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observation and analysis of the structure of winter precipitation-generating clouds using ground-based sensor measurements

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In this study, we used a 28-day database corresponding to December, January and February of 2011/2012 and 2012/2013 campaigns to analyze cloud structure that produced precipitation in the Sierra Norte near Madrid, Spain. We used remote sensing measurements, both active type like the K-band Micro Rain Radar (MRR) and passive type like the Radiometrics MP-3000A multichannel microwave radiometer. Using reflectivity data from the MRR, we determined the important microphysical parameters of Ice Water Content (IWC) and its integrated value over the atmospheric column, or Ice Water Path (IWP).

Among the measurements taken by the MP-3000A were Liquid Water Path (LWP) and Integrated Water Vapor (IWV). By representing these data together, sharp declines in LWP and IWV were evident, coincident with IWP increases. This result indicates the ability of a K-band radar to measure the amount of ice in the atmospheric column, simultaneously revealing the Wegener-Bergeron-Findeisen mechanism.

We also used a Present Weather Sensor (VPF-730; Biral Ltd., Bristol, UK) to determine the type and amount of precipitation at the surface. With these data, we used regression equations to establish the relationship between visibility and precipitation intensity. In addition, through theoretical precipitation visibility-intensity relationships, we estimated the type of crystal, degree of accretion (riming), and moisture content of fallen snow crystals.