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NCEP/NCAR Reanalysis data to predict the variability of the mean sea level on South Atlantic Ocean with ANN model

M. Oliveira (1), N. Ebecken (1), C. Neves (1), L. Calôba (1)

I. Santos (2) and J. Oliveira (3)

Federal University of Rio de Janeiro, COPPE, Brazil, (2) Federal University of Rio de Janeiro, Departament of Meteorology, Brazil, (3) Federal Fluminense University, Departament of Geography, Brazil. (marilia@coc.ufrj.br)

This work presents a study about the variations of the mean sea level in Paranaguá Bay-Paraná State, South Region of Brazil from 1997-1998 period. Tidal forcing is the main cause of the variability in the sea level, but the effects of meteorological variables are also present in rising and lowing of the observed coastal sea level. Hourly records of the water level from the gauge tide installed at the Port of Paranaguá city and atmospheric pressure and wind from the "National Centers for Environmental Prediction" (NCEP) and the "National Center Atmospheric Research" (NCAR), on some points over the oceanic area near the bay were used. The meteorological influences present in the original tide gauge records were extracted using a low-pass filter removing the oscillations with periods relative the astronomical tide patterns. Meteorological time series were filtered too. Atmospheric driving forces were studied using statistical analysis on time and frequency domains. Therefore, the correlations in this physical process were defined to know the time lag between the meteorological variables and the mean sea level response to the occurrences of the low frequency atmospheric systems (cold fronts). The relations between the atmospheric phenomena and the response of the mean sea level were studied from six points in the oceanic area. Atmospheric pressure and zonal and meridional wind components were used. An Artificial Neural Network (ANN) model was applied to predict the variability of the mean sea level related with the passage of the frontal system. Correlations between the low-frequency coastal sea level response and meteorological variables were used

as model input variables. The architecture of this ANN model is the multilayer perceptron and includes one hidden layer and one output layer. It was used for 6, 12, 18 and 24 hours time lag simulations. The ANN used to predict the mean sea level presented good performance learning very well the low frequency atmospheric phenomena variations. This model was able to capture the effect of the atmospheric interactions with an approach of 99% for 6 and 12 hours. The results for 18 and 24 time lag simulations were about 91% and 78%, respectively, suggesting the development of others architectures to improve the predictions to larger periods. It demonstrated to be useful as complement of the standard constant harmonic model used to predict the tide for that Port. The NCEP/NCAR Reanalysis data showed that they are a very good information source for the South Atlantic Ocean region where the lack of data is still substantial.