Assessing the impacts of climate change over wind power resource in Brazil through a neural network approach

Energias Renováveis e Não Renováveis

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Regional impacts of global environmental change are subject of extensive research, which usually adopts physical or statistical approach to downscale the outputs from the global models. Near surface winds, in particular, are difficult to be predicted even in short-term timeframe, mainly due to microscale circulations associated with surface heterogeneity and turbulence inside the atmospheric boundary layer (ABL). However, the prediction of its future trends would be a valuable information for airports, agriculture and mainly wind energy development, since wind farm projects have at least 20 years of operational perspective. This study aims to model the local effect of Eta-HadCM3 outputs over daily means of 10m wind fields using an artificial neural network (ANN) approach. The type of network developed is a Multilayer Perceptron (MLP) with one hidden layer, which is capable to represent any continuous function associated with the physical processes, including the non-linear ones typically found in the ABL. The predictors for the network were selected from the outputs of Eta-HadCM3 scenario A1B, which is a nesting of Eta/CPTEC 40km grid mesoscale model into the HadCM3 model, from the U.K. Met. Office. The observed 10m wind daily means were obtained from INMET stations for the period 1960 to 1990, matching the Eta-HadCM3 baseline, in a total of 20 stations distributed between northeastern and southern Brazil. These data was qualified and used to train and validate the ANN model for each station. The results for the validation demonstrated higher correlations and a significant reduction on RMSE for all of them, emphasizing the importance of data treatment prior to model development. Climate predictions were generated for three timeframes: 2010-2040, 2040-2070 and 2070-2099. Preliminary results indicated a tendency of increase over near surface winds, in both southern and northeastern regions of Brazil. The study is still ongoing and the next steps involves some improvements on network architecture and training strategy, in order to address some instabilities caused by the climatology shift introduced with the input models.