Leveraging Adaptive Viewing to Improve the Efficacy of Space-Borne Satellite Retrievals of Terrestrial Snow

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ABSTRACT

Space-borne sensors for snow estimation traditionally employ a "fixed" viewing strategy that applies a static look angle between the sensor and the observed portion of Earth's surface. However, a fixed viewing strategy often misses the target of interest (e.g., views snow-free valley rather than snow-capped peak). An alternative to fixed viewing is "adaptive" viewing such that the satellite-based sensor can slew in order to preferentially view the target of interest. This project developed an algorithm to model adaptive viewing strategies in order to explore how adaptive viewing by a sensor can maximize the information content of satellite observations. The synthetic retrievals developed in this project are ultimately used in an observing system simulation experiment (OSSE) to quantify how, and to what degree, adaptive sensor viewing has the potential to improve the characterization of terrestrial snow mass.

In this project, the adaptive viewing model is used to generate synthetic retrievals of snow depth and SWE. The adaptive viewing strategy is highly flexible but remains constrained to user-specified parameters such as satellite trajectory, swath width, maximum rate of slew angle, and maximum extent of slew angle. Results from the adaptive viewing strategy are compared relative to those from the fixed viewing strategy. When using a hypothetical LiDAR sensor with a wide swath width, for example, adaptive viewing model captures 30-50% more of the target of interest relative to the fixed viewing strategy. This investigative approach is repeated over a variety of satellite trajectories, swath widths, and slewing rates.

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