Evaluation of commercial satellite data for Essential Water Variables: snow cover fraction and annual minimum snow and ice extent

Karl Rittger, Institute of Arctic and Alpine Research, University of Colorado

Purpose: Monitoring of snow cover and extent

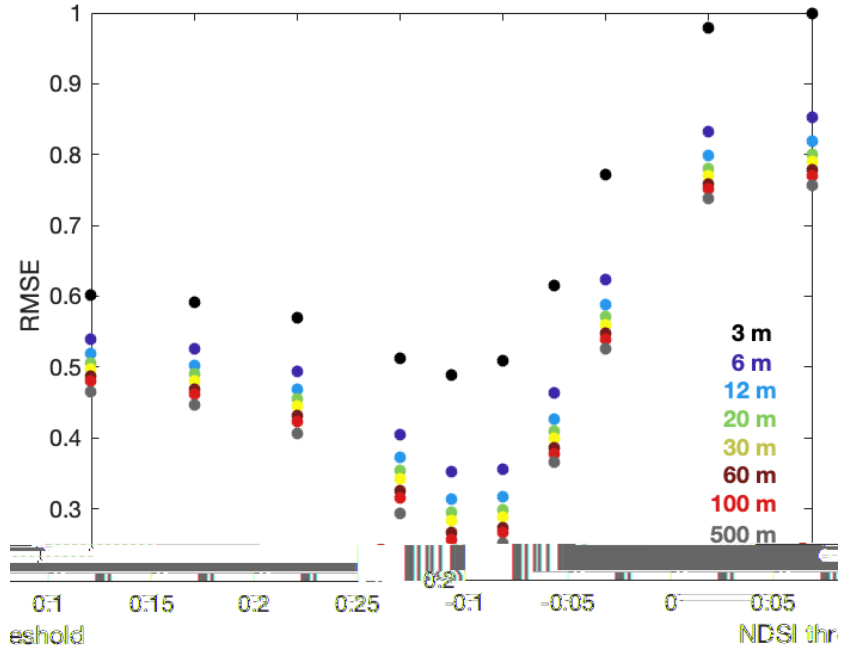
Study Objective: Evaluate the use of commercial imagery for deriving Normalized Difference Snow Index (NDSI), and compare against estimates derived from imagery acquired by the Airborne Snow Observatory (ASO).

Imagery: WorldView

Findings: The research objectives were more challenging that we initially estimated. The high spatial resolution (1.84 m) visible and near-infrared imagery from WorldView is finer than what is provided by ASO, making calibration/validation more complicated. In tree gaps we were able to view snow not seen by coarser resolution satellites. However, more work needs to be done with calibration and estimating surface reflectance instead of only top of atmosphere reflectance.

Geolocation and NDSI threshold

This graph shows the root mean squared error (RMSE) comparing a single Worldview 2 image with Airborne data. Coarsening the tow datasets from 3 m to 500 m is done to assess geolocation accuracy. The largest change in RMSE is between 3 m to 6 m a one to two pixel geolocation error, sufficient to assess Landsat and MODIS snow cover maps. In addition the lowest value of RMSE occurs when we use a normalized difference snow index threshold of 0.075 for this image. However, we found this value varied between images.



Accuracy of top of atmosphere reflectance over snow

The image on the left is a false color image. On the right we show spectra from the center of the image on a fully snow covered region on the right. The gray lines are modeled snow spectra. Worldview data are shown as points and have large errors relative to expected values for at least three of the seven wavelengths. More calibration and validation is needed to use the data for time series analysis.