

Some interesting observations of Bragg scattering of 53MHz signals from deep convective systems

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Abstract

Clear-air radars operating at VHF became the cynosure in the field of atmospheric sciences. These radars are extensively used for probing the Ionosphere, Mesosphere, lower Stratosphere and Troposphere. One such radar operating at 53MHz located at Gadanki (13.5⁰N, 79.2⁰E), a tropical station in India has been providing wealth of information on various aspects of atmosphere. Many of the studies carried out by this radar accentuate the importance of understanding the radar returns in interpreting the observed features of atmospheric systems. Moreover, at this juncture, where the VHF radar applications have been extending to operational meteorology, elucidation of their echo characteristics are of prime interest. The dominant scattering mechanism responsible for echoes observed by VHF radar is Bragg scattering, which arises from inhomogenities in radio refractive index caused by atmospheric turbulence. In addition, VHF radars get echoes through Rayleigh scattering from hydrometeors. However, these systems are sensitive to the hydrometeors, only when the precipitation is moderate to heavy. In deep convective systems, it is very interesting to observe echoes from both Bragg and Rayleigh scattering and poses a challenge to understand the echo characteristics during the passage of such systems.

Owing to the importance of characterizing the VHF radar echoes from deep convective systems, a series of experiments were carried out during the passage of such systems over this radar site. These observations revealed an interesting reflectivity pattern from these systems. Normally, one expects very strong Bragg scattering from moist air, however, the present observations clearly shown some weak echoes surrounded by strong ones from the convective systems. The pattern of weak echoes has been observed in quite a number of cases. The purport of this study is to discuss the radar observations of deep convective systems and to report an interesting pattern of VHF radar echo power *viz.*, weak echo regions. An attempt is also made to propose a plausible mechanism for the observed pattern in the light of existing mechanisms.