New Directions in Detecting Natural Hazards Using Ground-Based and Spaceborne Measurements

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Natural hazards, including earthquakes, volcanic eruptions, and tsunamis, have been significant threats to humans throughout recorded history. The Global Positioning System satellites have become primary sensors to measure signatures associated with such natural hazards. These signatures typically include GPS-derived seismic deformation measurements, co-seismic vertical displacements, and real-time GPS-derived ocean buoy positioning estimates. Another way to use GPS 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 first-principles physics-based modeling, we are on track to develop new technologies that can potentially save human lives and minimize property damage. It is also expected that ionospheric monitoring of TEC perturbations might become an integral part of existing natural hazards warning systems.