



The GNSS Reflectometry Response to the Ocean Surface

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Global Navigation Satellite System – Reflectometry (GNSS-R) exploits signals of opportunity from the Global Navigation Satellite System (GNSS). GNSS transmitters continuously transmit navigation signals at L-band toward the earth's surface. The scattered power reflected off the earth's surface can be sensed by specially designed GNSS-R receivers. The reflected signal can then be used to glean information about the surface of the earth, such as ocean surface roughness, snow depth, sea ice extent, and soil moisture. The use of GNSS-R for ocean wind retrievals was first demonstrated from aircraft. On July 8 2014, the TechDemoSat-1 satellite (TDS-1) was launched by Surrey Satellite Technology, Ltd as a technology risk reduction mission into sun-synchronous orbit. This paper investigates the GNSS-R measurements collected by the Space GNSS Receiver-Remote Sensing Instrument (SGR-ReSI) on board the TDS-1 satellite. The sensitivity of the SGR-ReSI measurements to the ocean surface winds and waves are characterized. The effects of sea surface temperature, wind direction, and rain are also investigated. The SGR-ReSI measurements exhibited sensitivity through the entire range of wind speeds sampled in this dataset, up to 35 m/s. A significant dependence on the larger waves was observed for winds < 6 m/s. Additionally, an interesting dependence on SST was observed where the slope of the SGR-ReSI measurements is positive for winds < 5 m/s and reverses for winds > 5 m/s. There appeared to be very little wind direction signal, and investigation of the rain impacts found no apparent sensitivity in the data. These results are shown through the analysis of global statistics and examination of a few case studies. This released SGR-ReSI dataset provided the first opportunity to comprehensively investigate the sensitivity of satellite-based GNSS-R measurements to various ocean surface parameters. The upcoming NASA's Cyclone Global Navigation Satellite System (CYGNSS) satellite constellation will utilize a similar receiver to SGI-ReSI and thus this data provides valuable pre-launch knowledge for the CYGNSS mission.