ON THE INFLUENCE OF STORM CHARACTERISTICS ON SURGE RESPONSE IN THE NEW ORLEANS COASTAL BASIN

AN IDEALIZED PROCESS-BASED SENSITIVITY STUDY

Storm surges are of great interest to the city of New Orleans. Storm surges are flood like phenomena caused by storms. Different methods for surge prediction are used until now. Nevertheless, these methods are not always capable to provide insight in observed surge patterns in the New Orleans basin. This study focuses on assessing and explaining spatial and temporal patterns of surge response depending on different storm characteristics. This is done with a new idealized storm surge model. This model is applied to a case study for the first time. First model performance is assessed and then a sensitivity study to storm parameters is done.

Hurricanes create low pressure and high wind stresses at the ocean's surface. These forces induce both local and large scale water movements. Six storm parameters based on the Holland model are used as model input for the meteorological part. The hydrodynamical part is forced by the meteorological model and solves the linear shallow water equations using the finite element method and a temporal Fourier transformation. The domain is a schematic representation of the north east corner of the Gulf of Mexico (Figure 1).

The realistic case study shows that reproduced water level are in fair agreement with observed water levels. The maximum surge levels are comparable but the water level trend is underestimated prior and after landfall. The timing of these peaks levels on the other hand, is comparable at all locations. The qualitative trend of observed water levels is reproduced by the model.

Figure 1: North eastern part Gulf of Mexico, with model domain and a schematic storm.

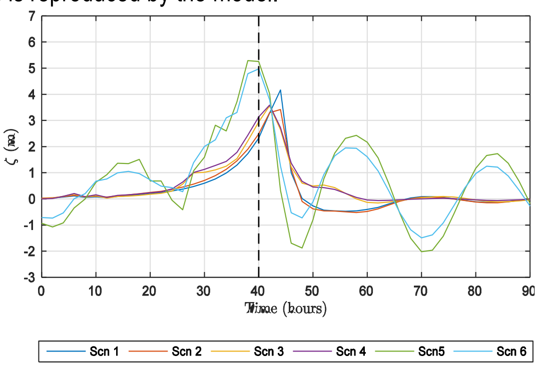

Figure 2: Simulated water levels at location of orange dot (see Figure 1).

A sensitivity study for storm parameters is done with six synthetic storm scenarios. These scenarios are based on three different storm directions and two combinations of central pressure and storm size.

The simulations demonstrate that in this study, storm direction is the dominant storm parameter. Water level time series (Figure 2) show a clear distinction per direction. Directions affect maximum surge, timing of the surge and the trend of the water level. The water level deviations caused by storm direction in the range from 40 cm to 2 m. The combinations of central pressure and storm size on the other hand, show only small differences in maximum surge (3-35 cm).

Local processes mainly determine the surge pattern through the basin. These are induced by geometry and bathymetry and wind direction. This pattern is different for each storm direction. In addition, direction affects the relative importance of large scale processes. Only a north west storm direction shows this contribution, as it generates a forerunner propagating along the coast of Florida towards New Orleans. This can be seen in both water levels and the amplitude spectra.

We conclude that the storm direction is an important parameter for the surge response in New Orleans affecting local and large scale surge response. This is notable because literature focusses on central pressure and storm size as main contributors. The effect of geometry should be noted . Therefore, it is important to extend this sensitivity study and focus more studies on a coastal geometry rather than commonly used, a straight coastline.

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