Geophysical Research Abstracts, Vol. 9, 03116, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-03116

Horizontal Motions of Faulting Dictate the 26 December 2004 Tsunami Genesis

Y. Song (1), L. Fu (1), V. Zlotnicki (1), C. Ji (2), V. Hjorleifsdottir (2), C. Shum (3) and Y. Yi (3)

(1) Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California 91109 (Tony.Song@JPL.NASA.gov; Phone: 818-393-4876, Fax: 818-393-6720)

(2) Seismological Laboratory, California Institute of Technology, Pasadena, California 91125

(3) Space Geodesy and Remote Sensing, Ohio State University, Columbus, Ohio 43210

For a long time, people have believed that the vertical motion of faulting during an undersea earthquake is the main cause of tsunamis. However, independent evidence from seismographs, satellite radar altimeters, and tide gauges have revealed that the lateral collision force of a continental slope into the ocean due to faulting was the main cause of the devastating 2004 tsunami. Seismically-inverted seafloor displacements of the Sumatra-Andaman earthquake show that the horizontal motions of faulting in that tsunami generated kinetic energy 5 times larger than the potential energy due to the vertical motion. Two different ocean models by rigorously using the seismic inversion have confirmed that the horizontal force accounted for about 70% of the satellite-observed tsunami height. The asymmetric tsunami pattern and arrival times, recorded by tide gauges showing leading depression waves toward Thailand and leading elevation waves toward Sri Lanka, are best explained by the horizontally-forced mechanism. The developed method has also been successfully tested on the Mach 2005 tsunami, suggesting that tsunami genesis can be predicted directly from seismic signals.