Assimilation of Airborne Gamma-Ray Observations Provides Utility for SWE Estimation in Forested Environments of the Northeastern United States

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ABSTRACT

An accurate estimation of snow water equivalent (SWE) has been a critical issue for water supply predictions and snowmelt-driven flood management. Data assimilation (DA) is a promising approach to improve modeled SWE estimations at a large spatial scale by merging remote sensing measurements into model predictions. In forested regions, however, most remote sensing techniques for estimating snowpack (e.g., passive microwave, photogrammetry, & lidar) is hampered by the effects of the forest canopy, resulting in large uncertainties in the SWE estimations. A well-established, but little-known airborne gamma radiation technique has provided a strong potential to estimate snowpack conditions in forested environments because the gamma-ray technique uses a difference in gamma-ray particles between snow-off and snow-on conditions by limiting canopy effects. In this study, we assimilated airborne gamma-based SWE retrievals into the Noah land surface model with multi-parameterization options (Noah-MP) in the Northeastern U.S. via the NASA Land Information System framework. Our results show that assimilation of the airborne gamma-ray SWE observations improved the modeled SWE despite the limited number of gamma SWE observations (up to only four observations during the winter period) even in densely forested regions.

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