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The Influence of Ionospheric Dispersion and Tropospheric Delay on Altimetry using Reflected GPS L1/L2 Signals

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GNSS signals reflected from the earth surface can be used for remote sensing. In contrast to an active system a GNSS Reflectometry receiver is a passive device using GNSS signals of opportunity. Reflection tracks from multiple GNSS satellites are distributed in the field of view. In a collaboration with ESA and IEEC we investigate GPS reflections from Sea Ice and Dry Snow (GPS-SIDS). The Sea Ice campaign was conducted in the winter period 2008/2009 in the Disko Bay at the western coast of Greenland. The experiment was running for several months. In the stationary setup, upon the steep coast, daily recurring GPS reflections from 31 satellites were recorded. The reflections covered an area of 40 km^2 with an outstanding spatial resolution. The objective is to develop a method for submeter altimetry using GPS carrier phase signals. Emphasis is placed on the influence of ionospheric dispersion and tropospheric delay at grazing and slant elevation angles. In collaboration with JAVAD GNSS a commercial receiver was extended for GPS Reflectometry. The receiver computes C/A correlations in the L1 band and L2C correlations in the L2 band. The carrier phase signal is recorded for both frequencies at a sampling rate of 200 Hz. The carrier phase delay of the reflected signal is usually non-coherent for most sea surface roughness conditions. The smooth sea ice surface in Disko Bay qualifies for coherent reflections. The carrier phase delay is inverted to an ellipsoidal height of the reflecting sea ice. The tropospheric bias is corrected using a ray tracing tool. The Total Electron Content (TEC) of the ionosphere is derived from GPS and GLONASS dual frequency measurements during the campaign for ionospheric reference.