



## **HySEA model verification for Tohoku 2011 Tsunami. Application for mitigation tsunami assessment**

Jorge Macias (1), José Manuel González-Vida (2), Javier García (2), Manuel Castro (1), Sergio Ortega (3), and Marc de la Asunción (1)

(1) Depto. de Análisis Matemático, Facultad de Ciencias, Universidad de Málaga, 29080-Málaga, Spain (jmacias@uma.es), (2) Departamento de Matemática Aplicada, Escuela Politécnica Superior, Universidad de Málaga, 29080-Málaga, Spain, (3) Laboratorio de Métodos Numéricos, Universidad de Málaga, 29080-Málaga, Spain

In many aspects Tohoku-Oki 2011 mega tsunami has changed our perception of tsunami risk. The tsunami-HySEA model is used to numerically simulate this event and observed data will be used to verify the model results. Three nested meshes of enhanced resolution (4 arc-min, 32 arc-sec and 2 arc-sec) will be used by the numerical model. The propagation mesh covers all Pacific Ocean with more of 7 million cells. An intermediate mesh with 5 millions cells contains the Japanese archipelago and, finally, two finer meshes, with nearly 8 and 6 millions cells, cover Iwate and Miyagi Prefectures at Tohoku region, the most devastated areas hit by the tsunami. The presentation will focus on the impact of the tsunami wave in these two areas and comparisons with observed data will be performed. DART buoys time series, inundation area and observed runup is used to assess model performance. The arrival time of the leading flooding wave at the vicinity of the Sendai airport, as recorded by video cameras, is also used as verification data for the model.

After this tsunami, control forests as well as breakwaters has been discussed as suitable mitigation infrastructures. As particular case, we will analyse the evolution of the tsunami in the area around the Sendai airport (Miyagi Prefecture) and its impact on the airport. A second simulation has been performed, assuming the existence of a coastal barrier protecting the area. The role of this barrier in modifying tsunami wave evolution and mitigating flooding effects on the airport area are discussed. The protection effect of the breakwaters near Kamaishi (Iwate Prefecture) is also assessed. The numerical model shows how these structures, although did not provide a full protection to tsunami waves, they helped to largely mitigate its effects in the area.

**Acknowledgements.** This research has been partially supported by the Junta de Andalucía research project TESELA (P11-RNM7069), the Spanish Government Research project DAIFLUID (MTM2012-38383-C02-01) and Universidad de Málaga, Campus de Excelencia Internacional Andalucía Tech. The multi-GPU computations were performed at the Laboratory of Numerical Methods (University of Malaga).