6B.8   ETA MODEL FORECASTS OVER SOUTH AMERICA WITH IMPROVED LAND-SURFACE
PROCESSES REPRESENTATION

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1. INTRODUCTION

The Centro de Previsão de Tempo e Estudos Climáticos (CPTEC) in Brazil has been running operationally the regional Eta model and producing 60-hour forecasts over South America on a twice-a-day basis. The forecasts have been satisfactory but some deficiency in the near surface variables has been noticed. A crude treatment of the land-surface processes based on the Bucket scheme may be responsible in part for the deficiencies. In this study another version of the model with the OSU scheme, which contains vegetation and soil properties, is evaluated through scores and a forecast example is shown.

2. THE MODEL

The regional Eta model (Mesinger et al., 1988; Black, 1994) is configured with 40 km in horizontal and 38 layers to run at CPTEC. The initial conditions are taken from NCEP analyses and the boundary conditions are provided every 6 hours from the CPTEC GCM forecasts at T062L28. The model uses the modified Betts-Miller scheme to treat convective precipitation, Zhao and Carr (1997) to resolve cloud water, Mellor-Yamada (1974) to treat turbulence, and the GFDL radiation package. The current operational version (Chou, 1996) uses the simple bucket scheme to treat soil moisture. The alternative version of the model uses the land-surface scheme developed at Oregon State University (OSU) (Betts et al., 1997). The new scheme has 12 vegetation types and two soil layers. Tropical forest type covers large portion of the continent. The integration domain in the Eta/OSU version is increased relative to the Eta/Bucket domain by about 5° in the north, south and east borders, and has the top raised from 50 hPa to 25 hPa. Short wave radiation tendencies were updated every 1 hour, different from the 2 hours of the Eta/Bucket.

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3. RESULTS

November is transition month and the rains are resuming over the central part of the continent. Figure 1.a shows an example of a frontal system passage over Southeast Brazil which caused heavy precipitation. This figure is a satellite estimated precipitation accumulated in the previous 24 hours. The 36-h forecast of total precipitation verifying on the 29 November 1999, 12 UTC produced by Eta/OSU model is shown in Figure 1.b. The forecast predicts correctly the precipitation band, but underestimates the maximum values. The Eta/Bucket version produces a similar forecast, but the values are even smaller, and the precipitation band is apparently displaced southward.

The comparison of the forecasts provided by each model was performed for a two-week period in November 1999. Figure 2 shows the equitable threat score and the bias score calculated for both models over South America. The Eta/OSU version shows improvement over the Eta/Bucket for all precipitation thresholds, but more noticeable on the weak rains. The equitable threat score is high at the rain-no rain threshold, but drops sharply at higher categories. Surface observations are distributed unevenly over South America. The numbers below the horizontal axis indicate the amount of observations where precipitation occurred above those thresholds and were used to calculate the scores. The bias score shows that at weak precipitation, the Eta/OSU is similar to Eta/Bucket, but overestimates the rains of moderate intensity. At heavy rain thresholds, the bias is closer to 1 in the Eta/OSU, which is an important improvement. These scores were evaluated for forecasts of 24, 36, 48 and 60 hours.

Forecast errors of the models are calculated for a few variables. The errors are defined here as the difference between the NCEP analyses at $1.875° \times 1.875°$ latitude-longitude resolution and the model forecasts at this coarse resolution. Figure 3 shows the root mean square error of 850 hPa temperature for the 60-h forecasts from both models. These errors in the Eta/OSU are relatively smaller by about 1 or 2 degrees, but are larger over the
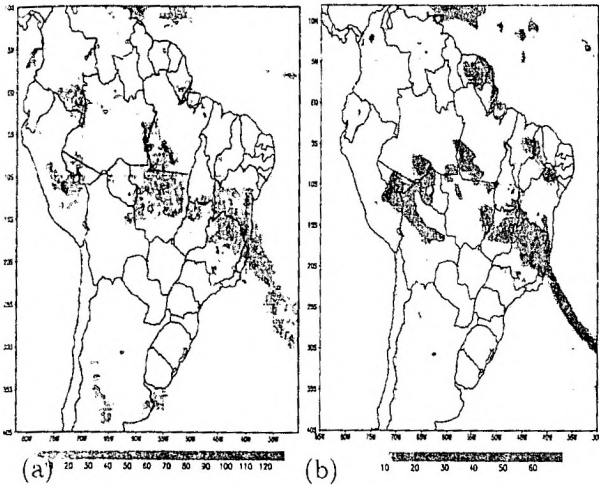
Figure 1: (a) Precipitation estimated from satellite on 29 November 1999,12 UTC. Eta model 36-hour forecast of total precipitation verifying on 29 November 1999,12 UTC.

Andes. However, in general the errors are approximately of the same magnitude in both models.

Improvements of the near surface variables such as surface temperature, shelter temperature and shelter humidity have been noticead in the use of the Eta/OSU in place of Eta/Bucket.

4. REFERENCES

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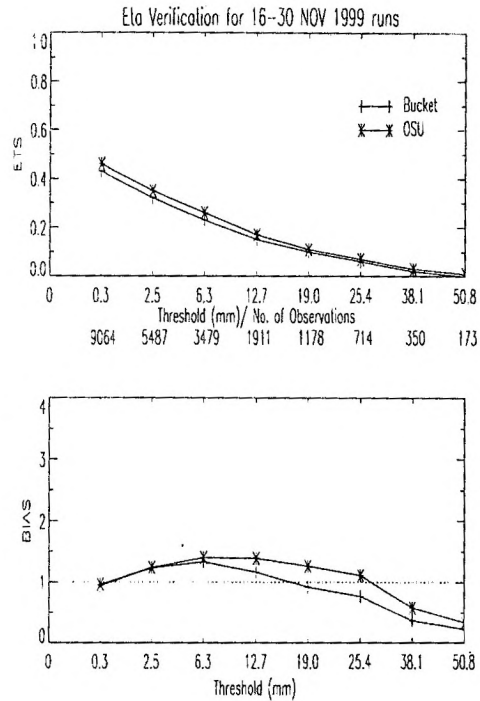
Figure 2: Equitable threat score and bias score of precipitation. simulations.
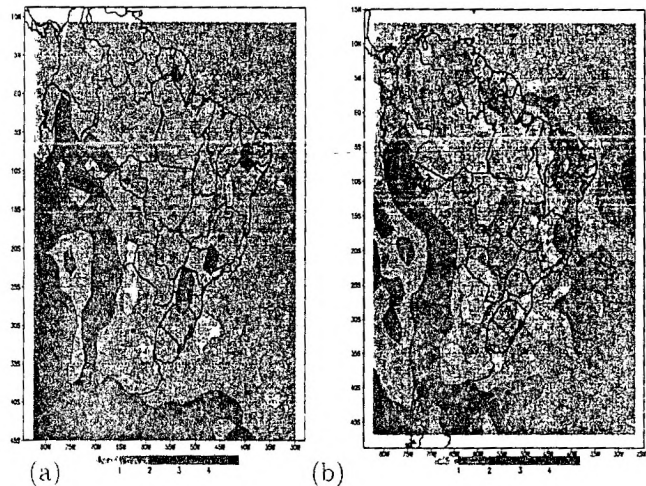

Figure 3: RMS of 850 hPa Temperature from (°C) (a)Eta/Bucket and (b) Eta/OSU runs.