

National Radio Astronomy Observatory (860929)
Socorro, New Mexico

25 Sept. 1986

To: Site Group
From: Craig Walker
Subject: Horizons

The attached plot shows the effect on available observing time of the horizons at most of the VLBA sites. Each line shows the horizon for a station plotted in Greenwich Sidereal Time and Declination, referring to a source at a Right Ascension of 6 hr (a convenient value for which transit on the VLBA occurs near the center of the plot). A source above a line for a station may be observed by that station. The horizons are the higher of the actual horizon (most data from Jim Oty's RFI survey memos) and 5 degrees. The dashed lines show what the limits would be if the horizon were 5 degrees at all azimuths at a few stations which have significantly higher real horizons. Those stations are Bonn and the VLBA stations in the Virgin Islands (site on the West Indies Lab as measured by Cam Wade and Emory Egler on 11 Aug 1985), Owens Valley, and on Mauna Loa.

The effect on the u-v coverage of lost observing time due to horizons can be determined from the u-v plots that have been distributed in the past (eg. Project Book Section 1). The dots on those plots correspond to 15 minutes each. The elevation limits of all stations were set to 10 degrees for those plots so consideration of the true horizons mostly will add to the u-v tracks.

The Bonn horizon is very close to the antenna. Therefore there is a large range of hour angles over which shadowing by the hills slowly increases. The dashed line for Bonn is the elevation at which 10 deg are added to the system temperature at cm wavelengths. It is clear that this horizon considerably restricts observations.

The Virgin Islands horizon cuts out between a half and one hour of observing with European antennas. This observing is at low elevations in a wet, tropical environment. Also, at low declinations, the time affected is one of relatively slow motion through the u-v plane. The logistical advantages of the site, along with the shelter provided by the hill that restricts the horizon, probably are more important than the lost observing time. Little VLBA observing time is lost because the hill is in the opposite direction from the other VLBA antennas.

The horizon at Owens Valley is high at some azimuths. The most significant effect will occur at declinations between about 20 and 50 degrees when the source is rising. The coverage of the array is good at these declinations so I doubt that the loss of up to an hour of low elevation observing will be

significant. I have used the horizon measured from the current observatory. The favorite site is now a bit east so the horizon is raised by about 1 degree. The effect should not be large.

The Mauna Loa site is on the side of a mountain so the first impression is that the blockage will be significant. However the plot shows that the only sky blockage occurs at very low declinations and at times when no other station can see the sources. In other words, the horizon at Mauna Loa does not restrict observations with other northern stations at all. This is true even if observations below 5 degrees are used. At many azimuths, the horizon at Mauna Loa is -2 degrees. I'd like to see the atmospheric pointing model for that!

The horizons for Pie Town, Kitt Peak, and Los Alamos are not shown to avoid clutter. The Fort Davis line is very close to all of them.

Period of Visibility for RA = 6.0 hr. Min elev = 5.0 deg.

