Feasibility of tundra vegetation height retrieval from Sentinel-1 and Sentinel-2 data

Bartsch A, B Widhalm, M Leibman, K Ermokhina, T Kumpula, A Skarin, EJ Wilcox, BM Jones, GV Frost, A Höfler, G Pointer. 2020. **Remote Sensing of Environment 237:111515 doi:10.1016/j.rse.2019.111515**

Background

Quantitative maps of tundra vegetation height are needed for biomass and habitat studies, permafrost modeling, and many other applications. Synthetic Aperture Radar (SAR) holds promise for canopy modeling over large extents, but its sensitivity to unfrozen soil water has confounded efforts to apply SAR in the Arctic. We hypothesized that vegetation heights can be modeled from combined use of optical data and winter SAR data (when soils are frozen).

Analysis

We modeled canopy heights using C-band SAR (Sentinel-1) and multispectral imagery (Sentinel-2) and compared the results with ground measurements collected along environmental gradients on Alaska's Y-K Delta and elsewhere in the Arctic.

Results

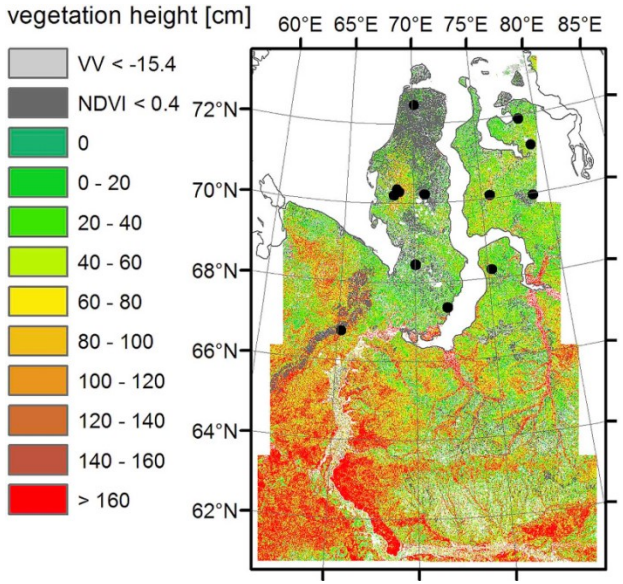
Canopy heights derived from C-band SAR compared well with those from multispectral indices such as NDVI. We developed a method for combining SAR and optical data to overcome limitations of SAR in Arctic wetland complexes, barrens, and tundra fire scars.

Significance

C-band SAR can be applied across circumpolar extents for canopy heights up to 160 cm. This method will support new applications and context for monitoring environmental changes in the Arctic.

Award Information:

This research was supported in part by NASA ABoVE Award #NNH16CP09C.



Map of vegetation canopy height based on Sentinel-1 C-band SAR backscatter along a latitudinal gradient in northwestern Siberia (above). Dots indicate ground validation sites in forest-tundra ecotones (below) and elsewhere.