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A New Algorithm for Attenuation Correction in Weather Radars for Ice Hydrometeors

Shashank S. Joshil*(1), and V. Chandrasekar(1)
(1) Colorado State University, Fort Collins, Colorado, USA; e-mail: sjoshil@colostate.edu

1. Extended abstract

Weather radars play a prominent role in remote sensing of the atmosphere. Various fields such as meteorology and hydrology rely on accurate weather radar data as input for their models. To improve the quality of the dual-polarization weather radar data, it is important to account for attenuation of the radar signal due to precipitation and correct for it. Attenuation depends on the path taken by the radar signal as it propagates through the precipitation medium. Different types of hydrometeors present during a weather event influence the amount of attenuation encountered by the radar signal. Also, as we go higher in radar operating frequency, the amount of attenuation increases. Attenuation correction for radar observations is necessary to improve the radar products and get accurate interpretation.

Most of the existing attenuation correction research in the literature is focused on rain hydrometeors. Research that addresses the attenuation correction due to ice particles in weather radars is limited. Although it is known that attenuation of radar signals when it encounters rain is much greater than that for ice hydrometeors, attenuation for all hydrometeors needs to be addressed for proper radar estimates. In this research work, the attenuation of different hydrometeors is studied using electromagnetic simulations. Various factors which influence attenuation, such as the altitude and particle size distribution are considered, and the results are presented. An attenuation correction algorithm which uses the hydrometeor classification and specific differential phase products from the DROPS2.0 algorithm is introduced [1]. Electromagnetic simulations are employed to obtain the relationship between specific attenuation and specific differential phase for different hydrometeors used in the proposed algorithm.

The attenuation correction method is applied on X-band and Ku-band radar data and the results are discussed. The data from X-band radar deployed in Santa Clara, California is used here for X-band dataset. The data from the dual-frequency, dual-polarization Doppler (D3R) radar for rain and snow events captured during the ICE-POP 2018 campaign is used here for the Ku-band dataset [2]. The method proposed for attenuation shows promising results at both X and Ku frequency bands.

2. References

[1] R. Bechini and V. Chandrasekar, "A semisupervised robust hydrometeor classification method for dual-polarization radar applications," *Journal of Atmospheric and Oceanic Technology,* vol. 32, no. 1, 2015, pp. 22–47.

[2] V. Chandrasekar, S. S. Joshil, M. Kumar, M. A. Vega, D. Wolff, and W. Petersen, "Snowfall observations during the winter olympics of 2018 campaign using the d3r radar," in *IGARSS 2019-2019 IEEE International Geoscience and Remote Sensing Symposium*, IEEE, 2019, pp. 4561–4564.