

High-Range Resolution Analysis of Atmospheric Layers and Precipitation Through Range Imaging of the Chung-Li VHF Radar

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The Chung-Li very-high-frequency (VHF) radar, operated at the central frequency of 52 MHz and located on the campus of National Central University (24.9°N, 121.1°E) in Taiwan, has employed the multi-frequency range imaging (RIM) for atmospheric studies since 2008. RIM uses a group of closely spaced transmitting frequencies and processes the echoes through appropriate signal inversion methods to obtain the power distribution at a range step much smaller than the pulse-defined range resolution. In this study, atmospheric layers and various rainfall situations such as convective and stratiform precipitations were examined to demonstrate the capabilities of the RIM in both temporal and Doppler-frequency domains. In the Doppler-frequency domain, a so-called conditional averaging (Chilson, 2004) in spectral power and Doppler velocity has been executed. It is shown that the RIM is indeed able to indicate distinct range-dependent structures.

The radar experiment were conducted between 20 and 23, August 2013, when the typhoon Trami passed through the Taiwan area. Five carrier frequencies, 51.5, 51.75, 52, 52.25, and 52.5 MHz, were used with radar pulse series, and the pulse width was 1-μs. The pulse-defined range resolution was 150 m, but the range-imaged step was only several to tens of meters. A two-dimensional optical disdrometer installed next to the Chung-Li VHF radar site was also operated to indicate the occurrence of precipitation during the VHF radar experimental period.