

National Radio Astronomy Observatory
Tucson, Arizona

12 March 1985

MEMORANDUM

TO: VLBA Site Selection Committee

FROM: R. L. Brown

SUBJECT: Wind Data at the 12-Meter Site

The 12-Meter Site

The 12-meter is located on the "southwest ridge" of Kitt Peak itself. The ridge is quite narrow at this point and runs nearly north-south. The local ridge contours steepen both to the north and to the south and provide some shielding from wind in these directions. On the other hand, the telescope is exposed to the west; Figure 1, taken from the U.S. Geological Survey, shows the terrain local to the 12-meter telescope and the VLBA site on Kitt Peak. Note especially the "horseshoe" shape of the contours particularly evident to the northwest of the 12-meter site but also seen (with some artistic license) continuing to the southwest. Some observers have noted that this horseshoe terrain seem to "focus" westerly winds to the vicinity of the 12-meter as the wind rushes over the southwest ridge. If so, then it's important to note, this remark applies specifically to westerly winds; winds from other directions cannot be so amplified.

Wind Data: Instrumentation

The 12-meter continuously records wind speed and direction on our analog chart recorder. The anemometer is mounted as a 35-40 foot tower located on a rise south of the telescope dome. The primary purpose of the wind information at the 12-meter is to aid the observer and telescope operator in optimizing the observing program. Briefly, the telescope drive motors are torque motors that have difficulty maintaining the telescope pointing precision (usually a 5" tolerance for data taking is specified) when the telescope is pointing into a wind that exceeds approximately 15 mph. Thus, as the wind speed increases and the fraction of time that the telescope is on-source diminishes the observer may elect

to either change sources or simply cease observing. The former is an option because the telescope is enclosed in an astrodome: one can often position the slit in the downwind direction and continue to observe even in winds considerably in excess of 15 mph. Obviously, this option isn't always available, single-source programs being the clear example here.

Since the wind information is used only for decision making, the analog chart records are discarded after a short period. I have managed to salvage nearly complete record for the period 17 April 1984 through the end of February 1985 exclusive of the month of August during which the telescope was shut down and when wind data was neither needed nor taken.

Data Presentation

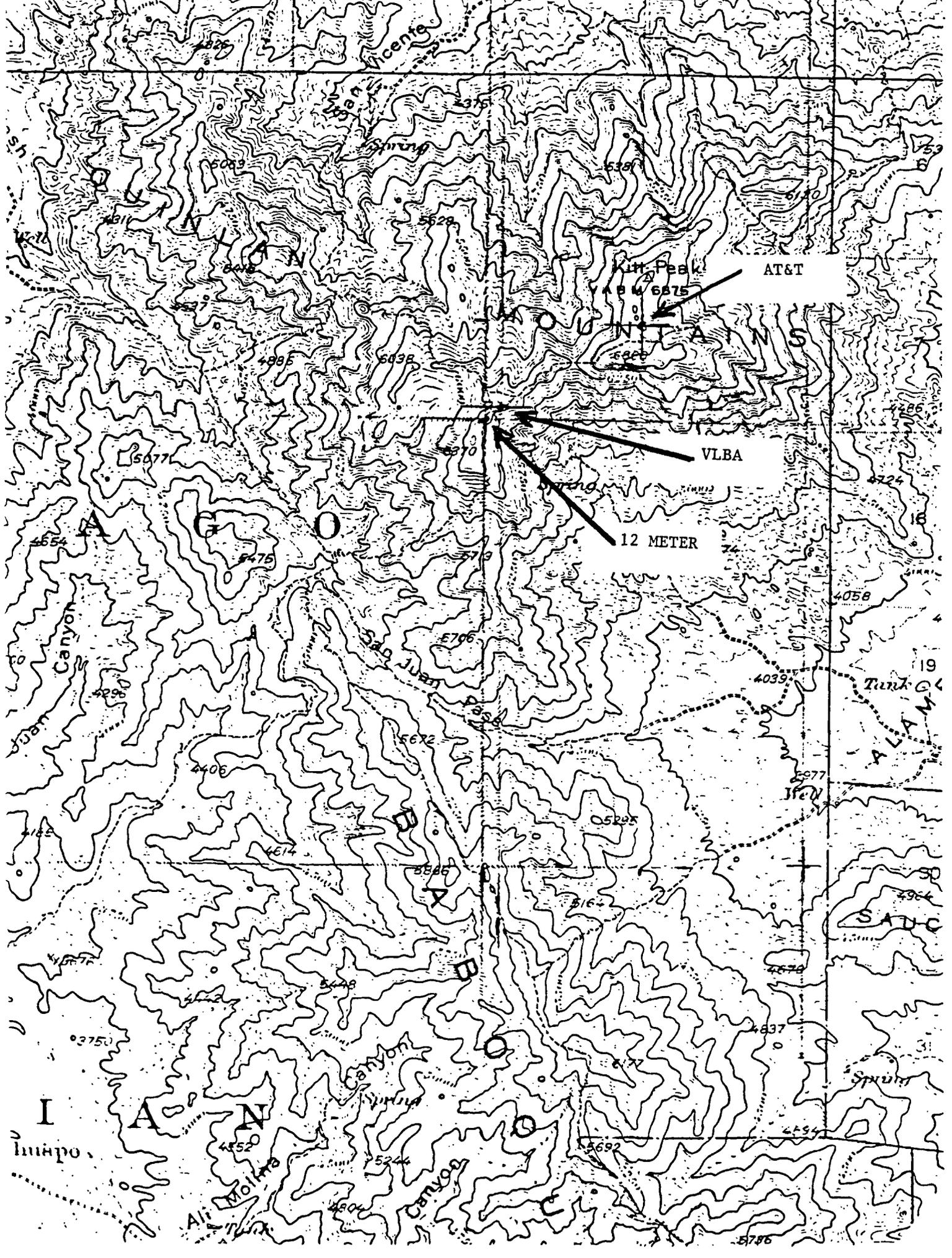
Figure 2 is a typical analog anemometer record showing both wind speed and direction. I "reduced" such data by treating each 1-hour interval as the shortest time unit that I could conveniently manage. I cataloged the wind speed in each such interval two ways, mean speed and peak speed. The characterization of mean speed is fairly obvious and above Figure 2 I note the values that I recorded for the 3 hours shown in this record. By "peak speed" I mean an estimate, crude to be sure, of the upper envelope of the wind speed in each hours' record. I mean it to reflect the maximum sustained speed, not the maximum speed seen in a brief gust. Again, perhaps this "definition" is best illustrated rather than described; in Figure 2 I note the values of the peak wind that I recorded in this sample. The operational definition here should be clear.

In the figures that follow, Fig. 3-12, I summarize both mean and peak wind statistics for each month in the sample. The histogram in the upper part of each figure refers to the mean wind and summarizes the fraction of time that the mean wind falls in various 5 mph intervals. The numbers on each bar are the number of hours of data included in that particular interval. The lower figure refers to the peak wind. Here I have summed the data in two bins: fraction of time that the peak wind exceeds 15 mph and the fraction of time it is in excess of 25 mph. These data are plotted as monthly averages in each 1 hour interval as a function of Mountain Standard Time. The idea here was to try and show whatever diurnal variations may be present. Finally, the last figure is abstracted from the lower plot of each of the monthly figures. It summarizes the fraction of time over the last 10 months that the peak wind exceeded 15 and 25 mph respectively.

Concluding Impressions

The Peak Wind at the 12-meter site:

- (1) Is equal to or exceeds 15 mph for an appreciable fraction of time (on the order of one-half) all year round;
- (2) Rarely exceeds 25 mph (less than 15 percent of the time are winds this strong and often the fraction is much less);
- (3) Are most diminished in the summertime;
- (4) Frequently diminished for the few hours around local noon.



MEAN WIND SPEED: 20

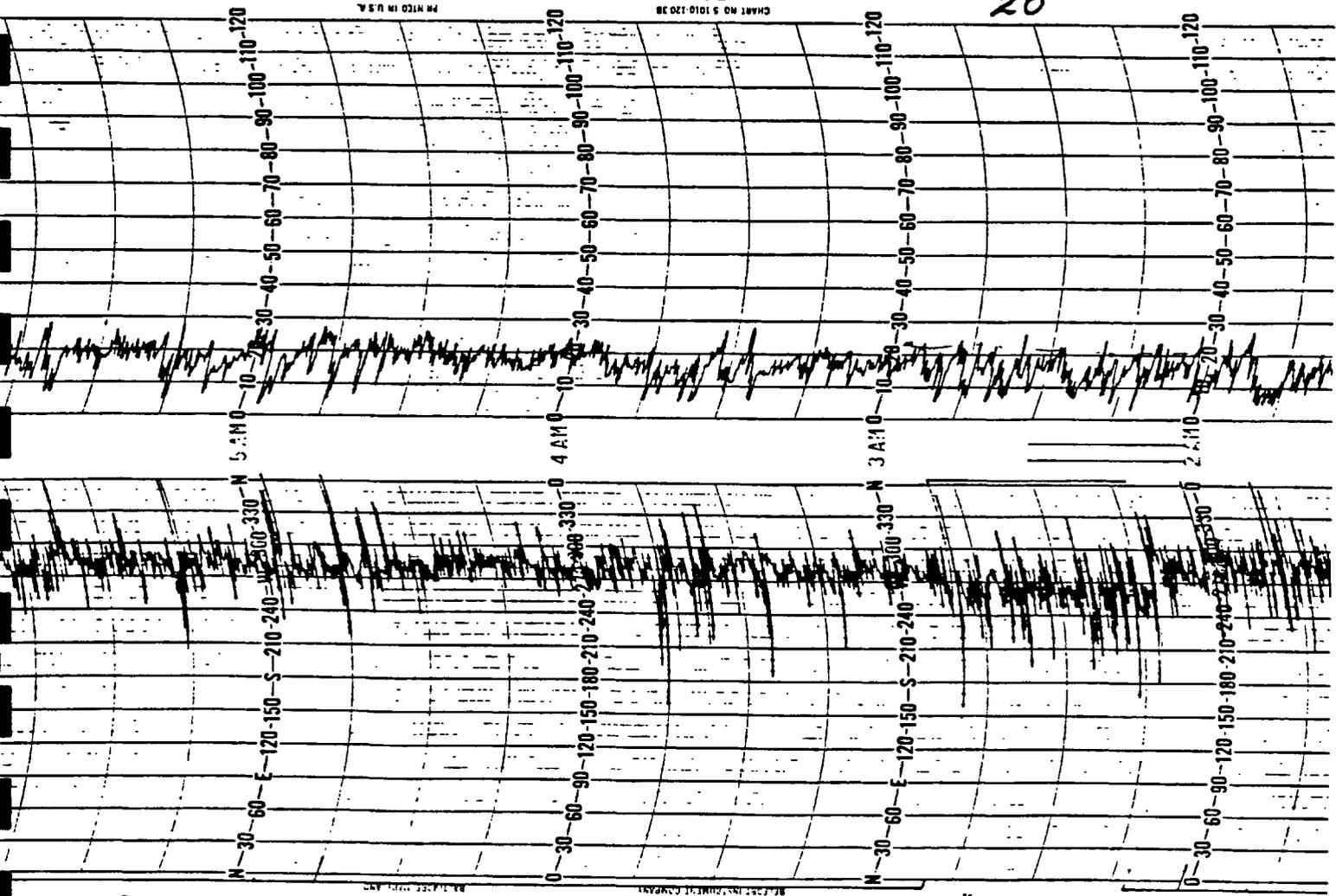
15

15

PK WIND SPEED: 25

20

20



DIRECTION

