

7.5 CPTEC GCM and Eta Model verifications against Rondônia Reference site in Brazil

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1. Introduction

Numerical models are often used to study climate conditions and atmospheric phenomena. To make use of model outputs it is necessary to identify the model deficiencies and errors, which can lead to numerical improvements and more accurate simulations. A straightforward identification of the errors is the comparison of forecasts against surface observations. The objective of this work is to evaluate the 24-h and 48-h forecasts from CPTEC GCM and Eta Model against surface observations collected at the Forest Site of Rondonia, located at about 10°S, 62°W, for the period between 1 July and 1 September 2001. The models are used operationally at CPTEC. This work is part of objectives of the CEOP project.

2. The Models

CPTEC GCM

The CPTEC GCM is a spectral model at T126L28 resolution (Bonatti, 1996). The model uses sigma vertical coordinate. The Kuo scheme modified by Anthes and Keyser (1977) treats the convective precipitation. The land-surface scheme is the SSiB scheme (Xue et al., 1991). Short-wave radiation is solved by Lacis and Hansen (1974) scheme and the long-wave radiation was developed by Harshvardham et al. (1984). The model verification grid-box has evergreen forest type of vegetation. Monthly climatological soil moisture is taken as the initial soil moisture. Albedo is obtained from a seasonal climatology.

Eta Model

The Eta model (Mesinger et. al, 1988) domain covers most of South America. It was configured with 40 km resolution and 38 layers. The convection precipitation is generated by the Betts-Miller-Janjic scheme. The land-surface processes are solved by OSU (Chen et al, 1997) scheme. The radiation package was developed by GFDL. The lateral boundaries are updated every 6 hours from CPTEC global model forecasts. The Eta Model verification grid-box also has evergreen forest type of

vegetation, and at 63m. The Eta Model uses the same initial soil moisture and albedo used in the GCM.

3. Verifications

Model grid-box comparison against observed point value may not be completely fair, however, bearing in mind model limitations, the comparison can still provide some indication on the model processes that generate the errors.

Precipitation

Precipitation was observed in Rondônia site between the 24 and 27 July 2001 (Fig.1). The global model clearly overestimated the precipitation events, as forecasts occurred in half of the studied period. The Eta also produced some precipitation overestimate, but not so largely as the global model and indicated the occurrence of the event. In both models, the 48-h precipitation forecast overestimate is larger than the 24-h forecasts. As the GCM grid-box represents a larger area, it may include the precipitation of neighboring sites.

Latent Heat Flux

The global model underestimates the latent heat flux. The diurnal cycle of the latent heat flux shows that at 18Z, the observed 6-h mean value of about 240W/m² was underestimated by the global model. The error increased at 48-h forecasts. The Eta model, on the other hand, showed smaller overestimate. The observed peak value of about 310 W/m² was forecast as 330 W/m². The 48-h Eta forecasts showed a small reduction of errors relative to the 24-h forecasts, in an opposite error behavior with respect to the GCM.

Sensible Heat flux

The global model largely overestimated the sensible heat flux. At 18Z, the observed 6-h mean value was about 100 W/m² whereas the observed peaked at about 300 W/m² at 24-h and 48-h forecasts. The Eta model also overestimated the sensible heat flux, but the errors were much smaller than the Global model

errors. Again, the Eta forecast errors reduced from 24-h to the 48-h forecasts (Fig. 2).

Temperature and winds

It was noticed that both models tended to overestimate near-surface temperatures particularly on those days when no precipitation was forecast by the models. Although the Eta Model overestimated less rain events, the Eta near-surface temperature errors were larger than the Global model errors.

The near-surface zonal and meridional winds are relatively well forecast by both models. The global model forecast better the zonal component, whereas the Eta forecast better the meridional component. The errors were of the order of 1 m/s.

Conclusions:

The evaluation of CPTEC global model and Eta Model was carried against surface observations at the Rondônia Forest Site in Brazil. Both models showed same error signs for precipitation, near-surface temperature, and sensible heat flux. The

global model tended to increase the error with forecast time, whereas the Eta tended to reduce the errors.

References:

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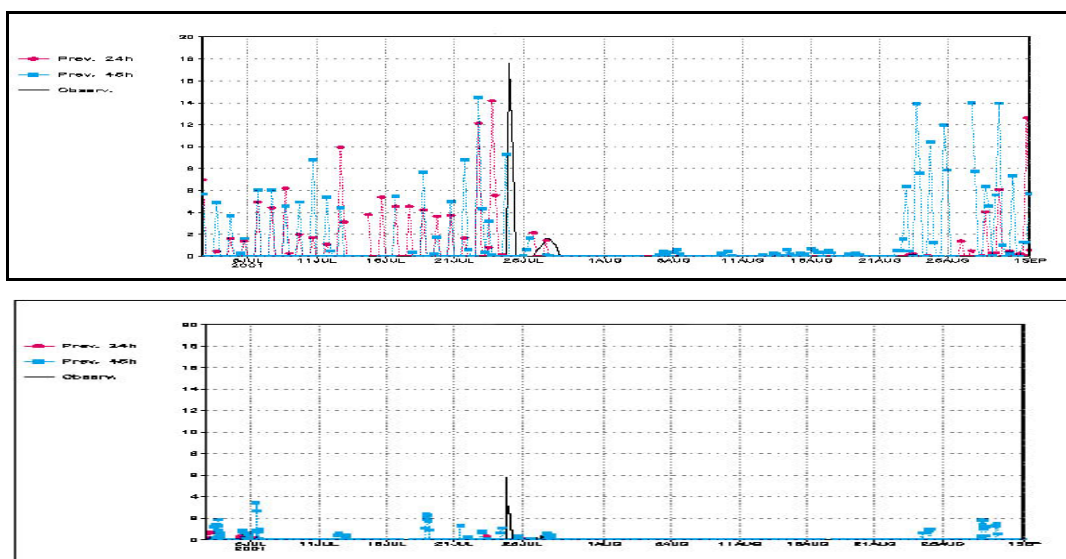


Figure 1 - 6-hour accumulated precipitation (mm) in Rondônia: (a) Global Model, (b) Eta Model.

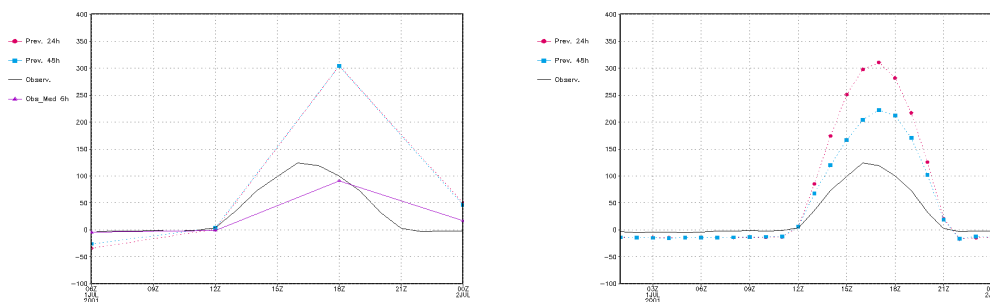


Figure 2 – Sensible heat flux (W/m^2) for Rondônia site. Solid line refers to hourly observed values, triangle marked line refers to observed 6-h mean value, the circle marks refer to the 24-h forecasts and the square marks refer to the 48-h forecasts. CPTEC GCM (top) and Eta Model (bottom).