A Sensitivity Study of the 2004 Sumatra Earthquake Fault Plane Mechanism

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ABSTRACT

We used the numerical model – COMCOT, which adopts a modified Leap-Frog finite difference scheme solving Shallow Water Equations (SWE), to simulate tsunami propagation and coastal inundation generated by the 2004 Sumatra earthquake. Several fault plane mechanisms proposed in the literature are examined as possible tsunami generation mechanisms. Comparing the simulated tsunami wave heights with the satellite measurements in the deep ocean indicates that the time scale for the seafloor deformation is still much shorter than the time scale of tsunami propagation. Therefore, an impulsive seafloor deformation model seems to be adequate. However, the spatial variation of the seafloor deformation plays a significant role. An optimized seafloor deformation distribution is obtained by minimizing the difference between the calculated wave heights and the satellite measurements (See Figure 1). Using the optimized seafloor deformation, the tsunami inundation in the vicinity of Trincomalee, Sri Lanka is investigated (Figure 2) and results agree well with the survey data (see Figure 3).

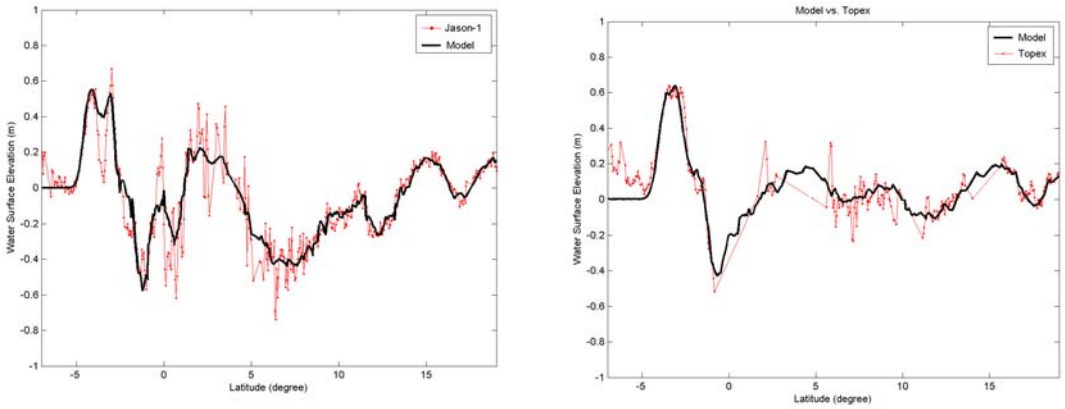

Figure 1 Comparison between calculated wave heights and satellite Jason-1 measurements (left panel) and satellite TOPEX measurements (right panel).

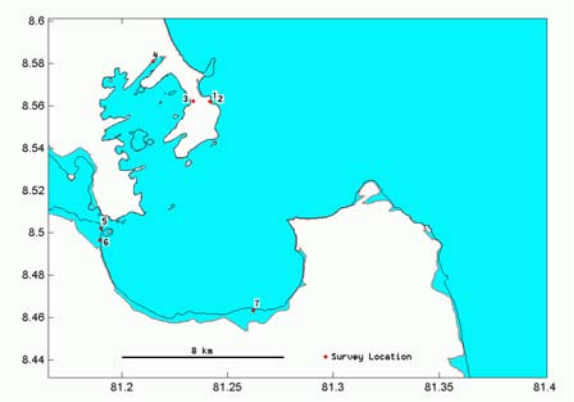

Figure 2 Inundation near Trincomalee, Sri Lanka.

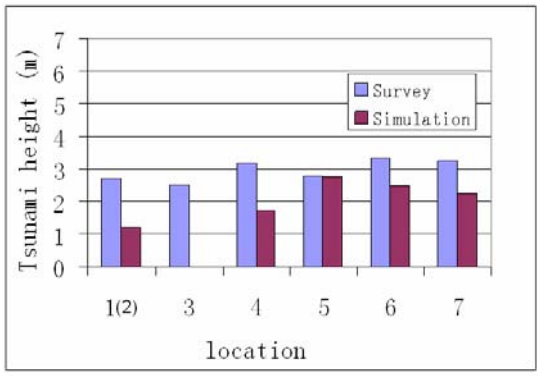

Figure 3 Comparisons between survey data and calculated results.