

# NATIONAL RADIO ASTRONOMY OBSERVATORY

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MEMO TO: Homology Telescope Group  
FROM: K. I. Kellermann  
SUBJECT: Weather requirements for short wavelength observations

I wish to make a few remarks about my impressions for site requirements for a radio telescope operating at centimeter and millimeter wavelengths. These comments are unprejudiced by any theoretical knowledge of how the weather is supposed to affect the performance of a radio telescope, but are based on my experience at Parkes at 11 cm, at Green Bank at 11, 6, and 3 cm and at Kett Peak at 9, 3 and 1 mm.

Generally, I feel that total precipitable water vapor is not the main consideration. The main difficulty appears to be due mostly to discrete clouds which give antenna temperatures from a few degrees to a few tens of degrees at centimeter wavelengths and over 100 degrees at millimeter wavelengths.

I cannot emphasize the importance of a cloud-free site.

Effective beam-switching (or polarization and frequency switching) systems can cancel 99 percent or more of the sky emission. However, with receivers currently being used at NRAO, sensitivities of 0.01 K in one second are possible for continuum observations, and 0.001 K should, in principle, be easily reached with reasonable integration times. Thus "thin" 1 °K cloud, even with beamswitching, will produce antenna temperatures comparable with or greater than receiver noise. As receivers improve, weather will become an even more important consideration.

I have my reservations about mountain sites. I have often seen heavy clouds over Kitt Peak, while the sky was clear in downtown Tucson. My initial impression is that a high desert site is optimum. But this has the obvious drawback of extreme diurnal and annual temperature changes. Even on the 140 foot telescope, on the days when the sky is clear, and the sky emission is small, the thermal distortions of the telescope are extreme, so that "ideal" observing conditions are almost non-existent.

In my opinion Green Bank should not be considered as a site for the homology telescope. I estimate that at present when the receiver is properly operating the weather is the limiting factor more than 85 percent of the time, and for about 50 percent of the time the performance is seriously degraded by the weather.

I intend to try to make quantitative measurements of noise fluctuations and compare with measurements of water vapor and morphological weather conditions using the 140-foot at 6 and 3 cm wavelength. Measurements of this type were started by Baars several years ago, but have not been followed up.

KIK/bbs