Geophysical Research Abstracts
Vol. 13, EGU2011-13598-1, 2011
EGU General Assembly 2011

Modeling influence of tide stages on forecasts of the 2010 Chilean tsunami

Burak Uslu (1,2), Marie Eble (1), Chris Chamberlin (1,2)

(1) Pacific Marine Environmental Laboratory, NOAA, Seattle, WA, United States, (2) JISAO, Univ. of Washington, Seattle, WA, United States.

The impact of the 2010 Chilean tsunami along selected coastlines is studied using the NOAA high-resolution tsunami flooding forecast model augmented to include modeled tide heights in addition to deep-water tsunami propagation as boundary-condition input. This Chilean tsunami was observed at the Los Angeles tide station at mean low water, Hilo at low, Pago Pago at mid tide and Wake Island near high tide. Because the tsunami arrived at coastal communities at a representative range of tide stages, the 2010 Chile tsunami provides an opportunity to study the tsunami impact on different communities at different tide levels. The current forecast models are computed for mean higher high water as a worst case scenario. The evaluation of techniques for including predictable fluctuations due to the local tide in this study provides the opportunity to improve tsunami forecasting. To model tides together with tsunami waves in the NOAA flooding model, a medium-resolution tidal model (Egbert and Erofeeva 2002) and the NOAA tsunami propagation model are combined to generate boundary conditions for a high-resolution tsunami flooding model. At the initial time step, the tidal results are interpolated over the entire tsunami propagation grid. At all future time steps, the combined tide and tsunami amplitudes are incorporated into the numerical model from the boundary locations.

Computed wave amplitudes, wave currents, and flooding are compared at selected coastal locations around the Pacific, taking into account the difference in tsunami impact due to tidal stage. The predicted tide and the tide at the pre-defined output cell differ, since the computations depend on shallow water equations. However, NOAA's forecast model handles the tidal stages and shows potential for predicting tsunami amplitudes with the inclusion of tides. The predicted tsunami amplitudes at the Los Angeles and San Francisco tide stations are consistent with observations. However, when the tidal dynamics are considered at Crescent City and Hilo, amplitudes are larger than expected. NOAA's forecast model computed tidal variations in the computation grids showing its potential for including tides in forecasting. Non-linear shallow water equations provide more accurate forecast with the inclusion of tides then with out them.

Egbert, Gary D., Svetlana Y. Erofeeva, 2002: Efficient Inverse Modeling of Barotropic Ocean Tides. J. Atmos. Oceanic Technol., 19, 183–204.