12.3 VERTICAL AIR MOTION IN PRECIPITATING CLOUDS FROM AN AIRBORNE MILLIMETER WAVELENGTH RADAR

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Measurements of vertical air motion and microphysics are essential for improving our understanding on the interaction of dynamics and microphysics in clouds. At the radar wavelength of 3.2 mm (W-band), the raindrop backscatter cross section oscillates between successive maxima and minima as a function of the raindrop diameter (D) that is described by Mie theory. The location of the first minimum, which occurs at D ˜1.65 mm, has been used successfully in ground-based cloud radars to retrieve the vertical air motion. Here, this technique is applied to the data from a vertically pointing (W-band) airborne Doppler radar to retrieve vertical air velocities in warm precipitating cumulus clouds over the eastern Caribbean Sea. The vertical air motion is formulated by considering the first order corrections to the vertical components of the Doppler velocity, which are contaminated by the aircraft motions and attitude such as pitch angle, speed of aircraft and the aircrafts physical up and down motions.

The air velocity retrieved using the Mie technique agrees well with air velocity obtained from the cloud droplets in a shallow precipitating clouds: velocity difference within 0.1-0.2 m s^{-1} and a correlation between them is about 0.995.