

**GEWEX/CLIVAR/VAMOS**

**LPB Program**

Marcelo Seluchi

CPTEC/INPE

18-19 September 2006

Guaratingueta -SP- Brazil

# Operational NP (Medium Range to Seasonal Prediction)

## Medium – Extended Range (8-30 days):

- Global Spectral Model T126L28 up to 15 days, two times a day
- Global Ensemble T126L28, up to 15 days, twice a day, 15 members
- Coupled Global Model (MOM3+T126L28) up to 30 days, once a day (Experimental)

## Seasonal Prediction:

- Global Spectral Model T062L28 up to 6 months, (RAS, KUO, GRELL), once a month: 10-15 members each
- Regional Eta Model 40kmL38, up to 3 months, once a month: 3-5 members (Experimental)

## Boundary conditions:

Monthly SST: persisted anomaly or predicted (Trop Atlantic and Pacific)

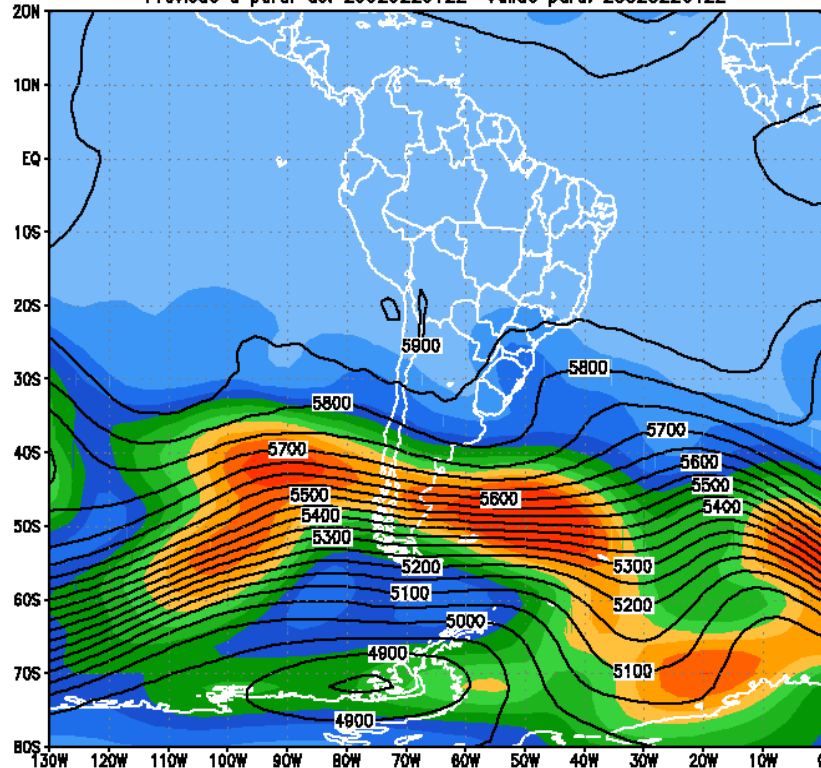
- Coupled Global Spectral (MOM3+T62L28) up to 8 months, once a month: 10 members (Experimental)
- Statistical Model (SIMOC) up to 12 month, once a month

# Up to 15 days

## Mean and spreading

## “Spaguetti” Diagram

CPTEC/INPE/MCT – PREVISÃO DE TEMPO GLOBAL POR ENSEMBLE – T06ZL28  
Altura Geopotencial \* (m) – 500 hPa [contorno] – Espalhamento do Ensemble (m) [cores]  
Previsão a partir de: 2002022012Z Valido para: 2002022612Z

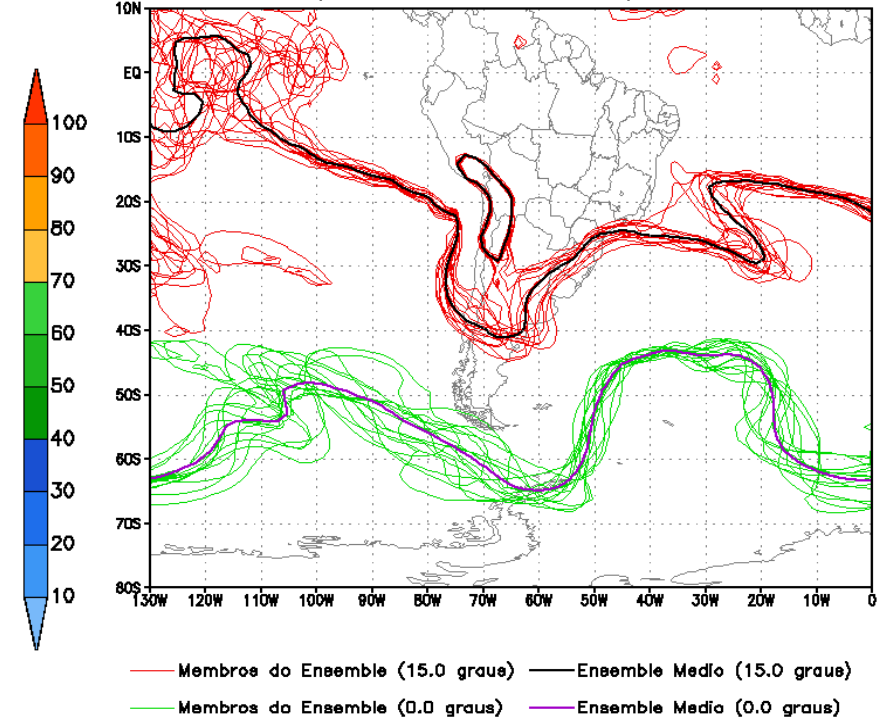


\* Média do Conjunto de Previsões

CPTEC/INPE/MCT – PREVISÃO DE TEMPO GLOBAL POR ENSEMBLE – T06ZL28

Diagrama "Spaguetti" – Temperatura (°C) (850 hPa)

Previsão a partir de: 2002022012Z Valido para: 2002022512Z



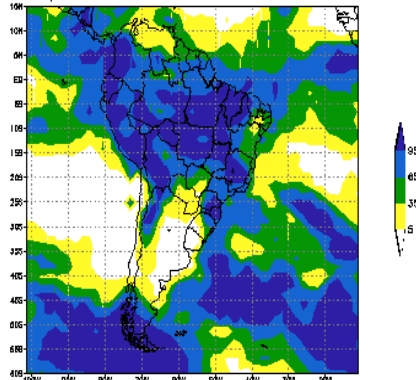
# Up to 15 days

## Probabilistic precipitation forecast

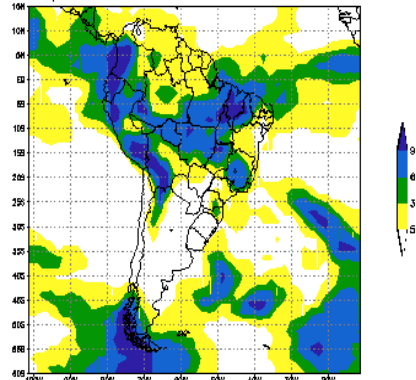
## Probability plumes

CPTEC/INPE/MCT – PREVISAO DE TEMPO GLOBAL POR ENSEMBLE – T06ZL28  
Previsao de Probabilidades (%) – A partir de: 2002022012Z Valido para: 2002022512Z

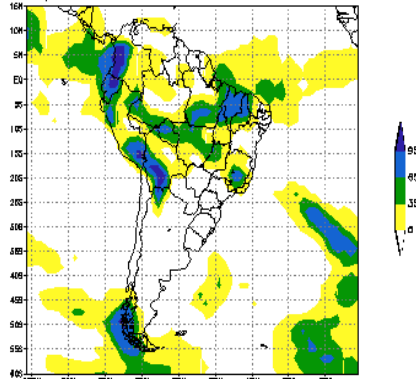
Precipitacao acumulada em 24 hrs > 1.0 mm



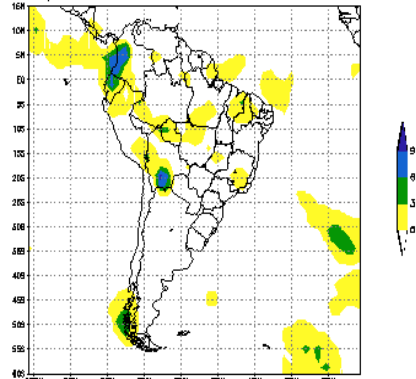
Precipitacao acumulada em 24 hrs > 5.0 mm



Precipitacao acumulada em 24 hrs > 10.0 mm

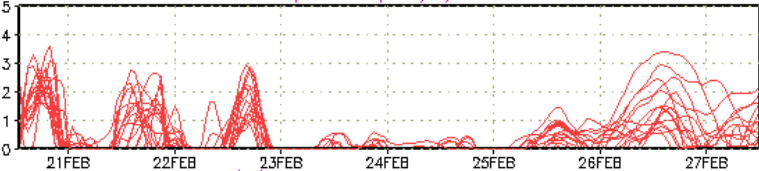


Precipitacao acumulada em 24 hrs > 20.0 mm

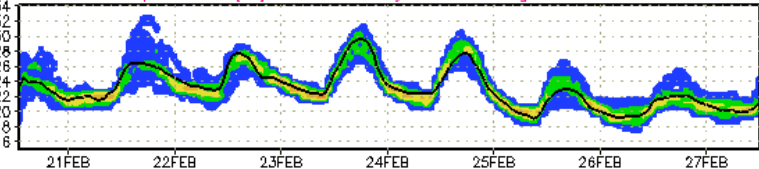


PROBABILITY PLUMES – GLOBAL ENSEMBLE FORECAST – T06ZL28  
CPTEC: 046:53W-23:19S SAO PAULO (SP)  
20FEB2002 12Z: Greenwich Meridian Time: Vertical Dotted Line: Midnight  
1 – 20 % 20 – 40 % 40 – 60 % 60 – 80 % 80 – 100 %  
Control Forecast

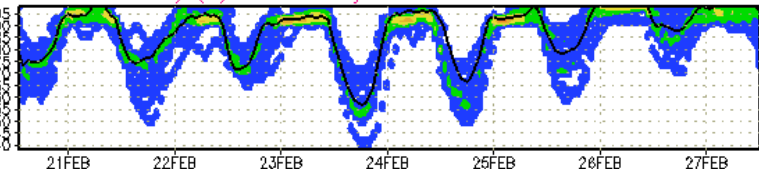
Ensemble Members of Precipitation (mm/h)



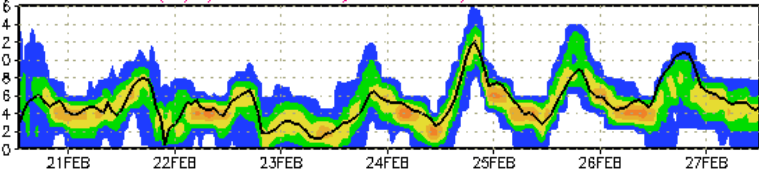
Surface Temperature (°C) – Probability for 1.0 deg intervals



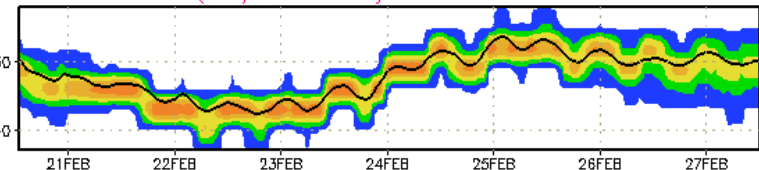
Relative Humidity (%) – Probability for 3.0% intervals



Surface Wind (m/s) – Probability for 2.0 m/s intervals



Surface Pressure (hPa) – Probability for 3.0 hPa intervals





Up to 15 days

## Clusters analysis

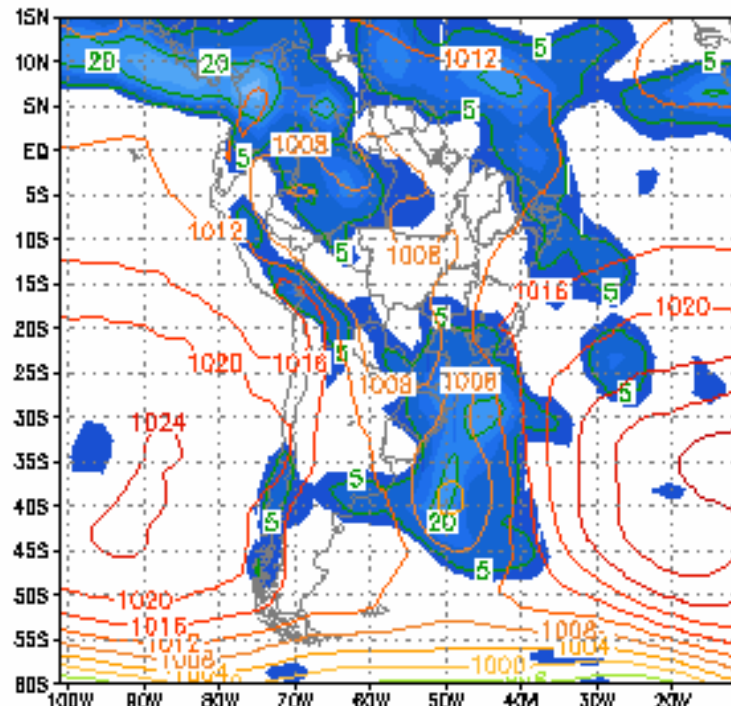
CPTEC/INPE/MCT – PREVISAO DE TEMPO GLOBAL POR ENSEMBLE – T062L28

Cluster Medio para Pressao ao Nivel Medio do Mar (hPa) (Contornos)  
e Precipitacao Acumulada em 24 horas (mm) (Cores)

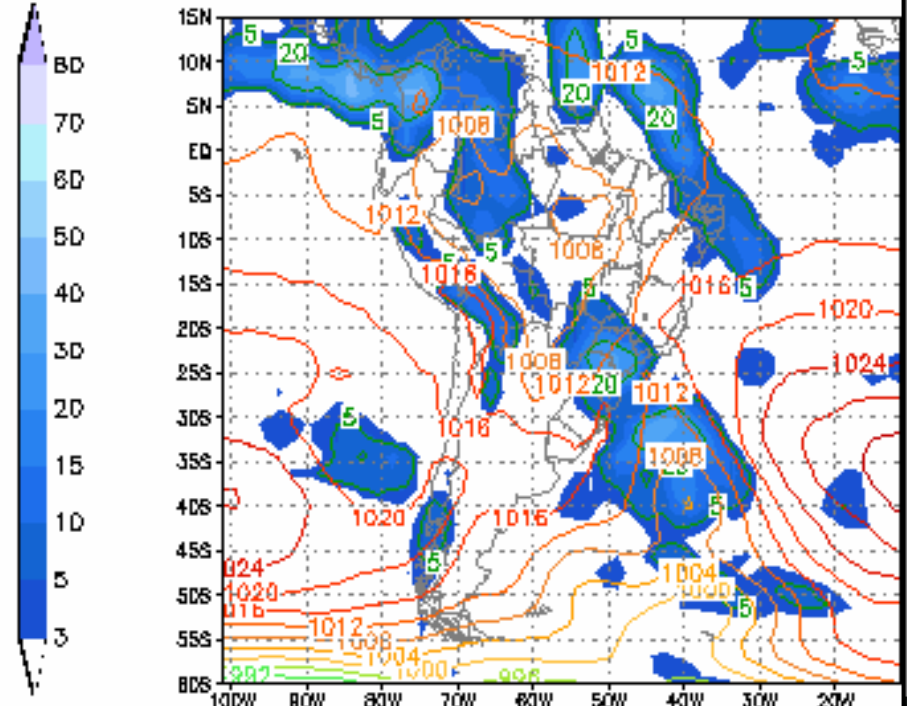
Previsao de: 2002102012Z

Valido para: 2002102700Z

cluster: 1 n.o de membros: 13



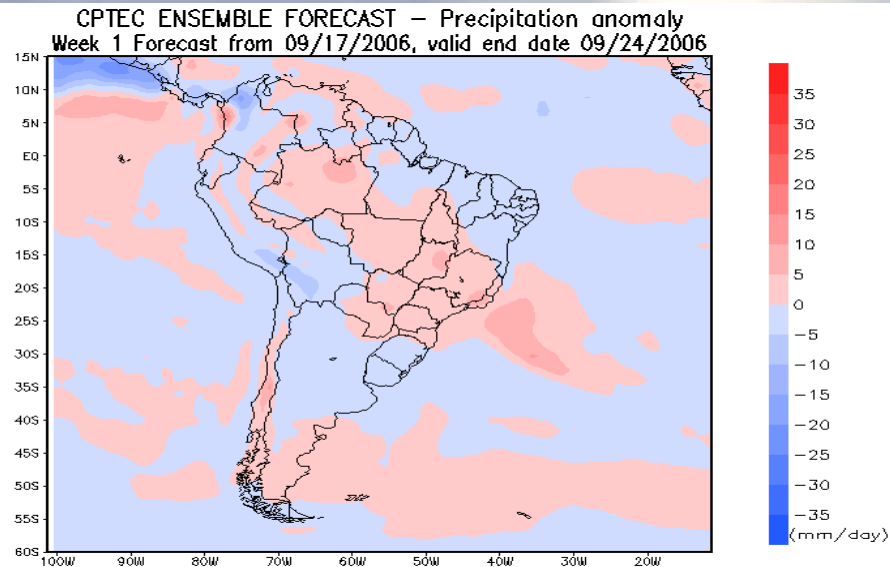
cluster: 2 n.o de membros: 2



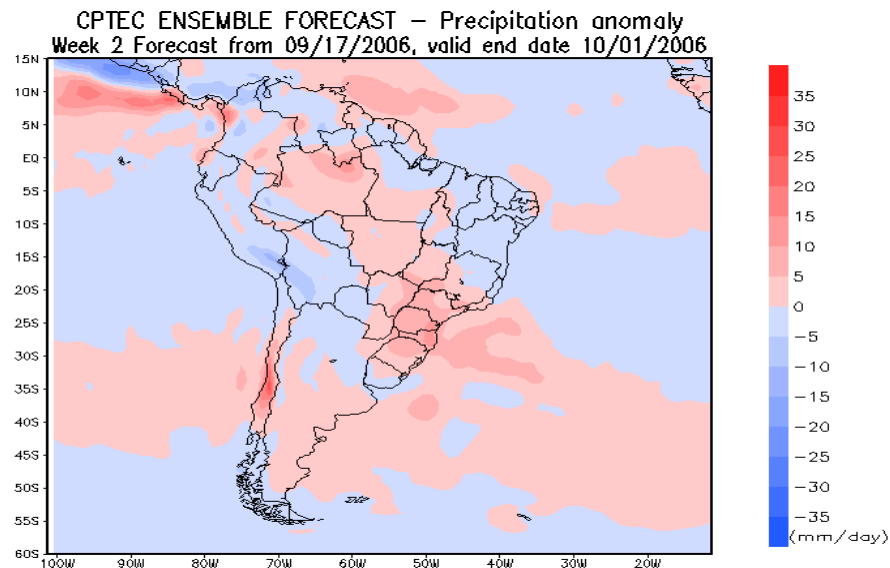
# Up to 15 days

## Weekly precipitation anomaly

1st week

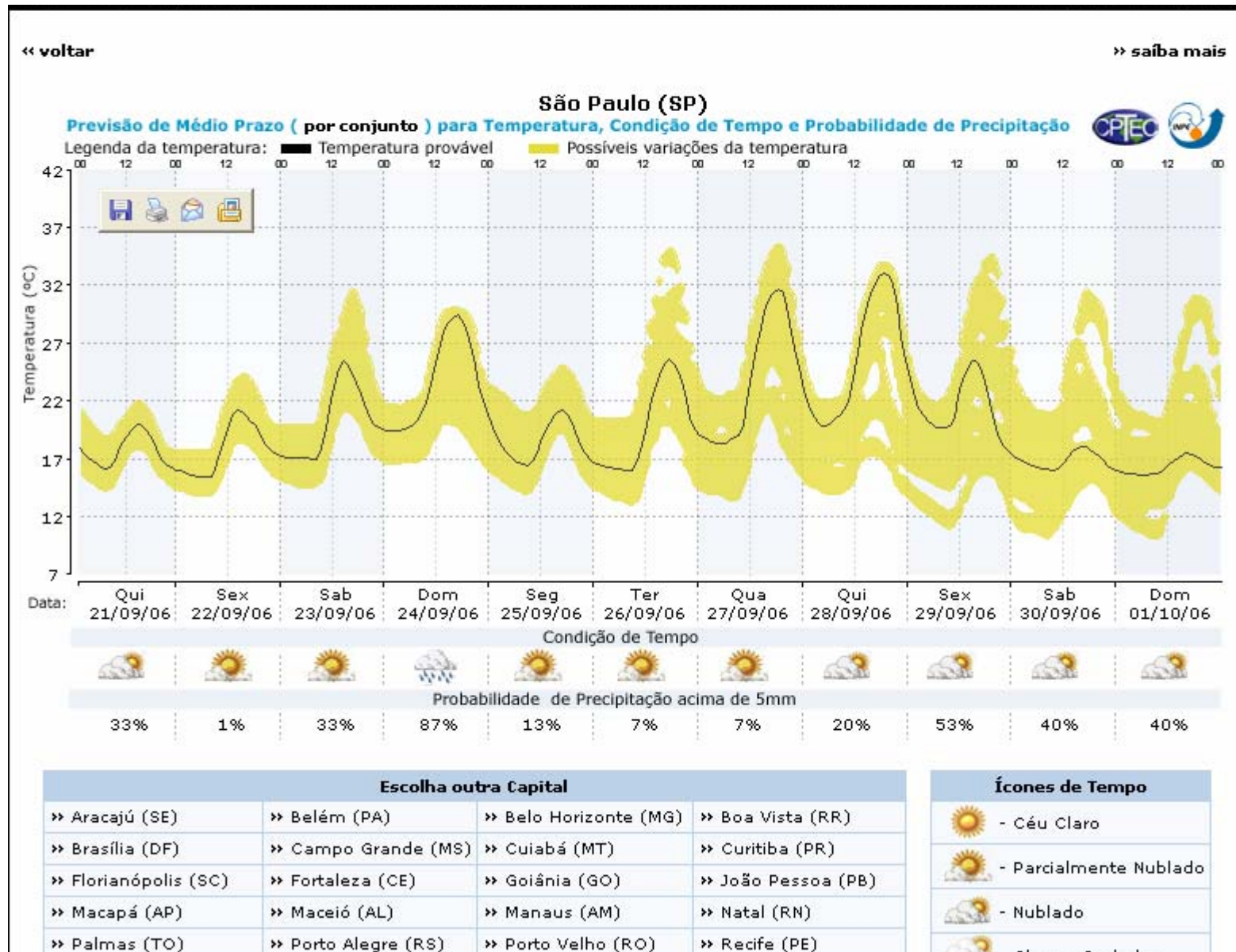


2nd week



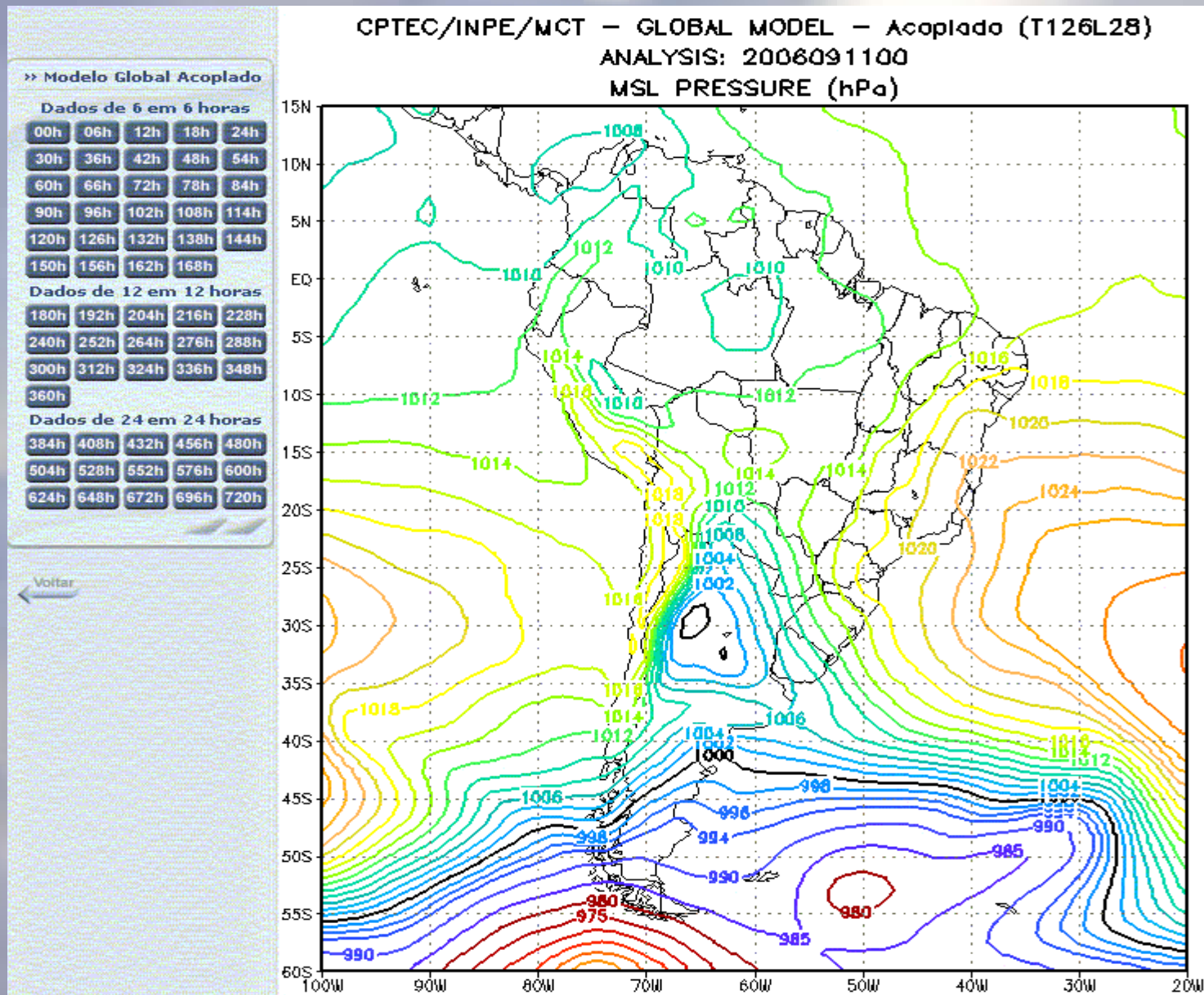
# Up to 15 days

## Extended numerical forecast for Brazilian cities





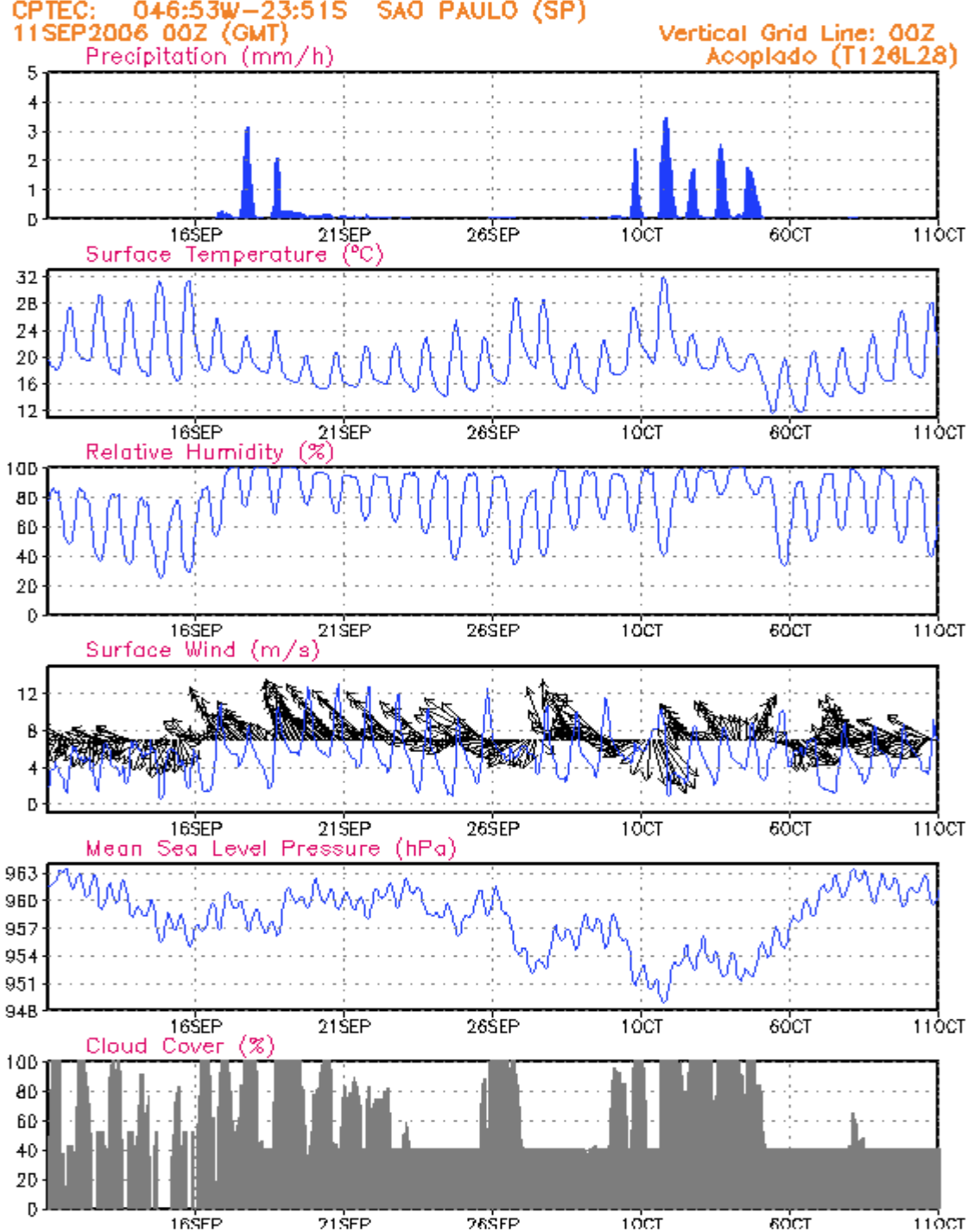
# Up to 30 days Coupled Model





Up to 30 days

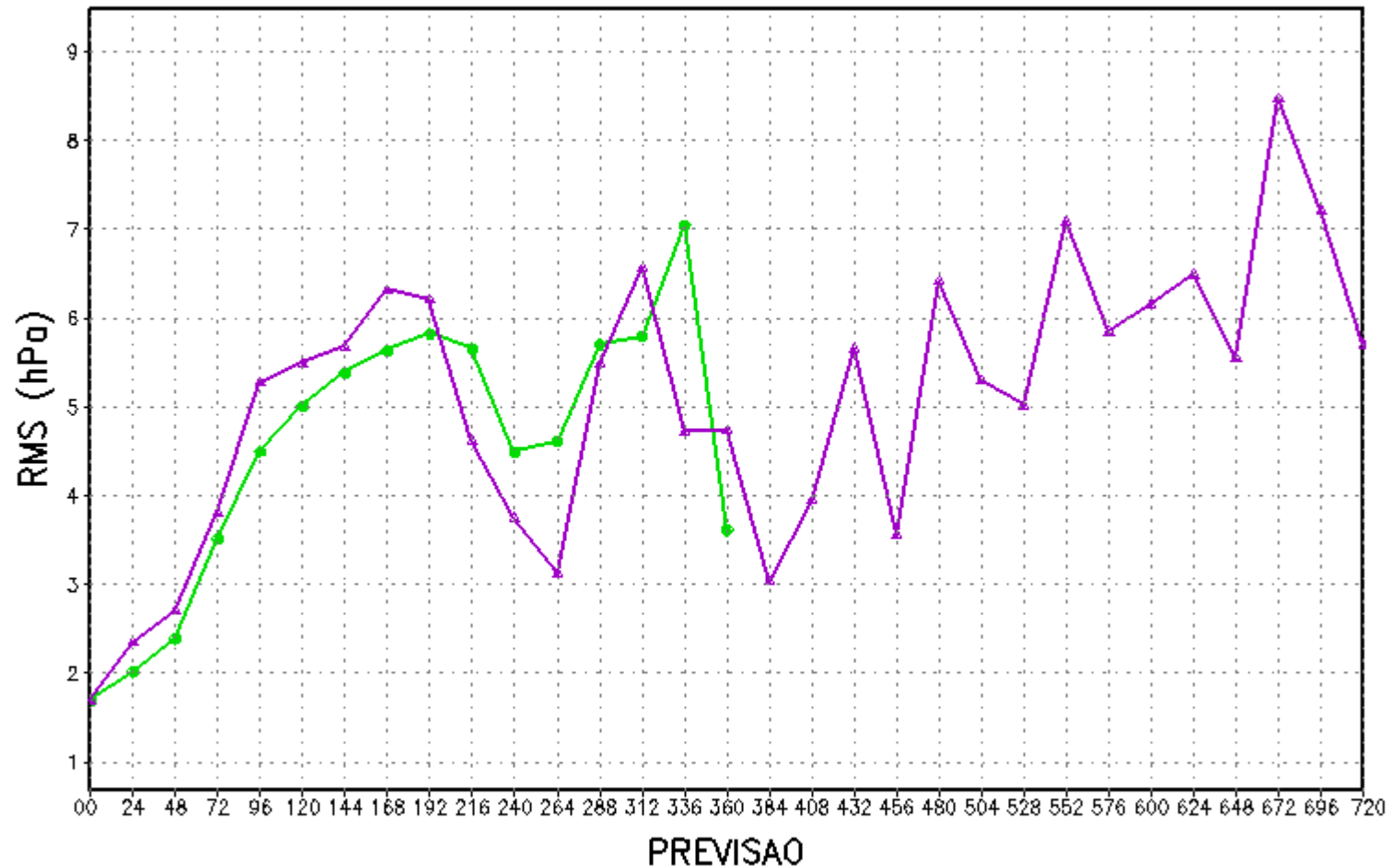
Coupled  
Model



# Up to 30 days Coupled vs Atm. Model

MODELOS X OBSERVACOES (P) — 00Z 06/09/2006

Avaliacao da Pressao dos Ultimos 15 e 30 dias

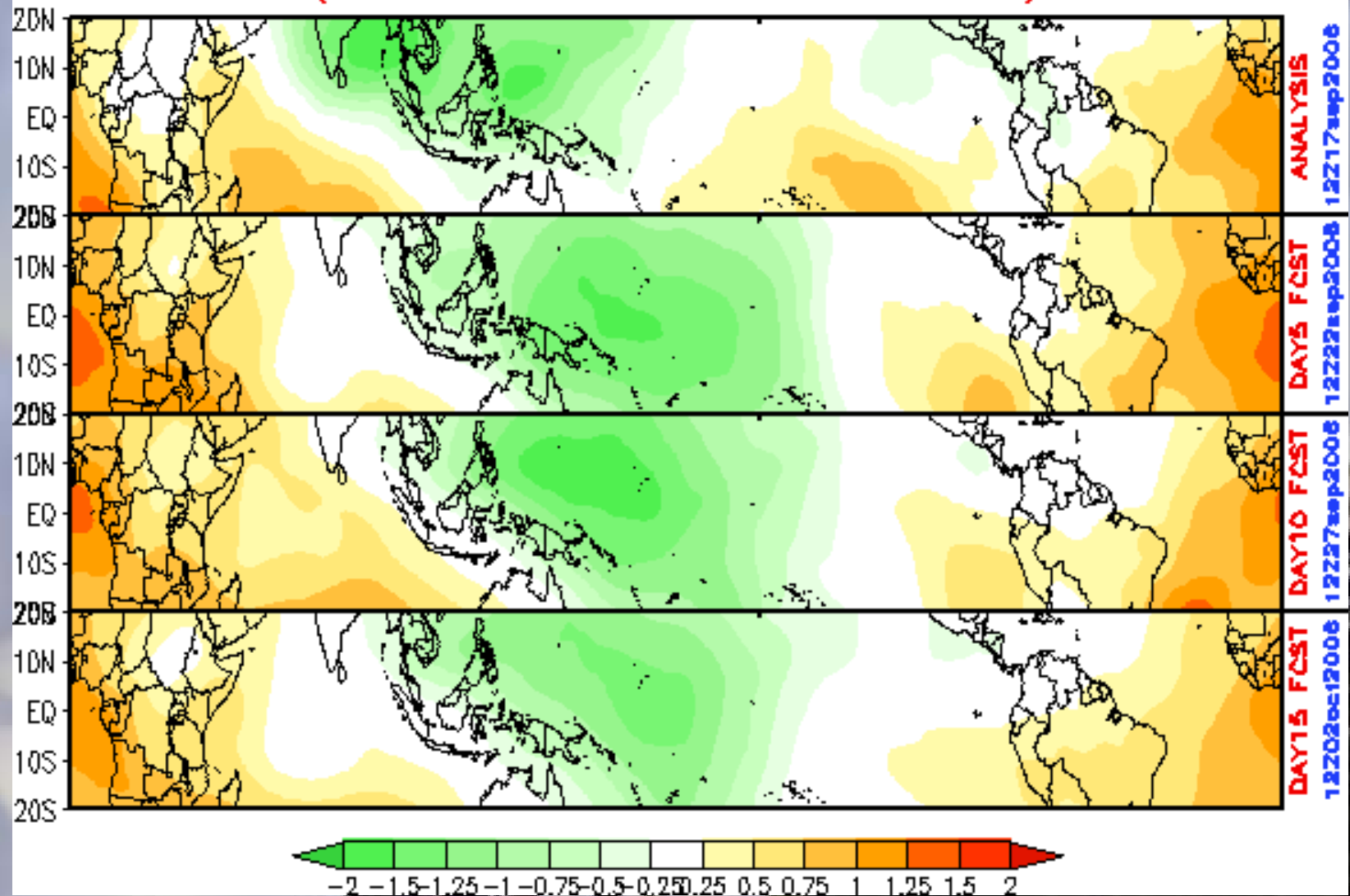


● T126L28 (15 dias)

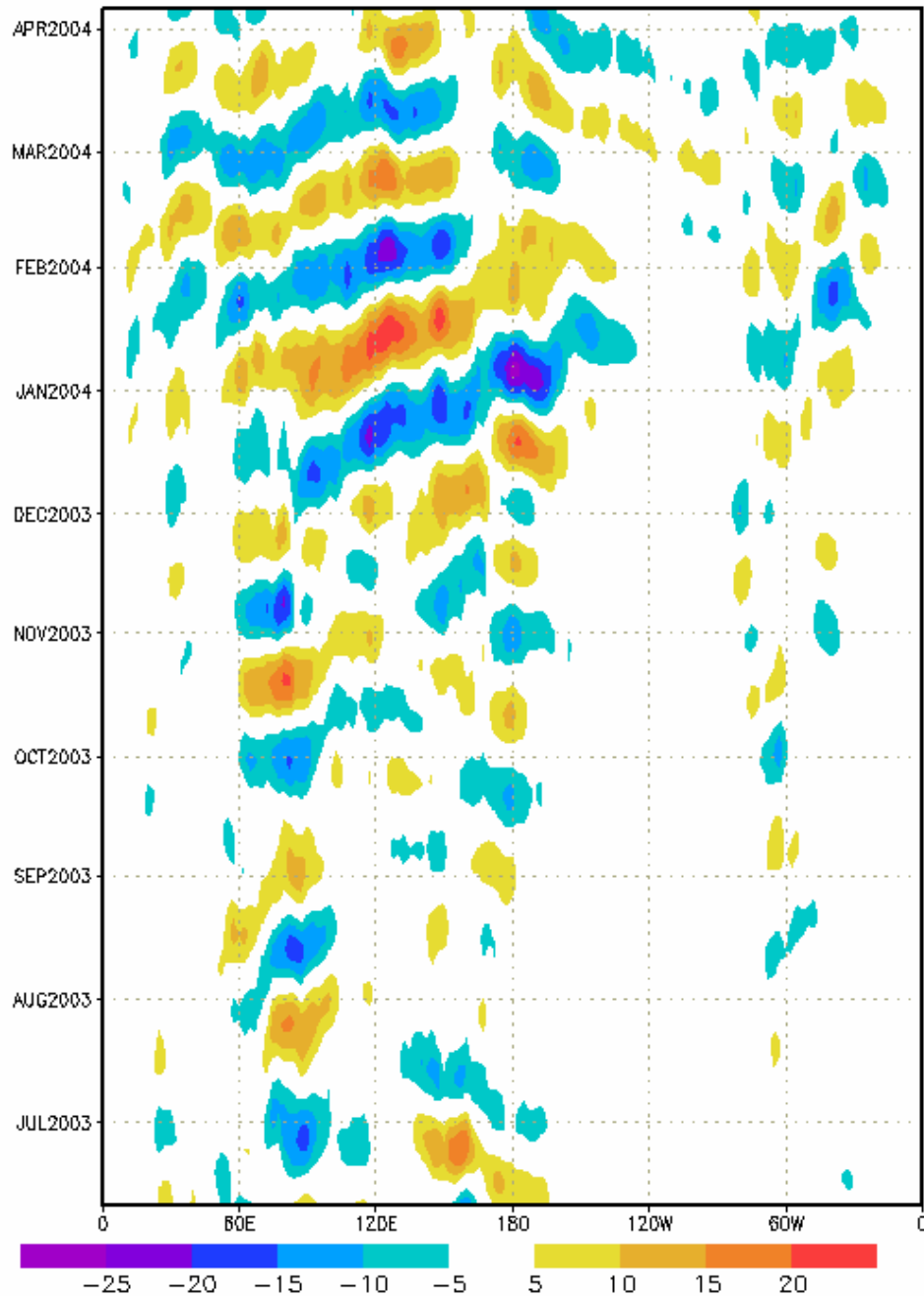
▲ Acoplado (30 dias)

# Intra-Seasonal forecast Ensemble Forecast

CHI 200 hPa 15-DAY forecast (12Z17sep2006-12Z02oct2006)  
(based on CPTec ENSEMBLE FORECAST)



23APR2003 07APR2004



## Intra-Seasonal Analysis

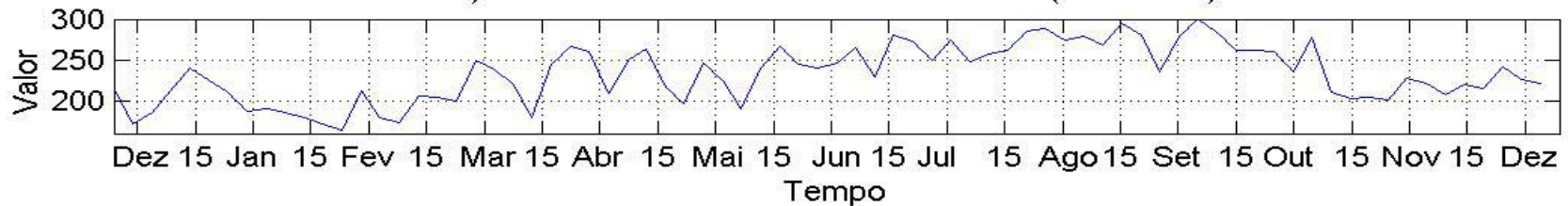
30-60 Day Oscillation



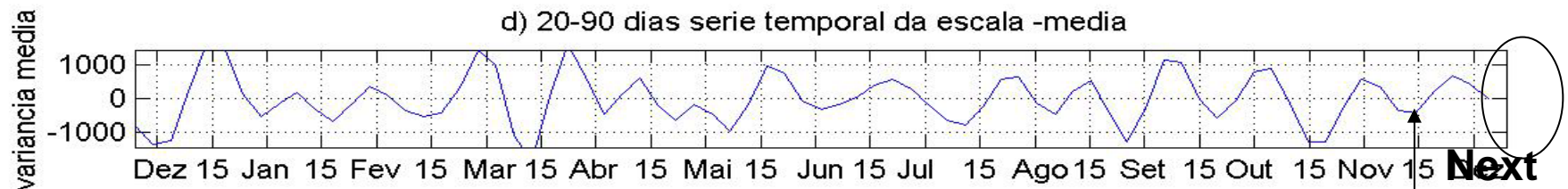
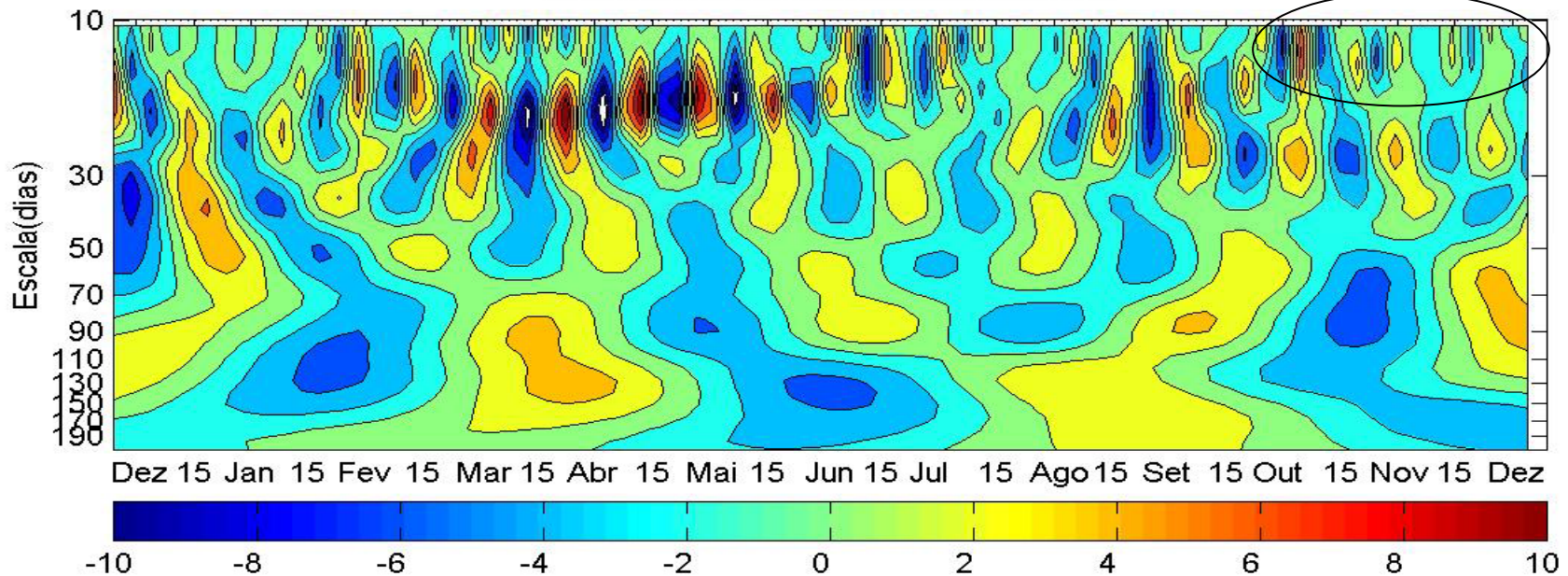
# Intra-Seasonal Analysis

## Wavelet Analysis

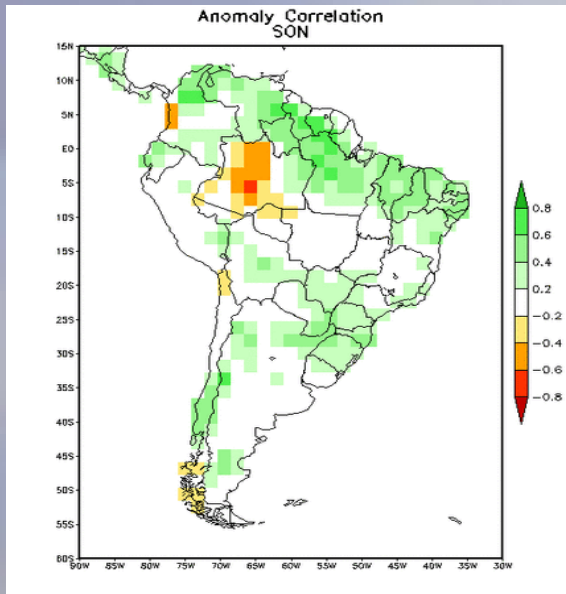
a) ROLE Pentada- 15-17.5S/53.7-56.2W (C.OESTE)



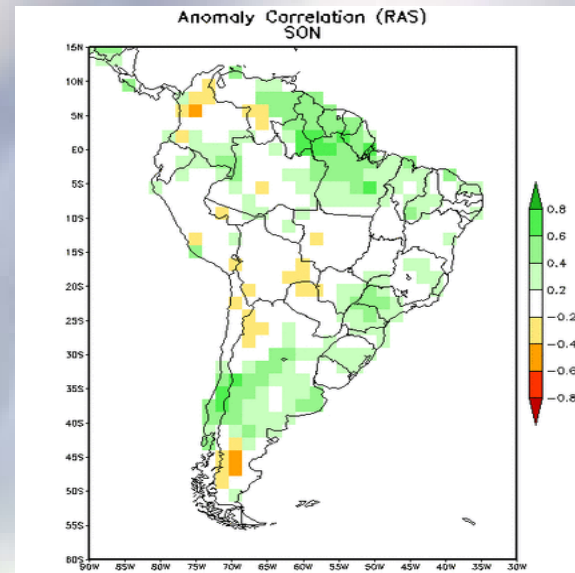
Parte real dos coeficientes da Ondeleta



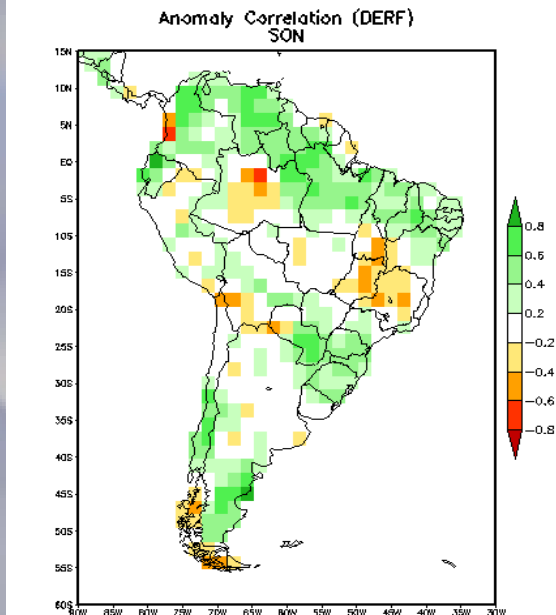
# Seasonal Numeric Forecast



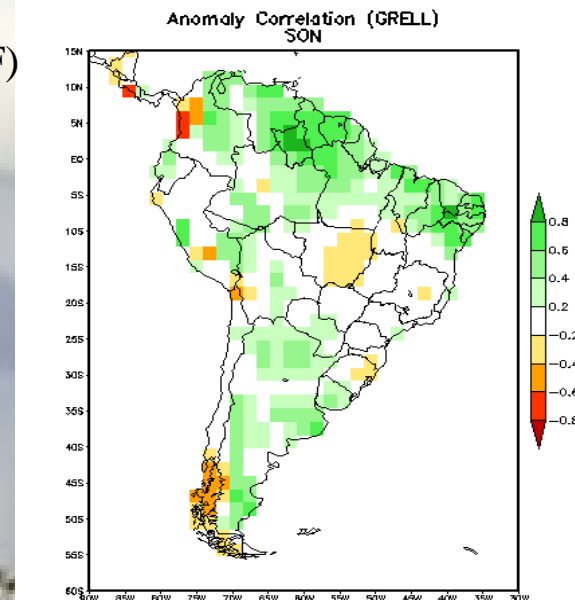
KUO  
(15 members)



RAS  
(10 members)



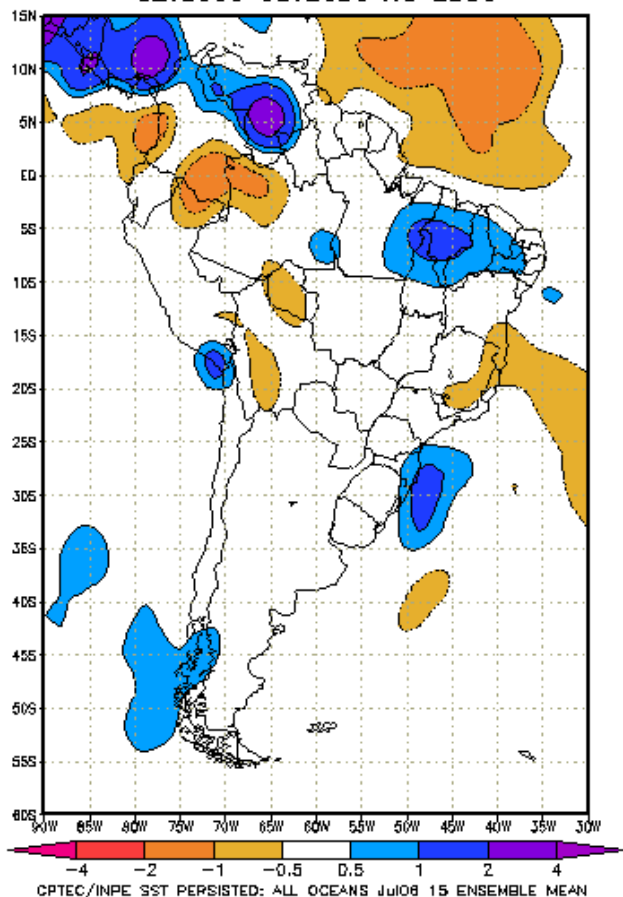
DERF (ECMWF)  
(10 members)



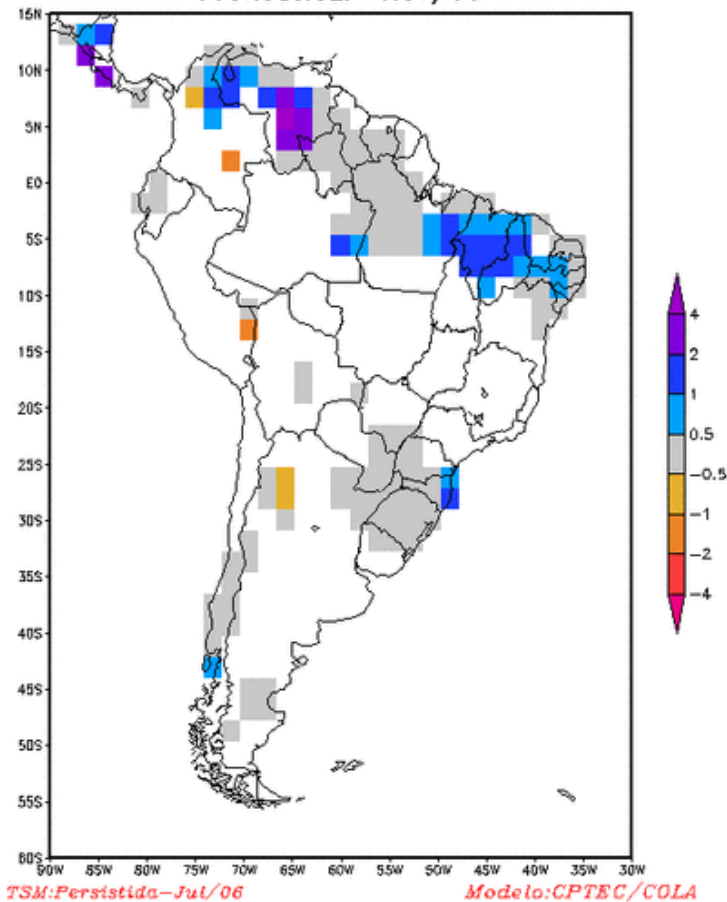
GRELL  
(10 members)

# Seasonal Numeric Forecast

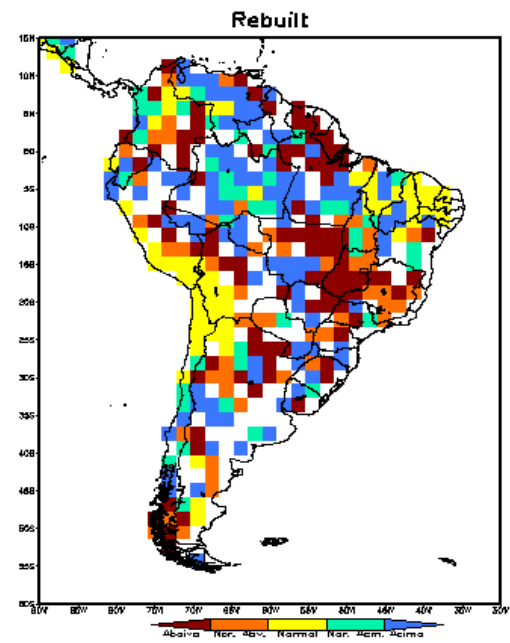
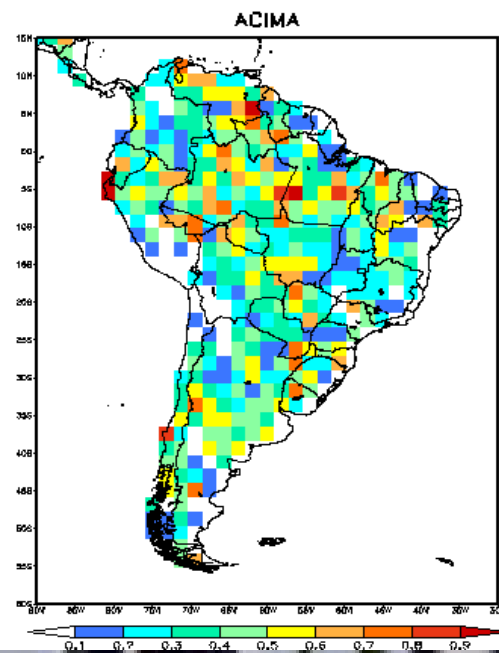
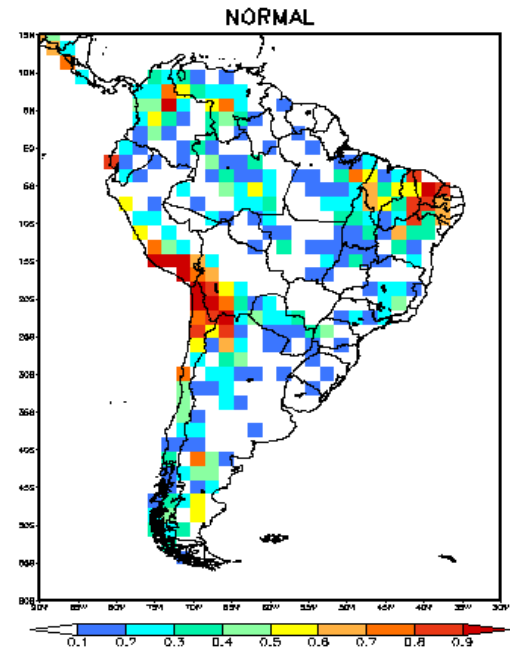
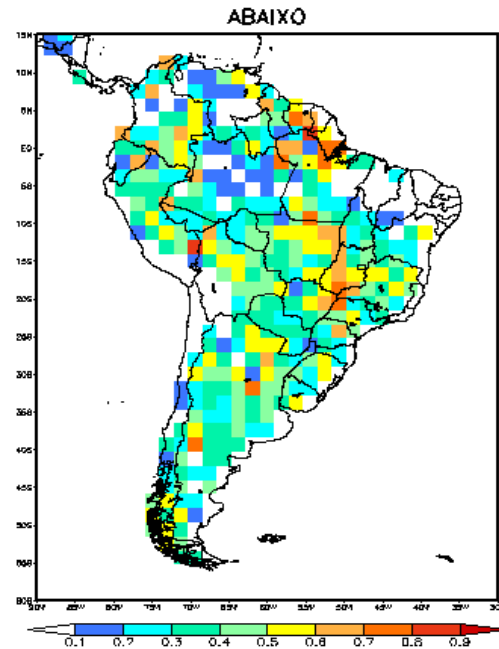
PREVISAO DE ANOMALIA DE PRECIPITACAO (mm/dia)  
SET2006 OUT2006 NOV2006



Anomalia de precipitacao - ( $r_{\min}=0.3$ )  
Previsao: SEP-NOV/06



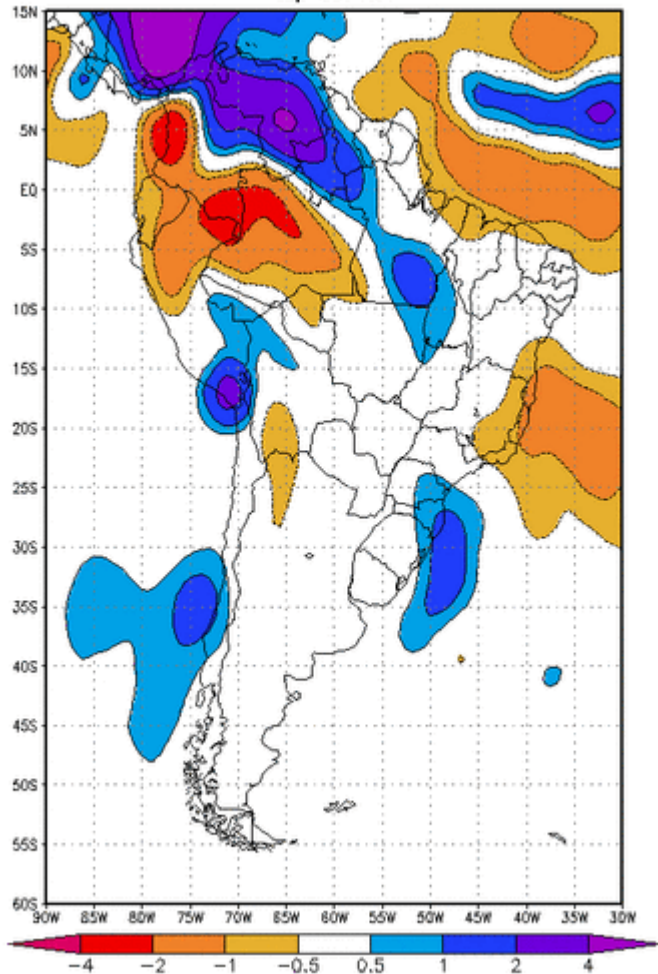
“Rebuilt”



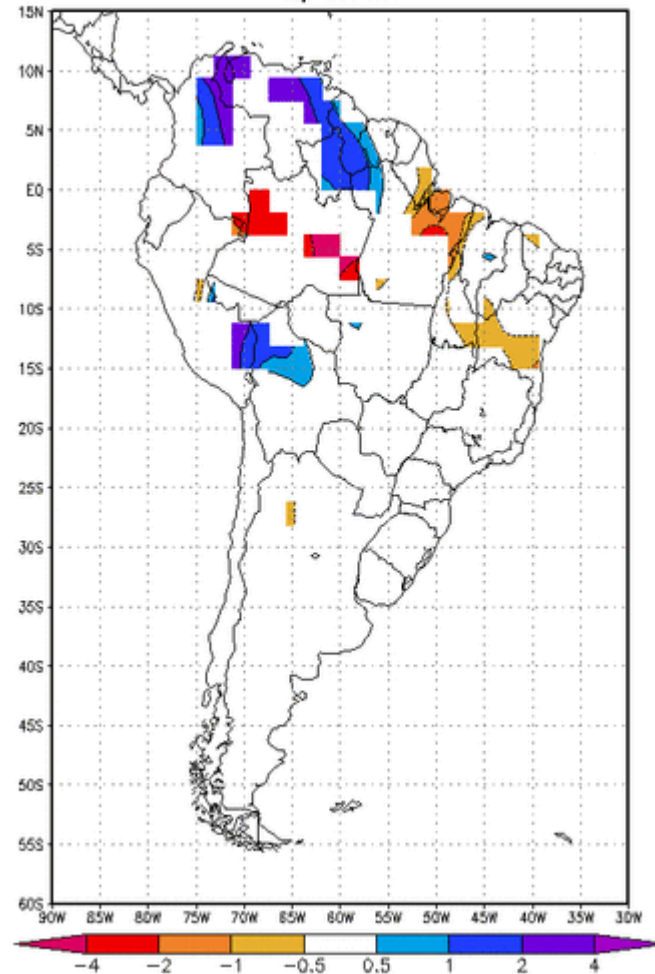


# Multi-Model Ensemble- CPTEC

CPTEC MULTIMODEL - Média  
PREVISÃO DE ANOMALIA DE PRECIPITAÇÃO (mm/dia)  
[Kuo + Ras + Grell]  
Sep Oct Nov



CPTEC MULTIMODEL - Média Ponderada  
PREVISÃO DE ANOMALIA DE PRECIPITAÇÃO (mm/dia)  
[Kuo + Ras + Grell]  
Sep Oct Nov



- Model average

- Higher SS

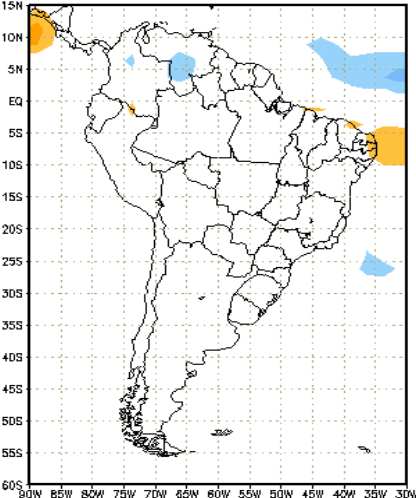
- Weight average

- Weight average ( $r > 0.3$ )

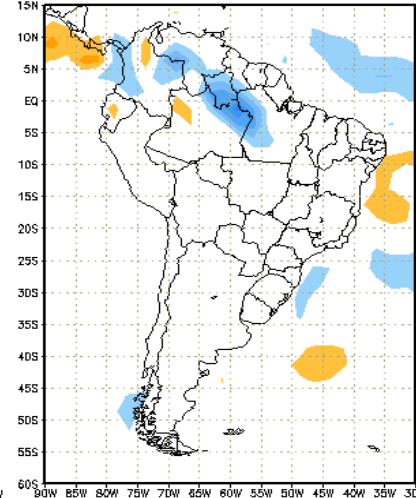
# Seasonal Forecast

# Bias removal

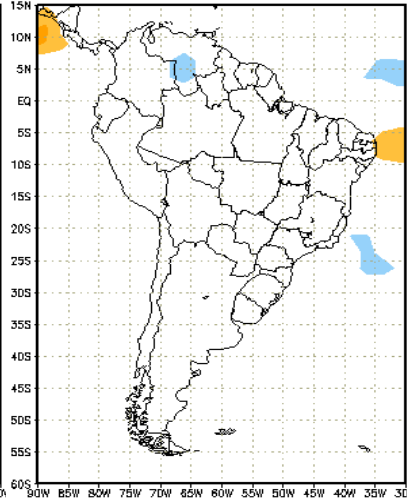
previsao AMJ2006 atsmFeb2006  
persDERF



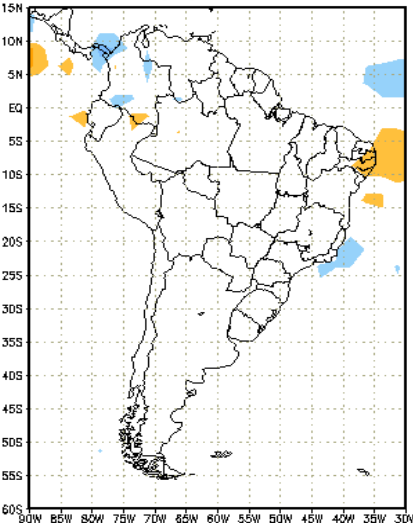
previsao AMJ2006 atsmFeb2006  
persRAST62



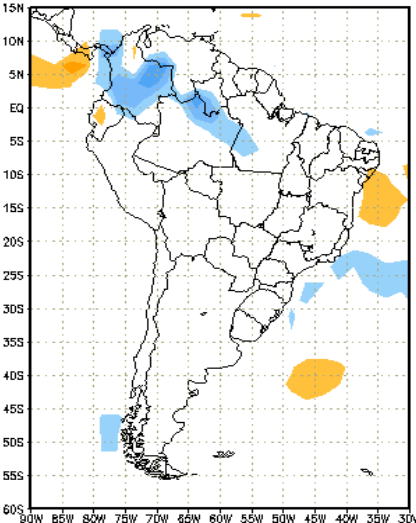
previsao AMJ2006 atsmFeb2006  
persT62L28



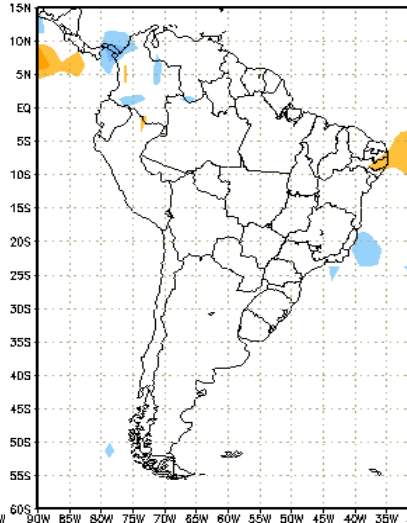
previsao AMJ2006 atsmFeb2006  
papaDERF



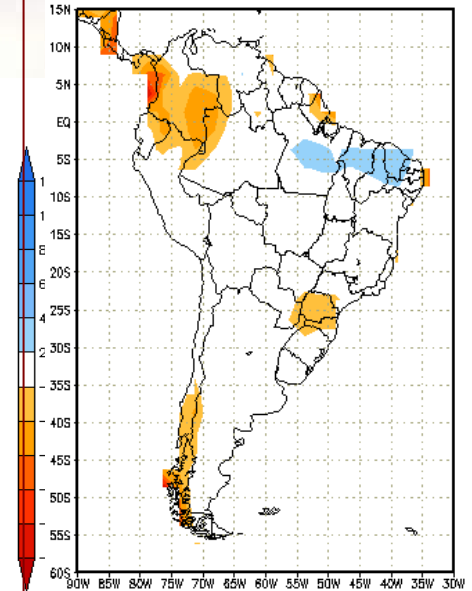
previsao AMJ2006 atsmFeb2006  
papaRAST62



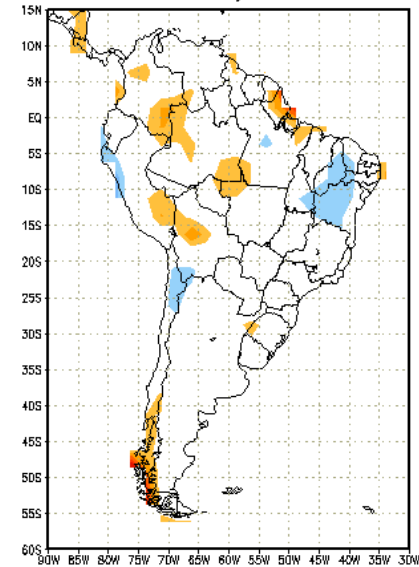
previsao AMJ2006 atsmFeb2006  
papaT62L28



observacao AMJ2006



Previsao "multimodel" AMJ2006 atsmFeb2006  
remvies/errm



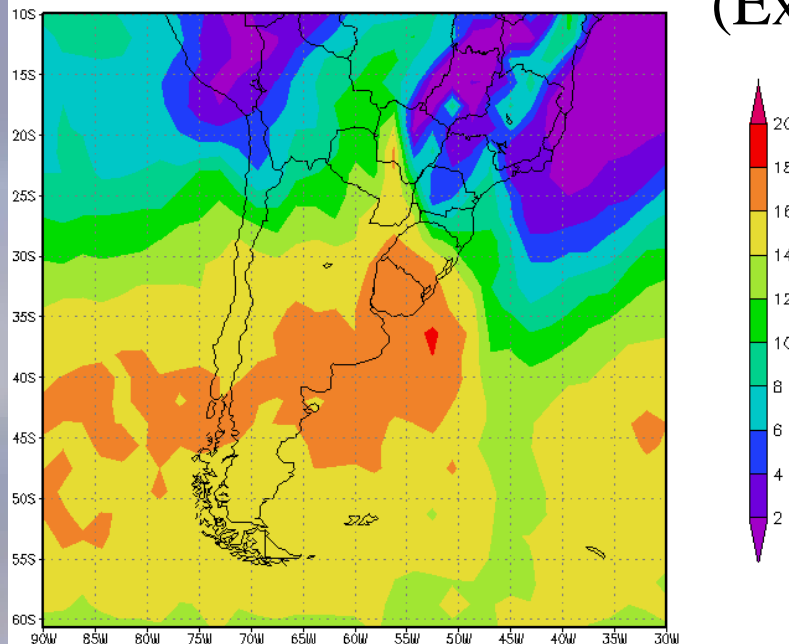
persT62L28 papaT62L28 persDERF papaDERF persRAST62 papaRAST62

# Seasonal Forecast

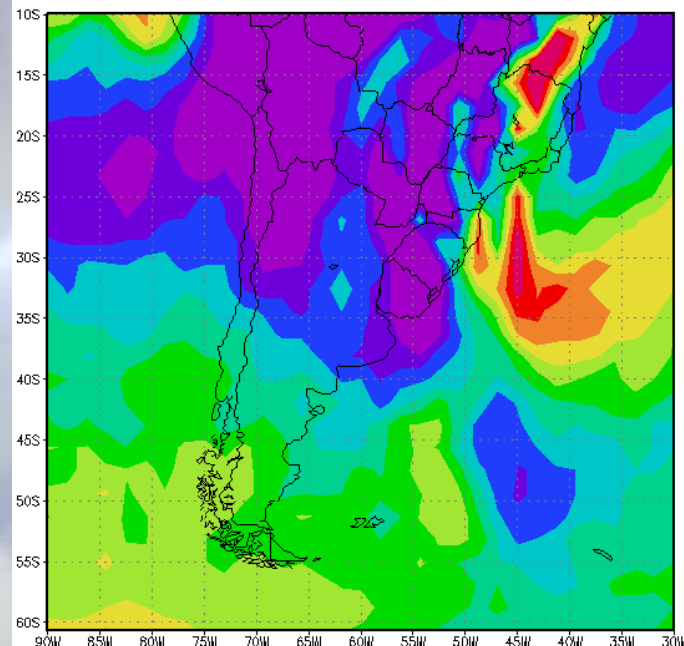
# Transient activity

(Experimental)

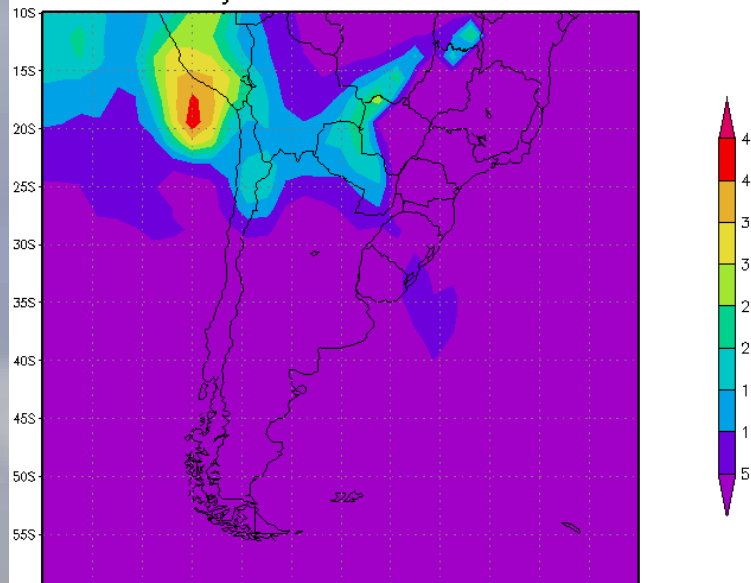
frentes - SON2006



zcas - SON2006

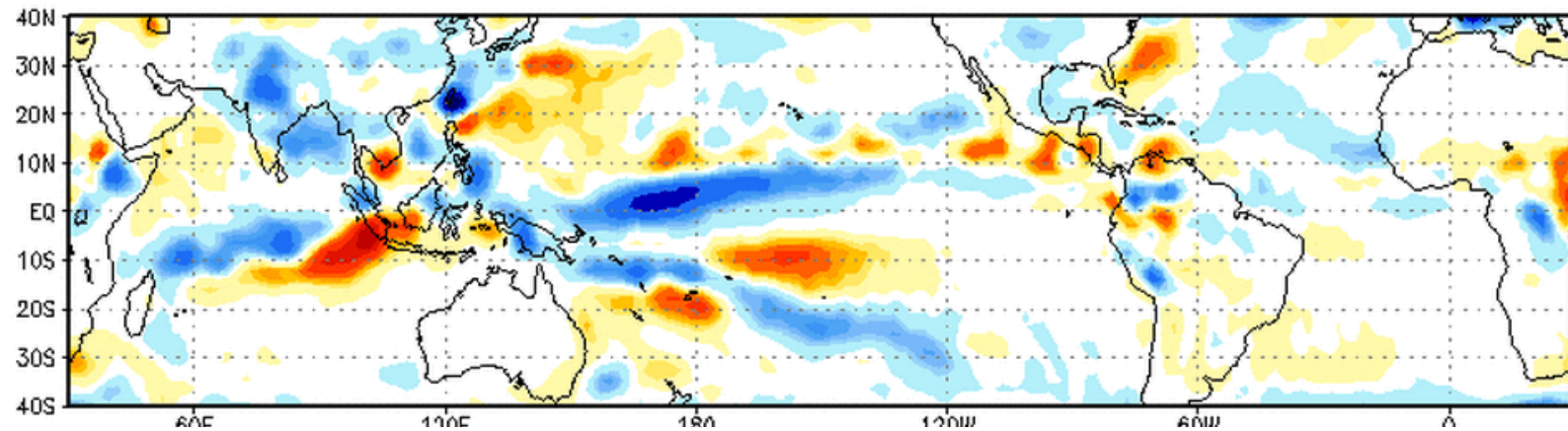


j850 - SON2006

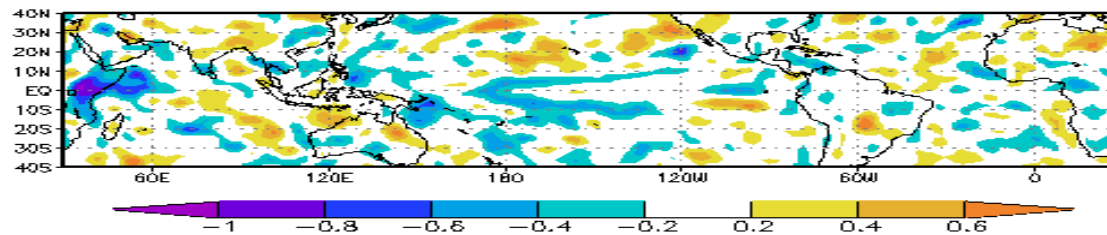




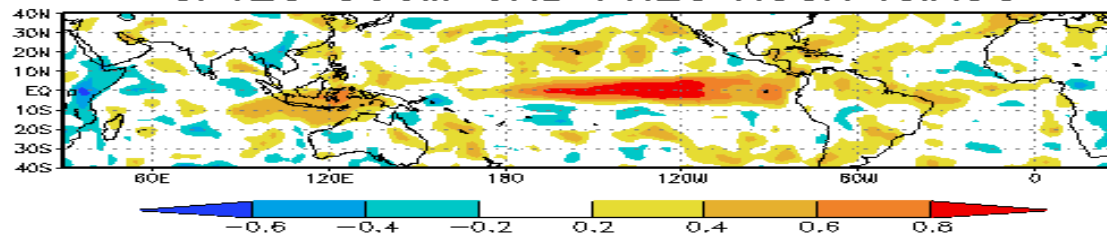
# CGCM prec ANM. FCST (SON 2006) IC JUL



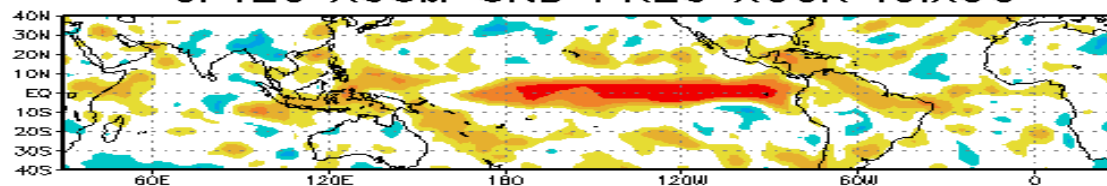
## CPTEC CGCM-AGCM OND PREC ACOR IC:AUG



## CPTEC CGCM OND PREC ACOR IC:AUG



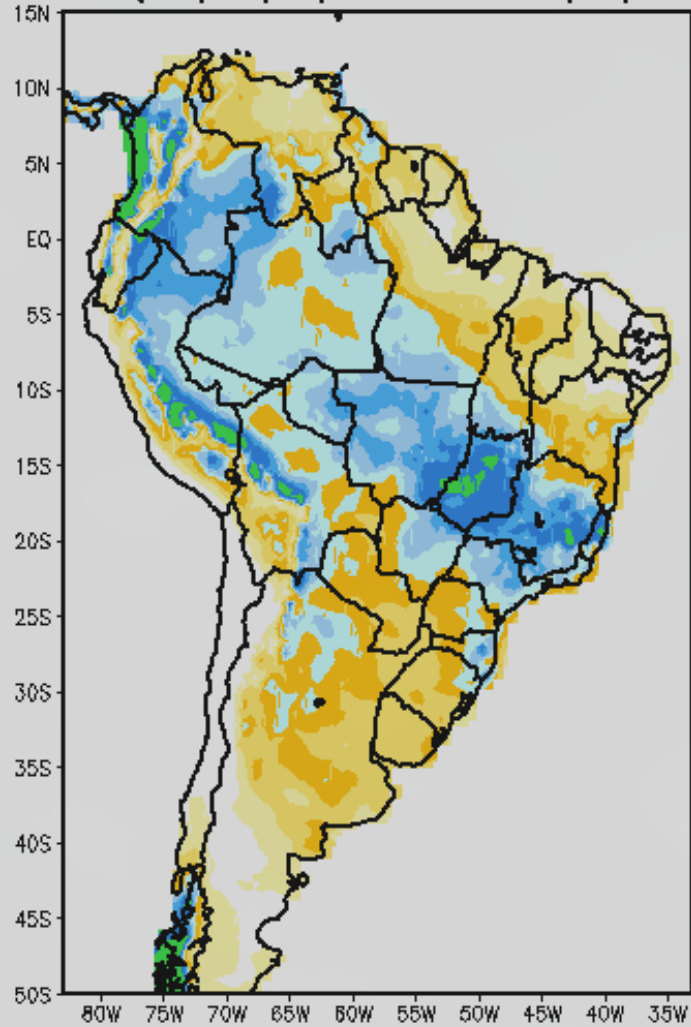
## CPTEC AGCM OND PREC ACOR IC:AUG





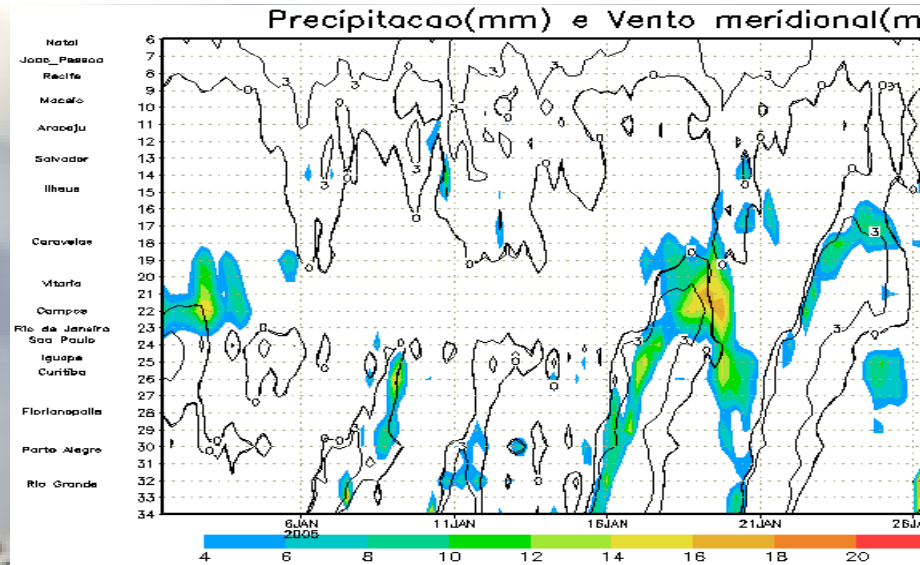
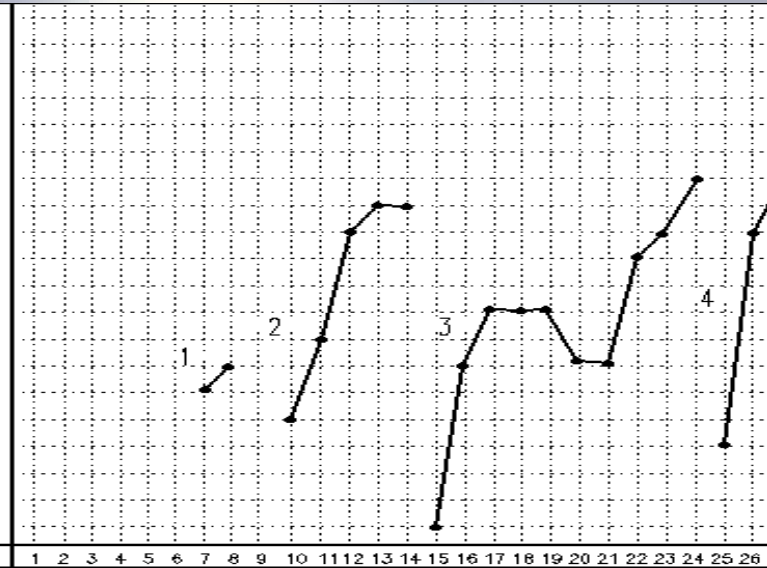
# Eta Model Forecast

Eta2d 40 km Initial Condition 2001112712  
Acc. Prec. (mm) 01/12/2001 12Z a 31/12/2001 12Z



MIRIM (RN)  
C (PE)  
O (AL)  
U (SE)  
SALVADOR (BA)  
S (BA)  
CARAVELAS (BA)  
VITORIA (ES)  
CAMPOS (RJ)  
CAMPO FRIO (RJ)  
RIO DE JANEIRO (RJ)  
BOA VISTA (BA (SP)  
S (SP)  
C (SP)  
AGUA (PR)  
FLORENOLIS (SC)  
S (RS)  
ALEGRE (RS)  
GRANDE (RS)  
BOA PALMAR (RS)

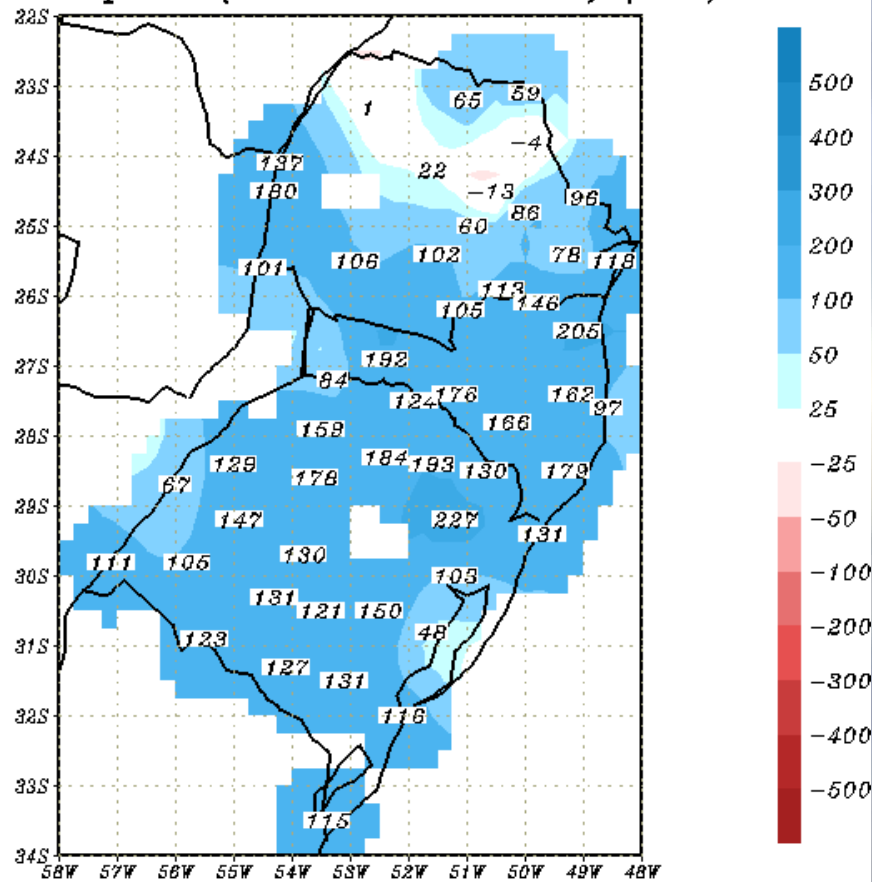
JAN 05



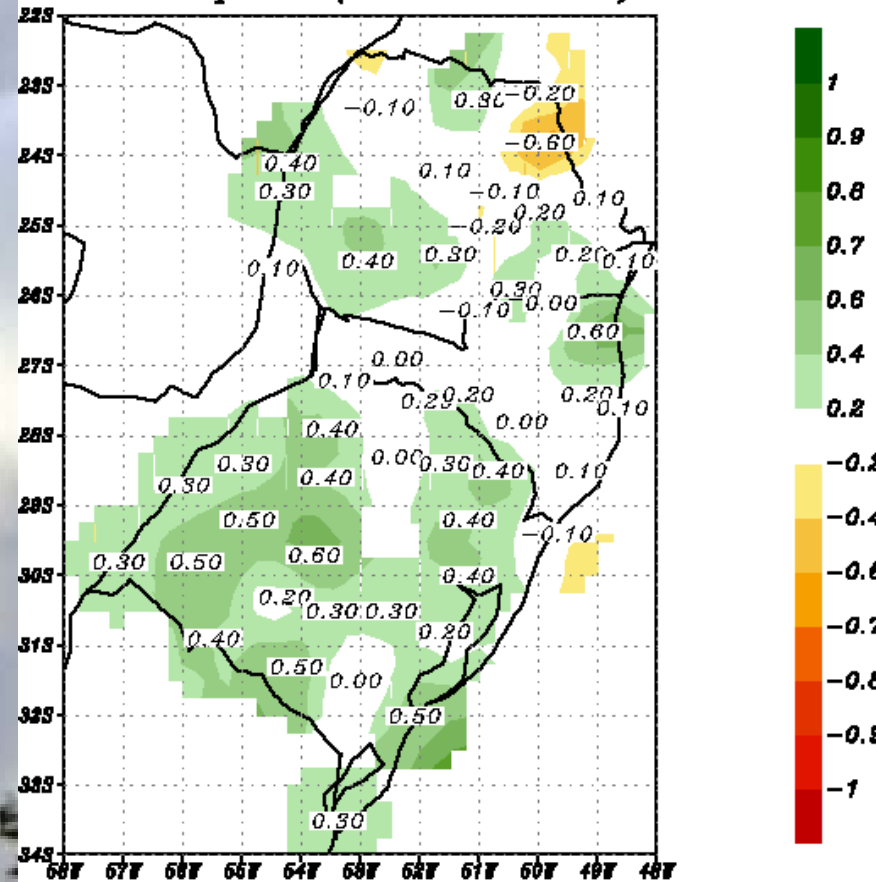
## Seasonal Forecast

## Statistic Model

**SIMOC - PREVISAO DE ANOMALIAS DE PRECIPITACAO**  
Valido para: (Out-Nov-Dez 2006) (mm)

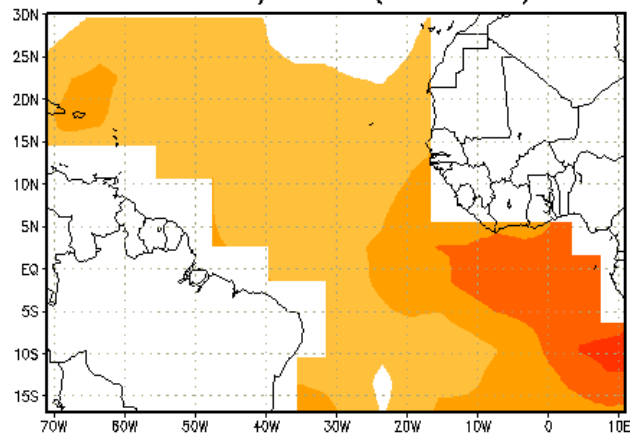


**SIMOC - MAPA DE CORRELACOES**  
Valido para: (Out-Nov-Dez )

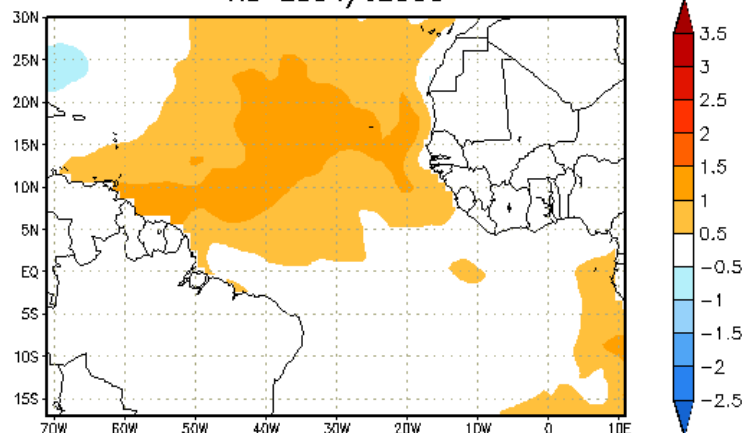


## Avaliacao - SIMOC

Previsao - Anomalia de TSM (Celsius)  
ND 2004/J2005 (ci 092004)



Observacao - Anomalia de TSM (Celsius)  
ND 2004/J2005



media da observacao = 0.498446

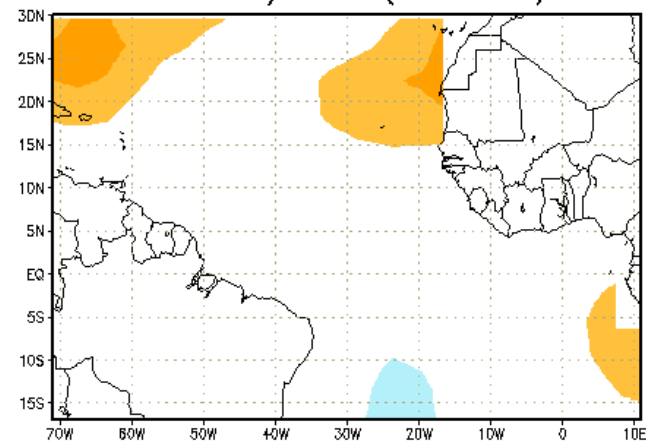
RMSE = 0.795329

BIAS = 0.470903

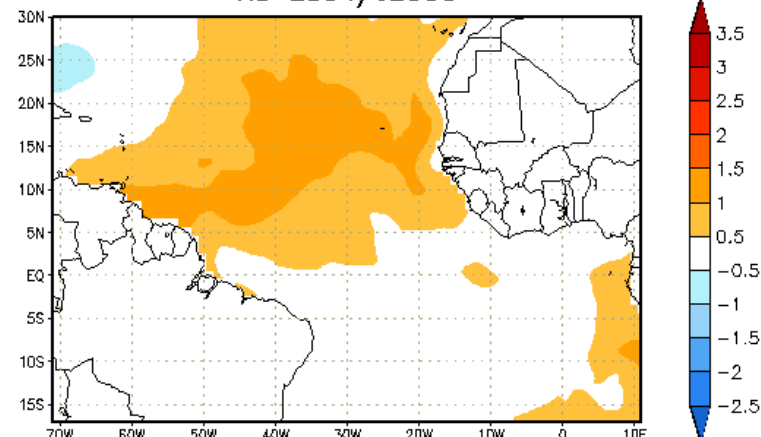
correlacao = -0.193149

## Avaliacao - SIMOC

Previsao - Anomalia de TSM (Celsius)  
ND 2004/J2005 (ci 102004)



Observacao - Anomalia de TSM (Celsius)  
ND 2004/J2005



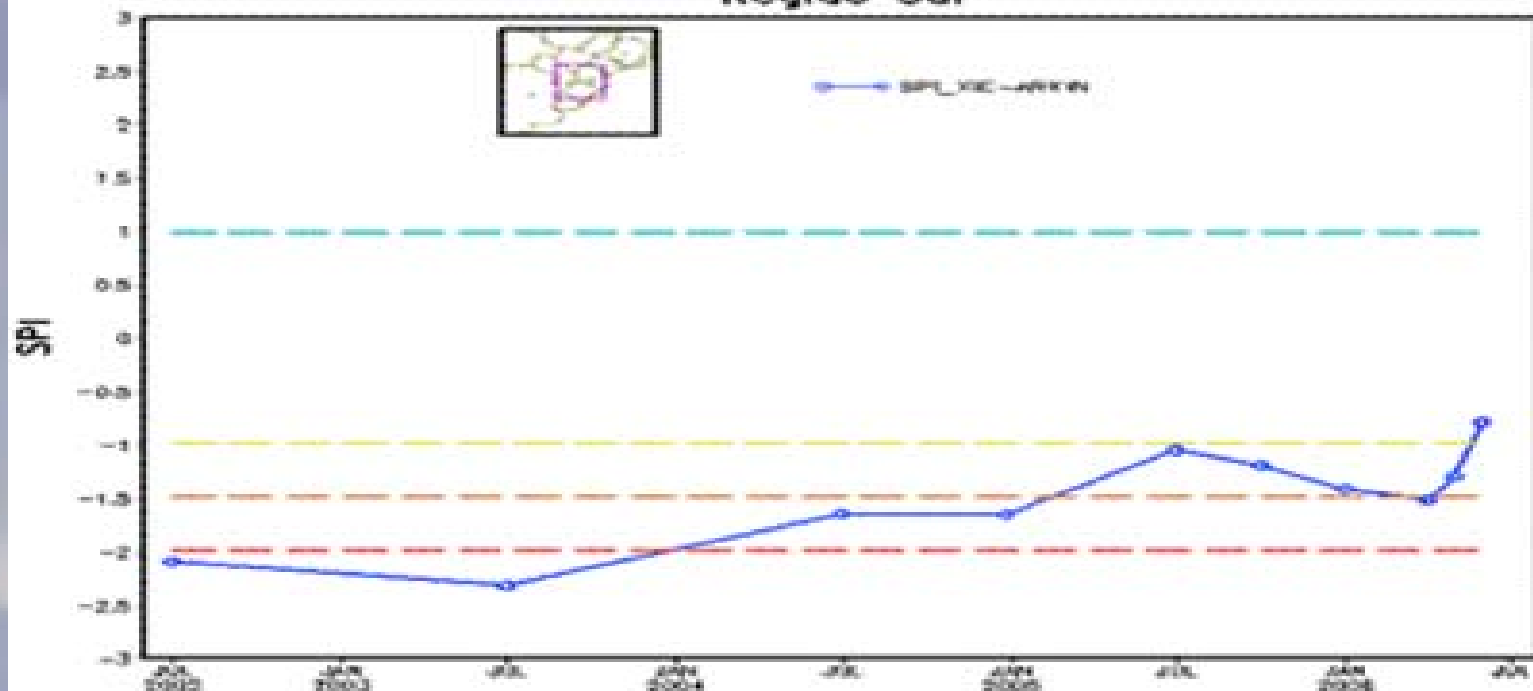
media da observacao = 0.498446

RMSE = 0.640462

BIAS = -0.318788

correlacao = 0.0956989

## Índice de Chuva Normalizado Região Sul



Valores de SPI			
		> 2	extremamente chuvoso
		entre 1.5 e 1.99	muito chuvoso
		entre 1.0 e 1.49	moderadamente chuvoso
		entre -0.99 e 0.99	Normal
		entre -1.0 e -1.0	moderadamente seco
		entre -1.5 e -1.99	muito seco
		< -2	extremamente seco

# NDJ 2004/2005 RPSS

