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Statistical Correction of the Result of Weather Forecast by Applying the Model Output Calibration

Carlos Amaral Hölbig[1], Vanessa Lago Machado[2], Willingthon Pavan[3]

Graduate Program in Applied Computing (PPGCA)
University of Passo Fundo (UPF)
Passo Fundo, Brazil

Abstract

This work describes the simulation models calibration method called Model Output Calibration. In order to verify its effectiveness, presents the application of the MOC in weather forecast correction generated by the Eta 15Km model at CPTEC/INPE. Eta is a regional model for numerical weather prediction. The results of the statistical correction of Eta forecast were positive, with satisfactory improvements in the variables tested (temperature and relative humidity). The use of this approach shows the possibility of gains in the results of simulation models of crops and diseases that use as predictive variables the variables generated by weather forecast models.

Keywords: Statistic correction, Weather forecast, MOC, Eta Model.

1 Introduction

Simulation models are important tools that act as forecast tools, enabling decisions to be made before the events occur. But even with all the developments in techniques for simulation modeling, the accuracy found in the data, in some cases, it is not yet satisfactory, and ultimately influences wrongly data verification.

Numerical weather prediction (NWP) models are composed of weather forecast techniques performed through computational modeling, allowing to analyze and decide on various situations related to weather and climate. These models are divided into global and regional models (limited area). Furthermore, numerical

[1] Email: holbig@upf.br
[2] Email: 154401@upf.br
[3] Email: pavan@upf.br

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weather prediction models divide their modeling space in boxes, which are defined by horizontal grids boxes with vertical levels. Thus, assume that the atmosphere is homogeneous in each of these boxes, it is necessary to know only the data of one point per box.

For purposes of this research, the numerical weather prediction model used in our work was the regional model Eta [6], used by the Center for Weather Forecasting and Climate Research (CPTEC [4]) of the National Institute for Space Research (INPE) in Brazil.

The forecast of this regional model extends up to 264 hours (11 days) are supplied twice a day (at 00:00 and 12:00, UTC time). Eta has grids with 40 km, 15 km, 5 km and 1 km. This model was developed by Mesinger et al. [15] and made operational at the National Centers for Environmental Prediction (NCEP [5]) [1]. It is a model based on the use of vertical coordinates, which remains approximately horizontal in mountainous areas, making it suitable for studies of steep topography regions, for example, the Andes Mountains [5].

The Eta model is used operationally at CPTEC/INPE since 1997 for weather forecasts [2] and, since 2002, to seasonal climate forecasts [3] in high resolution over South America for horizons of a few days, months or decades, for climate change studies.

The main sources of observed data of Eta model are: meteorological stations, surface stations, airports, ships, aircraft, satellites and radars. These sources are part of the Global Observing System (GOS) [11], as shown in Figure 1. When the observed data are received, some situations may occur, for example, some of the locations may not have measurement data observed at certain hours: caused by a lack of measurement of typing or even failure at the station; another situation is the analysis of unrealistic measurements: sometimes occurs the erroneous data entry in any station. To correct these errors is necessary the treatment of data by, for example, numerical interpolation of missing or unrealistic data available in the databases.

The prognostic variables Eta model are: air temperature, zonal and meridional wind components, specific humidity, surface pressure and turbulent kinetic energy. Thus, the model is proposed to predict atmospheric phenomena in more detail, when associated with these variables, such as storms or fog. As these variables do not have linearity and can vary more frequently in large spaces of time due to climate changes involved, such a prediction is best defined when it occurs in a short time.

This paper describes and analyzes the application of statistical calibration method for simulation models called Model Output Calibration (MOC) with the aim to verify if there is a significant improvement in correcting the result of the forecast the weather forecast model Eta 15km at CPTEC/INPE.

Section 2 will describe some methods for simulation models correction, presenting its main features. Section 3 will address the Model Output Correction, high-

[4] http://www.cptec.inpe.br/

[5] http://www.ncep.noaa.gov/