An Observing Simulation System Experiment (OSSE) for Snow Mass Estimation over Western Colorado using Adaptive Viewing from Space

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ABSTRACT

Snow plays a key role in the freshwater supply of many basins with headwaters in mountainous regions. Optical LiDAR is a promising technology that can help improve our knowledge of snow mass. However, optical LiDAR viewing, in general, is significantly constrained by swath width limitations and cloud attenuation. One potential technique to ameliorate this issue is to dynamically slew the space-based sensor so that it preferentially views the target of interest, and as a result, observes the target of interest (i.e., snow-covered land) more often relative to a traditional, fixed viewing approach.

In this study, we develop an observing simulation system experiment (OSSE) in order to explore the trade-off space between a strategy of fixed sensor viewing versus adaptive sensor viewing. In the experiment, we first generate a "synthetic truth" of snow depth using the NoahMP-4.0.1 land surface model within the NASA Land Information System (LIS). Afterwards, synthetic snow depth retrievals for a given LiDAR configuration are generated using both fixed and adaptive viewing strategies, respectively. Next, a realistic amount of observation error is then injected into the synthetic retrievals so that they serve as a reasonable proxy for real-world LiDAR retrievals. The synthetic retrievals are then assimilated into NoahMP-4.0.1 using an ensemble Kalman filter (EnKF) in order to help quantify the added value that each type of snow retrieval has on the land surface model performance. The results from this OSSE help reveal the advantages (and disadvantages) of adaptive viewing strategies, and in turn, can help mission planners in determining how to get the most observational "bang for the buck" in the selection of a future snow mission.

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