New Directions in Detecting Natural Hazards Using Real-Time and Post-Processed Ground-Based GNSS Measurements

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Natural hazards, including earthquakes, volcanic eruptions, and tsunamis, have been significant threats to humans throughout recorded history. The GNSS satellites have become primary sensors to measure signatures associated with such natural hazards. These signatures typically include GNSS-derived seismic deformation measurements, co-seismic vertical displacements, and real-time GNSS-derived ocean buoy positioning estimates. Another way to use GNSS observables is to compute the ionospheric total electron content (TEC) to measure and monitor post-seismic ionospheric disturbances caused by earthquakes, volcanic eruptions, and tsunamis.

We will show examples for new directions in detection of natural hazards generated ionospheric signatures using ground-based and space-borne measurements. We will discuss recent results from the U.S. Real-time Earthquake Analysis for Disaster Mitigation Network (READI). By studying the propagation properties of ionospheric perturbations generated by natural hazards along with applying sophisticated physics-based modeling, we are on track to develop new techniques that can potentially save human lives and minimize property damage. It is also expected that real-time ionospheric monitoring of TEC perturbations might become an integral part of existing natural hazards warning systems.