

# **Ground-based sea level altimetry using carrier phase delay observations of reflected GPS signals**

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This paper focuses on the retrieval of sea surface height within a field experiment, that was conducted at the Onsala Space Observatory (OSO) using the phase-based altimetry method. A comprehensive methodology for ground-based sea level measurement is proposed, which considers the experiment configuration and all the impact of the atmospheric environment and instrumental components. For retrieval of sea surface height under high wind speed, a continuous phase tracking algorithm, which relies on the GNSS amplitude and phase observations is also proposed. Ground-based sea level measurements from June 10 to July 3, 2015 demonstrate, that altimetric information about the reflecting water surface can be obtained with a Root Mean Square Error of 4.37 cm with respect to a reference tide gauge dataset. The sea surface changes, derived from our field experiment and the reference tide gauge, are highly correlated with a correlation coefficient of 0.93. The altimetric information can be retrieved even when the sea surface is very rough based on our proposed method. Moreover, the use of inexpensive conventional GNSS antennas shows that the system is useful for future large-scale sea level monitoring applications including numerous low-cost coastal ground stations.

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