On the hydrodynamic circulation on ocean waves produced by tropycal cyclones

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Summary: This paper presents a numerical hydrodynamic model, based on the solution of the 2-D depth-averaged shallow water equations, using a finite volume formulation on Quadtree mesh. The solution uses a second-order Godunov-Type approximation, with the inviscid fluxes at the interface between two cells calculated using Roe´s approximate Riemann Solver. A real case is presented, the numerical model is applied to evaluate the storm surge produced by the hurricane Wilma and its effect on the coastal line on the Península of Yucatán, México.

Application of the model

The main goal of a hydrodynamic numerical model of storm surge presented in this paper, is to evaluate the water levels as well as the speeds and directions of currents caused by hurricanes on the water sea. To illustrate the utility of the model, we applied this methodology to the effect of hurricanes Wilma (2005), this phenomenon had been the most intensive tropical cyclone had whipped the Mexican coast2. The maximum water level observed was around 3 meters on the coastal line, producing damages on the structures near to coast and morphological changes on the beach. This numerical model consist in two parts, one of this is the evaluation of the field velocity of winds and the low pressure field, this values are introduced into the SWE. Figure 3 show the Quadtree mesh for the Península of Yucatán used to discretized the governing equations and its adaptability to the line coast The storm surge calculated by the model is shown in Figure 4, the maximum water level calculated was four meters on the north of Península as a consequence of wind direction.. The results obtained by the model are in good agreement by those observed on the coast, to model six days of phenomenon, was necessary only 24 computer hours, this main that the model is efficient and reliable.

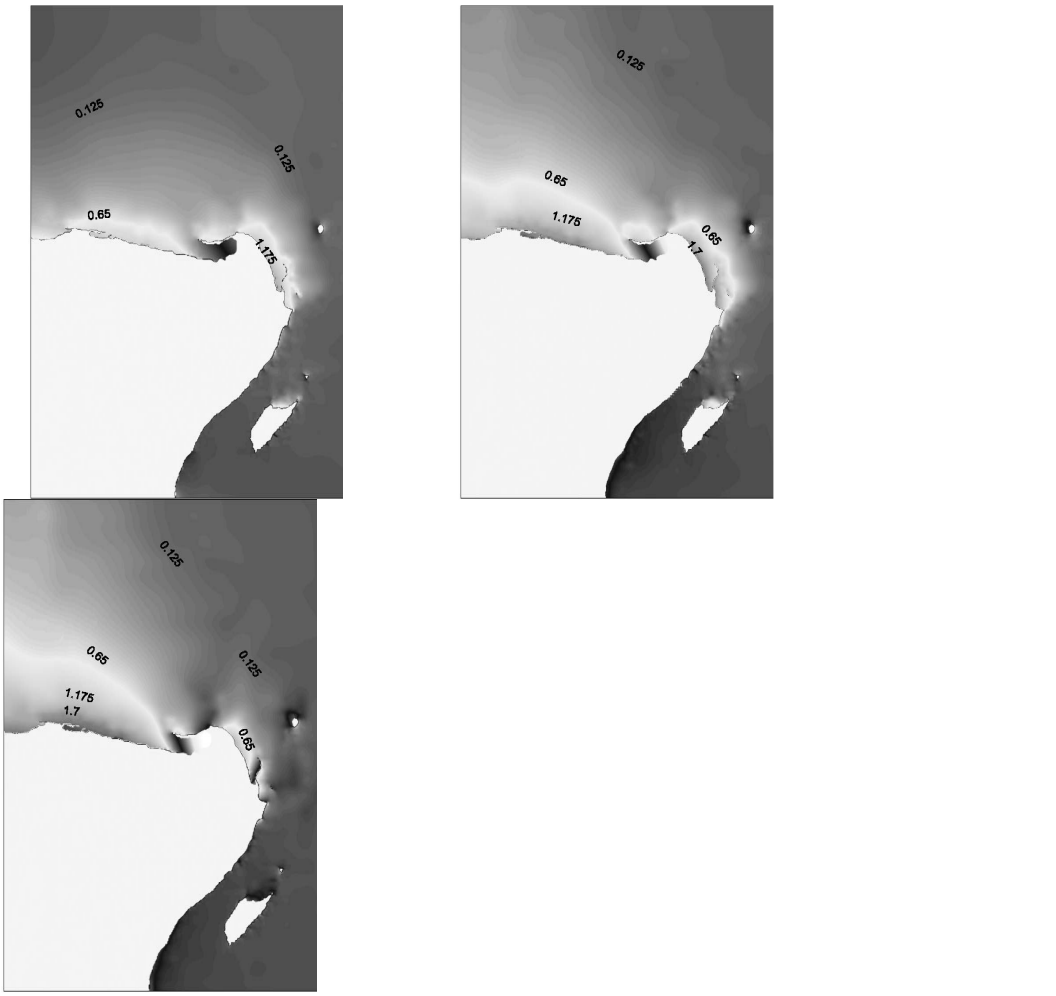

Figure 4: Storm surge calculated by the numerical model