TechDemoSat-1 Land Altimetry and Sea Ice Boundary Detection
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TechDemoSat-1 was launched in July 2014 with the Surrey Satellite Technology designed SGR-ReSI GNSS-R receiver onboard. This receiver has since recorded GPS reflections data from pole to pole over all surface types and these data have been made freely available for use. We have investigated the ability of these data to measure land surface elevation and arctic sea ice and water boundary. Surface height retrievals are made over the continents of North America, Africa, and Asia. The receiver is designed to measure ocean reflections to infer surface roughness and is therefore not optimized for altimetry. Height retrievals were made from one second integrated delay-Doppler maps (DDM) by re-tracking the estimated specular point delay and comparing that to an Earth ellipsoid based delay model. Corrections for ionosphere, and troposphere delay effects are considered. Measured heights are compared to the U.S. Geological Survey GTOPO30 elevation model and are characterized by signal strength, and variance of the reflecting terrain elevation. We have determined that the measured surface heights generally agree with the GTOPO30 model across all three continents. Sea ice detection is examined in the northern hemisphere with data from February 2015, close to the annual ice extent maximum. Ice detection is based on correlation waveform width. An empirically determined minimum threshold is used to distinguish between specular ice reflections (narrow waveforms) and diffuse open water reflections (wide waveforms). These results are correlated with the NSIDC MASIE product and show good agreement in ice-water boundary detection. An analysis of the boundary detection accuracy as compared to the MAISE product is carried out.