Spire GNSS-R data products and observations for surface characterisation

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Abstract

Spire Global operates a growing constellation of Earth observation nanosatellites in low-Earth orbit (LEO). Spire satellites use a state-of-the-art GNSS receiver to observe the Earth in a variety of ways: GNSS radio occultation (GNSS-RO) for atmospheric sounding, ionospheric slant total electron content and scintillation for space weather monitoring, GNSS-Reflectometry (GNSS-R) for soil moisture, sea ice, and ocean wind remote sensing.

Spire's GNSS-Reflectometry missions consist of 2 types of payload, conventional GNSS-R and grazing angle GNSS-R. The defining characteristics of the conventional GNSS-R are observations around nadir (elevation 20 to 90 degrees) for which the payload uses LHCP antennas and processing of Delay-Doppler Maps to map out the reflection power. We shall present our initial results from simultaneous onboard processing of these reflections with coherent and incoherent observations.

For the grazing angle GNSS-R (elevation angles 5 to 30 degrees), the payload uses RHCP antennas and dual-frequency processing tuned to coherent signals with outputs of phase and amplitude.

This presentation will describe the separate Spire GNSS-R missions and briefly the derived data products that are available in agency portals, NASA CSDAP and ESA Earthnet.

The focus of the talk is on the simultaneous observation of coherent and incoherent reflection components in the onboard processing of reflections. These multiple observations provide complementary information that can help in the separation of soil moisture and surface roughness. Here we introduce this new observation and how the multi-geometry, polarization and frequency GNSS-R observations provide a suitable source for data fusion.