Proceedings of 8 ICSHMO, Foz do Iguaçu, Brazil, April 24-28, 2006, INPE, p. 565-567.

ETA MODEL SEASONAL PRECIPITATION FORECASTS WITH DIFFERENT INITIALIZATION PERIODS

Jorge L. Gomes, Sin Chan Chou, Josiane F. Bustamante

[1] Center for Weather Prediction and Climate Studies - CPTEC
National Institute for Space Research - INPE
Cachoeira Paulista, SP, 12630-000, Brazil

1. Introduction

General Circulation models (GCM) are generally initialized about a few months before the forecast period to allow some spin-up time for the soil moisture. During this initialization period, observed sea surface temperature are used over the ocean. While in the GCM, the integration is mostly controlled by the lower boundary, in the limited area models, the climate state is mostly determined by the lateral boundaries, which are provided by the GCM. In longer spin-up time, model errors in the atmosphere are also allowed to grow larger before saturation error is reached.

In this work an evaluation of seasonal forecasts produced by CPTEC GCM and the regional Eta Model initialized at different spin-up times. The evaluation was taken over South America for 0.5 and 2.5 months of spin-up times. The objective is to chose the initialization time that produces best precipitation forecasts for the regional model.

2. The models

2.1 The CPTEC GCM

The CPTEC GCM (Cavalcanti et al. 2002) was run at T62L28 resolution. The soil moisture was initialized from monthly climatology, whereas sea surface temperature was taken from observed weekly mean. Convective precipitation is produced by the Kuo scheme.

2.2 The Eta Model

The Eta model (Mesinger et. al, 1988) domain covers most of Southeast coast of Brazil. It was configured with 40-km resolution and 38 layers. The convection precipitation is generated by the Betts-Miller-Janjic scheme (Betts and Miller, 1986). Stable precipitation is generated by the Zhao scheme. The land-surface processes are solved by the OSU scheme (Chen et al, 1997). The radiation package was developed by GFDL. The initial condition were taken from NCEP analyses. The lateral boundaries were updated every 6 hours from CPTEC T62L28 global model forecasts. The Eta Model uses the same initial monthly climatology of soil moisture and seasonal albedo as the driver model.

3. Results

The initialization period of 0.5 months for longer integration forecasts was adopted in the Eta Model by Chou et al. (2000) and in the Regional Spectral Model by Misra et al. (2003). The 2.5 month spin-up time has been adopted by the GCM models (Cavalcanti et al., 2002)

Results are shown for December-January-February (DJF) season of 3 different years: 1997, 1998 and 1999, which comprise one El Niño and one La Niña event. DJF is the rainy season for most part of the South America continent.

Precipitation forecasts from the CPTEC GCM are compared against surface observations in three major regions: Amazon region (N), Center-South (CS), Northeast Brazil (NE).

The GCM seasonal forecasts for the 0.5 month are very similar to the 2.5 month initializations, the 0.5 month tend to produce some peak values in all three regions (Fig. 1). This behavior is clear in the year 1997 and 1999. In 1998, when more precipitation occurred, the differences are negligible.

The Eta Model runs driven by these two GCM runs show different behavior from the GCM. The 2.5 month initialization runs show systematic underestimate of the precipitation forecasts for all regions, in 1997 and 1999. No clear difference is observed in the 1998 runs.

The inter-annual variability of daily mean precipitation averaged over the three regions can be seen in Fig. 3. The GCM clearly overestimates the precipitation in the NE region using both initialization periods. The Eta forecasts are closer to the observations, but tend to underestimate more the precipitation in the 2.5 month initialization. The inter-annual variability of precipitation for this region is better captured by the 0.5 month initialization runs.

In the CS and N regions, the GCM and Eta Model with 0.5-month initialization produced total precipitation closer to observations.

Conclusions:

Results show no clear advantage using longer spin-up period for the GCM seasonal forecasts. On the other hand, the Eta Model using 0.5-month spin-up time showed better results in 1997 and 1999. More investigations are necessary to understand the different forecast error behavior in 1998.

References:

Betts, A. K.; Miller, M. J., 1986: A new convective adjustment scheme. Part II: Single column tests using GATE wave, BOMEX, and arctic air-mass data sets. **Quart. J. Roy. Meteor. Soc.**, 112, 693-709.

Cavalcanti, I. F. A.; Marengo, J. A.; Satyamurty, P. et al, 2002: Global climatological features in a simulation using the CPTEC/COLA AGCM. **J. Climate**, 15, 21, 2965-2988.

Chen, F.; Janjic, Z.I.; Mitchell, K., 1997: Impact of atmospheric surface-layer parameterization in the new land-surface scheme of the NCEP mesoscale Eta model. **Bound. Layer Meteor.**, 85, 391-421.

Mesinger, F.; Janjic, Z.I.; Nickovic, S.; Gavrilov, D.; Deaven, D.G., 1988: The step-mountain coordinate: Model description and performance for cases of Alpine lee cyclogenesis and for a case of Appalachian redevelopment. **Mon. Wea. Rev.,** 116, 1493-1518.

Misra, V.; Dirmeyer, P. A.; Kirtman, B.P., 2003: Dynamic downscaling of seasonal simulations over South America. **J. Climate**, 16, 103-117.

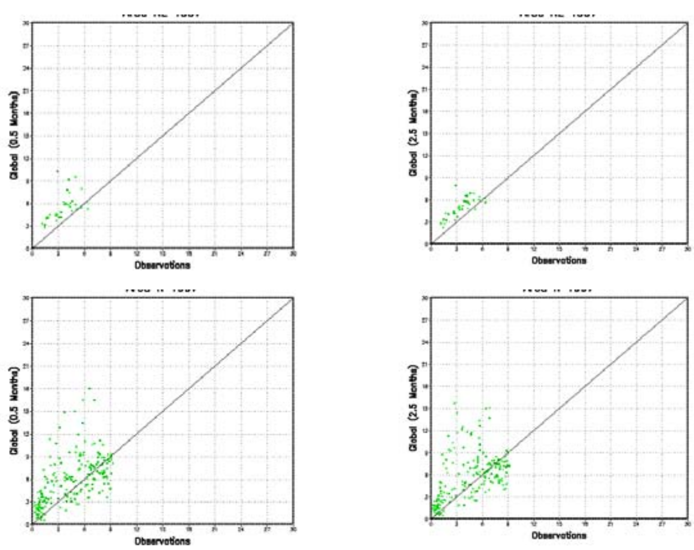
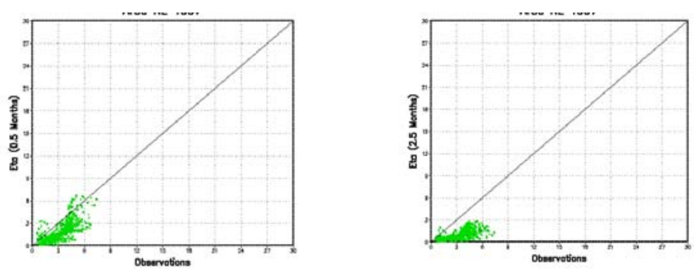


Figure 1 – Scatter diagram of seasonal mean daily precipitation (mm), observation vs GCM forecast. Top panels refer to NE region and bottom panels to N region, for 0.5-month (left panels) and 2.5-month (right panels) initializations.



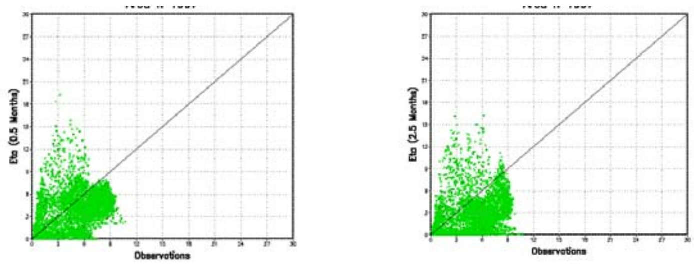


Figure 2 – Scatter diagram of seasonal mean daily precipitation (mm), observation vs Eta Model forecast. Top panels refer to NE region and bottom panels to N region, for 0.5-month (left panels) and 2.5-month (right panels) initializations.

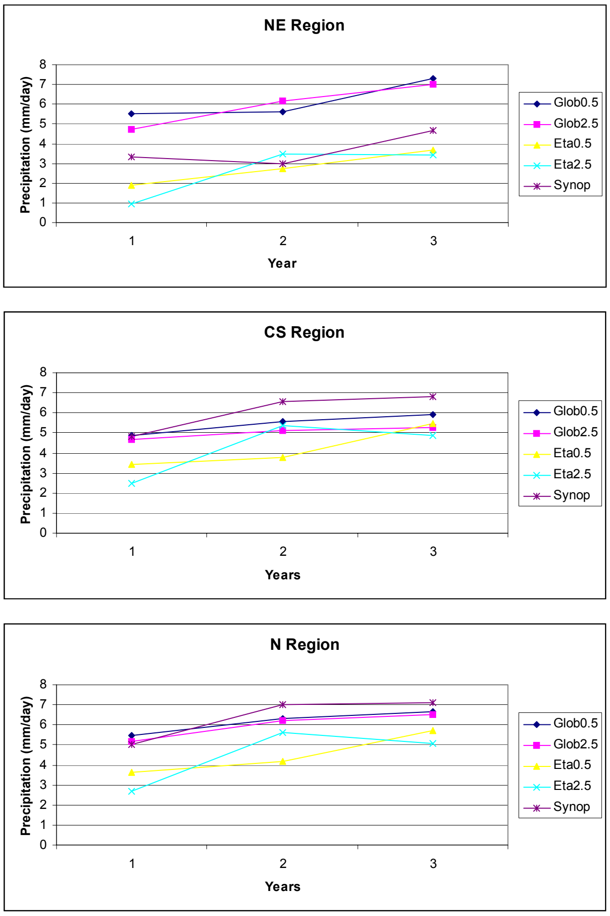


Figure 3 – DJF area mean daily precipitation (mm) for the years: (1) 1997, (2) 1998 and (3) 1999, in NE (top panel), CS (middle) and N (bottom) regions.