Gnss Applications to Monitor, Measure and Study Subduction Zone Earthquakes and Their Resulting Tsunamis

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Earthquakes at subduction zones pose significant hazards to nearby populations, and also distant populations through the tsunamis they produce. Earthquake early warning systems are being developed in many countries to provide small amounts of warning (likely measured in seconds) before strong shaking arrives. There can be a longer warning period before tsunami waves arrive, although for locally generated tsunamis this remains short (minutes). Trans-oceanic tsunamis take hours to transit across an ocean basin, allowing a much longer warning period if warning systems are in place. Historically, operational warning systems have relied primarily on networks of seismometers for several reasons, including their high instrumental sensitivity, existing real-time infrastructure, and data that provide a direct measurement of ground motions (tsunami warning systems also rely on real-time tide gauges or buoys to measure sea level directly). The monitoring networks of the future will augment these instruments with real-time GNSS observations, which complement the existing instruments and become of increasing value for the largest seismic events. GNSS data are better suited to determining quantities like rupture dimensions and magnitude for M>>8 earthquakes, and can provide valuable additional rupture information for situational awareness for M>7 events as well.

There is already a large installed base of GPS/GNSS instruments at subduction zones worldwide, but in many cases the data are not available in real-time, or are not freely shared. International initiatives for enhanced study of subduction zones offer a mechanism to expand instrumentation to critical areas where it is lacking, and a mechanism to improve the exchange of data and products for enhanced monitoring and public safety.