Towards the Incorporation of Adaptive Viewing in Observing System Simulation Experiments (OSSEs) to Preferentially View Snow-Covered Terrain

COLIN P. MCLAUGHLIN[1], BARTON A. FORMAN[1], AND LIZHAO WANG[1]

ABSTRACT

Observing system simulation experiments (OSSEs) can be used to develop optimal satellite configurations to help improve the characterization of snow mass, and hence, global freshwater. Results from OSSEs are dependent on the quality of the geophysical retrievals obtained, which are a function of the spacecraft platform architecture, the number of spacecraft in a given constellation, and the types of satellite-based sensors used. Typically, retrievals are acquired using a static (fixed) look angle. This project explores how a dynamic look angle through the usage of adaptive viewing can be used to collect more data of specific targets of interest (e.g., snow-covered mountain peak rather than a snow-free valley) in order to improve the end results of an OSSE and thereby enhance our understanding of hydrologic phenomena.

Adaptive viewing is the process of preferentially viewing an area of interest by changing a satellite's field of view as a function of look angle. Adaptive viewing can help increase the snow-covered land that is viewed, thereby improving predictions of snow-water equivalent and associated surface runoff. In this project, a random walk algorithm with re-initialization is used to determine an optimal viewing strategy as a function of user-defined satellite parameters. To quantify the marginal benefit of an adaptive viewing strategy using the random walk approach over fixed viewing, toy experiments are first performed using a synthetically-generated binary surface target to model snow-covered land versus snow-free land. The toy experiments include sensor constraints such as a maximum look angle and maximum rate-of-change in look angle to better diagnose the marginal improvements associated with adaptive viewing relative to static viewing. Lessons learned from the toy problem experiments are then applied across the globe using real-world remote sensing datasets to maximize viewing of snow-covered land, topographical elevation, change in forest density, and irrigated agricultural areas.

[1] University of Maryland, College Park, MD, USA