1. NEOWAVE

For last two decades, researchers are aware of the importance of wave dispersion, bore propagation, and wave breaking in tsunami numerical modeling. More recent models can address either one or two of the three processes.

We developed a new tsunami numerical model, NEOWAVE (Non-hydrostatic Evolution of Ocean WAVE), which can handle wave dispersion, bore propagation, and wave breaking using an alternate theoretical and numerical formulation [1].

We further extended NEOWAVE to model tsunami evolution processes from its generation, propagation to run-up, through implementation of following methods and schemes [2]:

- Dynamic Sea Floor Deformation
  To account for detailed earthquake rupture processes in tsunami generation.
- Spherical Grid
  To properly model basin-wide tsunami propagation.
- Grid Refinement Scheme (Two-way Grid Nesting)
  To use appropriate grid resolution for each tsunami processes.

2. Tsunami Modeling

The 2009 Samoa Earthquake occurred near the Tonga trench. The resulting tsunami reached the shores of Tutuila Island, American Samoa with a maximum elevation of 12 m. Post-tsunami surveys show significant variation of the run-up and impact between adjacent beachfront villages [3,4]. We reconstruct the 2009 Samoa Tsunami using NEOWAVE to examine these disparities in the recorded data [2].

NEOWAVE uses a coupled, 4-level grid nesting system to model the entire tsunami evolution in one computation (FIG.2) considering wave dispersion, wave breaking and bore propagation. NOEWAVE successfully reproduce the run-up/inundation in Pago Pago Harbor, which shows significant east-west variation of tsunami impact (FIG.3).

3. Future Studies and Applications

Applications

- Tsunami Inundation Mapping - Hawaii, Northwest Hawaiian Islands, American Samoa, Western Samoa, the US Gulf coasts, Puerto Rico, and Chile.
- Storm Surge and Wave Modeling - Pacific Islands, and the US East coasts.
- Tsunami Modeling Workshop - Chile (FIG.4)

Recent and Future Tsunami Researches

- The 2009 Samoa Tsunami - Resonance analysis due to insular shelf [5].
  - Investigation of tsunami generation mechanism.
- The 2010 Chile Tsunami - Resonance analysis over continental shelf [6].
  - Modeling water level and velocity at Hawaiian water.
  - Modeling run-up/inundation along Chile coast.
- The 2010 Mentawai Tsunami - Earthquake and Tsunami source study [7].
- The 1700 Cascadia Tsunami - Tsunami impact on coastal infrastructure [8].