# CLIMATOLOGICAL FEATURES REPRESENTED BY THE CPTEC/COLA GLOBAL CIRCULATION MODEL

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## 1. INTRODUCTION

Seasonal climate predictions using GCMs have been performed in several research centers around the world and show results comparable to observations in some specific areas and specific seasons. The predicted seasonal anomalies depend on the model climatology that must represent the main features of the observed climatology. The continuous increase of the computer power enables increased model resolution, sophisticated parameterizations schemes and large number of integrations that lead to an improved simulated atmosphere. The chaotic behaviour of the atmosphere made the ensemble technique a useful way to improve model results, submitting the atmosphere to different initial conditions (Murphy, 1988).

## 2. SIMULATION DESIGN

In order to analyse the CPTEC/COLA model climatology, a set of nine integrations, using different initial conditions was performed from september 1981 to november 1991. Monthly observed Sea Surface Temperature was applied as boundary condition and the initial conditions were derived from 9 consecutive days of ECMWF daily analyses, from 11th to 19th September, 1981. CPTEC/COLA is a spectral Global Circulation Model developed by Center for Ocean, Land and Atmosphere studies (COLA) and modified by Centro de Previsão de Tempo e Estudos Climáticos (CPTEC). The dynamical and physical processes are described in Kinter et al (1997), and for this experiment, Kuo scheme of convection and resolution of T62L28 were used. Climatological atmospheric features of Southern Hemisphere were analysed considering the ensemble mean of the nine members integrations and the ten years seasonal mean. NCEP and CMAP observational data sets were used for validation purposes.

## 3. DJF AND JJA SIMULATION

The seasonal variability of precipitation is well represented in the simulation, as well as the related atmospheric circulation. The tropical and Southern Hemisphere (S.H) main features are consistent with observations, as the summer convergence zones over Pacific (SPCZ), South America/South Atlantic (SACZ) and over Africa (SICZ) (Fig.1a). The upper air atmospheric flow shown in Fig.1b, depicts the anticyclonic circulations over South America, Africa and West South Pacific. The Pacific and Atlantic troughs are also well simulated in this summer season.

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In the winter the atmospheric circulation changes over South America and Africa, where there is reduction in precipitation amount (Fig. 1c and 1d). The Australian subtropical jet is well simulated and the vertical structure of zonal mean zonal wind represents the double jet in the winter (not shown). The anticyclonic circulation over West South Pacific still persists in the winter, as well as precipitation associated with the SPCZ, features that are less intense and not well defined in observations. Although the model captures the precipitation patterns, there are errors related to the amount. The south parts of the three S.H. convergence zones are overestimated and the north part are underestimated. Convection over Amazonia and part of Indonesia are underestimated. The same patterns are seen in OLR fields.

Zonal anomalies of geopotential at 200 hPa show the simulated features of the stationary waves in Southern Hemisphere. The wavenumber one identified in observational data sets is reproduced in the model results but there are some differences related to the intensity and position of zonal anomaly centers, (Fig.1e). As in observations, the wavenumber one at subtropical latitudes has opposite sign to that at mid/high latitudes. A zonal wavenumber three pattern is also identified in the vertical cross section analysis of geopotential zonal anomaly in JJA at 45$^{0}$ S (Fig.1f). Although the model captures the wavenumber vertical structure, the anomalies are too weak in the two seasons.

## 4. CONCLUSION

The model is able to represent the global and regional climatological features of the Southern Hemisphere and the tropical region. However the precipitation is overestimated in some areas of the ITCZ, SACZ, SICZ and underestimated over part of Indonesia region and Amazonia, in South America. The Bolivian High and the African anticyclone are well detected, as well as the convection associated with the S.H. convergence zones. Dominant wavenumber one and three are captured by the model and the jet streams core is simulated at the right level and close to the observed position.

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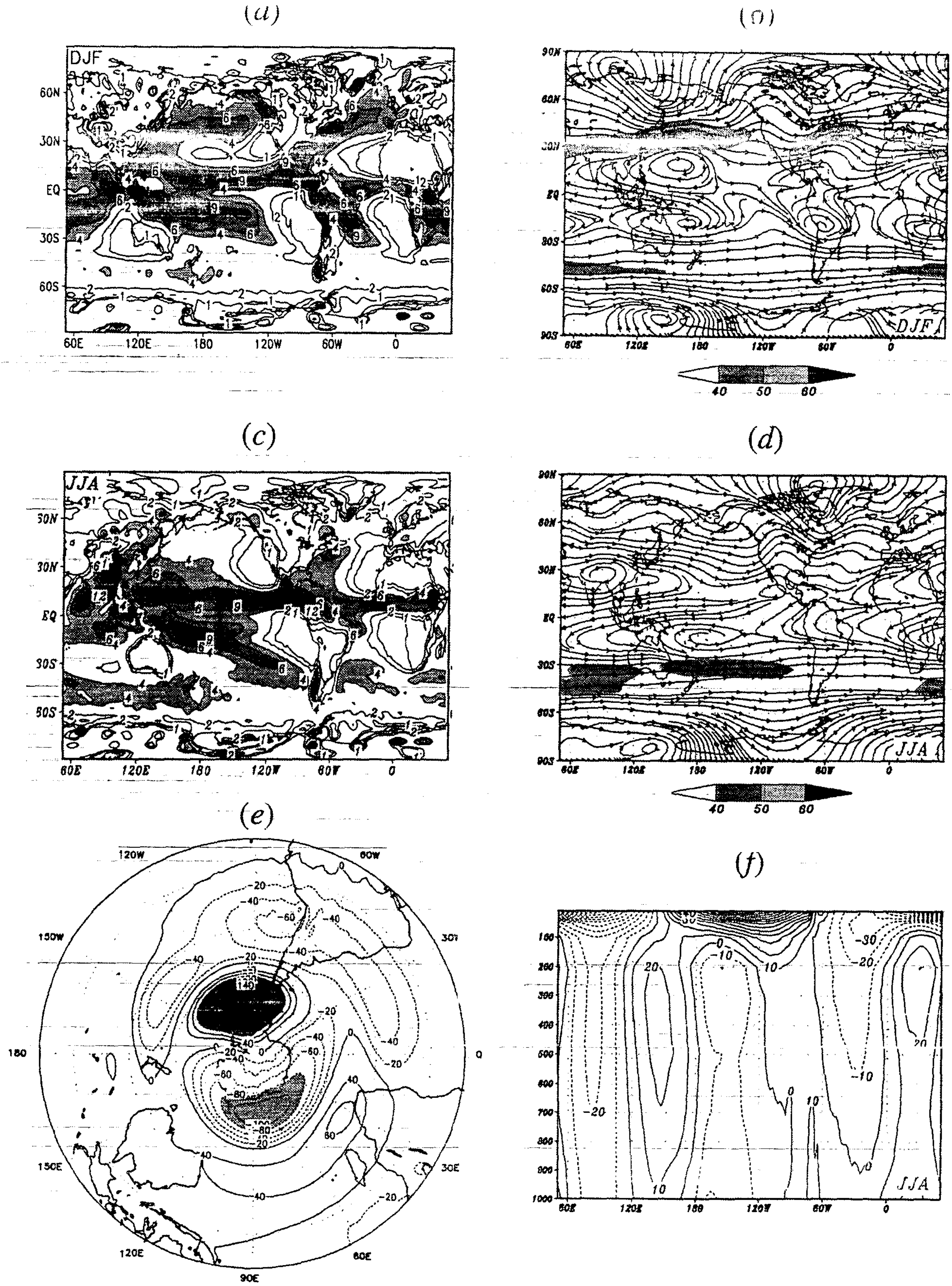


**Fig. 1** - Climate CPTEC/COLA GCM Results of

( *a* ) DJF Precipitation; ( *b* ) DJF 200 hPa Wind Field; ( *c* ) JJA Precipitation; ( *d* ) JJA 200 hPa Wind Field; ( *e* ) JJA 200 hPa geopotential zonal anomaly; ( *f* ) JJA Vertical cross-section of geopotential zonal anomaly at 45°S