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A high resolution study of a hurricane storm surge and inundation in Veracruz, Mexico

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Veracruz is the most populated city along the Mexican shoreline of the Gulf of Mexico and also is the country's largest commercial port. In recent years the city has been affected by hurricanes of medium intensity that have provoked human casualties, property damaged and economic loss. Two of the most recent events were hurricane Karl (2010), which caused a storm surge and severe flooding, and hurricane Ernesto (2012). The purpose of this work is to study, based on high-resolution numerical simulations, scenarios of storm surge flooding using state-of-the-art open source numerical models: the Weather, Research and Forecasting (WRF), and the coupled models ADvanced CIRCulation (ADCIRC) and Simulating WAves Nearshore (SWAN) for weather and storm surge hindcast, respectively. We also use topography high resolution data from LIDAR and bathymetry from GEBCO 30", the Mexican Navy and nautical charts from Electrical Federal Commission. We present the validation of the models evaluating several statistical parameters against measurements from Acoustic Data Current Profilers, pressure sensors, tide gauge and meteorological stations for these events. In the case of hurricane Karl, it made landfall 15 km north of Veracruz City, reducing the maximum surge along the city shoreline. The hurricane Ernesto made landfall 200 km southeast of the city, too far to have a significant impact. We did some numerical experiments slightly changing the trajectory, reported by the best track data, for these two hurricanes with the purpose of evaluating storm surge scenarios. The results shows that the worst storm surge cases were when the tracks of this hurricanes made landfall south of the city in the range of 30 to 60 km.