IDENTIFICATION OF THE BEST WRF SETUP FOR SOLAR RADIATION SIMULATION IN NORTHEAST BRAZIL

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ABSTRACT: This study evaluated the performance of mesoscale model WRF in forecasting solar irradiation at the surface for the Brazilian Northeastern region in order to found the best model setup. Sensitivity tests were performed using different vertical resolutions (27 levels, 45 levels and 65 levels) and 10 different microphysics parameterization schemes (WSM3, WSM5, Ferrier, WSM6, Goddard GCE, graunpel Thompson, Morrison-2, Double-5 Moment , Double-Moment 6 and Thompson). Two horizontal resolutions were investigated: 16km and 4km. The RRTM scheme was used to parameterize the radiative processes for longwave radiation and Dudhia method was used for shortwave radiation. The simulations were performed with the WRF model for March 2009. Observational data acquired at four ground sites located in typical climate characteristics of Brazilian Northeastern region were used to evaluate the model performance. Hourly solar radiation data was acquired in automatic weather stations operated by FUNCEME at the coastal area (Itapipoca and Acaraú) and at the semi-arid area (Acopiara and Cedro) of Ceará. The results demonstrated that it is quite important to evaluate the optimal mesoscale model setup before start using it to forecast solar energy forecast in Brazilian Northeastern region due to the particular climate features observed in the region, mainly related to the effect of clouds. It was observed that the Bias and RSME was reduced in more than 50% for Acaraú and 15% for Itapipoca in coastal area by increasing vertical resolution. However, the number of vertical layers did not present influence on the simulations for the semi-arid area. Regarding the microphysical parameterizations, the Morrison scheme, Ferrier scheme, WSM 5 scheme, Thompson Graupel scheme and Double Moment -6 scheme have present similar performances. The results showed that it is important to use a scheme with more liquid content to better simulate the cloud influence at the coastal area, especially for simulations with horizontal resolution lower than 4km. In the semi-arid region, where the annual rainfall is lower than 1000 mm/year, the microphysical schemes present larger differences. The smaller BIAS was obtained when the simplest microphysical scheme was used.