Data Fusion to estimate sea-ice permittivity: a GNSS processor for 1-year MOSAiC data

Semmling, Maximilian[1]; Wickert, Jens[2,3]; Hoque, Mainul[1]; Divine, Dmitry[4]; Gerland, Sebastian[4]; Spreen, Gunnar[5]

1 German Aerospace Center (DLR-SO), Germany

2 German Research Centre for Geosciences (GFZ), Germany

3 Technische Universität Berlin, Germany

4 Norwegian Polar Institute (NPI), Norway

5 University of Bremen, Institute of Environmental Physics, Ger

Abstract

The retrieval of Earth surface parameters using GNSS reflectometry techniques has become a valuable source for Earth observation. Typical parameters can be found over the open ocean (sea state, ocean wind), over land (soil moisture, inundation areas) or over sea ice (for example its extent and concentration). The compactness of passive GNSS receiver instrumentation is a crucial advantage for the versatile application scenarios of GNSS reflectometry techniques. We demonstrate here the estimation of sea-ice permittivity based on the fusion of GNSS and ancillary data. In the given scenario, GNSS observations were performed on the German research icebreaker Polarstern during its one-year drift with the Arctic sea ice as part of the MOSAiC expedition (Multidisciplinary drifting Observatory for the Study of Arctic Climate). A dedicated GORS type (GNSS Occultation Reflectometry Scatterometry) receiver was used with three antenna links attached: up-looking master link with right-handed polarization and two side-looking slave links (dual-polarization, left- and right-handed). Coherent samples (in-phase and quadrature) of the respective links are provided by the receiver.

The processing comprises a fusion of GNSS reflectometry data, ship trajectory and attitude, broadcast orbits of GNSS satellites and ancillary data on sea ice concentration for the final inversion of sea ice permittivity. The GNSS data processor, presented here, is focused on reflectometry considering the challenges of a ship-based setup (multipath signals and ship's attitude changes). Currently, the processor is enhanced to GNSS remote sensing concept that also monitors ionospheric impact on the MOSAiC GNSS data record.