EGU21-8064
https://doi.org/10.5194/egusphere-egu21-8064
EGU General Assembly 2021

Further validation of an open-source low-cost GNSS-R remote sensor for coastal sea level altimetry

Manuella Fagundes[1] and Felipe Geremia-Nievinski[2]
[1]Postgraduate Program in Remote Sensing, Federal University of Rio Grande do Sul (UFRGS), Brazil (manuellafagundes@hotmail.com)
[2]Department of Geodesy and Postgraduate Program in Remote Sensing, Federal University of Rio Grande do Sul (UFRGS), Brazil (felipe.nievinski@ufrgs.br)

Contemporary sea level rise renders tide gauging essential in support of adaptation and mitigation strategies and to minimize its economic and societal impacts. Global Navigation Satellite System Reflectometry (GNSS-R) has been widely demonstrated for coastal sea level monitoring. One particular configuration of GNSS-R, called GNSS multipath reflectometry (GNSS-MR), is based on the combined tracking of direct and reflected radio waves against a single signal replica. The most common observable in GNSS-MR is the signal-to-noise ratio (SNR), which records the constructive/destructive interference pattern arising from the superposition of the two coherent ray paths. Recently we reported the development of a complete hardware and software system for SNR-based GNSS-R. We made it freely available as open-source based on low-cost commercial off-the-shelf components. We have deployed multiple working units of the sensor in the field, where they have operated uninterruptedly 24/7 for years, having resisted severe weather conditions. Initial validation was done by a lake (30.0277° S, 51.2287° W) for 317 days by comparison to a co-located radar-type tide gauge. Statistics confirmed that the sensor can retrieve water level with a very high correlation (0.989) and centimeter-level RMSE (2.9 cm). Here we report further coastal validation results of our GNSS-R sensor. The experiment was setup in a port (28.232019° S, 48.651064° W) with several co-located tide gauges within 100-m distance, including a radar sensor with 5-minute update interval and millimeter numerical resolution. We analyzed the time series of one week (June 19-25, 2019), and found a correlation of 0.885 and RMSE of 8.0 cm. We should emphasize this is the instantaneous sea level results and results for daily mean sea level would be improved. Although the location is sheltered from breaking waves, wind-driven waves are much greater, compared to the initial lake experiment. The increased surface roughness affects the coherence of radio wave reflections, which may eventually hamper the interferometric superposition principle, essential in GNSS-MR. This is part of ongoing validation efforts to quantity how correlation and RMSE in sea level altimetry are degraded due to the above error sources.