Integration of a Spatiotemporal Subsampler for use in Observing System Simulation Experiments: Linking TAT-C with NASA LIS to Study Snow across Western Colorado

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ABSTRACT

When considering large-scale remote sensing of snow mass, it is desirable to achieve high spatial resolution with a short revisit period and a large signal noise ratio. However, it is difficult to achieve an optimal balance between these different variables as an improvement in one is often achieved at the expense of another. To explore the trade-off space between sensor design and orbital configuration, an Observing System Simulation Experiment (OSSE) is proposed for evaluating a suite of designs and configurations of a future satellite program.

In this study, we focused on the generation and evaluation of synthetic passive microwave brightness temperature observations over snow-covered terrain. To obtain the synthetic observations, our work consists of 3 steps: 1) generate synthetic observations of brightness temperature using a well-trained support vector machine to map “true” snow information from the NASA Land Surface System (LIS) into observational space, 2) use the Trade-space Analysis Tool for Constellations (TAT-C) to simulate the overpasses of a passive radiometer for a given orbital configuration, and 3) apply the space-time sub-sampler to mask out the non-observed portions of the study domain. In addition, we investigated how the properties of the sub-sampler would impact the error characteristics of the synthetic observations along with the trade-off between swath width, repeat frequency, spatial resolution, and signal-to-noise ratio. Results illustrate the quantitative interaction between the orbital configurations and desired observational characteristics, which can be useful for decision making based on the results from the OSSE to be pursued in a follow-on study.

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