

## **Altimetry with reflected GPS signals: results from a lakeside experiment**

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In the fall of 1999 an experiment was performed at Crater Lake, Oregon, to demonstrate the feasibility of surface altimetry with GPS. A broadbeamed GPS antenna was directed at the lake - its axis pointing slightly downward – from a steeply dropping rock below the Cloudcap Vista Point. This arrangement allowed to collect both the direct GPS signal as well as that reflected off the lake surface. The relative delay between direct and reflected signals, related to the height of the receiver above the body of water and the reflection geometry, is used to infer the height of the lake surface. This site was chosen since it offers high enough locations for temporary antenna/receiver installations resulting in clear separation of direct from reflected signal waveforms. The paper discusses the experimental set-up, the data processing main steps and the findings of the investigation to determine feasibility and accuracy of this new type of altimetric measurement. Based on preliminary findings, height precision better than 5 cm in 1 sec can be inferred based on the analysis of carrier phase of coarse acquisition signals alone. In addition to height, the roughness properties of the surface can be determined by the shape of the received waveforms as well as other indicators such as signal polarization. These measurements are the first step in understanding measurements of reflections from airborne and spaceborne receivers, since they provide the means for uncovering the systematic instrumentation and processing errors, unmasked by the effects of platform motion and strong surface variation.