Delivering GNSS Algorithms and Data as a Fourth Observation for Local Tsunami Warning

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This collaborative research to operations demonstration brings together the data and algorithms from NASA research, technology, and applications-funded projects to deliver relevant data streams, algorithms, predictive models, and visualization tools to the NOAA National Tsunami Warning Center (NTWC) and Pacific Tsunami Warning Center (PTWC). We are introducing real-time GNSS data and models in an environment that already includes seismic, tide gauge, and DART (Deep Ocean Assessment and Reporting of Tsunami) buoy data. Our work is particularly focused on local tsunami warnings that cause the greatest devastation; currently there is limited operational capability. Each of three research groups collect data from a selected network of real-time GNSS stations, exchange data consisting of independently processed 1 Hz station displacements, and merge the output into a single, more accurate and reliable set. The resulting merged data stream is delivered from three redundant locations to the TWCs with a latency of 5-10 seconds. Data from a number of seismogeodetic stations with collocated GPS and accelerometer instruments are also processed for displacements and seismic velocities. Algorithms for locating and determining the magnitude of earthquakes as well as algorithms that compute the source function of a potential tsunami using this new data stream are included in the demonstration. The delivered data, algorithms, models and tools are hosted on NOAA-operated machines at both warning centers, and, once tested, the results will be evaluated for utility in improving the speed and accuracy of tsunami warnings. This collaboration has the potential to dramatically improve the TWCs local tsunami information over current methods.

In the first two years of this work, we have established and deployed an architecture for data movement and algorithm installation at the TWC's. We have delivered modules for earthquake detection and location, estimating moment magnitude (Mw) from Peak Ground Displacement (PGD), within 2-3 minutes of the event, computing coseismic displacements converging to static offsets, and visualization tools. These modules are being installed in the operational framework and tested using both historical data recordings as well as new events as they occur.