Assimilating Satellite-Based Snow Depth and Snow Cover Products for Improving Snow Predictions in Alaska

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Several satellite-based snow products are assimilated, both separately and jointly, into the Noah land surface model for improving snow prediction in Alaska. These include the standard and interpreted versions of snow cover fraction (SCF) data from the Moderate-Resolution Imaging Spectroradiometer (MODIS) and the snow depth (SD) estimates from the Advanced Microwave Scanning Radiometer for the Earth Observing System (AMSR-E). The satellite-based SD estimates are adjusted against in situ observations via statistical interpolation to reduce the potentially large biases, prior to being assimilated using an ensemble Kalman filter. A customized, rule-based direct insertion approach is developed to assimilate the two SCF datasets. Our results indicate that considerable overall improvement on snow prediction can be achieved via assimilating the bias-adjusted satellite SD estimates; however, the improvement does not always translate into improvements in streamflow prediction. Assimilating the standard MODIS SCF is found to have little impact on snow and streamflow predictions, while assimilating the interpreted SCF estimates, which have reduced cloud coverage and improved snow mapping accuracy, has resulted in the most consistent improvements on snow and streamflow predictions across the study domain. When the SCF and SD products are jointly assimilated, the impact of SD assimilation is found to be dominant on the results of snow and streamflow predictions.

Reference:

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