Augmenting GNSS and Teleseismic networks for improved tsunami early warning

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For the last 10 years, we have been developing both theories and algorithms to detect tsunami source energy and scales directly from real-time Global Navigation Satellite System (GNSS) for tsunami early warning [Song 2007; Xu and Song 2013]. However, Real-time GNSS stations are sparse along most of the active faults and unreliable for tsunami early warnings in those regions.

Recently, we have further developed an automatic earthquake finite source inversion (AutoQuake Inversion) algorithm jointly using near-field GNSS data and mid-range teleseismic P displacement waveforms. Neither the near-field GNSS nor the mid-range teleseismic data clip or saturate during large earthquakes, while the fast-traveling P-waves are still essential to constrain the source in regions where very few or no GNSS stations are available [Chen et al, 2019].
The new algorithm has been implemented in JPL’s GNSS-Aided Tsunami Early-detection System (https://gates.jpl.nasa.gov) for real-time events in the last three years. Here we present results and evaluate the performance of the global real-time earthquake and tsunami detection system. Detailed results on particular events, including the 2018 Indonesia Palu M7.5 earthquake and tsunami, as well as the more recent 2019 California Ridgecrest M7.1 earthquake, will also be discussed.