

## ***GPS Detection of Tsunami Scales for Early Warnings***

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This study discusses how tsunamis form from earthquakes and how GPS technologies can be used to detect tsunami scales in real time. According to the conventional theory, tsunamis are formed by the vertical deformation of the seafloor during undersea earthquakes. However, our recent studies contradict the established theory (Song et al, 2007: *Ocean Modelling*, doi:10.1016/j.ocemod.2007.10.007; Song and Han, 2011: *Remote Sensing of the Changing Oceans*, DOI 10.1007/978-3-642-16541-2, Springer-Verlag Berlin Heidelberg). We will first show evidence—based on GPS displacement measurements, satellite-inferred gravity changes (fault movements), radar altimeter data, and seismic inversions—that the momentum transferred by the horizontal motions of continental slopes is the major force of tsunamis. The tsunami propagation patterns, in three historical cases, are shown to be controlled by the horizontal slope motions with asymmetric features with both leading elevation waves and depression waves, best explained by the horizontally-forced mechanism (Song, 2007: *Geophys. Res. Lett.*, doi:10.1029/2007GL031681). We will then demonstrate how these remote sensing technologies in conjunction with the new theory have been used effectively to detect tsunami genesis and its energy scales in the M8.8 Chilean earthquake and corresponding tsunami.