Snowfall Rate Estimation Using X-band Dual-Polarization Radar

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It has been challenging to accurately estimate the snow water equivalent (SWE) in mountainous regions because of the characteristics of snowflakes and severe beam blockages precluding radar observations near the surface. This work presents an SWE estimation study using X-band dual-polarization radar observations in the south-central Colorado, USA. Specifically, the observed reflectivity is first corrected from the attenuation, and the corrected reflectivity is then used in the SWE estimation through S-Z relations. Because of the variation of possible snow types and mixture of the winter storm, however, a fixed S-Z relation can’t be implemented in the SWE estimation for all the precipitation events. It was observed that the radar derived SWE is over and/or under estimated in some of the snow events if single S-Z relation is used considering the surface gauge measurement as the ground truth. To pursue a solution by automatically tuning the S-Z relation for different snow types, the polarimetric variables in radar observations (i.e. Z, Zdr), and the environmental humidity and wind field are grouped and statistically analyzed according to the S-Z performance. This research reveals the SWE estimation using S-Z relation can be improved in accuracy and robustness through the S-Z self-adjustment.