	.99	.99	.99	.99	.85	.65	.99	.82	.38	.20
Cheyenne, WY	JUL	.99	.69	.22	.05	.96	.05	*	*	.53	*	*	*
Cheyenne, WY	SEP	.81	.02	*	*	.26	*	*	*	.04	*	*	*
Chicago, IL	JUL	.99	.99	.98	.93	.99	.87	.51	.35	.99	.42	.11	.04
Chicago, IL	AUG	.99	.99	.98	.89	.99	.88	.57	.28	.99	.44	.14	.02
Denver, CO	AUG	.99	.59	.19	.03	.97	.06	*	*	.84	*	*	*
Ely, NV	AUG	.91	.03	*	*	.34	*	*	*	.10	*	*	*
Grand Junction, CO	JUL	.76	.01	*	*	.29	*	*	*	.06	*	*	*
Houston, TX	MAY	.99	.99	.99	.99	.99	.99	.85	.54	.99	.80	.32	.10
Houston, TX	JUN	.99	.99	.99	.98	.99	.96	.83	.56	.99	.71	.26	.10
Huntsville, AL	MAY	.99	.99	.92	.70	.99	.71	.14	.04	.99	.13	.01	*
Huntsville, AL	JUL	.99	.99	.99	.99	.99	.98	.81	.53	.99	.68	.23	.06
Internat'l Falls, MN	JUL	.99	.94	.68	.31	.99	.30	.11	.01	.99	.03	*	*
Internat'l Falls, MN	SEP	.99	.83	.29	.07	.99	.19	.01	*	.89	.04	*	*
Key West, FL	JUL	.99	.99	.99	.95	.99	.85	.47	.24	.99	.25	.08	.02
Key West, FL	AUG	.99	.99	.99	.99	.99	.96	.70	.40	.99	.38	.15	.09
Lexington, KY	JUN	.99	.99	.88	.68	.99	.58	.12	.03	.99	.07	*	*
Lexington, KY	JUL	.99	.99	.99	.99	.99	.97	.77	.55	.99	.63	.36	.15
Miami, FL	JUN	.99	.99	.99	.99	.99	.99	.93	.73	.99	.76	.41	.22
Newark, NJ	AUG	.99	.99	.95	.77	.99	.84	.30	.13	.99	.29	.02	*
New Orleans, LA	JUL	.99	.99	.99	.99	.99	.99	.89	.66	.99	.86	.37	.10
New Orleans, LA	AUG	.99	.99	.99	.99	.99	.99	.95	.75	.99	.90	.50	.19
NYC (Kennedy), NY	JUN	.99	.99	.79	.42	.99	.60	.12	*	.99	.13	.01	*
NYC (Kennedy), NY	AUG	.99	.99	.86	.59	.99	.67	.11	.05	.99	.12	.02	*

* < .01

Table 24. Estimated probability of at least 3 system outages due to rain in the worst months for the indicated durations (based on a frequency of 30 GHz and a fade margin of 15 dB). (Cont.)

		PROBABILITY OF AT LEAST 3 OUTAGES											
		10-min Duration				20-min Duration				30-min Duration			
		Elevation Angle (in degrees)				Elevation Angle (in degrees)				Elevation Angle (in degrees)			
Location	Month(s)	10	30	50	70	10	30	50	70	10	30	50	70
Oklahoma City, OK	MAY	.99	.99	.98	.88	.99	.95	.54	.28	.99	.59	.21	.07
Oklahoma City, OK	JUN	.99	.99	.99	.93	.99	.95	.61	.30	.99	.61	.15	.07
Omaha, NE	JUL	.99	.99	.92	.74	.99	.56	.25	.10	.99	.15	.03	.01
Omaha, NE	AUG	.99	.99	.84	.57	.99	.73	.22	.04	.99	.22	.01	*
Philadelphia, PA	JUN	.99	.99	.95	.74	.99	.73	.25	.03	.99	.19	*	*
Philadelphia, PA	JUL	.99	.99	.98	.84	.99	.89	.53	.10	.99	.44	.03	*
Philadelphia, PA	AUG	.99	.99	.99	.94	.99	.87	.45	.19	.99	.39	.05	*
Phoenix, AZ	JUL	.99	.34	.06	*	.85	*	*	*	.43	*	*	*
Phoenix, AZ	AUG	.99	.27	.06	.02	.95	.01	*	*	.59	*	*	*
Pittsburgh, PA	JUL	.99	.98	.73	.33	.99	.24	.03	*	.99	.04	*	*
Raleigh, NC	JUN	.99	.99	.97	.84	.99	.76	.43	.17	.99	.34	.08	.01
Raleigh, NC	JUL	.99	.99	.99	.90	.99	.92	.55	.14	.99	.42	.10	.01
Raleigh, NC	AUG	.99	.99	.98	.87	.99	.93	.55	.24	.99	.51	.07	*
Rapid City, SD	JUN	.99	.75	.88	.07	.99	.08	.18	*	.99	.01	.03	*
Rapid City, SD	JUL	.99	.63	.20	.14	.99	.03	*	*	.92	*	*	*
St. Louis, MO	JUN	.99	.99	.91	.60	.99	.61	.12	.03	.98	.15	.01	*
St. Louis, MO	JUL	.99	.97	.84	.56	.99	.27	.08	.02	.98	.02	.01	*
San Angelo, TX	MAY	.99	.79	.50	.28	.99	.10	.04	.01	.97	*	*	*
San Sebastian, PR	SEP	.99	.99	.99	.99	.99	.99	.99	.94	.99	.97	.80	.47
San Sebastian, PR	OCT	.99	.99	.99	.99	.99	.99	.98	.91	.99	.97	.80	.48
Santa Maria, CA	JAN	.99	.16	*	*	.99	*	*	*	.93	*	*	*
Santa Maria, CA	DEC	.99	.55	.04	*	.99	.06	*	*	.98	*	*	*
Seattle, WA	AUG	.99	.01	*	*	.99	*	*	*	.95	*	*	*
Seattle, WA	SEP	.99	.05	*	*	.99	*	*	*	.96	*	*	*
Shreveport, LA	MAY	.99	.99	.99	.99	.99	.99	.85	.77	.99	.84	.46	.32
Shreveport, LA	SEP	.99	.99	.88	.52	.99	.80	.28	.05	.99	.40	.03	*
Spokane, WA	MAY	.60	*	*	*	.04	*	*	*	*	*	*	*
Spokane, WA	JUN	.99	.04	*	*	.64	*	*	*	.18	*	*	*
Tallahassee, FL	AUG	.99	.99	.99	.99	.99	.99	.97	.87	.99	.92	.52	.28
Tallahassee, FL	NOV	.99	.99	.96	.82	.99	.89	.44	.21	.99	.52	.14	.04
Topeka, KS	JUN	.99	.99	.97	.87	.99	.82	.48	.22	.99	.44	.09	.02
Topeka, KS	JUL	.99	.99	.90	.71	.99	.63	.29	.09	.99	.12	.01	*
Topeka, KS	OCT	.99	.79	.15	.04	.99	.13	*	*	.99	.01	*	*
Urbana, IL	JUL	.99	.99	.97	.86	.99	.60	.21	.05	.99	.03	*	*
Yuma, AZ	AUG	.99	.43	.13	.04	.88	.07	.01	*	.53	*	*	*
Yuma, AZ	SEP	.99	.16	*	*	.78	.01	*	*	.44	*	*	*

* < .01

Table 25. Estimated probability of at least 3 system outages due to rain in the worst months for the indicated durations (based on a frequency of 45 GHz and a fade margin of 15 dB).

PROBABILITY OF AT LEAST 3 OUTAGES

Location	Month(s)	10-min Duration, Elevation Angle (in degrees) 10	30	50	70	20-min Duration, Elevation Angle (in degrees) 10	30	50	70	30-min Duration, Elevation Angle (in degrees) 10	30	50	70
Aberdeen, SD	JUN	.99	.99	.99	.88	.99	.99	.60	.19	.99	.76	.11	.02
Aberdeen, SD	JUL	.99	.99	.99	.91	.99	.96	.71	.28	.99	.67	.32	.07
Albuquerque, NM	AUG	.99	.98	.60	.35	.99	.51	.07	.02	.99	.12	*	*
Allentown, PA	JUL	.99	.99	.99	.99	.99	.99	.99	.80	.99	.99	.78	.17
Allentown, PA	AUG	.99	.99	.99	.99	.99	.99	.99	.83	.99	.99	.88	.27
Asheville, NC	JUL	.99	.99	.99	.99	.99	.99	.98	.77	.99	.99	.75	.28
Asheville, NC	SEP	.99	.99	.99	.99	.99	.99	.99	.74	.99	.99	.92	.27
Bakersfield, CA	MAR	.99	.06	*	*	.99	*	*	*	.98	*	*	*
Bakersfield, CA	MAY	.99	.23	.10	.03	.99	.03	*	*	.93	.01	*	*
Billings, MT	JUL	.99	.73	.19	.05	.99	.21	.01	*	.99	.04	*	*
Boise, ID	SEP	.99	.31	.01	*	.99	.01	*	*	.98	*	*	*
Boston, MA	AUG	.99	.99	.99	.95	.99	.99	.81	.21	.99	.97	.29	.02
Cape Hatteras, NC	SEP	.99	.99	.99	.99	.99	.99	.99	.95	.99	.99	.90	.60
Charleston, SC	JUN	.99	.99	.99	.99	.99	.99	.99	.97	.99	.99	.92	.65
Cheyenne, WY	JUL	.99	.99	.83	.38	.99	.75	.22	*	.99	.15	*	*
Cheyenne, WY	SEP	.99	.20	.03	*	.98	.02	*	*	.96	*	*	*
Chicago, IL	JUL	.99	.99	.99	.99	.99	.99	.96	.68	.99	.95	.60	.28
Chicago, IL	AUG	.99	.99	.99	.99	.99	.99	.97	.72	.99	.98	.75	.20
Denver, CO	AUG	.99	.99	.71	.33	.99	.62	.10	.02	.99	.24	.01	*
Ely, NV	AUG	.99	.39	.04	.01	.99	.02	*	*	.98	*	*	*
Grand Junction, CO	JUL	.99	.27	.02	*	.99	.02	*	*	.87	*	*	*
Houston, TX	MAY	.99	.99	.99	.99	.99	.99	.99	.94	.99	.99	.96	.56
Houston, TX	JUN	.99	.99	.99	.99	.99	.99	.99	.92	.99	.98	.85	.52
Huntsville, AL	MAY	.99	.99	.99	.98	.99	.99	.93	.36	.99	.98	.40	.05
Huntsville, AL	JUL	.99	.99	.99	.99	.99	.99	.99	.93	.99	.99	.86	.43
Internat'l Falls, MN	JUL	.99	.99	.99	.84	.99	.99	.57	.19	.99	.85	.11	.01
Internat'l Falls, MN	SEP	.99	.99	.89	.55	.99	.73	.25	.05	.99	.30	.07	*
Key West, FL	JUL	.99	.99	.99	.99	.99	.99	.97	.74	.99	.93	.54	.19
Key West, FL	AUG	.99	.99	.99	.99	.99	.99	.99	.88	.99	.96	.66	.24
Lexington, KY	JUN	.99	.99	.99	.97	.99	.99	.76	.29	.99	.98	.24	*
Lexington, KY	JUL	.99	.99	.99	.99	.99	.99	.99	.91	.99	.99	.85	.49
Miami, FL	JUN	.99	.99	.99	.99	.99	.99	.99	.98	.99	.99	.95	.66
Newark, NJ	AUG	.99	.99	.99	.99	.99	.99	.95	.60	.99	.99	.62	.05
New Orleans, LA	JUL	.99	.99	.99	.99	.99	.99	.99	.97	.99	.99	.95	.66
New Orleans, LA	AUG	.99	.99	.99	.99	.99	.99	.99	.99	.99	.99	.98	.76
NYC (Kennedy), NY	JUN	.99	.99	.99	.96	.99	.99	.84	.35	.99	.98	.45	.03
NYC (Kennedy), NY	AUG	.99	.99	.99	.97	.99	.99	.88	.41	.99	.95	.30	.05

* < .01

Table 25. Estimated probability of at least 3 system outages due to rain in the worst months for the indicated durations (based on a frequency of 45 GHz and a fade margin of 15 dB). (Cont.)

		PROBABILITY OF AT LEAST 3 OUTAGES											
		10-min Duration				20-min Duration				30-min Duration			
		Elevation Angle (in degrees)				Elevation Angle (in degrees)				Elevation Angle (in degrees)			
Location	Month(s)	10	30	50	70	10	30	50	70	10	30	50	70
Oklahoma City, OK	MAY	.99	.99	.99	.99	.99	.99	.99	.80	.99	.99	.81	.41
Oklahoma City, OK	JUN	.99	.99	.99	.99	.99	.99	.97	.82	.99	.98	.76	.31
Omaha, NE	JUL	.99	.99	.99	.97	.99	.99	.83	.42	.99	.94	.39	.06
Omaha, NE	AUG	.99	.99	.99	.95	.99	.99	.87	.38	.99	.94	.46	.03
Philadelphia, PA	JUN	.99	.99	.99	.99	.99	.99	.93	.47	.99	.96	.39	.06
Philadelphia, PA	JUL	.99	.99	.99	.99	.99	.99	.96	.80	.99	.98	.67	.23
Philadelphia, PA	AUG	.99	.99	.99	.99	.99	.99	.96	.73	.99	.99	.67	.13
Phoenix, AZ	JUL	.99	.87	.50	.14	.99	.26	.02	*	.85	.03	*	*
Phoenix, AZ	AUG	.99	.90	.42	.18	.99	.42	.03	*	.93	.05	*	*
Pittsburgh, PA	JUL	.99	.99	.99	.90	.99	.99	.70	.05	.99	.92	.14	.01
Raleigh, NC	JUN	.99	.99	.99	.99	.99	.99	.84	.57	.99	.96	.46	.16
Raleigh, NC	JUL	.99	.99	.99	.99	.99	.99	.97	.81	.99	.97	.64	.19
Raleigh, NC	AUG	.99	.99	.99	.99	.99	.99	.98	.77	.99	.98	.72	.25
Rapid City, SD	JUN	.99	.99	.88	.34	.99	.98	.18	.01	.99	.76	.03	*
Rapid City, SD	JUL	.99	.99	.84	.37	.99	.81	.14	.01	.99	.28	*	*
St. Louis, MO	JUN	.99	.99	.99	.97	.99	.99	.72	.36	.99	.86	.27	.03
St. Louis, MO	JUL	.99	.99	.99	.93	.99	.94	.44	.17	.99	.55	.04	.01
San Angelo, TX	MAY	.99	.99	.96	.68	.99	.95	.36	.07	.99	.60	.03	*
San Sebastian, PR	SEP	.99	.99	.99	.99	.99	.99	.99	.99	.99	.99	.99	.93
San Sebastian, PR	OCT	.99	.99	.99	.99	.99	.99	.99	.99	.99	.99	.99	.94
Santa Maria, CA	JAN	.99	.99	.38	*	.99	.89	.03	*	.99	.51	*	*
Santa Maria, CA	DEC	.99	.99	.89	.16	.99	.98	.29	*	.99	.75	.04	*
Seattle, WA	AUG	.99	.99	.16	*	.99	.72	*	*	.99	.29	*	*
Seattle, WA	SEP	.99	.99	.30	*	.99	.89	.01	*	.99	.42	*	*
Shreveport, LA	MAY	.99	.99	.99	.99	.99	.99	.99	.96	.99	.99	.92	.72
Shreveport, LA	SEP	.99	.99	.99	.98	.99	.99	.93	.56	.99	.97	.64	.16
Spokane, WA	MAY	.99	.04	*	*	.92	*	*	*	.70	*	*	*
Spokane, WA	JUN	.99	.42	.07	.01	.99	.03	*	*	.98	*	*	*
Tallahassee, FL	AUG	.99	.99	.99	.99	.99	.99	.99	.99	.99	.99	.98	.75
Tallahassee, FL	NOV	.99	.99	.99	.99	.99	.99	.96	.59	.99	.99	.69	.24
Topeka, KS	JUN	.99	.99	.99	.99	.99	.99	.96	.62	.99	.99	.68	.24
Topeka, KS	JUL	.99	.99	.99	.96	.99	.99	.83	.44	.99	.94	.30	.05
Topeka, KS	OCT	.99	.99	.92	.34	.99	.98	.28	*	.99	.90	.03	*
Urbana, IL	JUL	.99	.99	.99	.99	.99	.99	.82	.39	.99	.91	.13	*
Yuma, AZ	AUG	.99	.92	.60	.26	.98	.52	.14	.03	.90	.12	.01	*
Yuma, AZ	SEP	.99	.78	.36	.06	.96	.28	.05	*	.80	.07	.01	*

* < .01

Table 26. Estimated probability of at least 3 system outages due to rain for all months at Boston, MA for the indicated durations and fade margins (based on a frequency of 15 GHz).

PROBABILITY OF AT LEAST 3 OUTAGES

		10-min Duration				20-min Duration				30-min Duration			
		Elevation Angle (in degrees)				Elevation Angle (in degrees)				Elevation Angle (in degrees)			
	Month	10	30	50	70	10	30	50	70	10	30	50	70
	JAN	*	*	*	*	*	*	*	*	*	*	*	*
	FEB	*	*	*	*	*	*	*	*	*	*	*	*
	MAR	*	*	*	*	*	*	*	*	*	*	*	*
	APR	*	*	*	*	*	*	*	*	*	*	*	*
Freq = 15 GHz	MAY	*	*	*	*	*	*	*	*	*	*	*	*
	JUN	.07	*	*	*	*	*	*	*	*	*	*	*
Fade = 15 dB	JUL	.12	*	*	*	*	*	*	*	*	*	*	*
	AUG	.24	.01	*	*	*	*	*	*	*	*	*	*
	SEP	.08	*	*	*	*	*	*	*	*	*	*	*
	OCT	*	*	*	*	*	*	*	*	*	*	*	*
	NOV	*	*	*	*	*	*	*	*	*	*	*	*
	DEC	*	*	*	*	*	*	*	*	*	*	*	*
	JAN	*	*	*	*	*	*	*	*	*	*	*	*
	FEB	*	*	*	*	*	*	*	*	*	*	*	*
	MAR	*	*	*	*	*	*	*	*	*	*	*	*
	APR	*	*	*	*	*	*	*	*	*	*	*	*
Freq = 15 GHz	MAY	*	*	*	*	*	*	*	*	*	*	*	*
	JUN	*	*	*	*	*	*	*	*	*	*	*	*
Fade = 20 dB	JUL	.01	*	*	*	*	*	*	*	*	*	*	*
	AUG	.02	*	*	*	*	*	*	*	*	*	*	*
	SEP	*	*	*	*	*	*	*	*	*	*	*	*
	OCT	*	*	*	*	*	*	*	*	*	*	*	*
	NOV	*	*	*	*	*	*	*	*	*	*	*	*
	DEC	*	*	*	*	*	*	*	*	*	*	*	*
	JAN	*	*	*	*	*	*	*	*	*	*	*	*
	FEB	*	*	*	*	*	*	*	*	*	*	*	*
	MAR	*	*	*	*	*	*	*	*	*	*	*	*
	APR	*	*	*	*	*	*	*	*	*	*	*	*
Freq = 15 GHz	MAY	*	*	*	*	*	*	*	*	*	*	*	*
	JUN	*	*	*	*	*	*	*	*	*	*	*	*
Fade = 25 dB	JUL	*	*	*	*	*	*	*	*	*	*	*	*
	AUG	.01	*	*	*	*	*	*	*	*	*	*	*
	SEP	*	*	*	*	*	*	*	*	*	*	*	*
	OCT	*	*	*	*	*	*	*	*	*	*	*	*
	NOV	*	*	*	*	*	*	*	*	*	*	*	*
	DEC	*	*	*	*	*	*	*	*	*	*	*	*

* < .01

Table 27. Estimated probability of at least 3 system outages due to rain for all months at Boston, MA for the indicated durations and fade margins (based on a frequency of 30 GHz).

PROBABILITY OF AT LEAST 3 OUTAGES

		10-min Duration				20-min Duration				30-min Duration			
		Elevation Angle (in degrees)				Elevation Angle (in degrees)				Elevation Angle (in degrees)			
	Month	10	30	50	70	10	30	50	70	10	30	50	70
	JAN	*	*	*	*	*	*	*	*	*	*	*	*
	FEB	*	*	*	*	*	*	*	*	*	*	*	*
	MAR	.34	*	*	*	.03	*	*	*	*	*	*	*
	APR	.99	*	*	*	.88	*	*	*	.70	*	*	*
Freq = 30 GHz	MAY	.99	.36	*	*	.99	.02	*	*	.99	*	*	*
	JUN	.99	.82	.37	.09	.99	.16	.01	*	.99	.01	*	*
Fade = 15 dB	JUL	.99	.97	.64	.20	.99	.37	.03	*	.99	.05	*	*
	AUG	.99	.99	.72	.36	.99	.58	.05	.01	.99	.13	*	*
	SEP	.99	.99	.47	.10	.99	.63	.03	*	.99	.22	*	*
	OCT	.99	.50	.02	*	.99	.04	*	*	.99	*	*	*
	NOV	.99	*	*	*	.99	*	*	*	.97	*	*	*
	DEC	.19	*	*	*	.01	*	*	*	*	*	*	*
	JAN	*	*	*	*	*	*	*	*	*	*	*	*
	FEB	*	*	*	*	*	*	*	*	*	*	*	*
	MAR	.01	*	*	*	*	*	*	*	*	*	*	*
	APR	.64	*	*	*	.06	*	*	*	.02	*	*	*
Freq = 30 GHz	MAY	.99	*	*	*	.96	*	*	*	.73	*	*	*
	JUN	.99	.48	.09	*	.99	.02	*	*	.96	*	*	*
Fade = 20 dB	JUL	.99	.76	.24	.05	.99	.07	*	*	.94	*	*	*
	AUG	.99	.89	.36	.13	.99	.13	.01	*	.99	*	*	*
	SEP	.99	.78	.10	.03	.99	.10	*	*	.99	.01	*	*
	OCT	.99	.06	*	*	.99	*	*	*	.94	*	*	*
	NOV	.98	*	*	*	.67	*	*	*	.26	*	*	*
	DEC	*	*	*	*	*	*	*	*	*	*	*	*
	JAN	*	*	*	*	*	*	*	*	*	*	*	*
	FEB	*	*	*	*	*	*	*	*	*	*	*	*
	MAR	*	*	*	*	*	*	*	*	*	*	*	*
	APR	.04	*	*	*	*	*	*	*	*	*	*	*
Freq = 30 GHz	MAY	.98	*	*	*	.55	*	*	*	.14	*	*	*
	JUN	.99	.25	*	*	.92	*	*	*	.54	*	*	*
Fade = 25 dB	JUL	.99	.45	.06	.02	.95	*	*	*	.59	*	*	*
	AUG	.99	.55	.15	.03	.99	.02	*	*	.93	*	*	*
	SEP	.99	.17	.04	*	.99	*	*	*	.96	*	*	*
	OCT	.99	.01	*	*	.71	*	*	*	.27	*	*	*
	NOV	.71	*	*	*	.20	*	*	*	.03	*	*	*
	DEC	*	*	*	*	*	*	*	*	*	*	*	*

* < .01

Table 28. Estimated probability of at least 3 system outages due to rain for all months at Boston, MA for the indicated durations and fade margins (based on a frequency of 45 GHz).

PROBABILITY OF AT LEAST 3 OUTAGES

		10-min Duration				20-min Duration				30-min Duration			
		Elevation Angle (in degrees)				Elevation Angle (in degrees)				Elevation Angle (in degrees)			
	Month	10	30	50	70	10	30	50	70	10	30	50	70
	JAN	.94	*	*	*	.45	*	*	*	.07	*	*	*
	FEB	.87	*	*	*	.31	*	*	*	.09	*	*	*
	MAR	.99	*	*	*	.99	*	*	*	.94	*	*	*
	APR	.99	.19	*	*	.99	*	*	*	.99	*	*	*
Freq = 45 GHz	MAY	.99	.99	.55	*	.99	.94	.08	*	.99	.65	*	*
	JUN	.99	.99	.97	.58	.99	.99	.48	.04	.99	.90	.09	*
Fade = 15dB	JUL	.99	.99	.99	.82	.99	.99	.60	.12	.99	.86	.14	*
	AUG	.99	.99	.99	.95	.99	.99	.81	.21	.99	.97	.29	.02
	SEP	.99	.99	.99	.90	.99	.99	.83	.21	.99	.99	.45	.03
	OCT	.99	.99	.73	.06	.99	.97	.09	*	.99	.78	.01	*
	NOV	.99	.95	*	*	.99	.50	*	*	.99	.15	*	*
	DEC	.99	*	*	*	.98	*	*	*	.96	*	*	*
	JAN	.08	*	*	*	*	*	*	*	*	*	*	*
	FEB	.23	*	*	*	*	*	*	*	*	*	*	*
	MAR	.96	*	*	*	.71	*	*	*	.24	*	*	*
	APR	.99	*	*	*	.99	*	*	*	.99	*	*	*
Freq = 45 GHz	MAY	.99	.94	.07	*	.99	.42	*	*	.99	.08	*	*
	JUN	.99	.99	.67	.33	.99	.85	.07	.01	.99	.38	*	*
Fade = 20 dB	JUL	.99	.99	.90	.58	.99	.93	.18	.01	.99	.53	.01	*
	AUG	.99	.99	.98	.72	.99	.99	.32	.05	.99	.78	.04	*
	SEP	.99	.99	.96	.36	.99	.98	.38	.02	.99	.86	.08	*
	OCT	.99	.98	.16	.01	.99	.54	*	*	.99	.17	*	*
	NOV	.99	.18	*	*	.99	.01	*	*	.99	*	*	*
	DEC	.97	*	*	*	.56	*	*	*	.24	*	*	*
	JAN	*	*	*	*	*	*	*	*	*	*	*	*
	FEB	.01	*	*	*	*	*	*	*	*	*	*	*
	MAR	.65	*	*	*	.13	*	*	*	*	*	*	*
	APR	.99	*	*	*	.99	*	*	*	.95	*	*	*
Freq = 45 GHz	MAY	.99	.53	*	*	.99	.07	*	*	.99	*	*	*
	JUN	.99	.95	.45	.10	.99	.38	.01	*	.99	.06	*	*
Fade = 25 dB	JUL	.99	.99	.72	.28	.99	.59	.05	*	.99	.13	*	*
	AUG	.99	.99	.85	.40	.99	.80	.09	.01	.99	.28	*	*
	SEP	.99	.99	.70	.11	.99	.82	.06	*	.99	.43	*	*
	OCT	.99	.73	.03	*	.99	.09	*	*	.99	.01	*	*
	NOV	.99	*	*	*	.99	*	*	*	.99	*	*	*
	DEC	.48	*	*	*	.07	*	*	*	.01	*	*	*

* < .01

Table 29. Estimated probability of at least 3 system outages due to rain for all months at New Orleans for the indicated durations and fade margins (based on a frequency of 15 GHz).

		PROBABILITY OF AT LEAST 3 OUTAGES											
		10-min Duration				20-min Duration				30-min Duration			
		Elevation Angle (in degrees)				Elevation Angle (in degrees)				Elevation Angle (in degrees)			
	Month	10	30	50	70	10	30	50	70	10	30	50	70
	JAN	.37	*	*	*	.01	*	*	*	*	*	*	*
	FEB	.53	*	*	*	.01	*	*	*	*	*	*	*
	MAR	.77	*	*	*	.02	*	*	*	*	*	*	*
	APR	.65	.04	*	*	.03	*	*	*	*	*	*	*
Freq = 15 GHz	MAY	.95	.22	.01	*	.24	*	*	*	.06	*	*	*
	JUN	.99	.59	.16	.09	.56	.08	*	*	.14	*	*	*
Fade = 15 dB	JUL	.98	.54	.08	.06	.45	.01	*	*	.02	*	*	*
	AUG	.99	.78	.30	.16	.55	.06	*	*	.09	*	*	*
	SEP	.99	.54	.11	.03	.63	.02	*	*	.04	*	*	*
	OCT	.54	.05	*	*	.05	*	*	*	*	*	*	*
	NOV	.52	.01	*	*	.01	*	*	*	*	*	*	*
	DEC	.61	.03	*	*	.03	*	*	*	*	*	*	*
	JAN	.05	*	*	*	*	*	*	*	*	*	*	*
	FEB	.07	*	*	*	*	*	*	*	*	*	*	*
	MAR	.22	*	*	*	*	*	*	*	*	*	*	*
	APR	.23	*	*	*	.01	*	*	*	*	*	*	*
Freq = 15 GHz	MAY	.67	.01	*	*	.02	*	*	*	*	*	*	*
	JUN	.89	.15	*	*	.19	*	*	*	.01	*	*	*
Fade = 20 dB	JUL	.78	.08	.03	.02	.04	*	*	*	*	*	*	*
	AUG	.95	.23	.10	.04	.22	*	*	*	.01	*	*	*
	SEP	.85	.08	.01	*	.10	*	*	*	*	*	*	*
	OCT	.12	*	*	*	*	*	*	*	*	*	*	*
	NOV	.03	*	*	*	*	*	*	*	*	*	*	*
	DEC	.10	*	*	*	*	*	*	*	*	*	*	*
	JAN	*	*	*	*	*	*	*	*	*	*	*	*
	FEB	*	*	*	*	*	*	*	*	*	*	*	*
	MAR	*	*	*	*	*	*	*	*	*	*	*	*
	APR	.04	*	*	*	*	*	*	*	*	*	*	*
Freq = 15 GHz	MAY	.16	*	*	*	*	*	*	*	*	*	*	*
	JUN	.43	.01	*	*	.04	*	*	*	*	*	*	*
Fade = 25 dB	JUL	.41	.03	.01	*	.01	*	*	*	*	*	*	*
	AUG	.67	.10	.03	.02	.05	*	*	*	*	*	*	*
	SEP	.40	.01	*	*	*	*	*	*	*	*	*	*
	OCT	.05	*	*	*	*	*	*	*	*	*	*	*
	NOV	.01	*	*	*	*	*	*	*	*	*	*	*
	DEC	.04	*	*	*	*	*	*	*	*	*	*	*

* < .01

Table 30. Estimated probability of at least 3 system outages due to rain for all months at New Orleans for the indicated durations and fade margins (based on a frequency of 30 GHz).

		PROBABILITY OF AT LEAST 3 OUTAGES											
		10-min Duration				20-min Duration				30-min Duration			
		Elevation Angle (in degrees)				Elevation Angle (in degrees)				Elevation Angle (in degrees)			
	Month	10	30	50	70	10	30	50	70	10	30	50	70
	JAN	.99	.99	.77	.37	.99	.77	.08	.01	.99	.26	.01	*
	FEB	.99	.99	.87	.53	.99	.73	.08	.01	.99	.24	.02	*
	MAR	.99	.99	.98	.84	.99	.93	.42	.05	.99	.44	.02	*
	APR	.99	.99	.97	.75	.99	.90	.43	.05	.99	.56	.07	*
Freq = 30 GHz	MAY	.99	.99	.99	.97	.99	.98	.71	.34	.99	.67	.27	.09
	JUN	.99	.99	.99	.99	.99	.98	.87	.69	.99	.69	.46	.22
Fade = 15 dB	JUL	.99	.99	.99	.99	.99	.99	.89	.66	.99	.86	.37	.10
	AUG	.99	.99	.99	.99	.99	.99	.95	.75	.99	.90	.50	.19
	SEP	.99	.99	.99	.99	.99	.99	.89	.73	.99	.81	.39	.10
	OCT	.99	.99	.91	.69	.99	.89	.21	.05	.99	.42	.01	*
	NOV	.99	.99	.98	.71	.99	.97	.36	.05	.99	.69	.06	*
	DEC	.99	.99	.97	.70	.99	.94	.28	.04	.99	.50	.03	*
	JAN	.99	.92	.41	.11	.99	.24	.01	*	.99	.03	*	*
	FEB	.99	.95	.56	.16	.99	.23	.01	*	.99	.05	*	*
	MAR	.99	.99	.84	.48	.99	.65	.05	*	.99	.06	*	*
	APR	.99	.99	.75	.49	.99	.62	.05	.02	.99	.20	*	*
Freq = 30 GHz	MAY	.99	.99	.97	.88	.99	.80	.34	.14	.99	.34	.09	*
	JUN	.99	.99	.99	.98	.99	.92	.69	.47	.99	.54	.22	.08
Fade = 20 dB	JUL	.99	.99	.99	.97	.99	.94	.66	.38	.99	.48	.10	.01
	AUG	.99	.99	.99	.99	.99	.97	.75	.49	.99	.62	.19	.06
	SEP	.99	.99	.99	.99	.99	.93	.73	.49	.99	.49	.10	.01
	OCT	.99	.98	.69	.40	.99	.36	.05	.02	.99	.04	*	*
	NOV	.99	.99	.71	.20	.99	.57	.05	*	.99	.15	*	*
	DEC	.99	.99	.70	.30	.99	.65	.04	*	.99	.14	*	*
	JAN	.99	.66	.13	.03	.99	.04	*	*	.91	*	*	*
	FEB	.99	.76	.21	.03	.99	.05	*	*	.87	*	*	*
	MAR	.99	.95	.56	.20	.99	.22	*	*	.98	.01	*	*
	APR	.99	.92	.51	.26	.99	.27	.02	.01	.95	.02	*	*
Freq = 30 GHz	MAY	.99	.99	.90	.75	.99	.56	.16	.04	.99	.19	.01	*
	JUN	.99	.99	.98	.93	.99	.81	.50	.23	.98	.40	.10	.01
Fade = 25 dB	JUL	.99	.99	.98	.90	.99	.79	.41	.16	.99	.22	.01	*
	AUG	.99	.99	.99	.98	.99	.91	.51	.36	.99	.32	.08	.02
	SEP	.99	.99	.99	.95	.99	.78	.55	.26	.99	.25	.02	*
	OCT	.99	.84	.43	.19	.99	.14	.03	.01	.96	.01	*	*
	NOV	.99	.93	.24	.04	.99	.20	*	*	.99	.02	*	*
	DEC	.99	.92	.39	.09	.99	.14	*	*	.97	.01	*	*

* < .01

Table 31. Estimated probability of at least 3 system outages due to rain for all months at New Orleans for the indicated durations and fade margins (based on a frequency of 45 GHz).

PROBABILITY OF AT LEAST 3 OUTAGES

		10-min Duration				20-min Duration				30-min Duration			
		Elevation Angle (in degrees)				Elevation Angle (in degrees)				Elevation Angle (in degrees)			
	Month	10	30	50	70	10	30	50	70	10	30	50	70
	JAN	.99	.99	.99	.97	.99	.99	.92	.40	.99	.99	.47	.05
	FEB	.99	.99	.99	.97	.99	.99	.89	.38	.99	.99	.42	.08
	MAR	.99	.99	.99	.99	.99	.99	.99	.72	.99	.99	.77	.10
	APR	.99	.99	.99	.99	.99	.99	.97	.74	.99	.98	.72	.35
Freq = 45 GHz	MAY	.99	.99	.99	.99	.99	.99	.99	.87	.99	.99	.91	.41
	JUN	.99	.99	.99	.99	.99	.99	.99	.96	.99	.99	.89	.62
Fade = 15 dB	JUL	.99	.99	.99	.99	.99	.99	.99	.97	.99	.99	.95	.66
	AUG	.99	.99	.99	.99	.99	.99	.99	.99	.99	.99	.98	.76
	SEP	.99	.99	.99	.99	.99	.99	.99	.97	.99	.99	.96	.63
	OCT	.99	.99	.99	.99	.99	.99	.97	.56	.99	.98	.71	.10
	NOV	.99	.99	.99	.99	.99	.99	.99	.76	.99	.99	.84	.29
	DEC	.99	.99	.99	.99	.99	.99	.99	.72	.99	.99	.75	.19
	JAN	.99	.99	.99	.70	.99	.99	.56	.05	.99	.79	.11	*
	FEB	.99	.99	.99	.80	.99	.98	.52	.05	.99	.72	.13	*
	MAR	.99	.99	.99	.97	.99	.99	.84	.28	.99	.96	.24	.01
	APR	.99	.99	.99	.96	.99	.99	.80	.37	.99	.90	.44	.05
Freq = 45 GHz	MAY	.99	.99	.99	.99	.99	.99	.96	.66	.99	.98	.59	.24
	JUN	.99	.99	.99	.99	.99	.99	.97	.87	.99	.95	.65	.46
Fade = 20 dB	JUL	.99	.99	.99	.99	.99	.99	.98	.89	.99	.98	.73	.37
	AUG	.99	.99	.99	.99	.99	.99	.99	.95	.99	.99	.82	.50
	SEP	.99	.99	.99	.99	.99	.99	.98	.89	.99	.99	.70	.39
	OCT	.99	.99	.99	.91	.99	.99	.70	.21	.99	.92	.18	.01
	NOV	.99	.99	.99	.97	.99	.99	.90	.30	.99	.98	.49	.05
	DEC	.99	.99	.99	.95	.99	.99	.85	.21	.99	.95	.33	.02
	JAN	.99	.99	.88	.41	.99	.91	.18	.01	.99	.43	.02	*
	FEB	.99	.99	.91	.56	.99	.86	.12	.01	.99	.39	.03	*
	MAR	.99	.99	.99	.86	.99	.98	.49	.06	.99	.71	.03	*
	APR	.99	.99	.99	.83	.99	.96	.56	.12	.99	.68	.15	*
Freq = 45 GHz	MAY	.99	.99	.99	.98	.99	.99	.80	.41	.99	.84	.34	.12
	JUN	.99	.99	.99	.99	.99	.99	.91	.72	.99	.84	.51	.26
Fade = 25 dB	JUL	.99	.99	.99	.99	.99	.99	.94	.73	.99	.93	.48	.15
	AUG	.99	.99	.99	.99	.99	.99	.97	.84	.99	.97	.62	.25
	SEP	.99	.99	.99	.99	.99	.99	.93	.76	.99	.94	.49	.17
	OCT	.99	.99	.96	.76	.99	.96	.31	.06	.99	.66	.03	*
	NOV	.99	.99	.99	.77	.99	.99	.57	.06	.99	.82	.15	*
	DEC	.99	.99	.99	.74	.99	.98	.46	.04	.99	.70	.07	*

* < .01

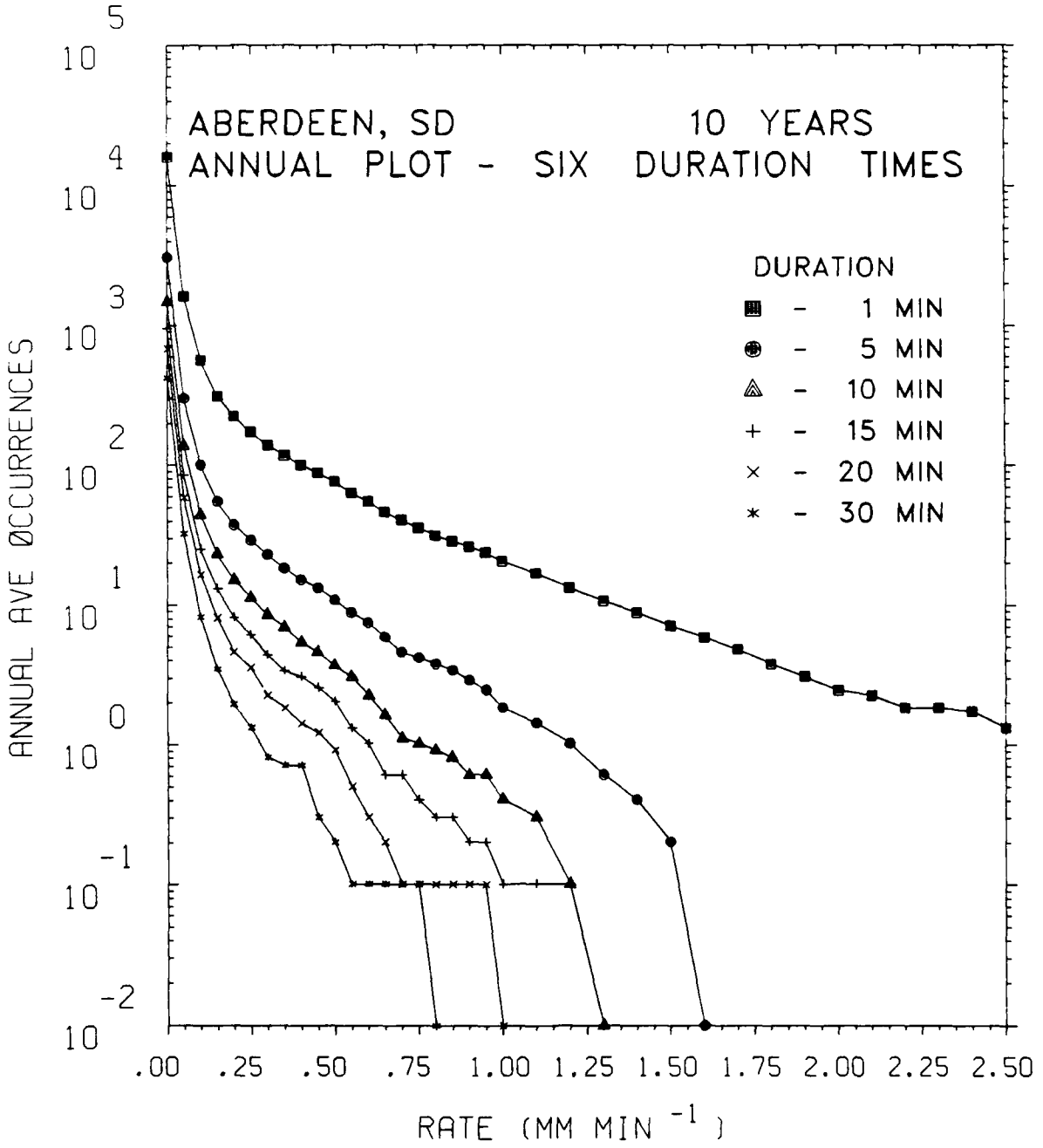


Figure 1. Annual Average Number of Occurrences of 1-min Rain Rates for Six Duration Times. Rain rates are those equalled or exceeded during each minute of the specified duration.

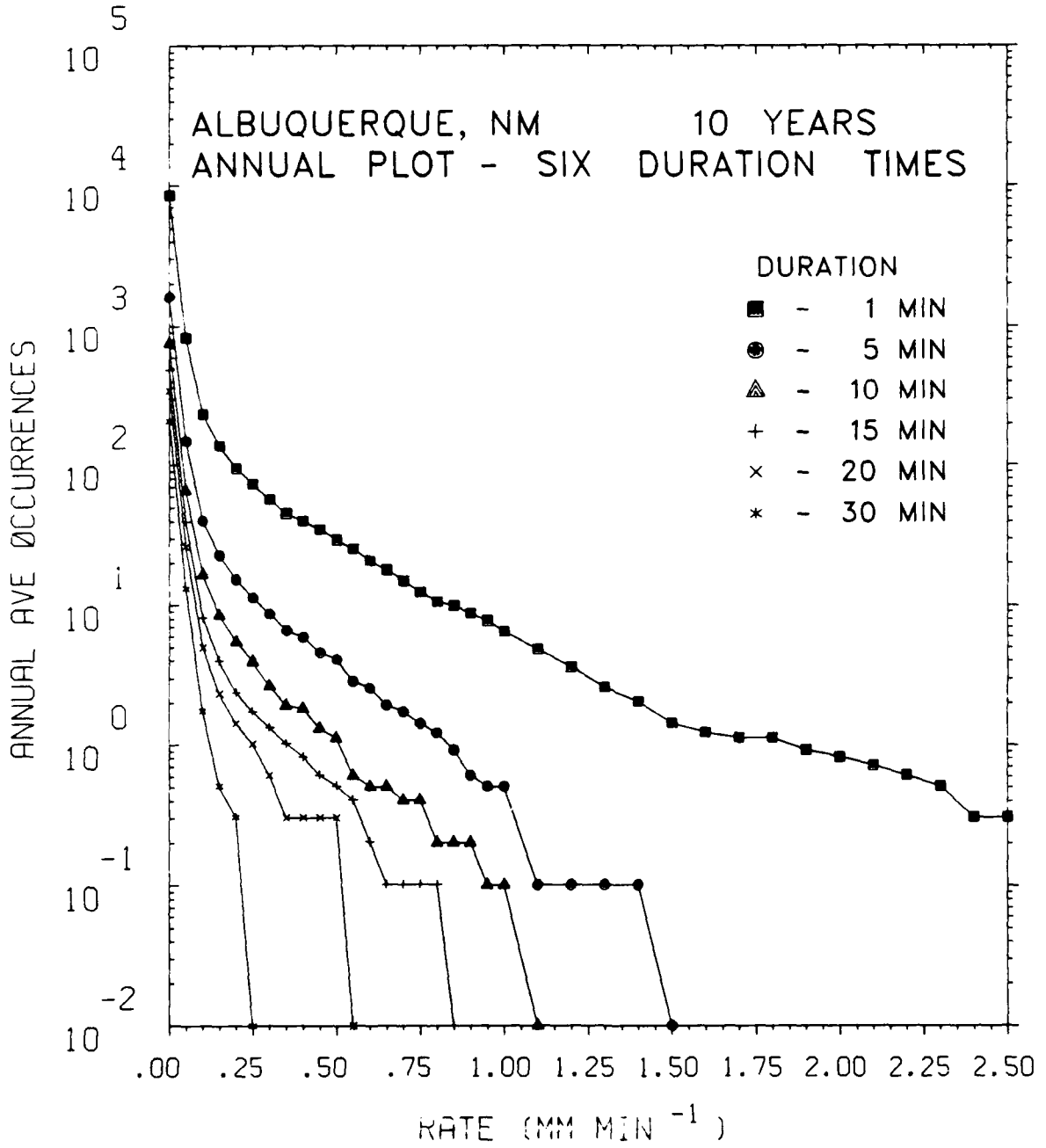


Figure 1. Annual Average Number of Occurrences of 1-min Rain Rates for Six Duration Times. Rain rates are those equalled or exceeded during each minute of the specified duration. (Cont.)

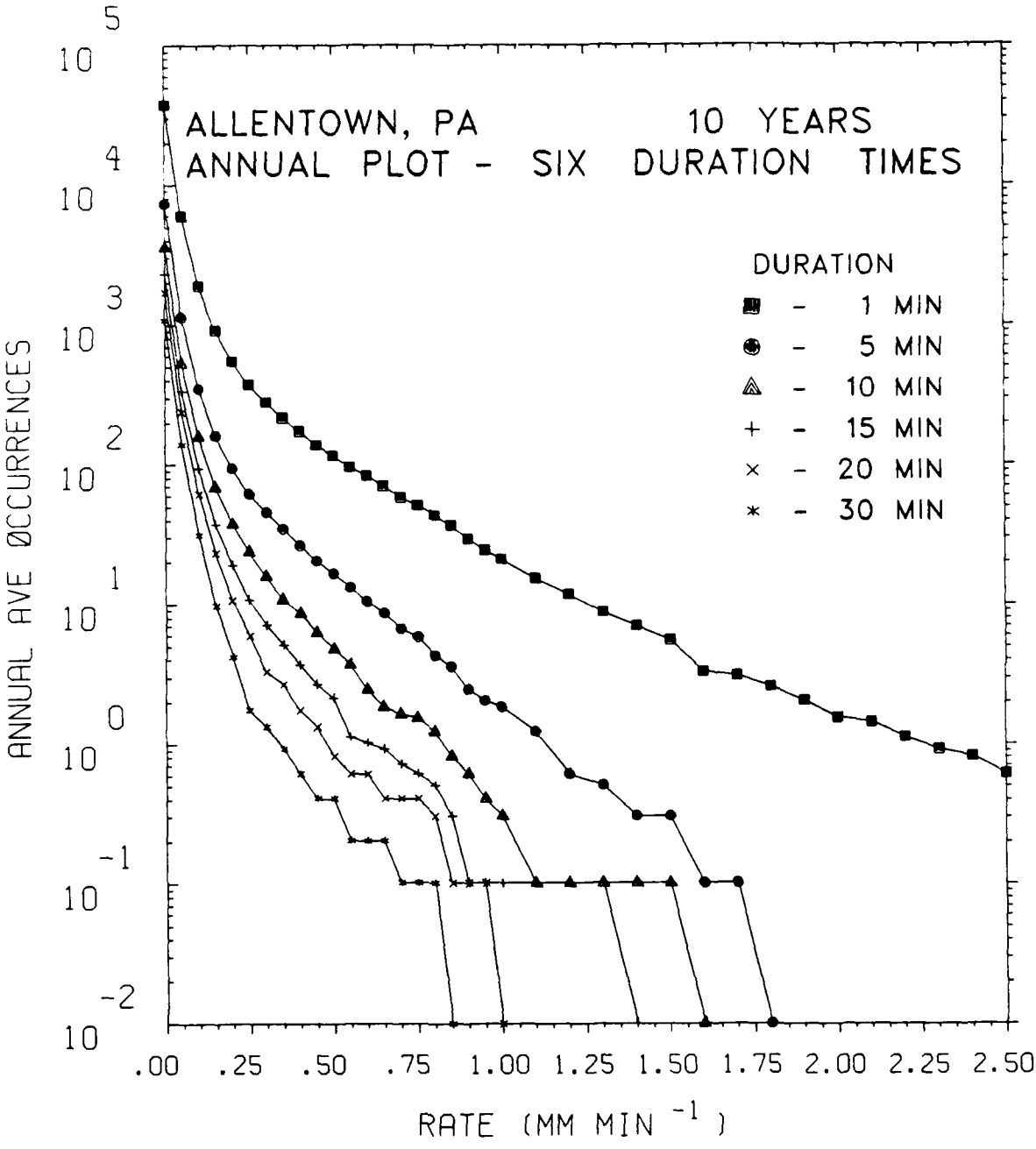


Figure 1. Annual Average Number of Occurrences of 1-min Rain Rates for Six Duration Times. Rain rates are those equalled or exceeded during each minute of the specified duration. (Cont.)

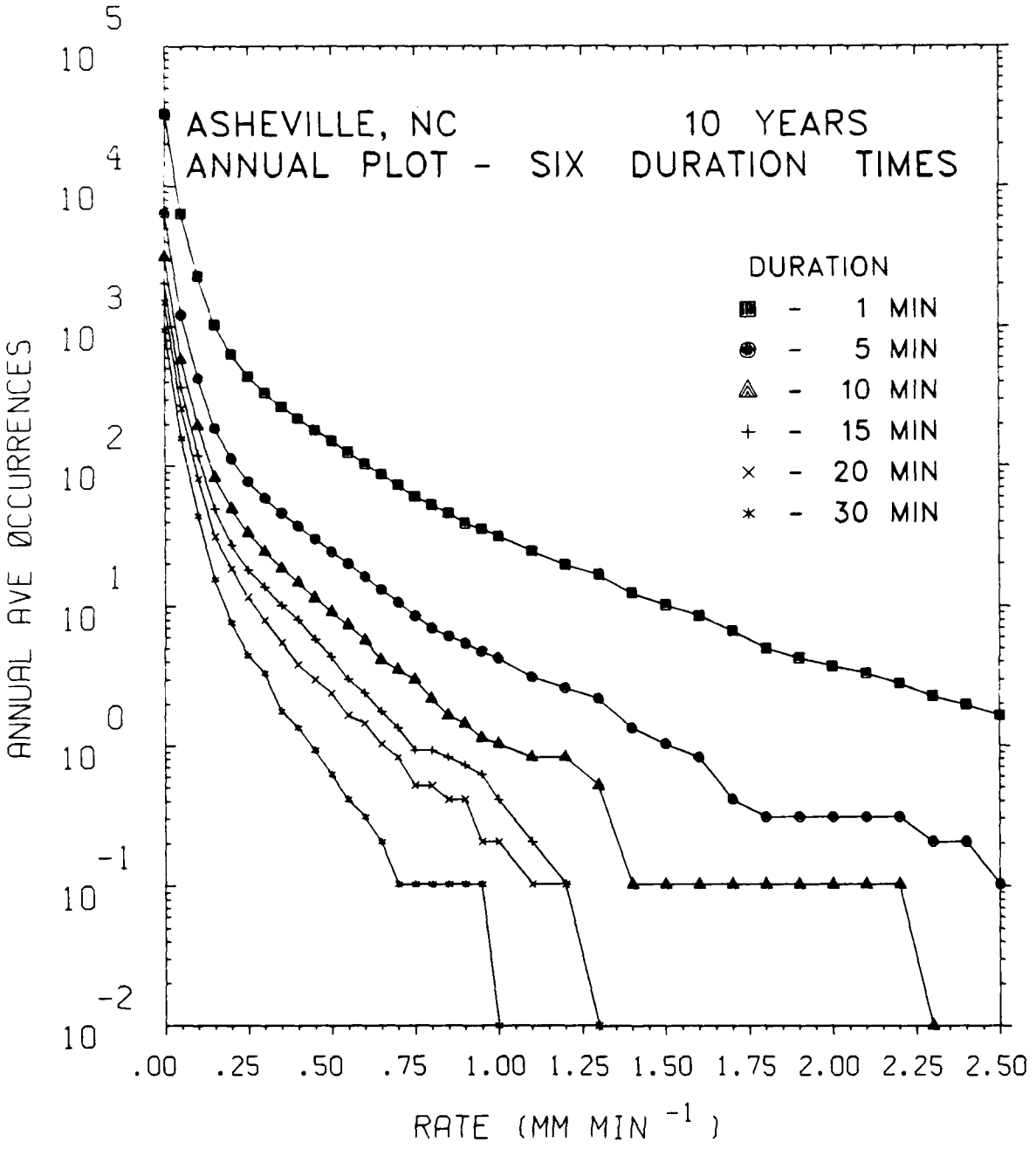


Figure 1. Annual Average Number of Occurrences of 1-min Rain Rates for Six Duration Times. Rain rates are those equalled or exceeded during each minute of the specified duration. (Cont.)

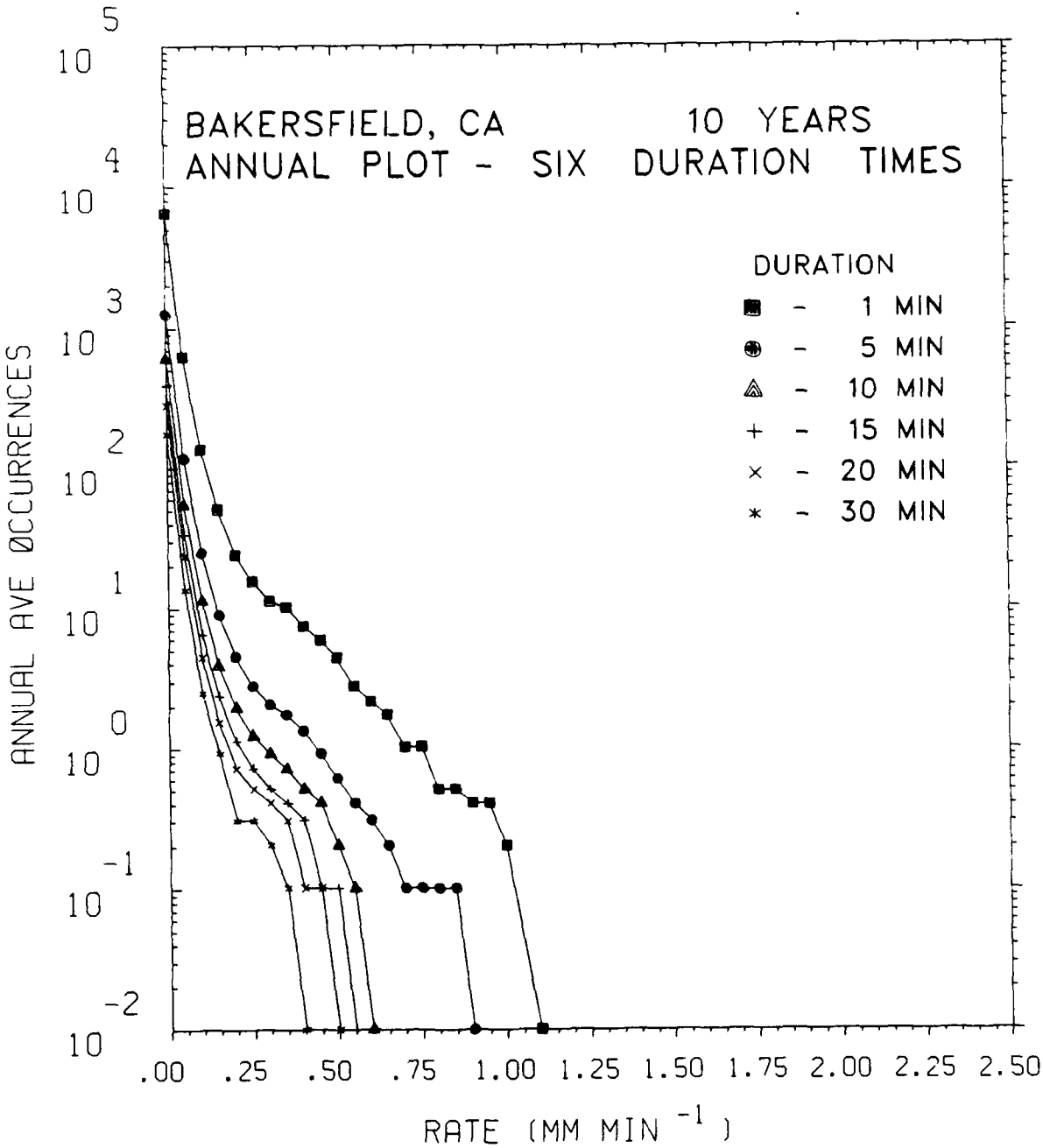


Figure 1. Annual Average Number of Occurrences of 1-min Rain Rates for Six Duration Times. Rain rates are those equalled or exceeded during each minute of the specified duration. (Cont.)

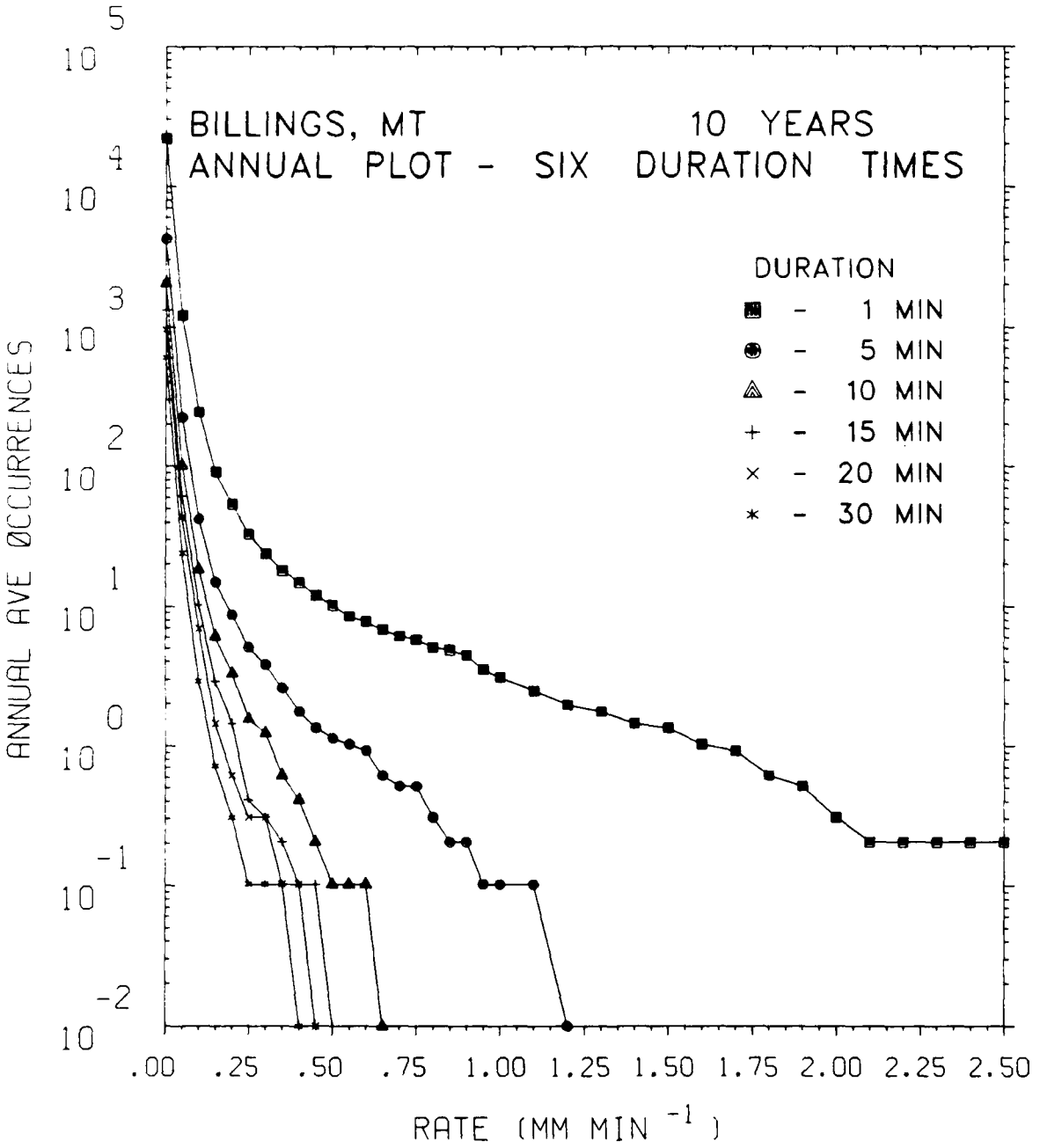


Figure 1. Annual Average Number of Occurrences of 1-min Rain Rates for Six Duration Times. Rain rates are those equalled or exceeded during each minute of the specified duration. (Cont.)

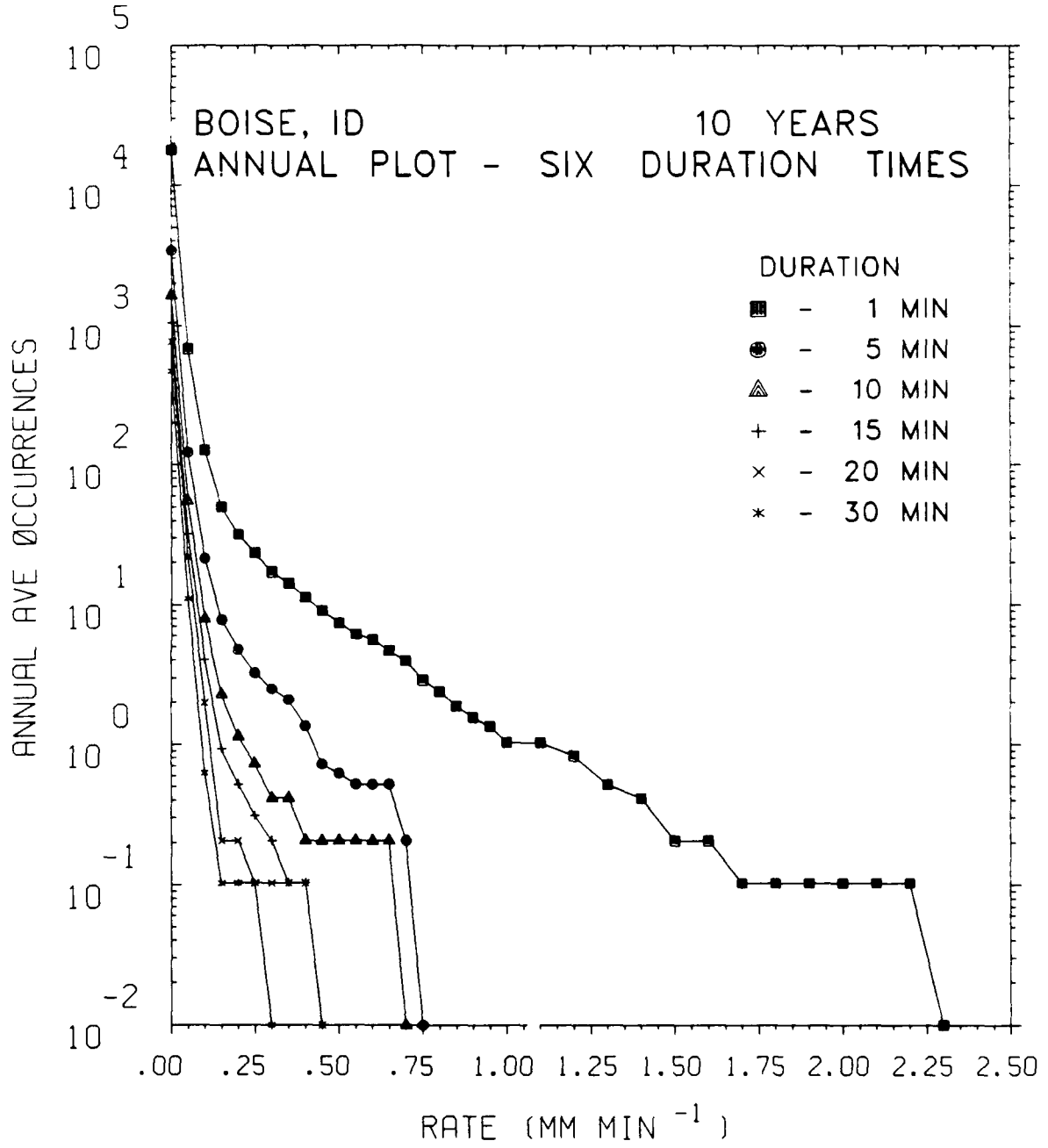


Figure 1. Annual Average Number of Occurrences of 1-min Rain Rates for Six Duration Times. Rain rates are those equalled or exceeded during each minute of the specified duration. (Cont.)

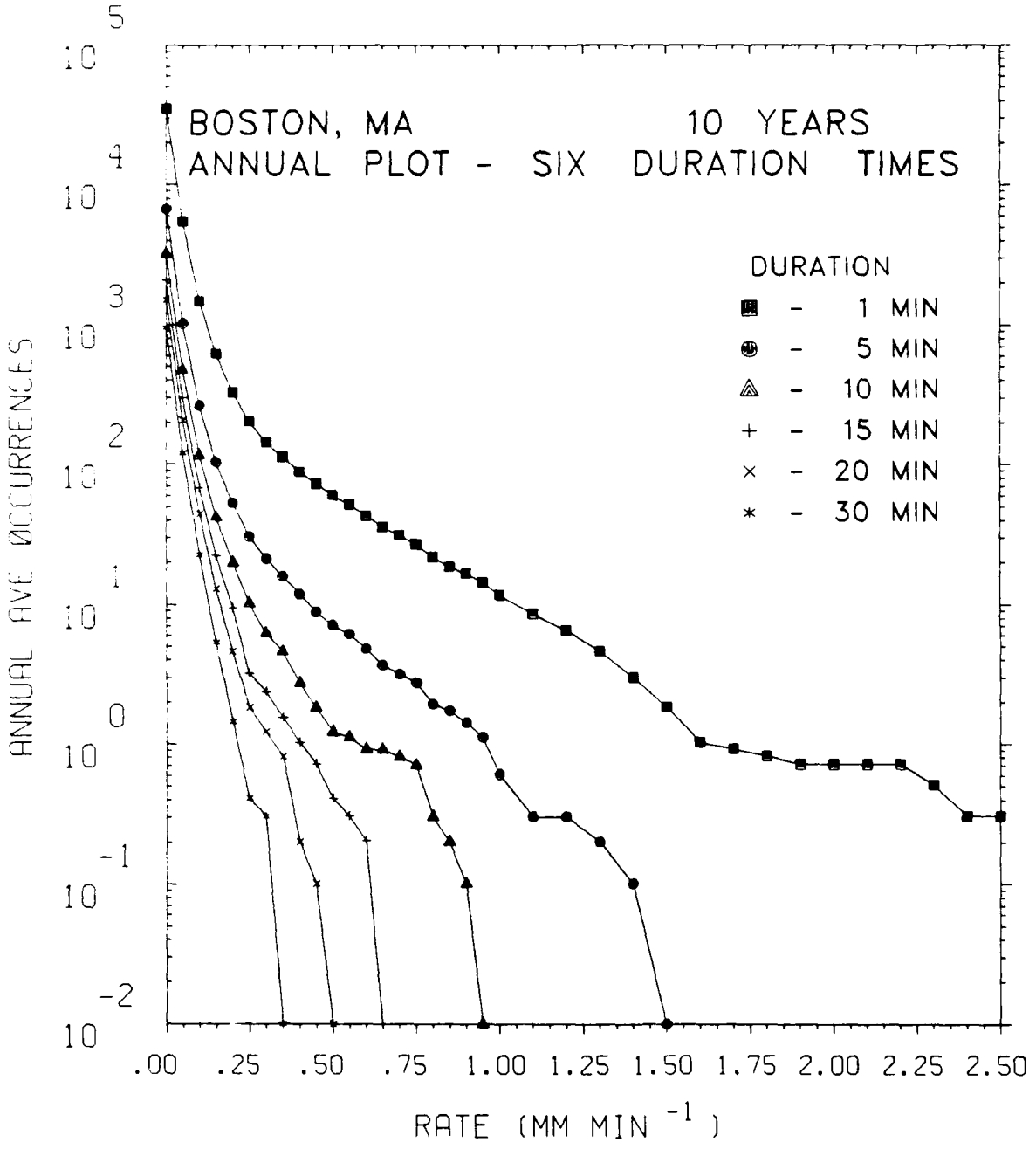


Figure 1. Annual Average Number of Occurrences of 1-min Rain Rates for Six Duration Times. Rain rates are those equalled or exceeded during each minute of the specified duration. (Cont.)

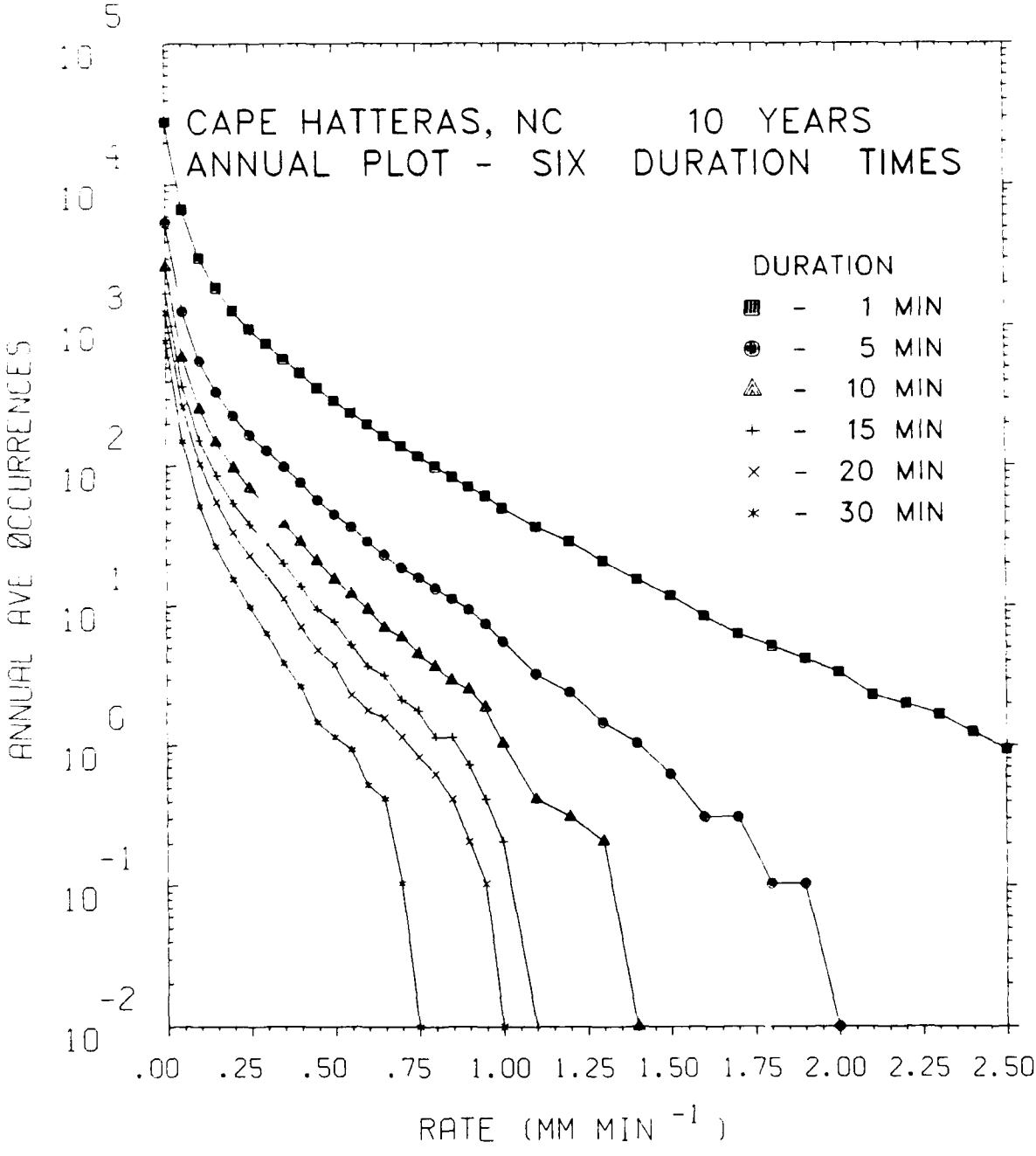


Figure 1. Annual Average Number of Occurrences of 1-min Rain Rates for Six Duration Times. Rain rates are those equalled or exceeded during each minute of the specified duration. (Cont.)

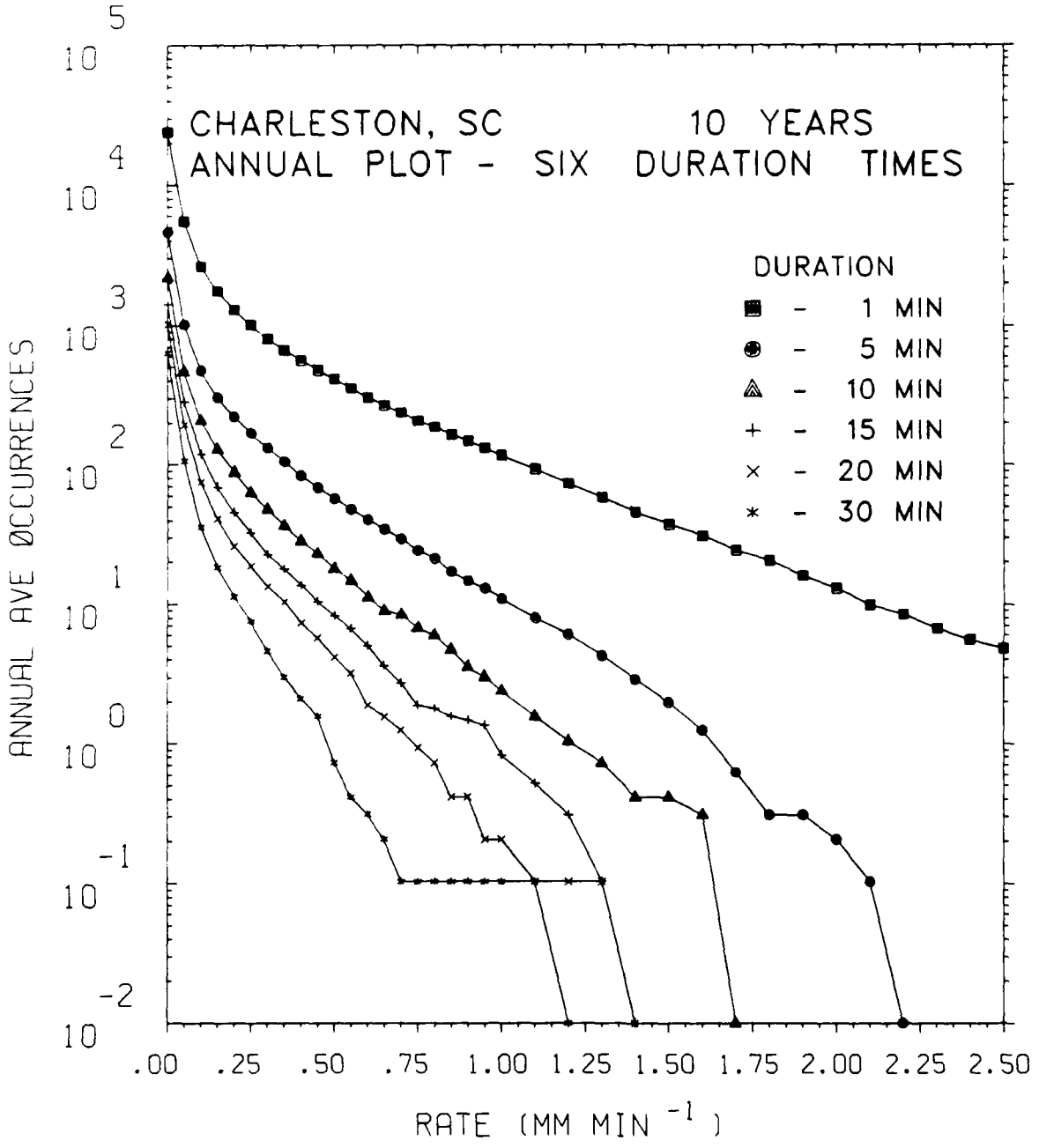


Figure 1. Annual Average Number of Occurrences of 1-min Rain Rates for Six Duration Times. Rain rates are those equalled or exceeded during each minute of the specified duration. (Cont.)

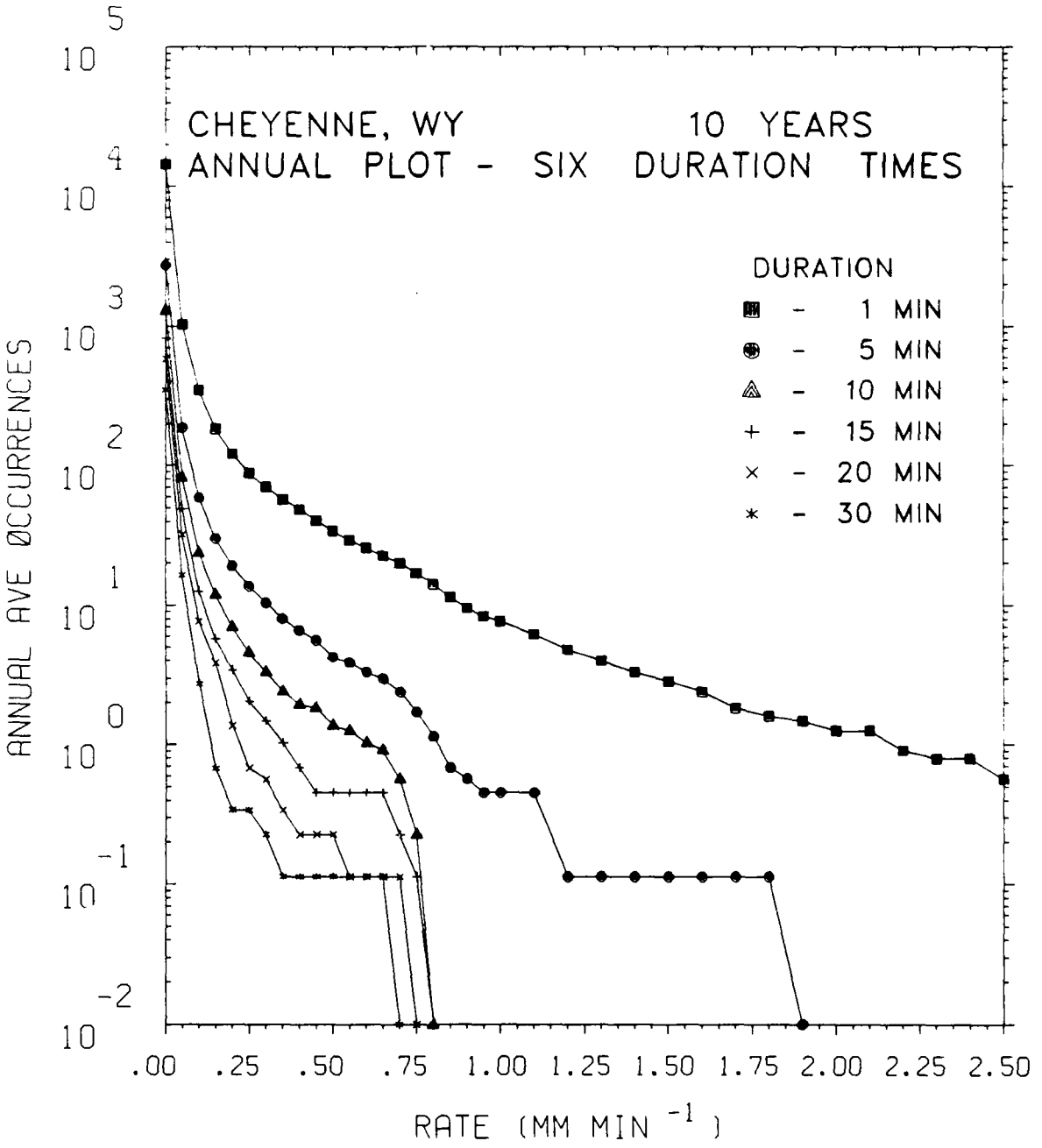


Figure 1. Annual Average Number of Occurrences of 1-min Rain Rates for Six Duration Times. Rain rates are those equalled or exceeded during each minute of the specified duration. (Cont.)

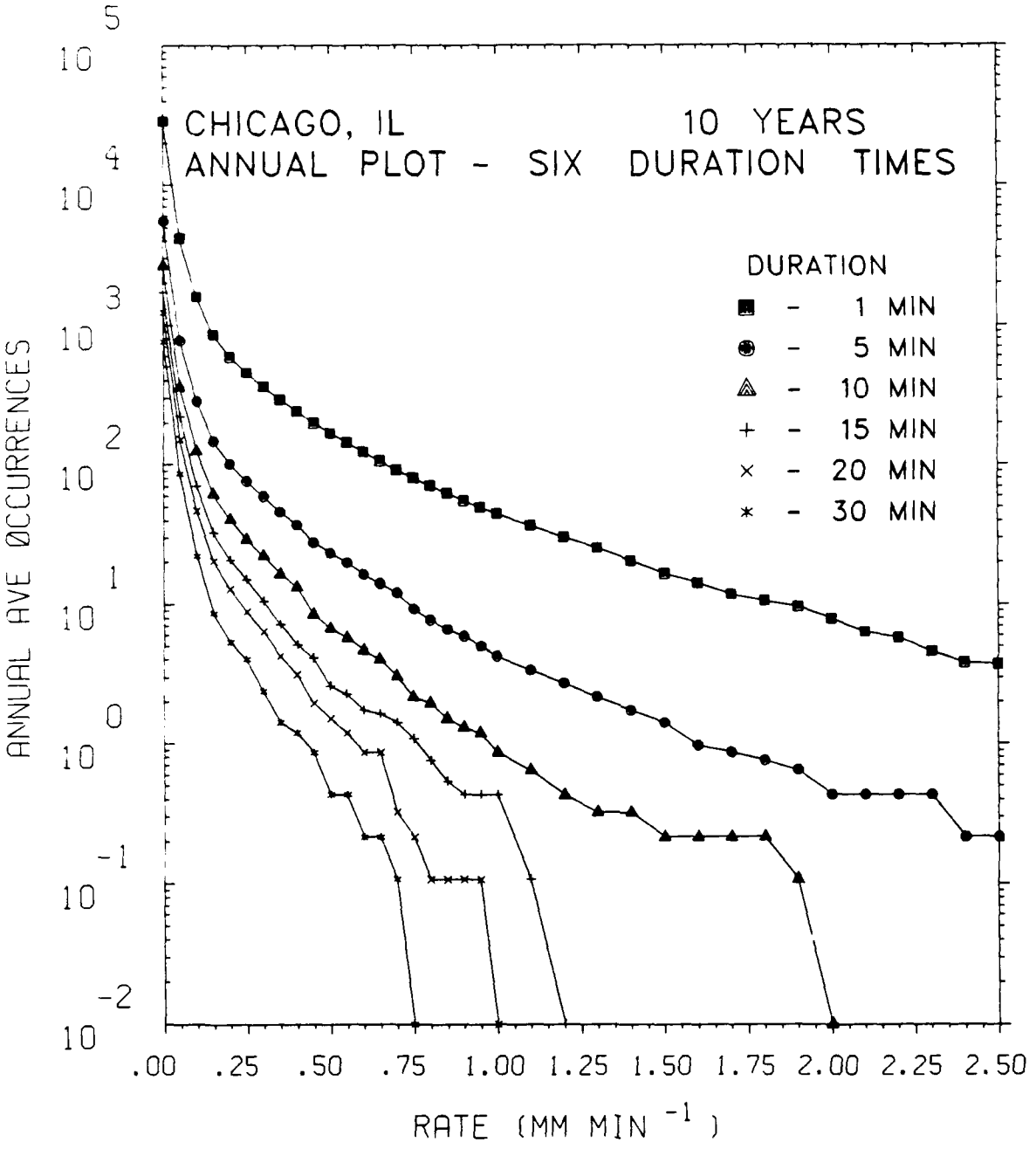


Figure 1. Annual Average Number of Occurrences of 1-min Rain Rates for Six Duration Times. Rain rates are those equalled or exceeded during each minute of the specified duration. (Cont.)

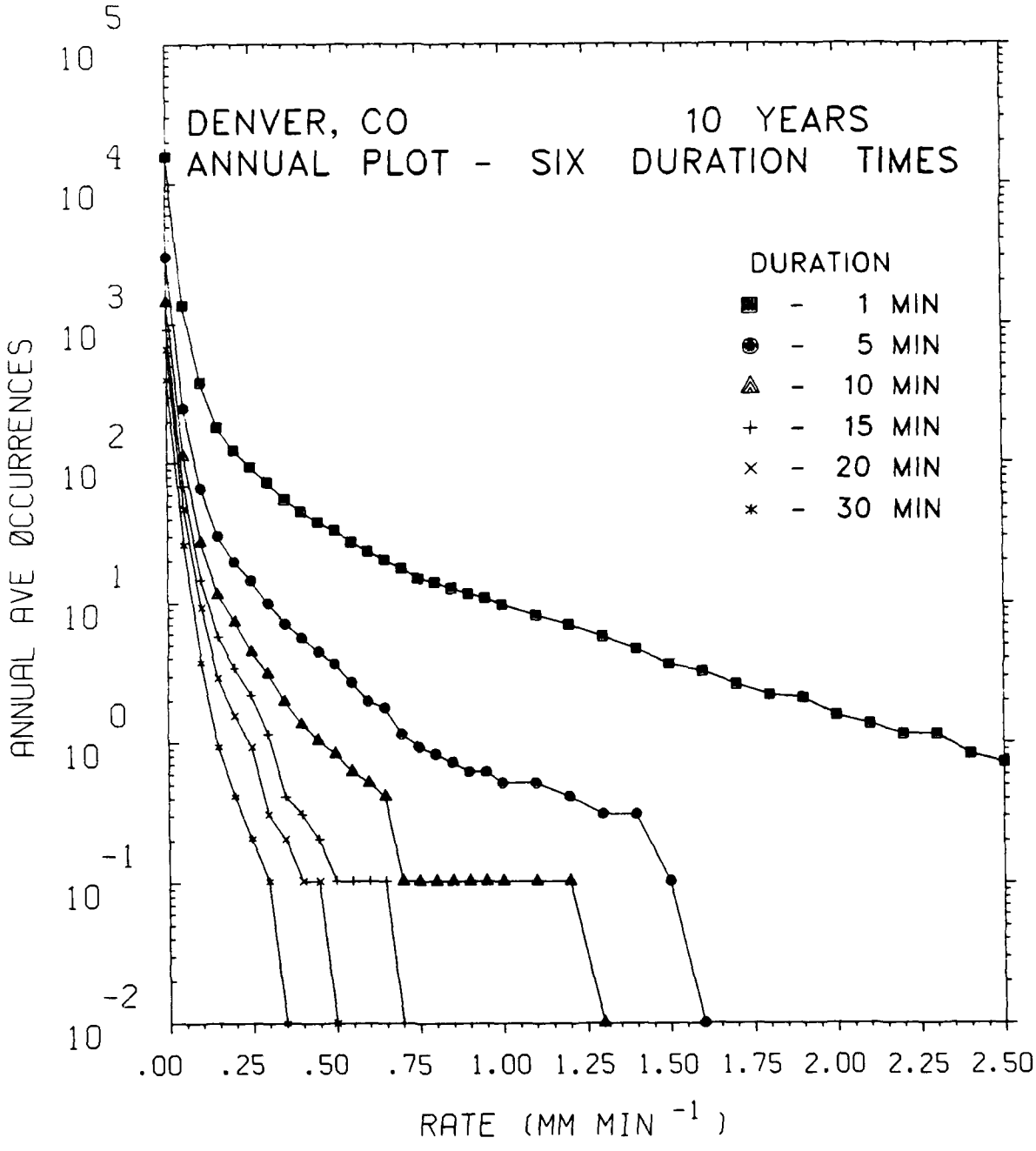


Figure 1. Annual Average Number of Occurrences of 1-min Rain Rates for Six Duration Times. Rain rates are those equalled or exceeded during each minute of the specified duration. (Cont.)

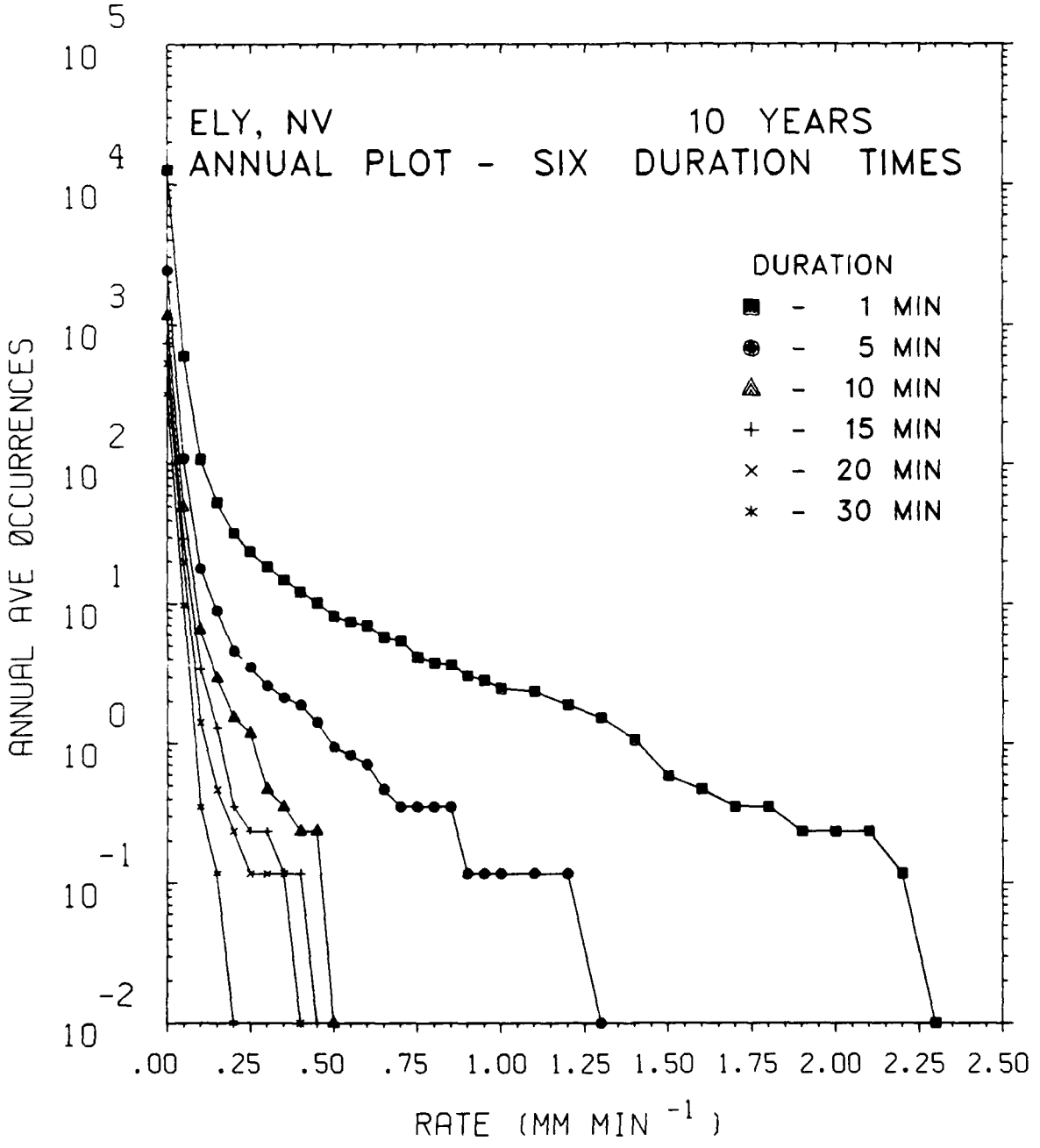


Figure 1. Annual Average Number of Occurrences of 1-min Rain Rates for Six Duration Times. Rain rates are those equalled or exceeded during each minute of the specified duration. (Cont.)

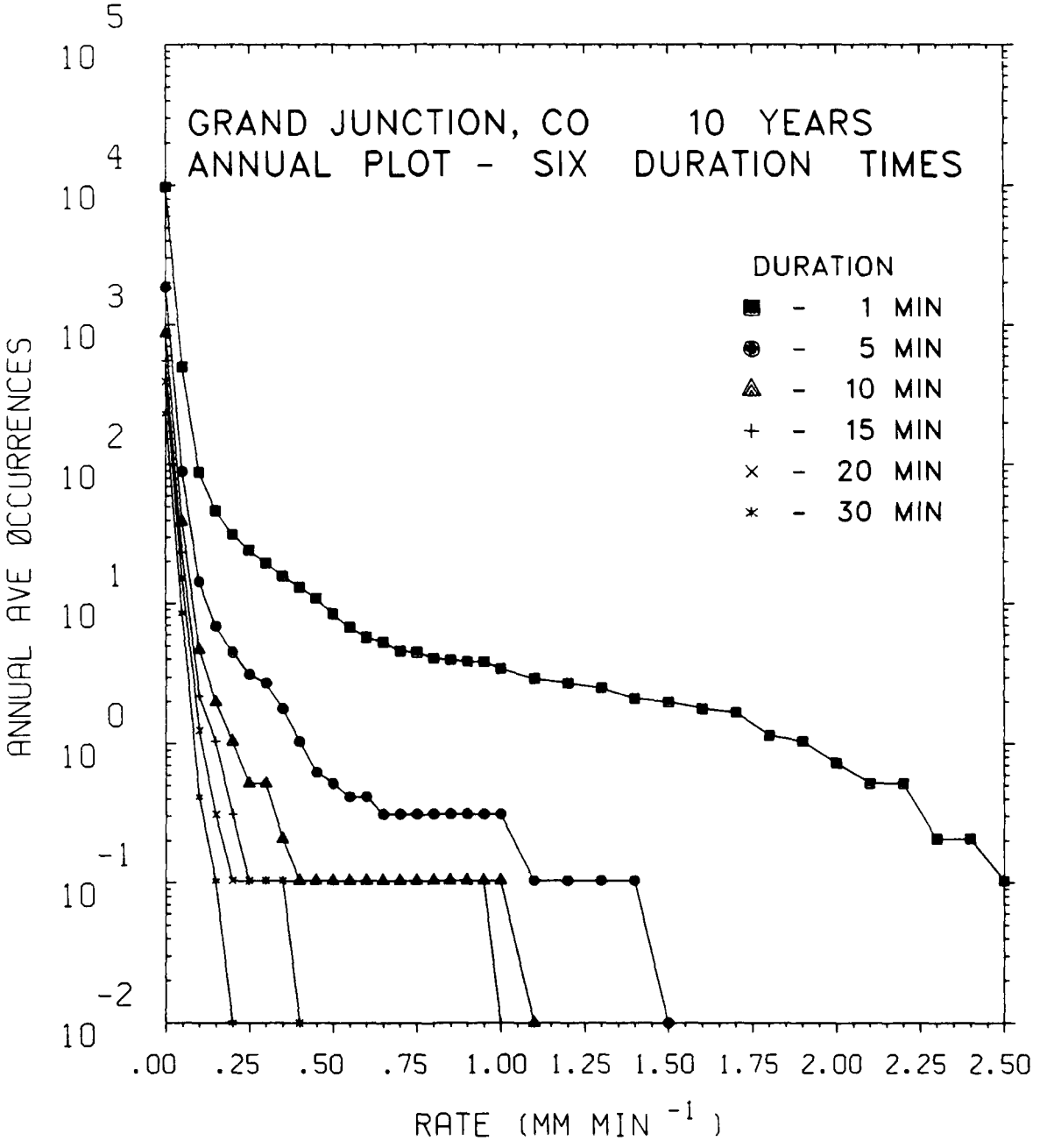


Figure 1. Annual Average Number of Occurrences of 1-min Rain Rates for Six Duration Times. Rain rates are those equalled or exceeded during each minute of the specified duration. (Cont.)

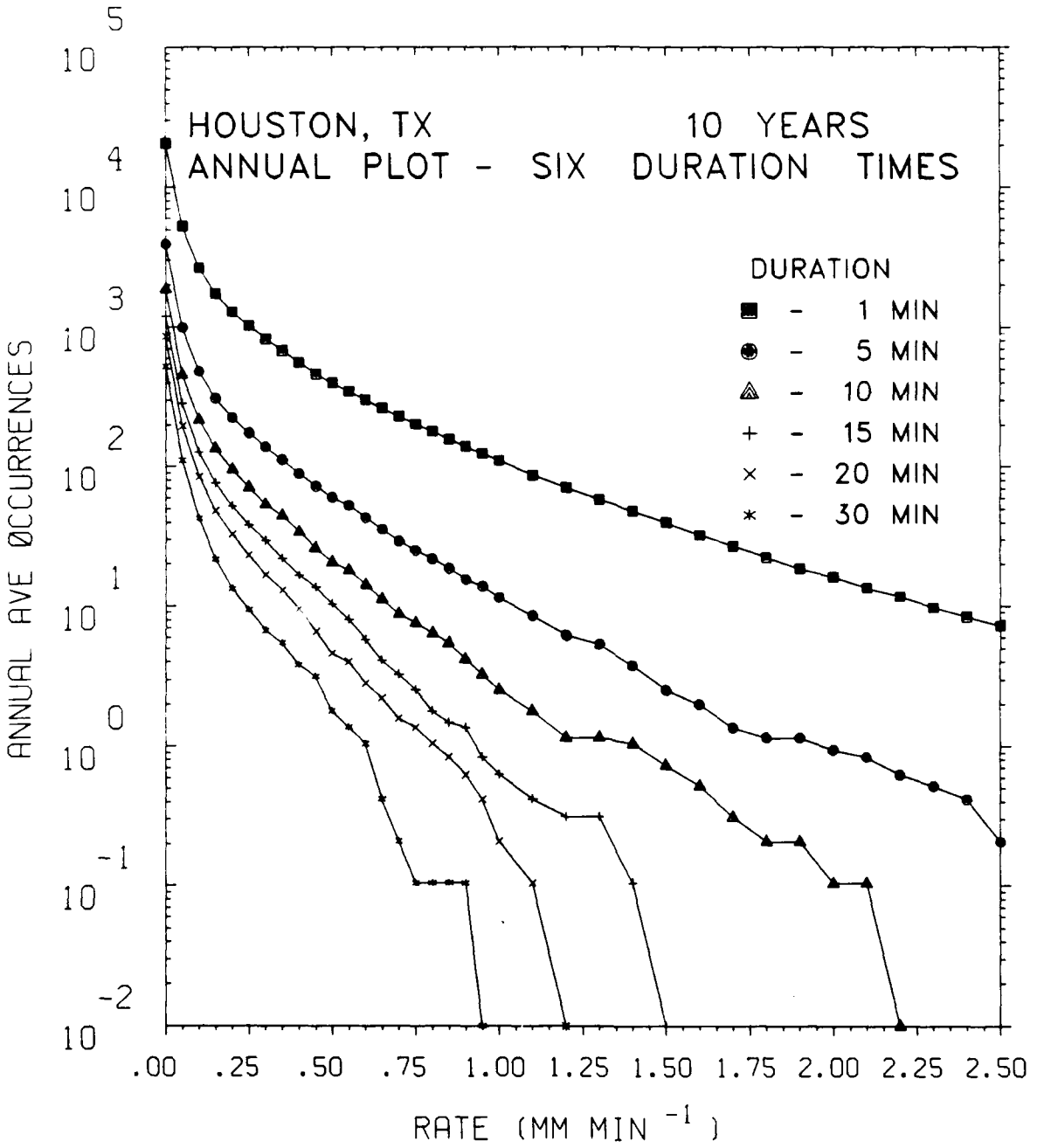


Figure 1. Annual Average Number of Occurrences of 1-min Rain Rates for Six Duration Times. Rain rates are those equalled or exceeded during each minute of the specified duration. (Cont.)

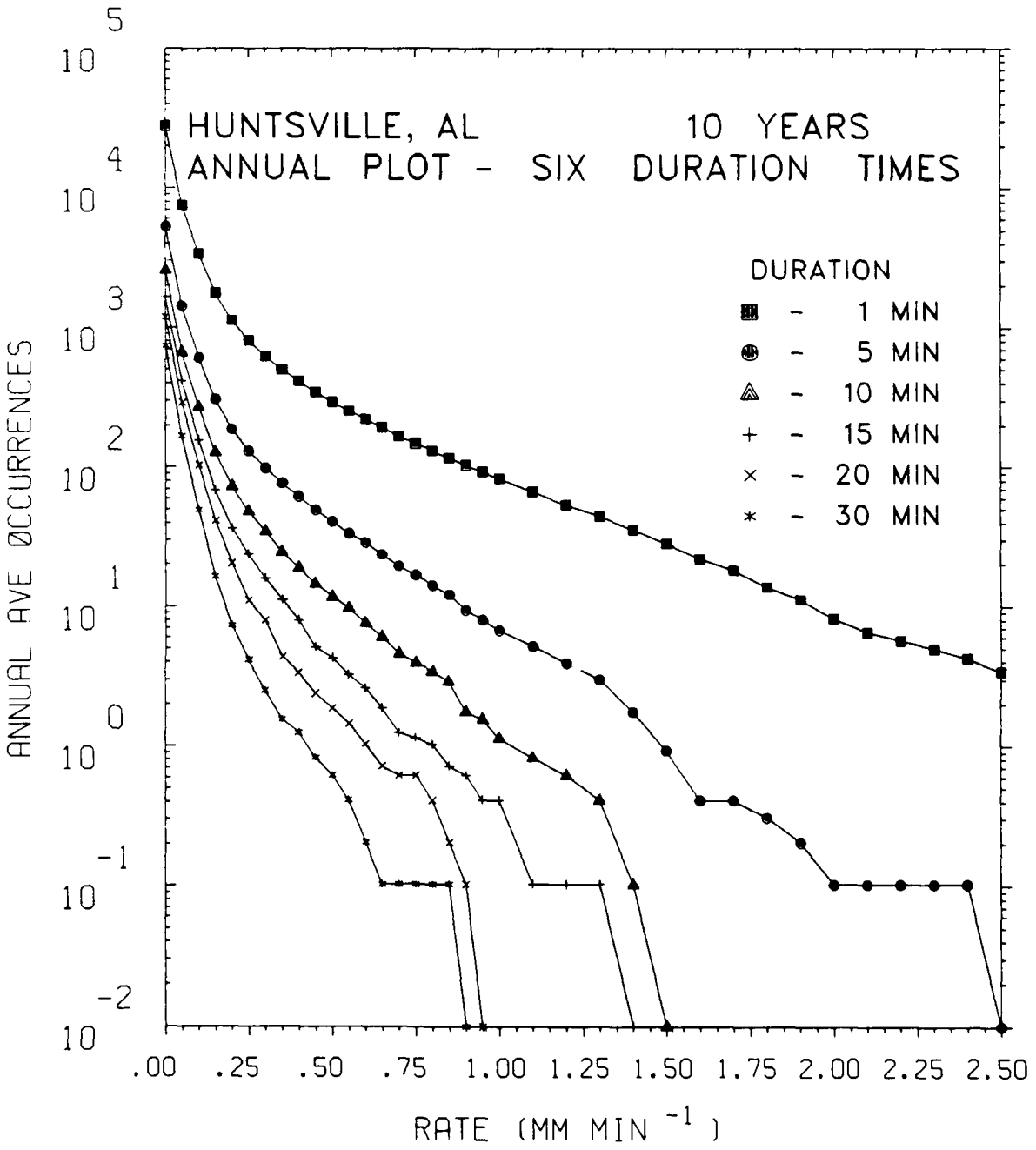


Figure 1. Annual Average Number of Occurrences of 1-min Rain Rates for Six Duration Times. Rain rates are those equalled or exceeded during each minute of the specified duration. (Cont.)

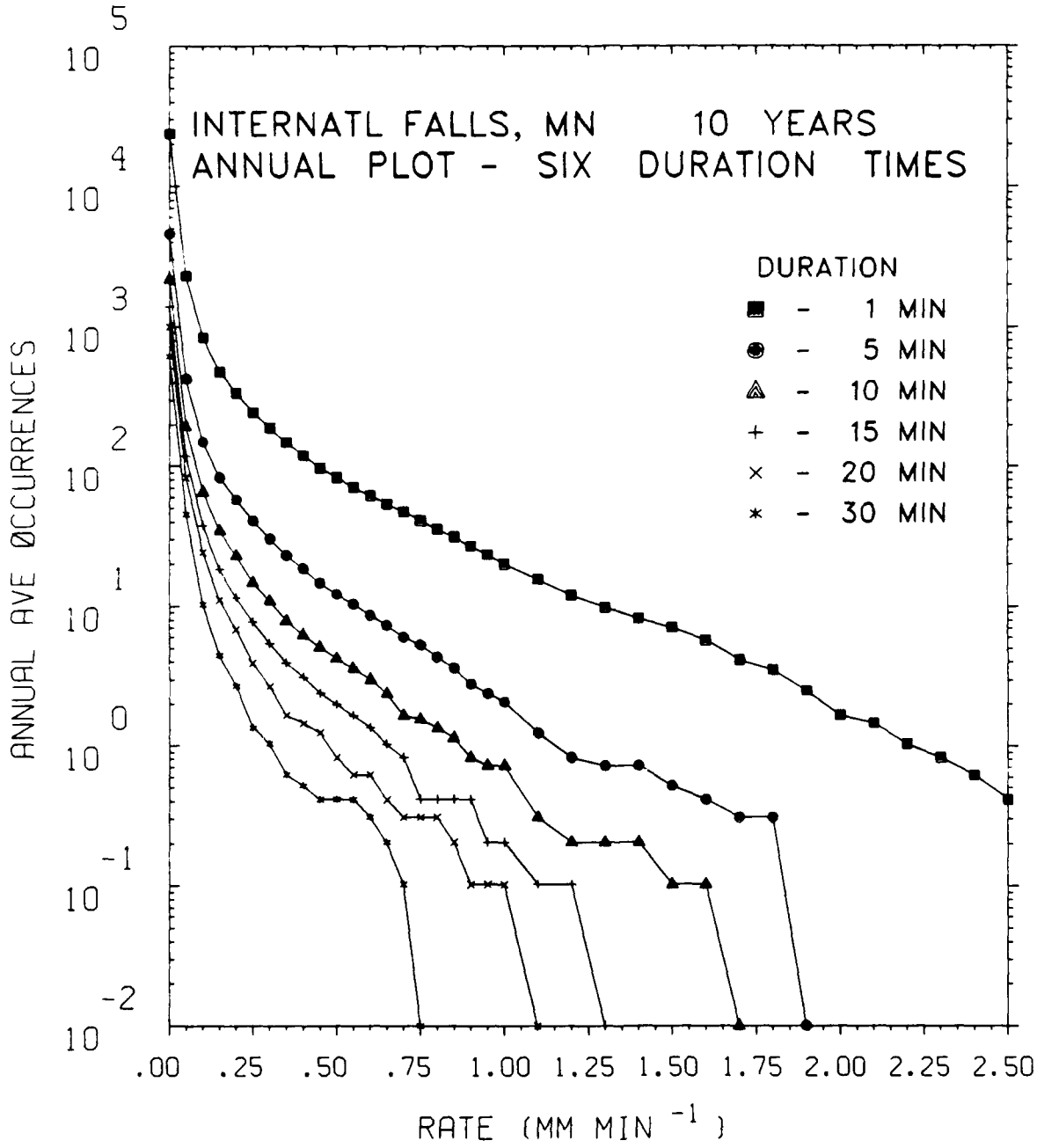


Figure 1. Annual Average Number of Occurrences of 1-min Rain Rates for Six Duration Times. Rain rates are those equalled or exceeded during each minute of the specified duration. (Cont.)

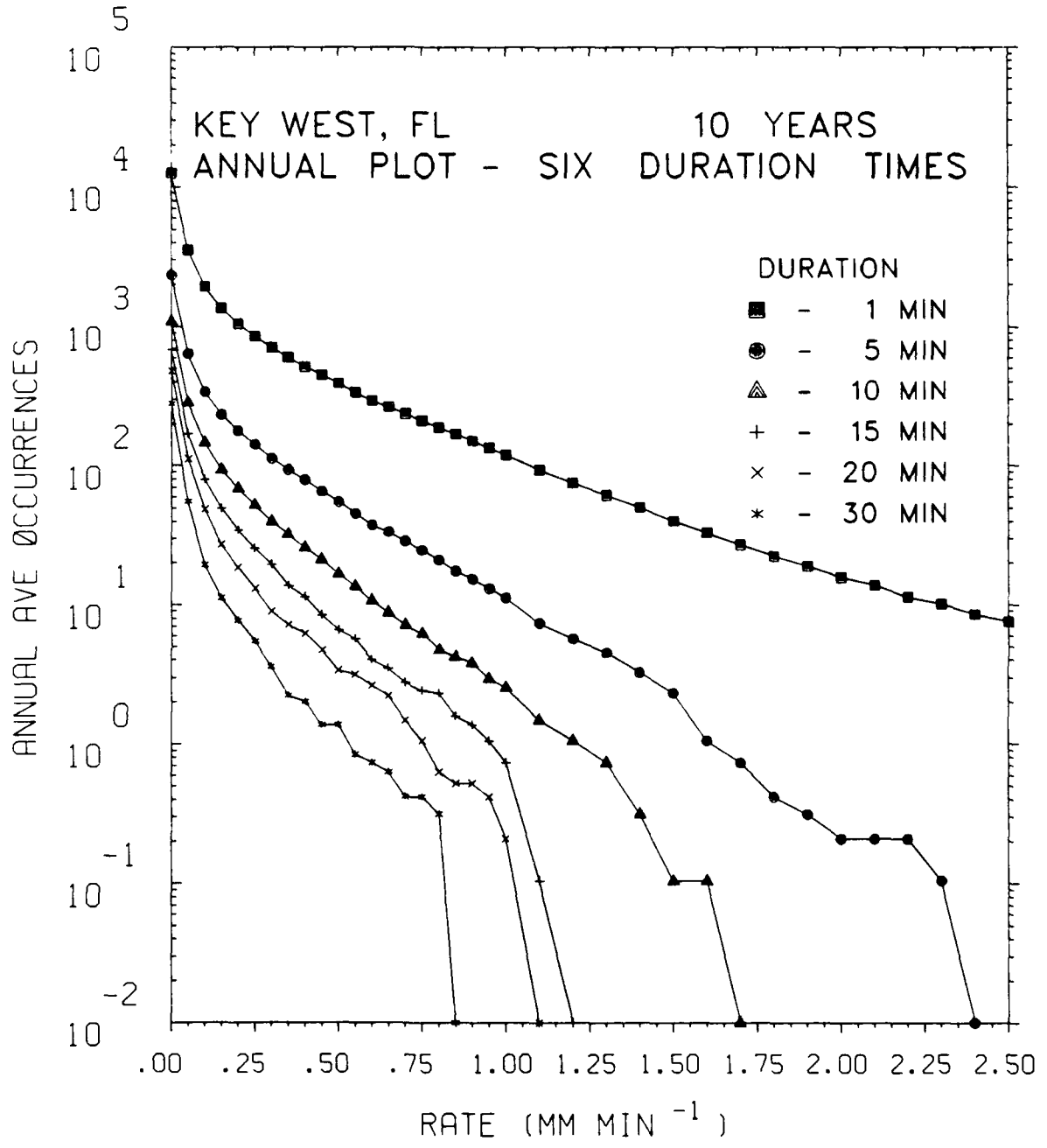


Figure 1. Annual Average Number of Occurrences of 1-min Rain Rates for Six Duration Times. Rain rates are those equalled or exceeded during each minute of the specified duration. (Cont.)

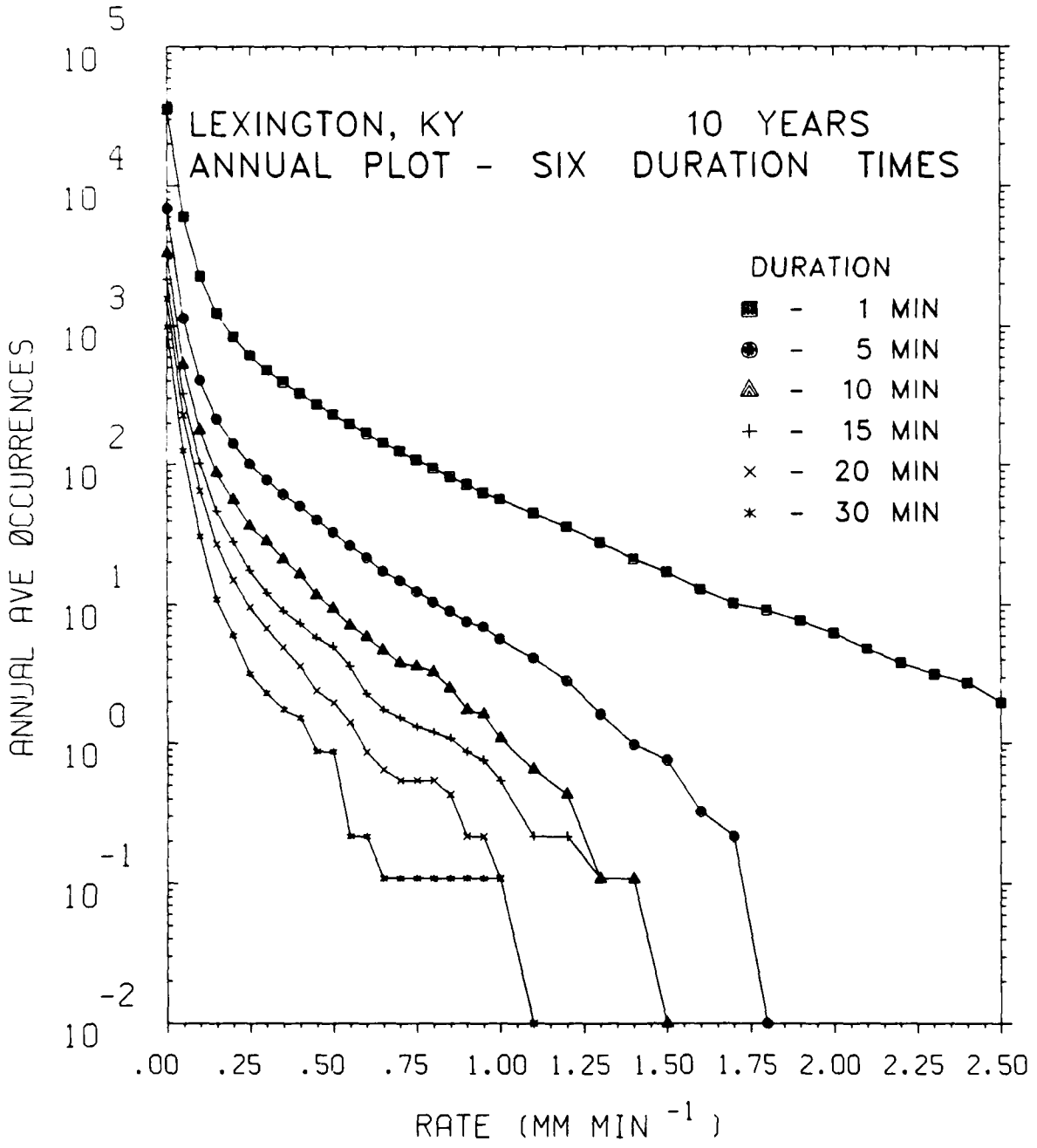


Figure 1. Annual Average Number of Occurrences of 1-min Rain Rates for Six Duration Times. Rain rates are those equalled or exceeded during each minute of the specified duration. (Cont.)

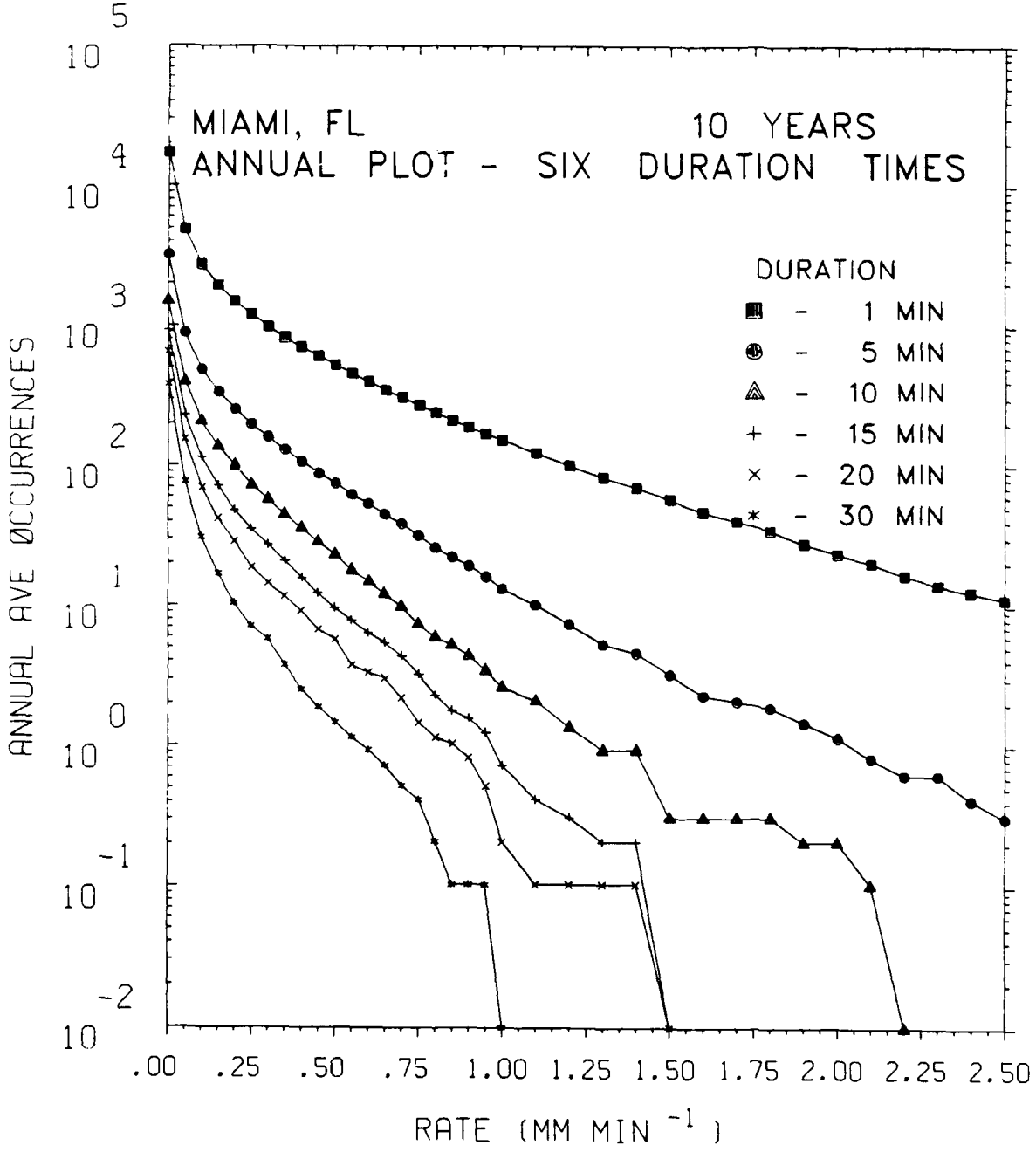


Figure 1. Annual Average Number of Occurrences of 1-min Rain Rates for Six Duration Times. Rain rates are those equalled or exceeded during each minute of the specified duration. (Cont.)

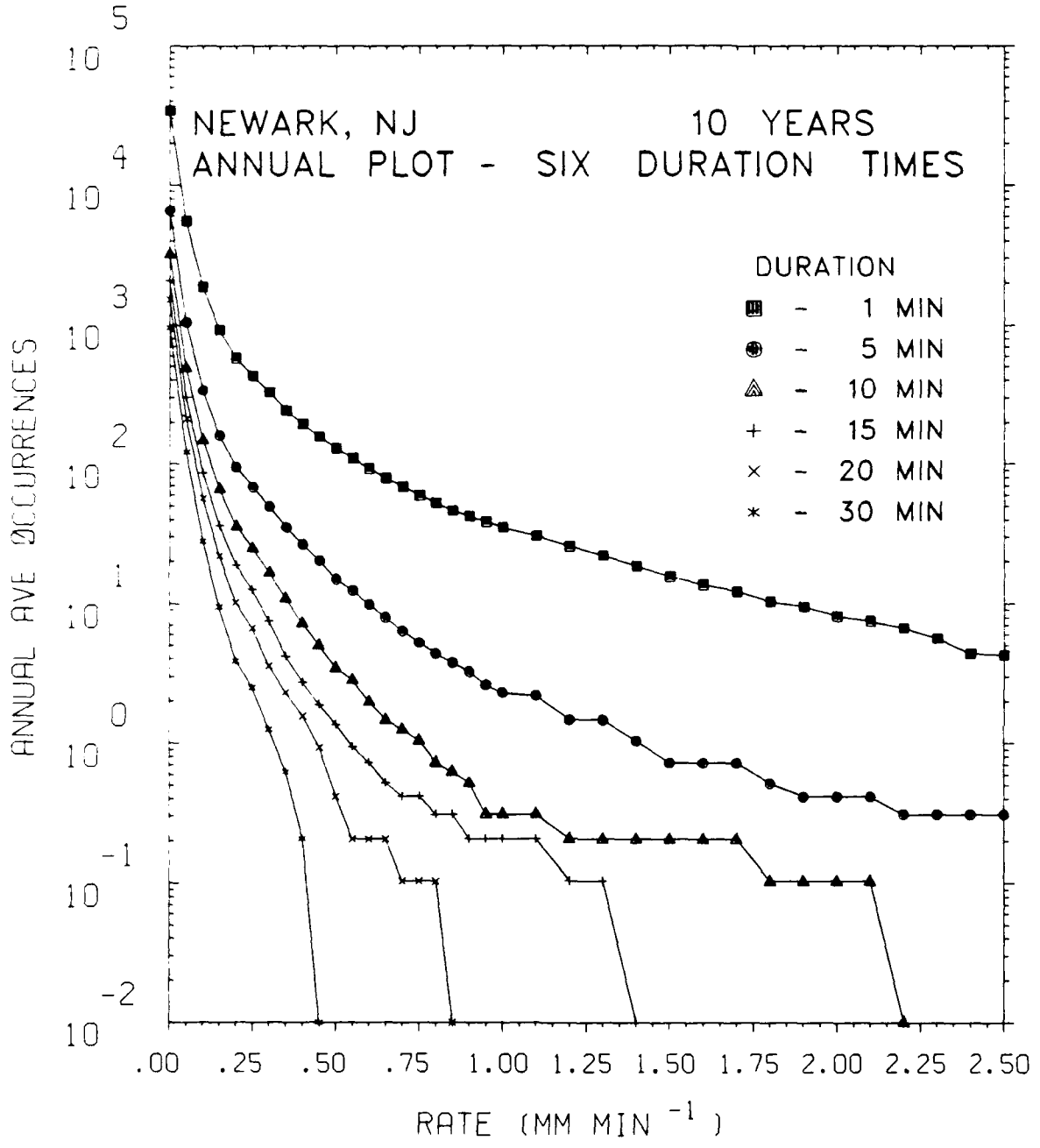


Figure 1. Annual Average Number of Occurrences of 1-min Rain Rates for Six Duration Times. Rain rates are those equalled or exceeded during each minute of the specified duration. (Cont.)

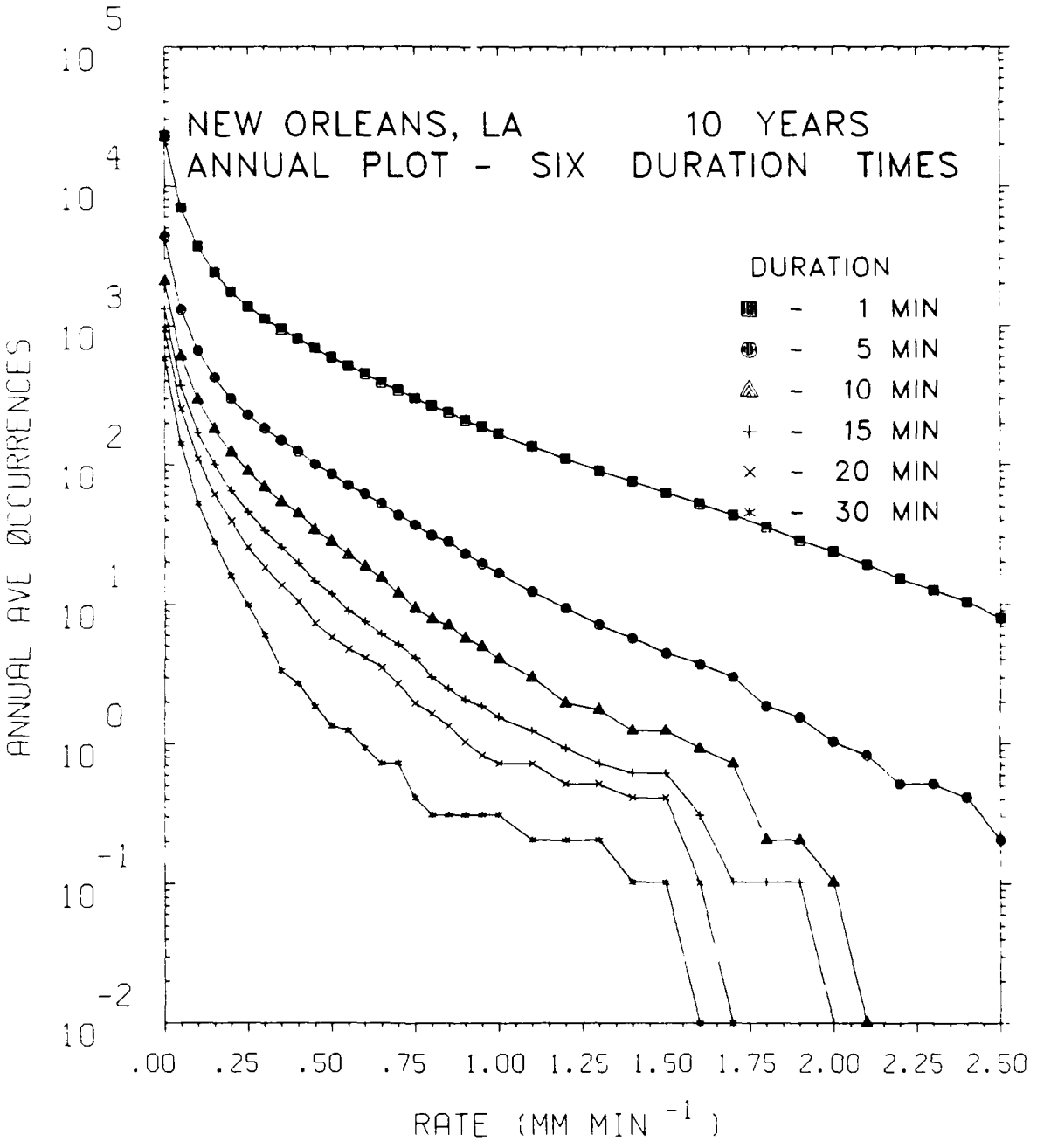


Figure 1. Annual Average Number of Occurrences of 1-min Rain Rates for Six Duration Times. Rain rates are those equalled or exceeded during each minute of the specified duration. (Cont.)

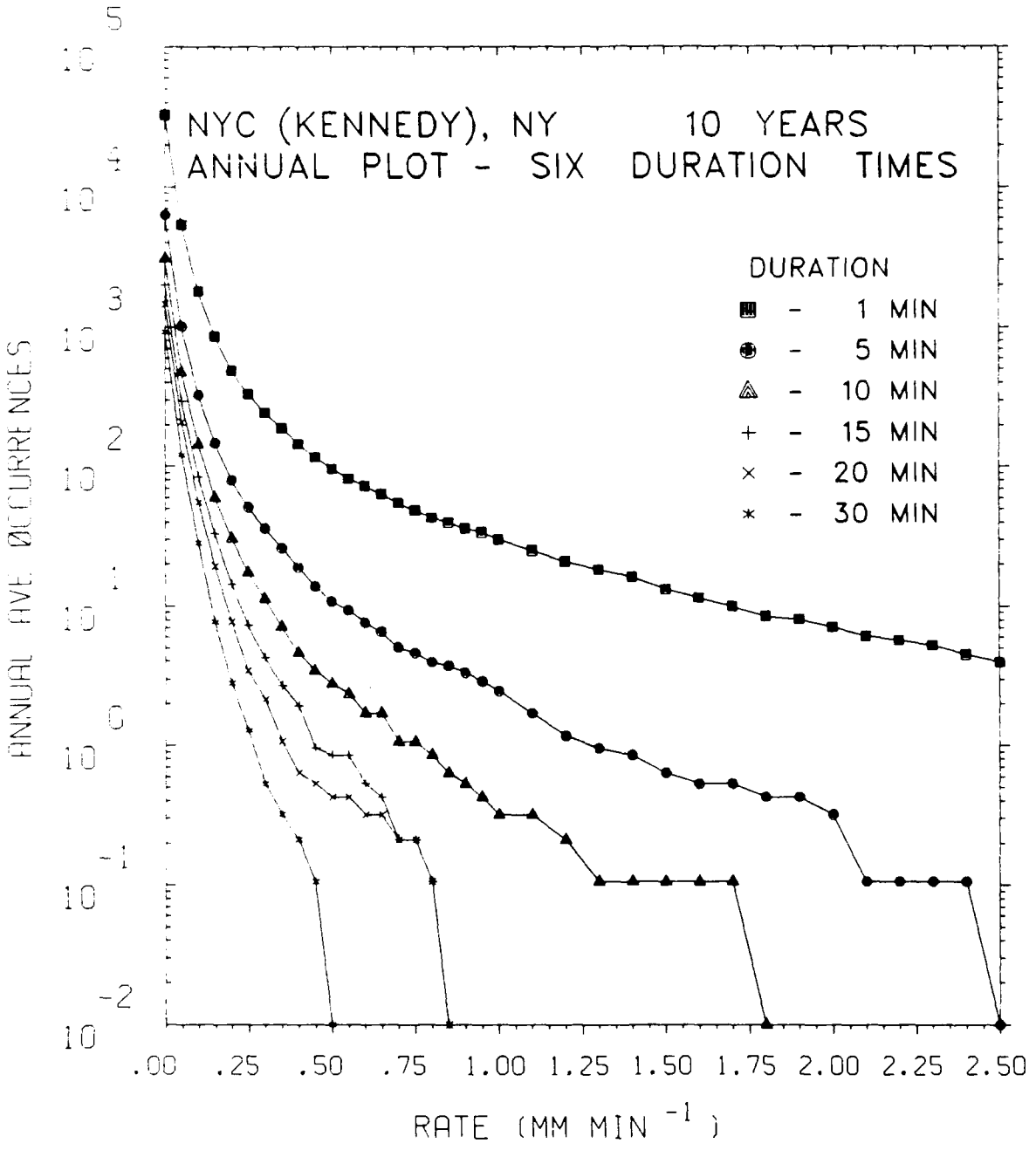
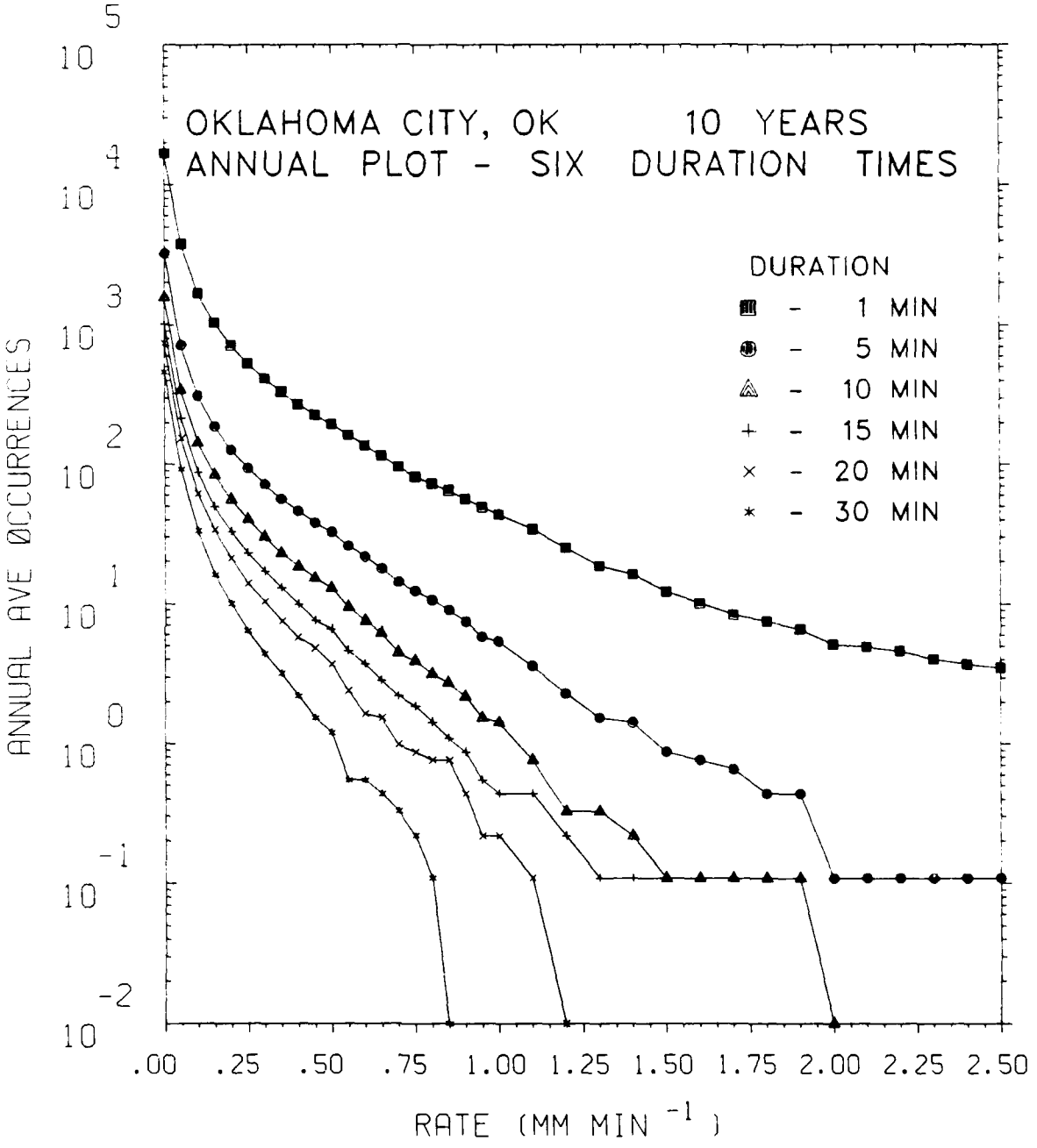


Figure 1. Annual Average Number of Occurrences of 1-min Rain Rates for Six Duration Times. Rain rates are those equalled or exceeded during each minute of the specified duration. (Cont.)



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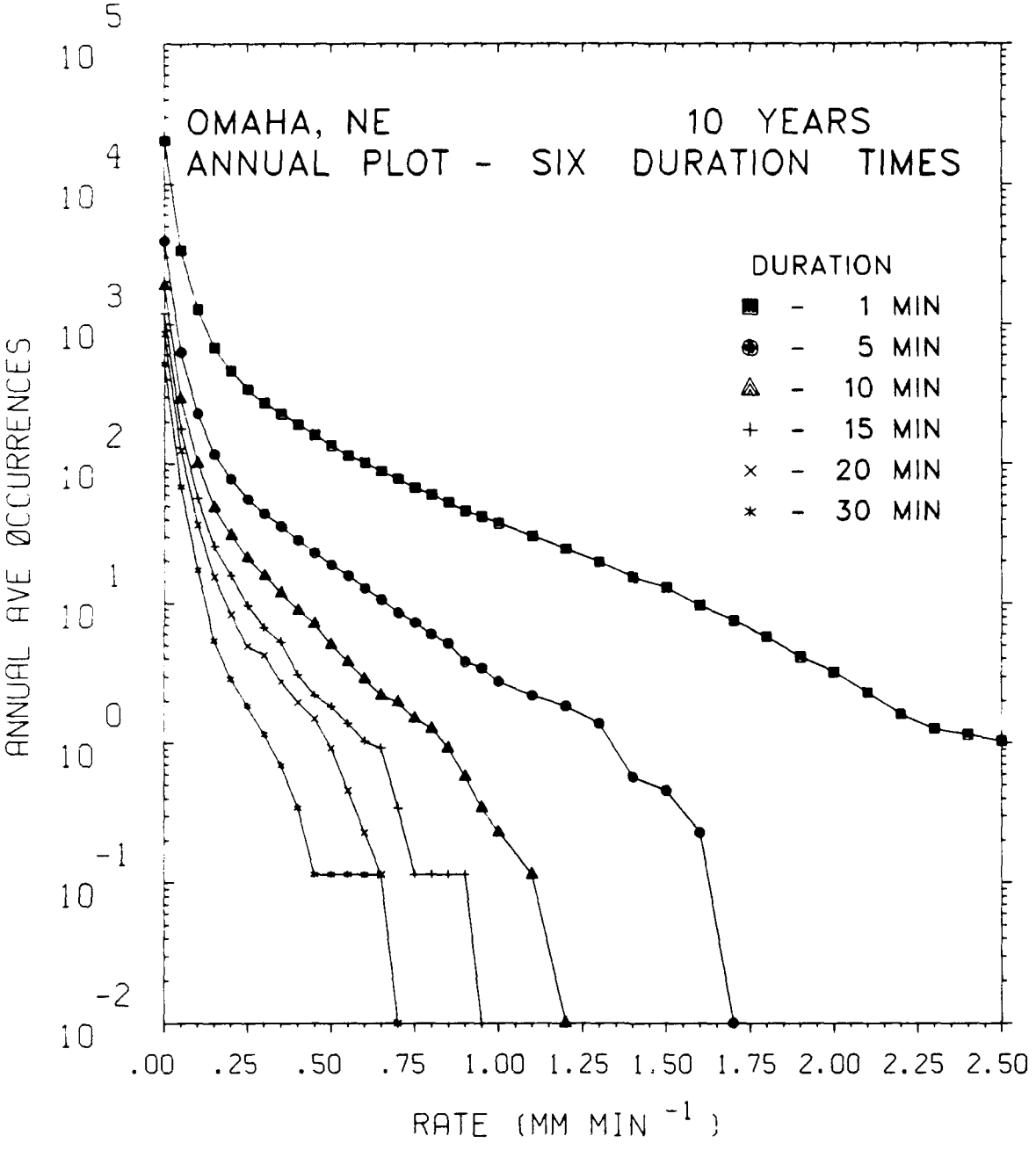

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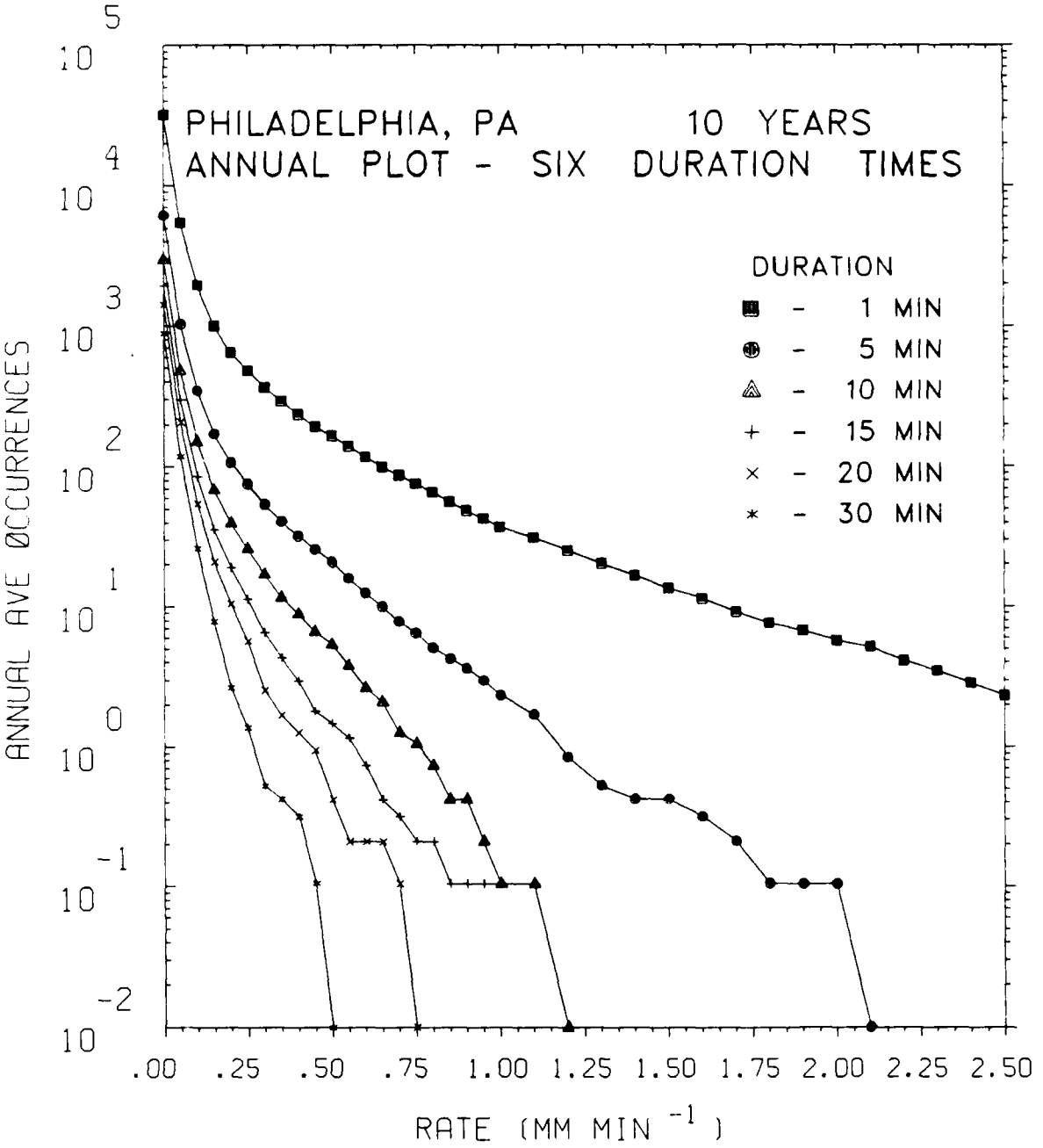

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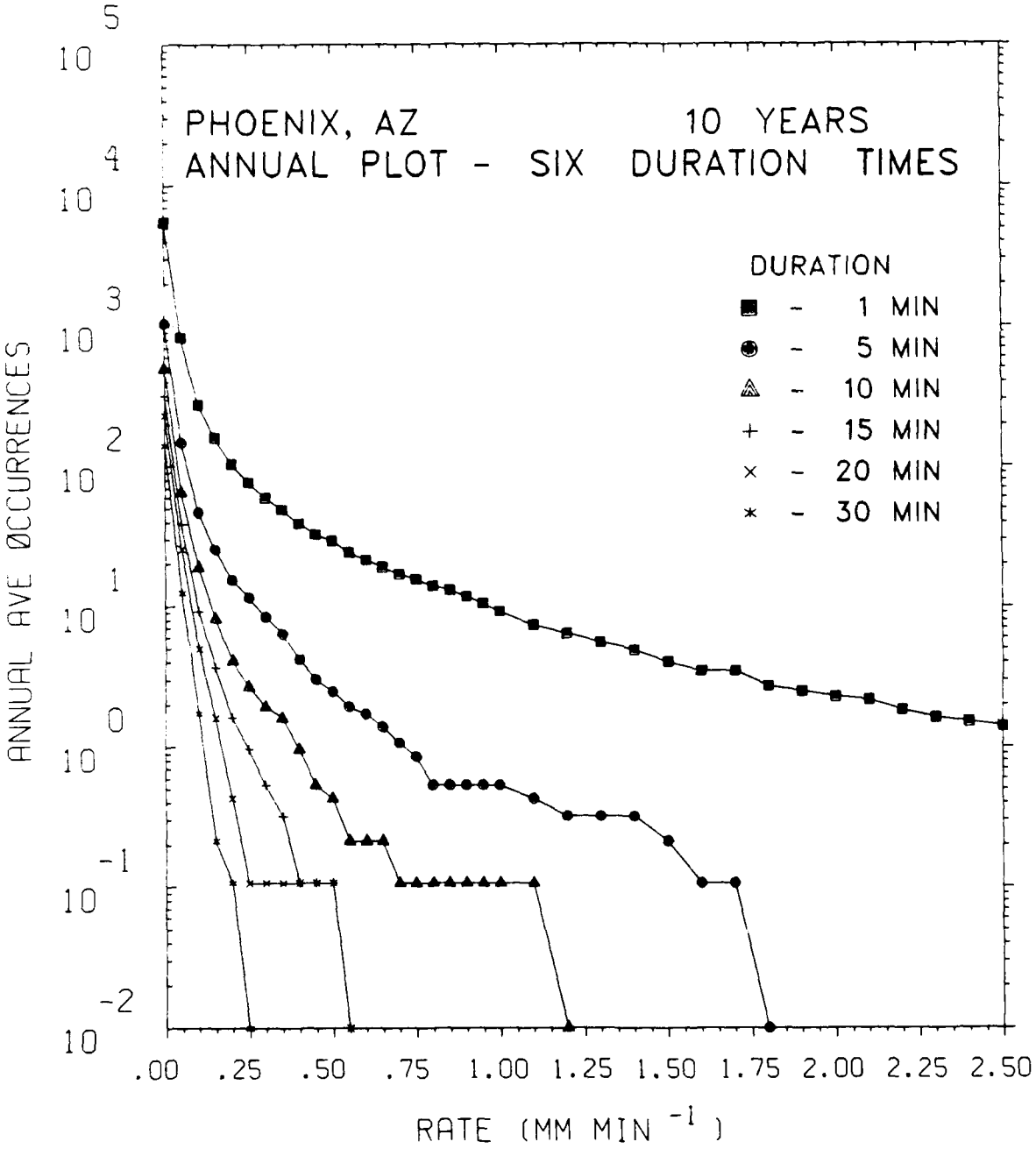

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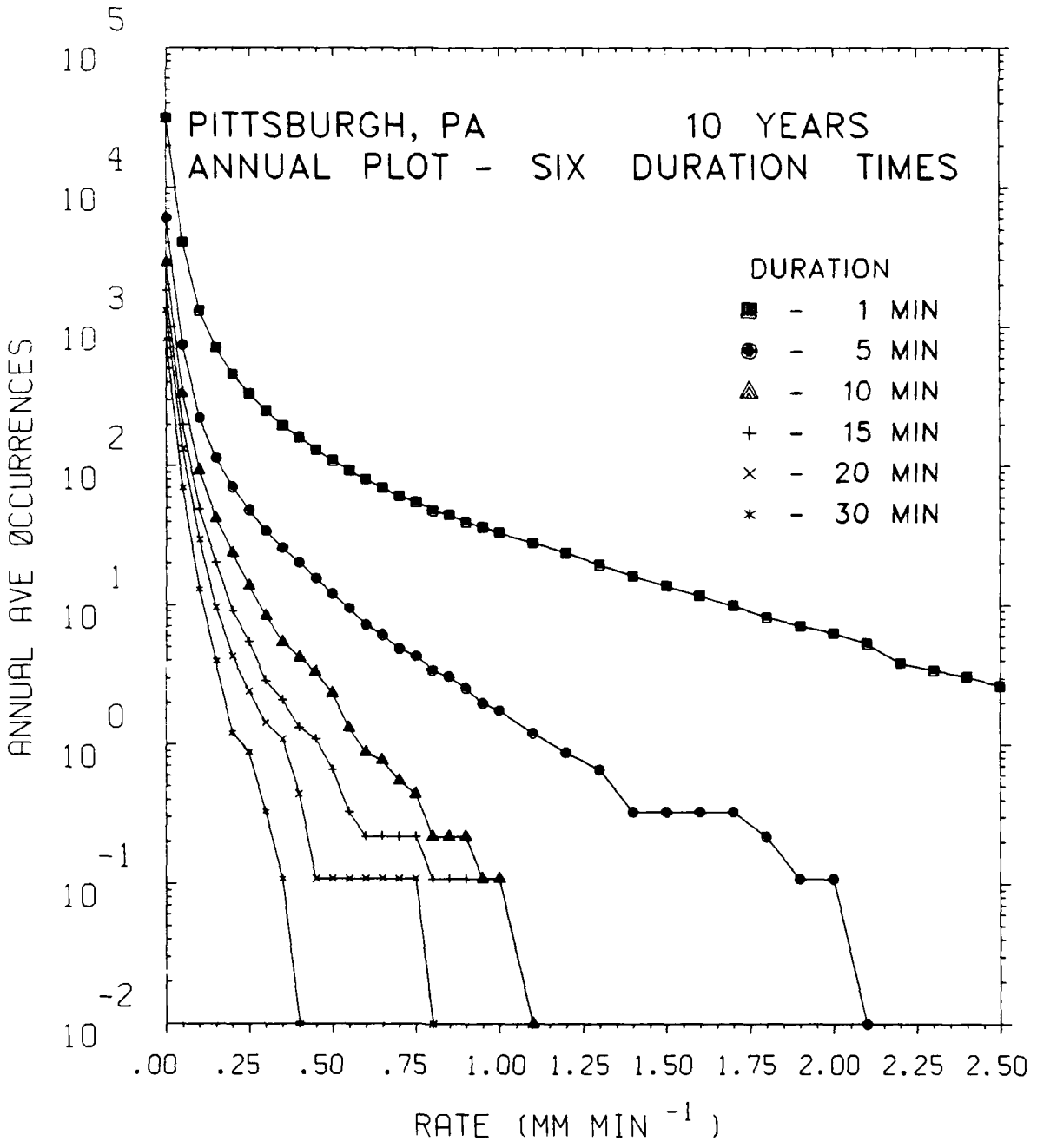

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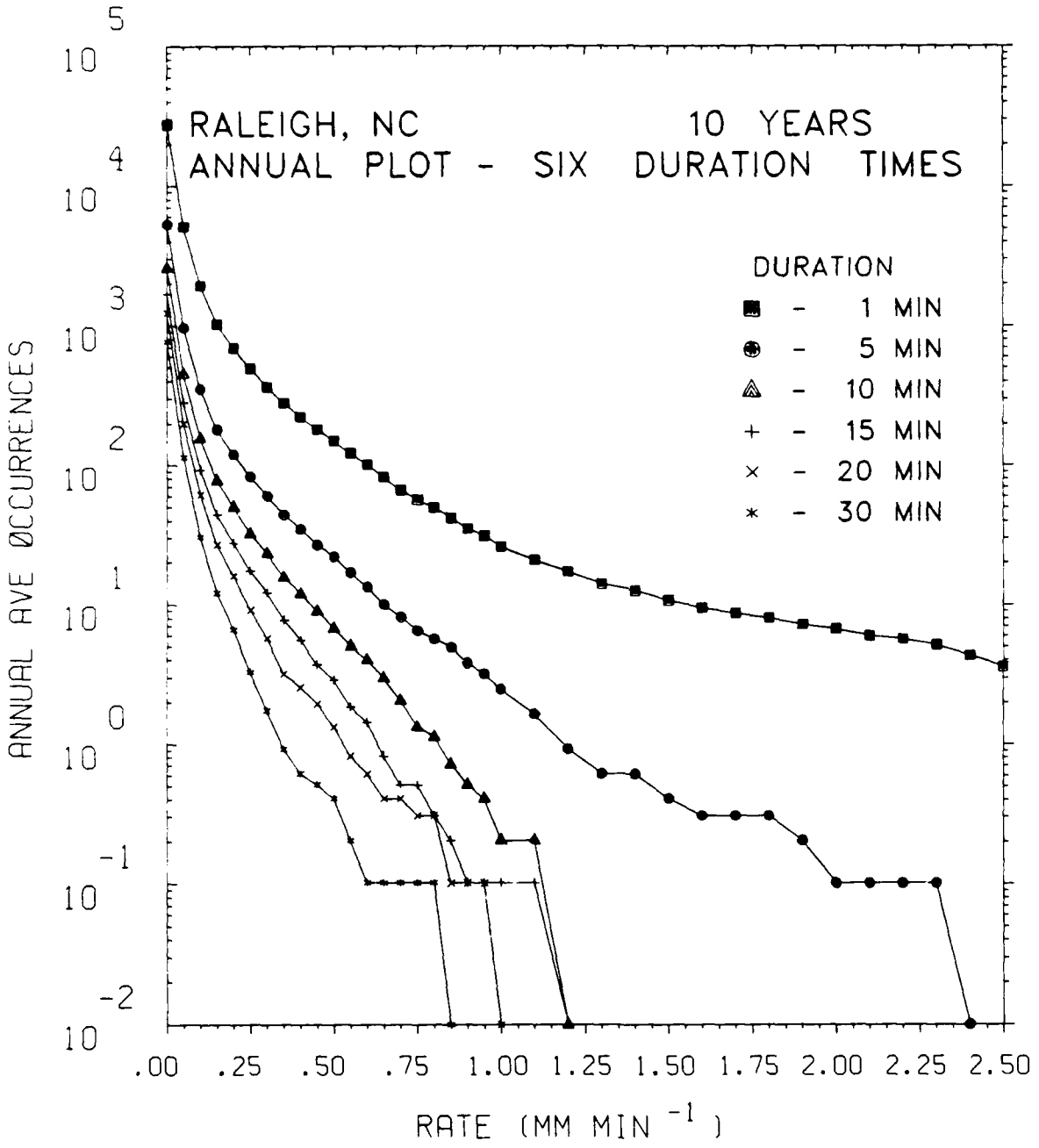

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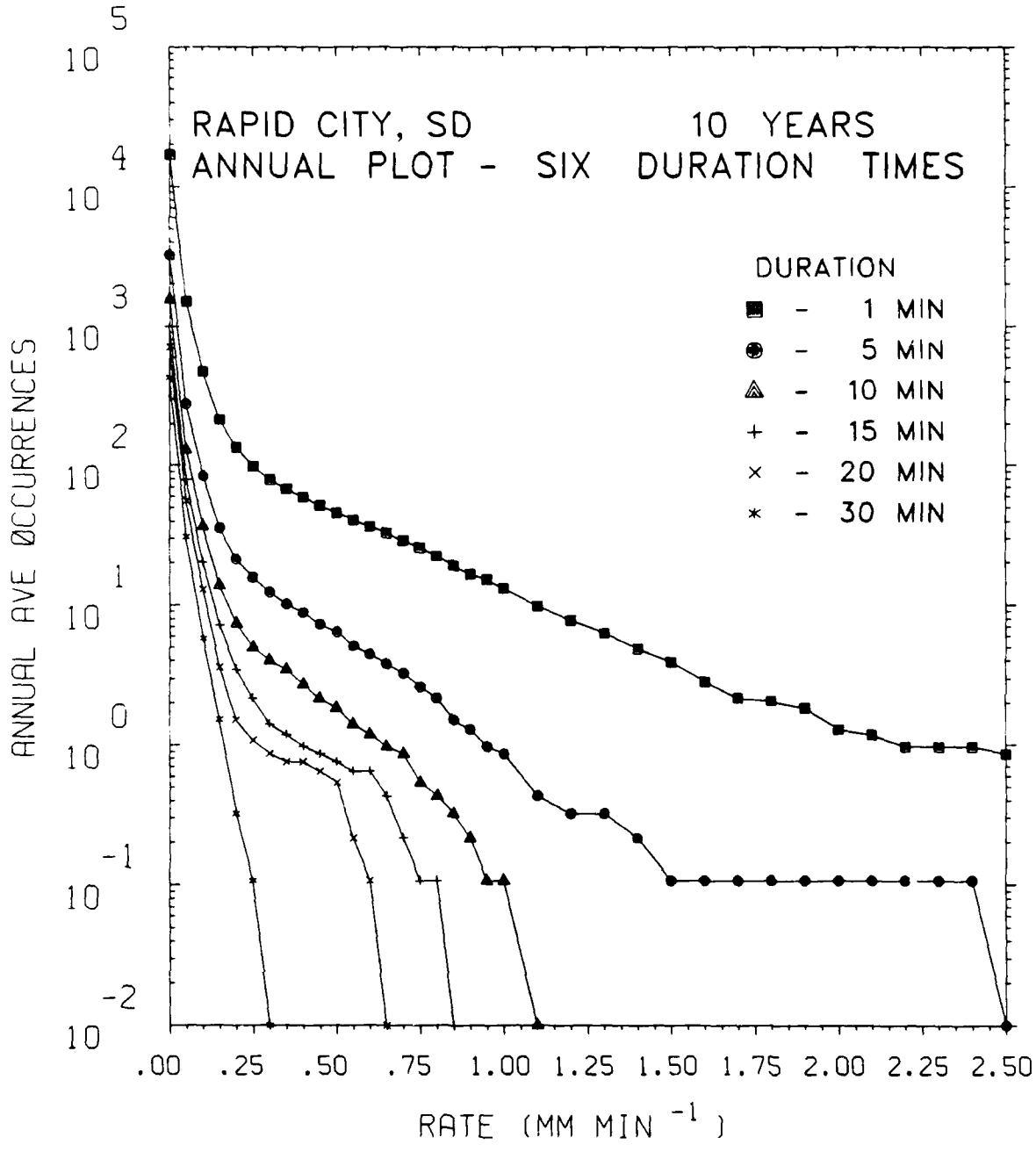

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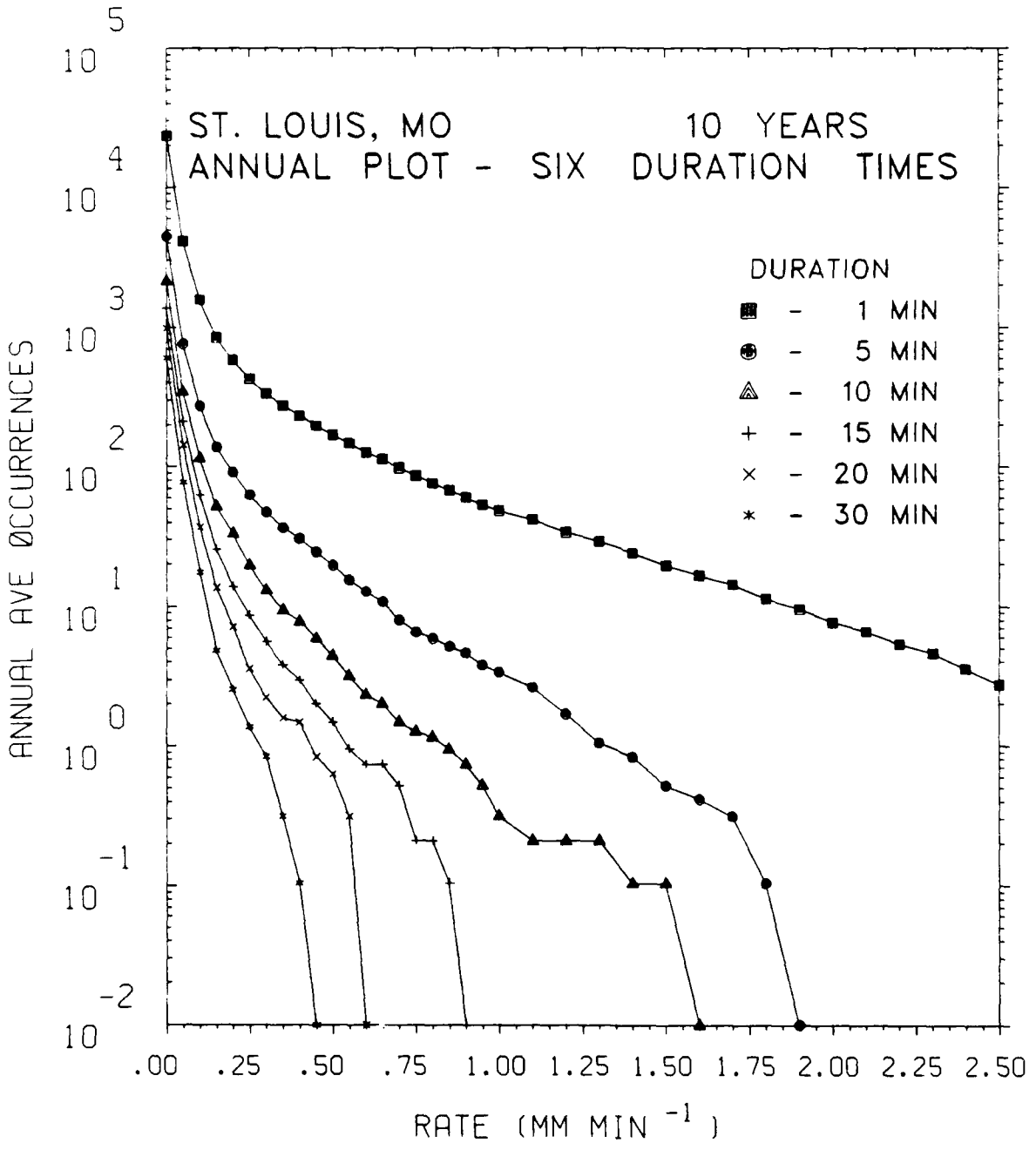

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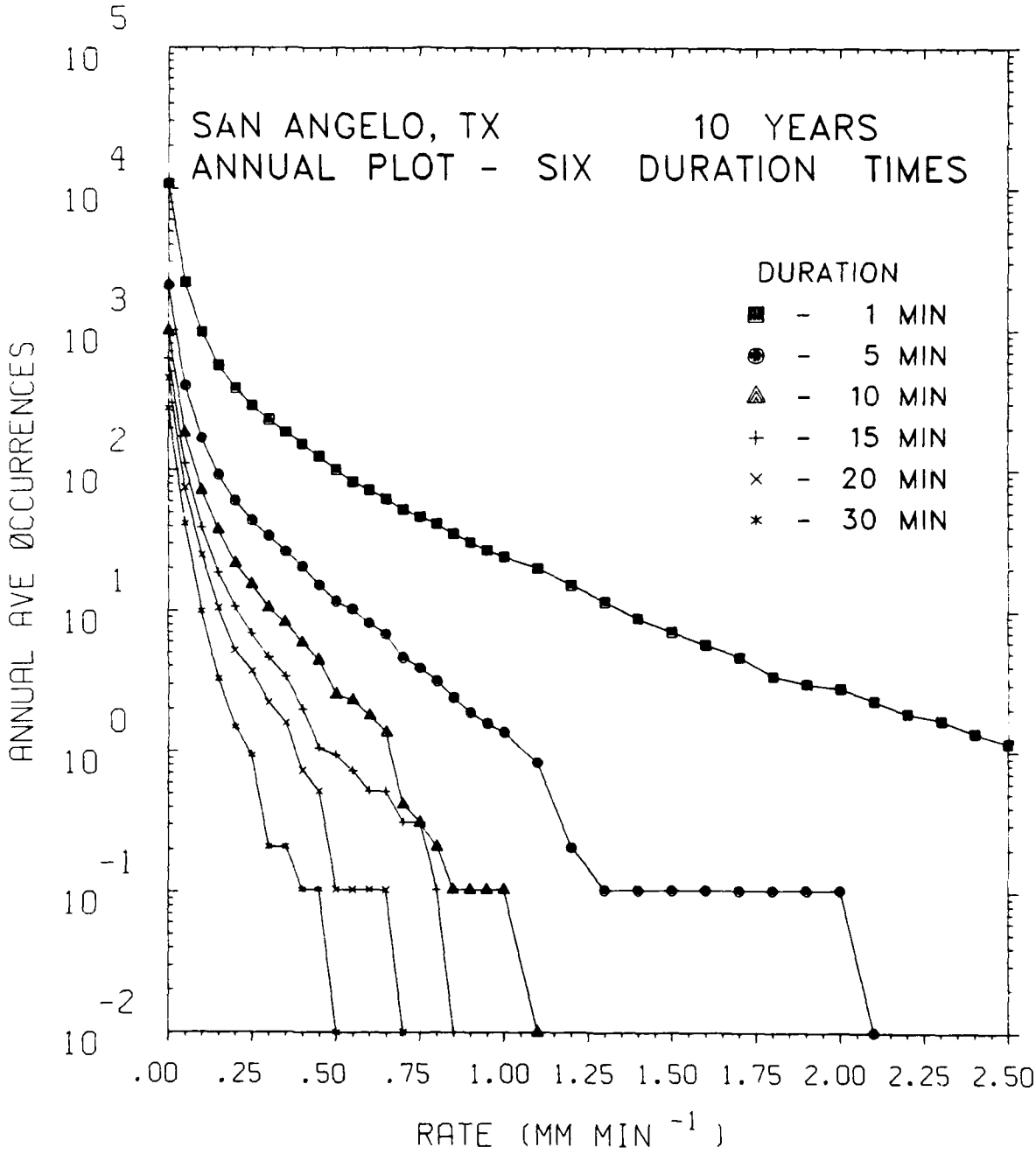

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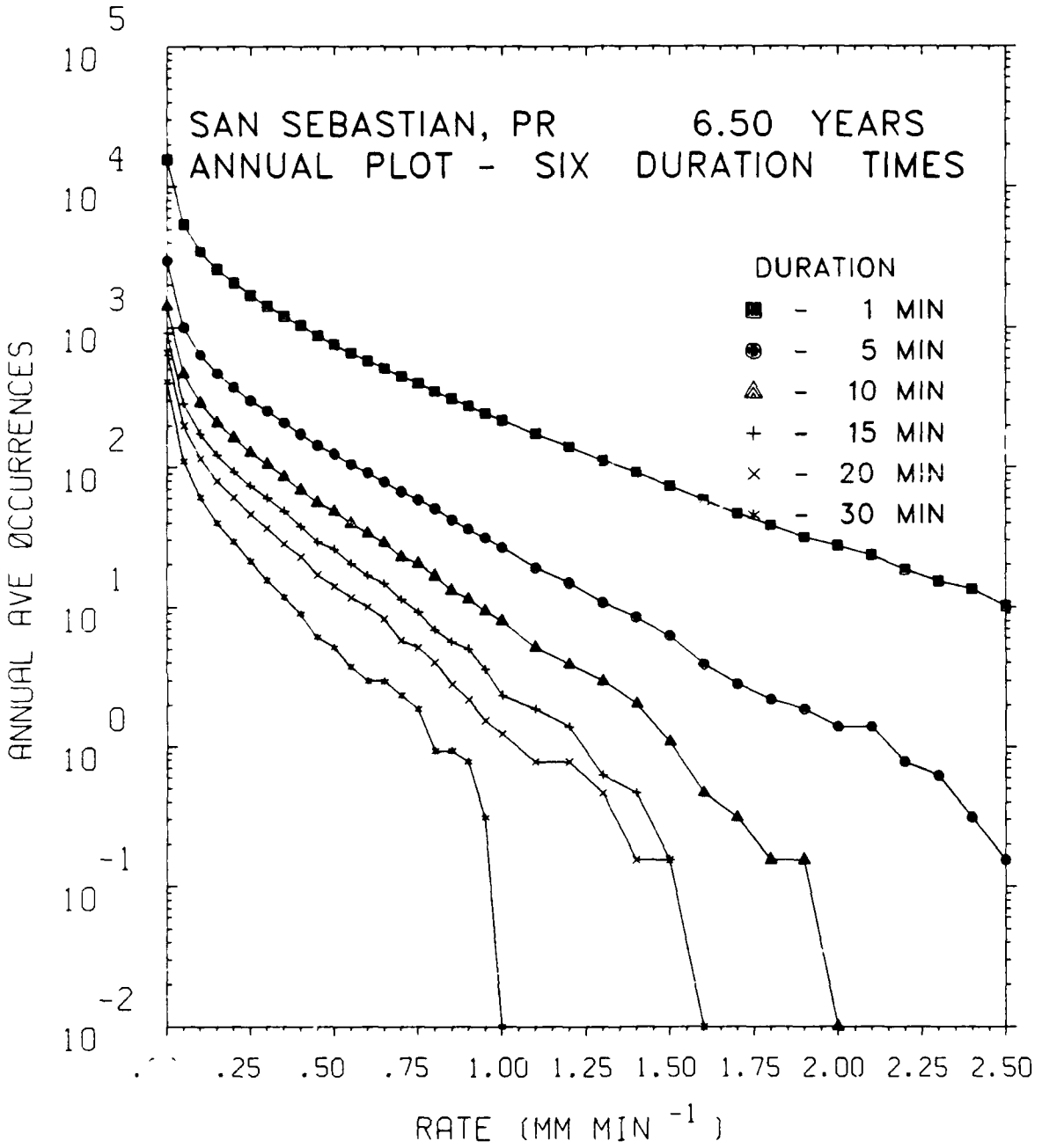

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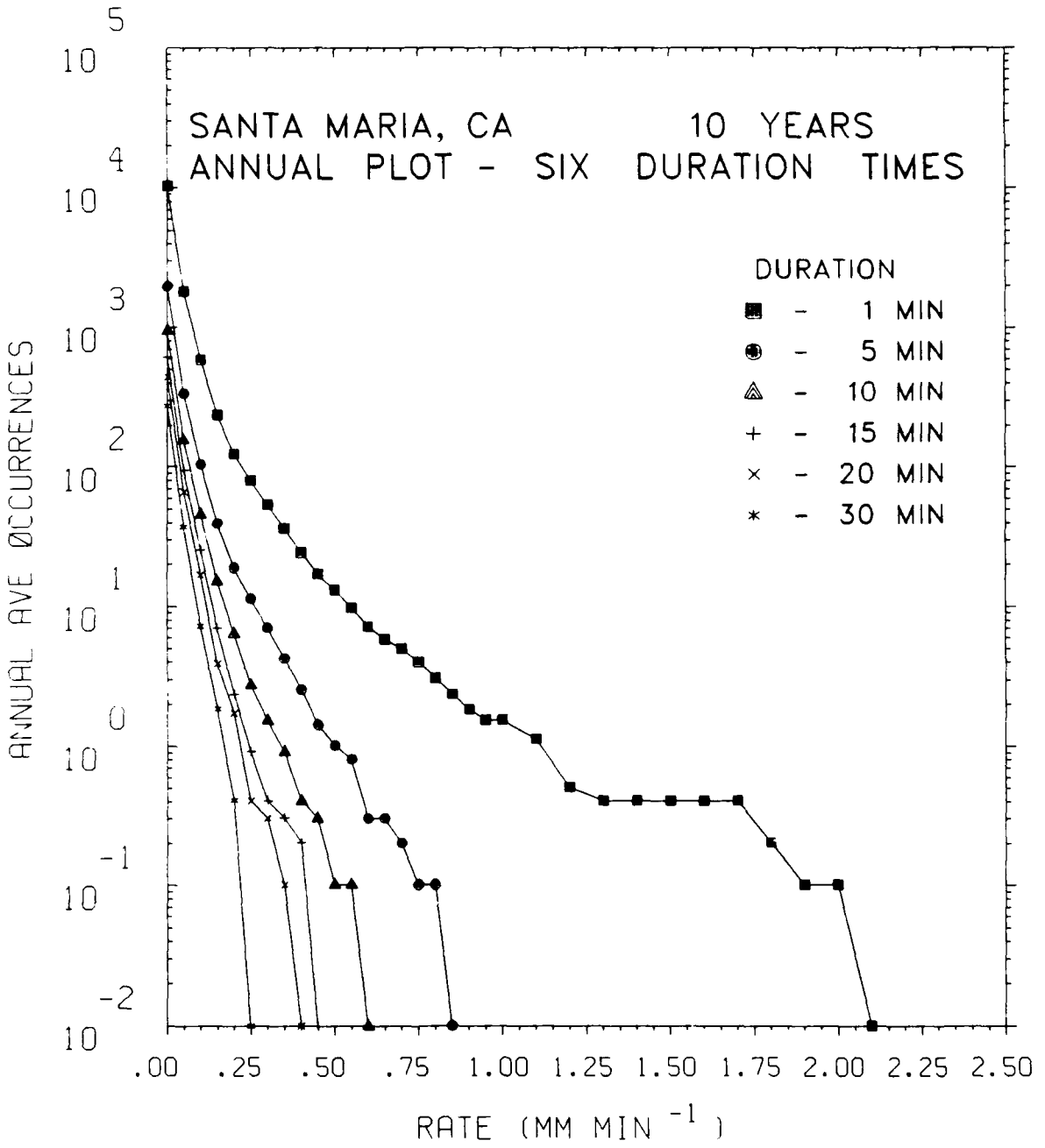

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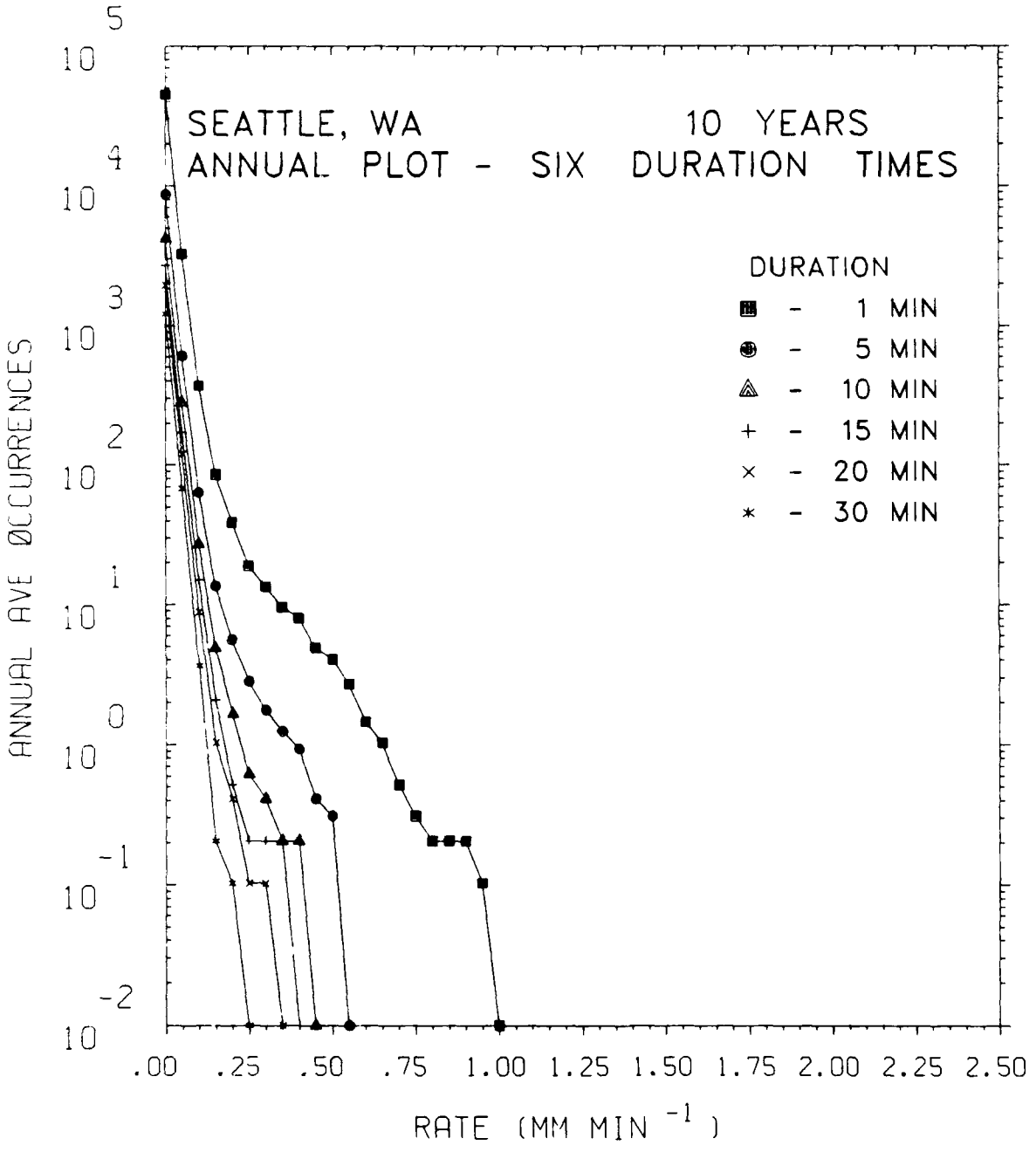

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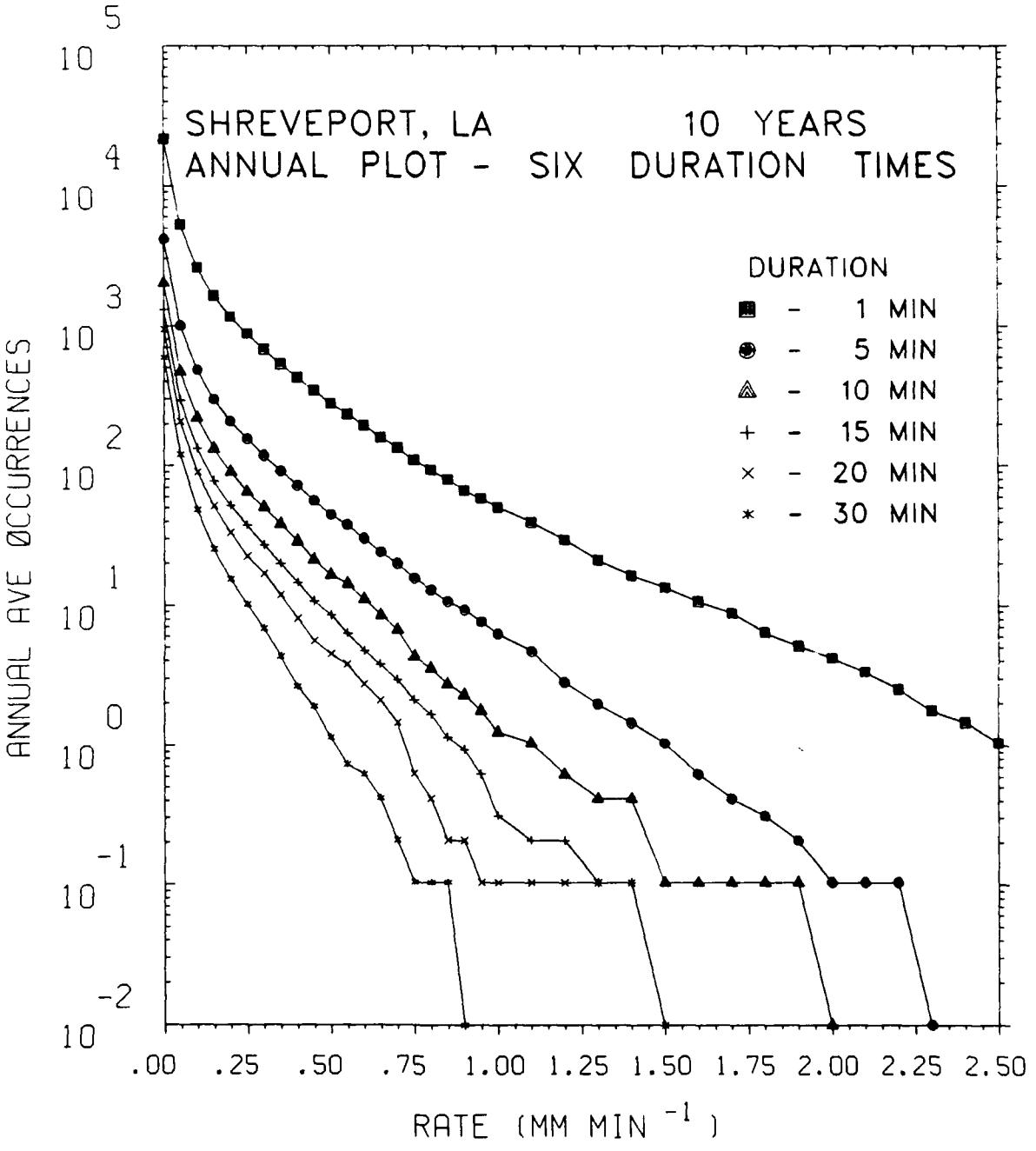

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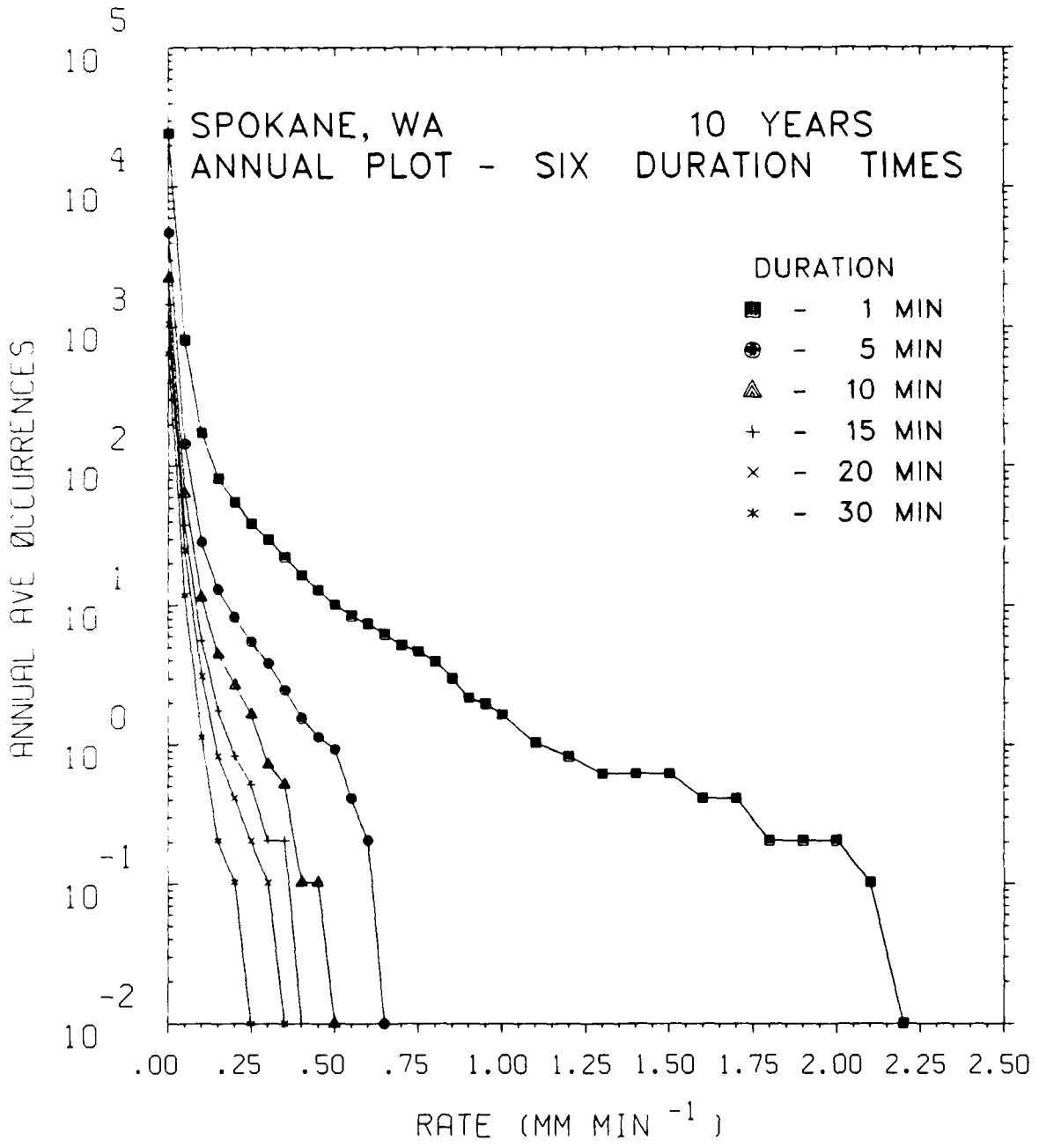

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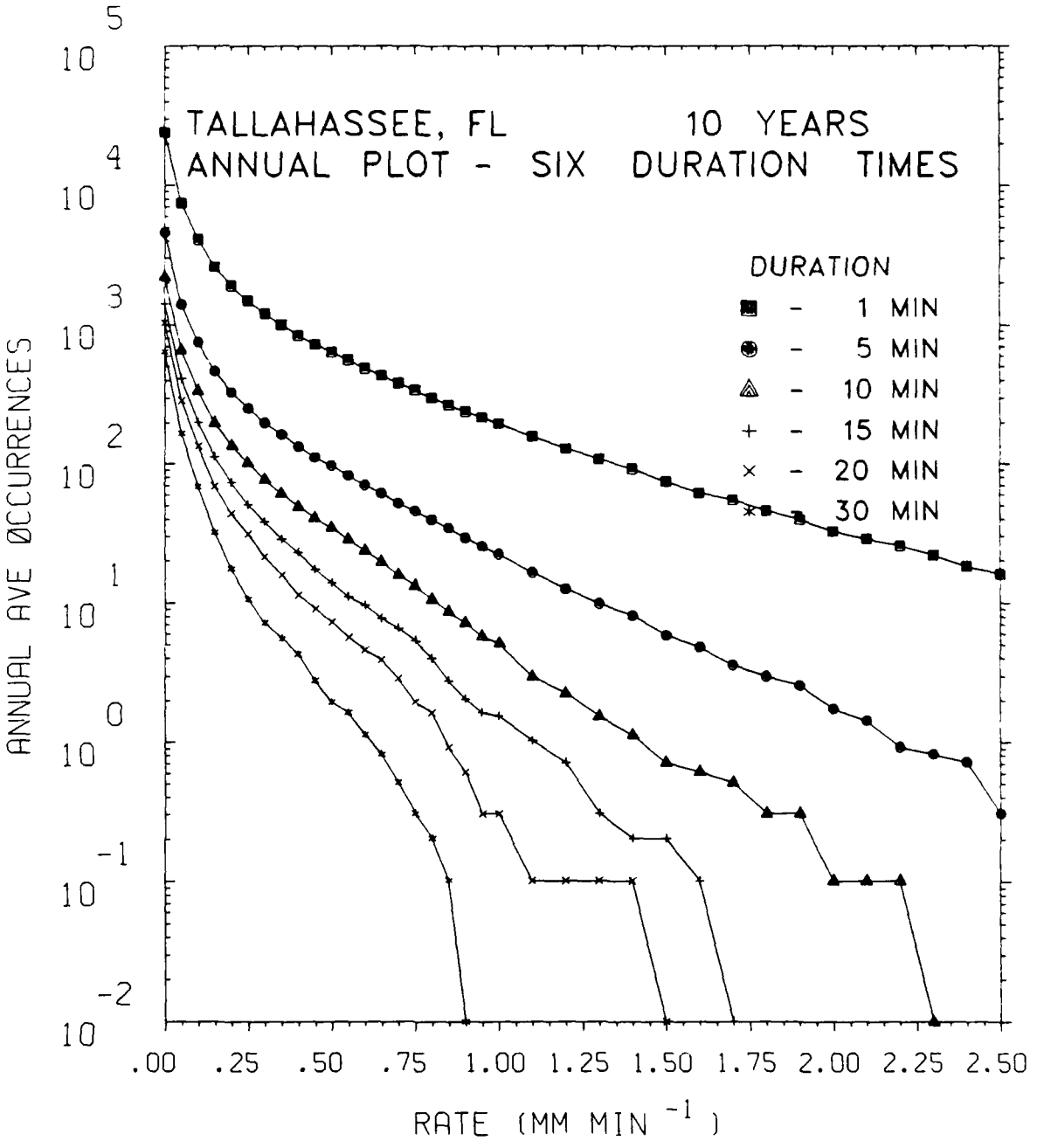

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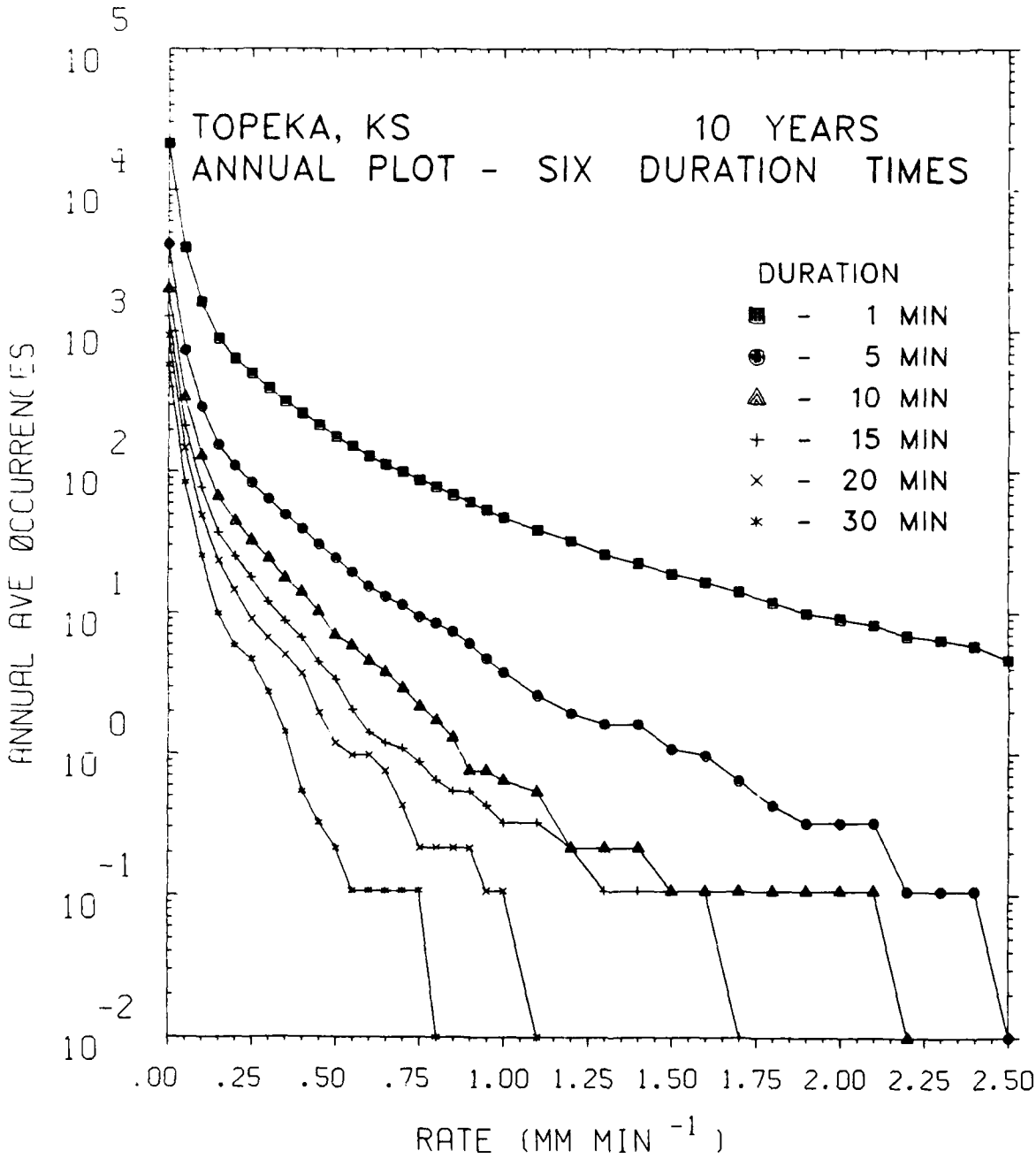

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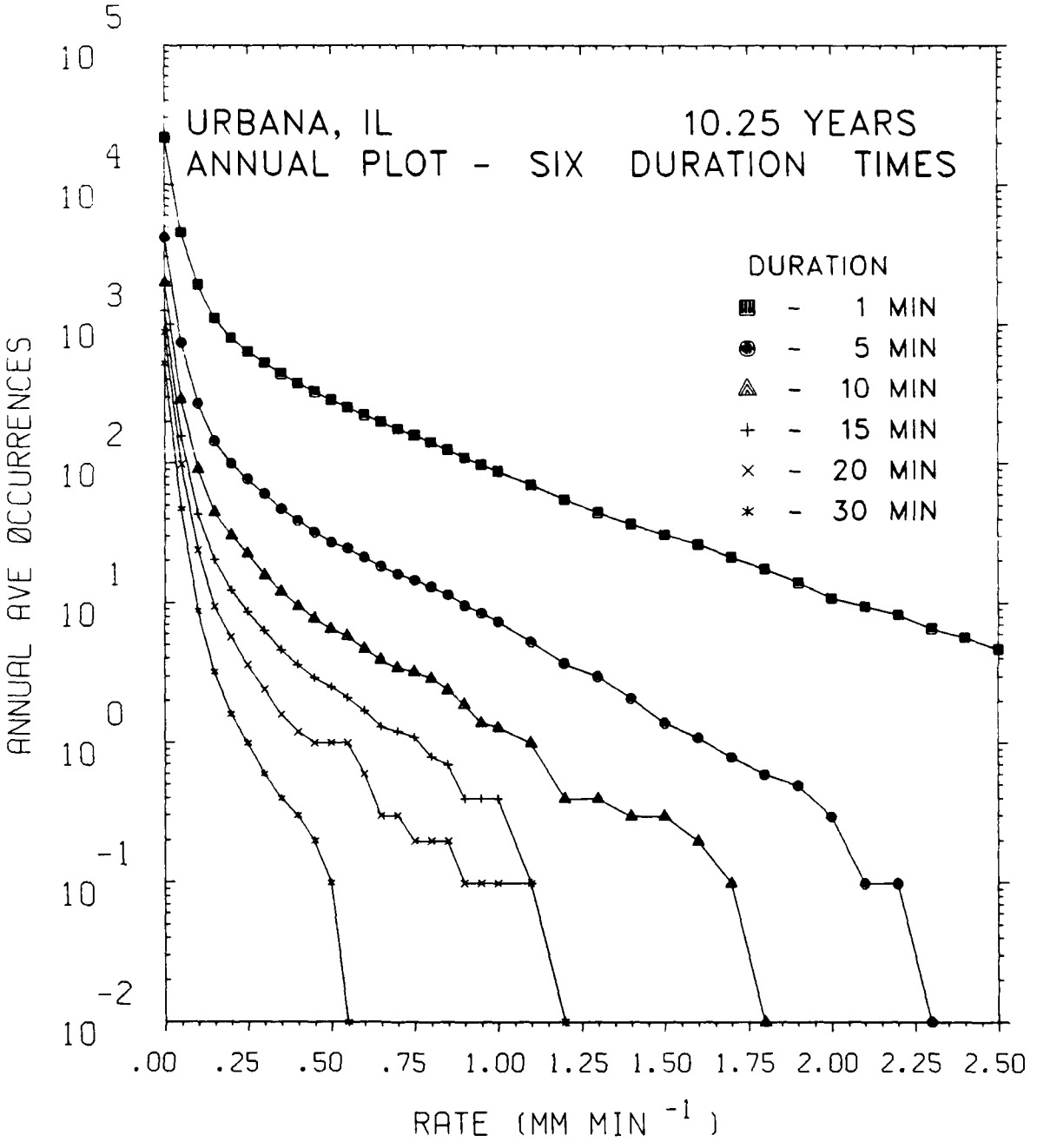

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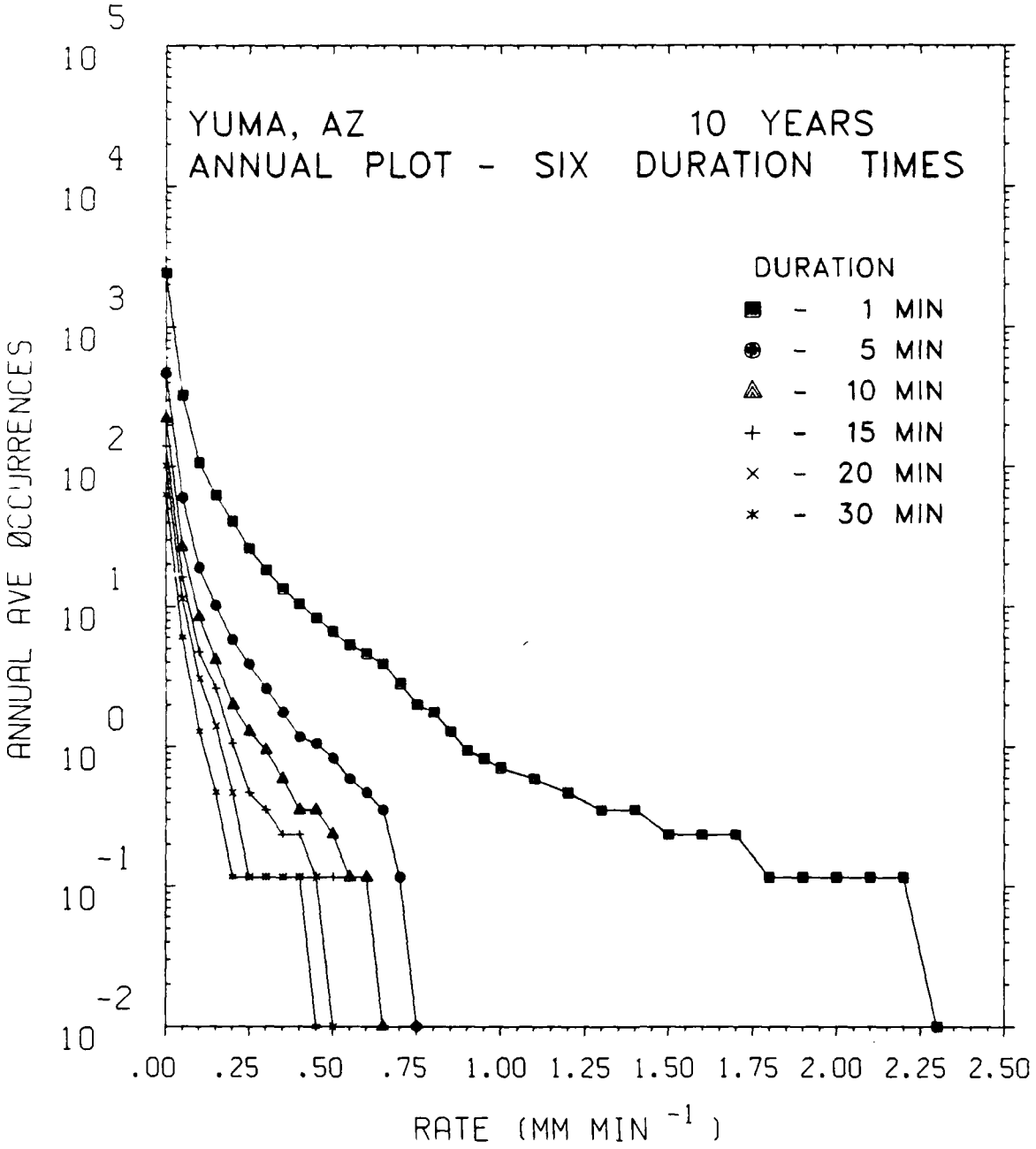

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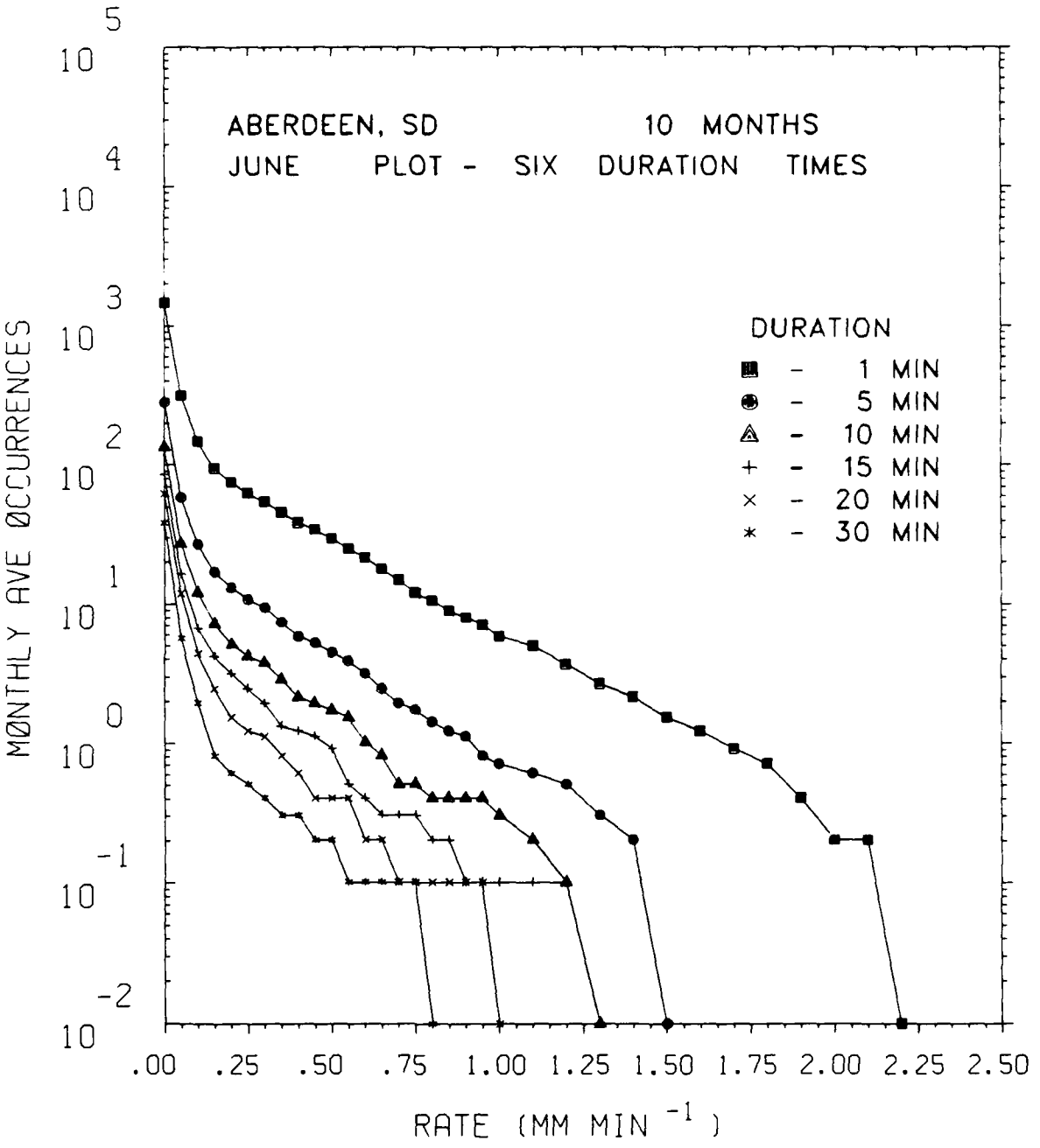

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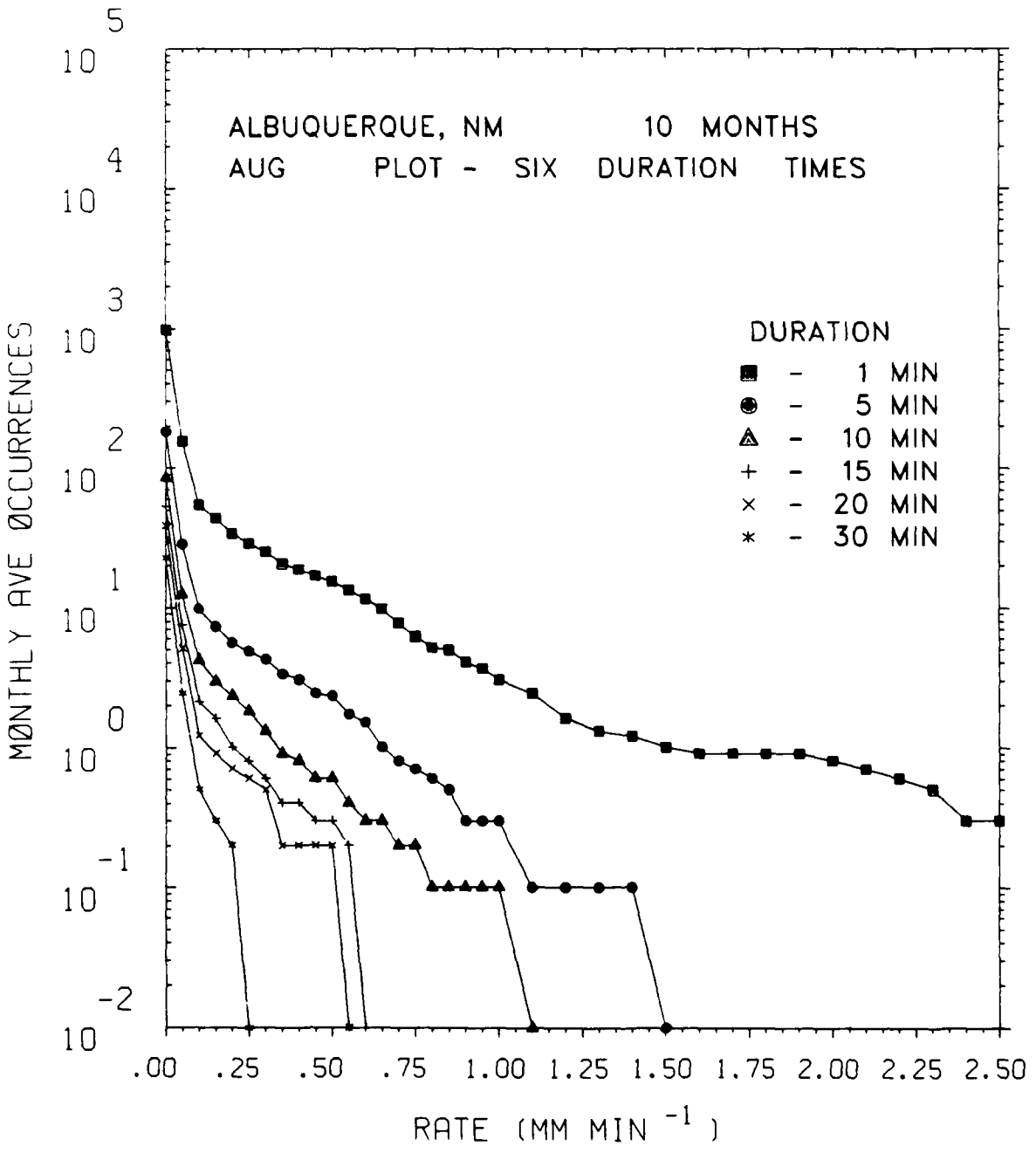

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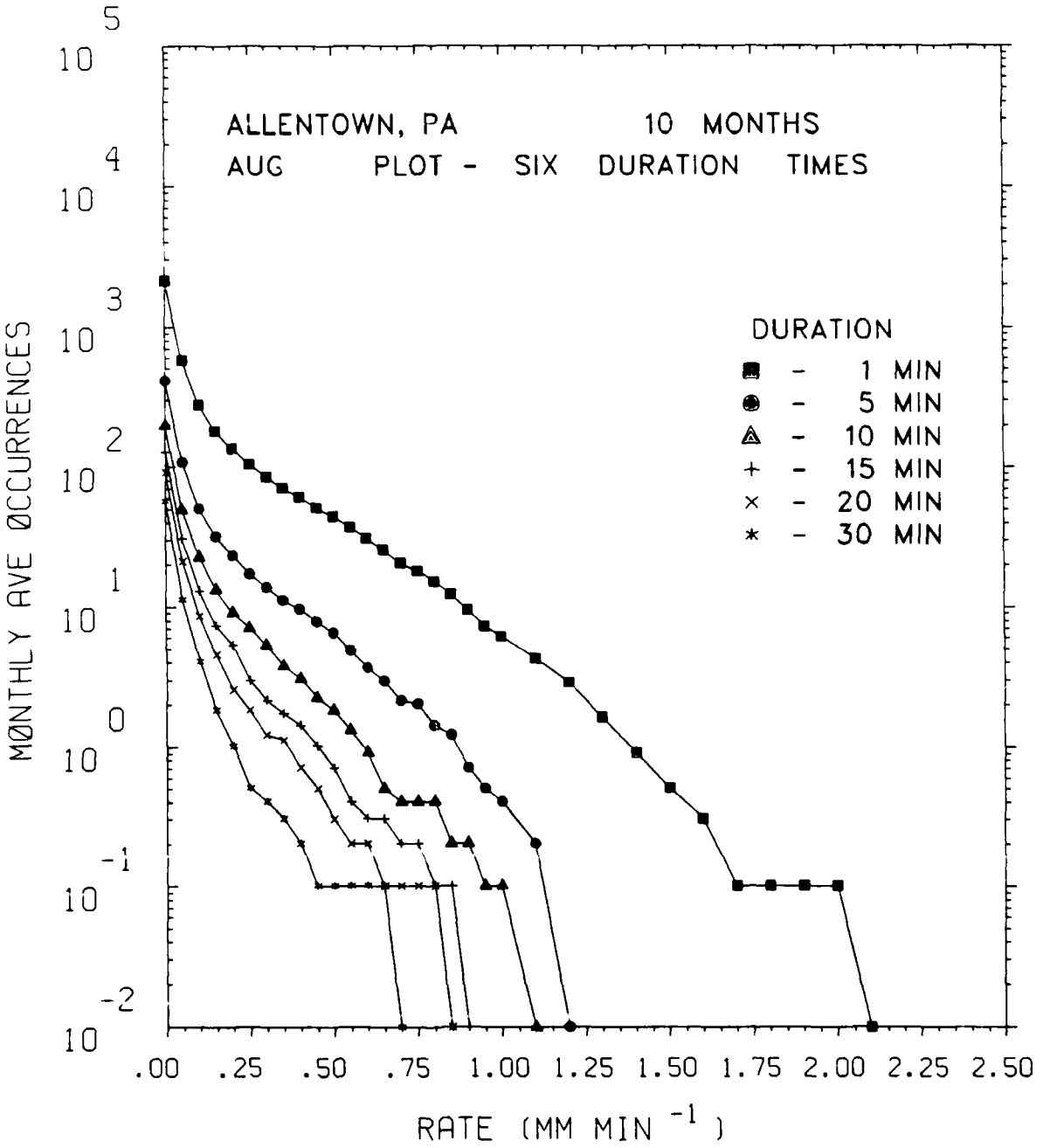

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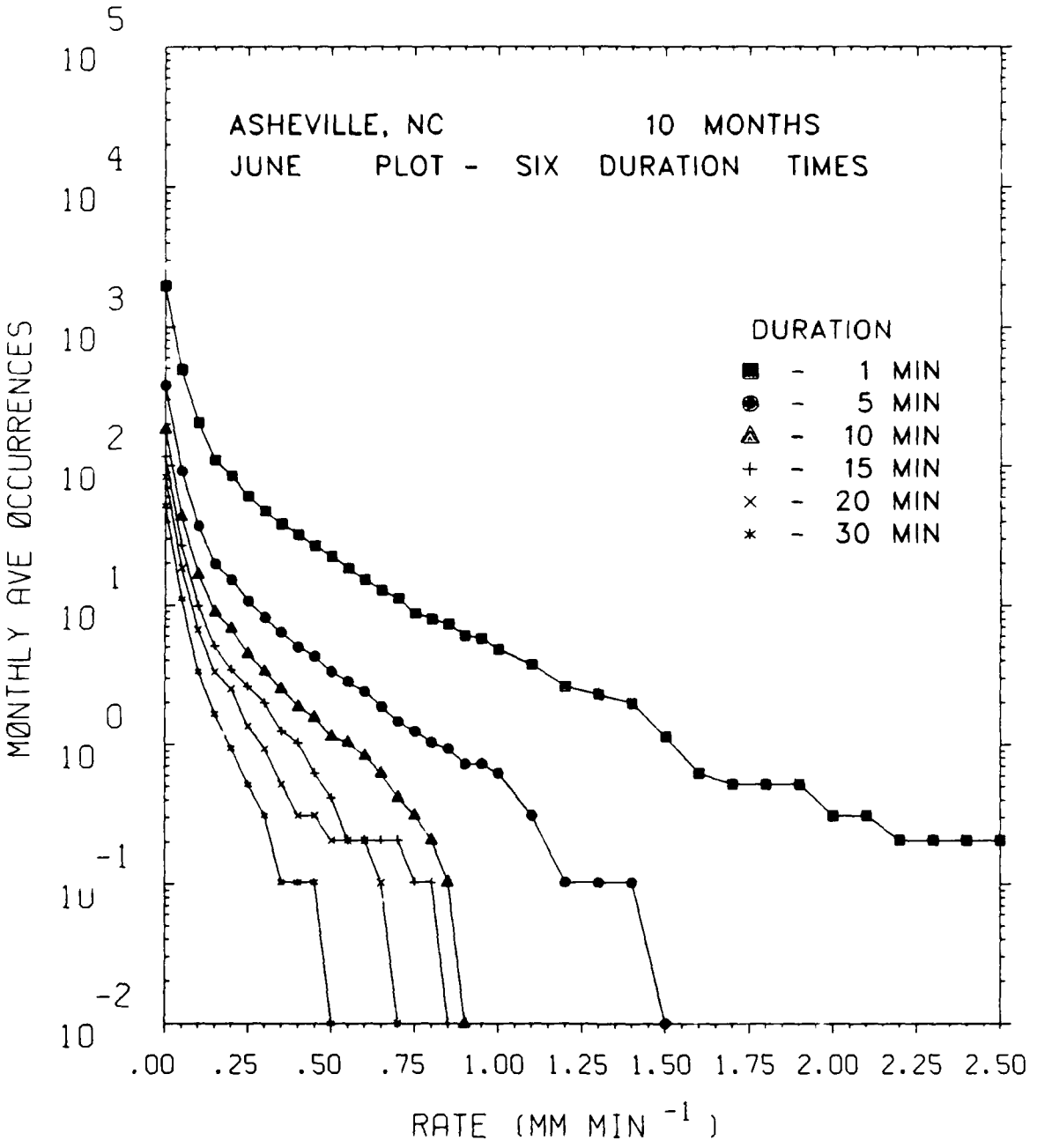

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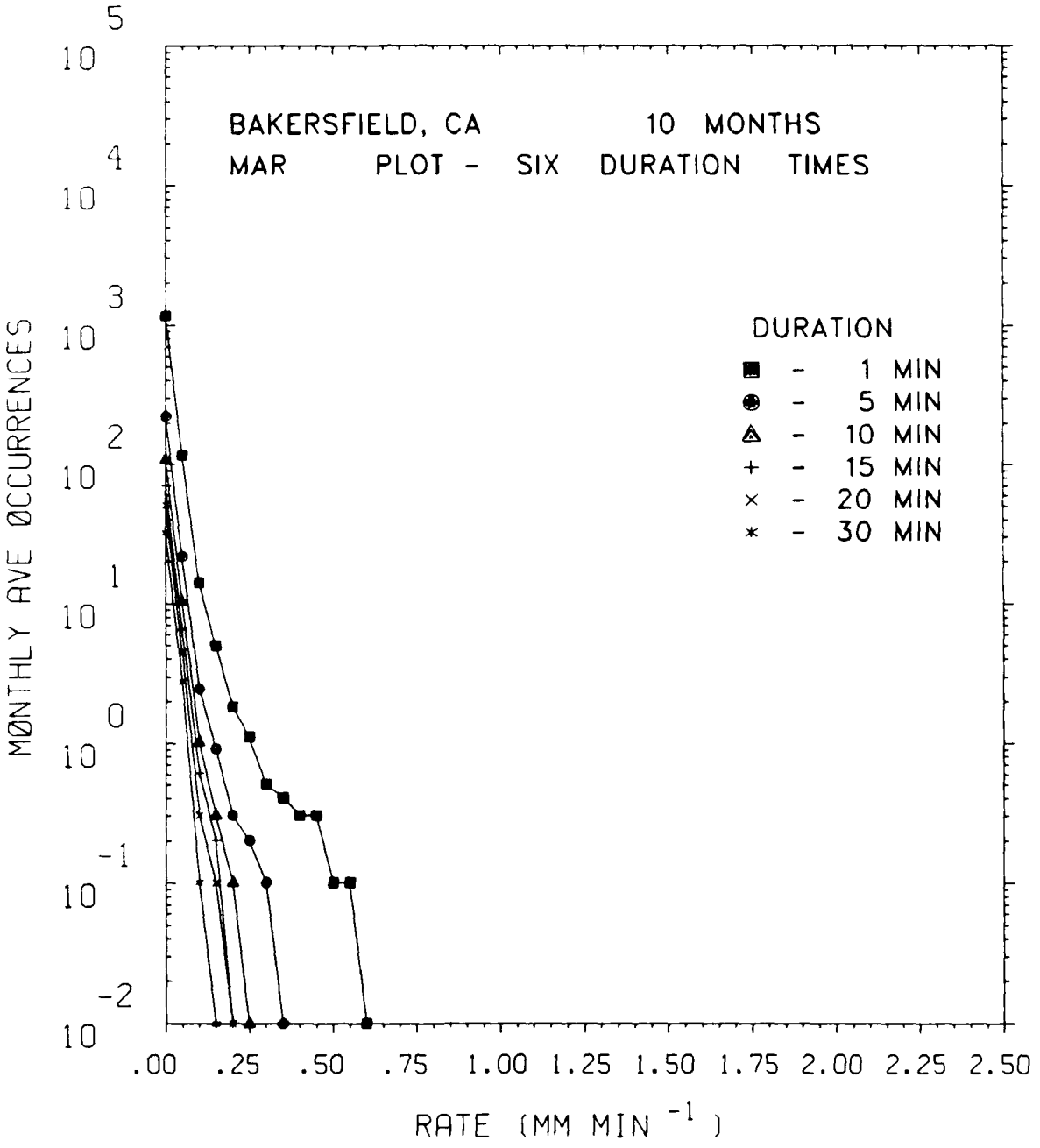

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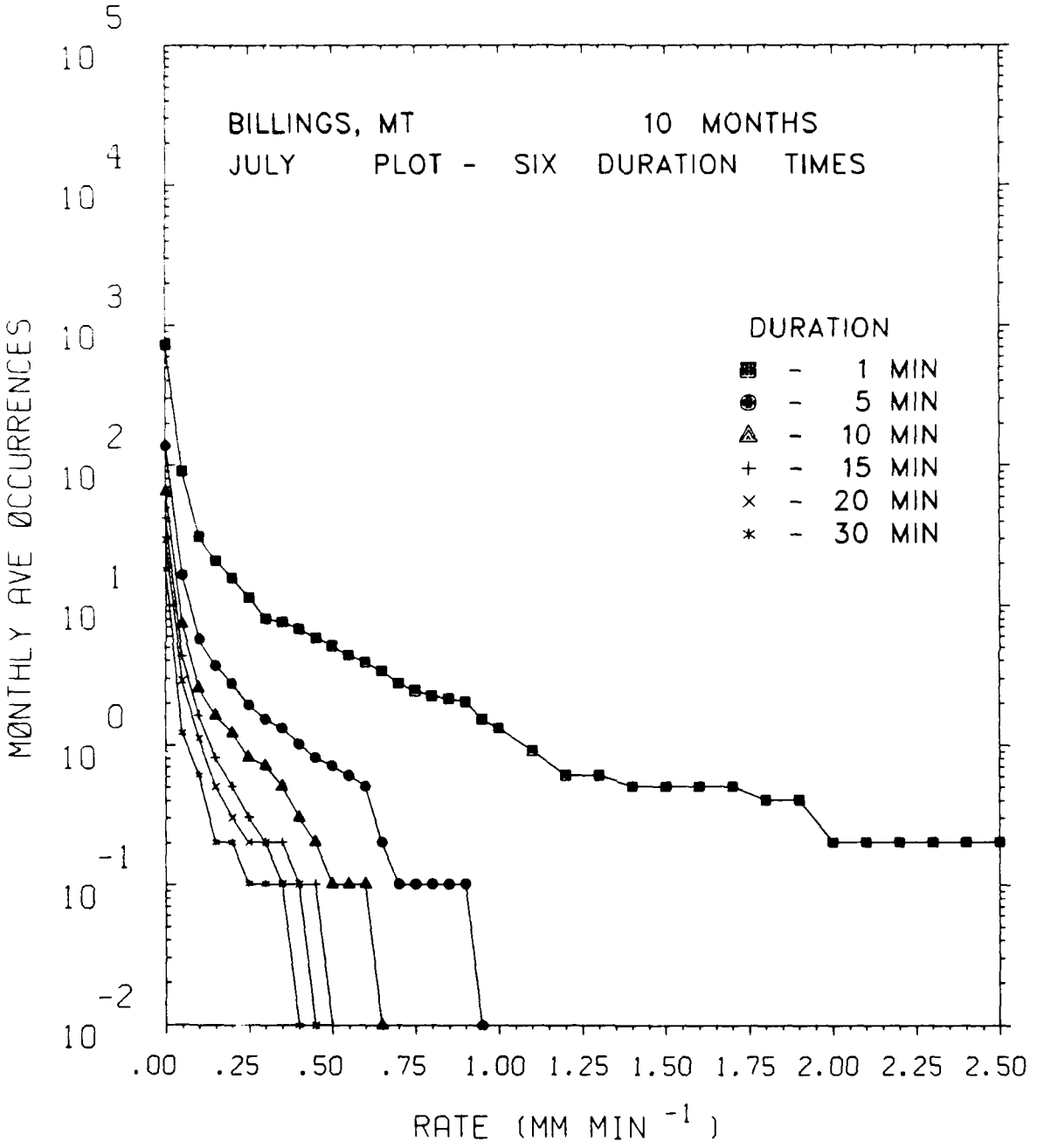

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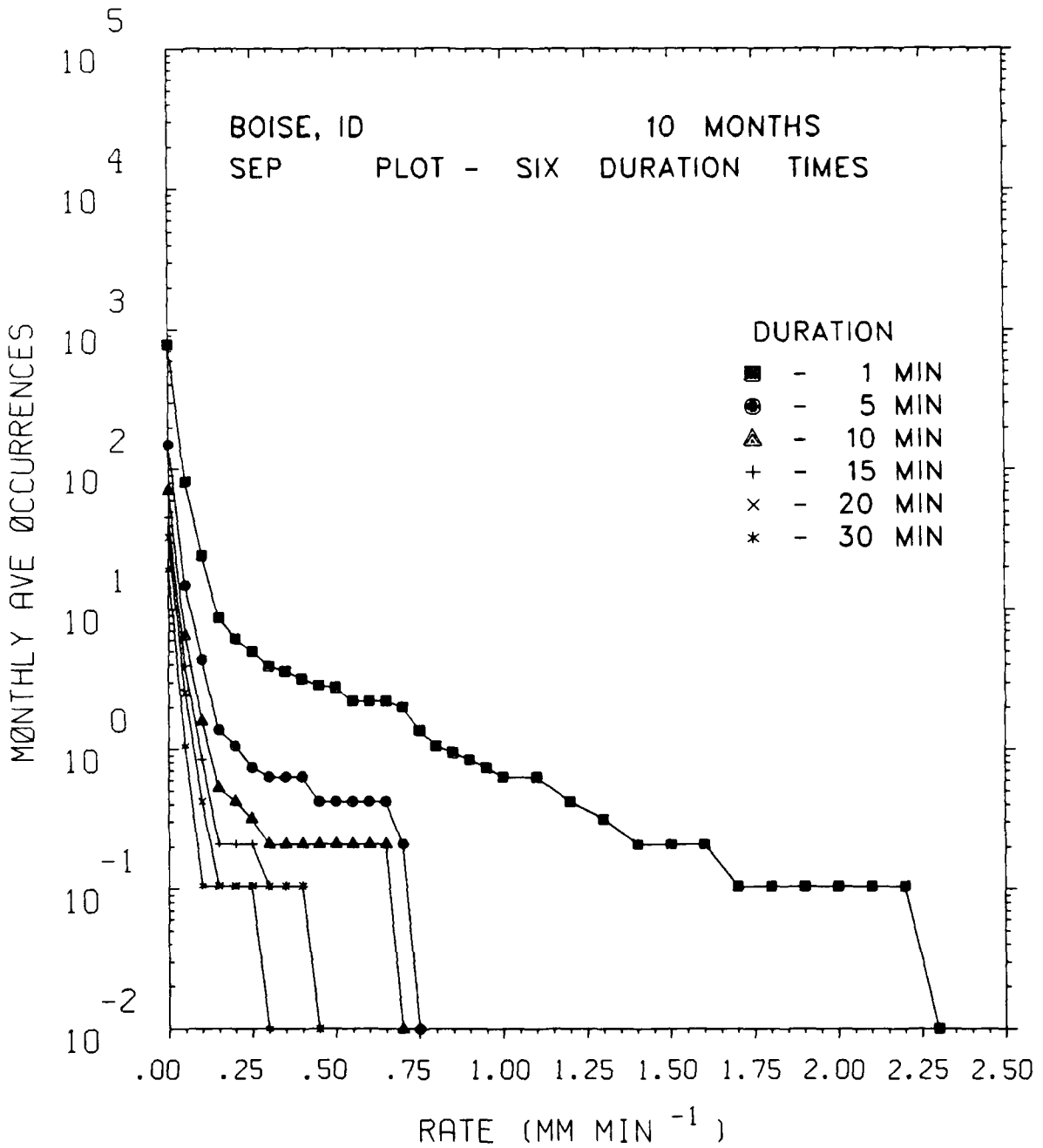

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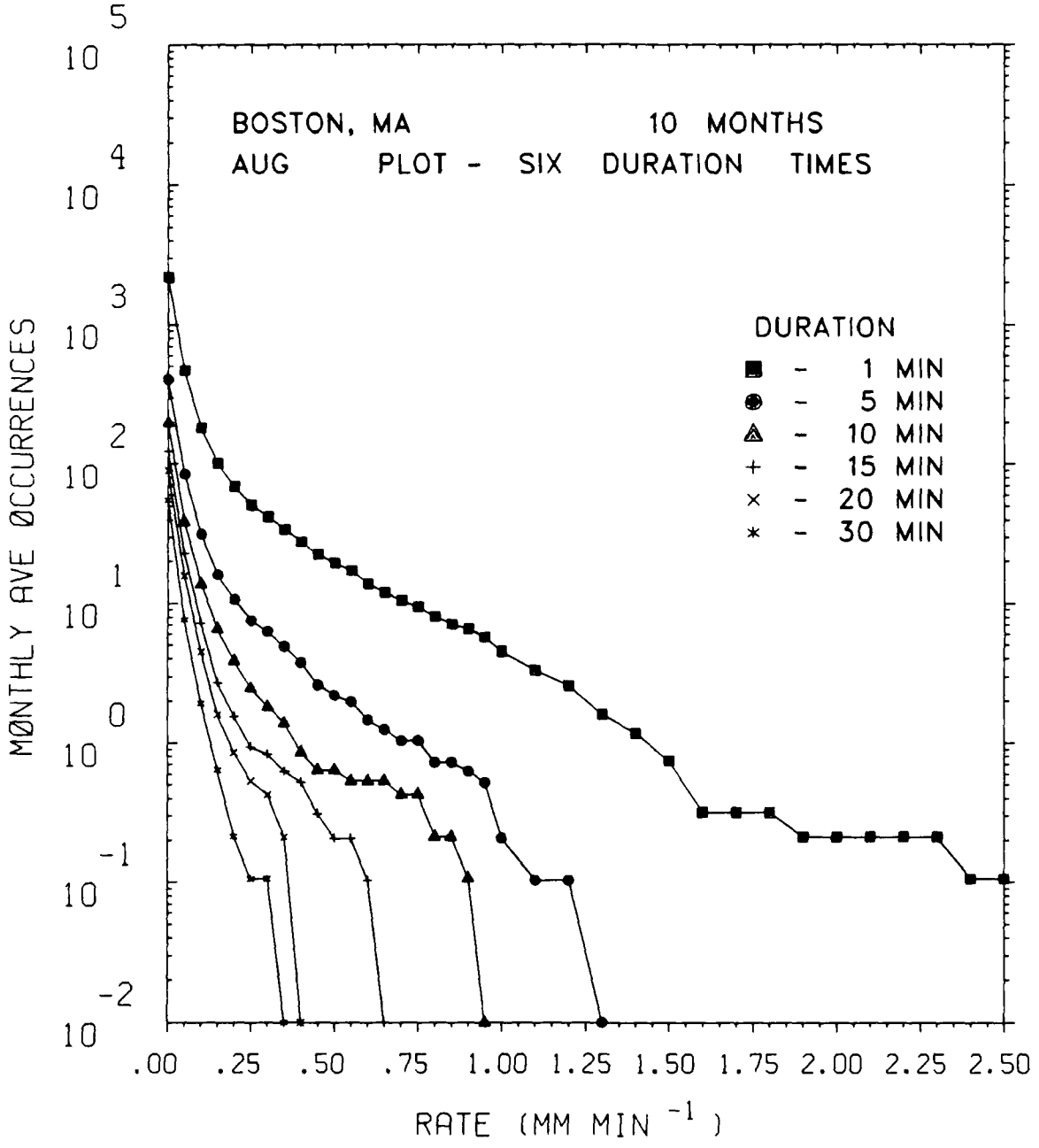

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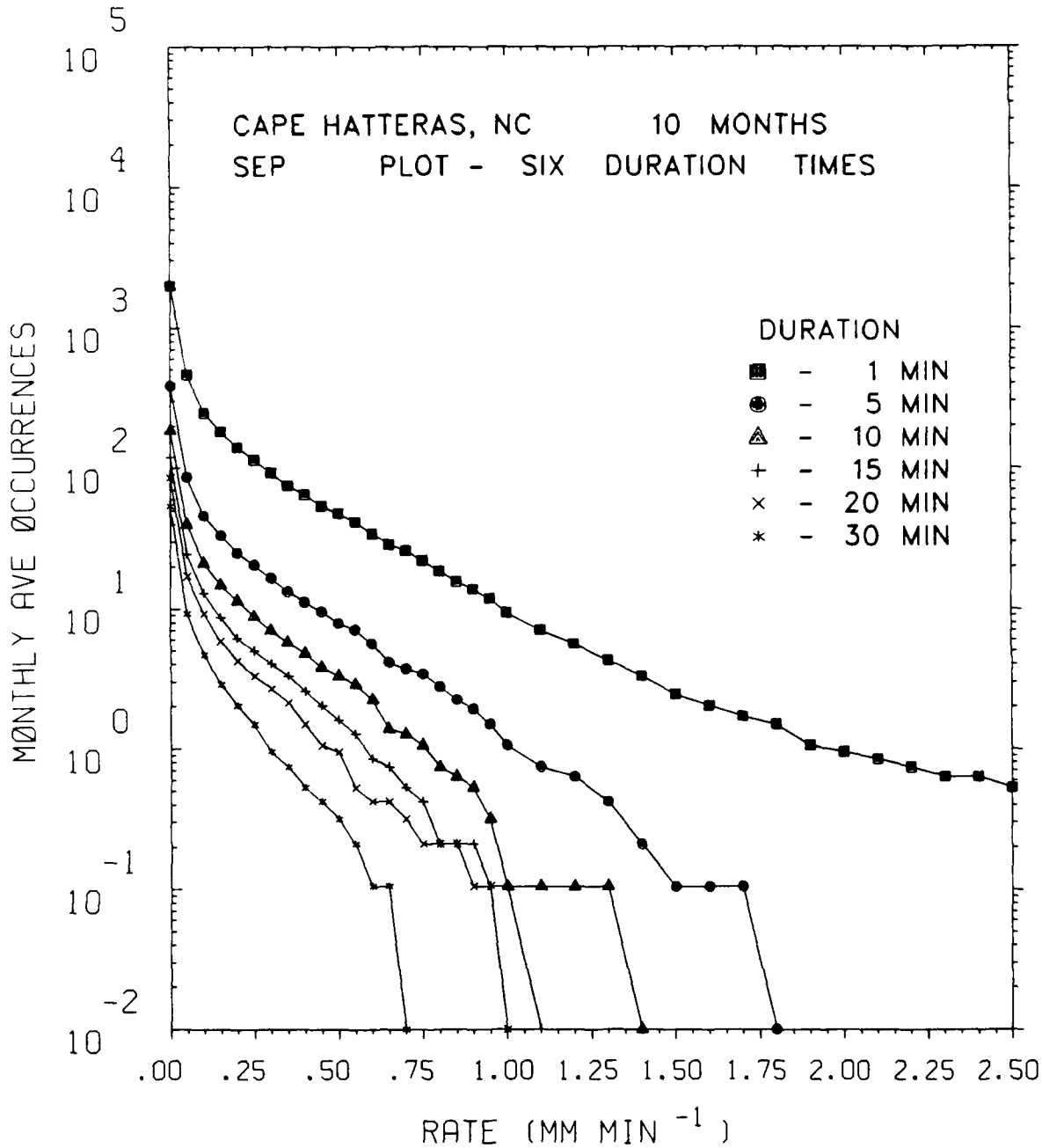

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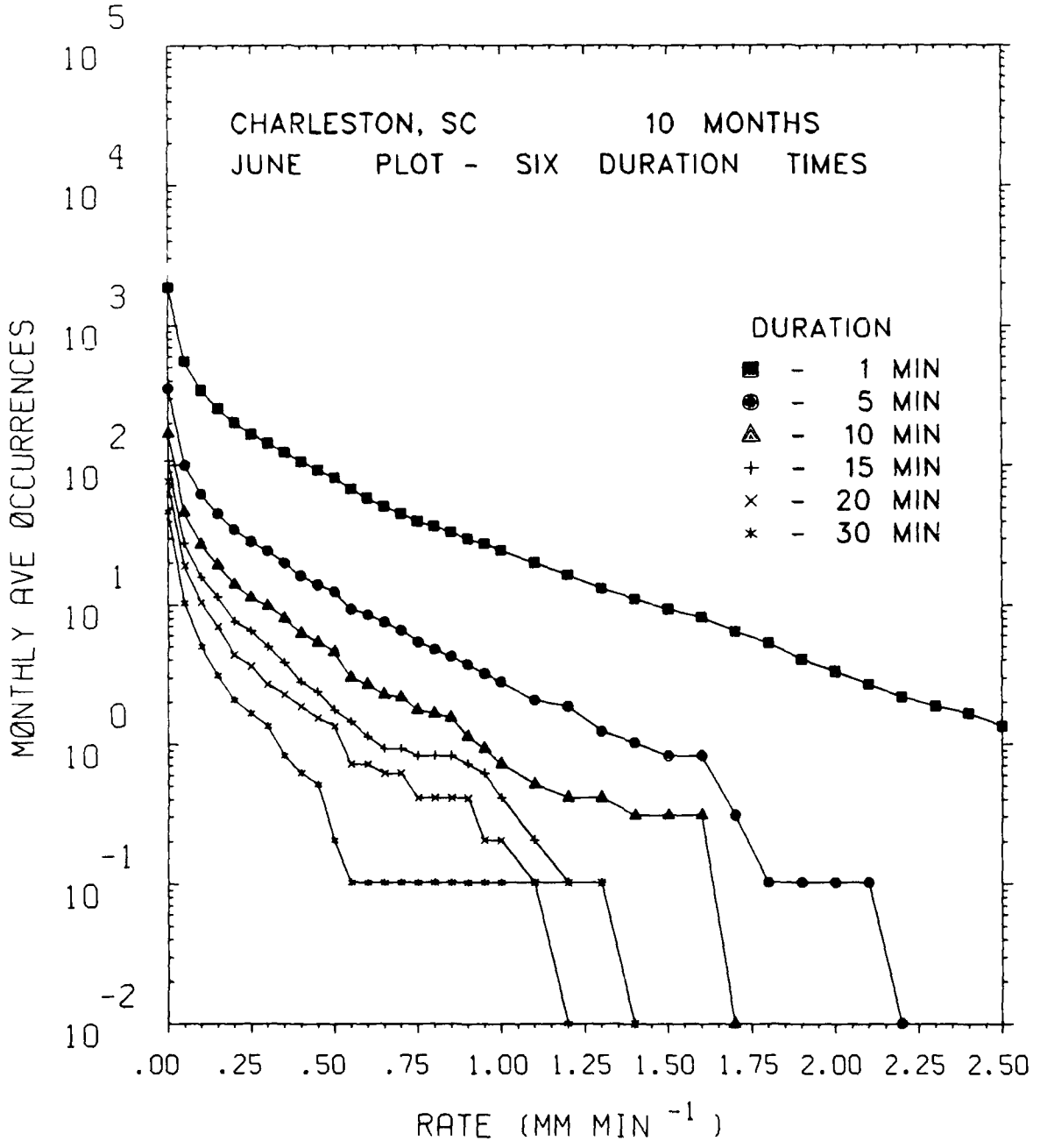

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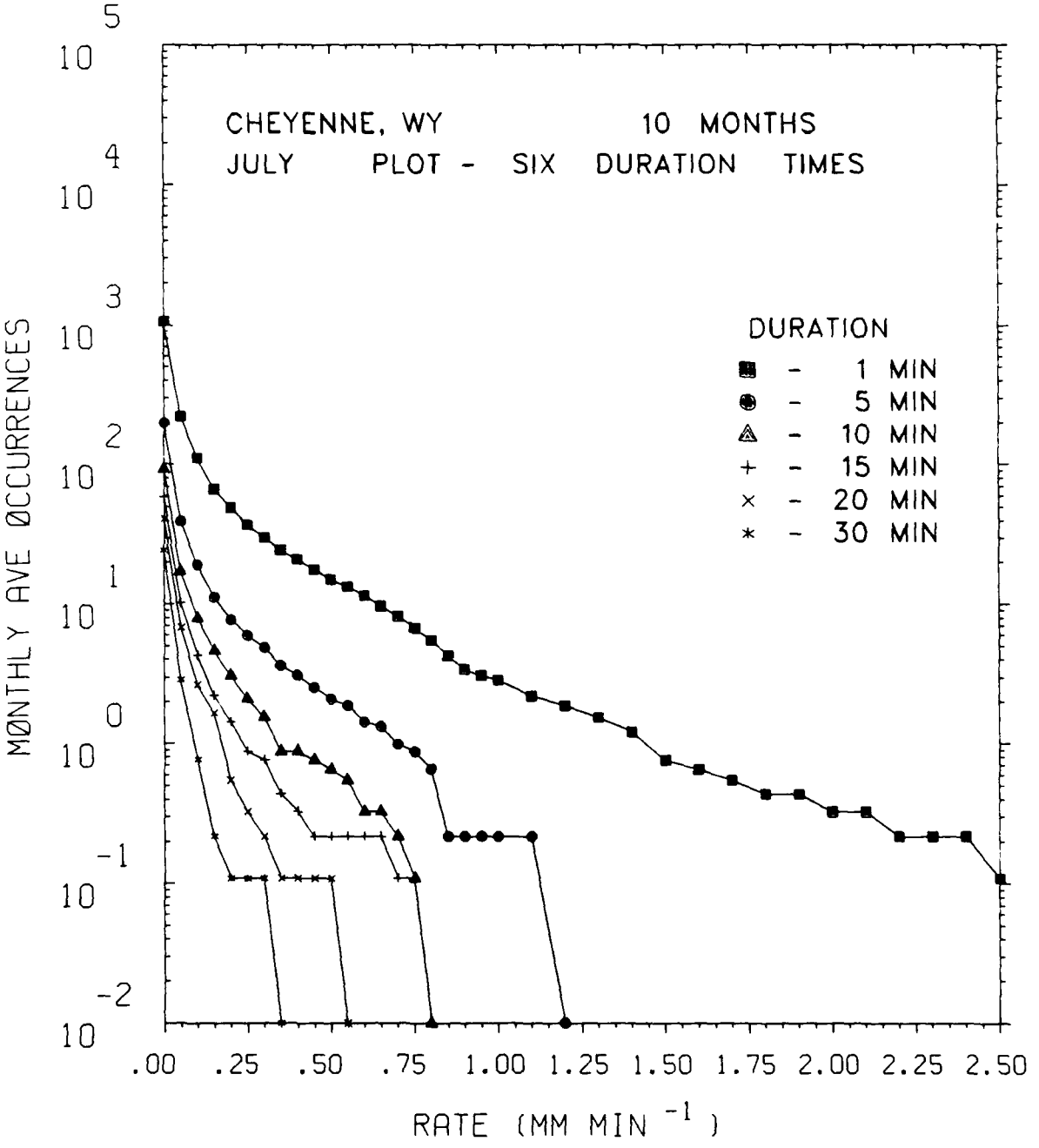

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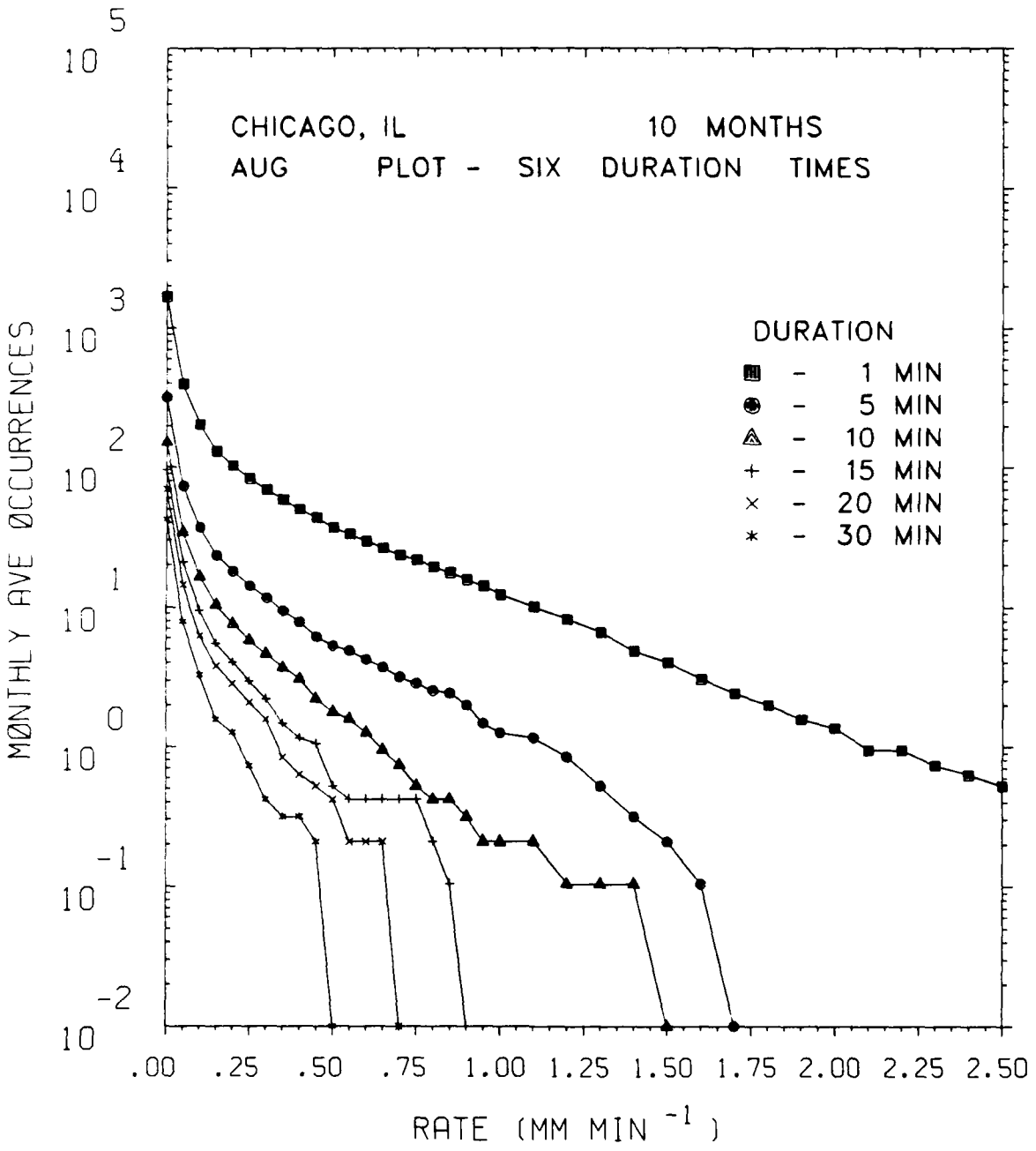

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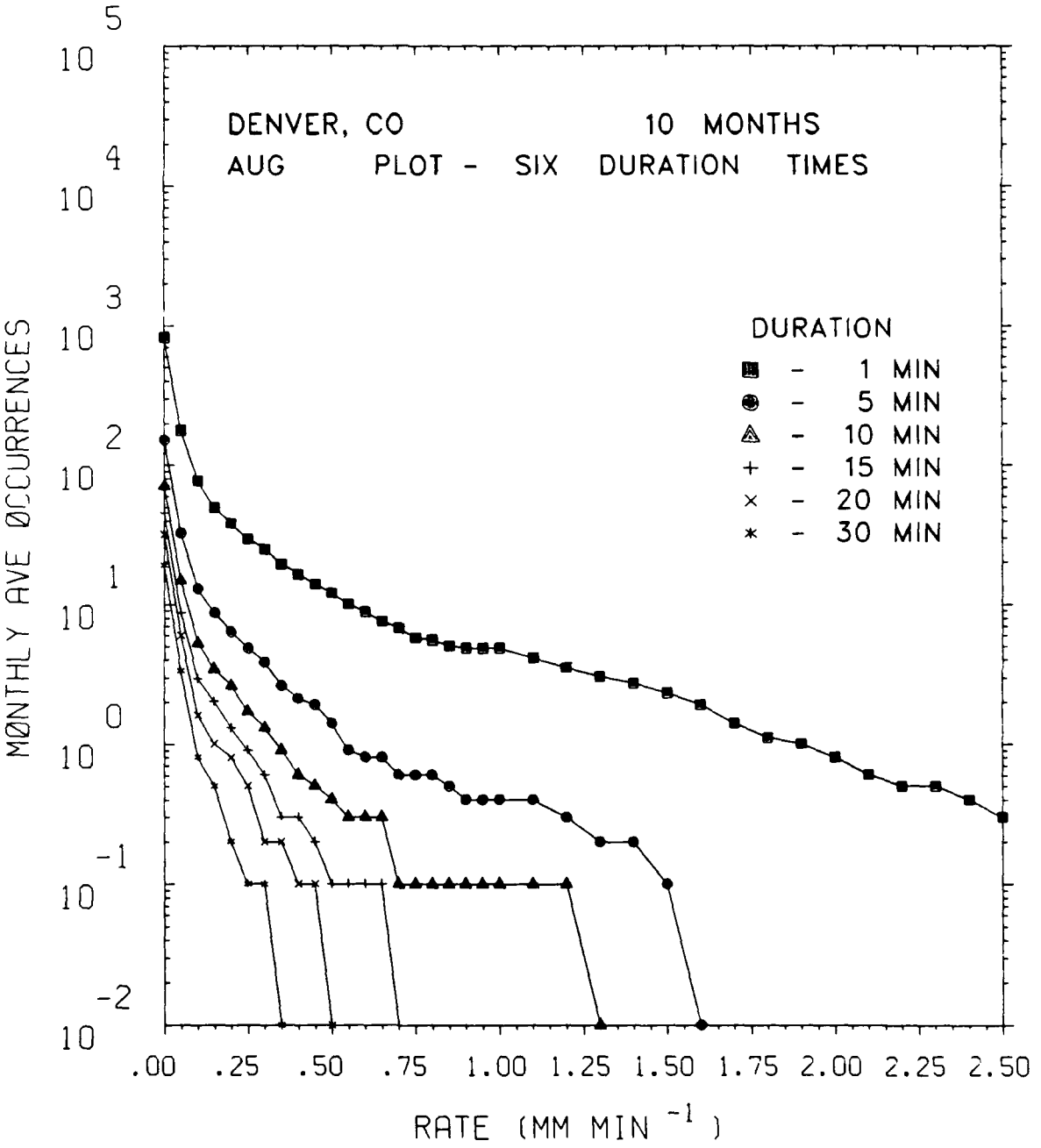

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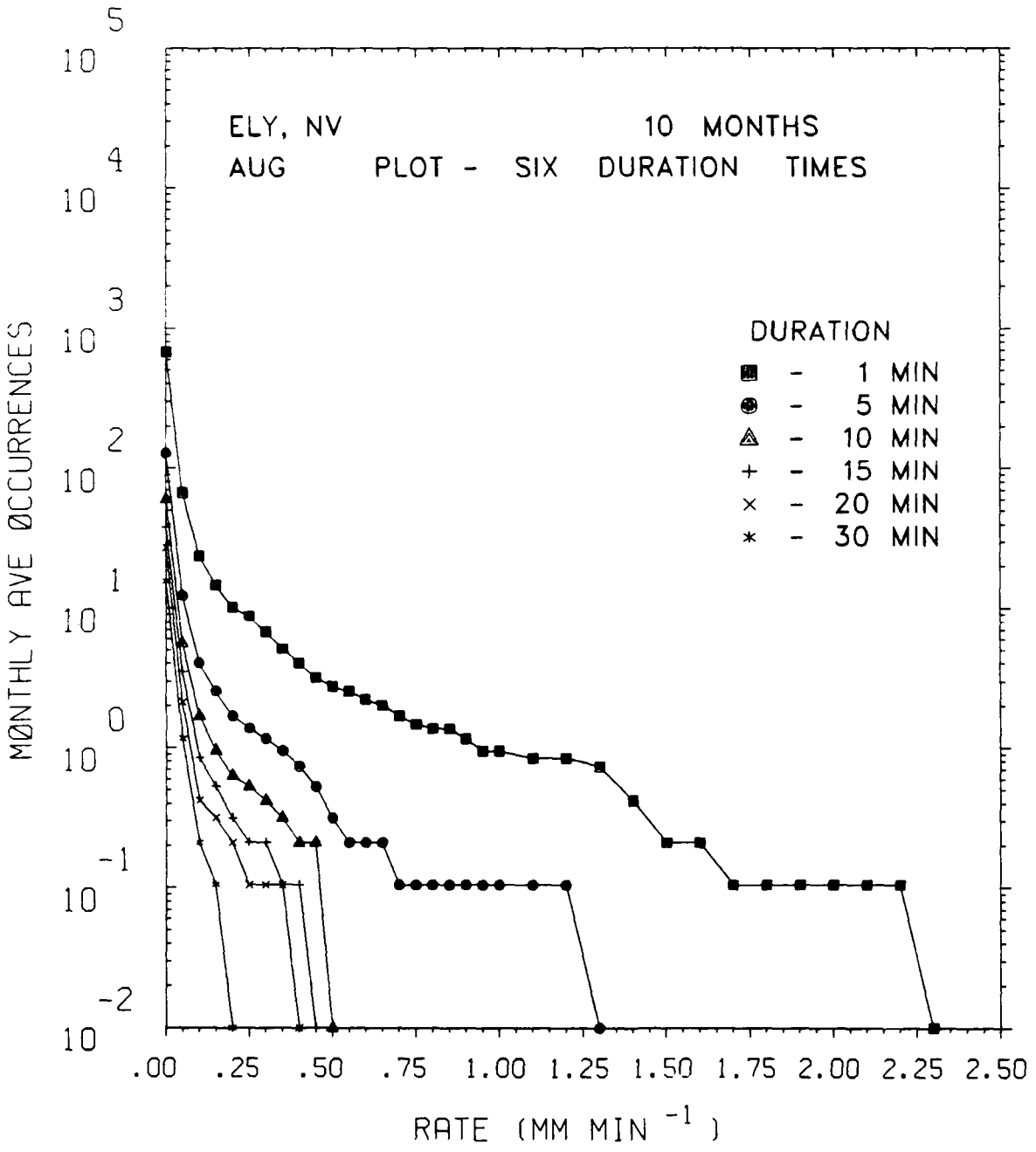

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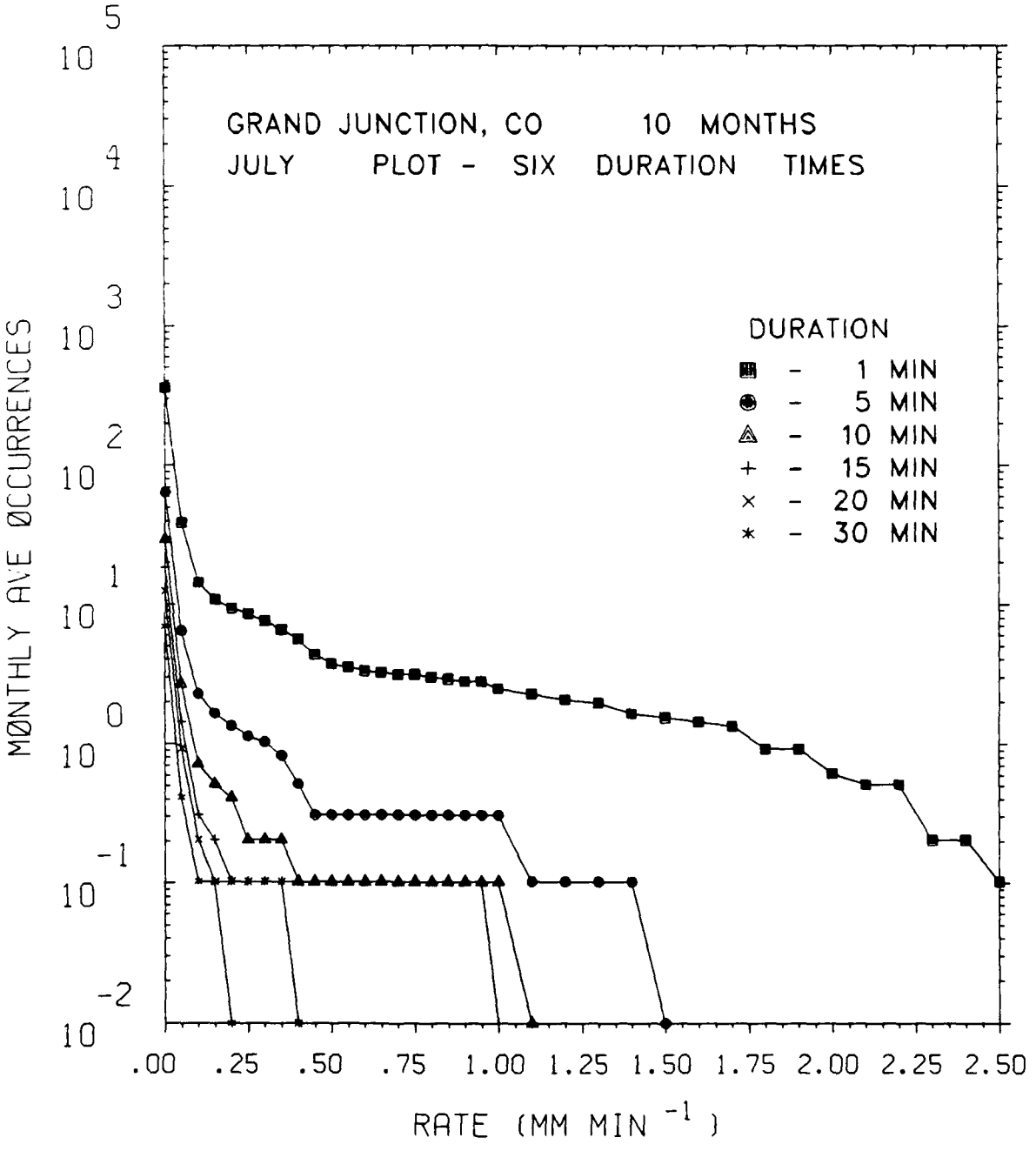

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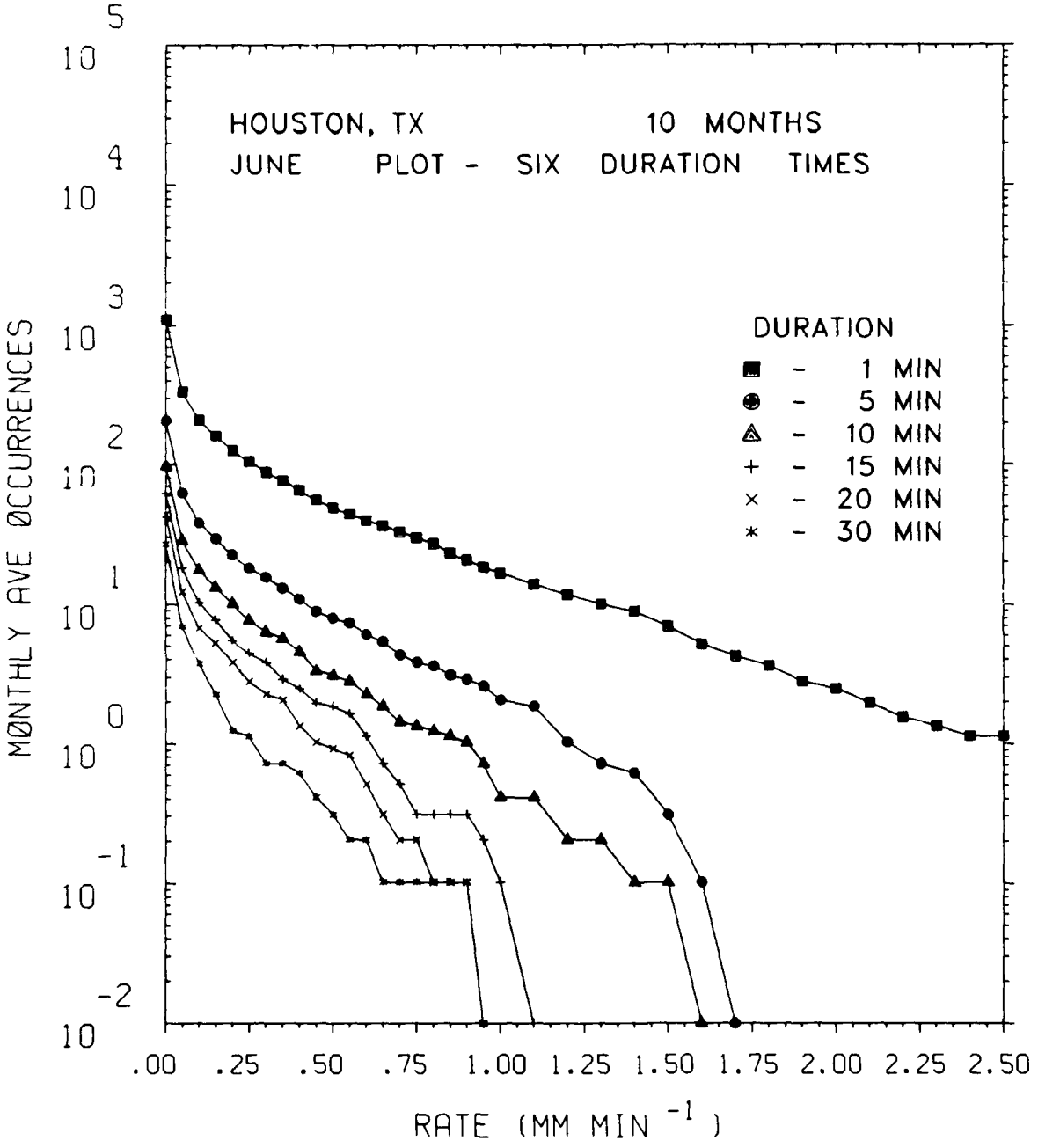

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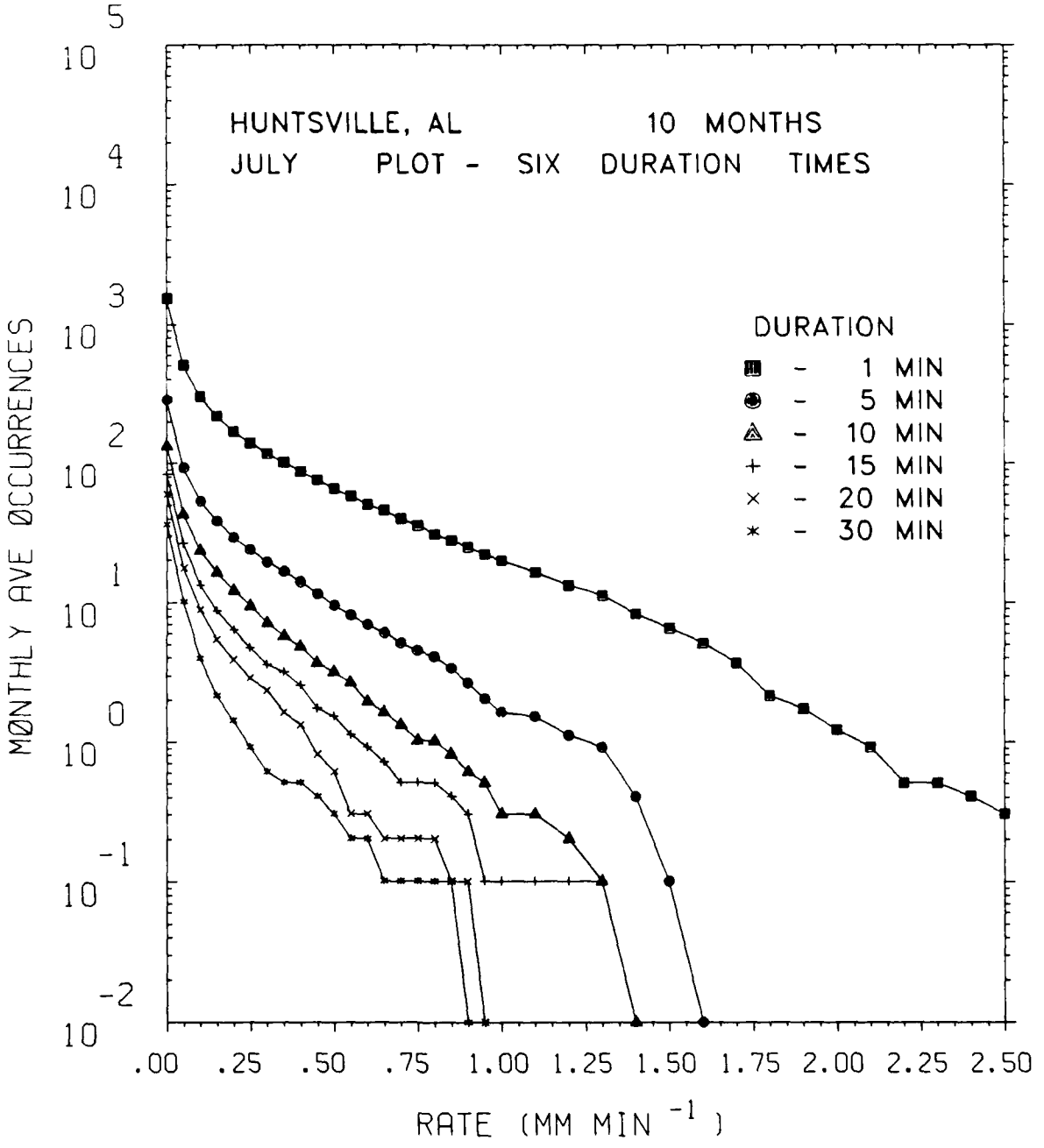

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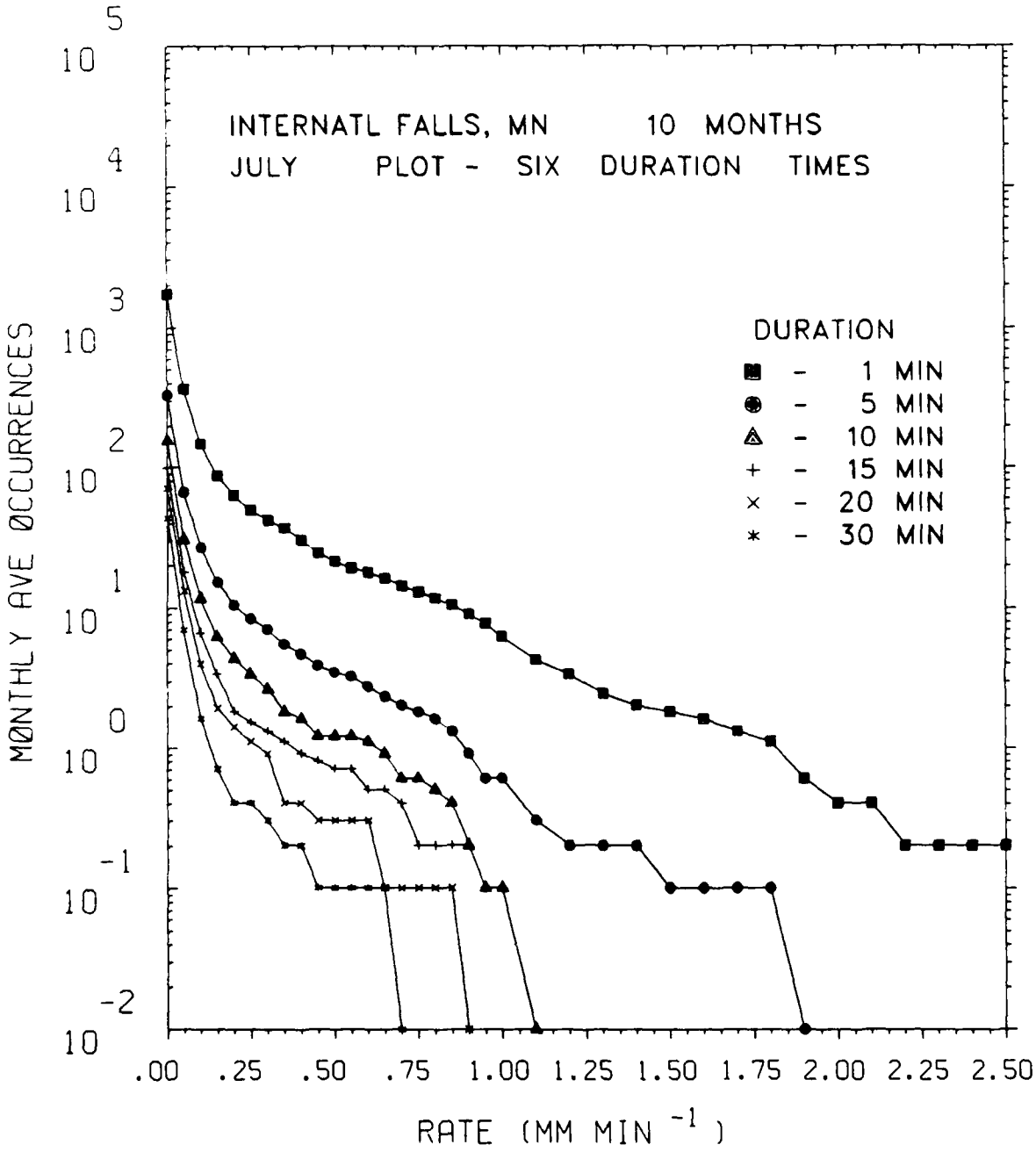

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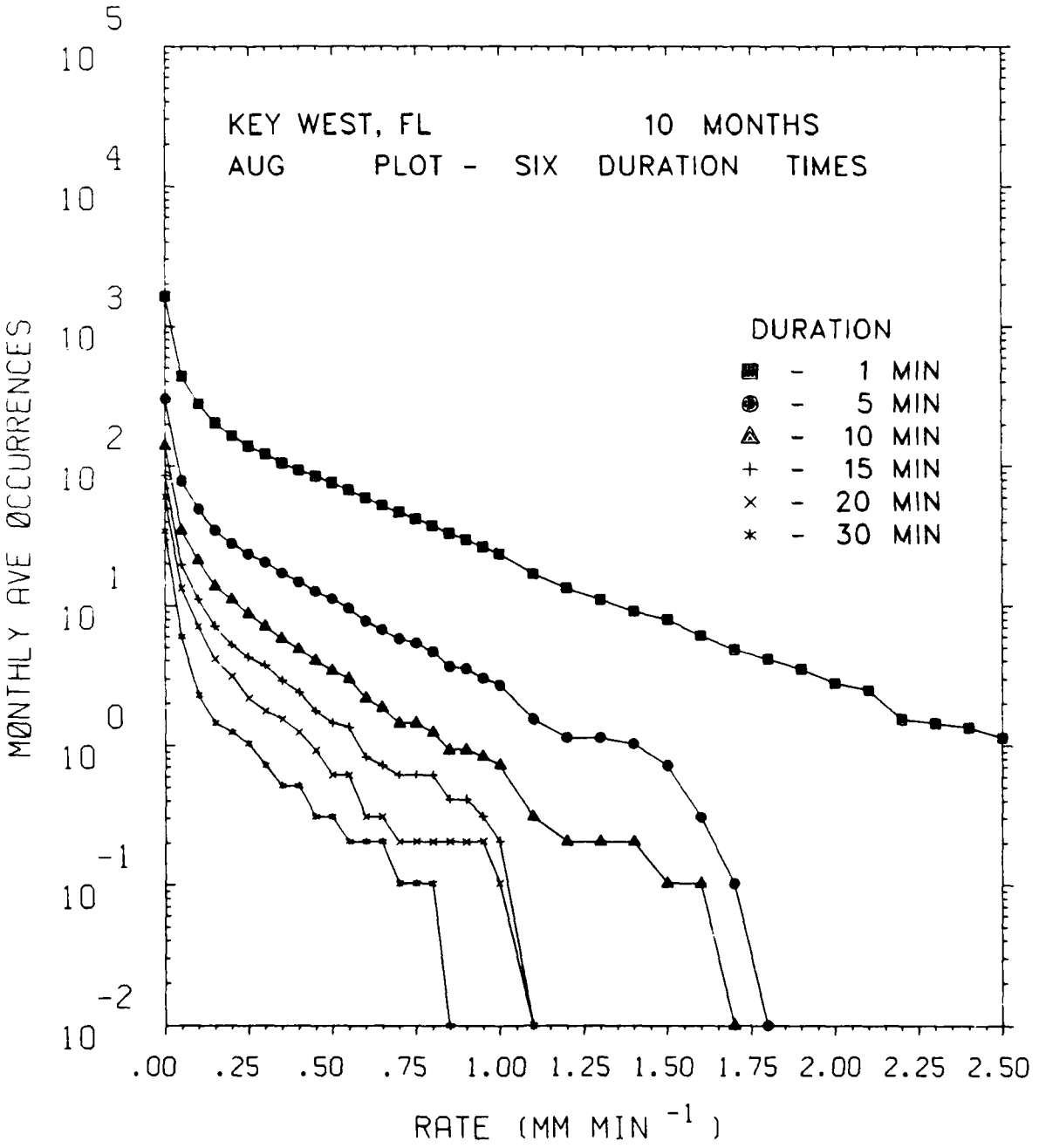

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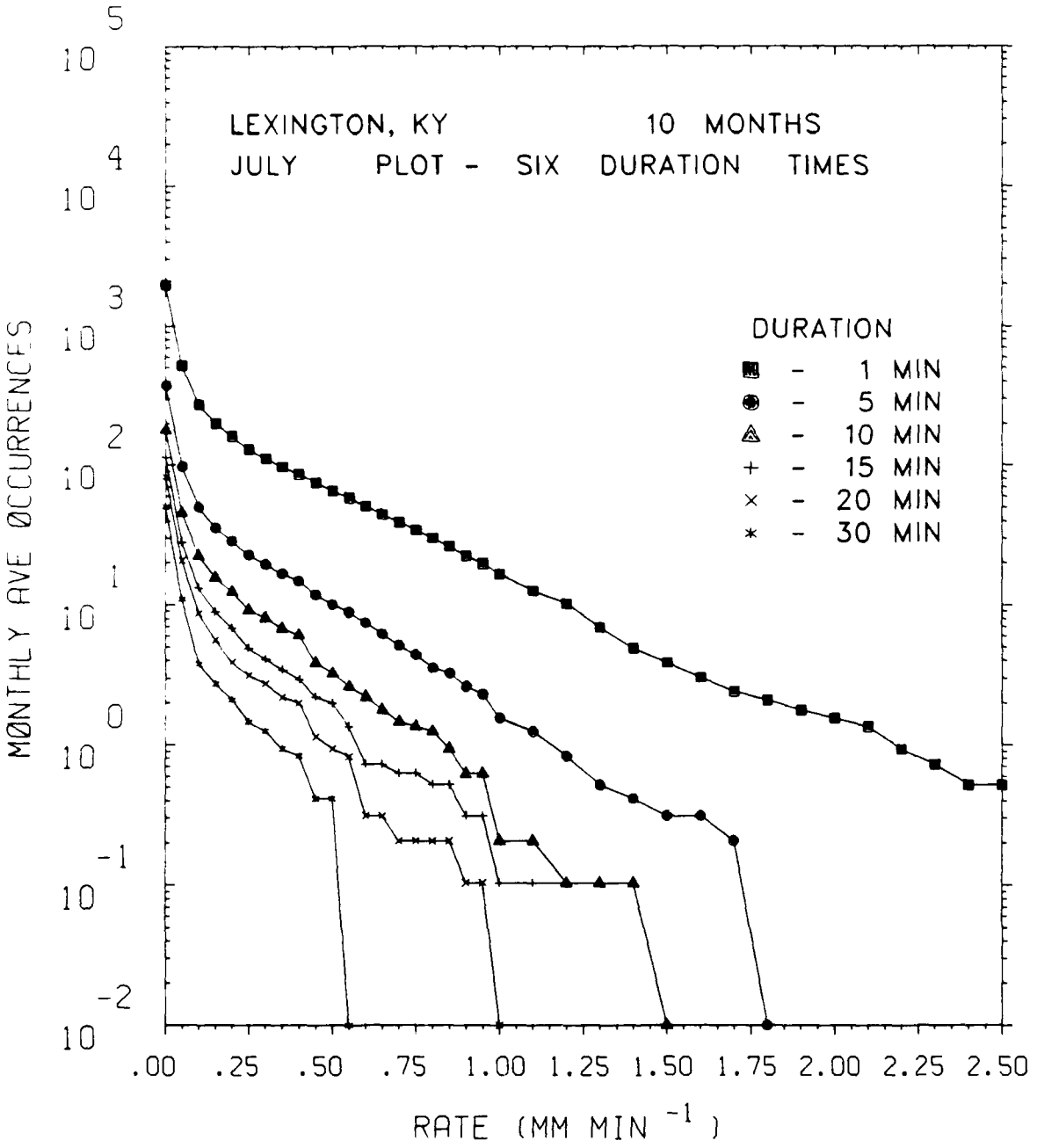

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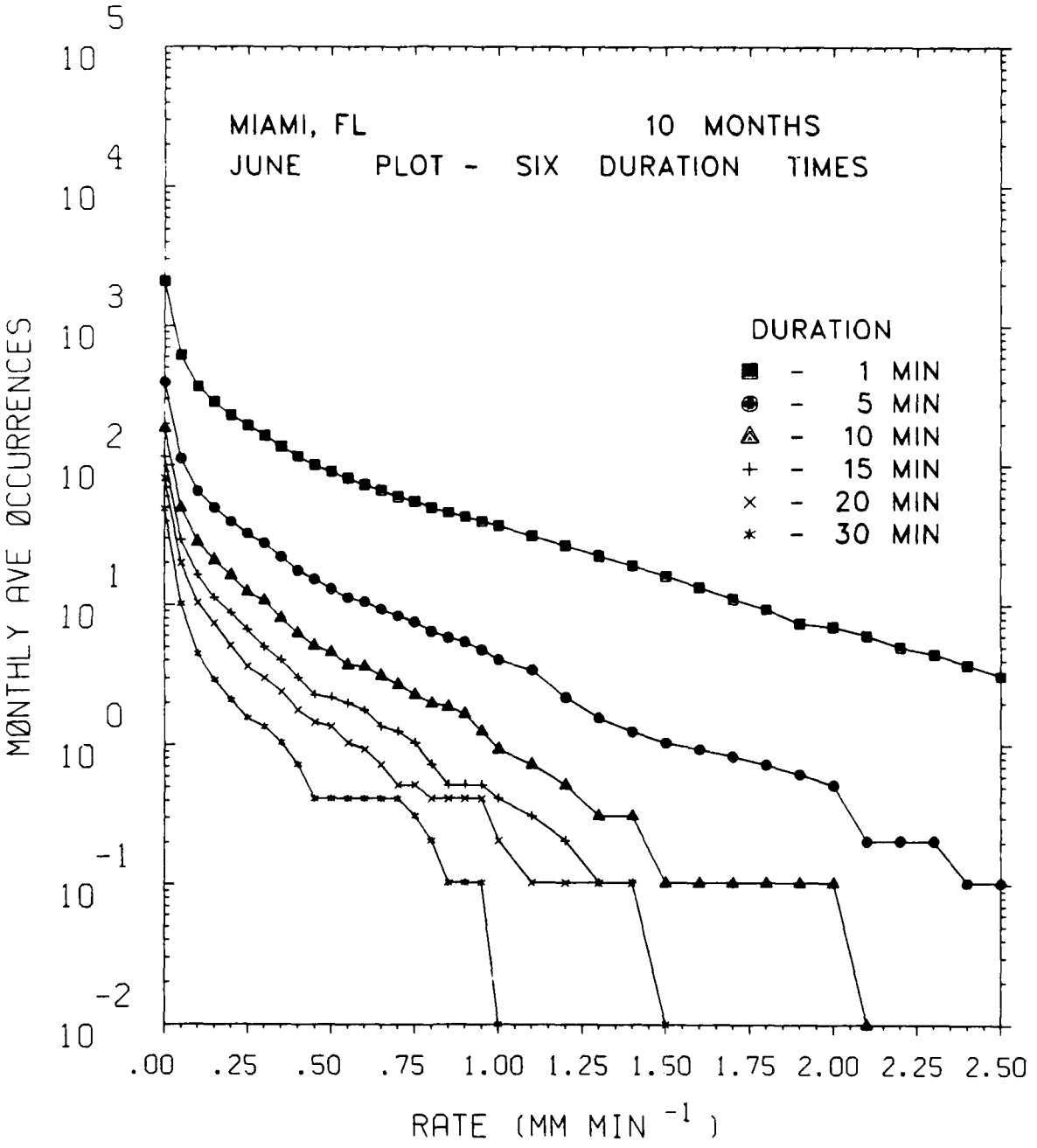

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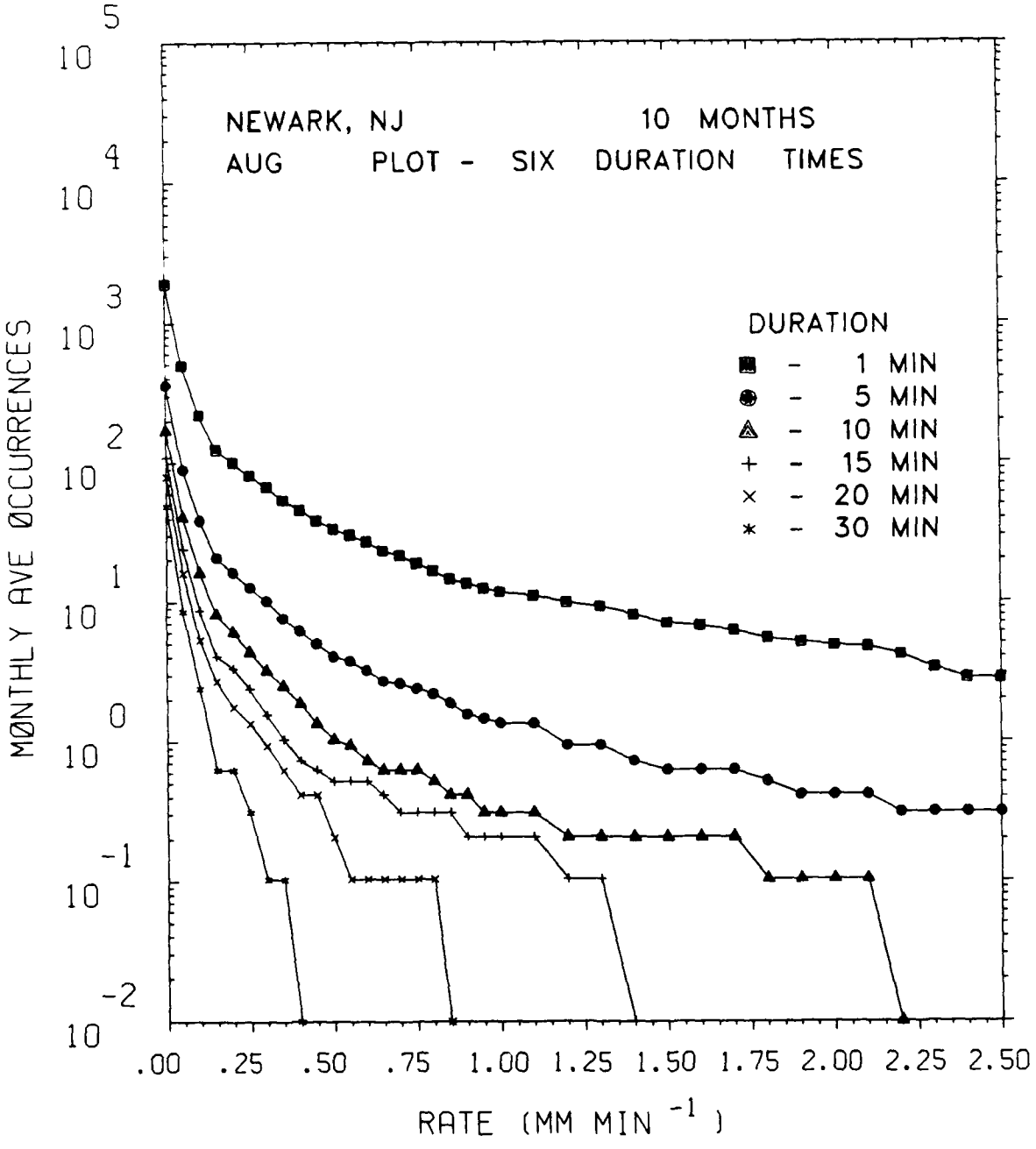

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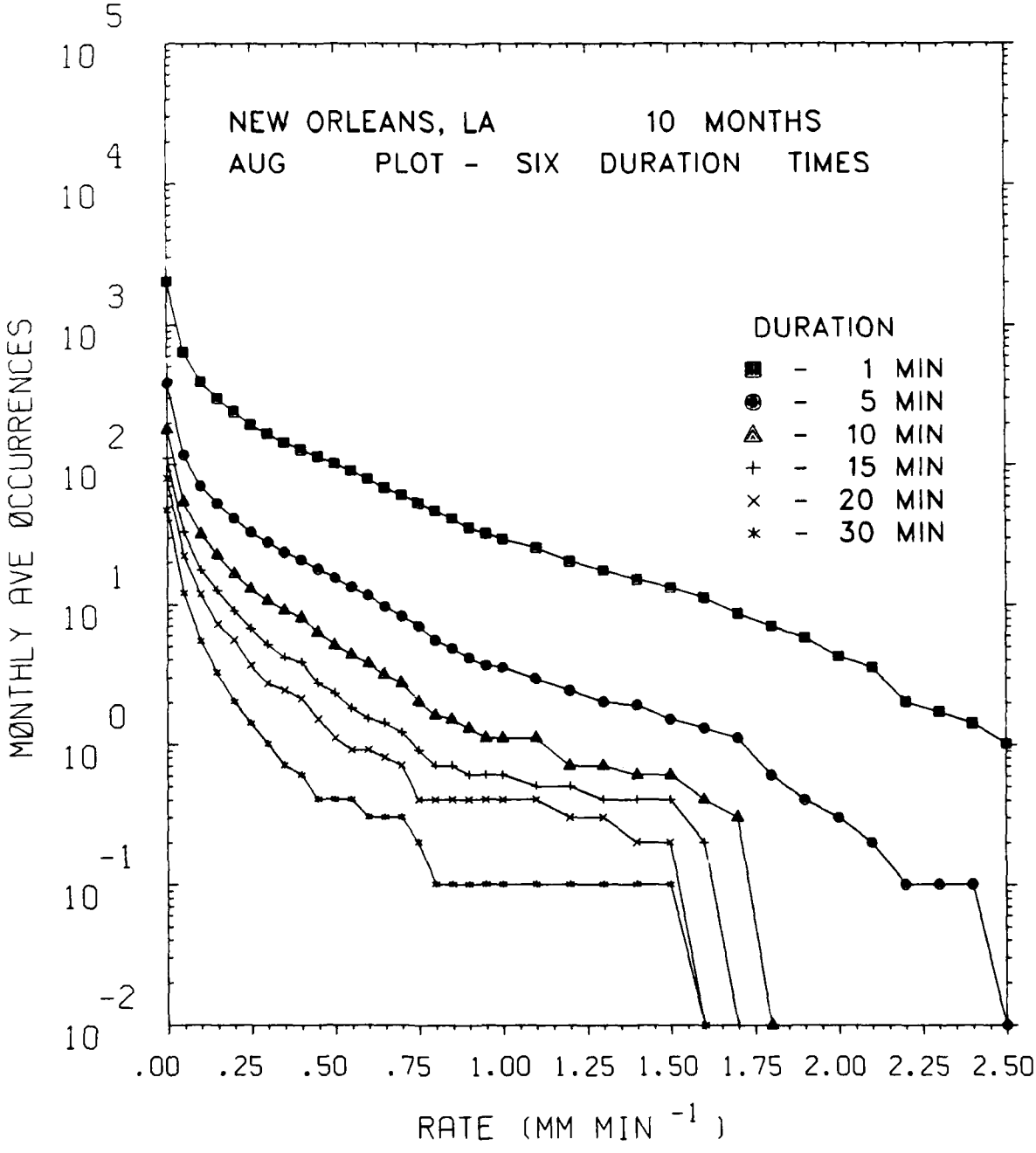

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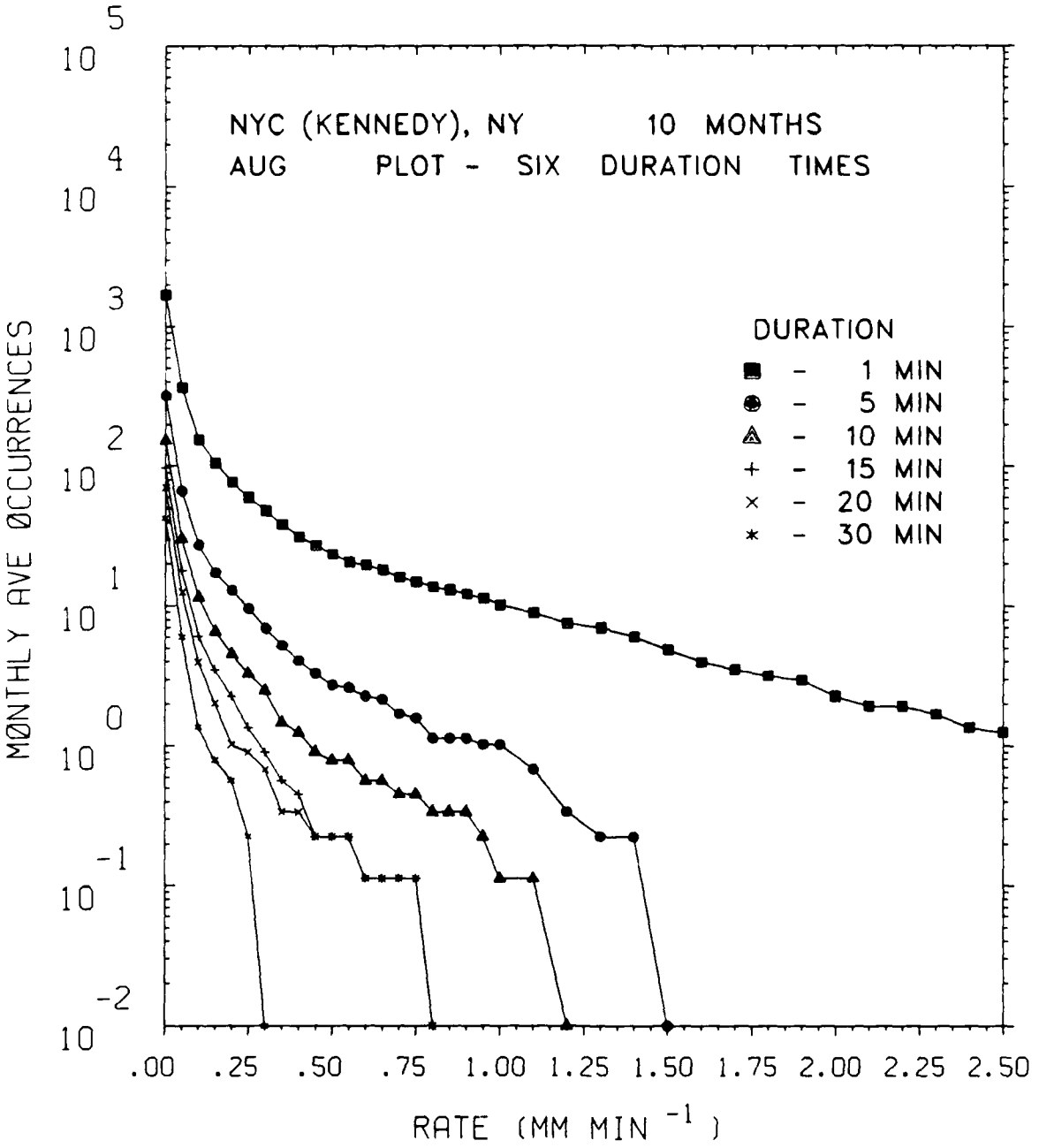

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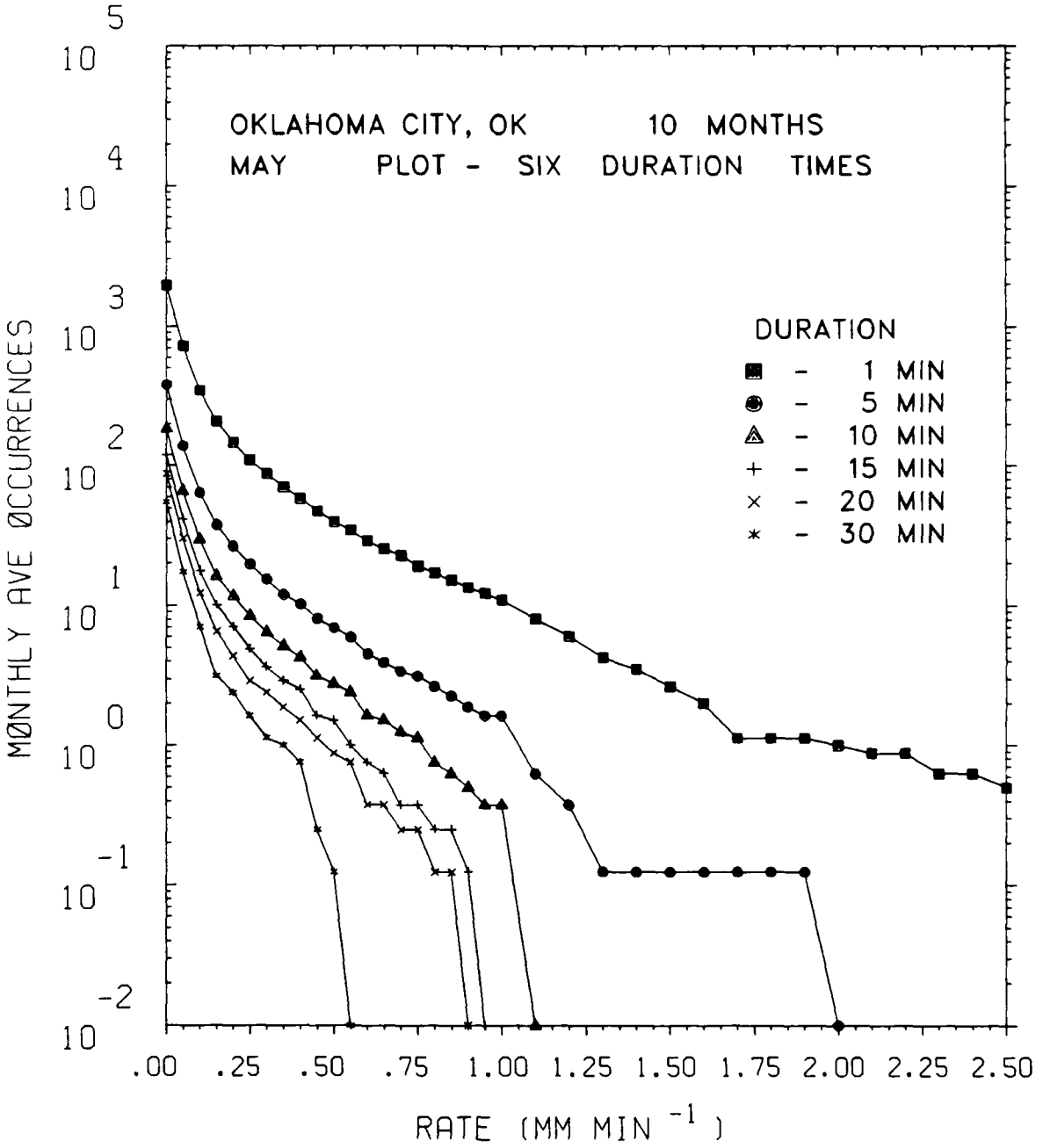

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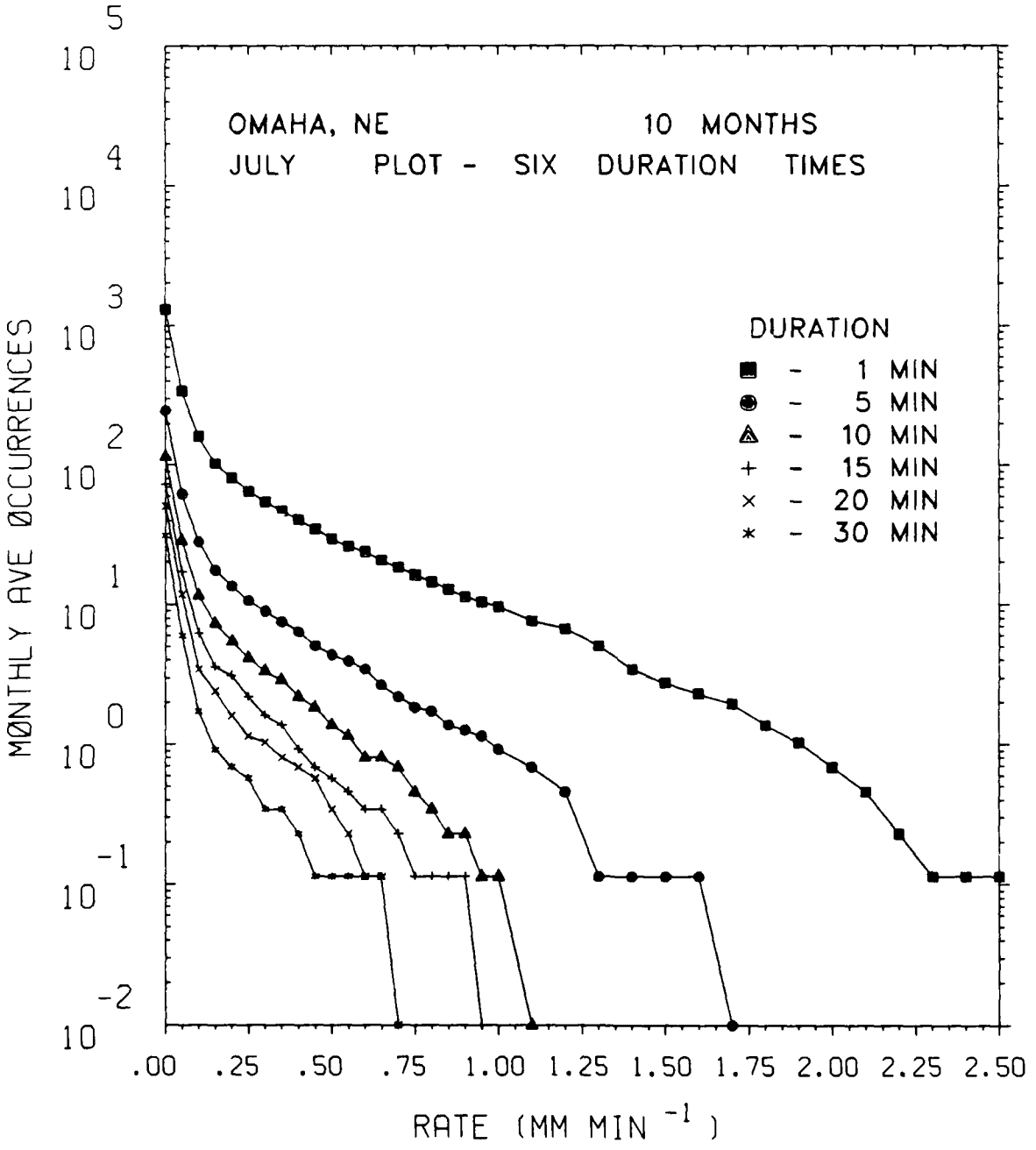

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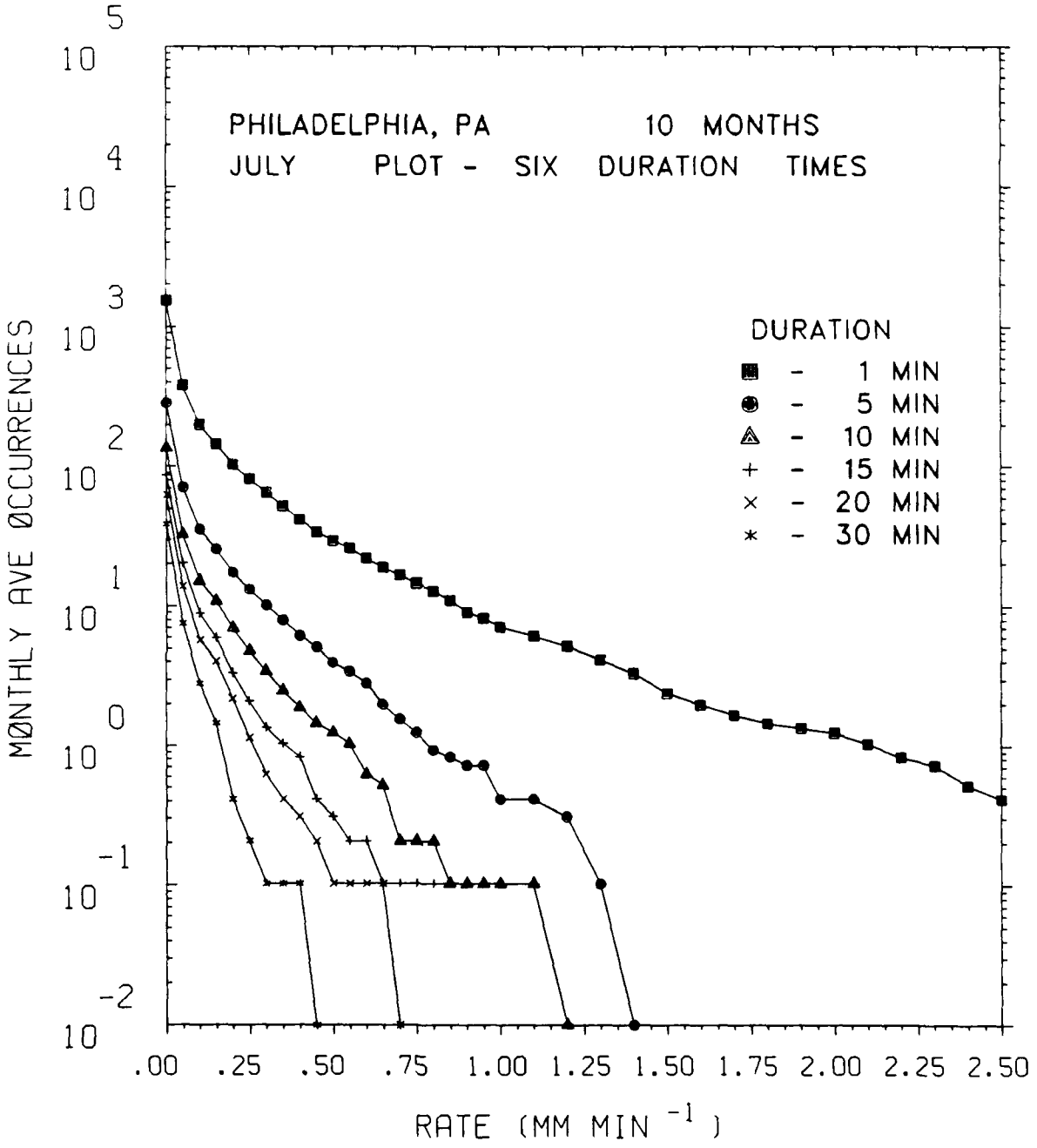

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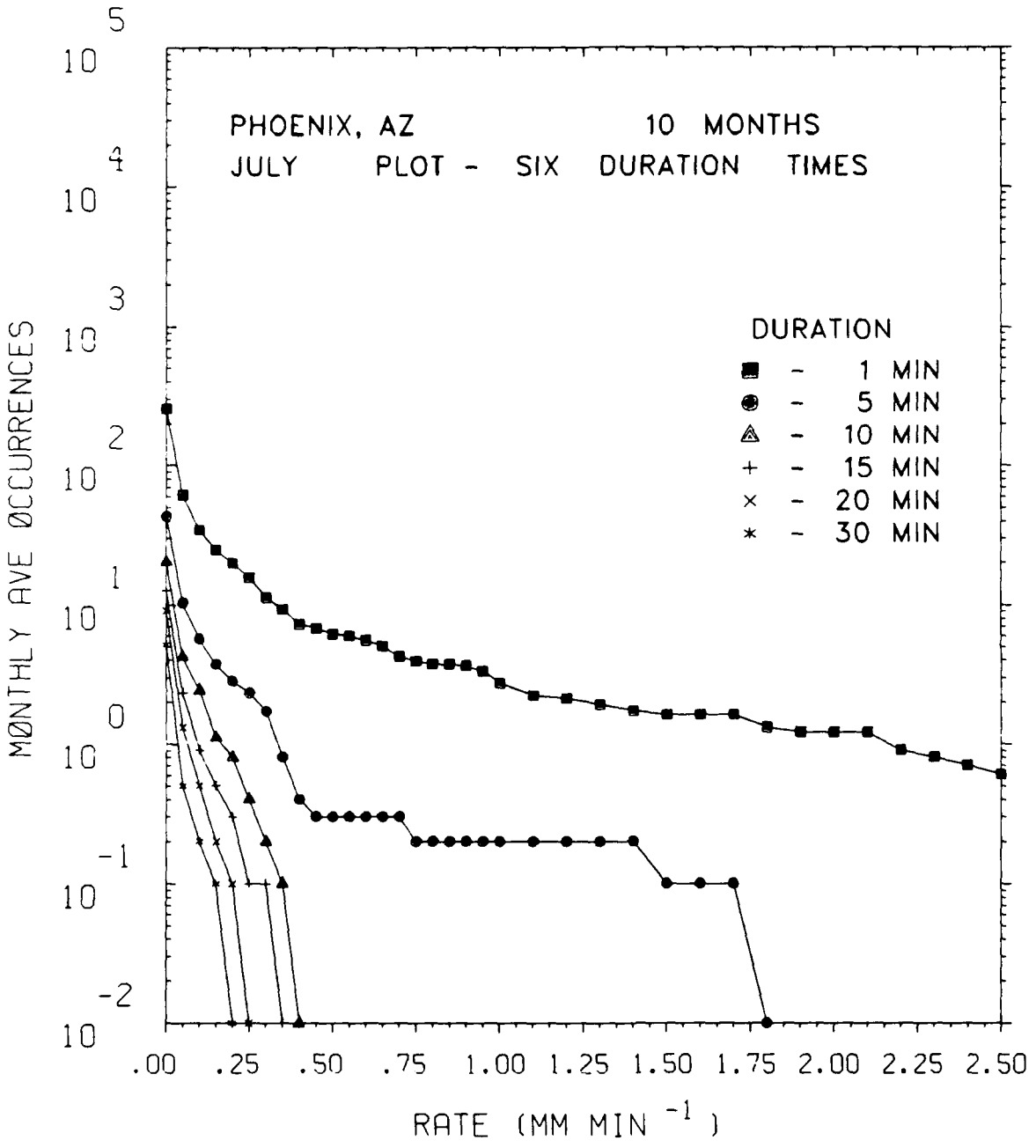

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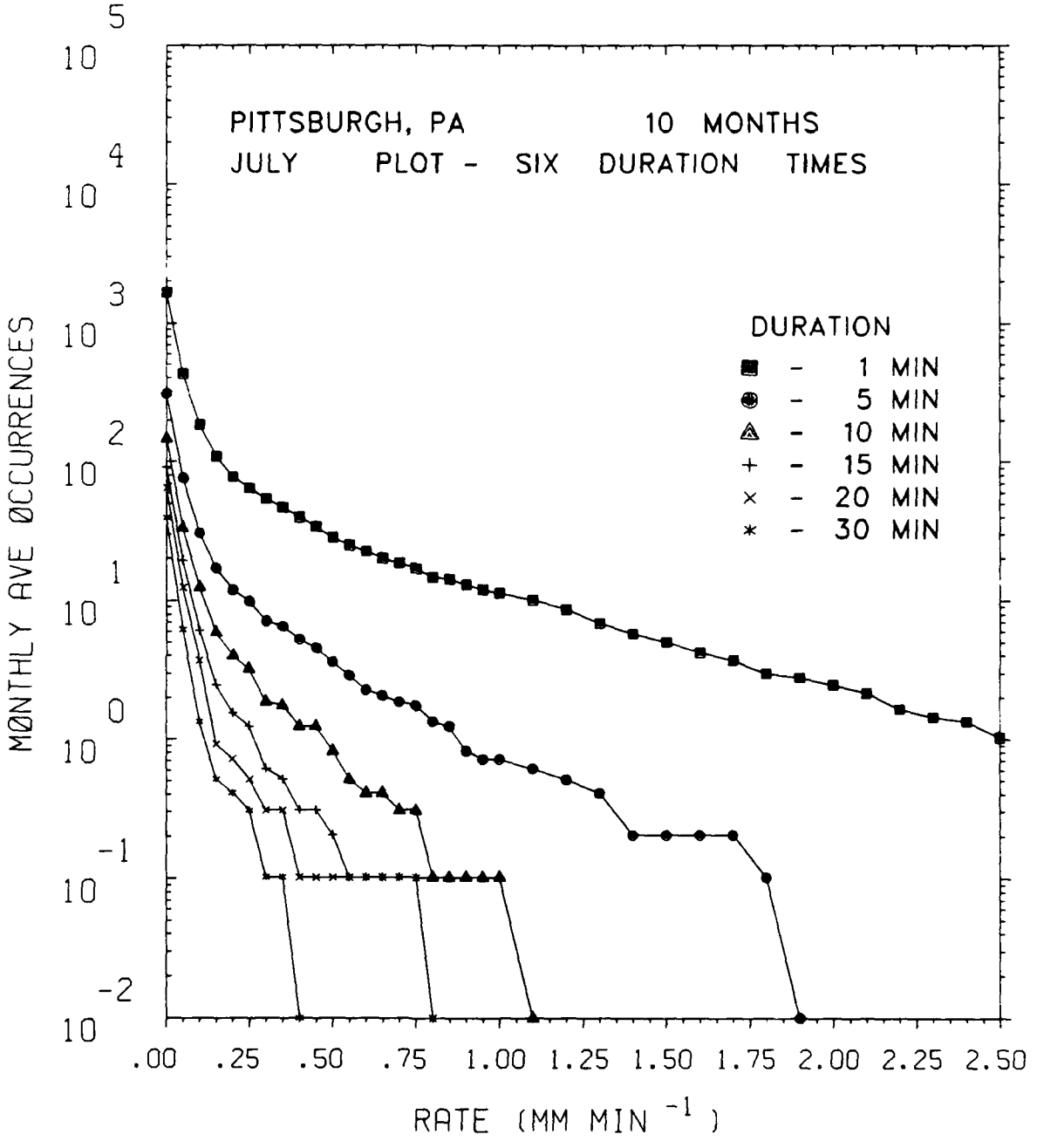

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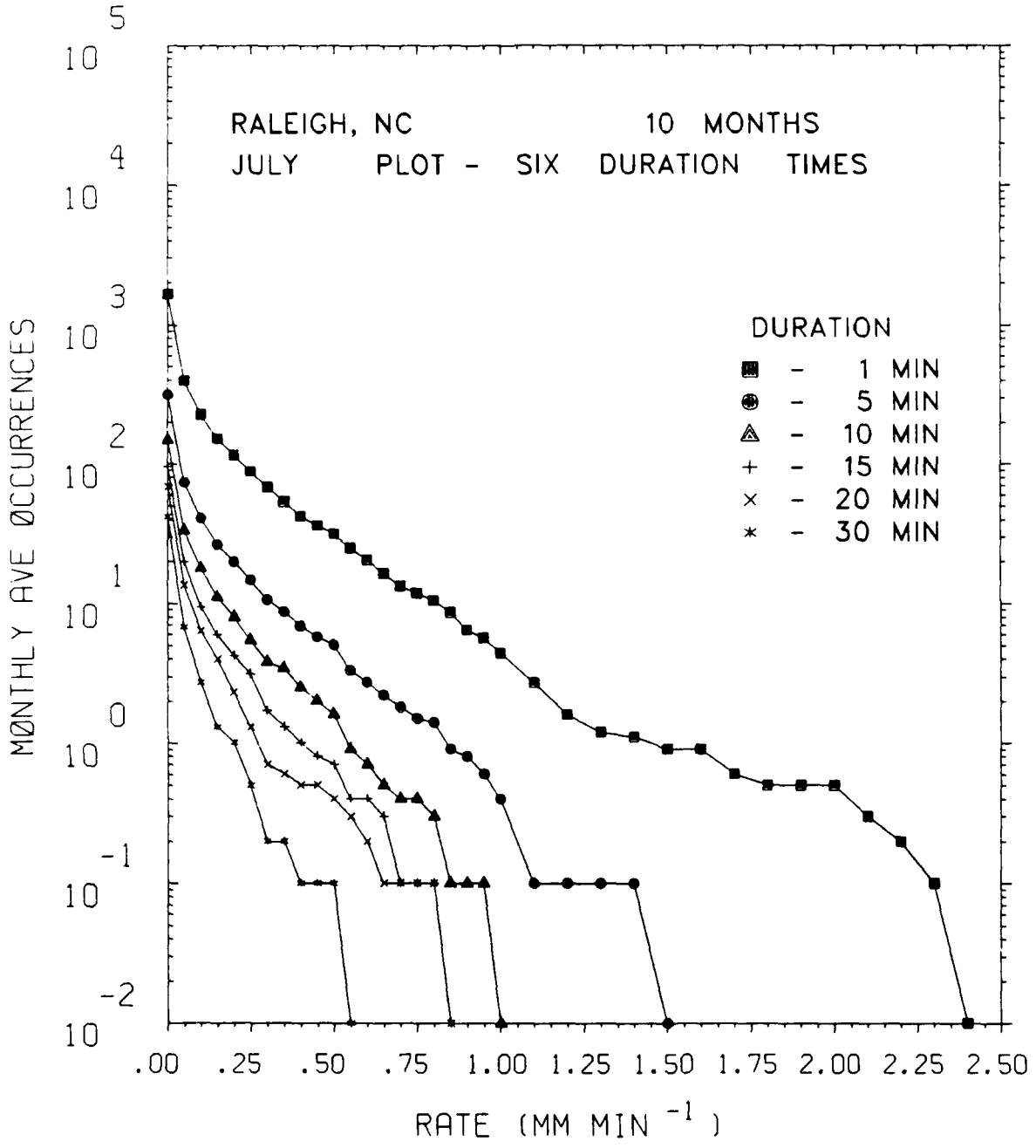

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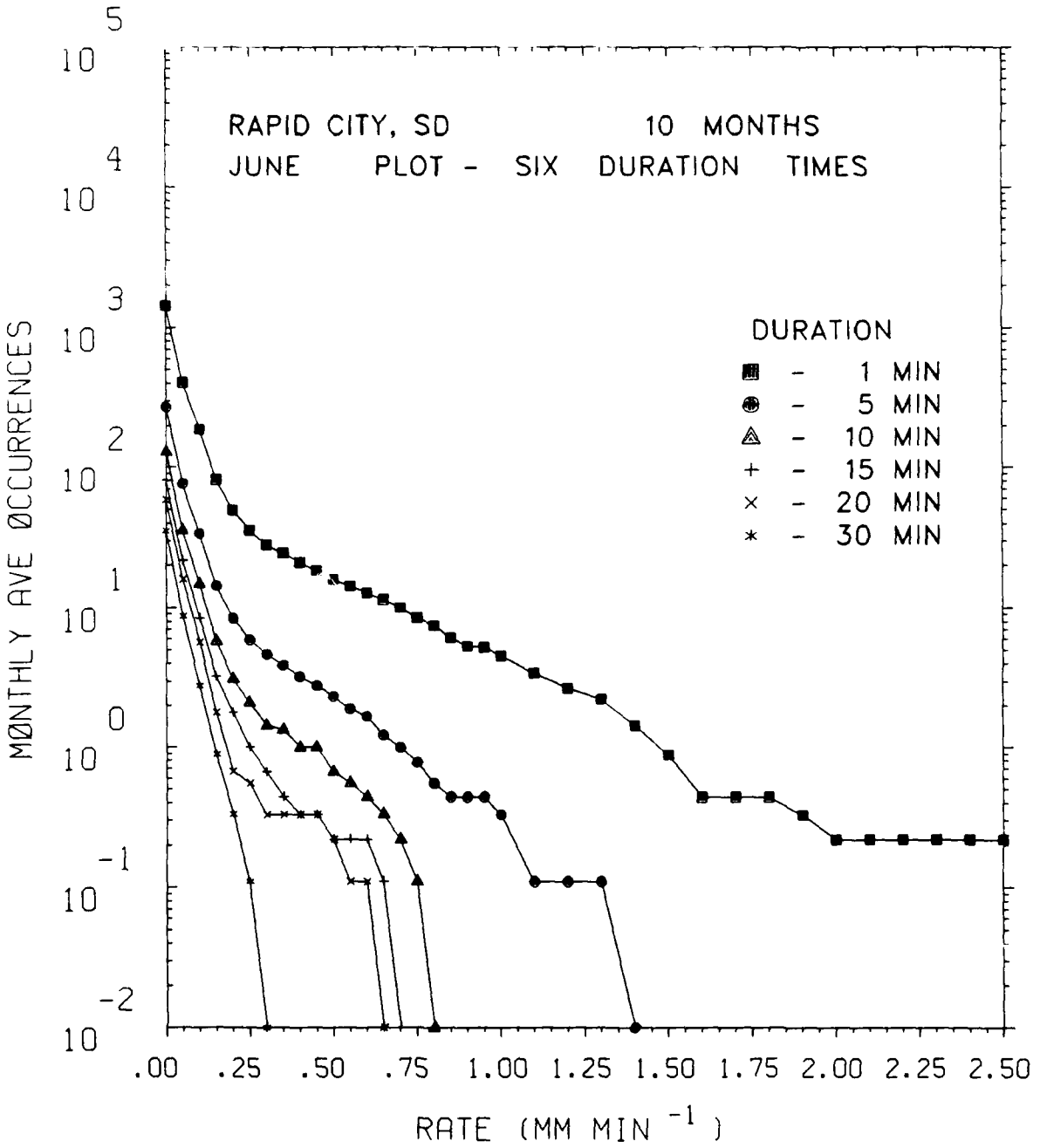

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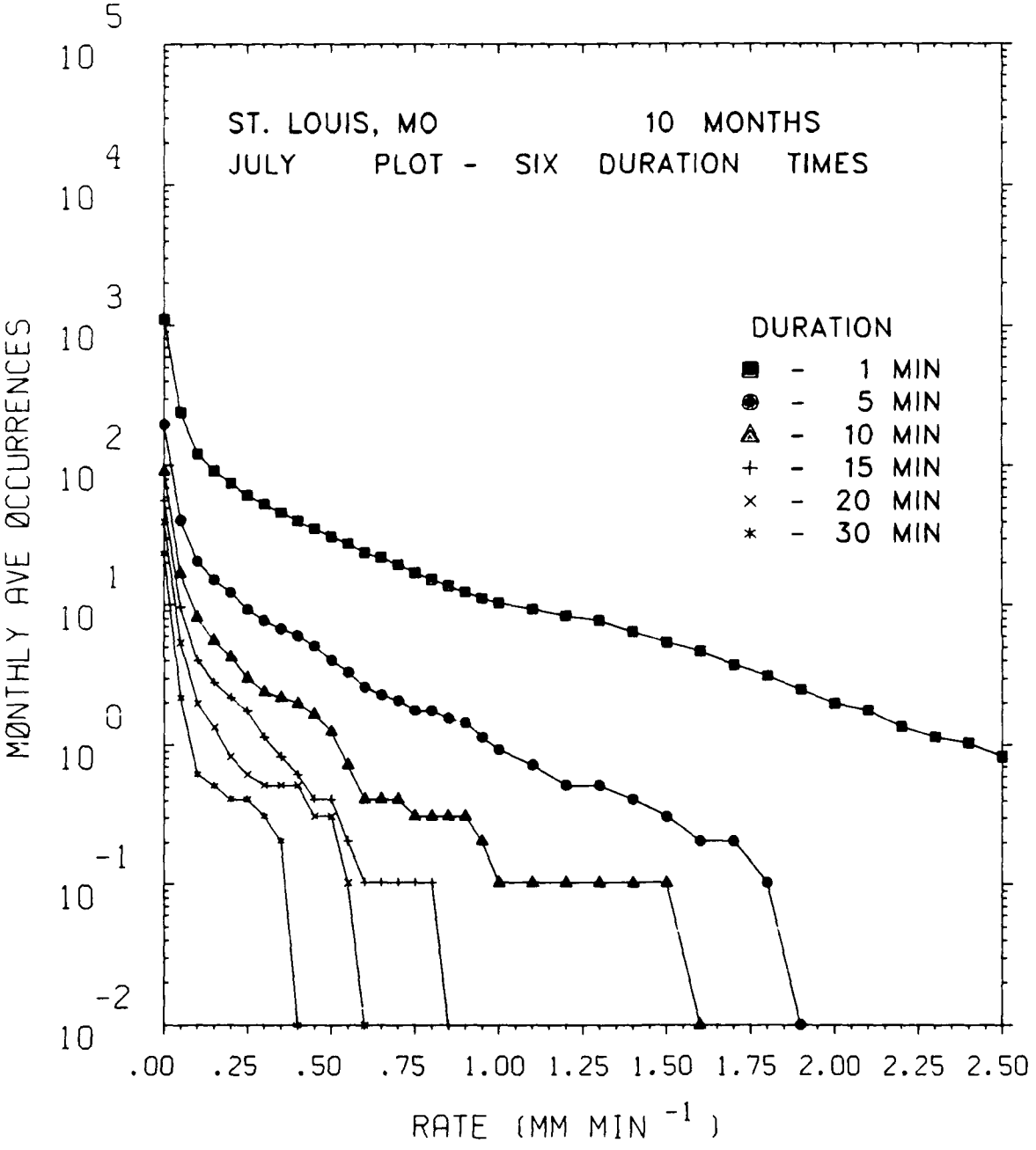

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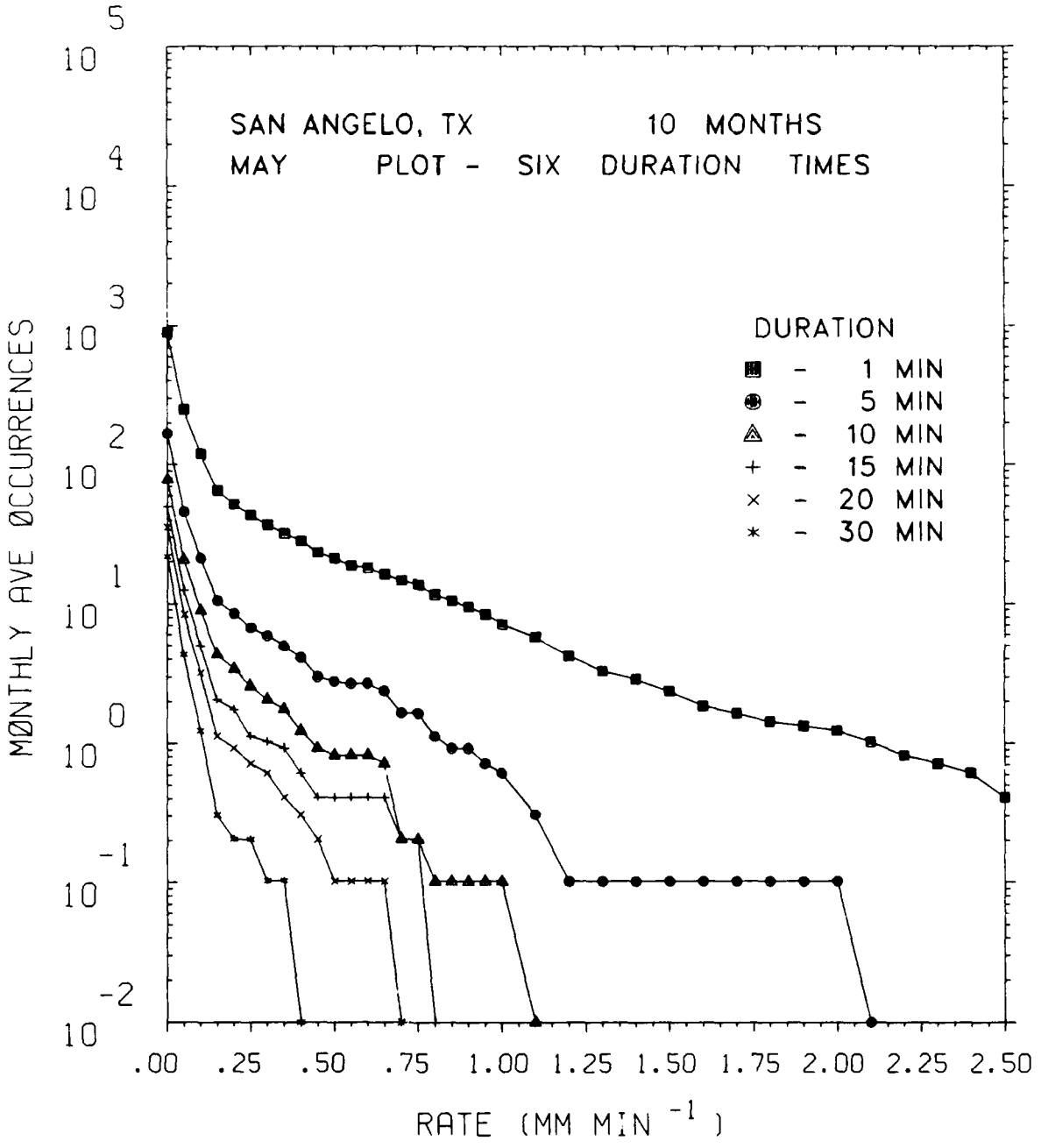

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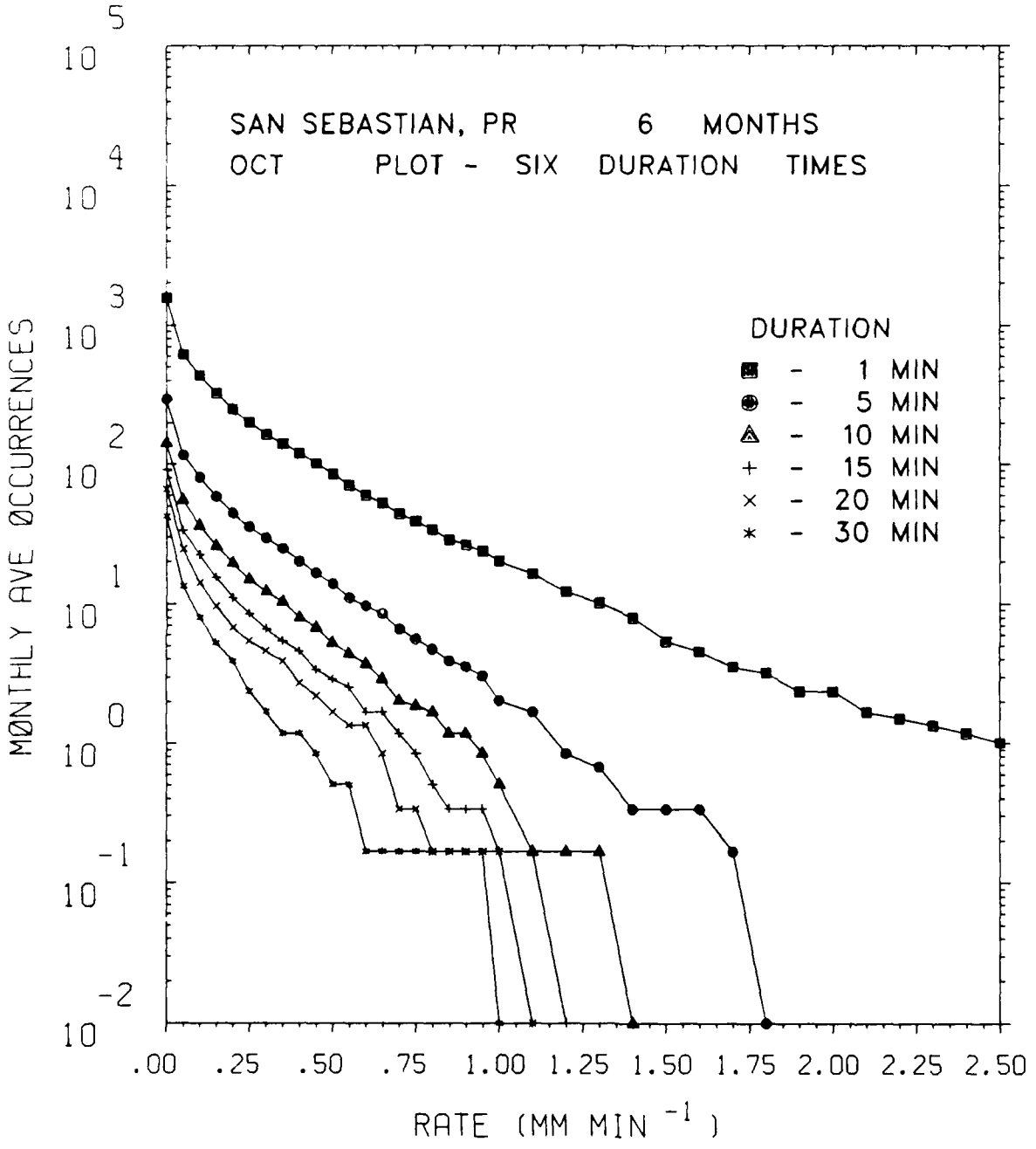

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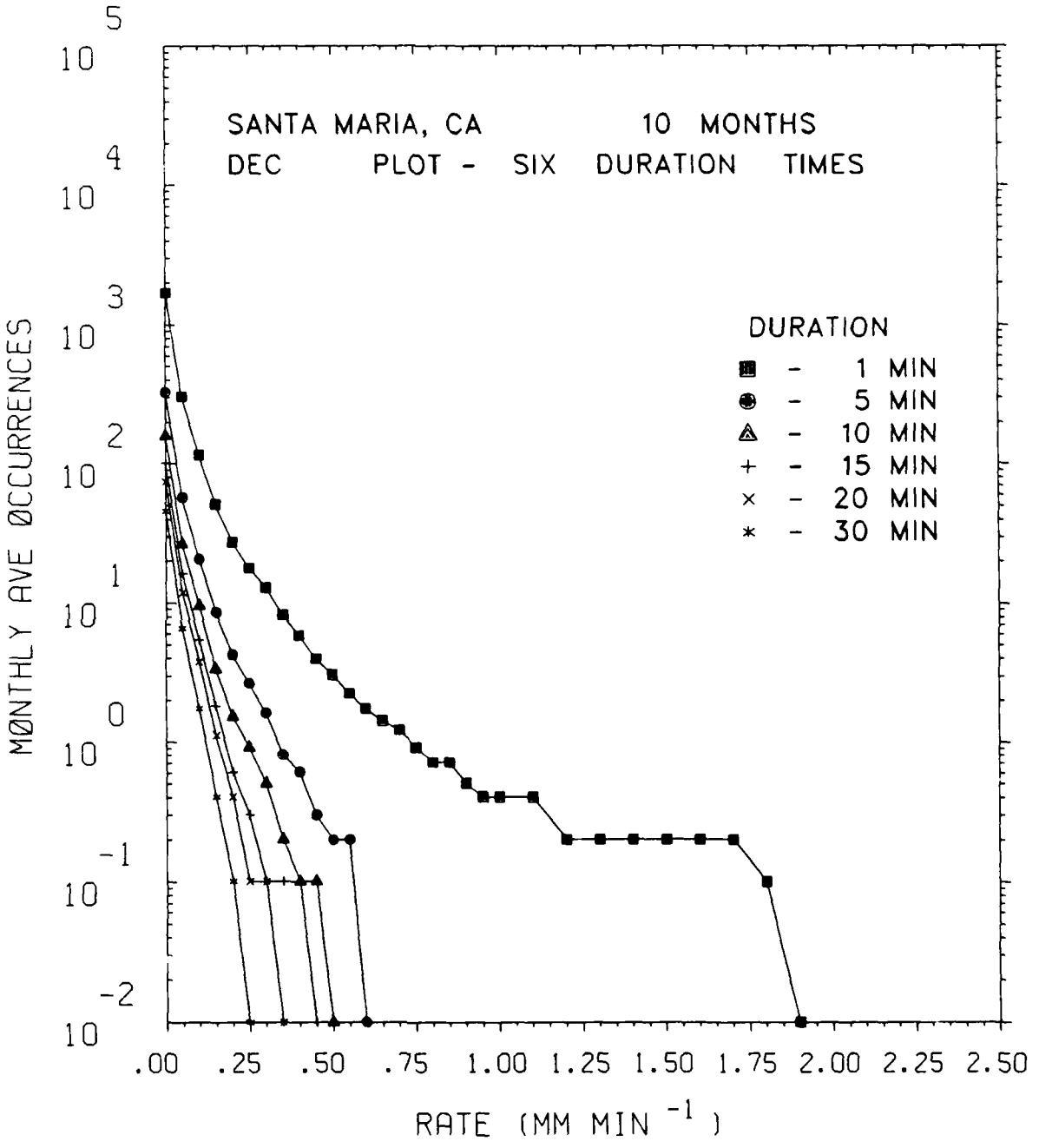

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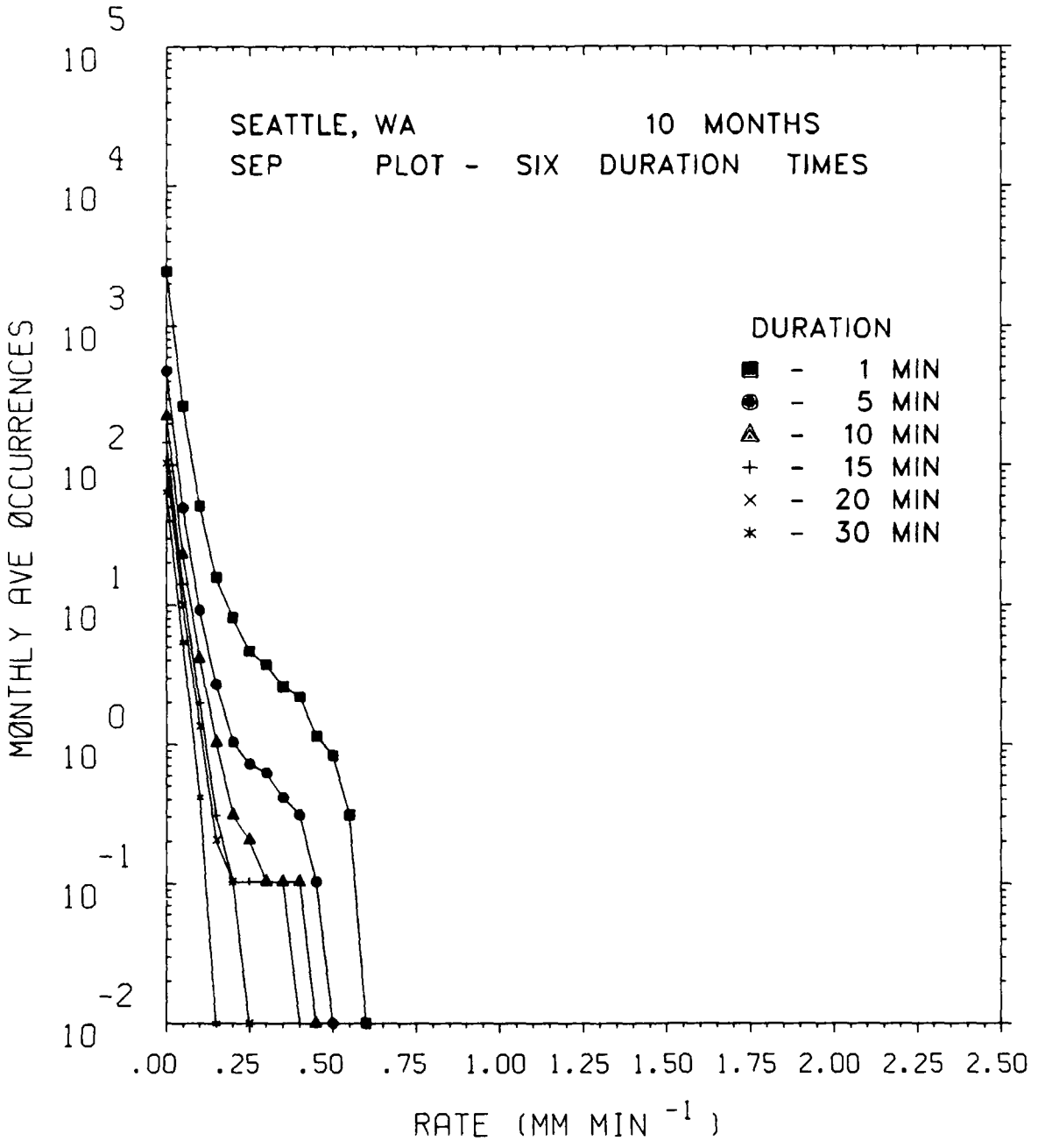

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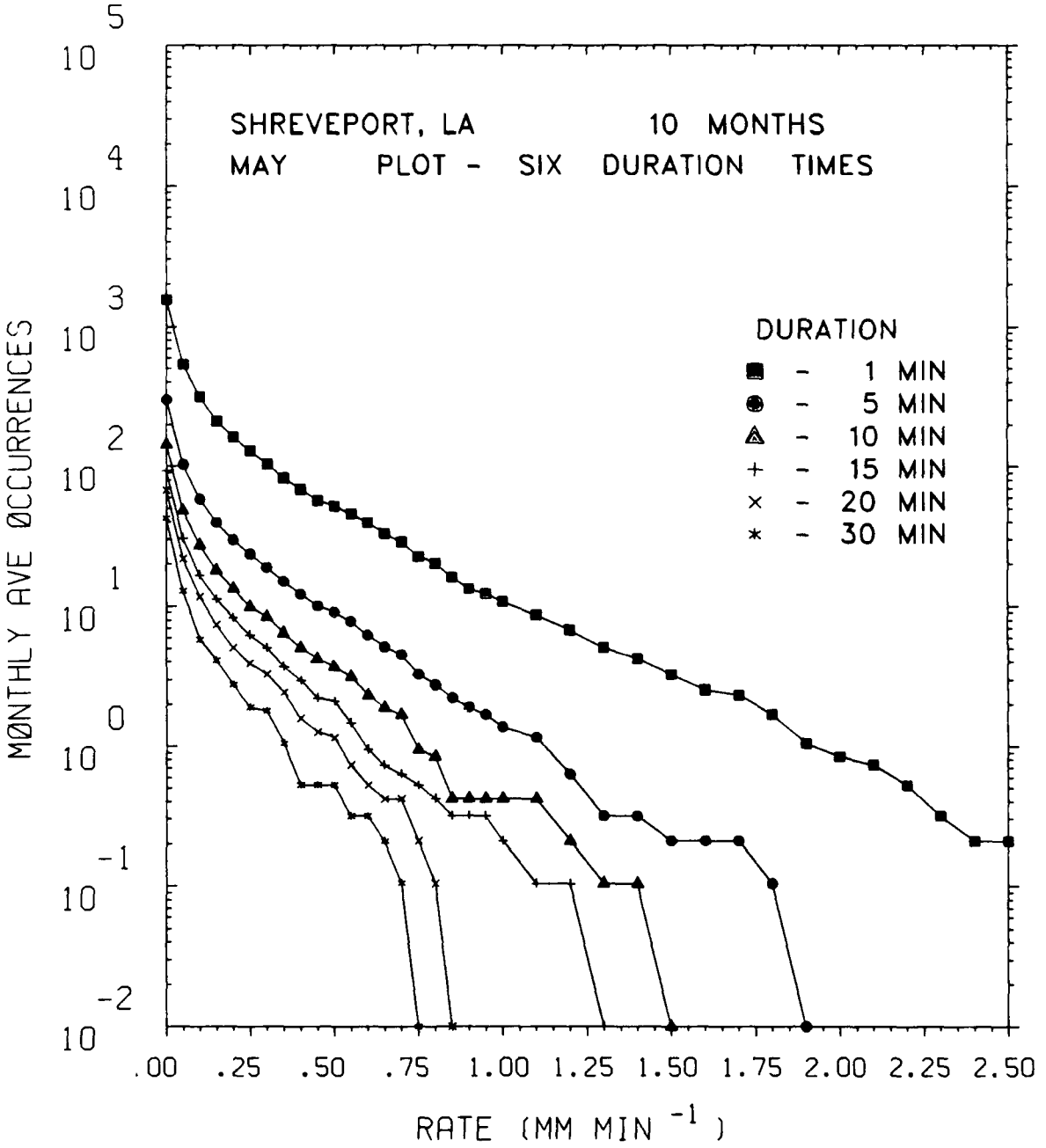

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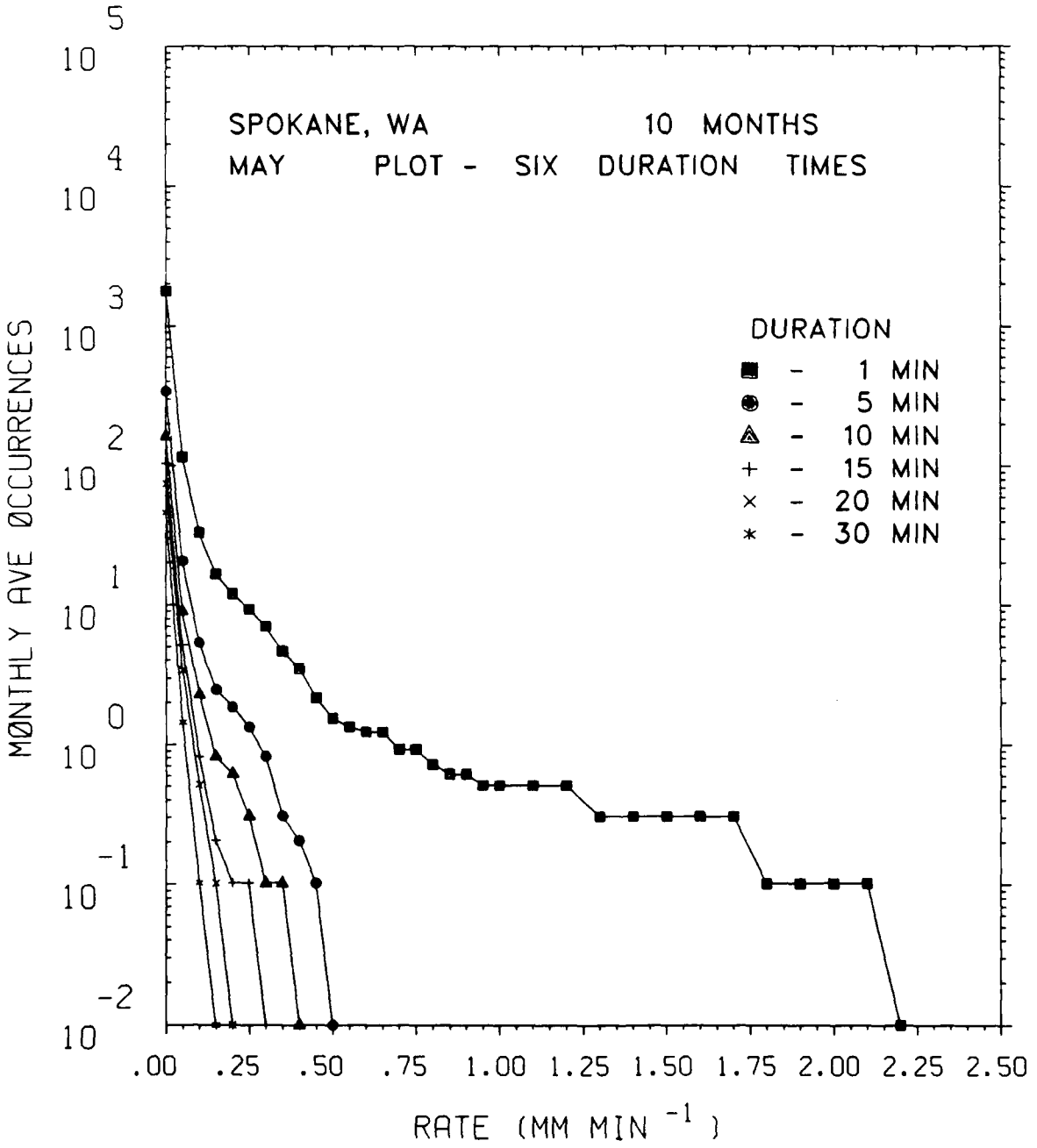

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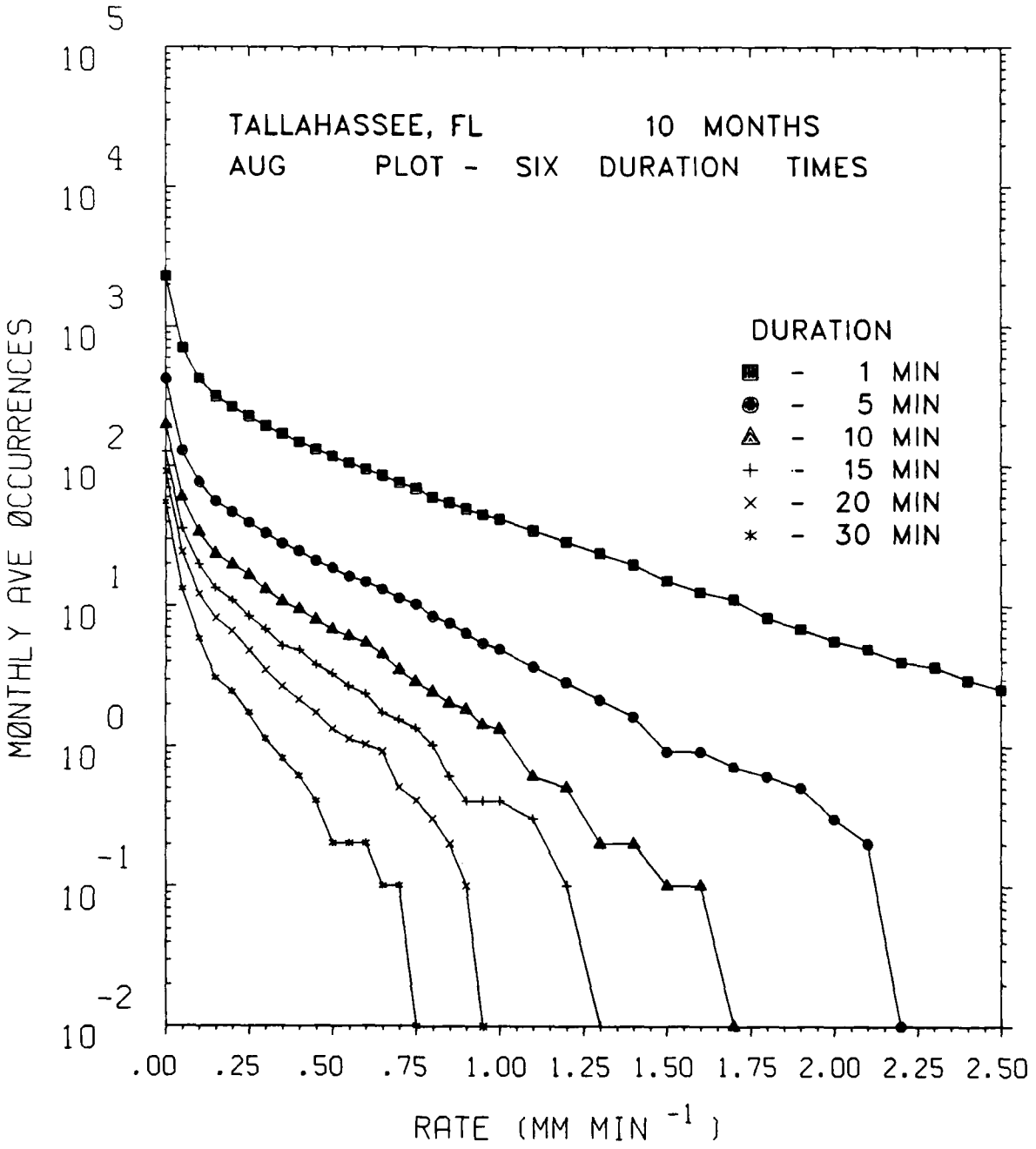

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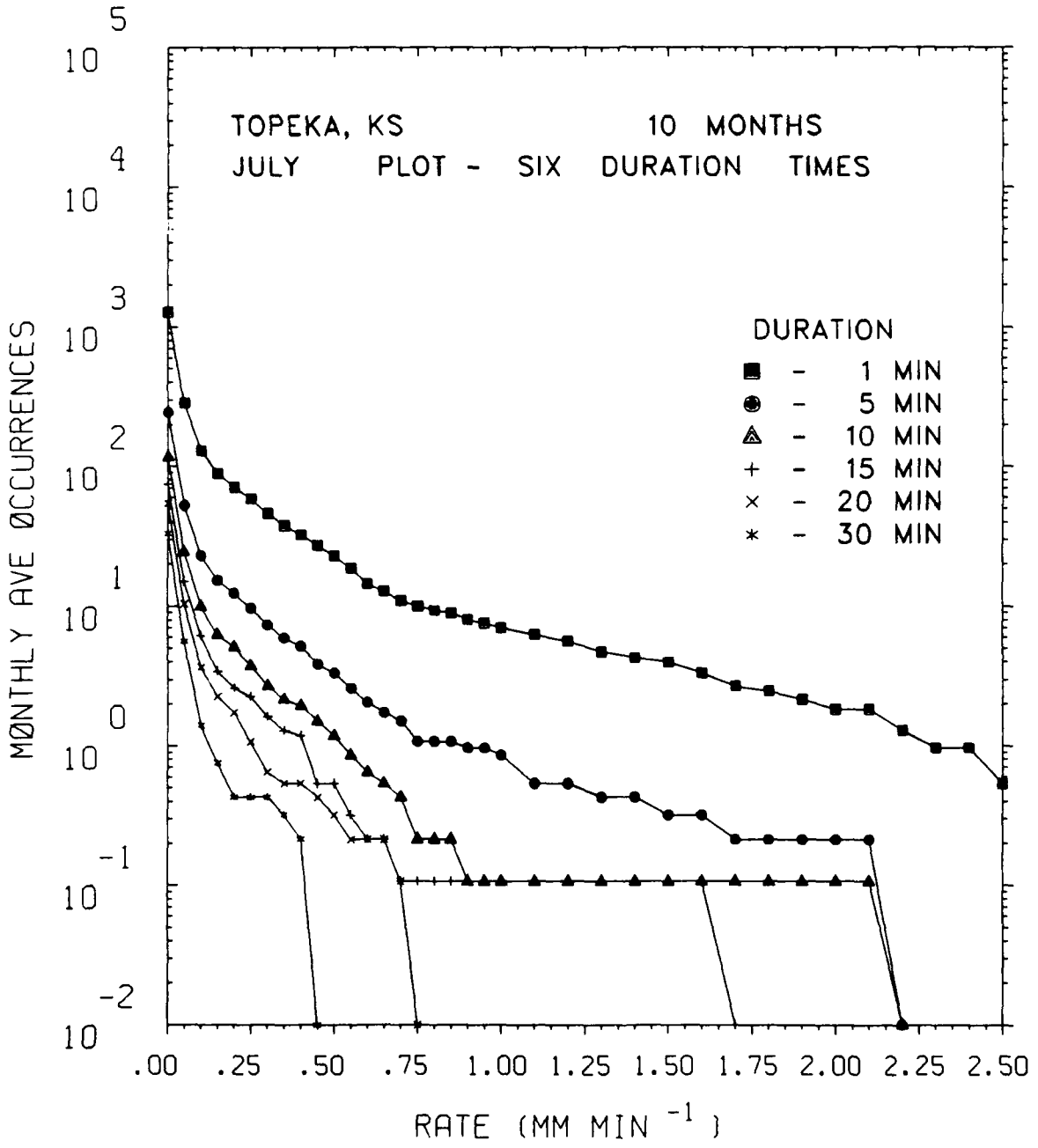

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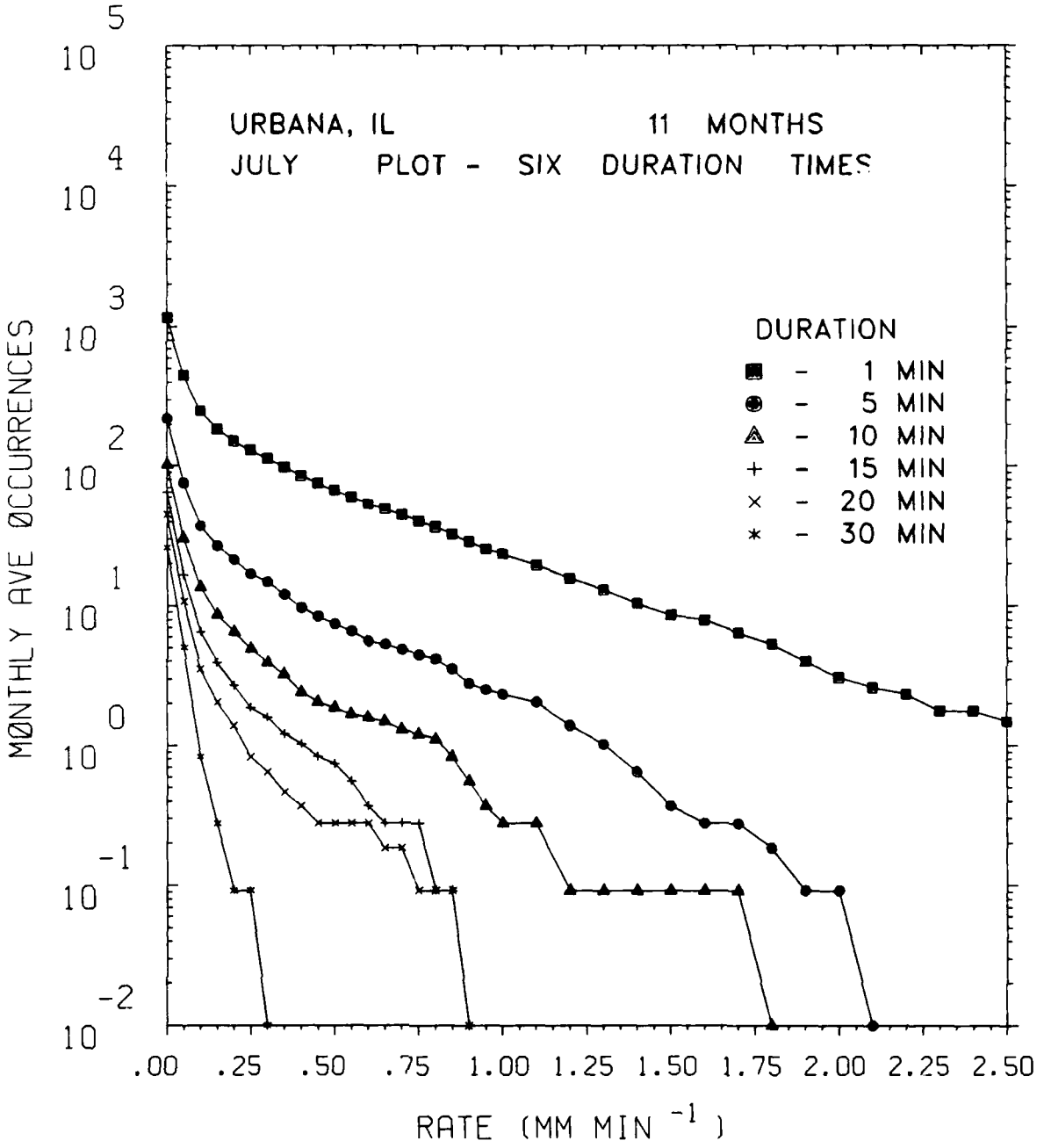

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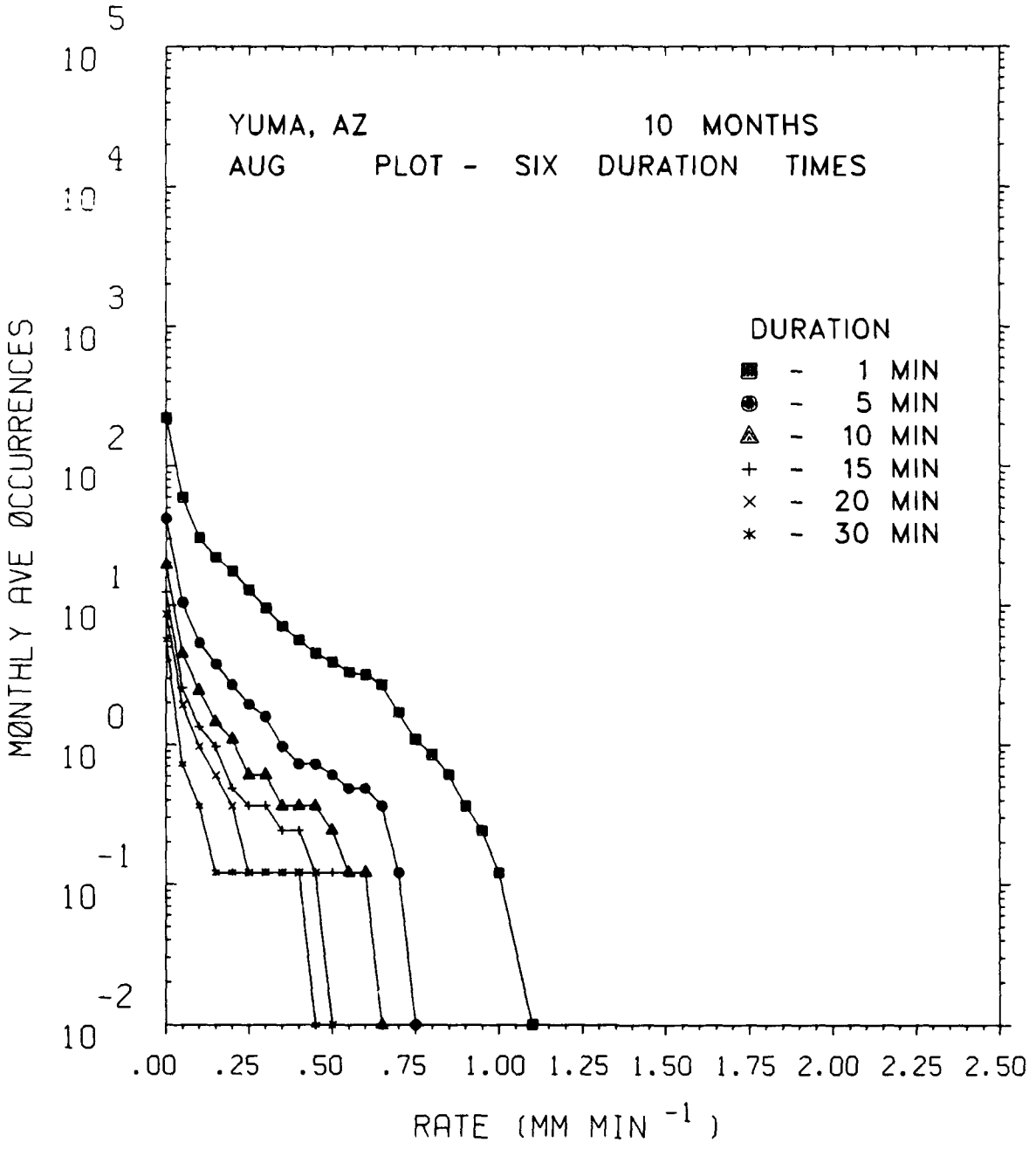

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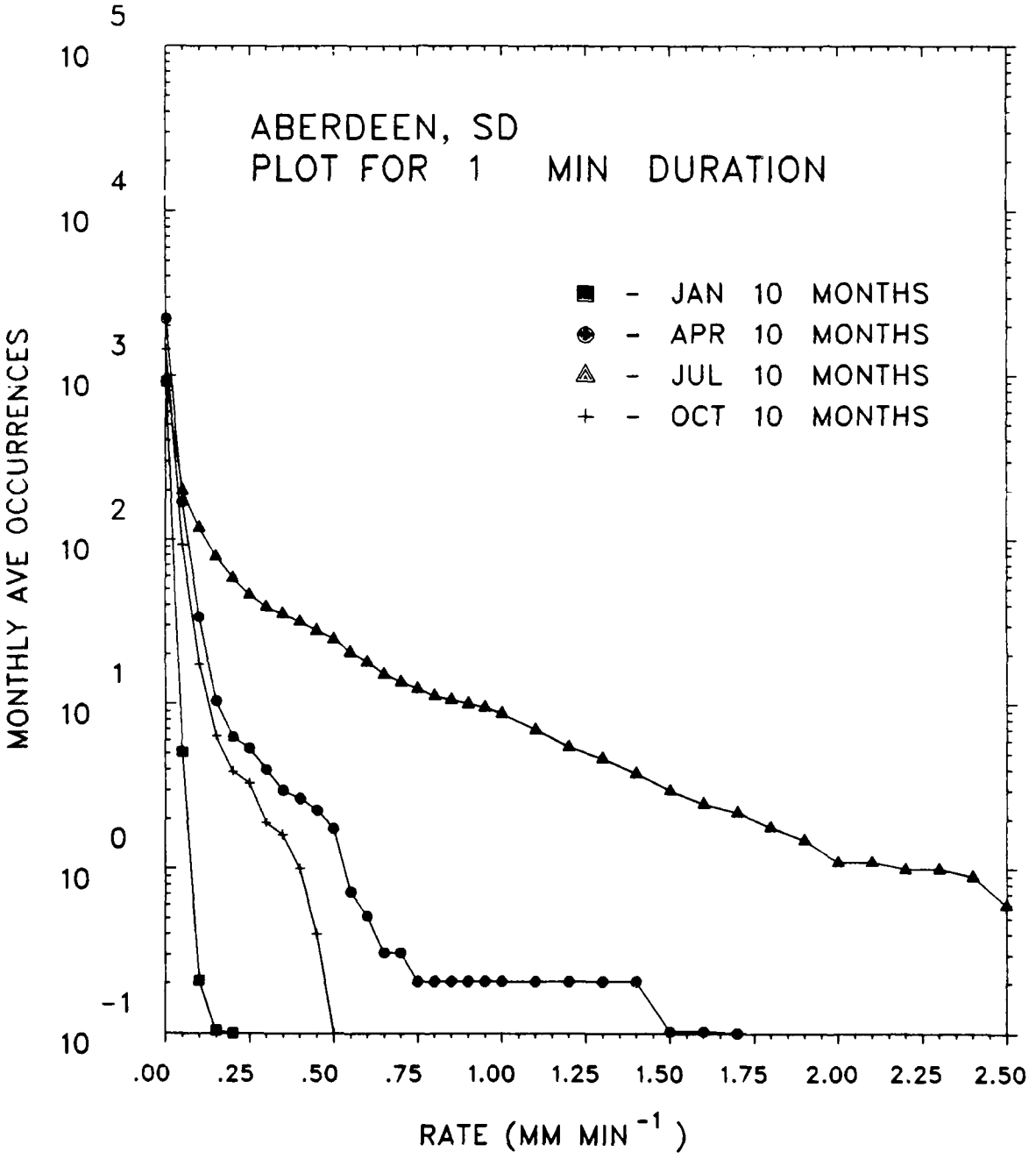

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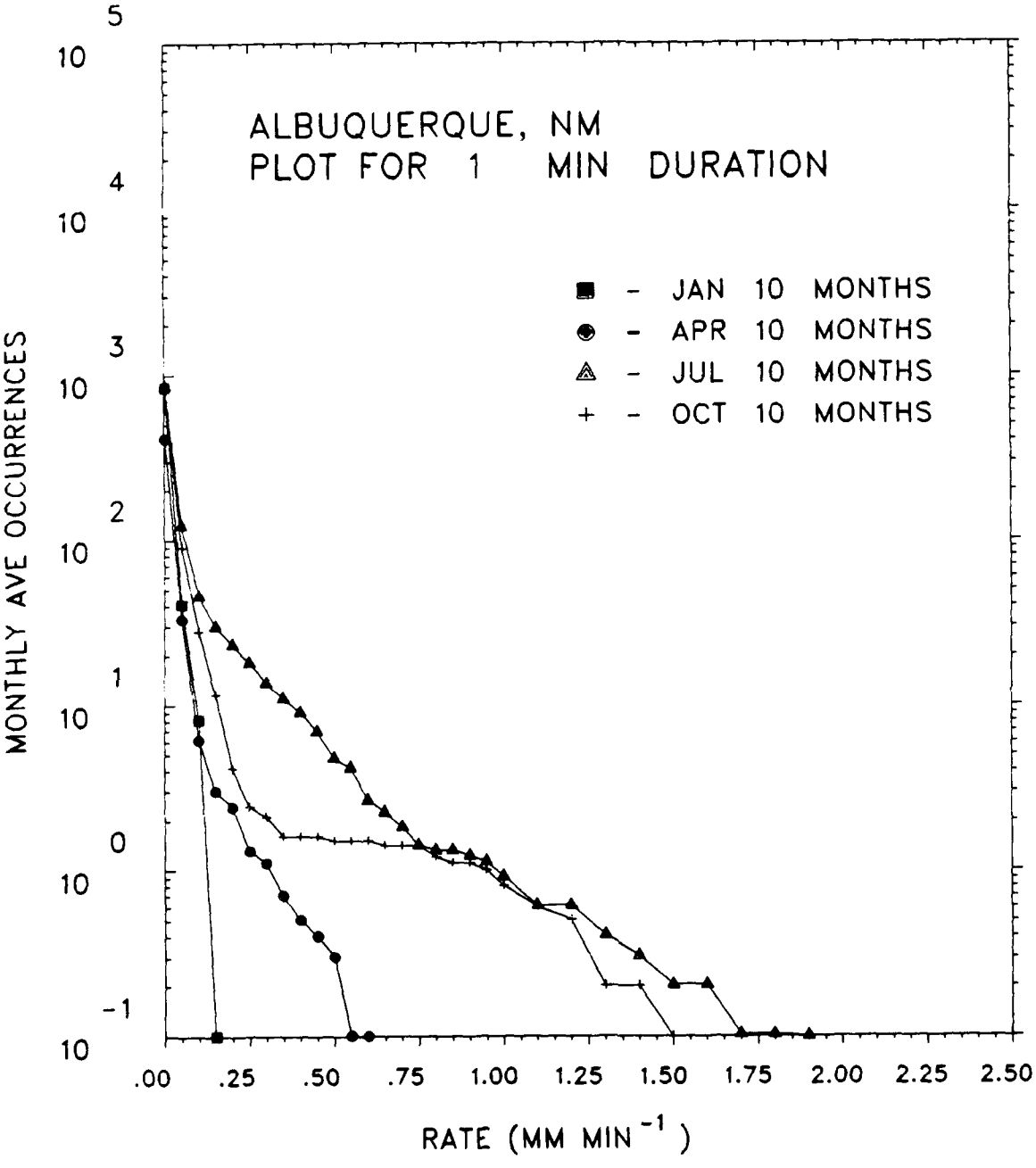

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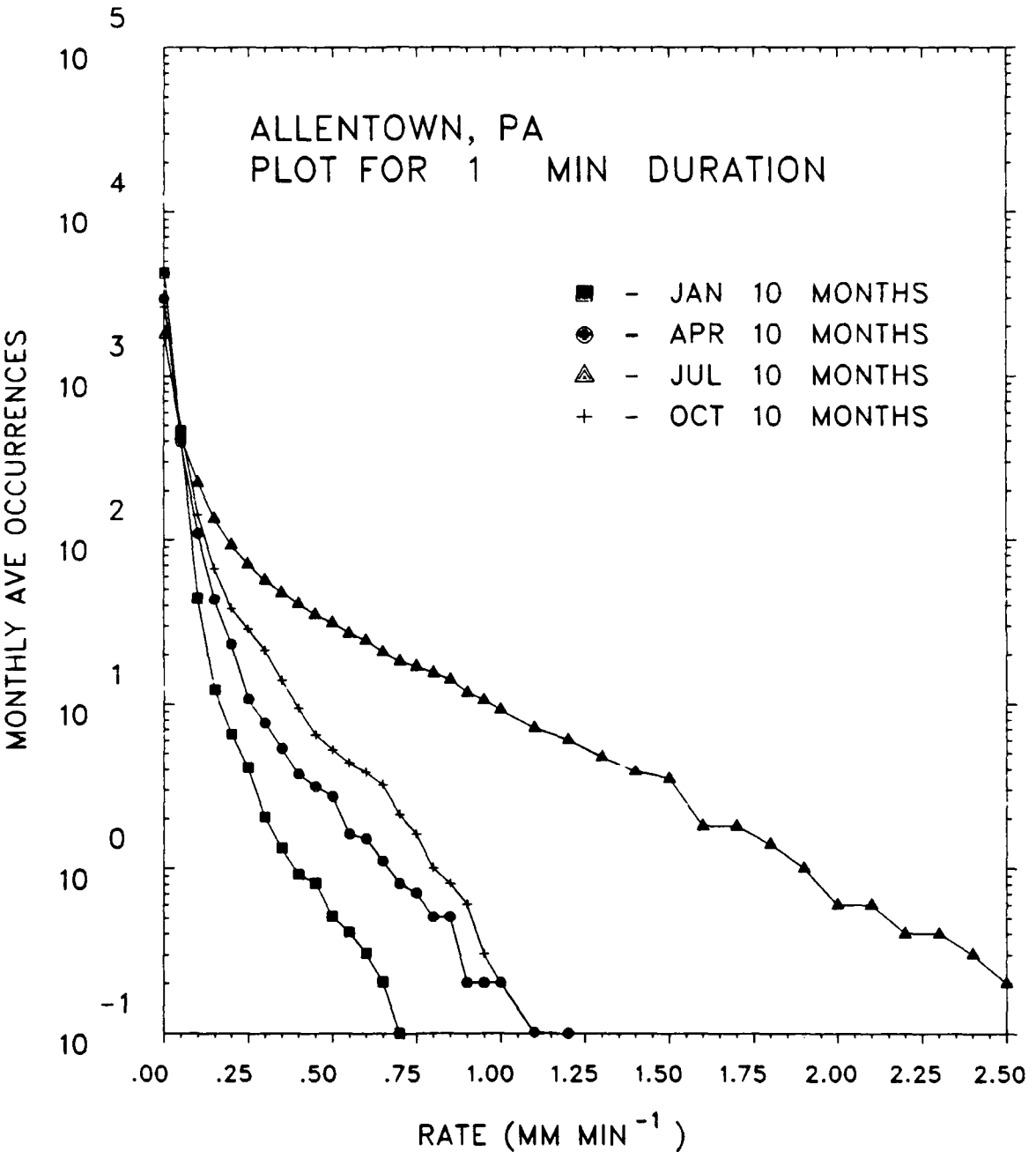

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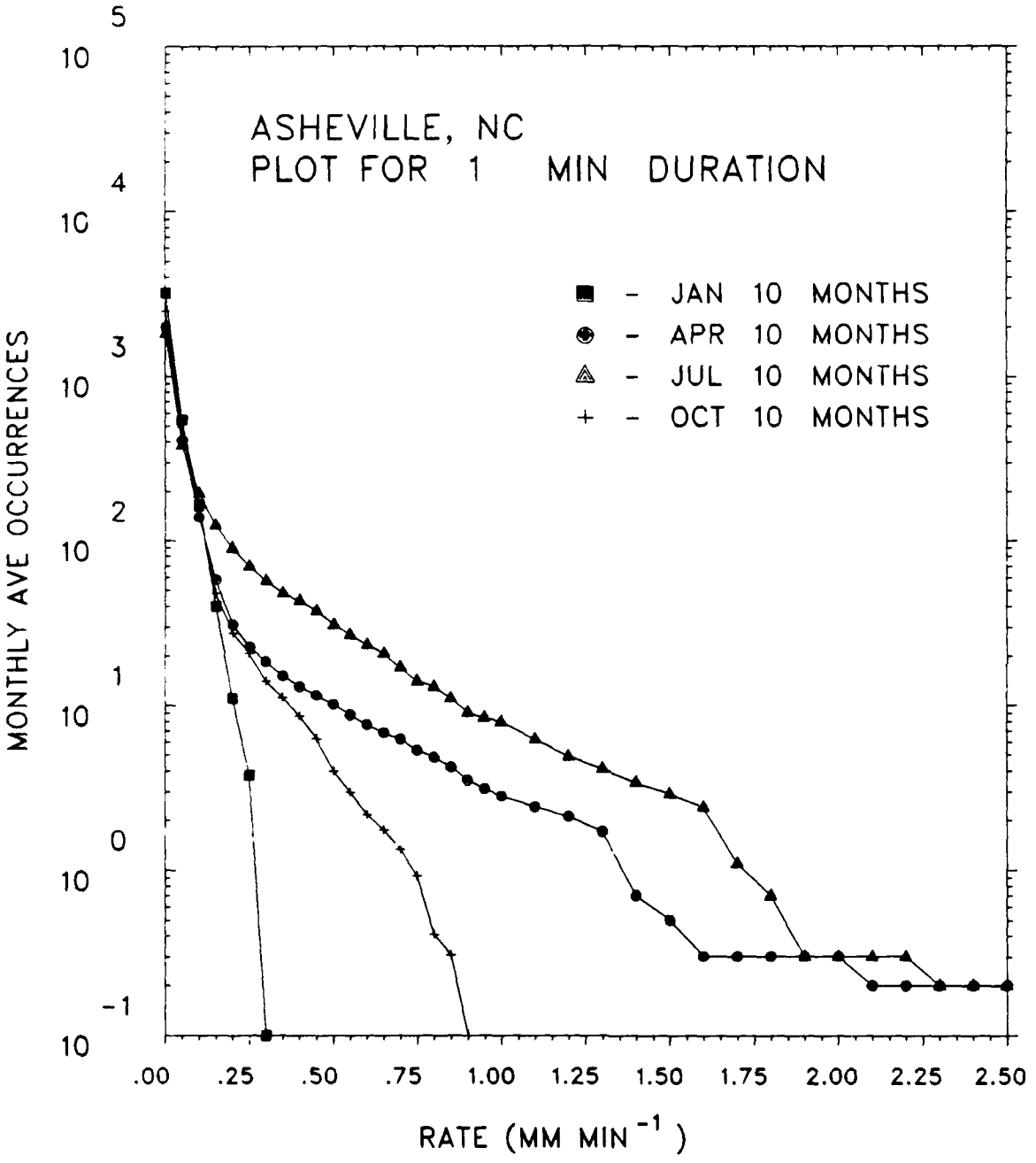

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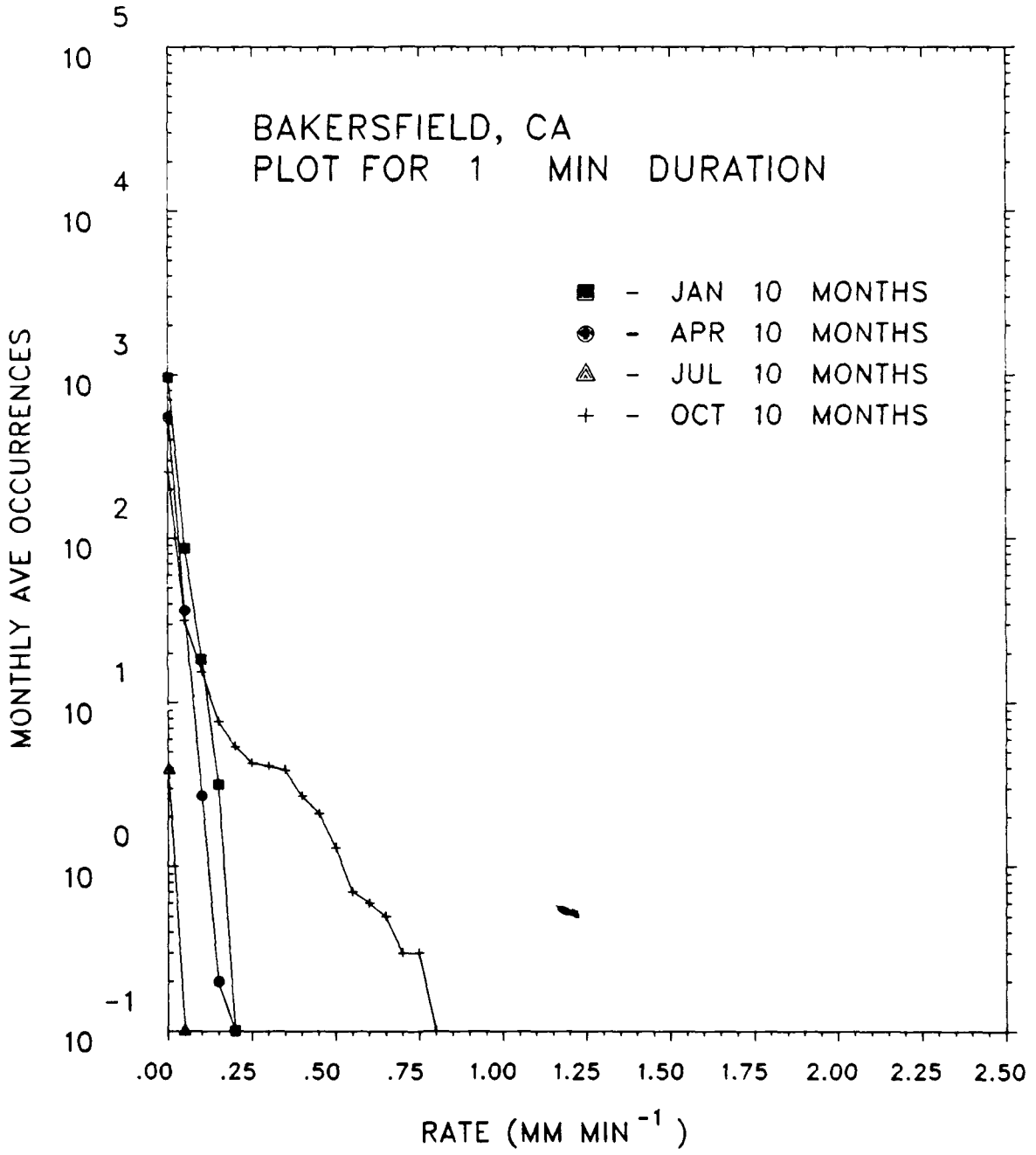

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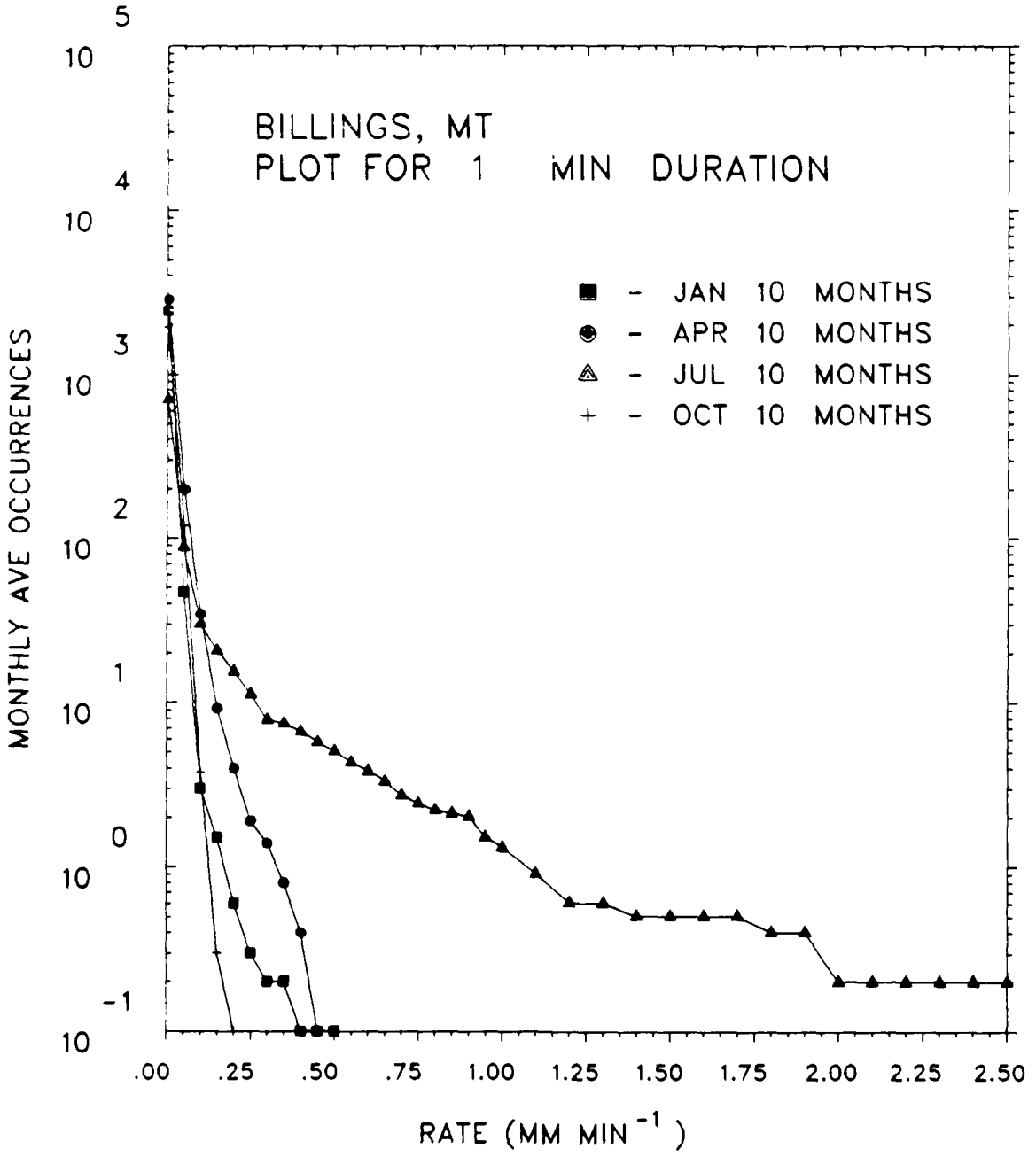

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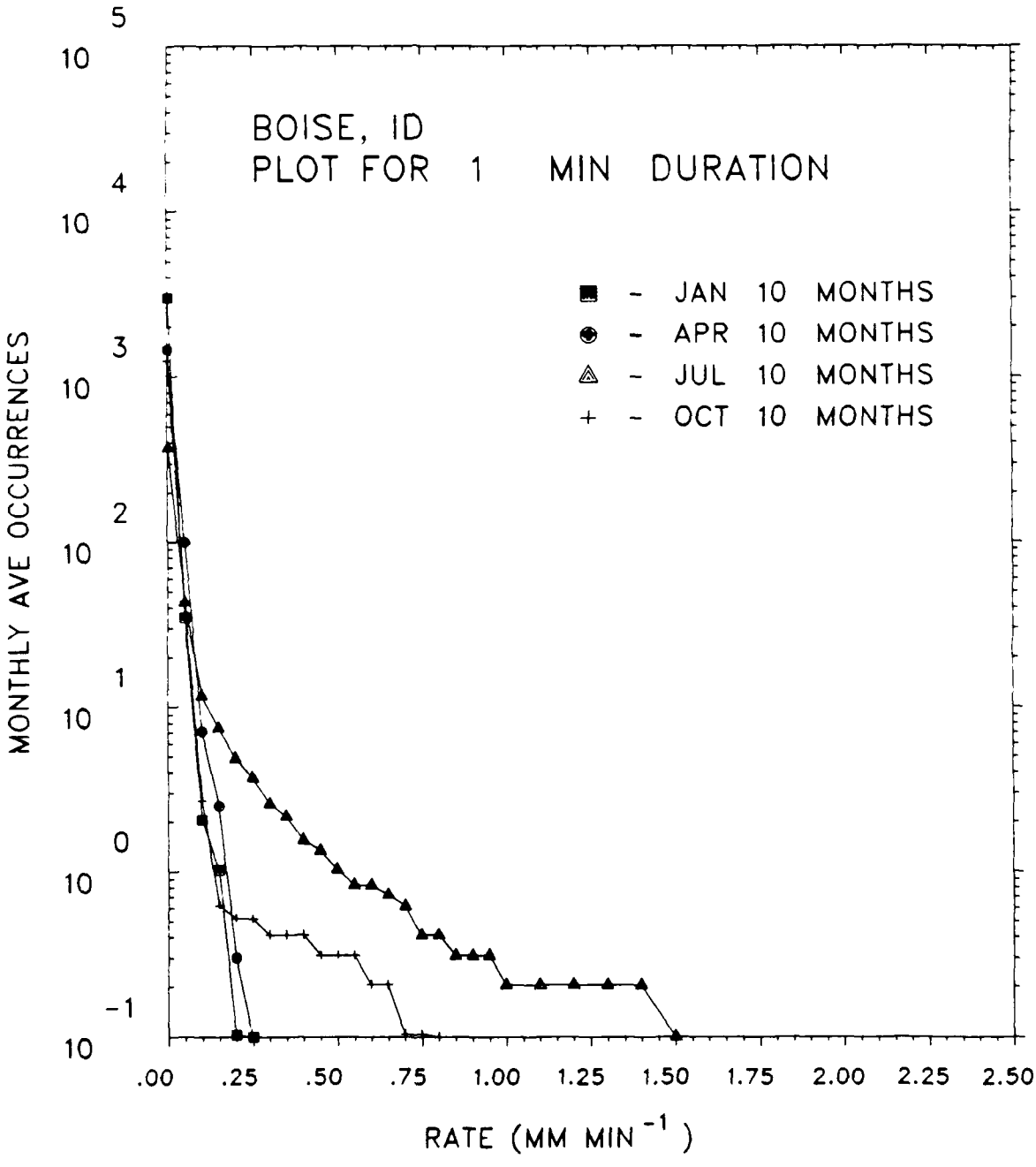

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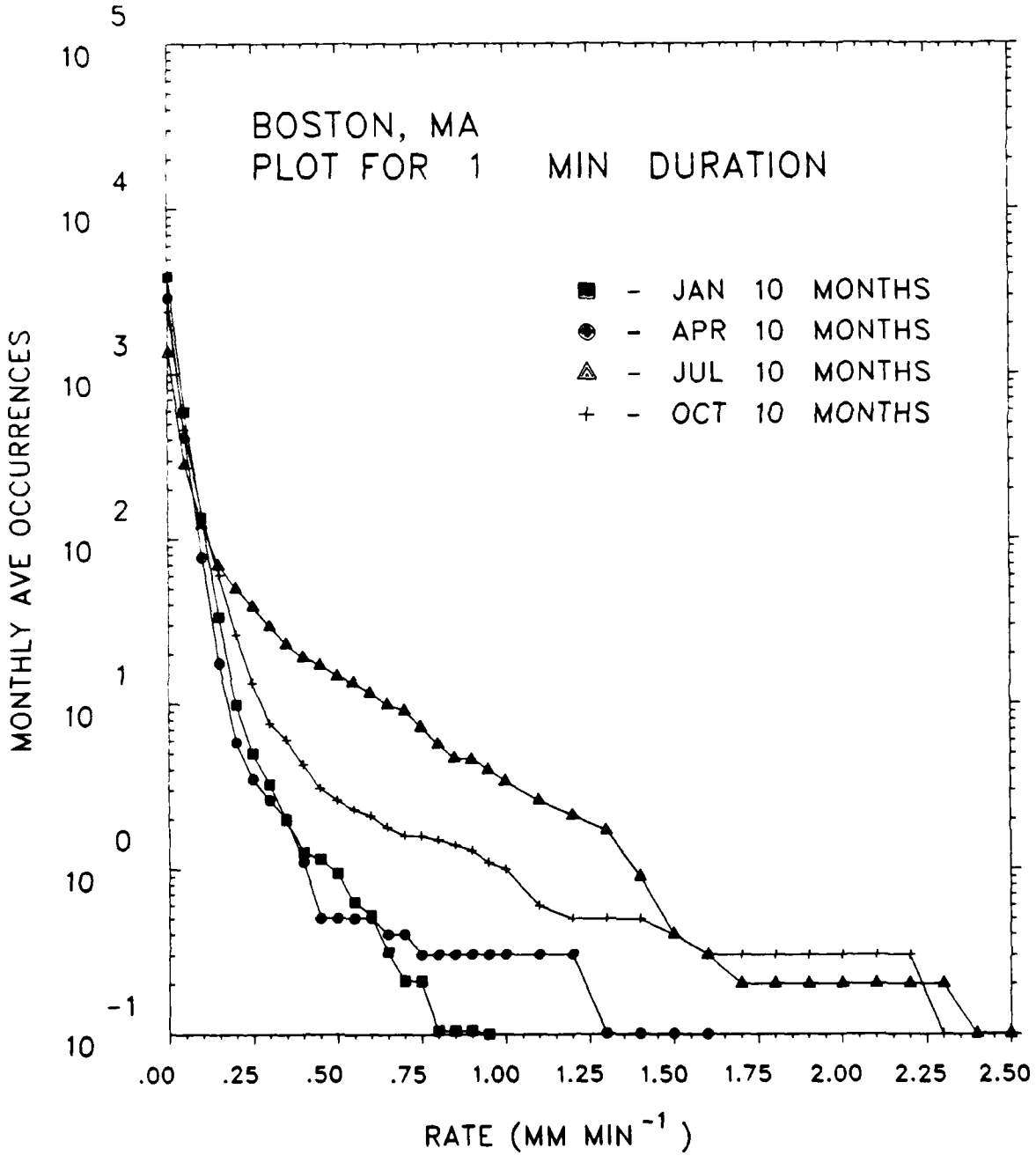

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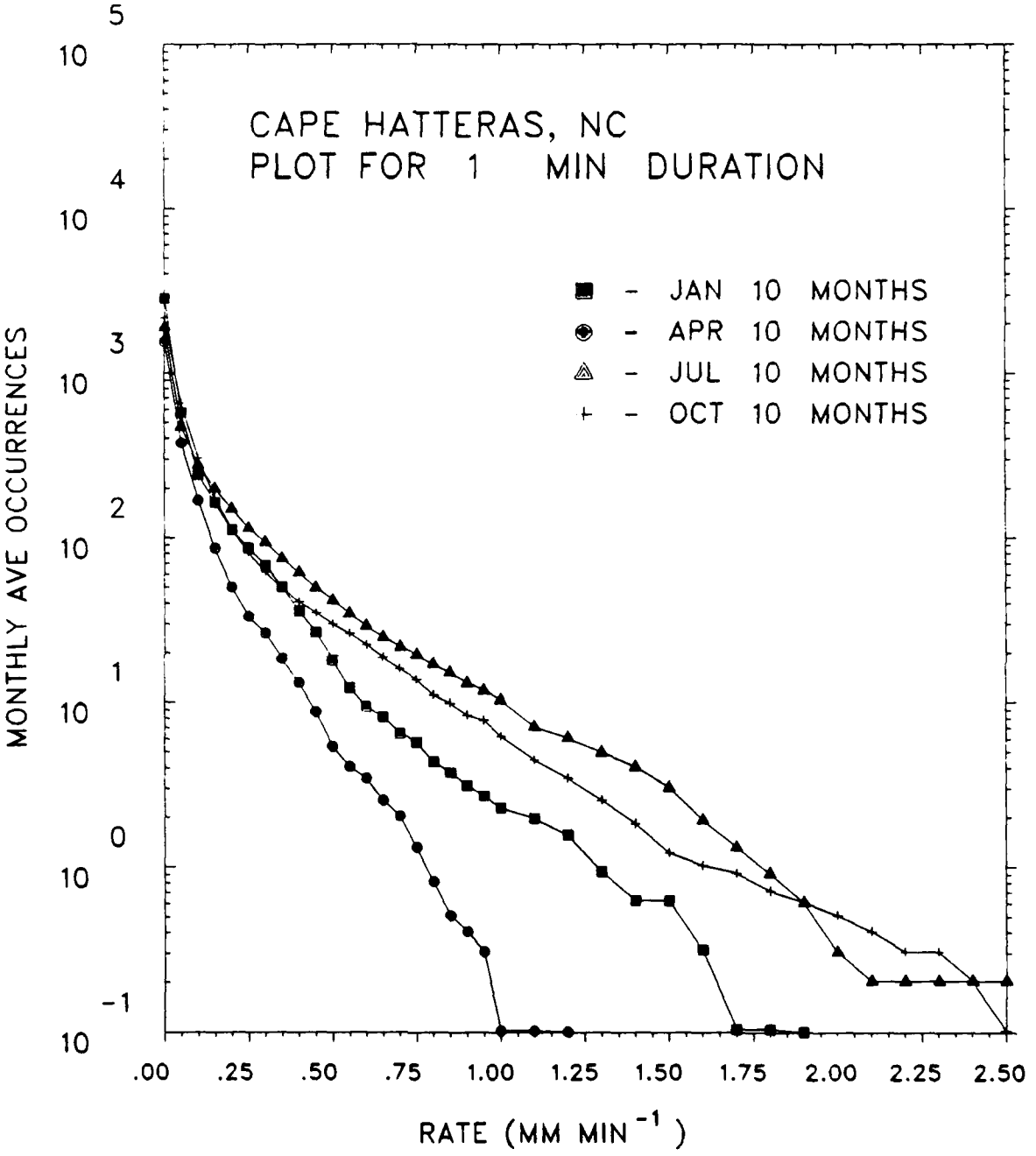

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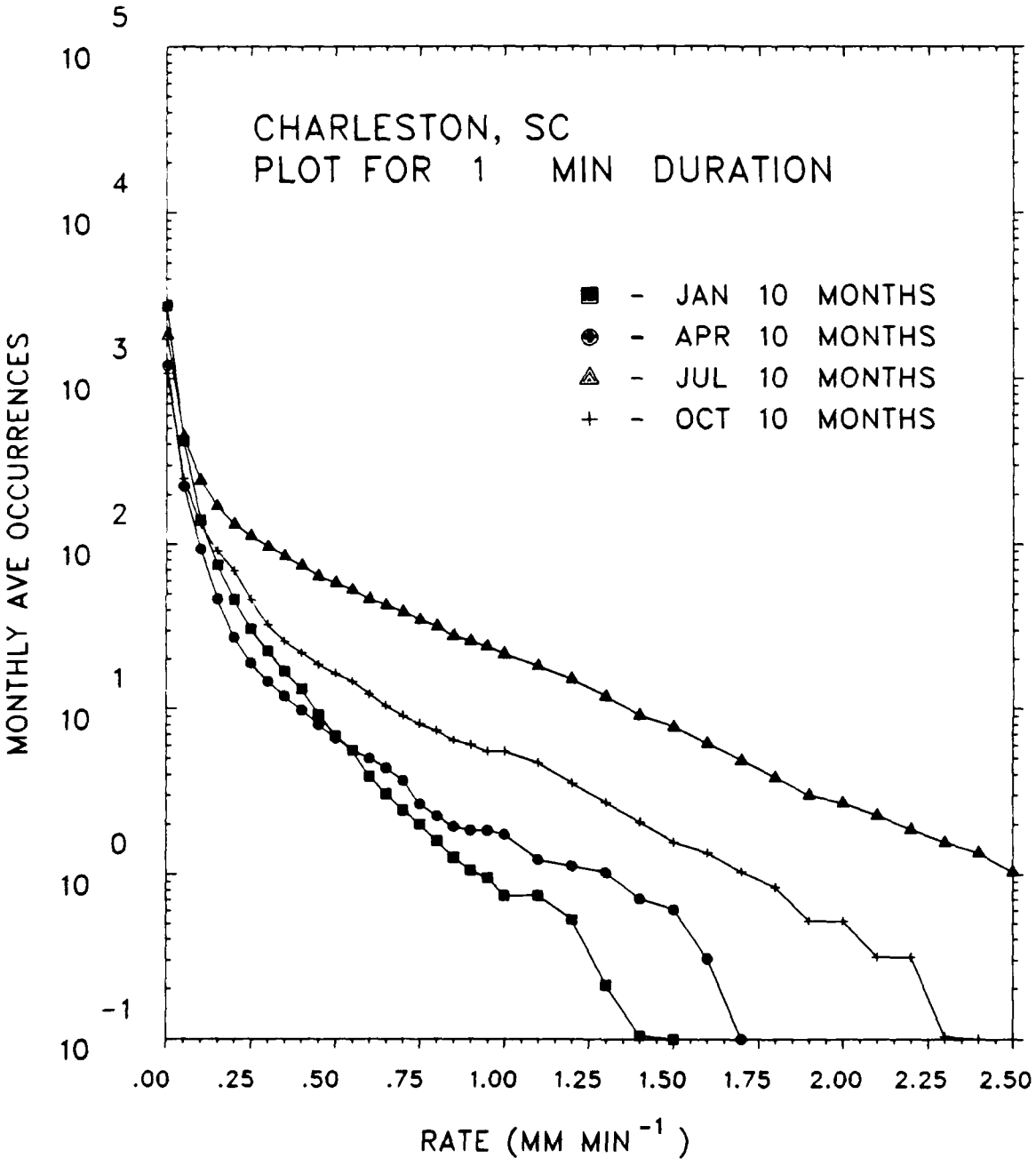

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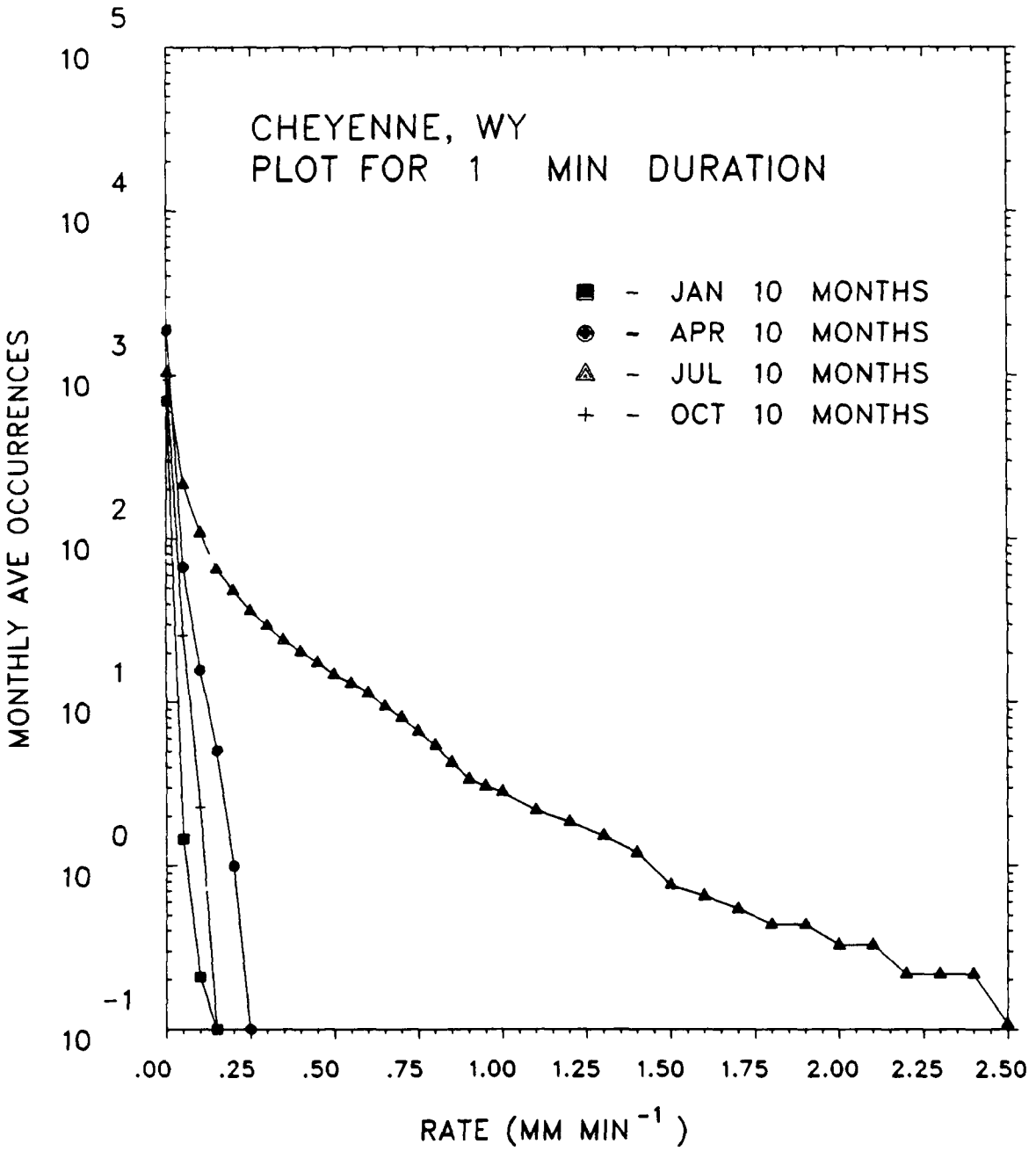

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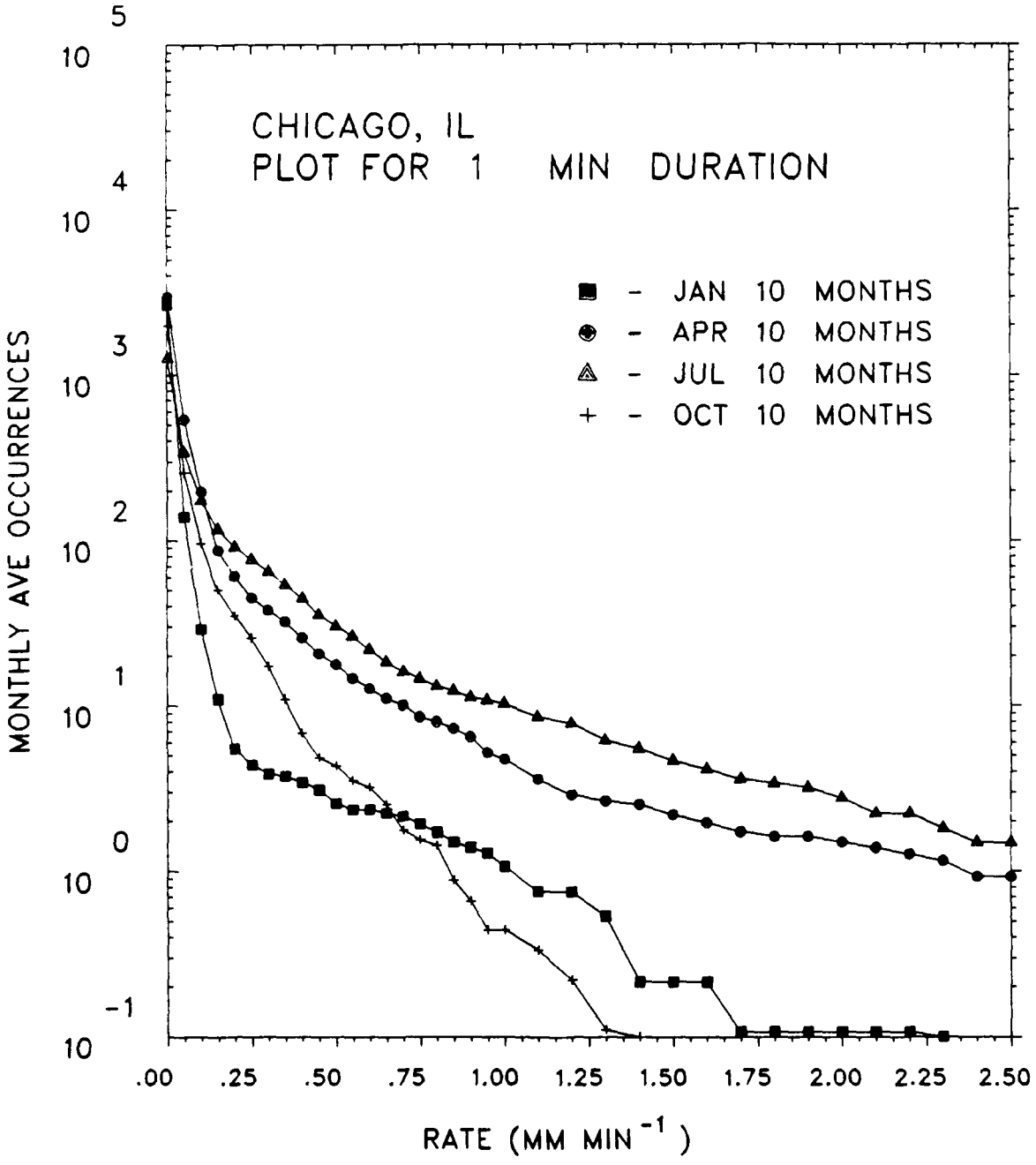

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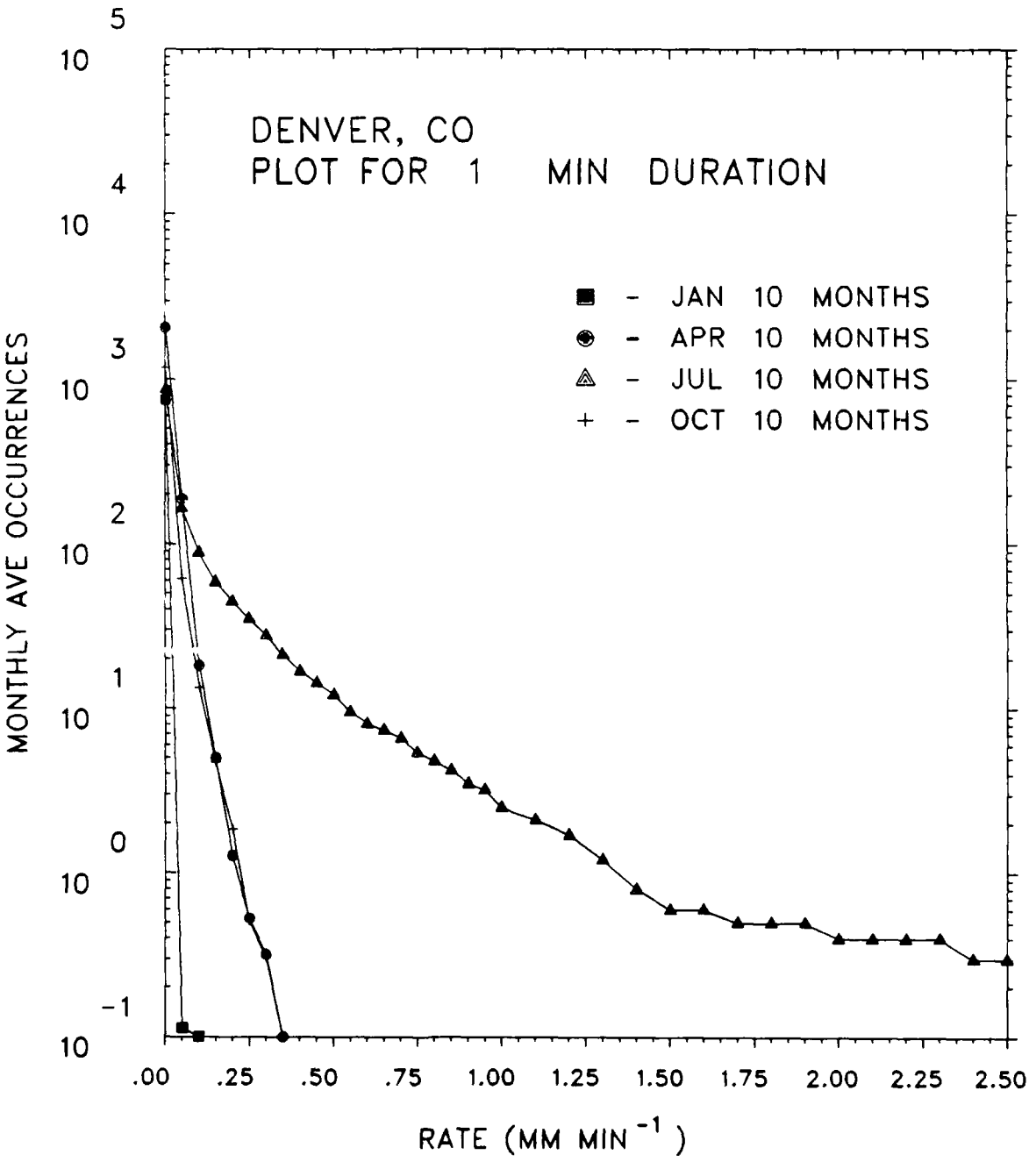

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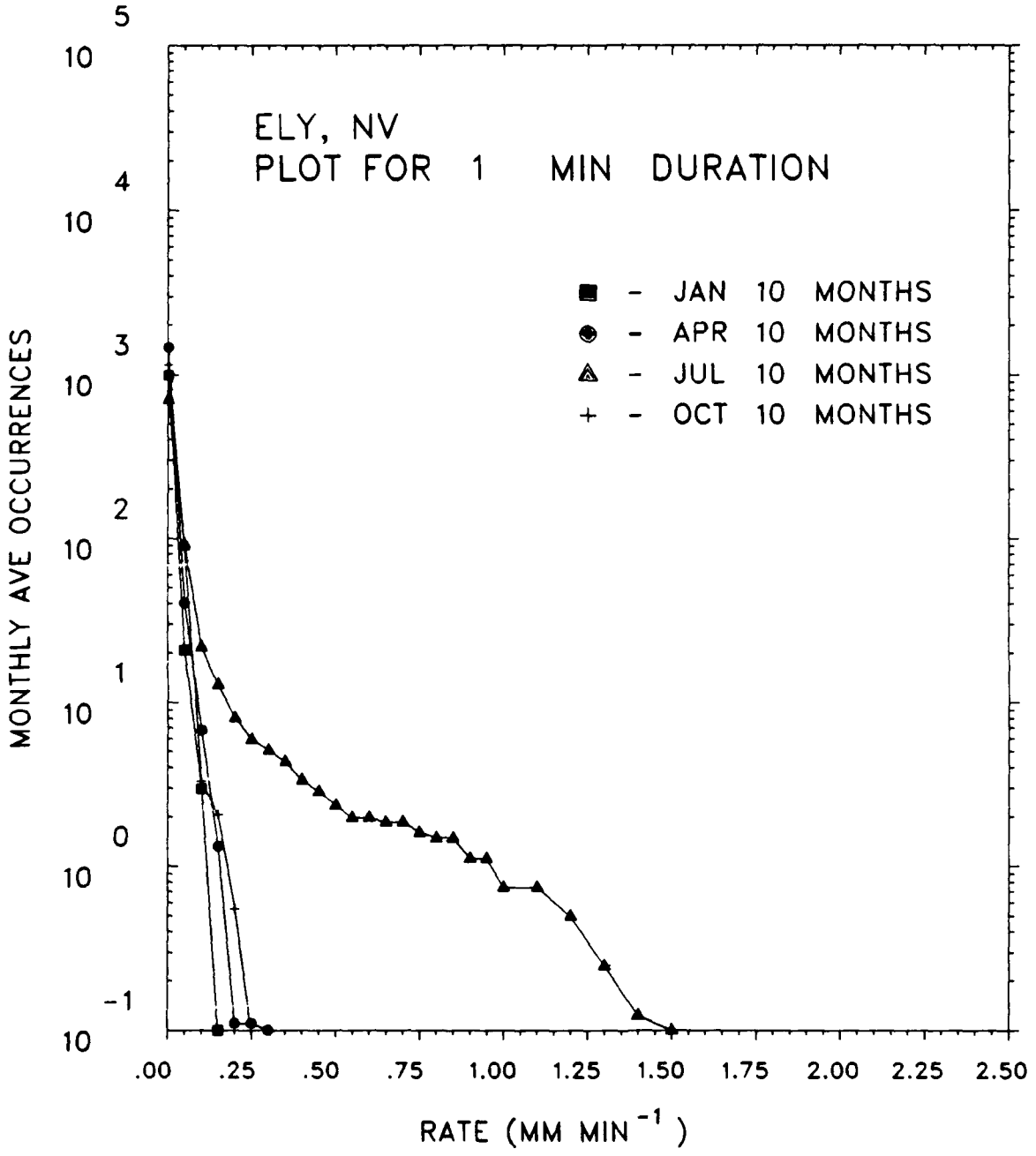

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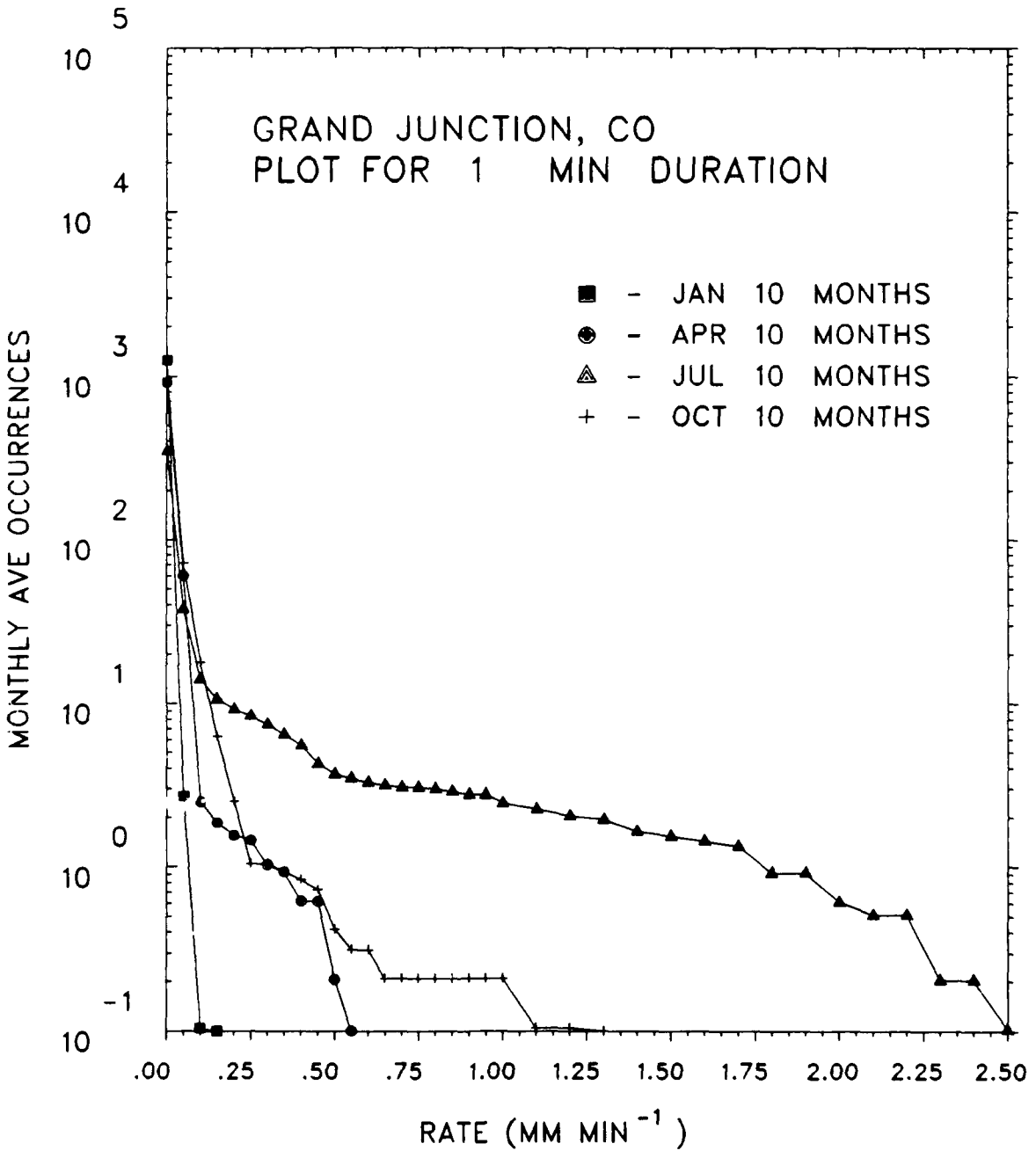

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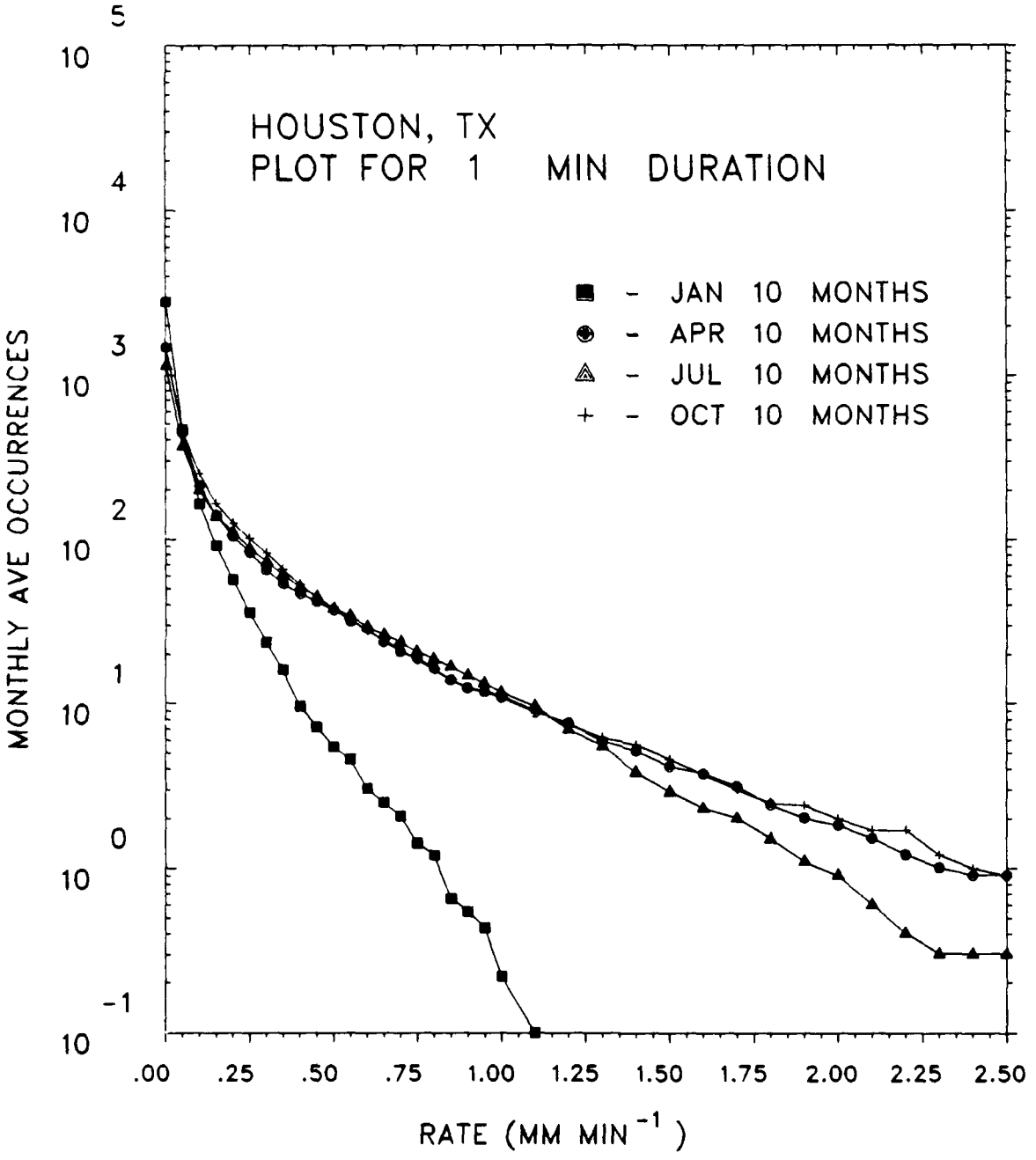

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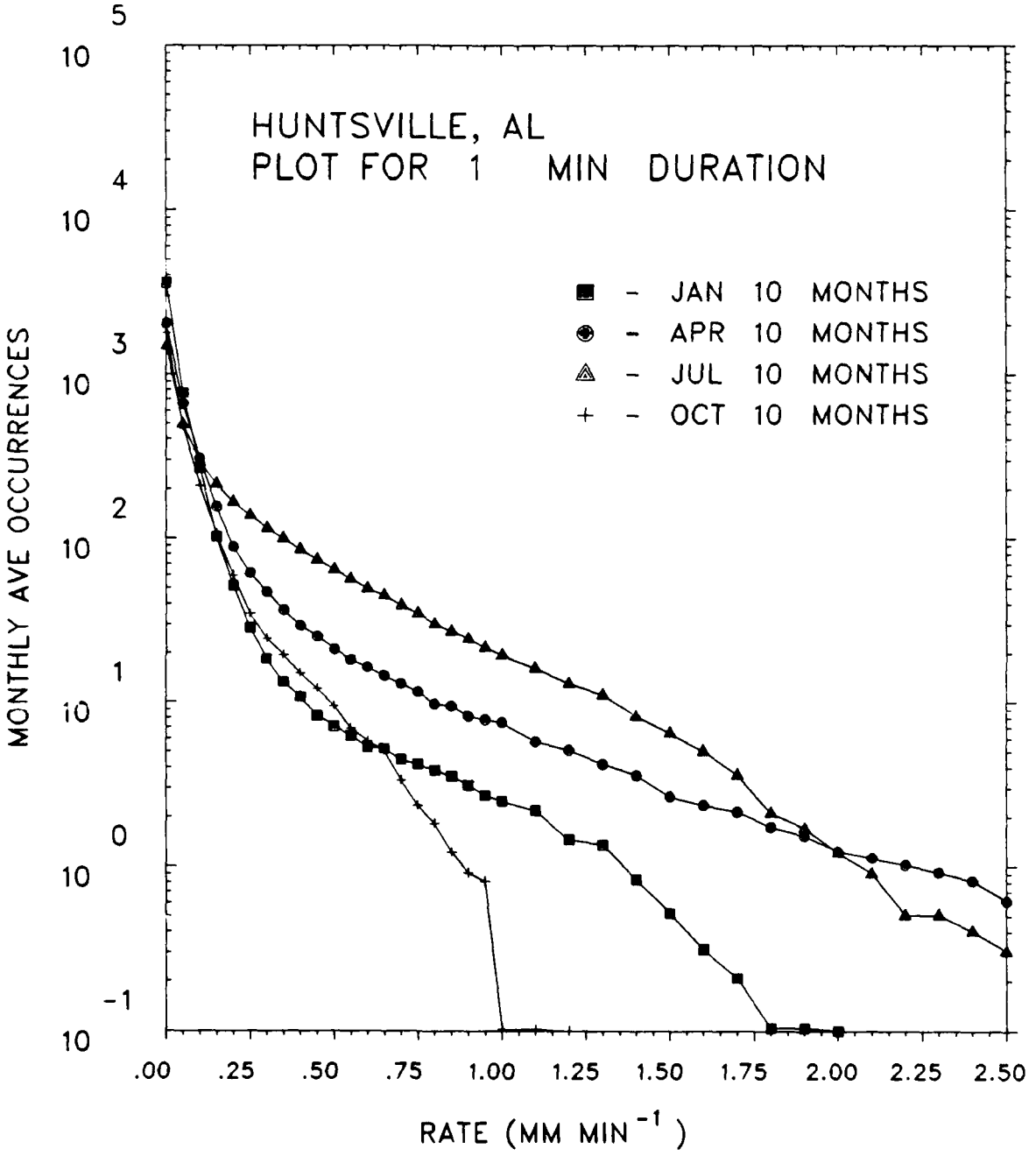

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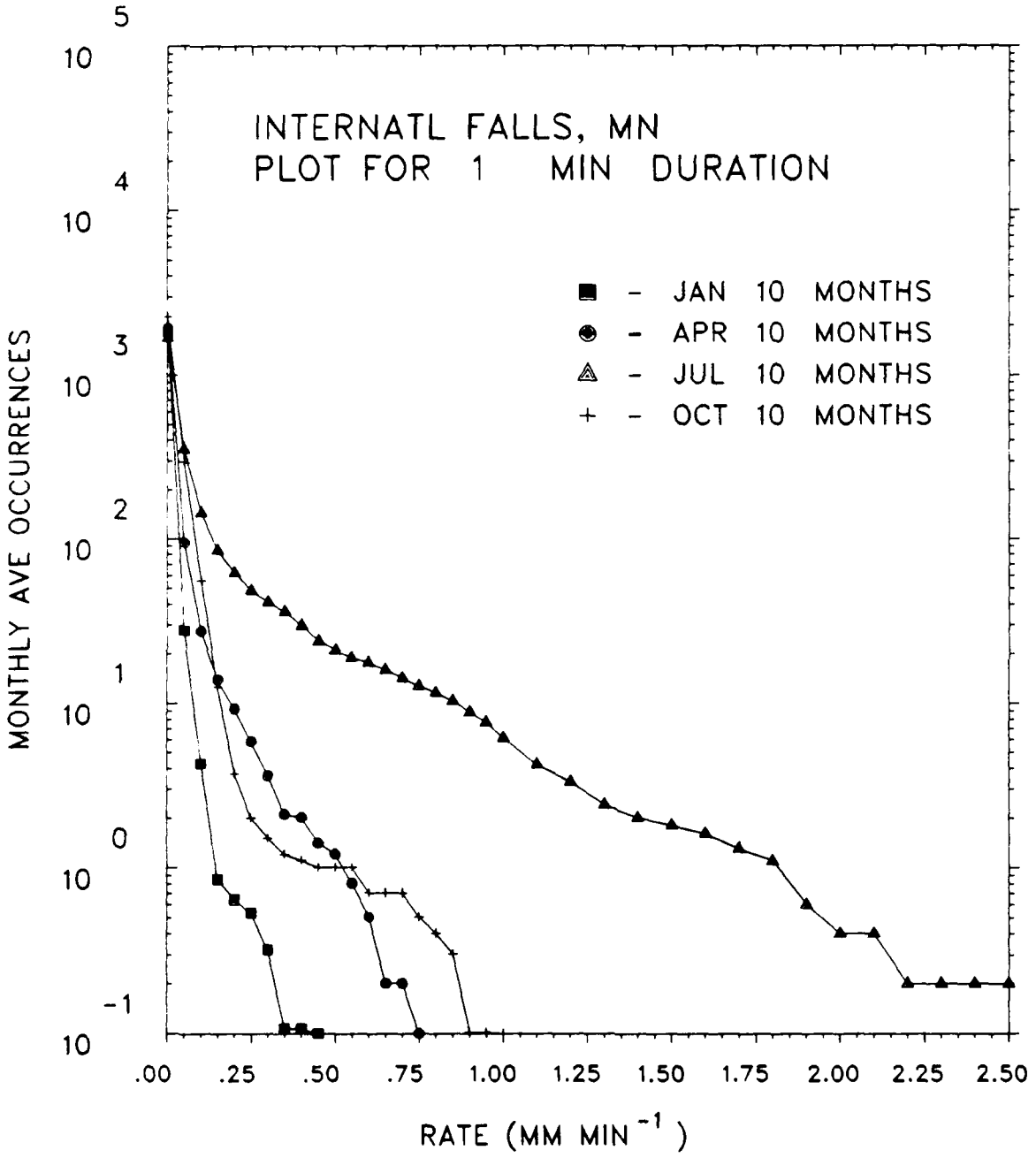

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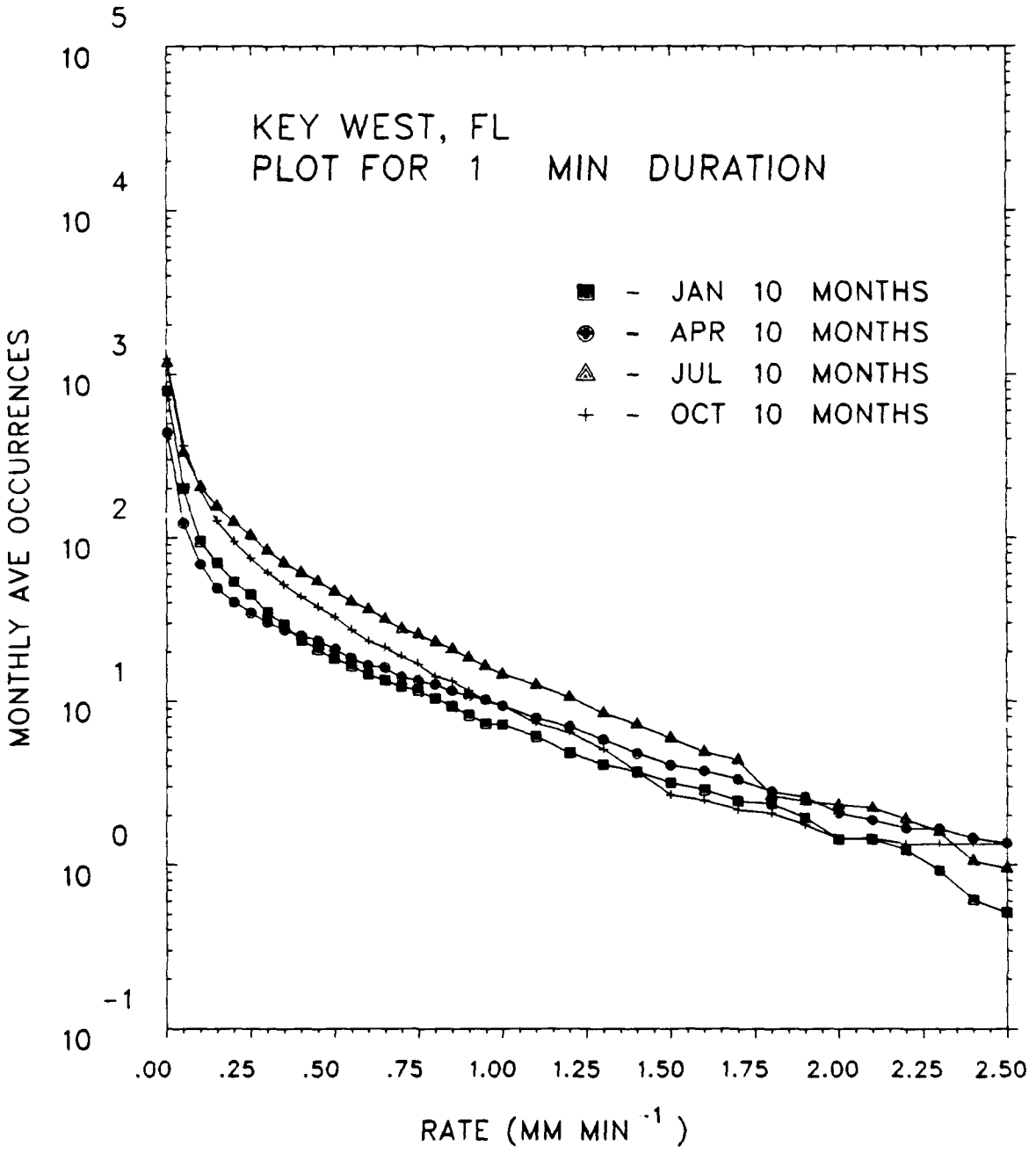

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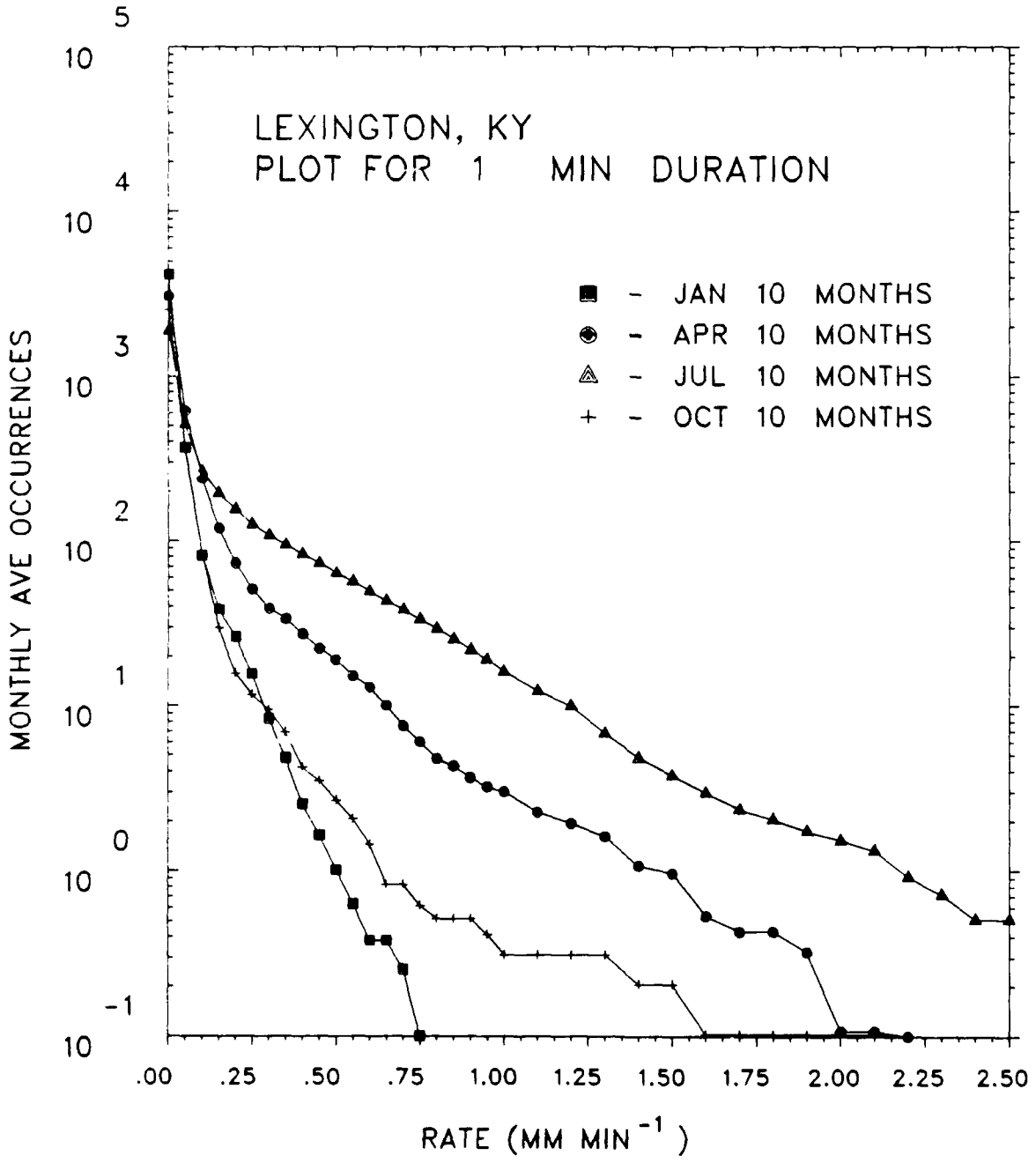

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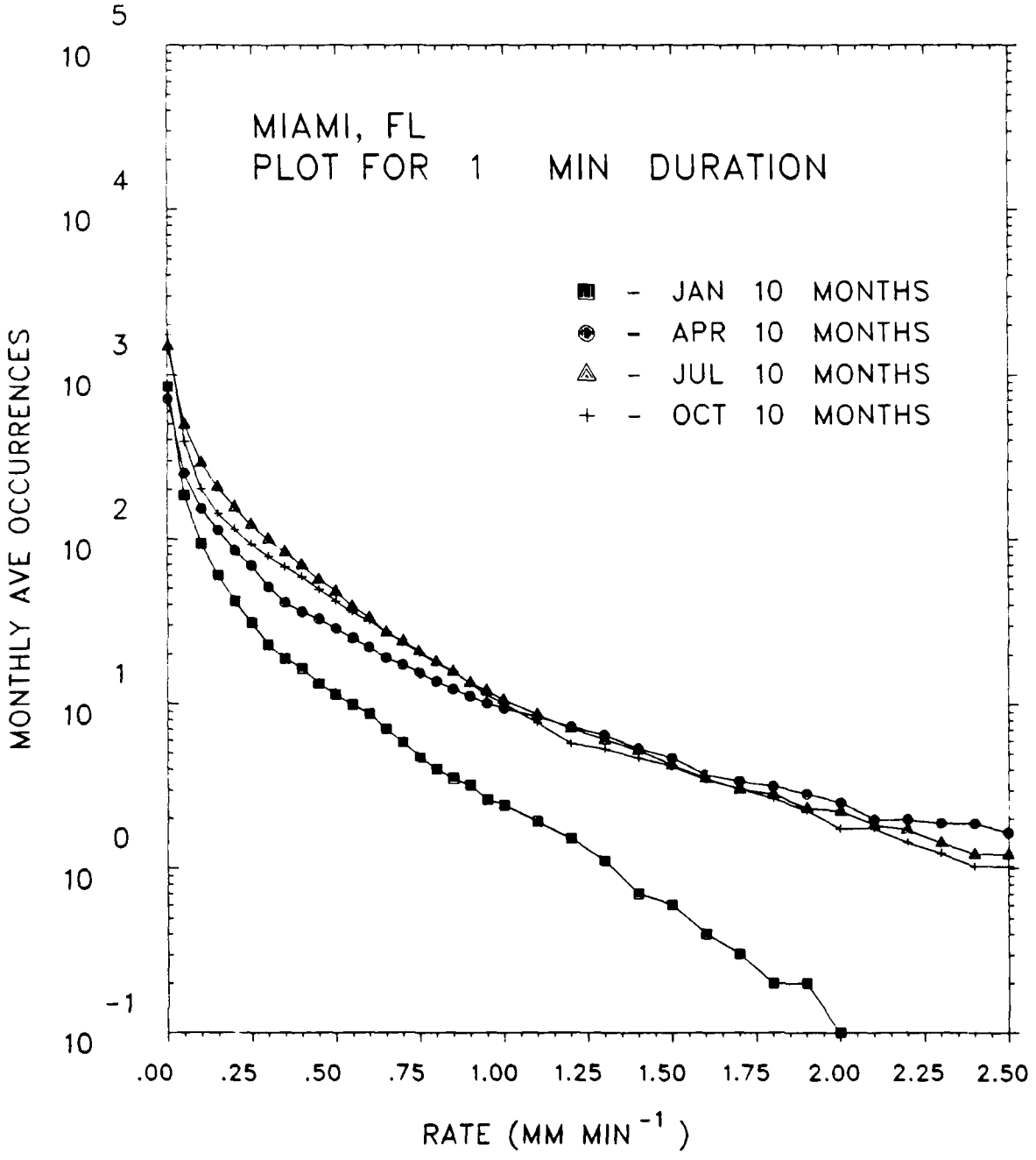

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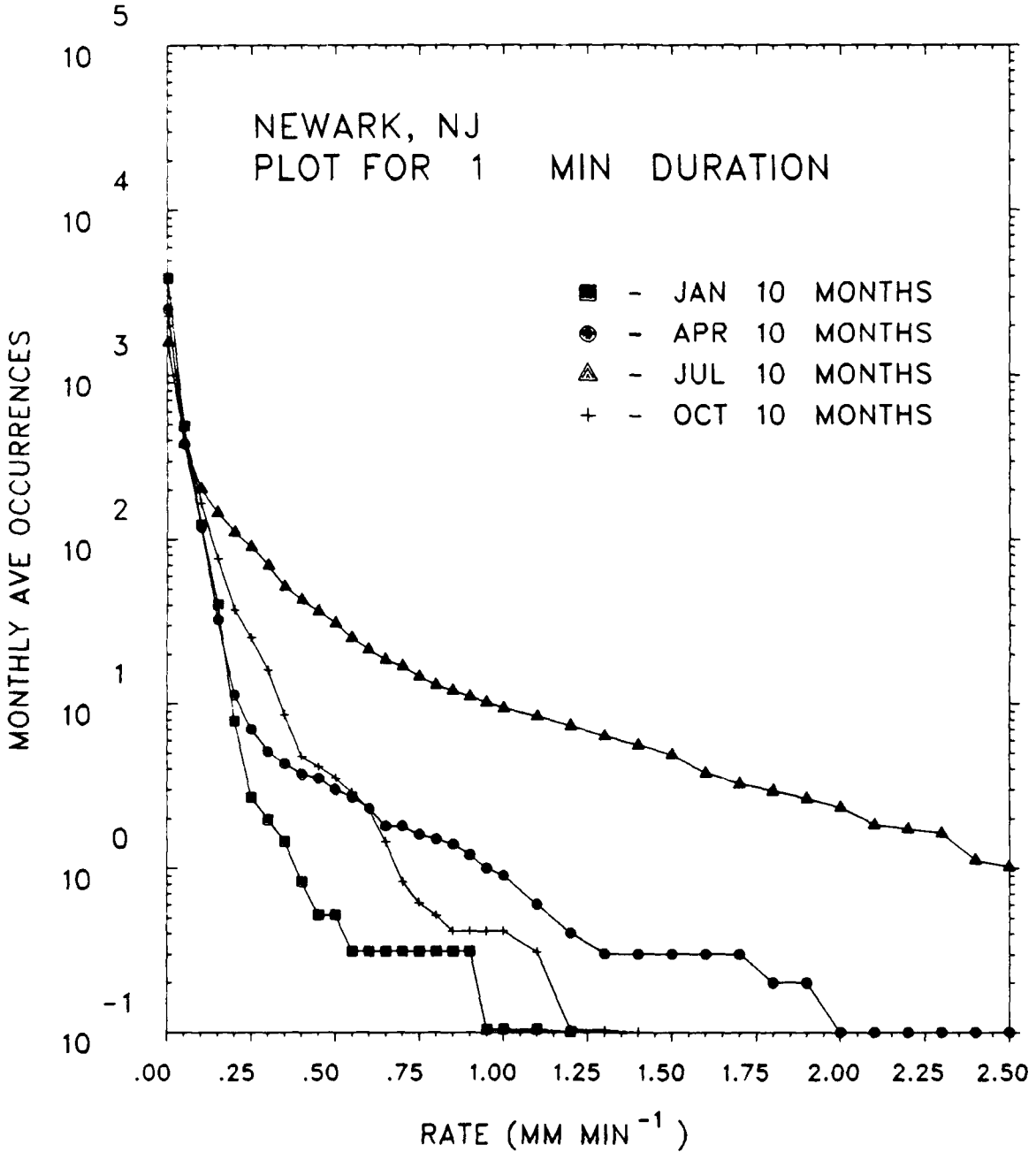

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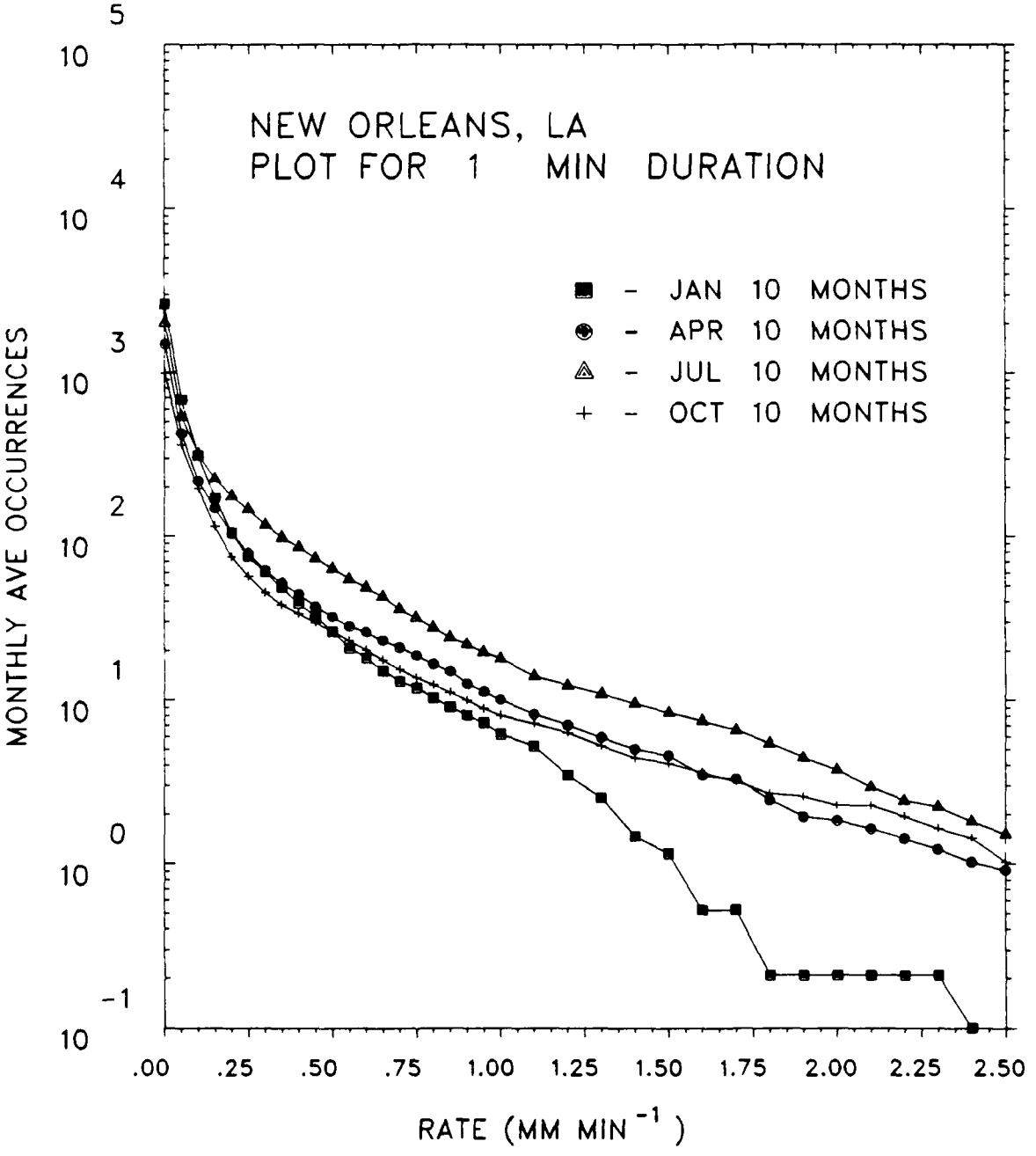

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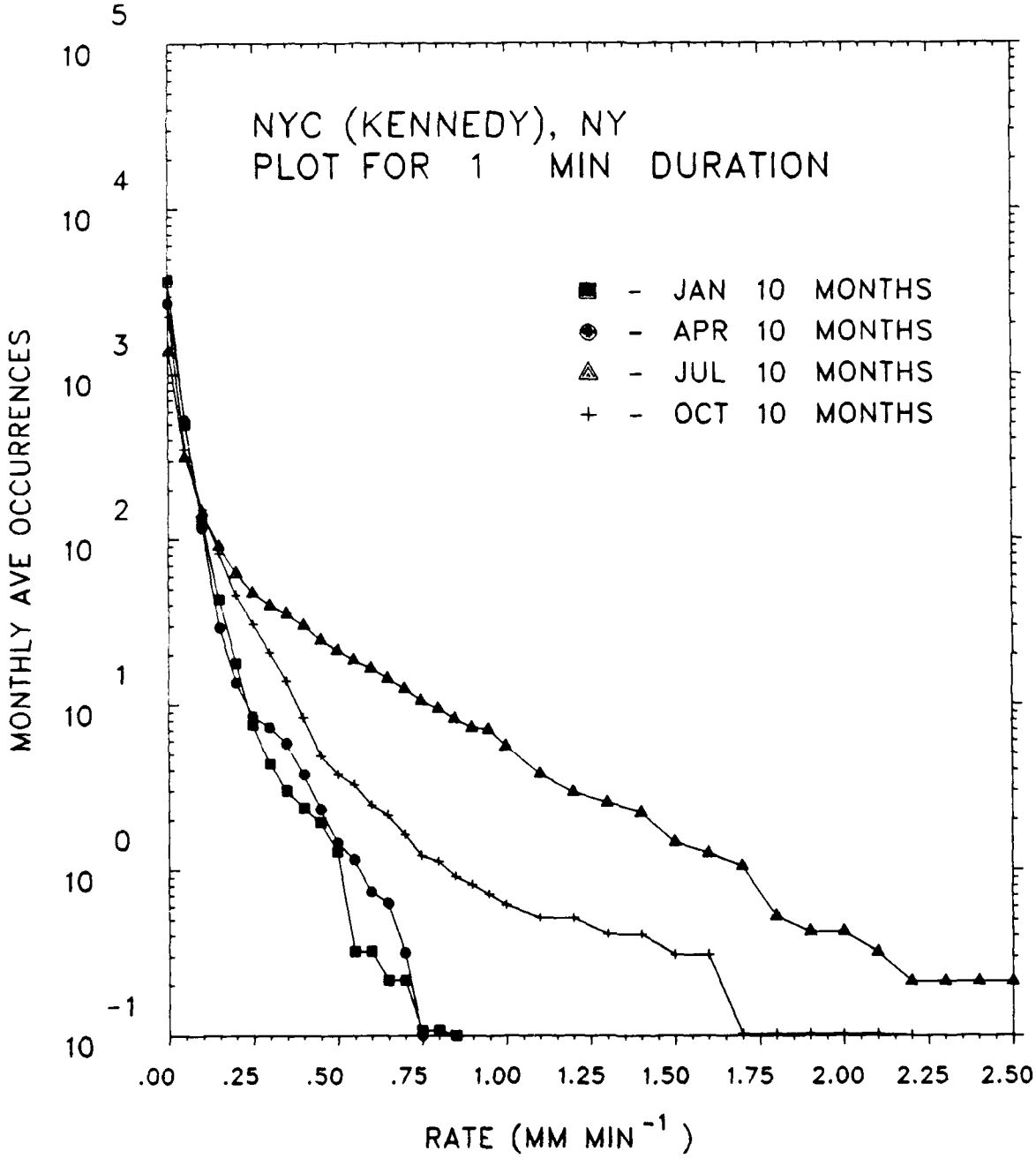

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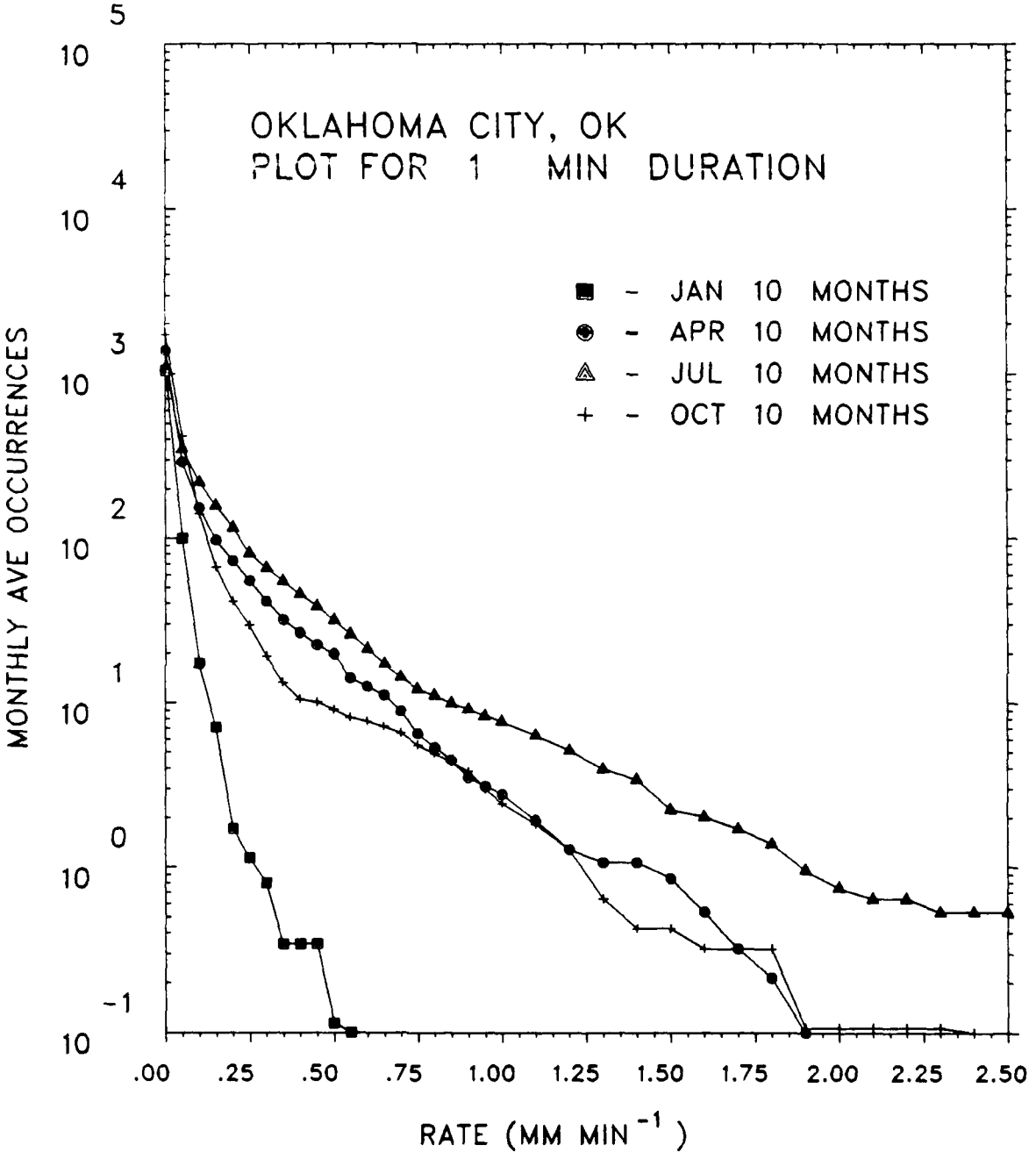

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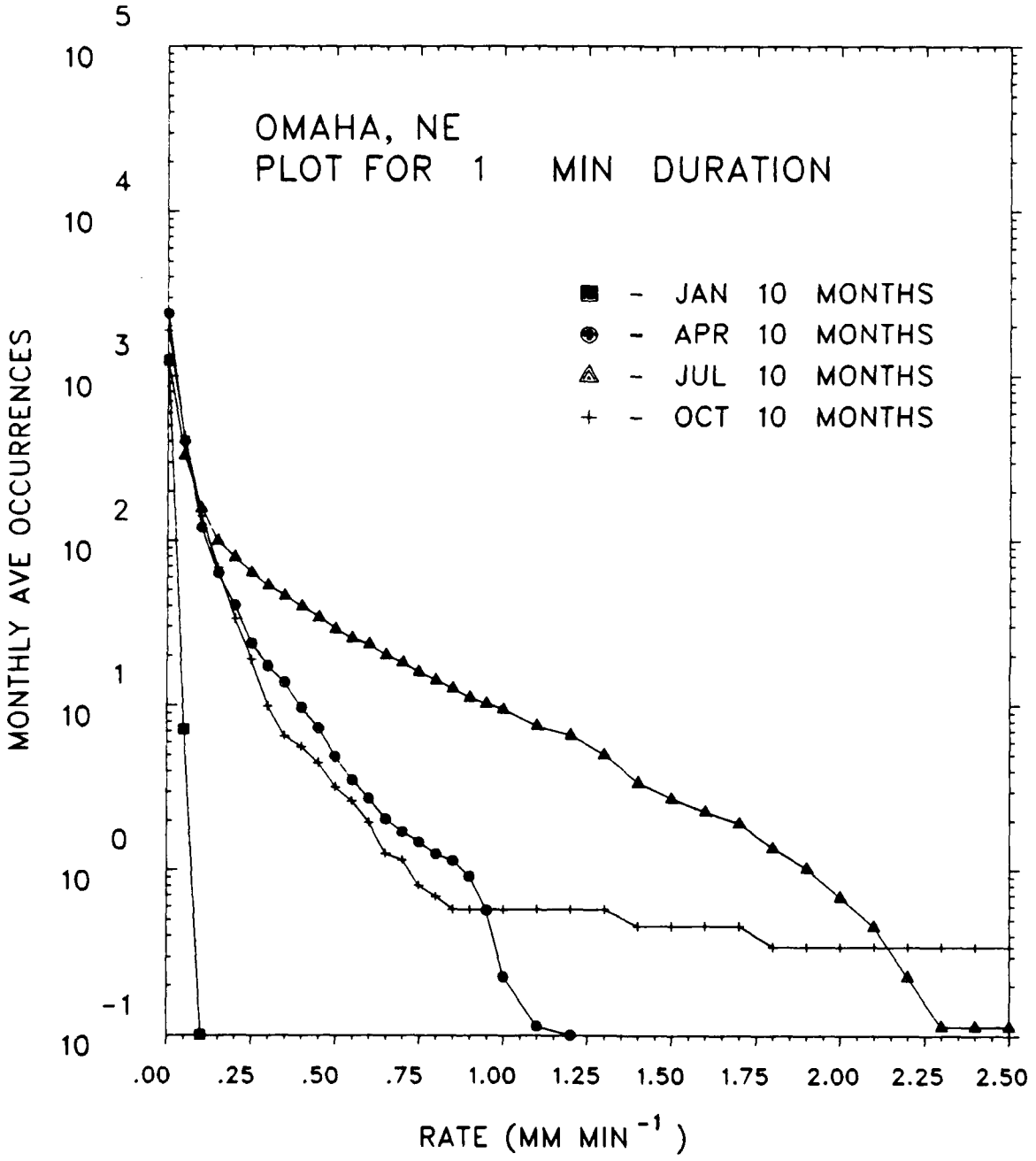

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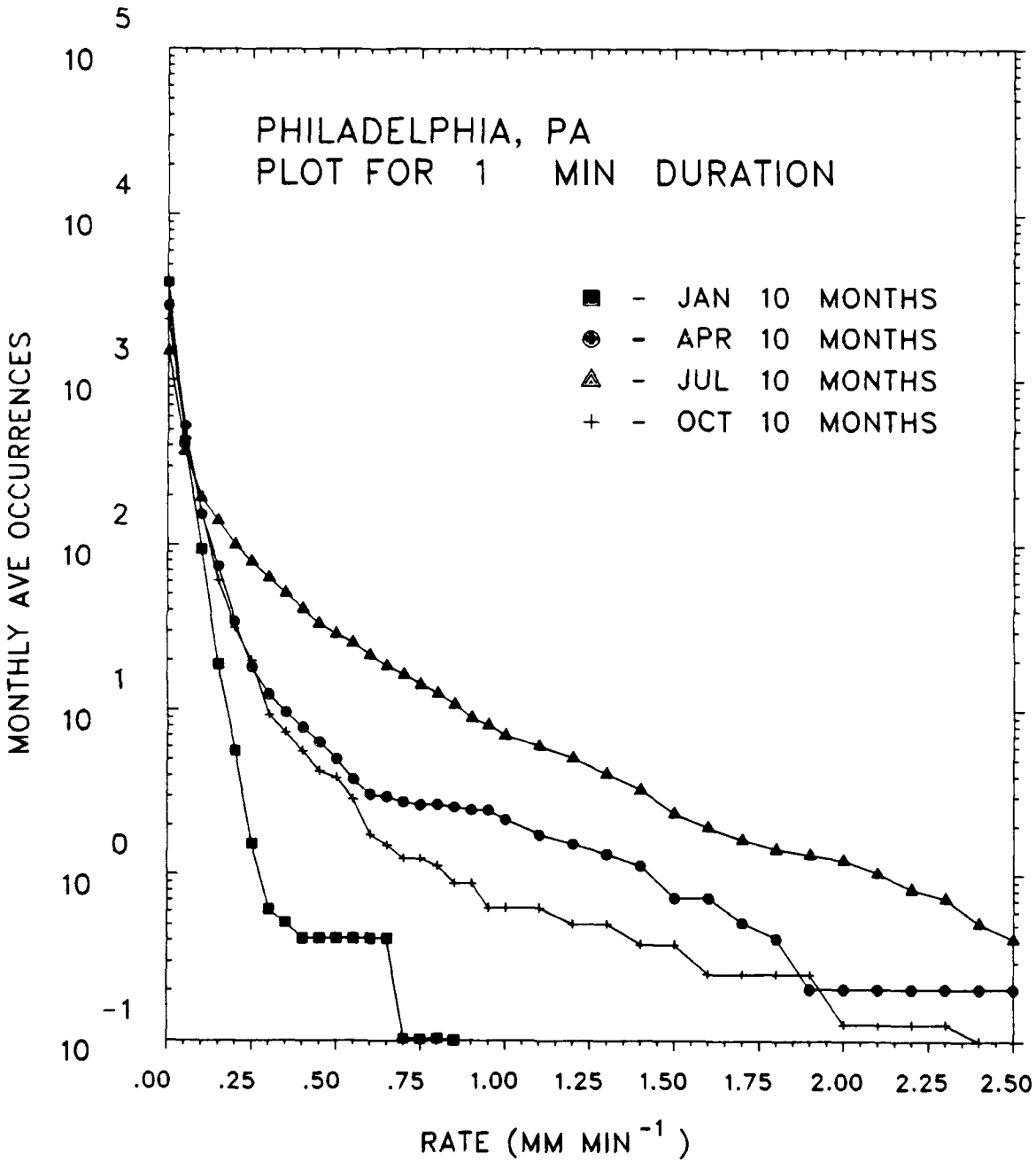

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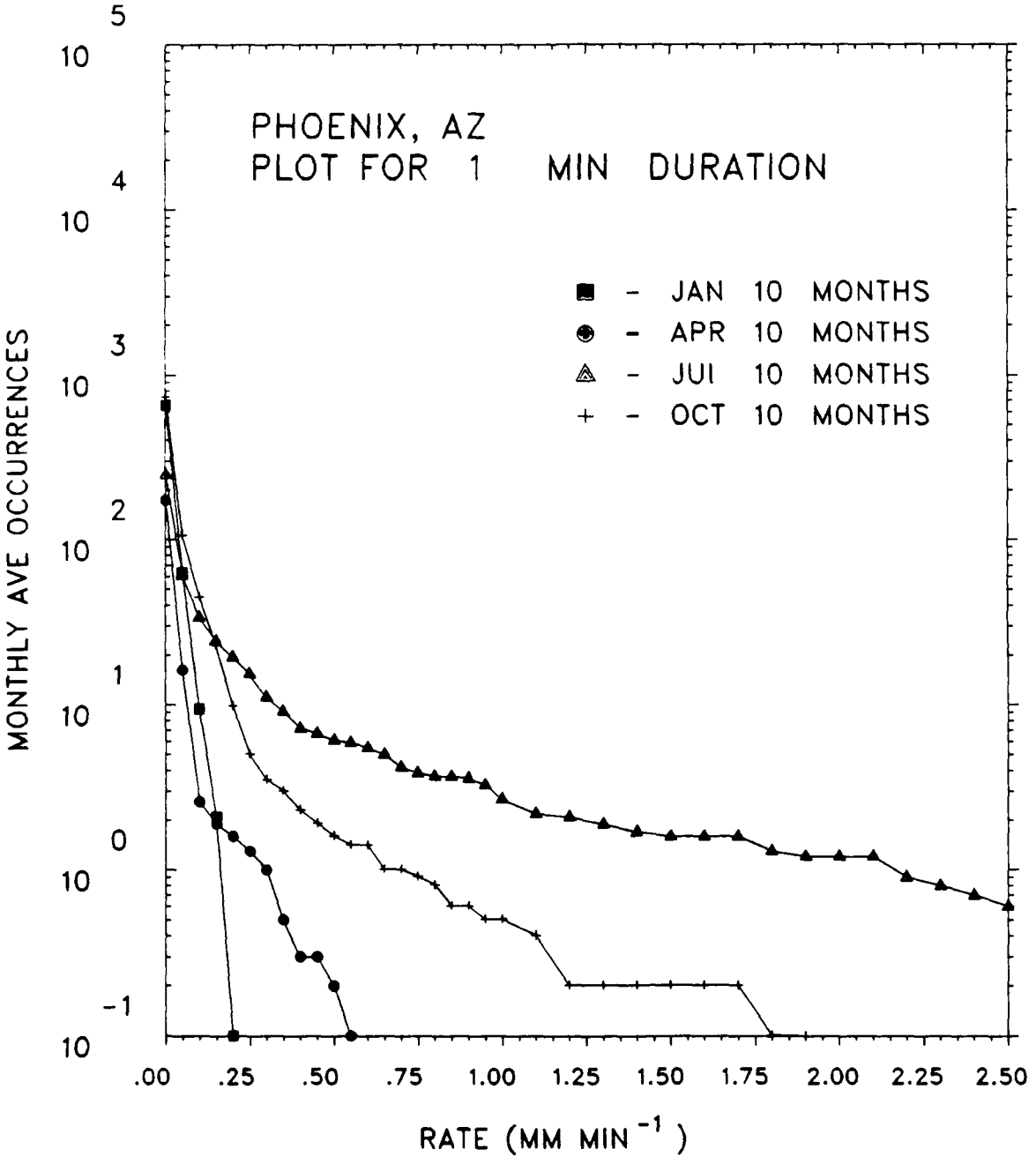

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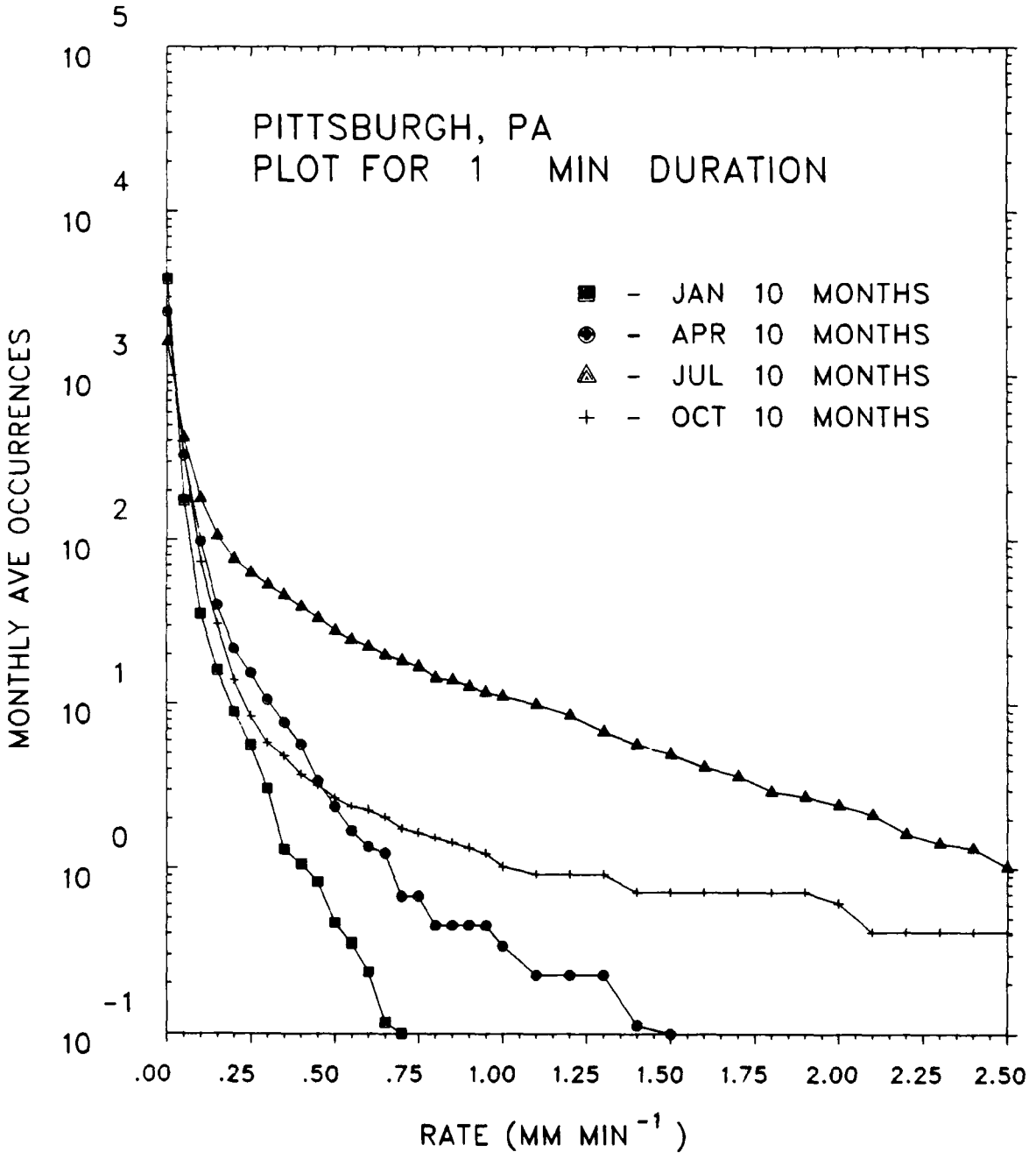

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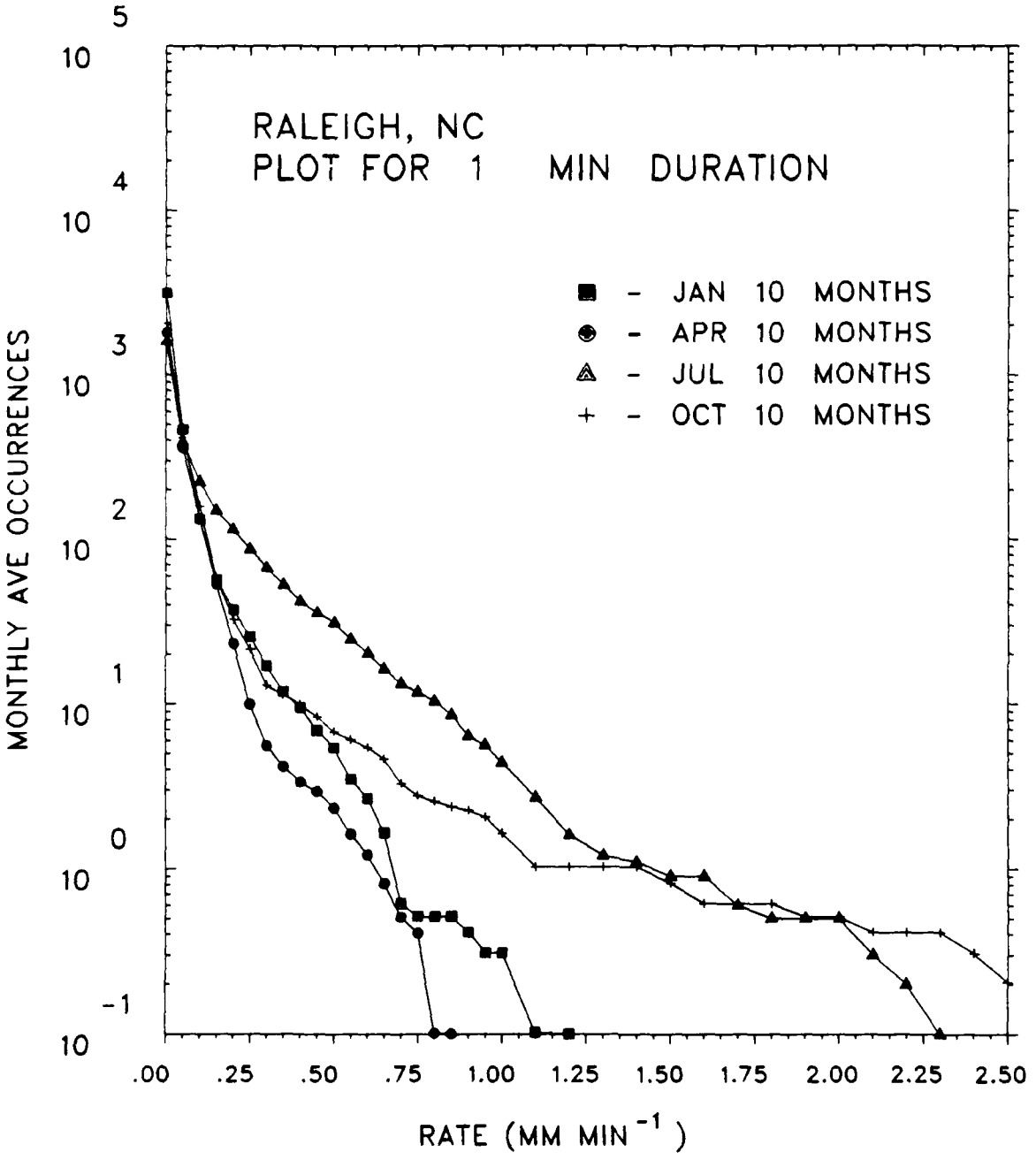

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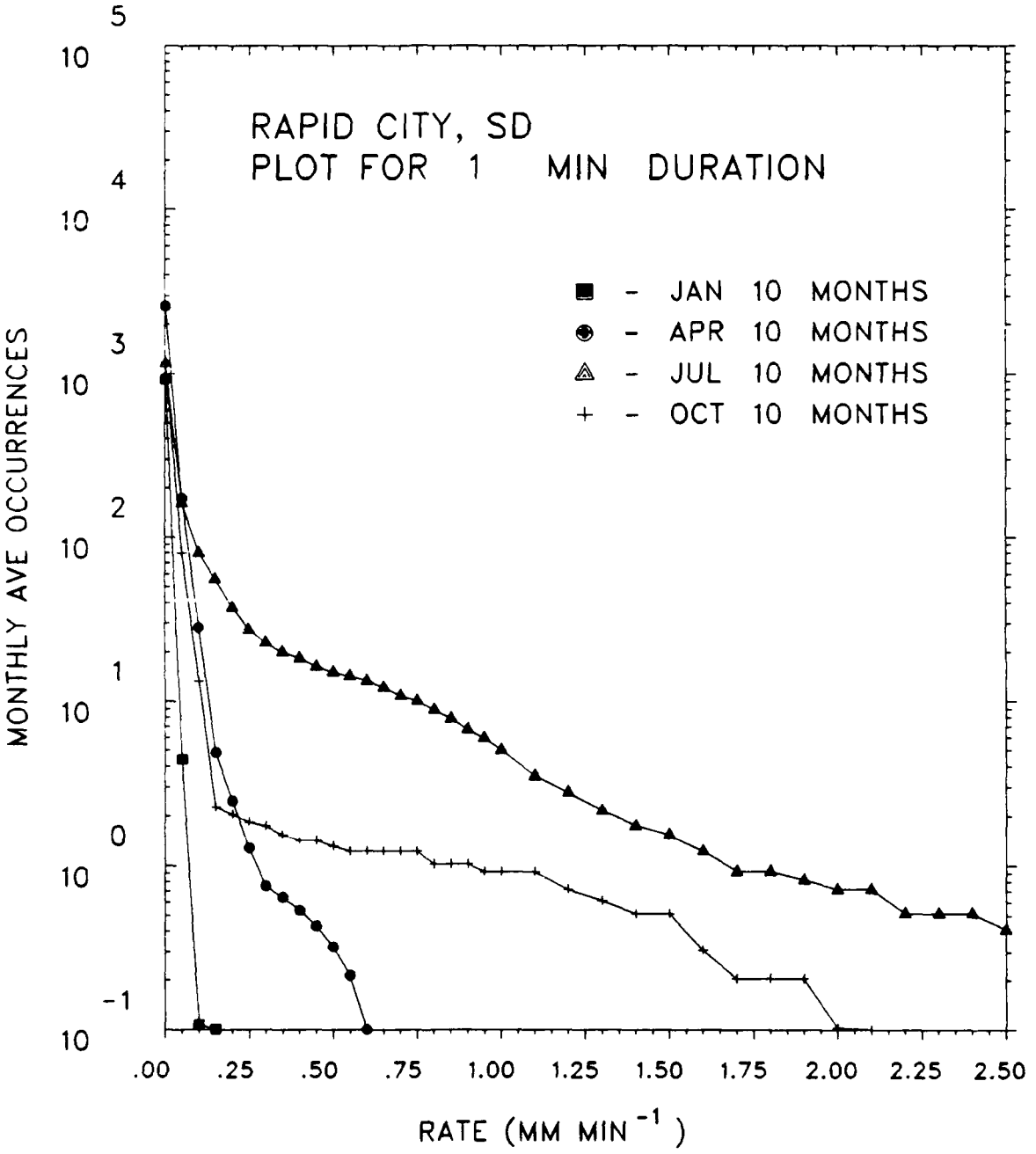

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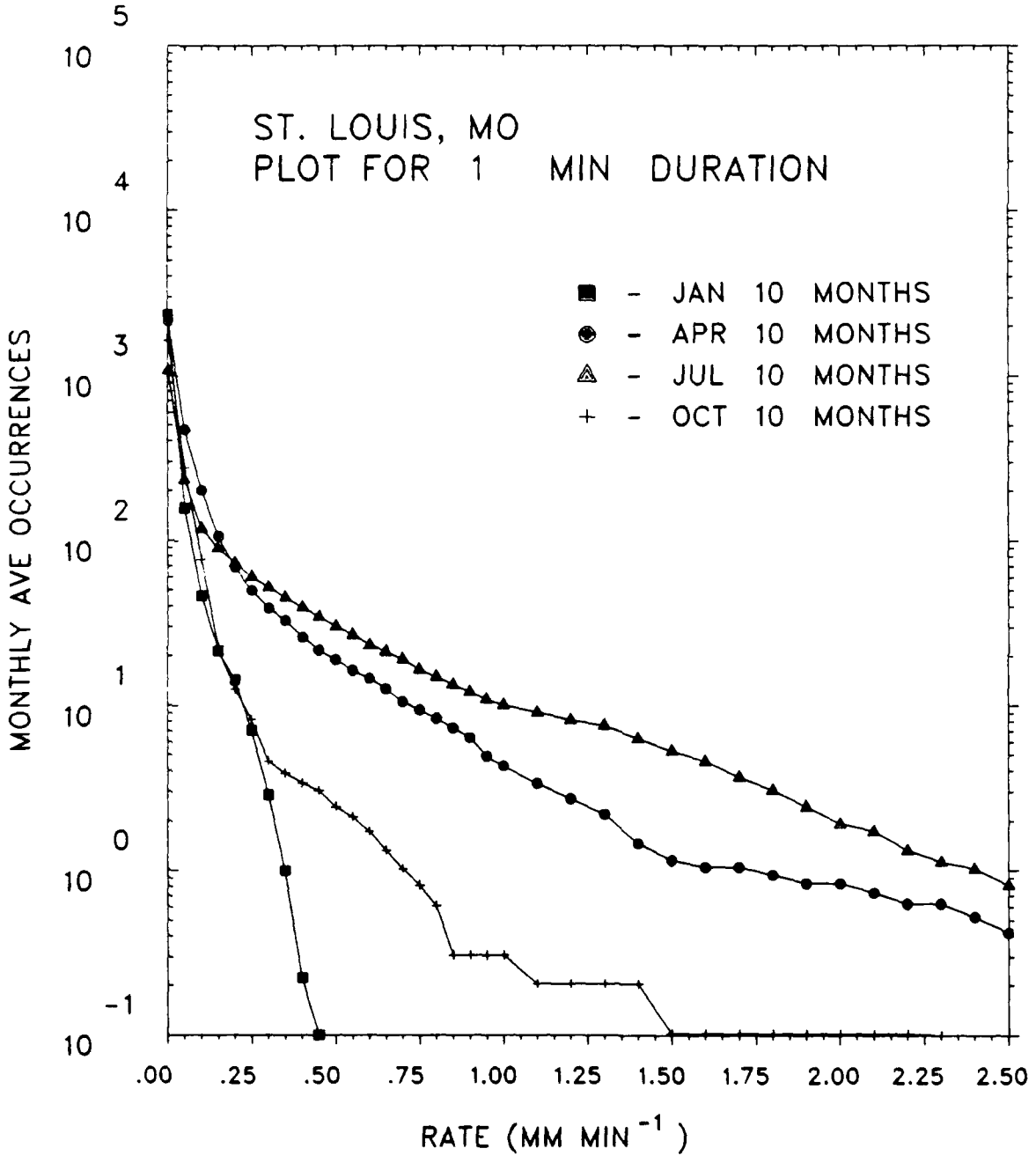

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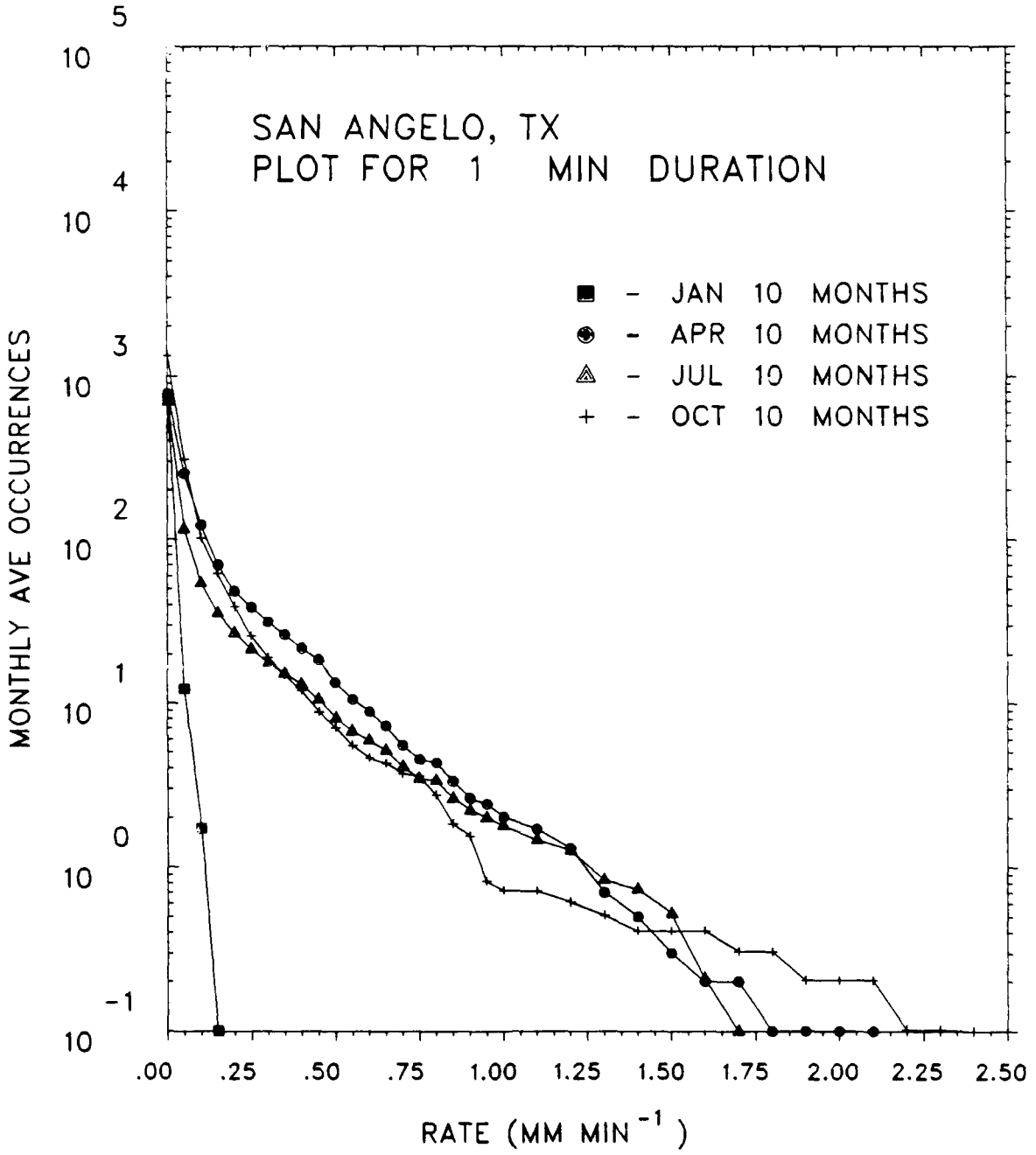

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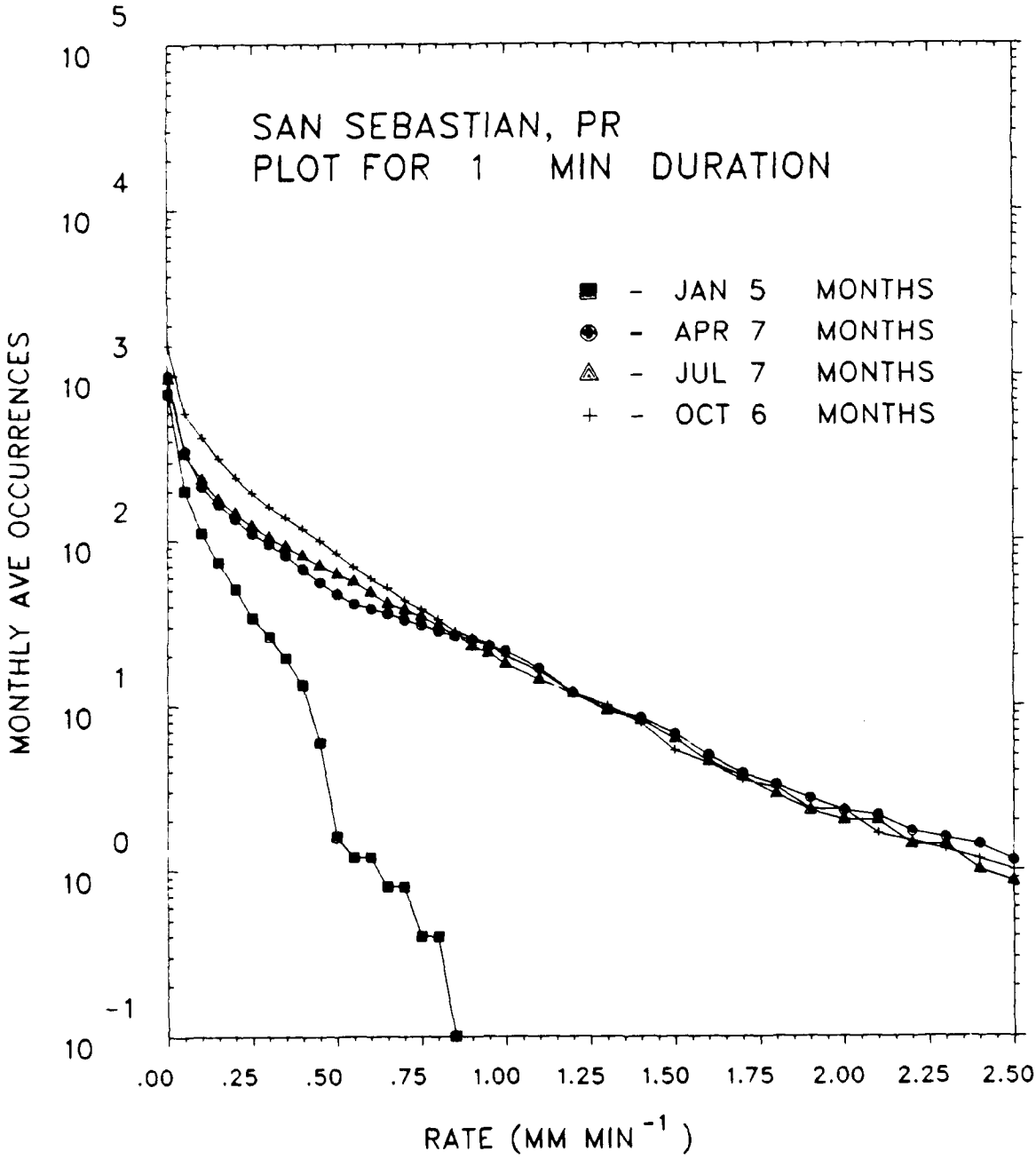
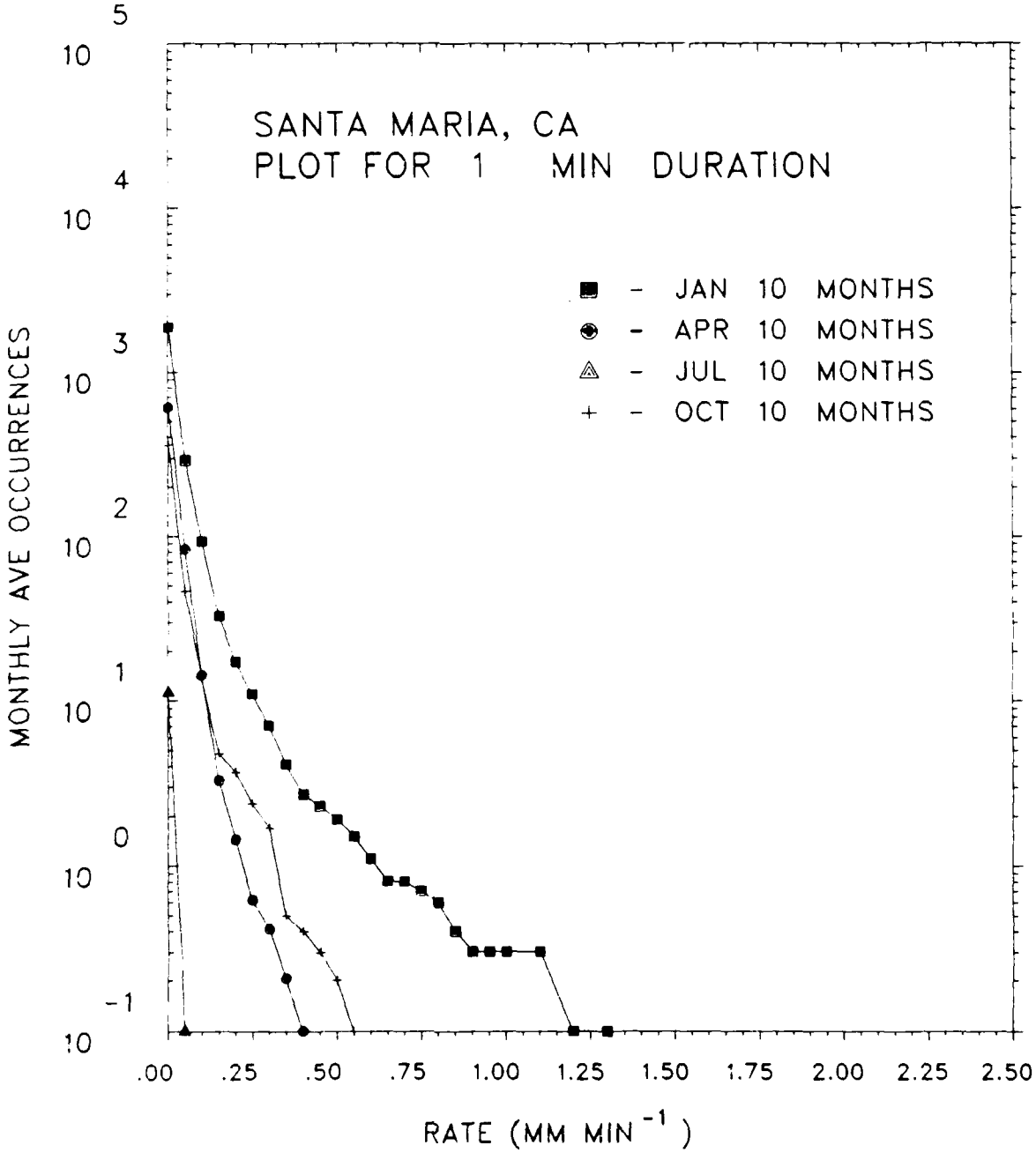


Figure 3. Monthly Average Number of Occurrences of 1-min Rain Rates for Mid-Season Months. Rain rates are those equalled or exceeded during each minute of the specified duration. (Cont.)



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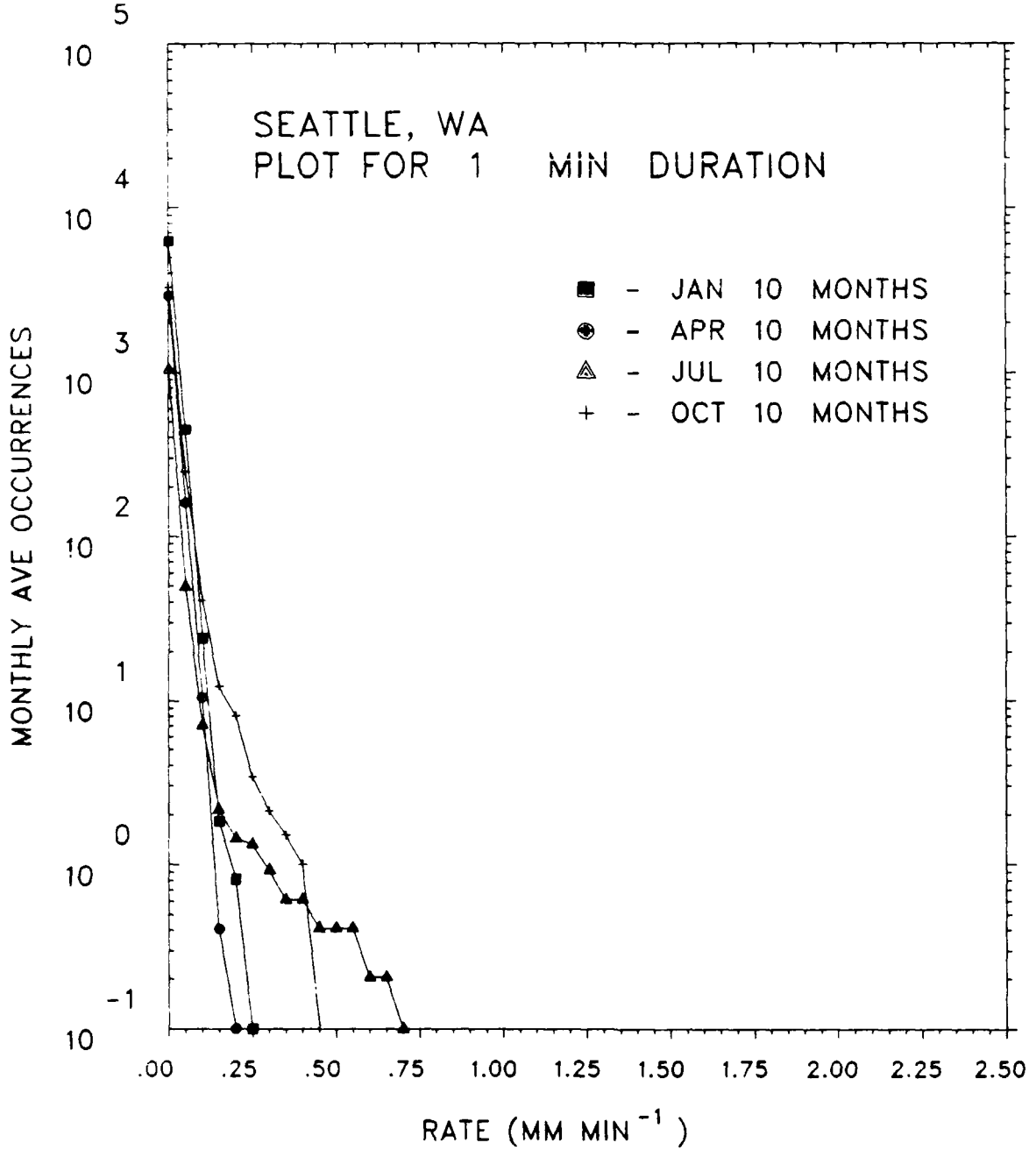

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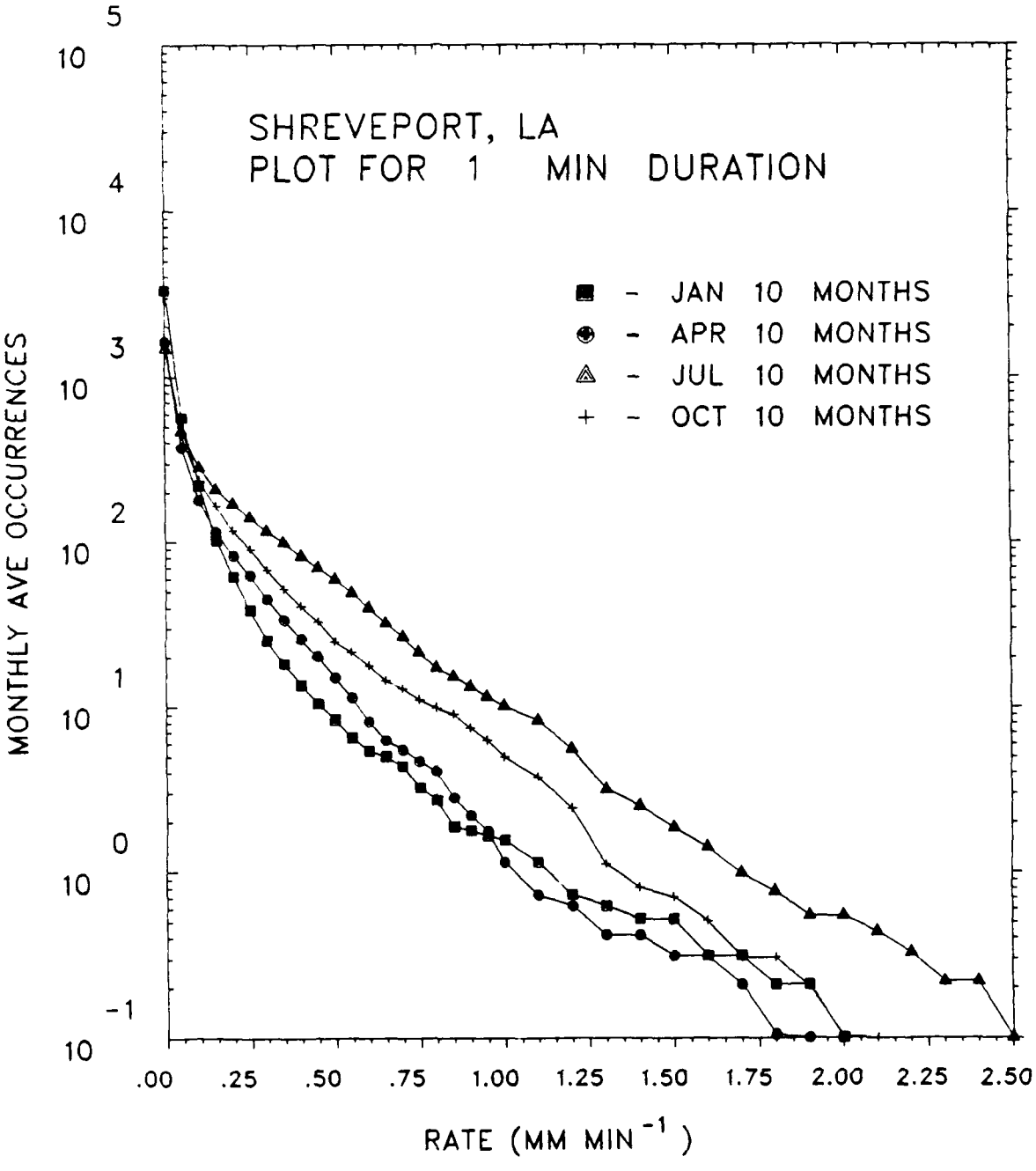

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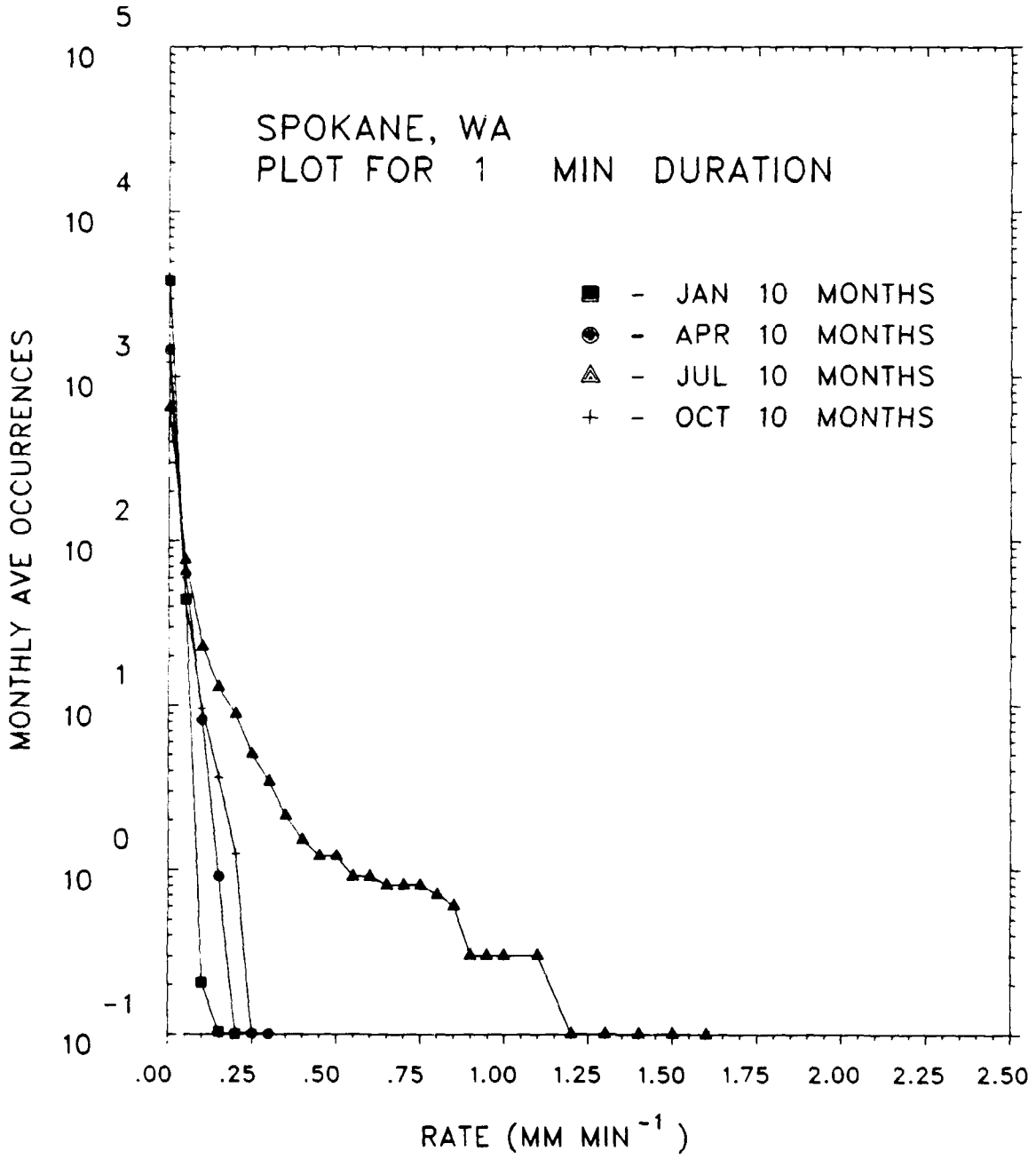

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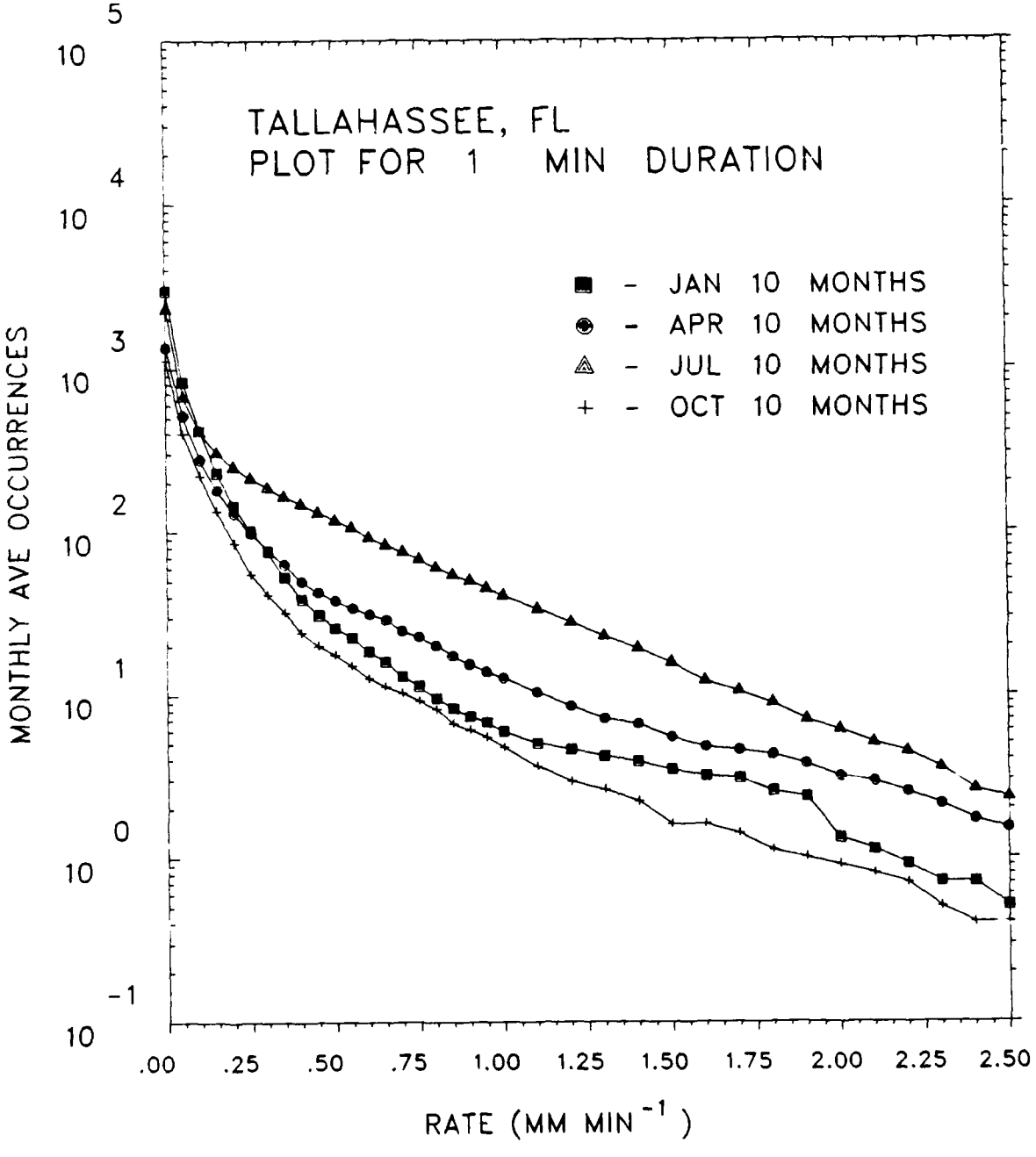

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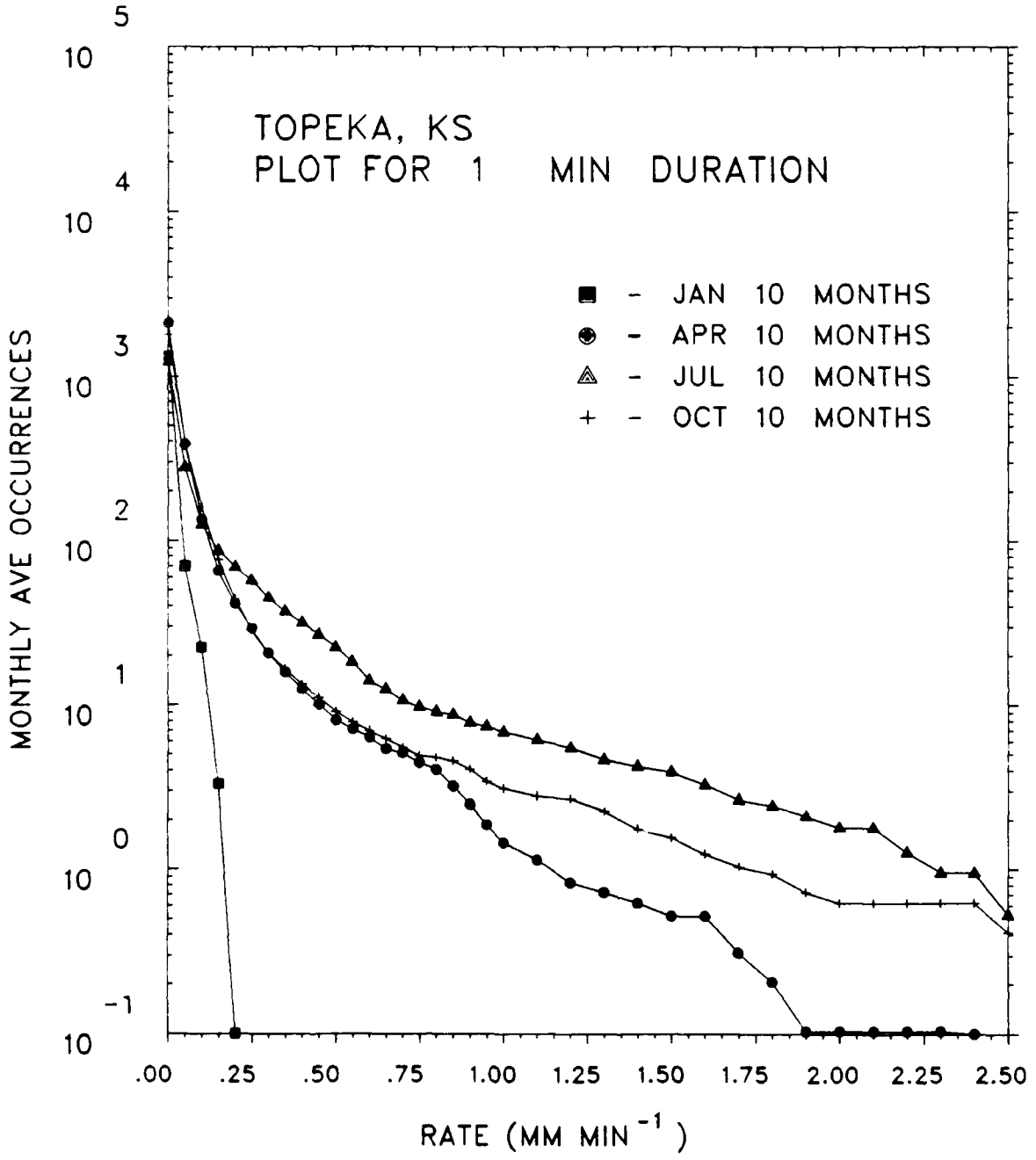

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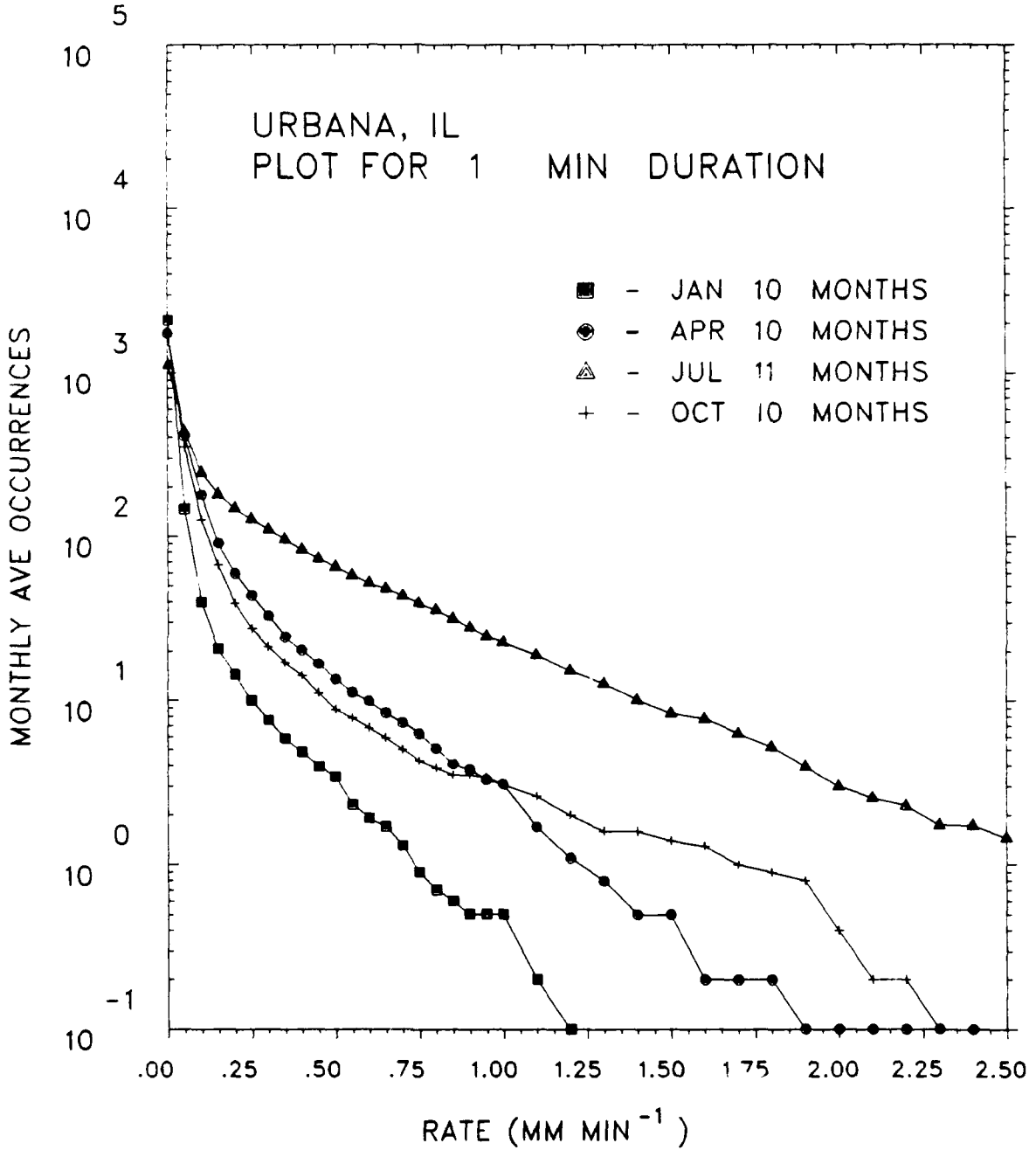

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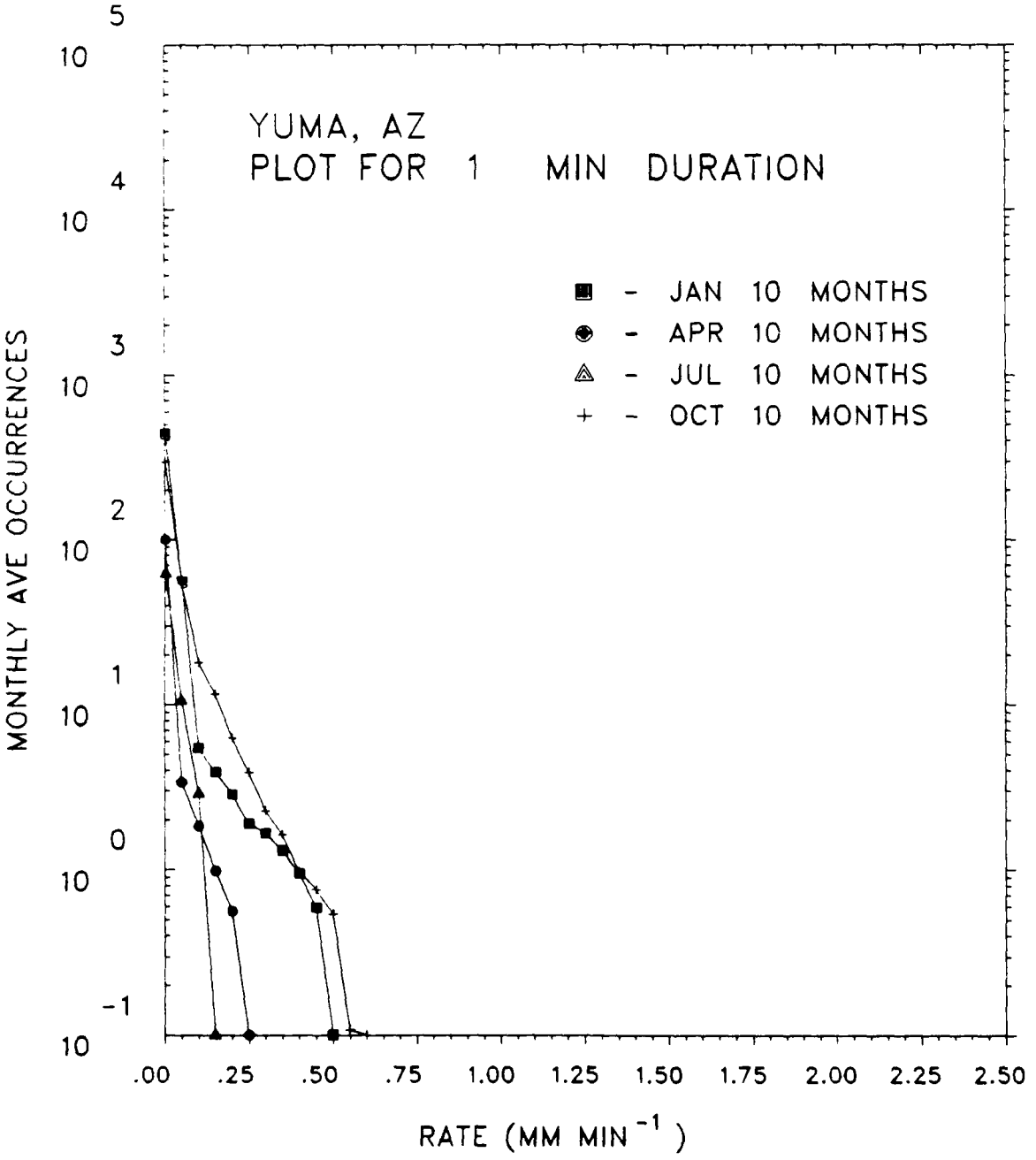

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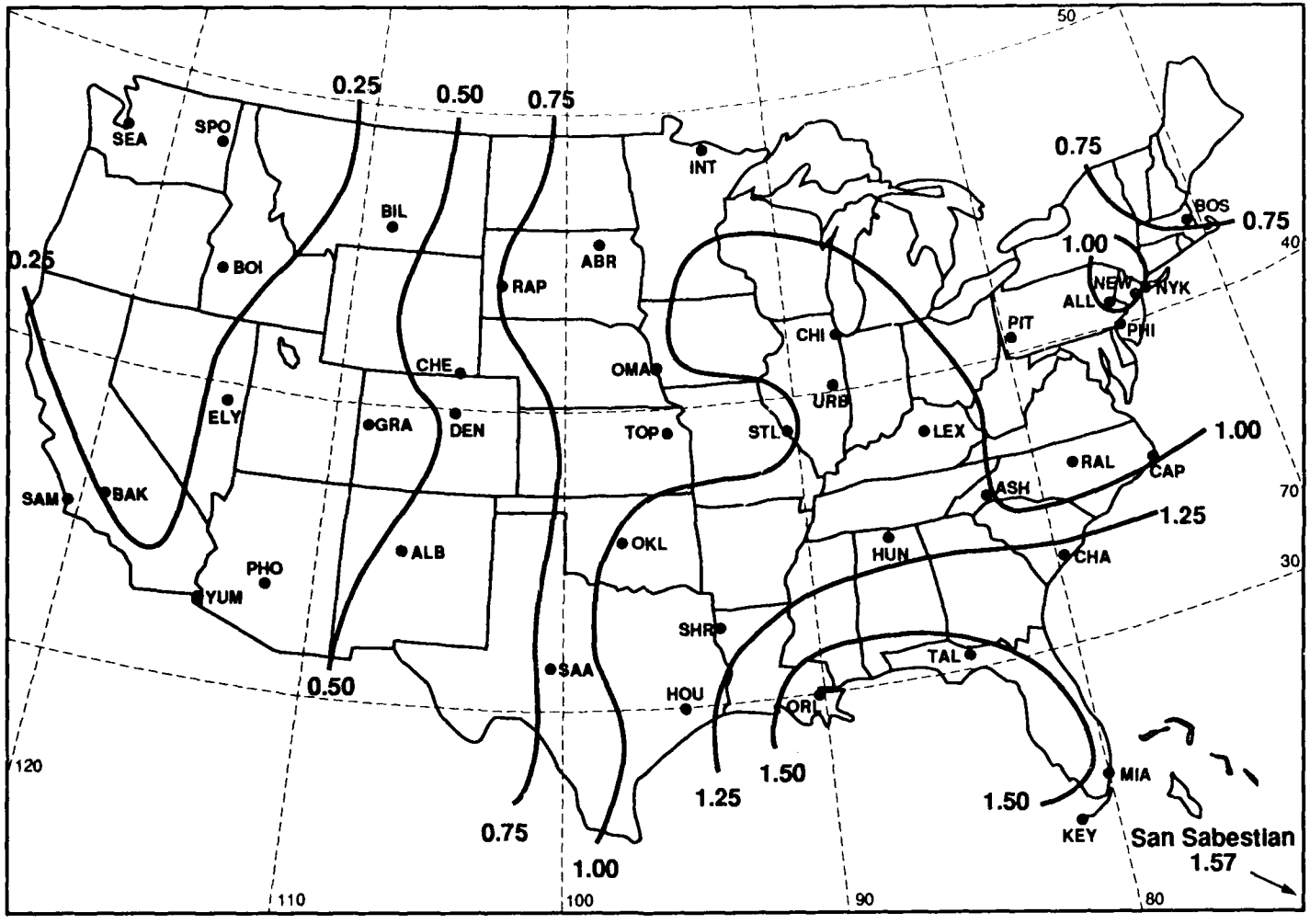

Figure 4. Rain Rate (mm/min) for a 5-min Duration with a 0.1 Probability of at Least 3 Occurrences During the Worst Month. (See Table 4 for station values)