EVALUATION OF THE INFLUENCE OF DIGITAL TERRAIN MODELS FOR A WAVE PROPAGATION MODEL APPLIED ON THE NORTHERN COAST OF RIO GRANDE DO NORTE, BRAZIL

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Paper topic: Coastal waves, currents, tides and storm surges

1. Introduction

The digital terrain models (DTM) are the numerical representation of topography, from a set of points, which is assigned an elevation value associated, where these points can be or not uniformly spaced. These data are usually processed through GIS tools, and much effort has been made towards obtaining improved interpolation schemes or optimization of the choice of points. Since the topography is a basic input data for several numerical models (e.g. wave propagation model) used in environmental studies, a natural question arises: how important the DEM are for the accuracy of the numerical simulations? The quality of the DEM depends on the accuracy and precision of the elevation data itself, which is directly related to the topographic surveying process. Therefore, this paper aims to investigate and to quantify the influence of the bathymetry, as obtained by a DEM, on the wave propagation model, off the coast of the State of Rio Grande do Norte, Brazil (Figure 1).

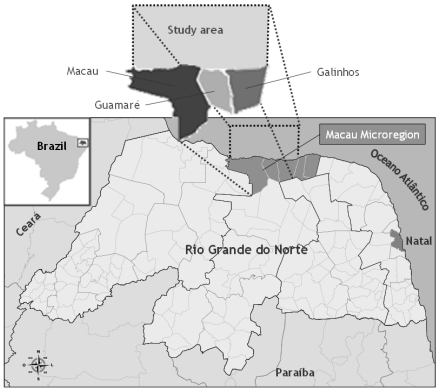

Figure 1. Study area.

2. Application of Wave Model

The SWAN model (BOOIJ et al., 1999; SWAN Team, 2006) is a nonlinear spectral model that includes the wave generation, wave propagation and wave dissipation. It is a phase-averaged model, based on the equation for the conservation of the wave action. This model allows the generation of waves by wind and makes the spread considering various phenomena involved in the propagation of waves - refraction, diffraction, wave breaking and generation of harmonics (non-linear interaction between waves). It is considered appropriate for large coastal areas (hundreds of kilometers).

This article presents a comparative analysis between field data collected in the Northern portion of the coast of the State of Rio Grande do Norte, encompassing the littoral of the municipalities of

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Galinhos, Guamaré and Macau, from the 15th to 22th of February of 2011 (MATOS et al., 2011), and numerical results obtained with the nonlinear spectral model SWAN, when different DEMs of the same region are used as input. We evaluated the variations between measured data and numerical simulations with the SWAN, associated with the DTM's use.

3. Results

The Natural Neighbor interpolation method generated good contours for areas with variable density of data. This method does not extrapolate values of 'z' out of the domain and according to Moura et al. (2011), this interpolation was the best to reproduce the bathymetric features of the area. Kriging produced maps with good consistency visual from irregularly spaced data. Kriging can be either an exact or a smoothing interpolator, depending on the user-specified parameters. It also can extrapolate values of 'z' out of the domain.

For the results of SWAN model was obtained the values of the wave heights (Figure 2, section A), Peak period (Figure 2, section B) and wave directions, for all wave conditions performed from the 15th to 22th of February of 2011, where the incident is from WAVEWATCH III model (TOLMAN, 1999).

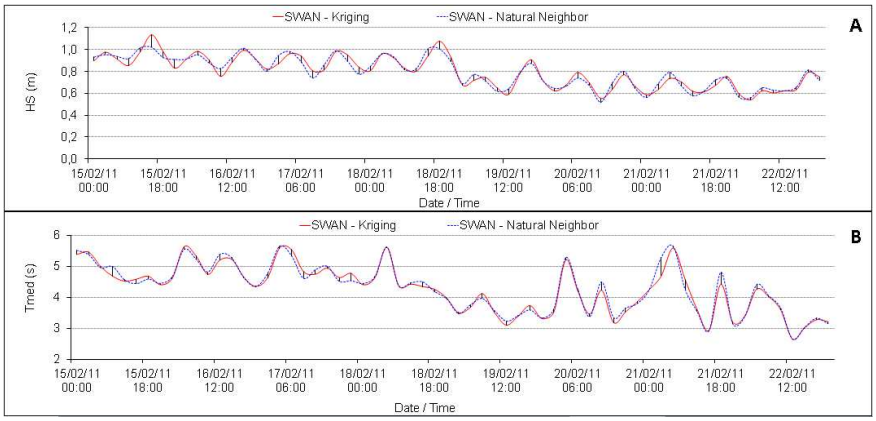

Figure 2. Results: A) Significant Height; B) Peak period.

4. Conclusions

Regarding the influence of the DEMs on modeling of the study area, we found that the interpolation methods used, Natural Neighbor and Kriging, present low variation of elevation values.

The simulation of the DEMs on SWAN computational domain, showed that overall, the interpolators present low variability.

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