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Spatial evolution of convection and rainfall using S-band Polarimetric radar over the East Coast of India

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Abstract

Tropical convection is an important phenomenon, which has a great impact on the Earth's weather and climate system. These convective systems can be of different size, shape, orientation, motion, and vertical extent. This paper describes the evolution of convective storms from ISRO's indigenously developed S-band Polarimetric Doppler Weather Radar (DWR) at Sriharikota High Altitude Range (SHAR), Sriharikota (13.66^{o}N, 80.23^{o}E). In addition we have assessed the DWR with Ku-band space-borne radar of Global Precipitation Mission (GPM). A good comparison is observed between SHAR-DWR with GPM-Ku radar in both space and height. A typical case study of Pethai cyclone is taken for comparison. The vertical structure of the cyclone is provided using Contour Frequency by Altitude Diagrams (CFAD) which show the vertical extent up to an altitude of 16 km with a reflectivity between 25 and 30 dBZ. Maximum occurrence of 30 dBZ occurs below 6 km. Bright band signatures show ~25 dBZ between 4 and 5 km depicting the stratiform precipitation of the cyclone. We estimated rain rate using both reflectivity and the polarimetric products and it compared well with rain estimated from IMD-DWR and rainfall observed from rain gauges around the radar location. Rain rate is observed from 5 to 35 mm hr^{-1}. The polarimetric products are used to classify hydrometeors during the passage of cyclones and mesoscale convective systems. The classification showed the presence of rain below 4 km and graupels, ice crystals and large droplets above. The results showed that between 4.5 km and 8 km, the low and high density graupels are dominating. Ice crystals are found above 8 km.

Keywords: Convective storm, Polarimetric Radar, Rainrate, GPM