4.3.4 COMPARISON OF REFLECTIVITY AND WIND PROFILES MEASURED ON 46.8 MHz AND 430 MHz AT THE ARECIBO OBSERVATORY

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First comparisons of troposphere and stratosphere radar experiments at UHF and VHF were done at the Arecibo Observatory in April 1980 with the 430 MHz radar and the 46.8-MHz radar. Comparisons of echo power, i.e., non-range corrected reflectivity, were described by ROTTGER et al. (1981). Taking into account differences in the average transmitter power, bandwidth, aperture illumination and sky noise temperature as well as near field correction and wavelength dependence of the scattering model, it was found that the average signals (at 12° zenith angle) at VHF were by about 10 dB stronger than at UHF. This was explained by a diffuse reflection process, favoring the longer wavelengths.

A more detailed comparison of signal power/reflectivity profiles at UHF and VHF is shown in Figure 1 (left diagram). The UHF operations and analysis were made by M. Sulzer and T. Sato, using the 430-MHz transmitter with 150 kW average power. The VHF operations were with the transportable SOUSY VHF radar with 160 W average power (e.g., ROTTGER et al., 1981). The profiles in Figure 1 are shifted with respect to each other along the abscissa, to obtain a best fit of the average profiles. The absolute power difference, thus, cannot be read from the graph. The variation of power with altitude is fairly well correlated on both frequencies. The fact that power peaks occur at about the same altitudes on both frequencies indicates that the same (turbulence) layers were seen. However, the peak-to-peak power fluctuations are smaller on VHF than on UHF. The UHF radar, because of its higher power aperture product, yields echoes up to larger heights, although the VHF radar pointed closer to the zenith (ZE = 6.5° on VHF, ZE = 12° on UHF).

In Figure 1 (right hand diagram), we compare the velocity profiles measured on both frequencies with the Doppler beam swinging mode. On VHF, the antenna pointed at 6.5°, and at 12°, on UHF. In general, the velocity profiles (only the zonal component u was measured on both frequencies) are equivalent. The VHF profile, however, shows more fluctuations with height than the UHF profile, although the latter was recorded with 150 m resolution instead of 300 m resolution on VHF. We have to compare carefully the analysis routines used on both frequencies to come to a final conclusion on this difference. However, we also may regard this as an effect of diffuse reflection at VHF which causes non-Gaussian Doppler spectra with superimposed spikes.

More detailed comparisons of 430-MHz and 46.8-MHz radar experiments will now be possible at the Arecibo Observatory (see ROTTGER et al., 1986, and HOLDEN et al., 1986), with the same data-acquisition and analysis routines.

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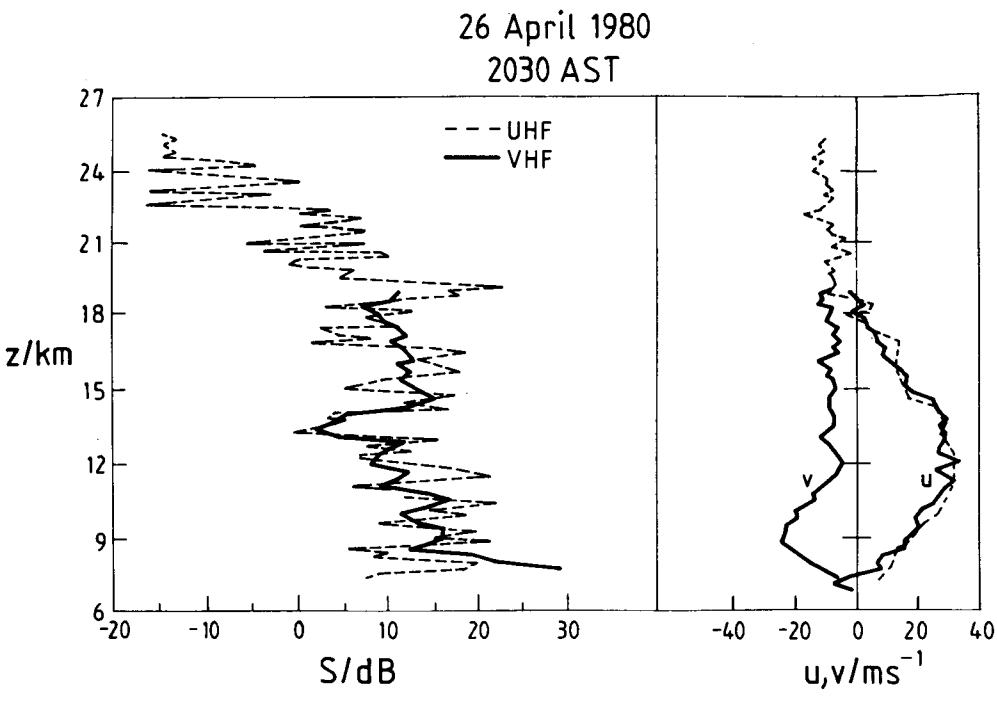

Figure 1. Profiles of relative power measured at UHF and VHF (left-hand diagram), and profiles of meridional (v) and zonal (u) wind velocities (right-hand diagram), the latter measured at UHF and VHF.

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