



Remote monitoring of the Baltic Sea surface off-shore Rügen by ground-based observations of reflected GPS signals

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Recent studies have shown that ground-based GPS receivers offer the potential to monitor ocean heights in coastal areas by observing GPS signals reflected from the water surface. Unlike a conventional tide gauge or a deployed GPS-equipped buoy such a receiver can collect the data from a remote position, covering a larger observation area and is protected against rough surf or storm damage which allows undisturbed long-term measurements.

Reprocessed results from a GPS reflectometry experiment are presented, conducted on September 20–24, 2004, during daytime at the chalk cliff coast on Rügen Island, Germany at the shore of the Baltic Sea. The OpenGPS receiver with a single patch antenna – tilted 45° toward the horizon – was positioned at the Königsstuhl cliff top (54.57°N , 13.66°E) at a height of about 118 m above sea level. Unobstructed view to the Baltic Sea was available from about -30° to 120° azimuth. The 12-channel L1 frequency receiver was modified to allow for open-loop tracking of reflected signals and can record up to 4 different reflected GPS signals simultaneously.

During all 5 days of the experiment height measurements based on carrier phase delays with some cm-accuracy could be made up to distances of 20 km from the coast. The roughness of the observed Baltic Sea surface was greater than the carrier wavelength λ_{L1} . Sufficiently strong coherent signals could be acquired at elevation angles below 8° . Here the sea surface appears smooth enough according to the Rayleigh criterion to derive height observations based on carrier phases.