A new tool for studying GNSS-R signals for applications in surface hydrology processes

Nicolas Roussel (1,2), Frédéric Frappart (1,2), Guillaume Ramillien (2,3), Camille Desjardins (2,4,5), Pascal Gegout (2,3), Richard Biancale (2,4), Félix Perosanz (2,4)

(1) Université de Toulouse, GET-OMP, 31400 Toulouse, FRANCE, (2) GRGS, GET-OMP, 31400 Toulouse, FRANCE, (3) CNRS, GET-OMP, 31400 Toulouse, FRANCE, (4) CNES, SI/GS, 31400 Toulouse, FRANCE, (5) CLS, 31400 Toulouse, FRANCE

Receiving Global Navigation Satellite System (GNSS) signals that are reflected off the surface, together with directly received GNSS signals makes possible the monitoring of the water level variations over land and ocean. In the context of the development of a new GNSS-R research activity at GRGS in Toulouse, we have built a simulator for modeling the trajectories of GNSS electromagnetic waves that are reflected on the surface of the Earth (i.e. water and soil), as realistic as possible, once the satellite constellation is known by orbit ephemeris, and the position of the receiver is fixed for a peculiar time session. It includes the possible masking of the terrestrial topography that may cancel the reception of GNSS satellites. Atmospheric delay effects derived from mapping functions are also taken into account for both direct and reflected signals. Our simulator helps us for determining the availability and geographical locations at an accuracy lesser than 10 cm of the specular reflection points, and thus selecting an optimal site for getting meaningful GNSS-R observations. In the future, analysis of the reflected waveforms proposed by our simulator would allow us to estimate other parameters such as significant ocean wave height, surface wind speed and soil moisture content.