Using GNSS to Evaluate Threats to Mobility of Resources and People on Coastal Roads in USDOT Region 10

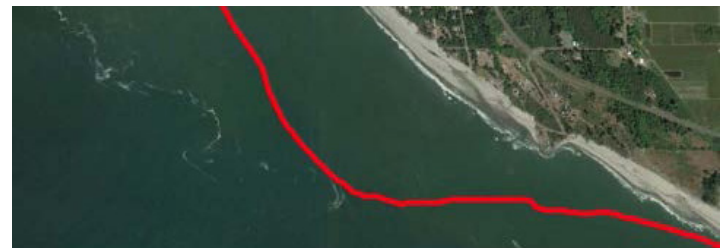Meagan Wengrove, PhD, Jihye Park, PhD

Background

Our objective is to develop a new technique to assess the hazard intensity of coastal erosion hotspots to existing and planned coastal roadways by continuously monitoring coastal water levels and wave heights using a new remote sensing technique with land-based GNSS. The proposed technique will measure nearshore water levels and wave heights using land-based and easily mobilized Global Navigation Satellite System (GNSS), which is an all-weather, continuous, global radio satellite system. GNSS is a remote sensing technique. GNSS is easy to install and maintain. GNSS can continuously monitor during storms without being in destructive sea-states (like tide gages and coastal buoys), or depending on optical clarity (like cameras).
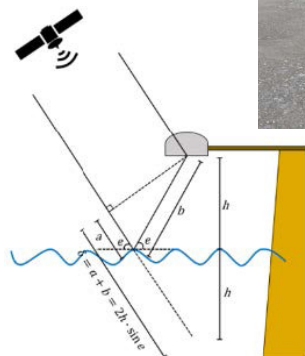
Research Project

GNSS, akin to Global Positioning System (GPS), uses satellites to measure an accurate 3D position of the antenna on a receiver. Unlike typical GNSS positioning, which exclusively collects radio signals from GNSS satellites directly to a receiver, this technique, referred to as GNSS-Reflectometry (GNSS-R), utilizes signal that has bounced off nearby objects before reaching the receiver, referred to as multipath. Figure 1 illustrates the concept of water level observations using GNSS multipath. The phase delay is converted to the vertical distance from the water surface to the GNSS antenna, which is fixed on the ground. By continuously computing this vertical distance in time, the water level variation can be obtained as a time series. Our objective is to extend the water level observation technique to possibly monitor variations in significant wave height of waves approaching the coast. With both water level and wave information, vulnerability of existing and planned USDOT infrastructure can be assessed.

ABOUT THE AUTHORS
The research team consisted of Meagan Wengrone and Jihye Park of Oregon State University.

ABOUT THE FUNDERS
This research was funded by the Pacific Northwest Transportation Consortium, with additional support from Oregon State University.

EXPECTED DATE OF COMPLETION
August 2021

FOR MORE INFORMATION
http://depts.washington.edu/pactrans/research/projects/using-gnss-to-evaluate-threats-to-mobility-of-resources-and-people-on-coastal-roads-in-usdot-region-10/