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Integrating space geodesy and coastal sea level observations

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The goal of the Global Geodetic Observing System (GGOS) is to monitor the Earth system, in particular with observations of the three fundamental geodetic observables: the Earth's shape, the Earth's gravity field and the Earth's rotational motion. A central part of GGOS is the network of globally distributed fundamental geodetic stations that allow the combination and integration of the different space geodetic techniques. One of these stations is the Onsala Space Observatory (OSO), on the west coast of Sweden, which operates equipment for geodetic Very Long Baseline Interferometry, Global Navigation Satellite System (GNSS), and superconducting gravimetry measurements, and additionally water vapour radiometers. The newest addition to the OSO fundamental geodetic station is a GNSS-based tide gauge (GNSS-TG). This installation integrates space geodesy with remote sensing of the local sea level.

The GNSS-TG uses both direct GNSS-signals and GNSS-signals that are reflected off the sea surface. This is done using a zenith-looking Right Hand Circular Polarized (RHCP) and a nadir-looking Left Hand Circular Polarized (LHCP) antenna, respectively. Each of the two antennas is connected to a standard geodetic-type GNSS-receiver. The analysis of the data received with the RHCP-antenna allows one to determine land motion, while the analysis of the data received with the LHCP-antenna allows one to determine the sea surface height. Analysing both data sets together results in local sea level that is automatically corrected for land motion, meaning that the GNSS-TG can provide reliable sea-level estimates even in tectonically active regions.

Previous results from the GNSS-TG, using carrier phase data, show a Root-Mean-Square (RMS) agreement of less than 5.9 cm with stilling well gauges located 18 km and 33 km away from OSO (Löfgren et al., 2011). This is lower than the RMS agreement between the two stilling well gauges (6.1 cm). Furthermore, significant ocean tidal signals have been derived from a several months long time series. Additionally, preliminary results from analysis of the Signal-to-Noise Ratio (SNR) from the RHCP antenna show an RMS agreement of 4.5 cm with a linear combination of the previously mentioned stilling well gauges (Larson et al., 2011).

We present new sea level results from the GNSS-TG data set, assessing several different analysis strategies. For example, we investigate optimal ways to analyse the carrier phase data (using observations from both antennas) and compare the results to those derived from the SNR analysis (using observations from the RHCP antenna only). Furthermore, the processing results are compared to independently derived sea level observations from co-located pressure sensor gauges.

References:

Löfgren J.S., Haas R., Scherneck H-G., Bos M.S., (2011), Three months of local sea level derived from reflected GNSS signals, Radio Science, 46 (RS0C05).

Larson K., Löfgren J.S., Haas R., (2011), The GPS tide gauge problem revisited, AGU Fall Meeting, 5-9 December, San Francisco, USA, Poster.