The CPTEC global model bias in the Amazonia region: Results of a long term simulation and predictive skill in seasonal forecasting

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Operational Seasonal forecasts have been issued by the Center for Weather Forecasting and Climate Studies (CPTEC) based on an Atmospheric General Circulation Model (CPTEC AGCM - spectral resolution T62 and 28 vertical levels) since 1995. These runs are performed in two different modes: the first mode assumes that the Sea Surface Temperature anomalies (SSTA) is persisted during the 8 month integration; the second mode is based on the SSTA predicted by the NCEP Equatorial Pacific coupled model and/or CPTEC's Tropical Atlantic Canonical Correlation model with persisted SST anomalies elsewhere. The evaluation of the CPTEC AGCM reference skill is based on a 50 year simulation forced by the observed SSTA (1952-2001) with 9 members of the ensemble (which differ by the choice of different initial conditions). Simple statistical analysis for the Amazon was performed. Results show that even though acceptable and statistically significant linear correlation values were found for northern Amazon for March-April-May (MAM) concerning on the long term simulation, interannual variability shows positive and negative bias, comparing to the CMAP precipitation. Considering the last few operational forecasts (15 ensemble mean), results show a positive biased signal for northern Amazon. In the southern portion of the region although the last forecasts captured the observed negative anomalies, no statistically significant correlation values were found for the rainy season (December-January-February - DJF). An analysis of the last 7 months performance of the operational forecasting is also presented.

DATA AND METHODOLOGY

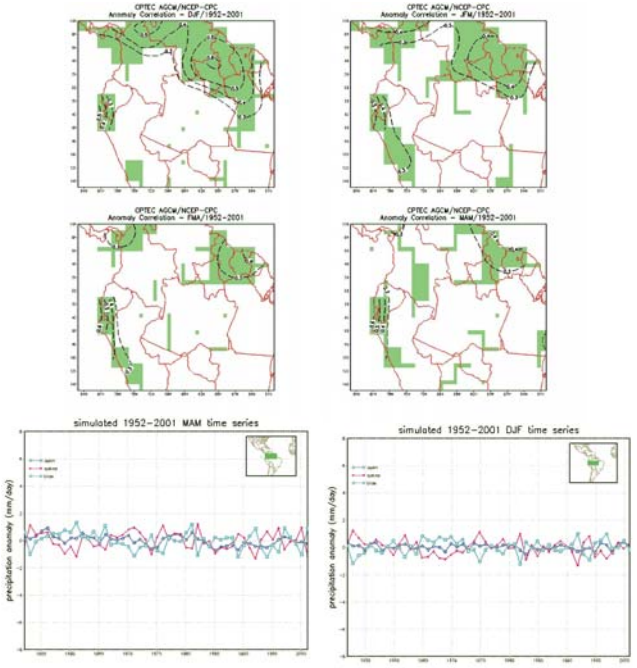
Bias calculation was performed using CMAP (CPC Merged Analysis of Precipitation, spatial resolution 2.5º x 2.5º) rainfall data set and anomaly correlation calculation was done by using the National Centers for Environmental Predictions (NCEP) from Climate Prediction Center (CPC) GMPOL (Global Monthly Precipitation Over Land, spatial resolution 2.5º x 2.5º).
Bias and statistical significance applied to correlation are listed below:
Bias = f - o
Where f = forecast and o=observation

$$t_0 = r\sqrt{\frac{n-2}{1-r^2}}$$

t_0= t distribution random variable, r = Pearson correlation coefficient and n = number of degrees of freedom

RESULTS

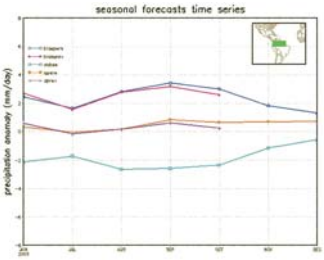
In general, correlation analysis between A 50-year simulation (1952-2001) and observed CPC GMPOL data show statistical significance at 95% confidence level (green shaded areas) for northern Amazonia and **r** values ranging from 0.3 to 0.5. For southern Amazonia, no significant **r** values are shown.



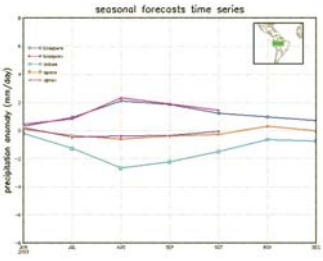
Northern Amazonia 1952-2001 MAM precipitation anomaly

Southern Amazonia 1952-2001 DJF precipitation anomaly

However, even though the CPTEC AGCM shows some skill in northern Amazonia, the last few operational forecasts seemed not to represent the observed intraseasonal variability. For northern and southern portion of Amazonia, the CPTEC AGCM biased positively the observation. For southern Amazonia, although negative signed observed anomalies were predicted, forecasts were biases positively as well.

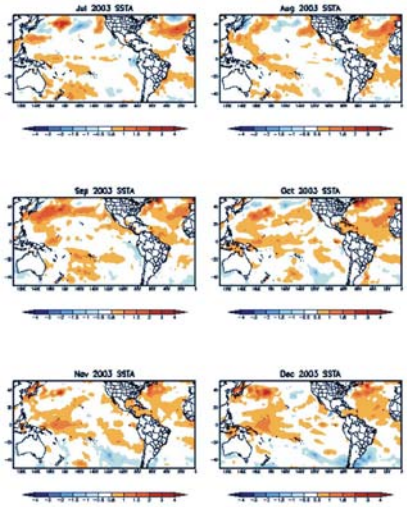


Northern Amazonia operational forecasts: precipitation anomaly forecasts (orange and purple), bias (blue and magenta) and observed (light blue)



Southern Amazonia operational forecasts: precipitation anomaly forecasts (orange and purple), bias (blue and magenta) and observed (light blue)

Interannual variability of rainfall anomalies time series plot shows positive and negative bias for the simulation. For northern Amazonia (above), which seems to respond deeper to SST anomaly variations than the southern portion (below), simulation matches observation trends.



Due to Amazonia importance in the world scenario, seasonal forecasts have been gaining importance and demand by various levels of Government and other users have been rising. The recent 2004 operational CPTEC AGCM forecasts showed the importance of improving the knowledge of the regional physical processes over Amazonia. Regional models might do a good job on capturing statistical frequencies of extreme rainfall episodes or dry spells, which consist a considerable improvement concerning on seasonal forecasts. This is to be explored in future studies

CONCLUSIONS

It was shown by (Nobre *et al.*, First LBA Scientific Conference, 2000) that CPTEC´s AGCM did predict correctly the 1997-98 El Niño-related drought of northern Amazonia. In that particular case, SST anomalies from Pacific were strongly forcing the negative anomaly precipitation over northern Amazonia. Although simulation shows significant skill (high seasonal predictability) for northern Amazonia, the last operational forecasts did not captured seasonal variability and did not show significant anomalies (positive or negative) for Amazonia. One of the possible reasons is that we have no ENSO forcing over Pacific. Over the Atlantic, changes were observed mainly over the northern basin, but without affecting Amazonia. Slight changes of SST in tropical oceans anomalies do not affect directly the precipitation over Amazonia, specially in years like 2004 where the SST forcing was weak and the intraseasonal variability was unusually very active.

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