

MCMURDO STATION, ANTARCTICA FOG CLIMATOLOGY: 1973-1998

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Figure 1. Fog looms to the East of McMurdo Station, Antarctica (Image courtesy of Maj. James A. Cotturone Jr., USAF TRANSCOM)

An on-going research project at the University of Wisconsin has been studying the polar fog events that impact flights planned to and from McMurdo Station, Antarctica. The first part of the project aimed to learn some characteristics of the fog events at McMurdo Station/Ross Island area of Antarctica via the collection of fog particles. With some limited success, a few droplets were indeed captured (Lazzara et al. 2003). The next phase of work includes a simple climatological review of fog events as reported at McMurdo Station. A database of McMurdo Station synoptic observations from 1973 to 1998 has been used as the basis for this review with some initial review of a second database of observations directly from the McMurdo Weather Office from 1999 to 2003. This paper reviews the occurrences of fog, a variety of meteorological parameters during fog events, and the implications of this climatology. The data used in this climatology are from two sources. Observations from 1973 to 1998 are from the National Climatic Data Center (USAFETAC, 1986). US Navy personnel took observations during this time period. Observations from 1999 to 2003 are direct from the McMurdo Weather Office, via the archives at the Antarctic Meteorological Research Center. Both datasets are available online at:

<ftp://amrc.ssec.wisc.edu/pub/mcmurdo>

In working with the observations of fog events with a goal of ease of use and quantifying the events, a "fog day" was defined. A fog day in this climatological review is defined as a day when at least one observation (current observation time or past observation time) reported fog.

McMurdo Fog Climatology: What's Normal?

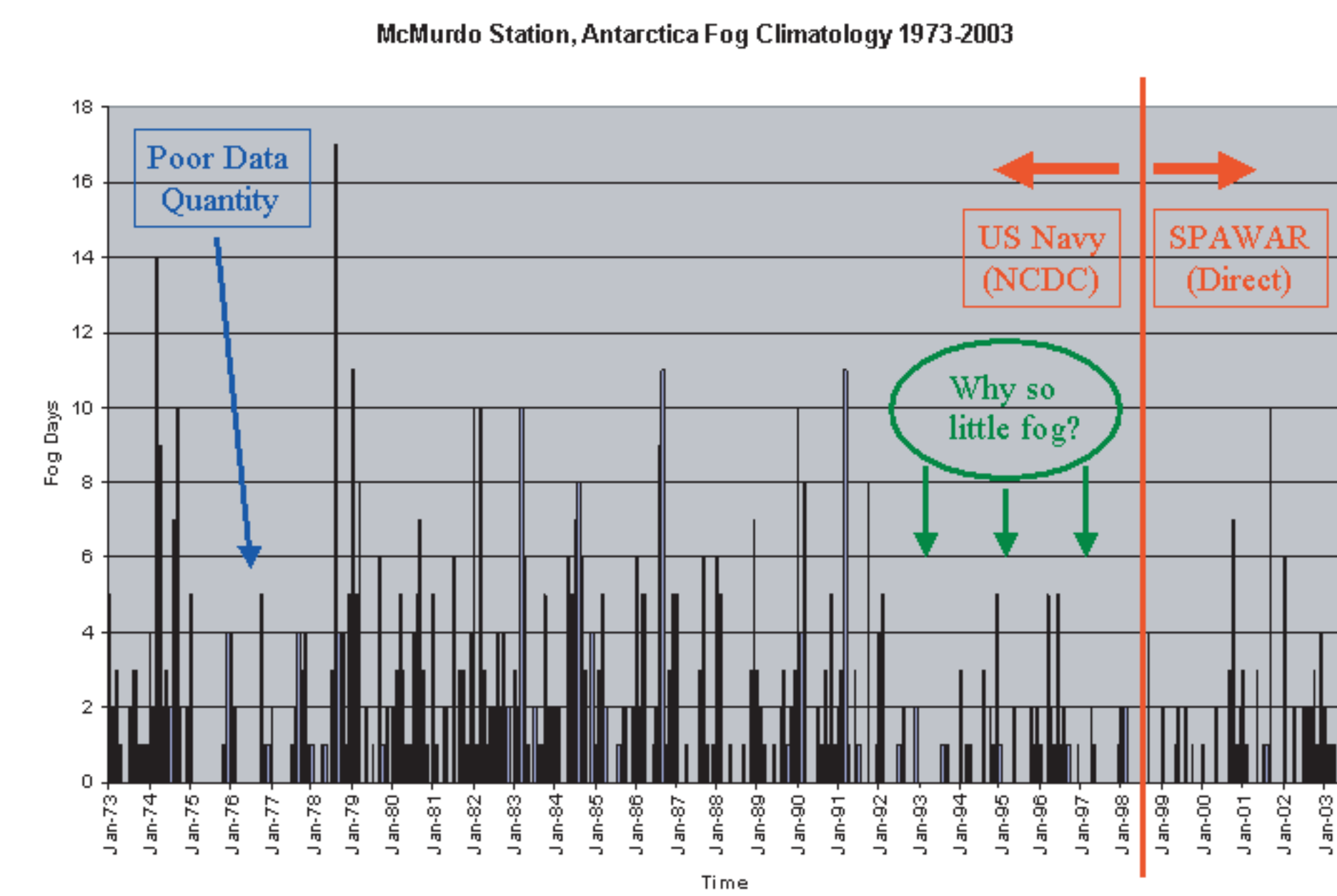


Figure 3. Fog days (all WMO reporting types) from 1973 to 2003 plotted by month with brief analysis.

McMurdo Fog Climatology 1973-2003: Monthly View

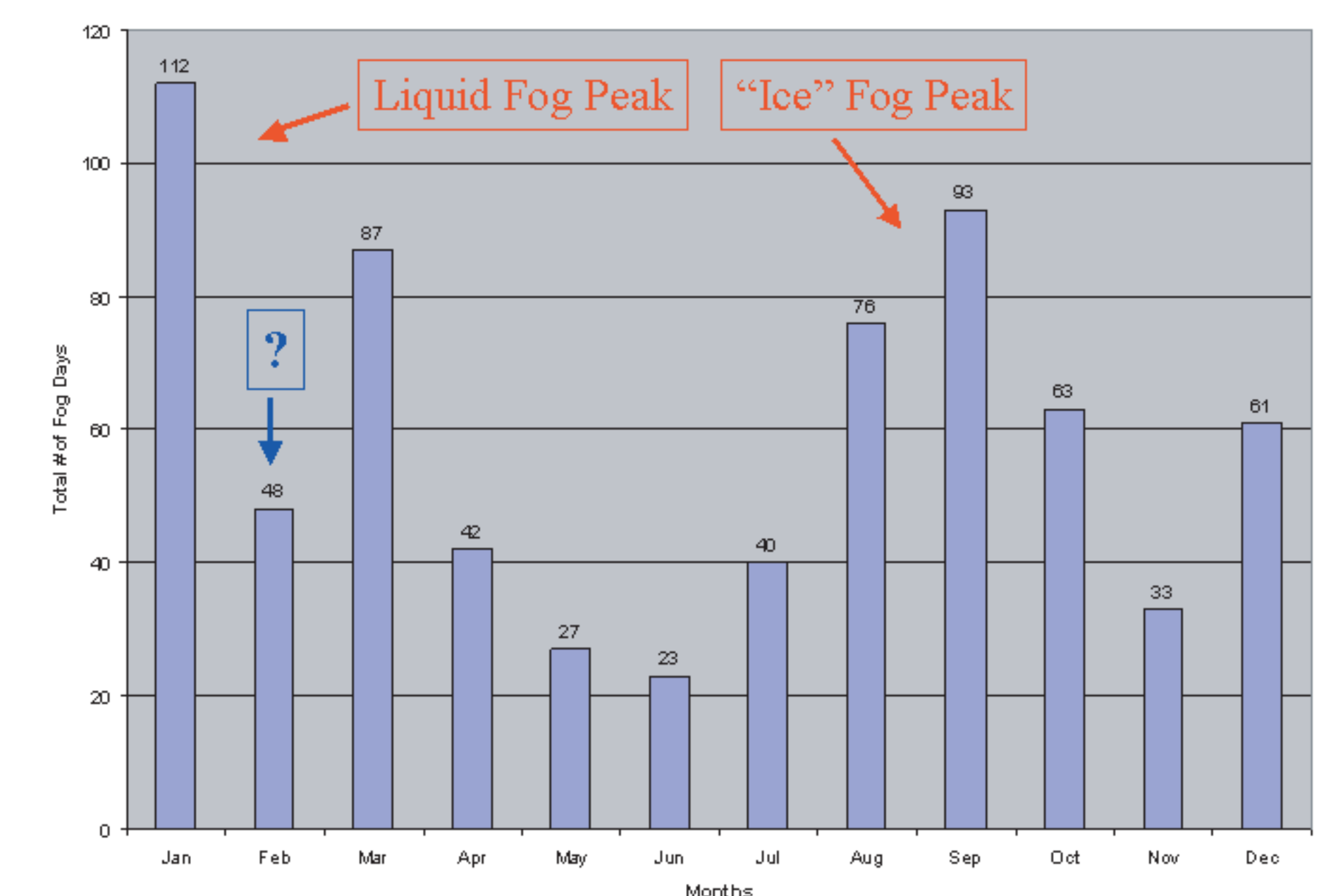


Figure 4a. (left) depicting the same information as in figure 3, however on a month by month basis, revealing two seasons for fog events at McMurdo. The unexpected low occurrence of fog in the month of February may be explained by Figure 4b. (left) which is an unverified monthly mean snowfall for McMurdo, depicting that February has the most snow (hence, with increased precipitation, less chance for fog).

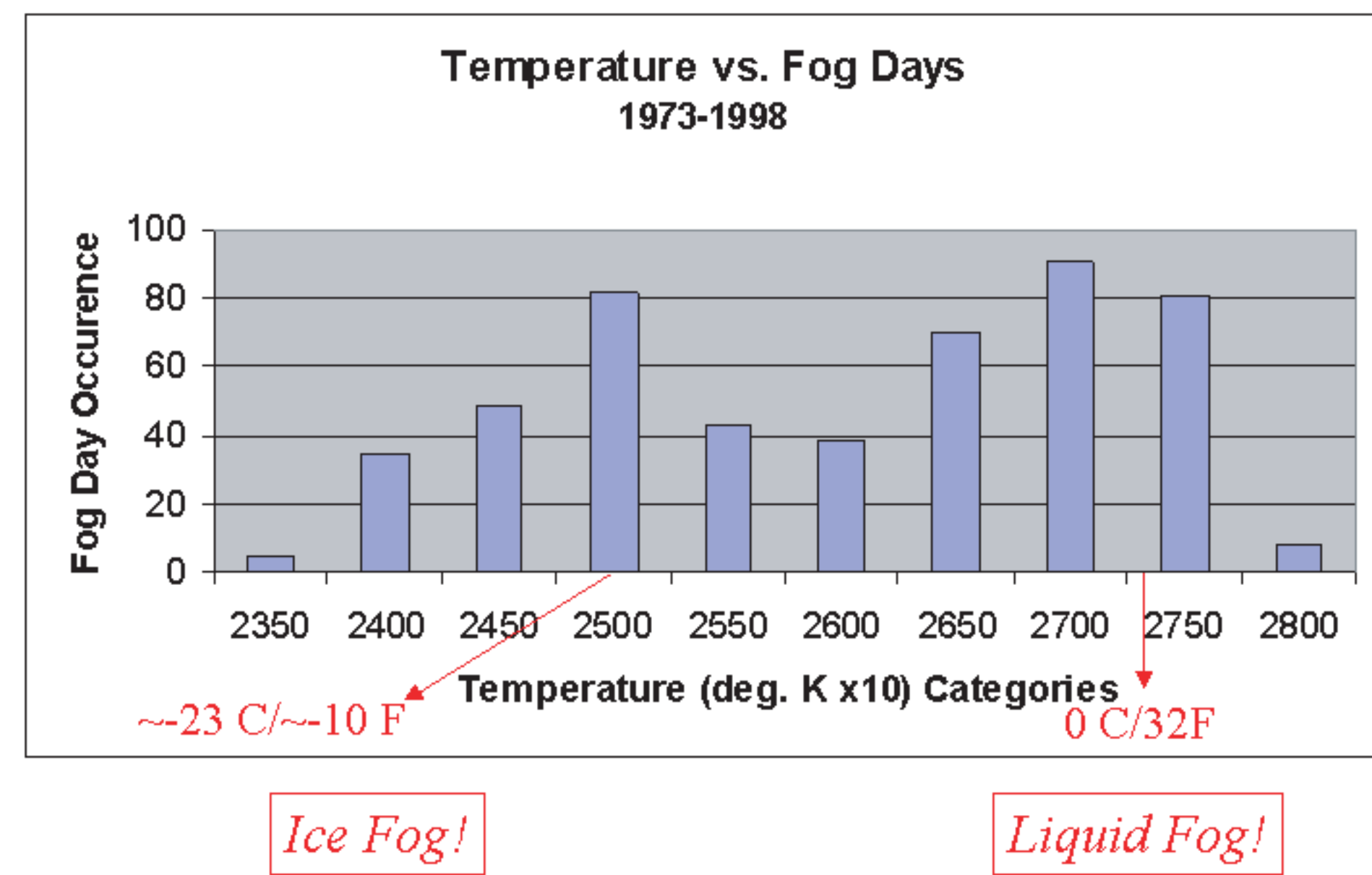
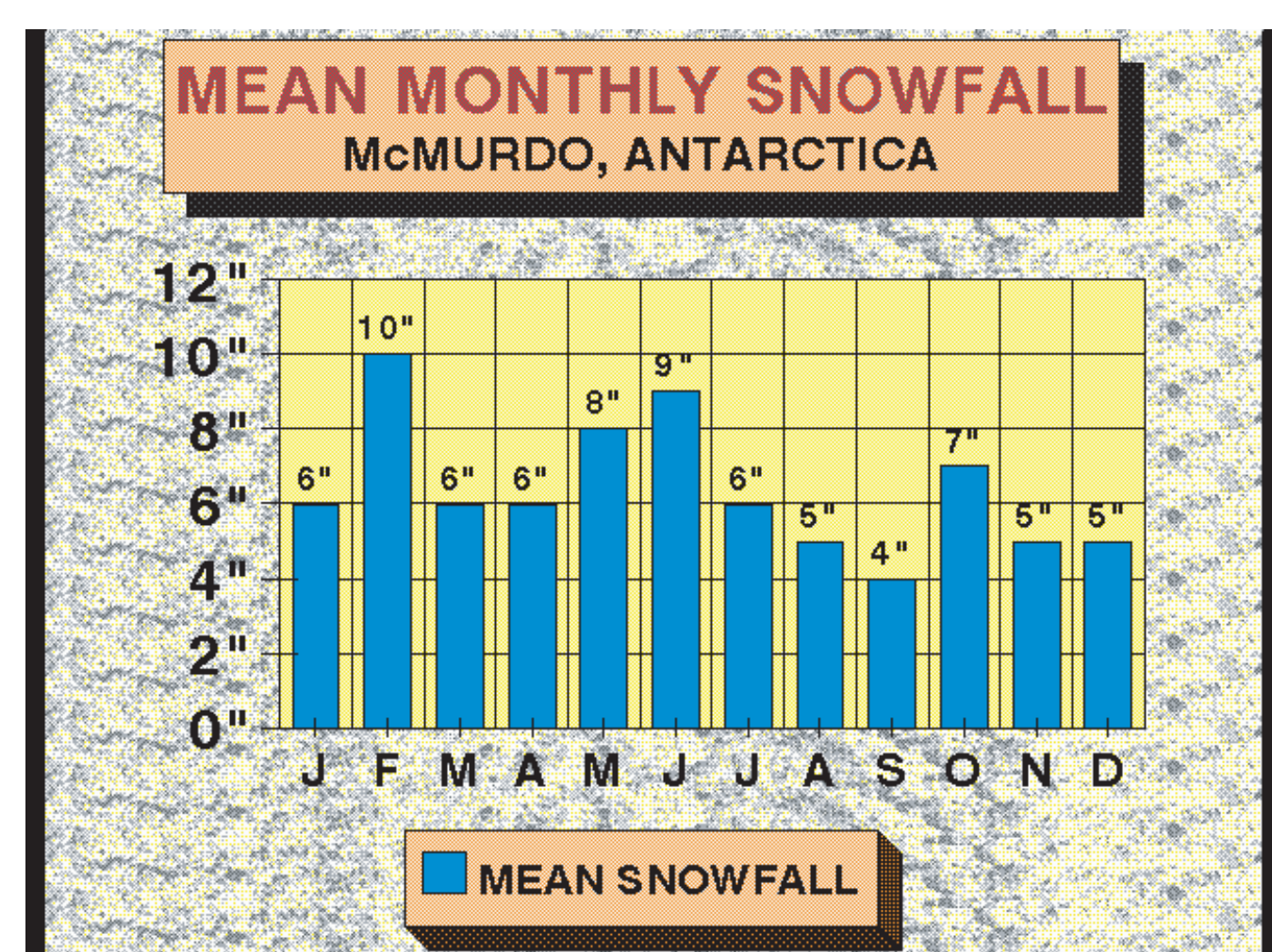


Figure 5. Fog days (only WMO type #40) and its relationship to temperatures from 1973 to 1998. The data indicates a bimodal clustering of fog events around two central temperatures, which may relate to the two types of fog McMurdo experiences - ice fog and liquid fog.

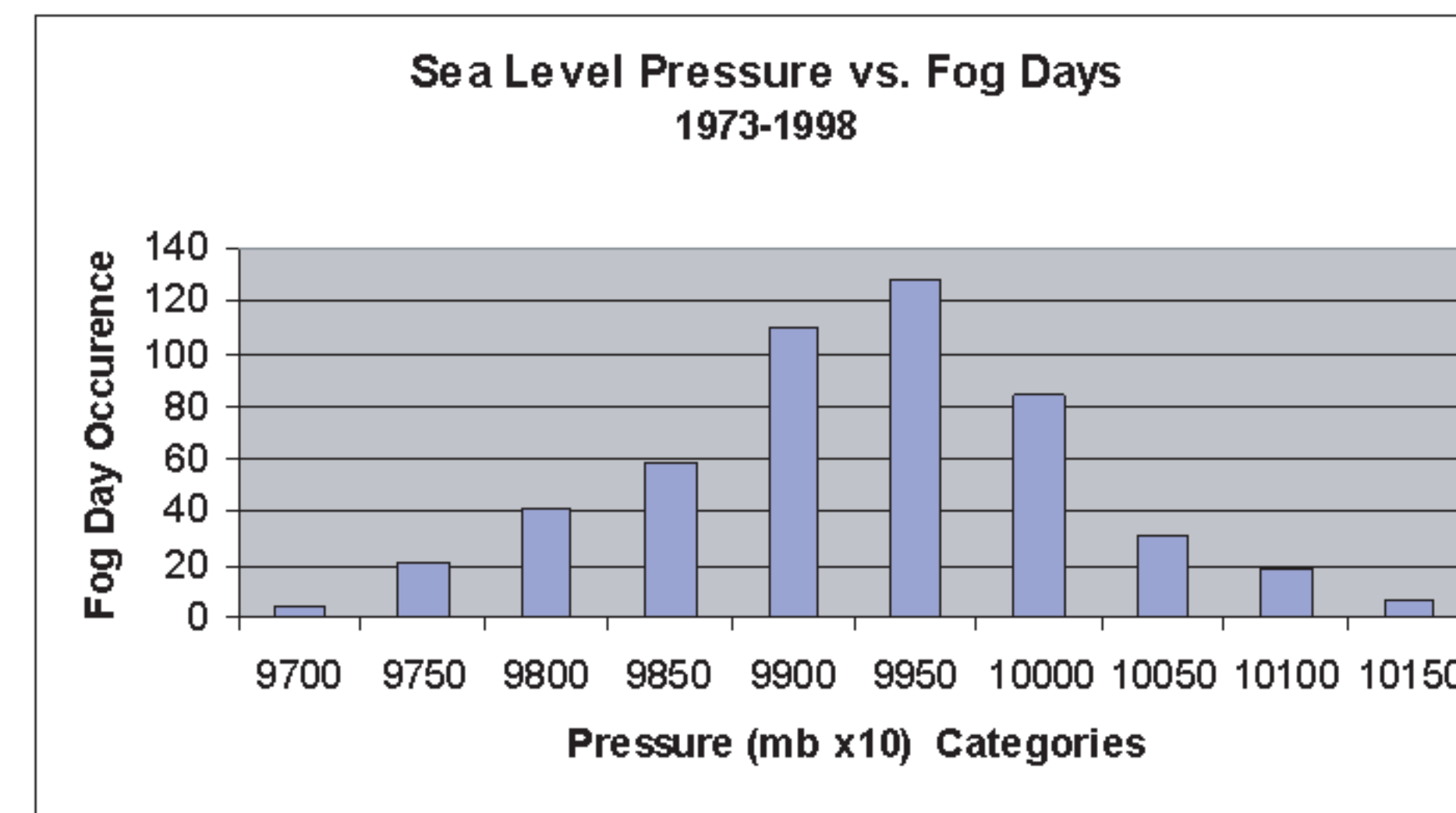


Figure 7. Fog days (only WMO type #40) as related to sea level pressure. These pressures nearly match both the mean/median sea level pressure for McMurdo, but also match forecasters comments that fog events occur near the edge of high pressure system - in an area of neither high nor low pressure.

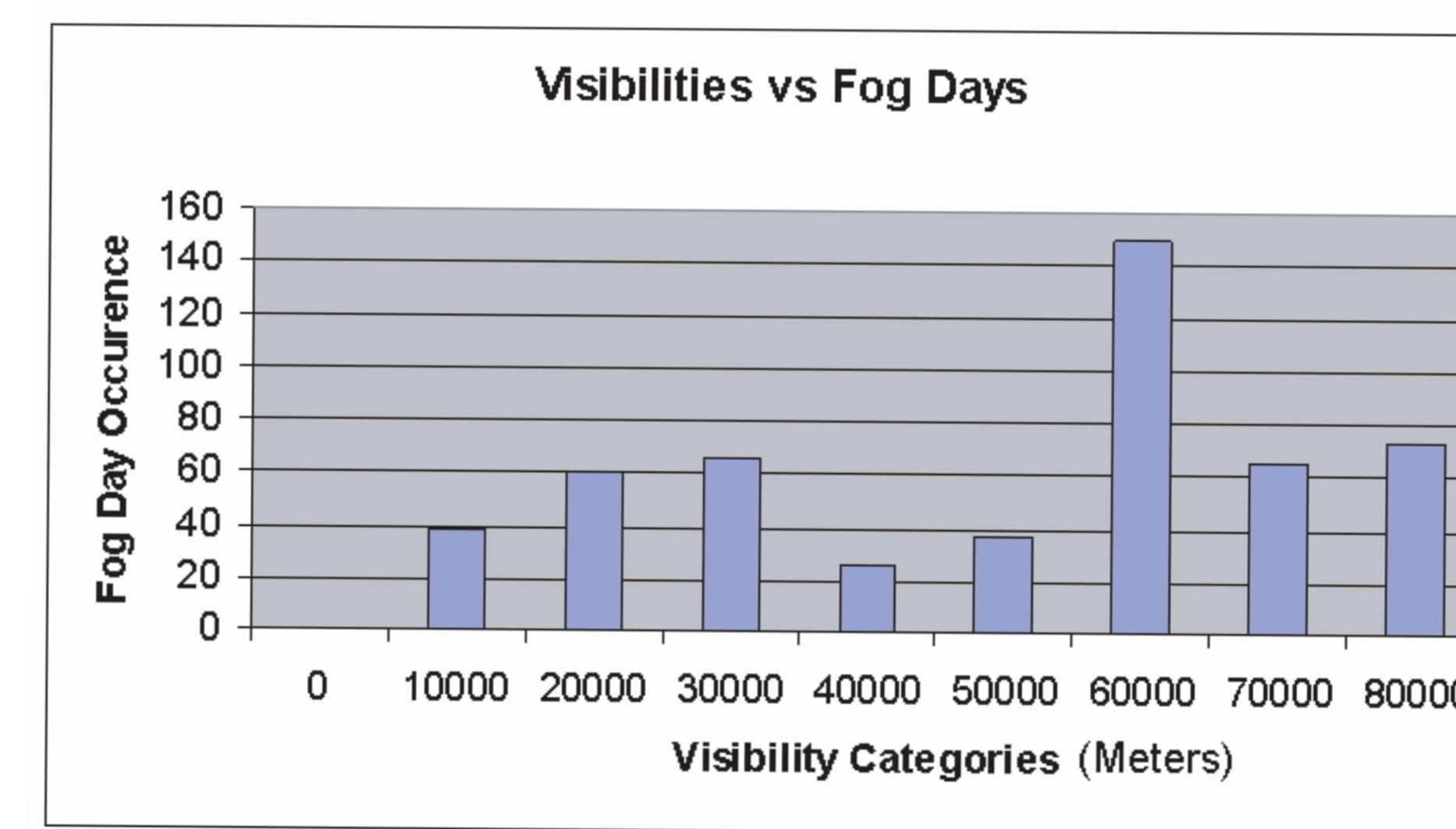
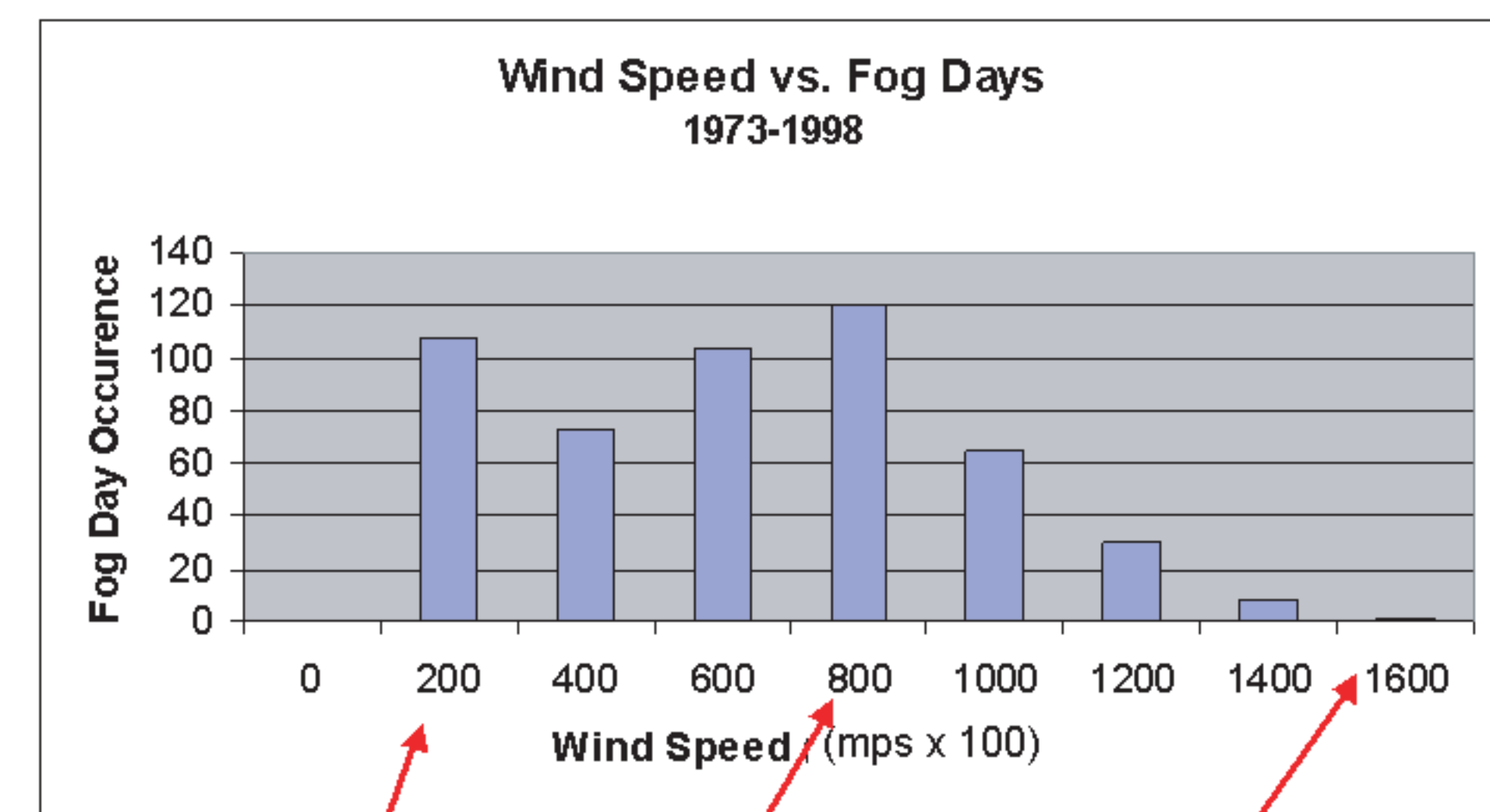


Figure 9. Fog days (only WMO type #40) compared with visibility. As expected with WMO type #40, with fog in the vicinity, visibility from the McMurdo Weather Office is still very good during this type of fog. The upper limits for fog between 60 and 80 kilometers has varied over the years perhaps due to improved measurement of landmarks in the McMurdo Sound basin.



Winds 0 to 4 MPH to 18 MPH to as high as 35 MPH!!

Figure 6. Fog days (only WMO type #40) and its relationship to wind speed from 1973 to 1998. Note the peak of fog events at both the very low speeds, and at mid-speeds with fog events even occurring with higher winds.

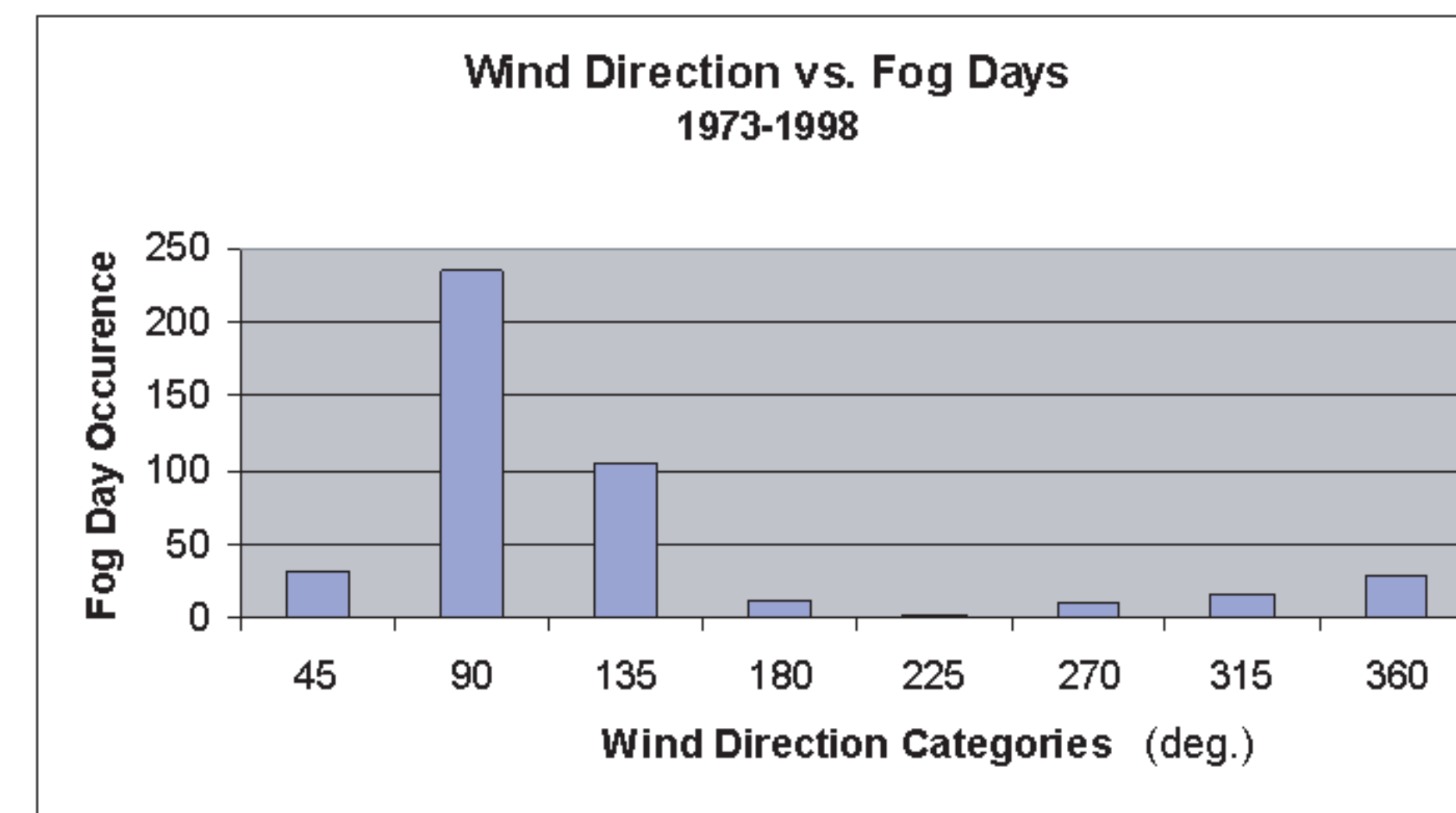


Figure 8. Fog days (only WMO type #40) compared with wind directions. Note the strongly East to Southeasterly component associated with fog.

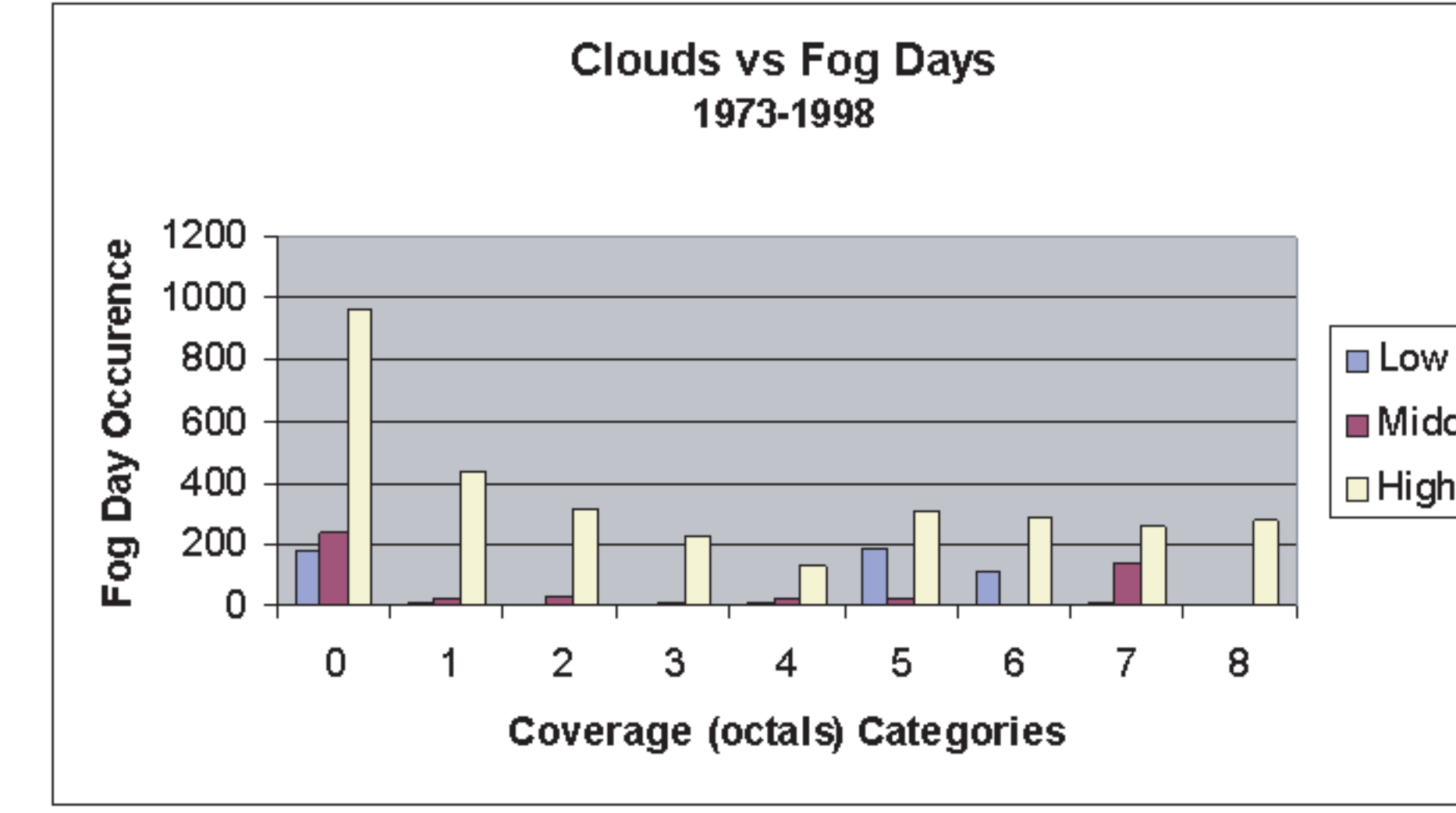


Figure 10. Fog days (only WMO type #40) compared with Clouds. This implies that although many fog events have few clouds associated with them, there are events with clouds at especially high levels in the area. This has implications for satellite retrieval of fog areas.

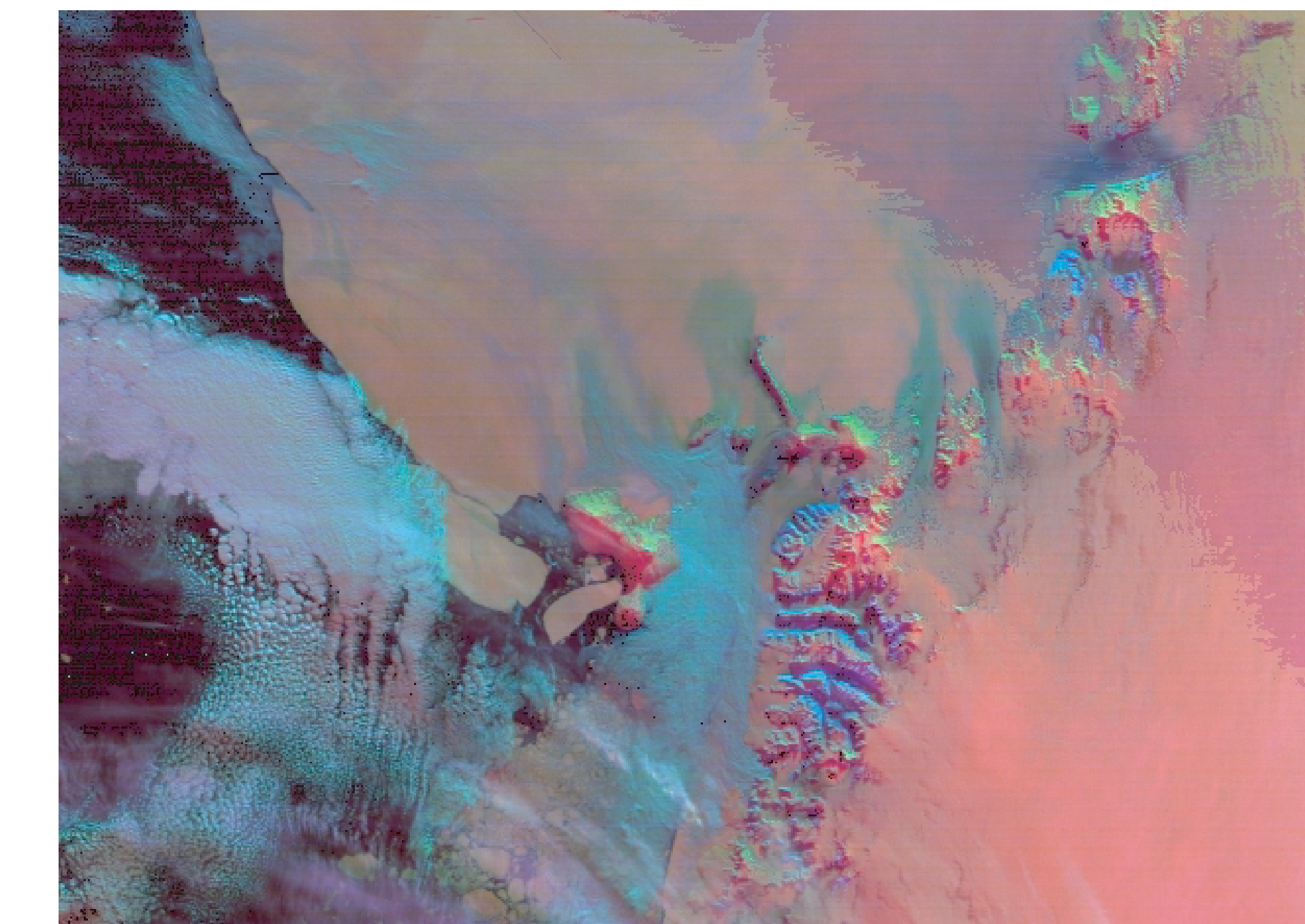


Figure 2. A sample MODIS three channel Principal Component Image depicting fog in the McMurdo Sound Basin (blue enhancement in the center of the photo).

Future Work:

With two phases of this project completed, the next phase involves a very close examination of the last 5 years of fog events during the operational field season from 1999 to 2004. This comprehensive review of fog events using all available observations from the ground, airborne and space may lead to increased understandings of Antarctic fog, and perhaps open the door to improved forecasting of these events, cost savings and greater safety for aviation and other logistical operations. In addition, these case studies will be a valuable resource for forecaster training and extend some previous related efforts (Cayette, 1998 and 1999; ATS, 1999).

<http://amrc.ssec.wisc.edu/fog.html>

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