



PACIFIC REGION TECHNICAL NOTES

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Fog Occurrence at Prince George Airport

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INTRODUCTION

The purpose of this report is to provide an up-to-date study of fog occurrence at the Prince George Airport. Previous publications were over a shorter period and covered only up to 1972. Increased industrialization of this area and a significant increase in population mean that earlier statistical reviews do not really apply to current conditions.

Except where noted, graphs and tables presented represent the period 1953-1982 - a 30 year record. The most significant environmental change occurred in the period 1966-68 when 3 large pulp mills went into operation within a few miles of the airport.

HISTORY AND TOPOGRAPHY

Prince George city is located in a valley at the junction of the Nechako River with the Fraser River. Surrounding the city and about 100 metres higher in elevation is a relatively flat plateau with higher ridges some distance off in a direction from southeast to northeast. The airport was established on this plateau about three and a half miles southeast of the city in 1942 at an altitude of 672 metres above sea level. Surrounding the airport is a mixture of farm land and coniferous forest.

Weather observations began in the Prince George area in August, 1912, in South Fort George and continued at several locations in the river valley until July, 1944. An official weather station was opened at the airport in July, 1942, and has continued with no significant change.

ANALYSIS OF GRAPHS

For the purpose of this report, fog has been determined as a hydrometeor suspended in the atmosphere near the earth's surface which reduces the visibility to or below $\frac{1}{2}$ mile. In compiling the data an occurrence of fog is tabulated whenever the visibility on the hourly weather report is recorded as $\frac{1}{2}$ mile or less. A fog day is considered as any day on which at least one occurrence of fog was reported.

Figure 1 illustrates the occurrence of fog throughout the year. The trend shown is similar to that of previous studies - despite changes in local conditions the seasonal distribution pattern remains unchanged. The strong September maximum occurs due to seasonal cooling in combination with normally stable weather patterns. The cooling of late fall and early winter months is nullified in part by stormy conditions and unsettled weather patterns.

Figure 2 illustrates the occurrence of fog by hour of day over the 30 year period. The maximum occurrence is at 6 a.m. local time and the minimum occurrence between 1 and 3 p.m. This shows graphically the problems encountered with early morning airport operations.

Figure 3 dramatically shows the increase in fog days over the 30 year period. Note that no year prior to 1968 exceeded the mean of the period and that only 3 years since 1968 have been below the same 30 year mean.

Figure 4 depicts the seasonal distribution pattern of fog at Prince George. January shows a maximum occurrence of fog at midnight and a minimum just after noon. The increase around sunset is typical. The slight decrease between midnight and sunrise is unusual but suggests that very rapid radiation occurs immediately after sunset so that fog forms very quickly up to midnight. The slow decrease thereafter may be accounted for by the deposition of frost or ice crystals on the snow surface and hence a lack of available moisture for continuing the formation process.

February and March are more typical of the usual pattern and show a very rapid increase in fog after sunset to a maximum frequency near sunrise and a rapid decrease thereafter.

April is the month with the fewest occurrences of fog.

May through August show rapid increases in occurrences from near midnight until sunrise and similarly rapid decrease thereafter.

The highest occurrence of fog for the year occurs in September. Note the strong peak around sunrise. September is also the month that the first significant evening fogs occur.

The October peak at sunrise is much lower but much broader than is September's. This is the first month of fall to show occurrences throughout the afternoon hours.

November occurrences are similar to those of October but more evenly spread throughout the 24 hours. The low spot in occurrence is at 1:00 p.m. with an immediate rise again thereafter.

December shows a more or less uniform pattern throughout the 24 hours. There are three relative crests - just before midnight, just after midnight, and at sunrise - and a low at 1:00 p.m. However, the amplitude between low and high is much less than in any other month. The early peak before midnight is the first sign of the unusual pattern that is noted in January.

AN ANALYSIS OF THE EFFECTS OF INCREASED INDUSTRIALIZATION UPON FOG OCCURRENCE AT THE PRINCE GEORGE AIRPORT

Several changing environmental factors have led to an increase in fog occurrence over the last 30 years. These factors are:

1. More land is cleared around the airport each year allowing the effects of radiational cooling to become more widespread over larger areas.
2. Additional nuclei being pumped into the air from increased automobile traffic, city industries, and homes.
3. Additional water vapour from the above mentioned sources.
4. The opening of 3 large pulp mills between 1966-68.

THE PULP MILLS EFFECT

The three pulp mills became operational in the Prince George area between 1966-68. By referring to Figure 3, note the dramatic increase in fog days immediately after those dates.

Figure 5, which shows the occurrence of fog by wind speed and year, shows a sudden increase in calm weather fogs after 1967. Perhaps an explanation for this would be the fact that with the mills nearby, more condensation nuclei and water vapour were suddenly available for fog formation, especially under quiet atmospheric conditions.

Another substantive feature is that after the initial operational stages of pulp mill production, the increase in fog occurrence has levelled off again.

- A more substantive report is to be published as an AES Technical Memoranda.

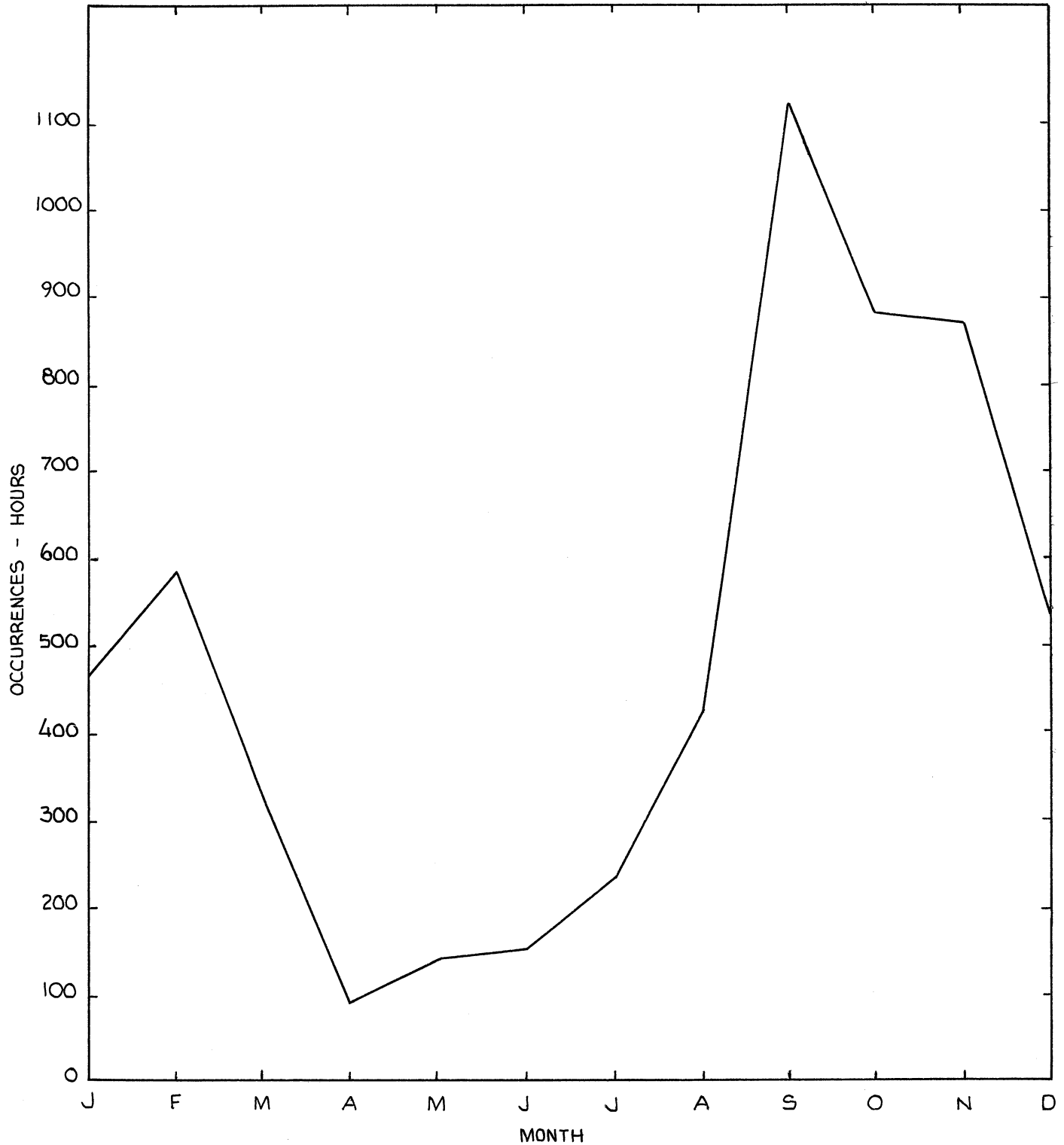


FIGURE 1
TOTAL HOURS OF FOG BY MONTH
1953 - 1982

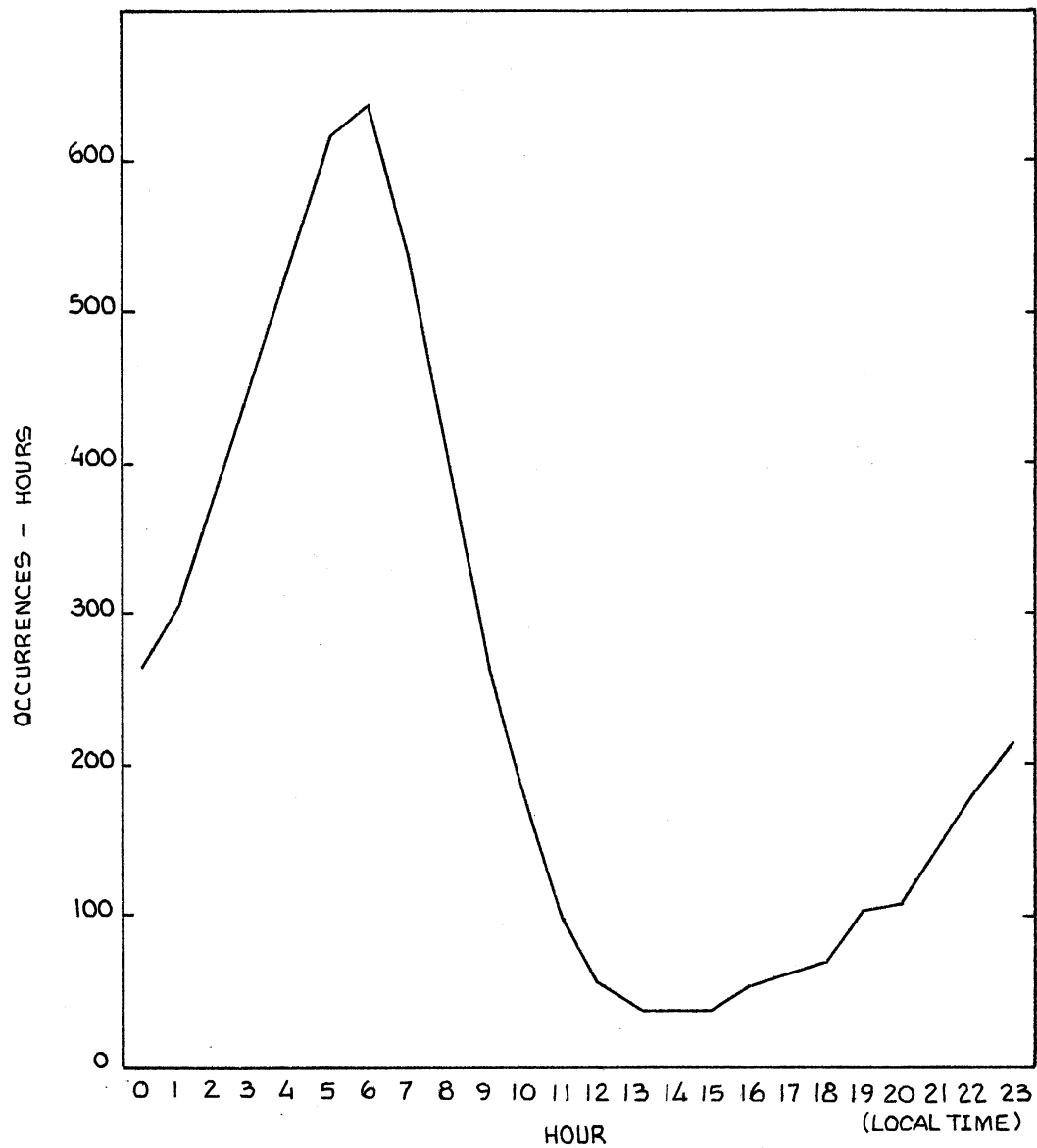


FIGURE 2.
OCCURRENCE OF FOG BY HOUR OF DAY
1953 - 1982

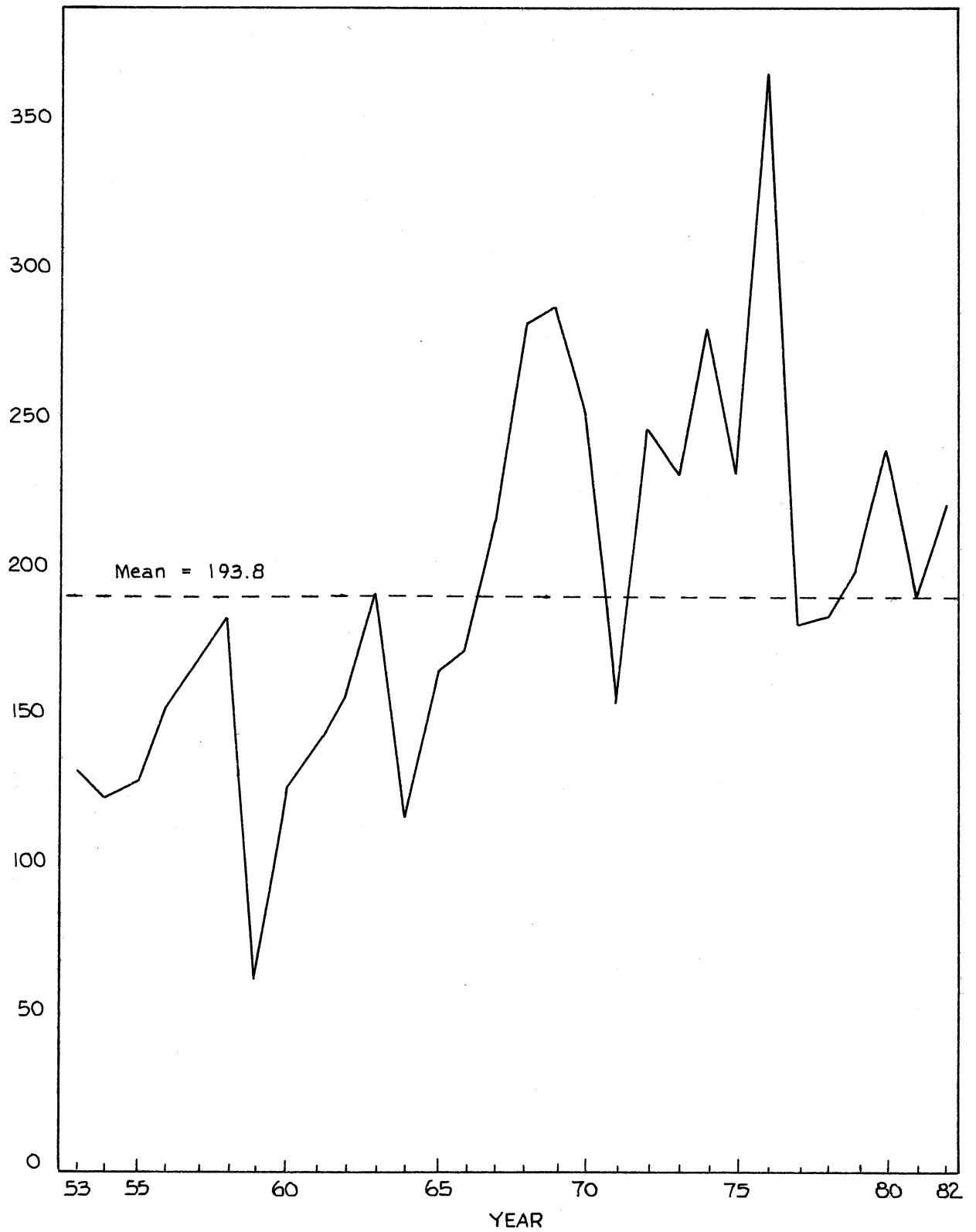


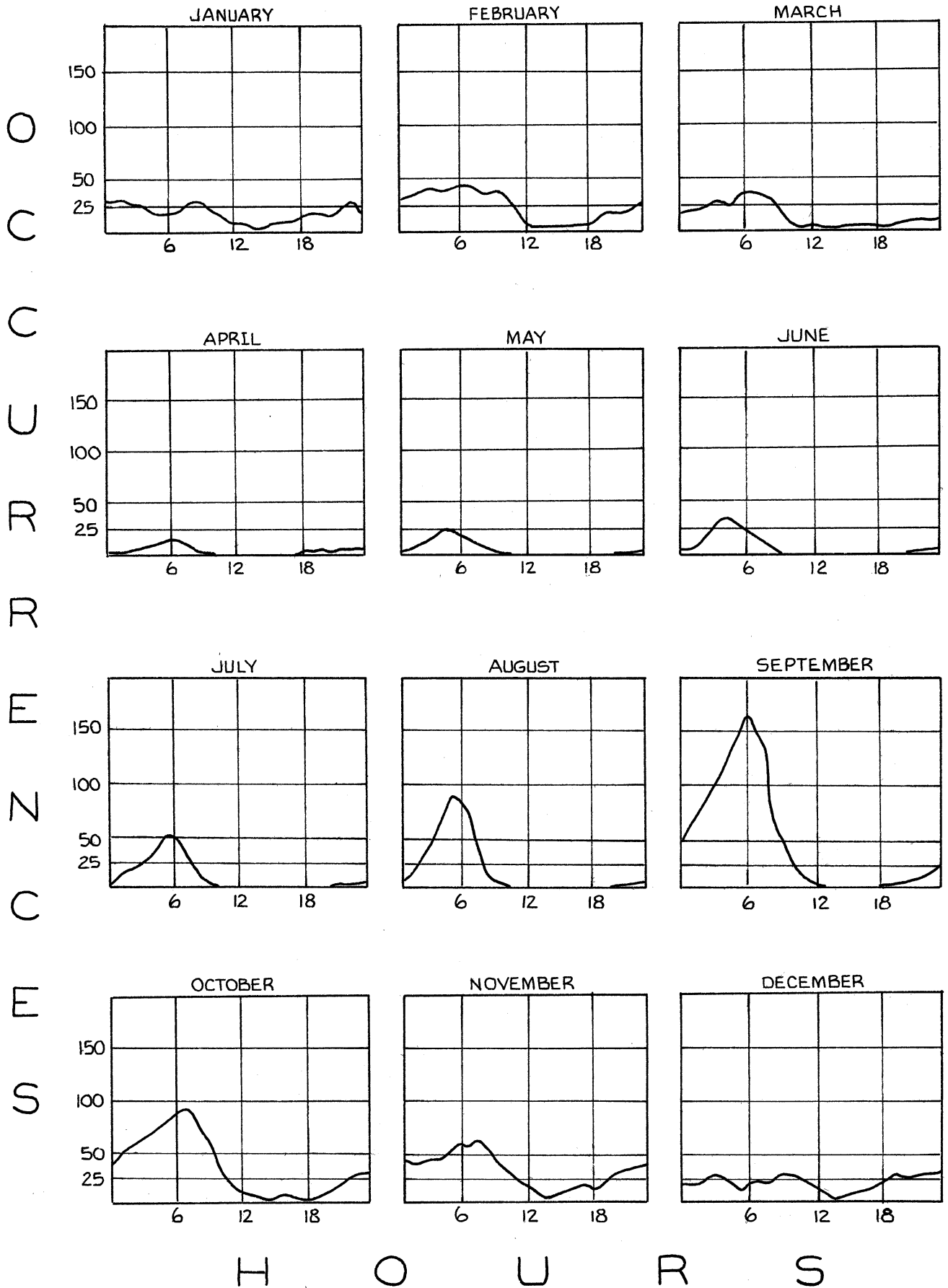
FIGURE 3.

DAYS WITH FOG - AS COMPARED TO NORMAL

FIGURE 4.

SEASONAL DISTRIBUTION

Number of fog hours versus daily hours (local time)



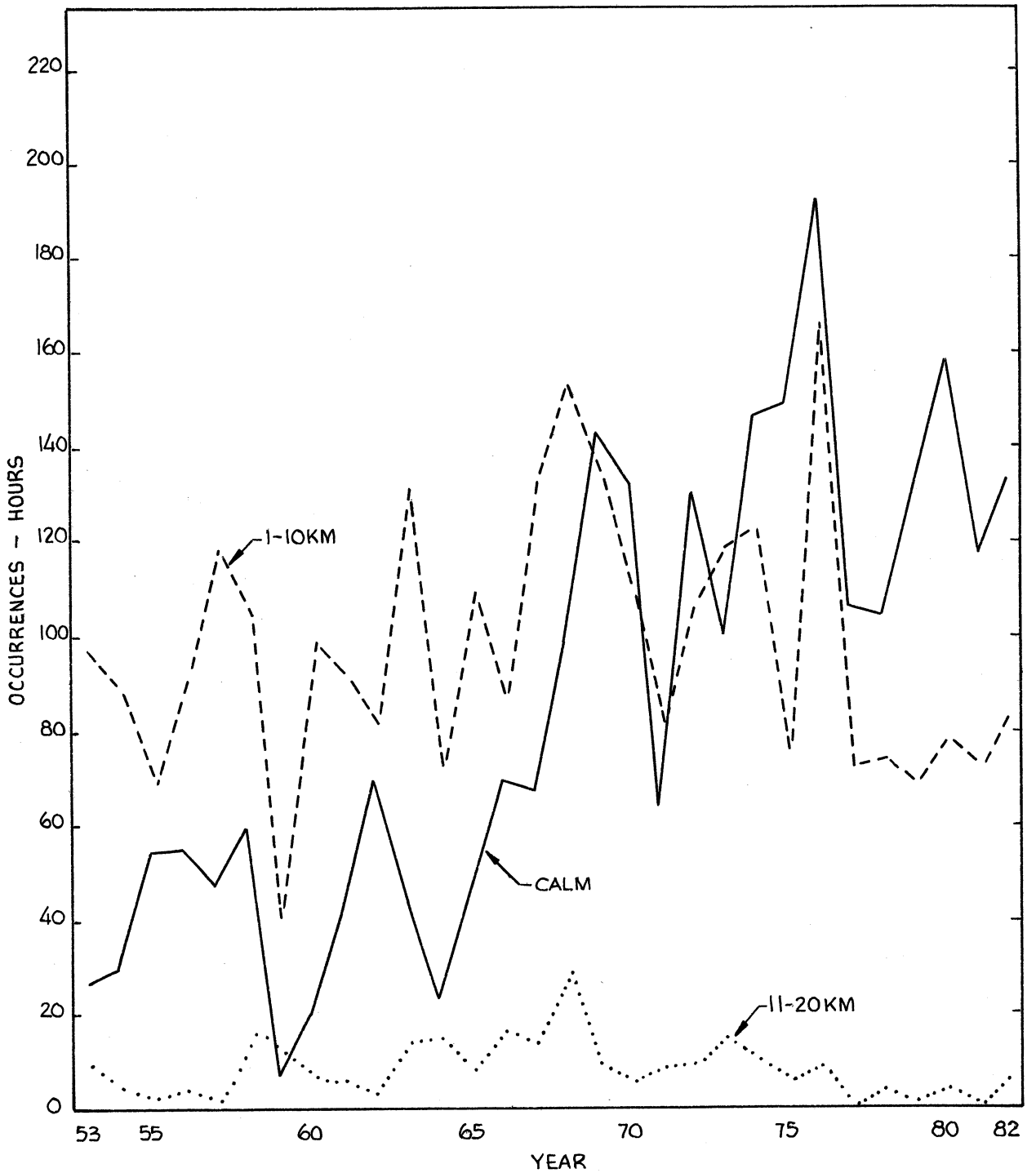


FIGURE 5.
OCCURRENCE OF FOG BY WIND SPEED AND YEAR