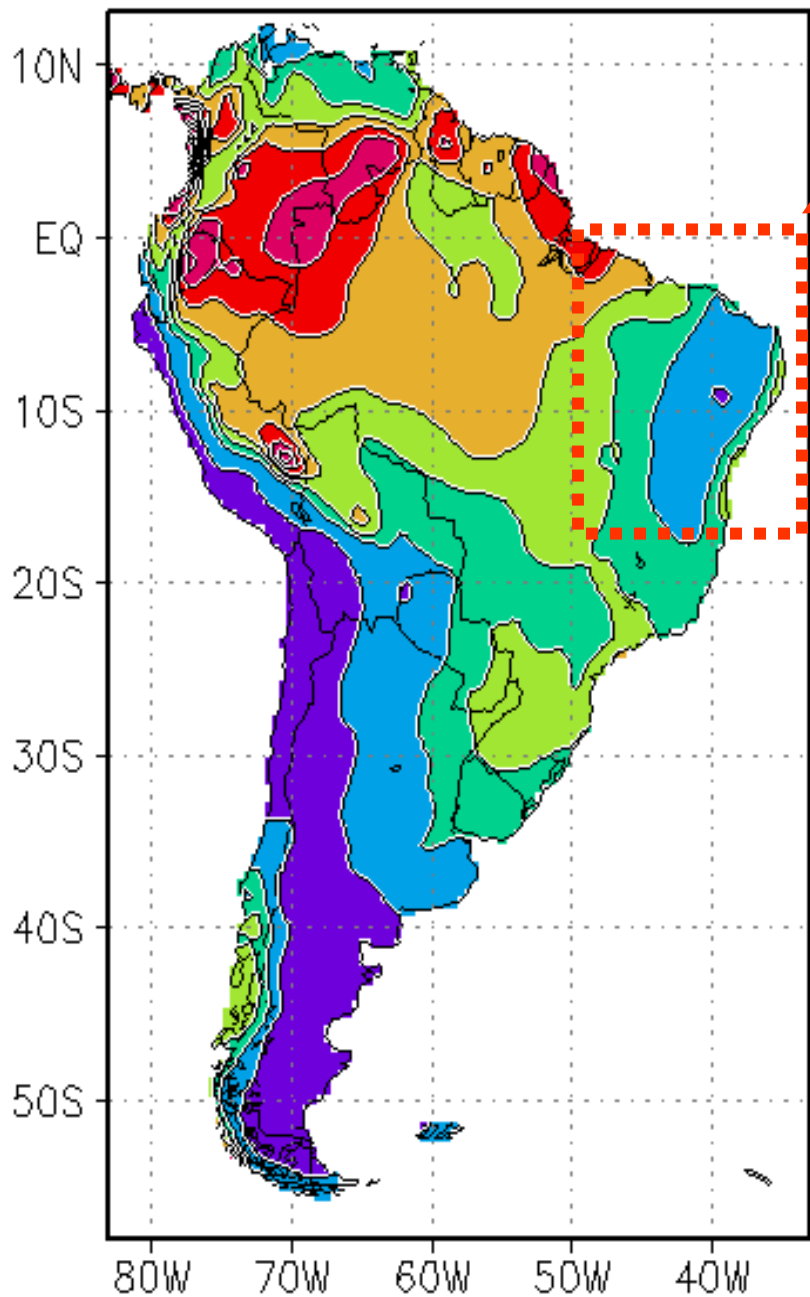




Ministério da Agricultura, pecuária e Abastecimento
INSTITUTO NACIONAL DE METEOROLOGIA

Seasonal Climate Forecast over Northeast Brazil: Evaluation of models and applications

A. D. Moura, INMET, Brazil



Nordeste of Brazil (NEB)

Precipitation Annual Mean (mm/day)

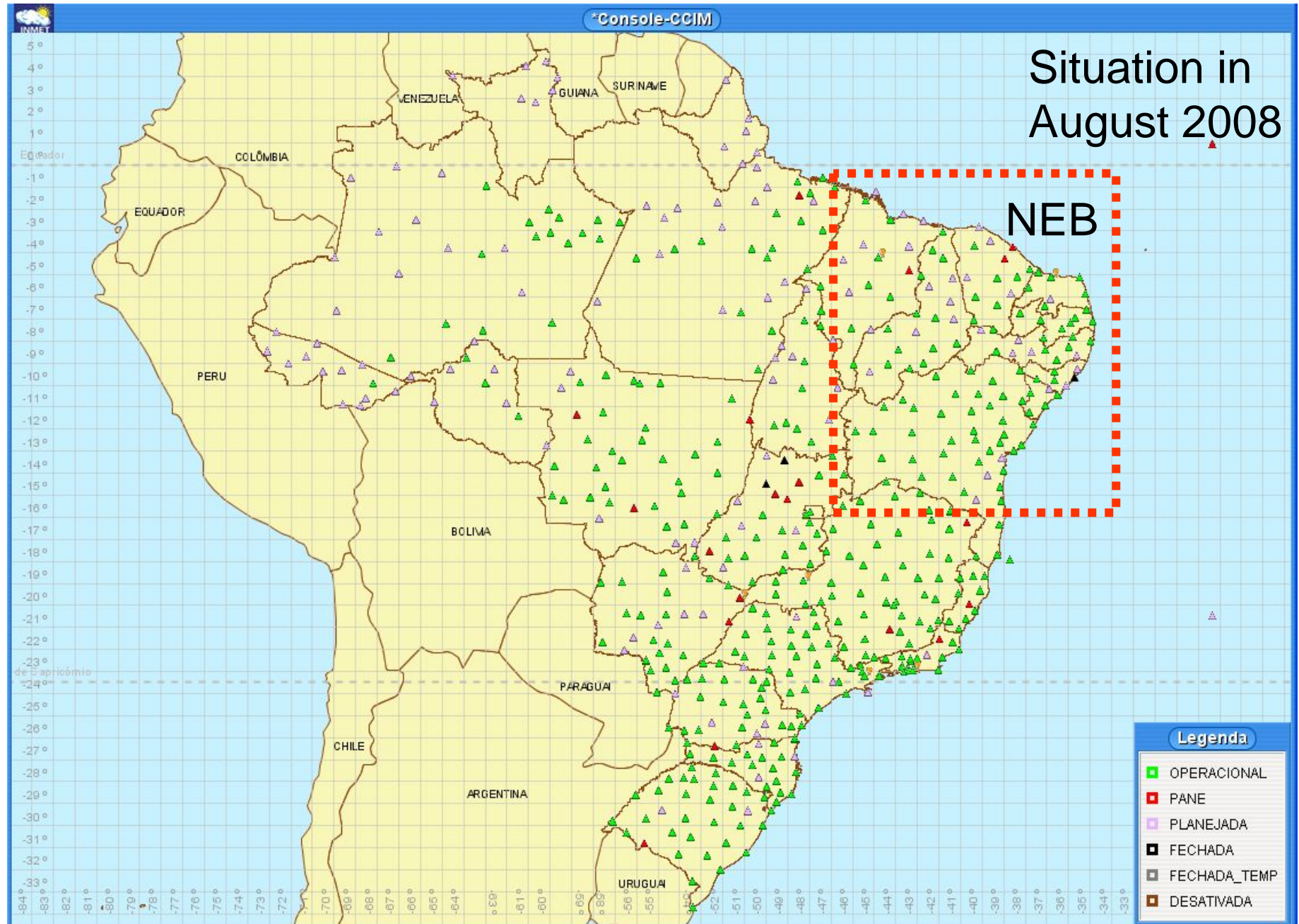
Base period: 1961-90



Data source: East Anglia C.R.U.

Courtesy: P. Nobre

AUTOMATIC Stations: Real time DATA



Automatic Station



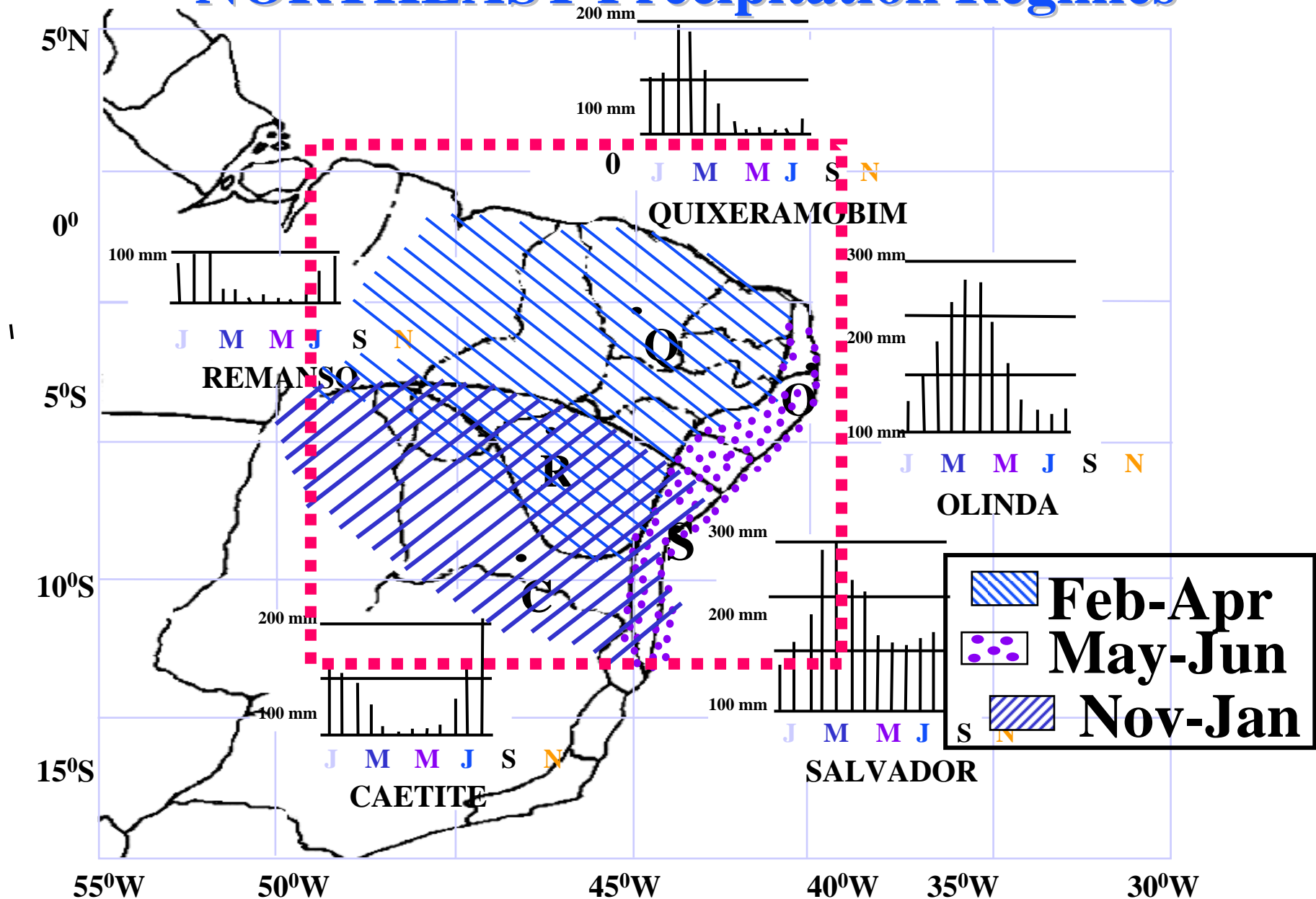
Function

colect meteorological parameters every hour:

- precipitation
- temperature
- humidity
- wind direction and intensity (10 m)
- solar radiation
- pressure

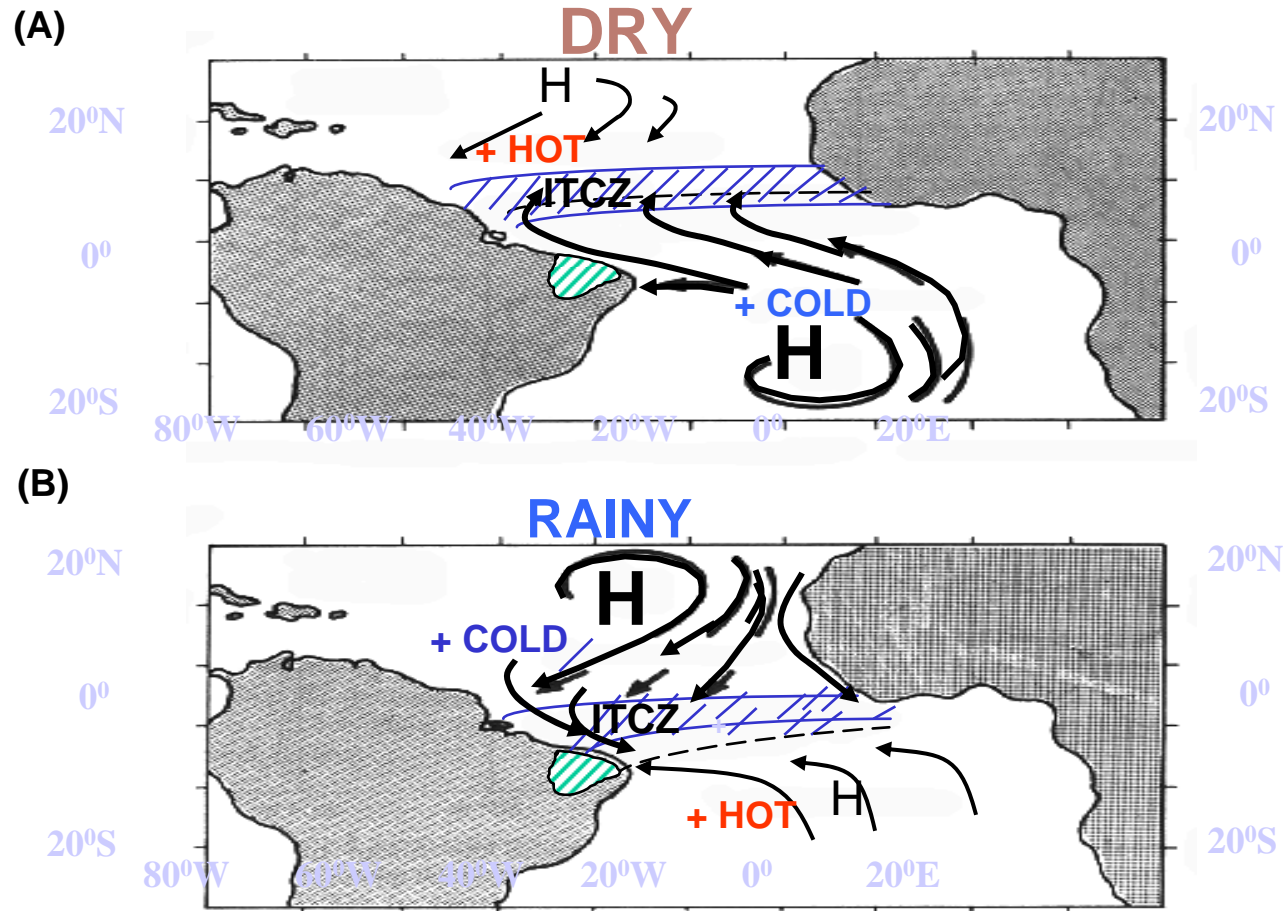
real time transmission- reception

NORTHEAST Precipitation Regimes



Adapted from Kousky et al. (1980)

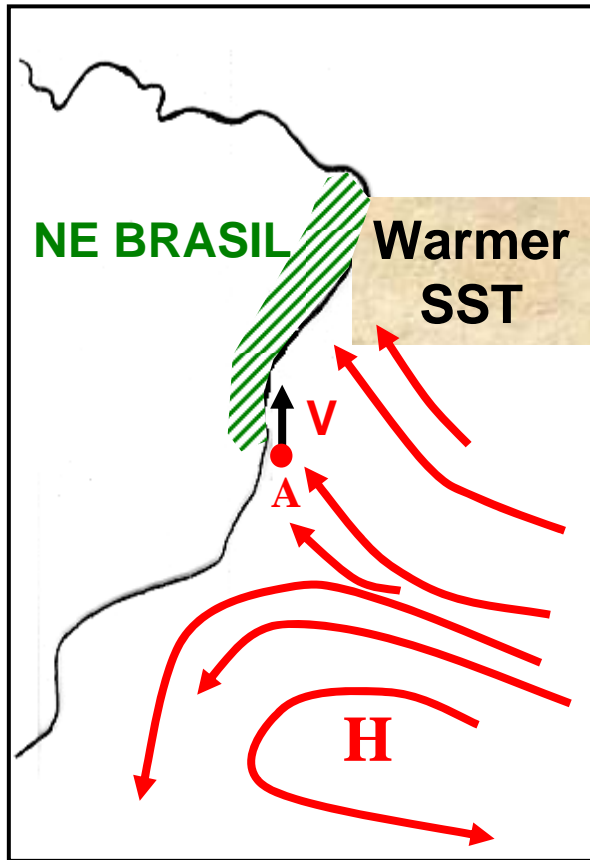
ATLANTIC Influence over NEB



Adapted from: C. Nobre and L. Molion (1988)

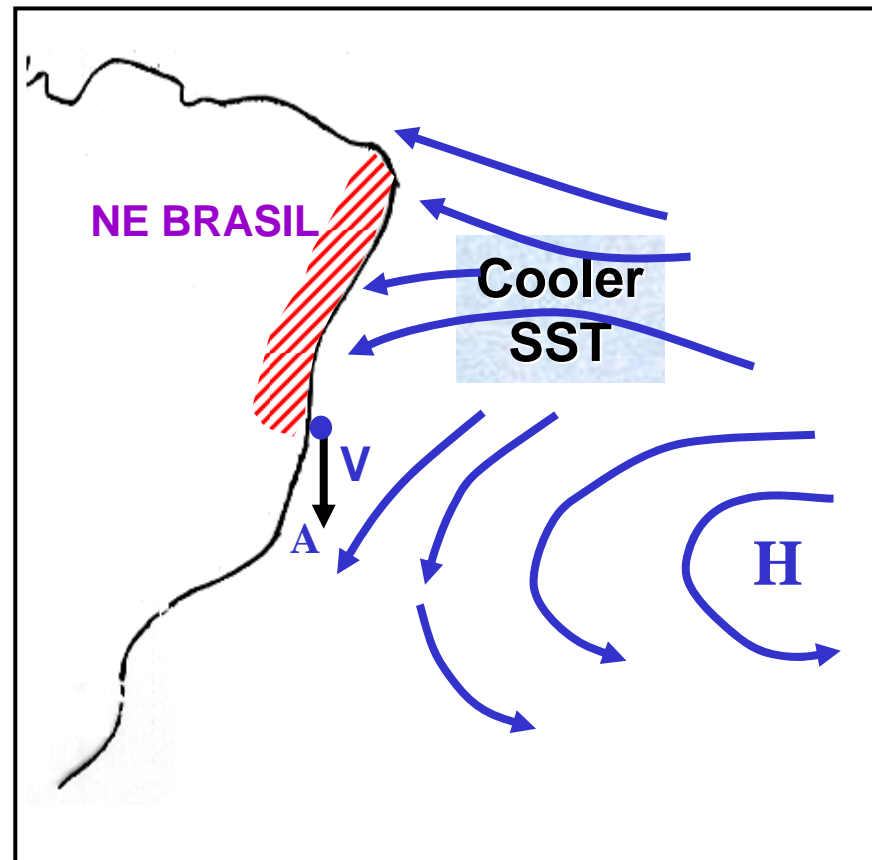
Eastern NEB Climate Predictability

WET Year



H PRESSURE Displaced SW

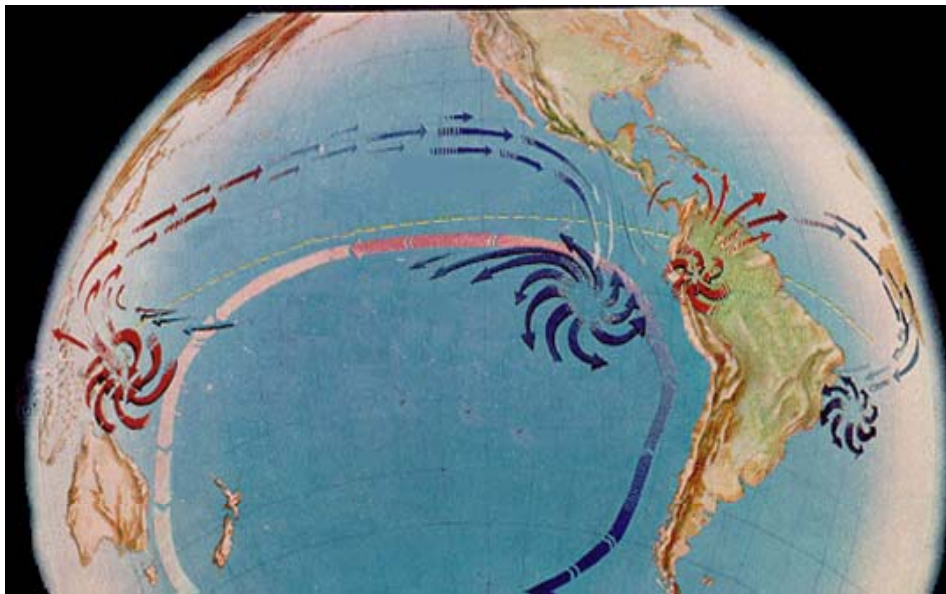
DRY Year



H PRESSURE Displaced NE

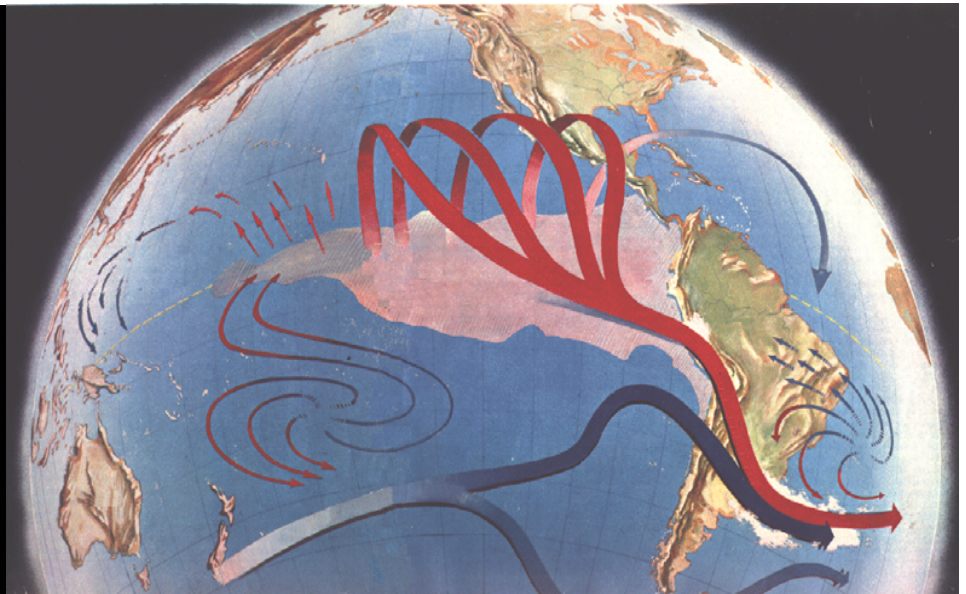
Adapted from Rao and Lima (1991); Courtesy: P. Nobre

Equatorial Pacific influence over NEB



ENSO Cold (La Niña)

Indirect influence

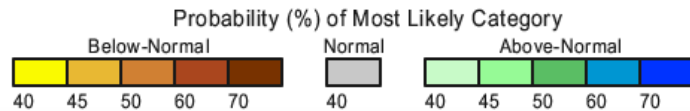
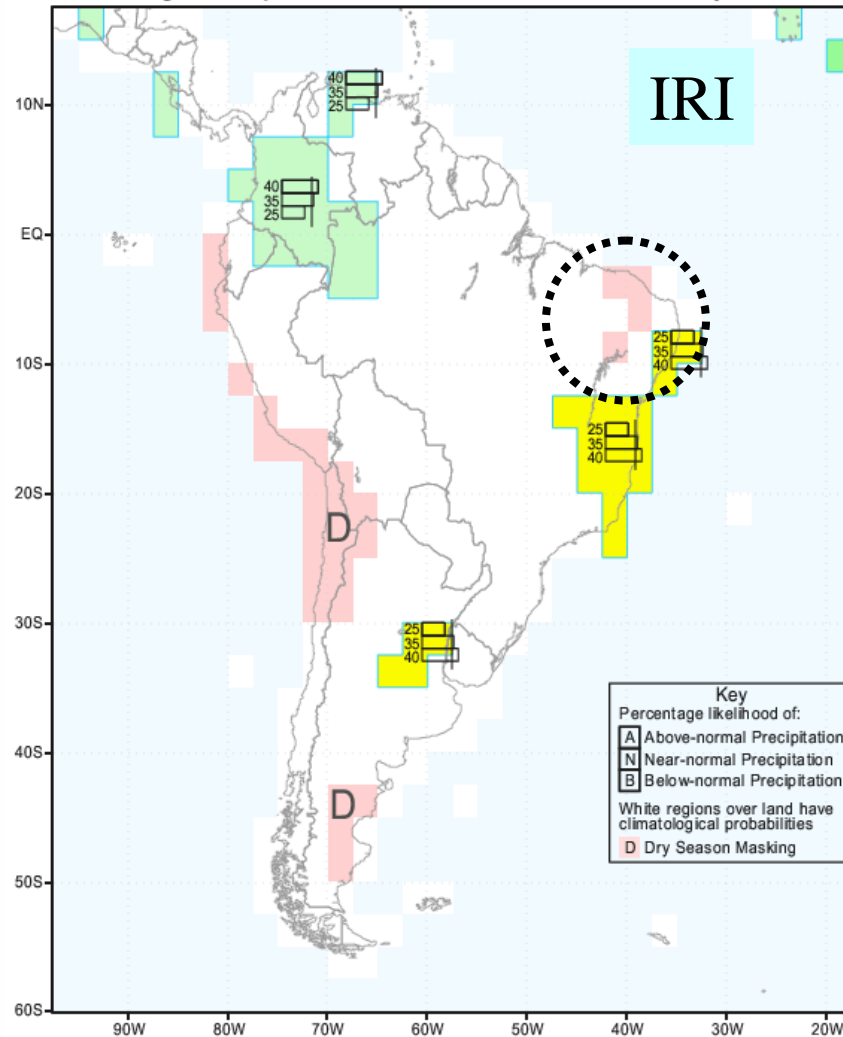


ENSO Warm (El Niño)

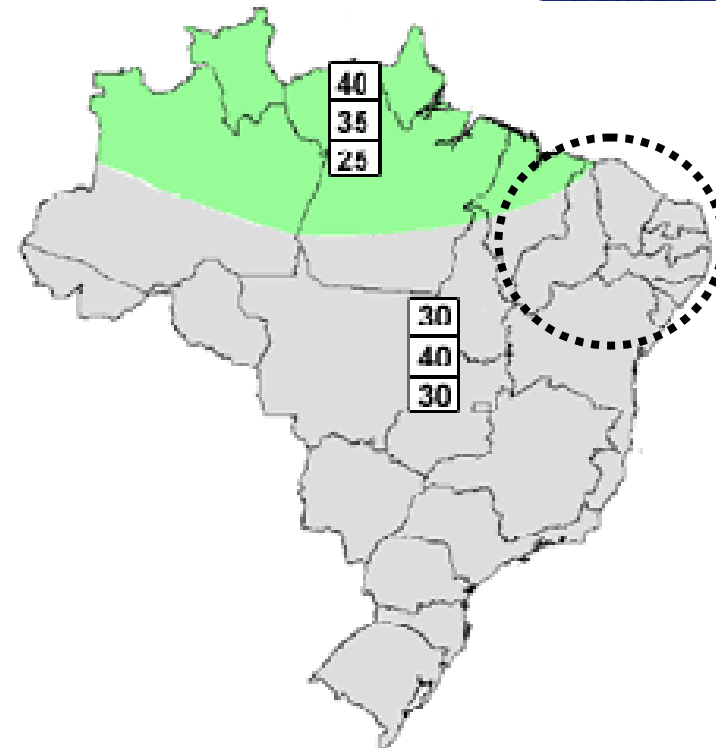
Direct influence

Seasonal Prediction

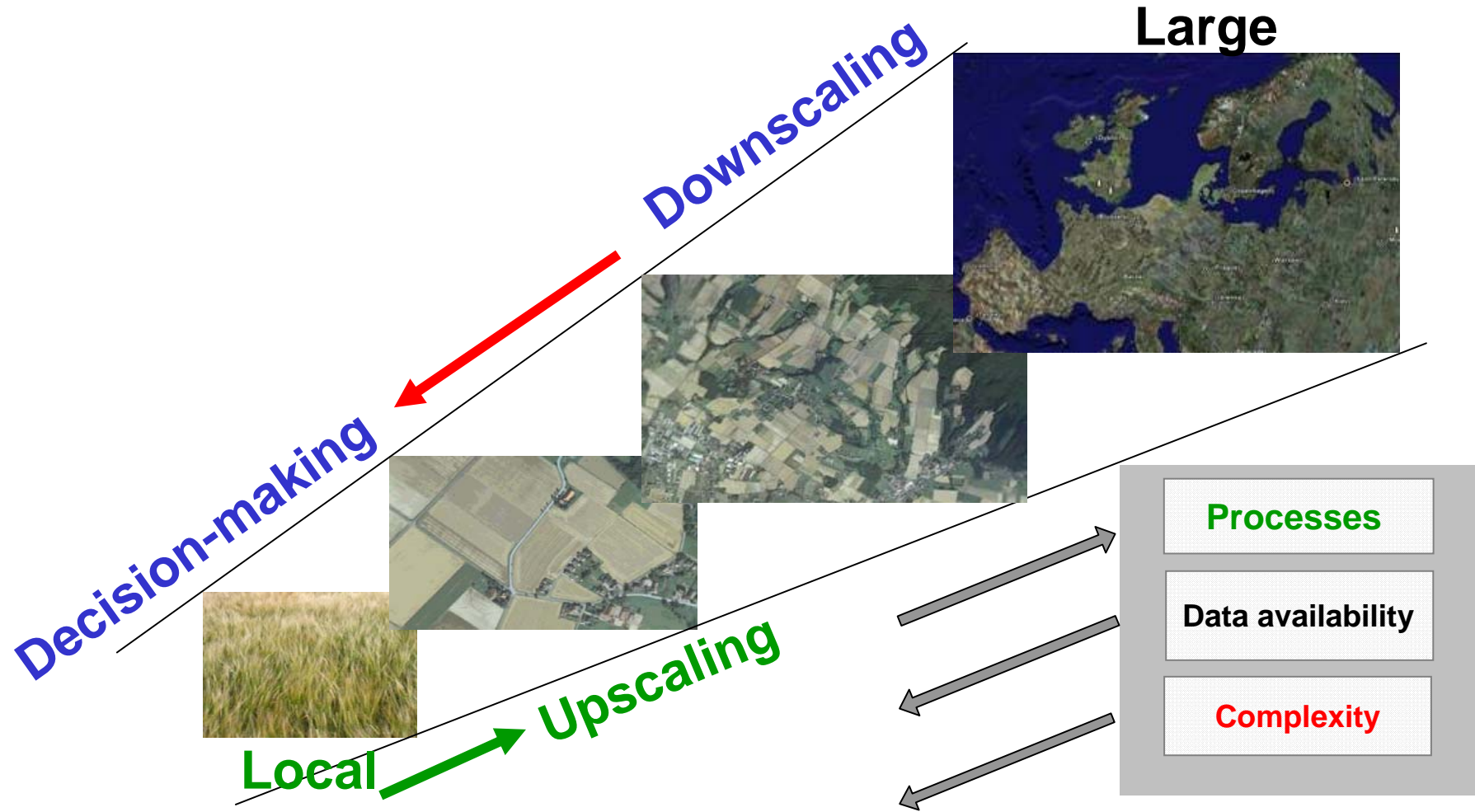
IRI Multi-Model Probability Forecast for Precipitation for August-September-October 2008, Issued July 2008



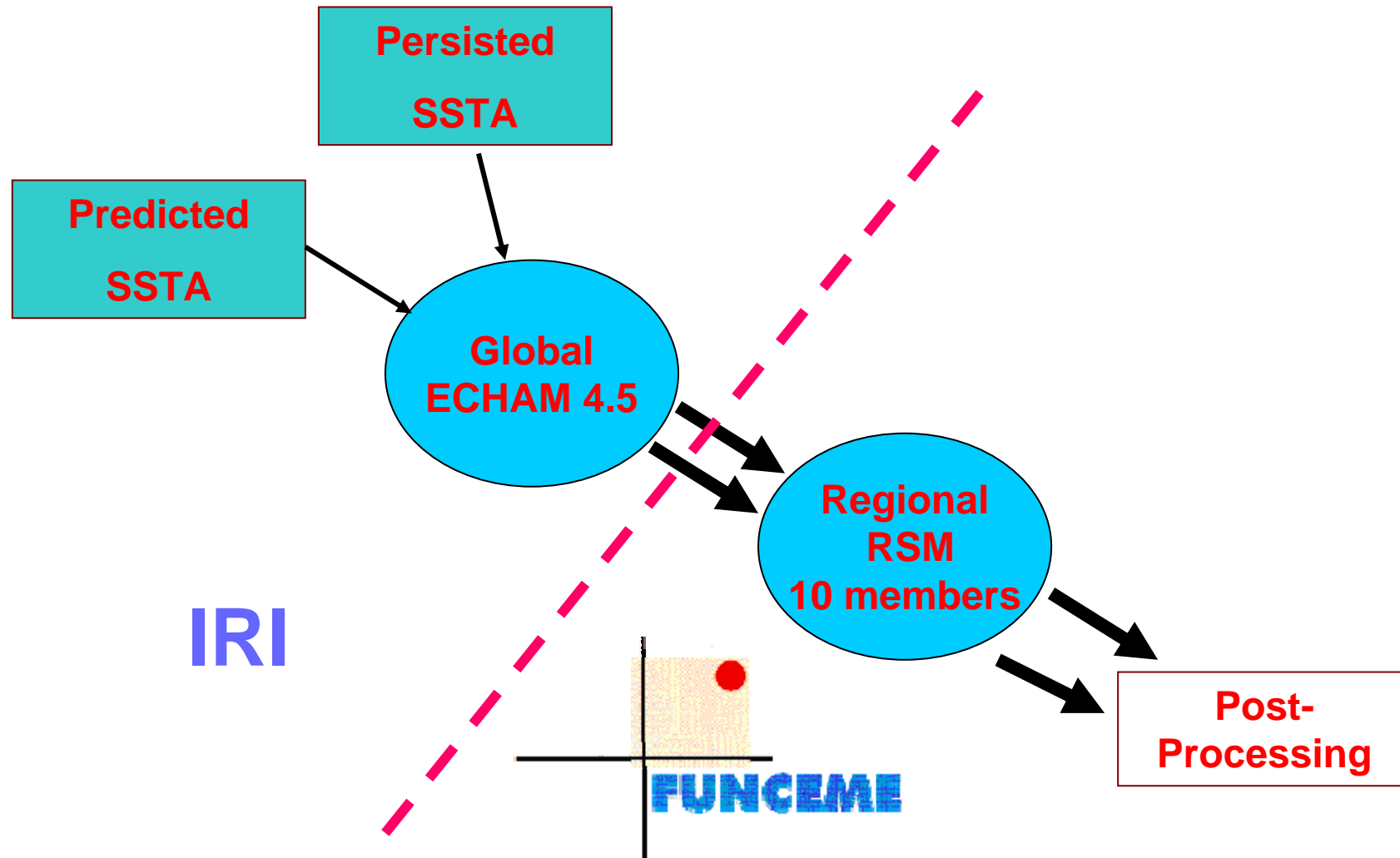
CPTEC AGO/SET/OUT 2008 INMET



Scale challenge



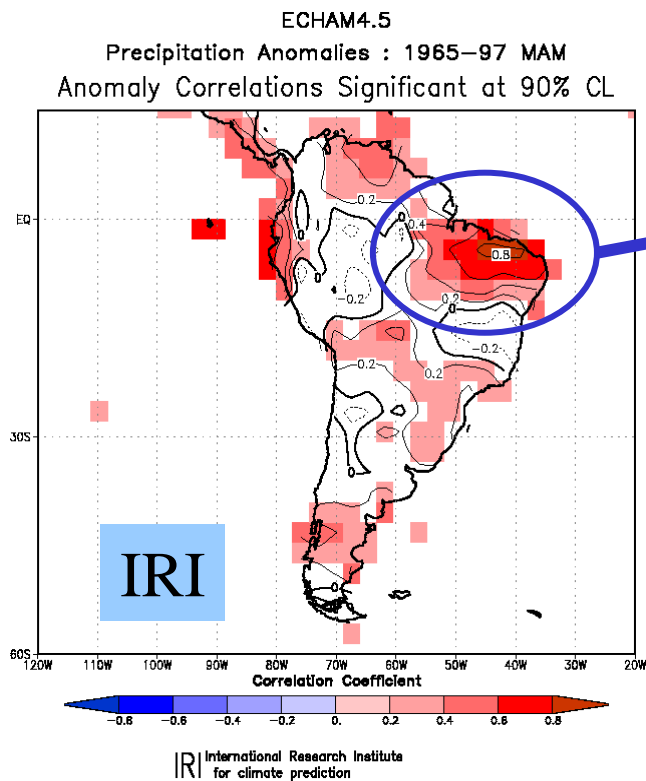
Downscaling Forecast System for Northeast Brazil (IRI - FUNCEME)



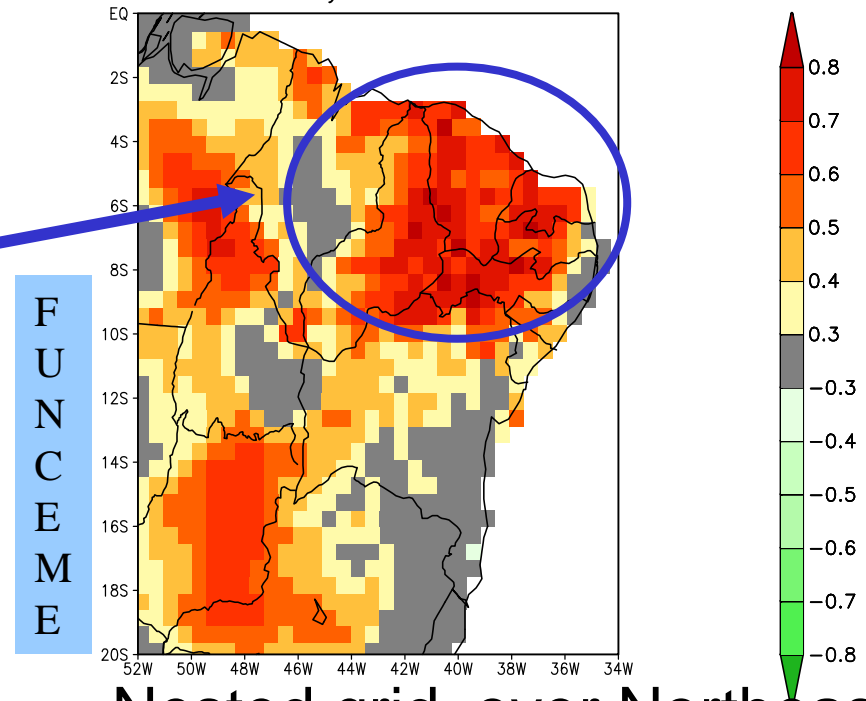
Downscaling

from global model: 300 km
to smaller scale: 60 km
(decision level)

Global seasonal climate
forecasting with ECHAM4.5
(good correlation > 70%)



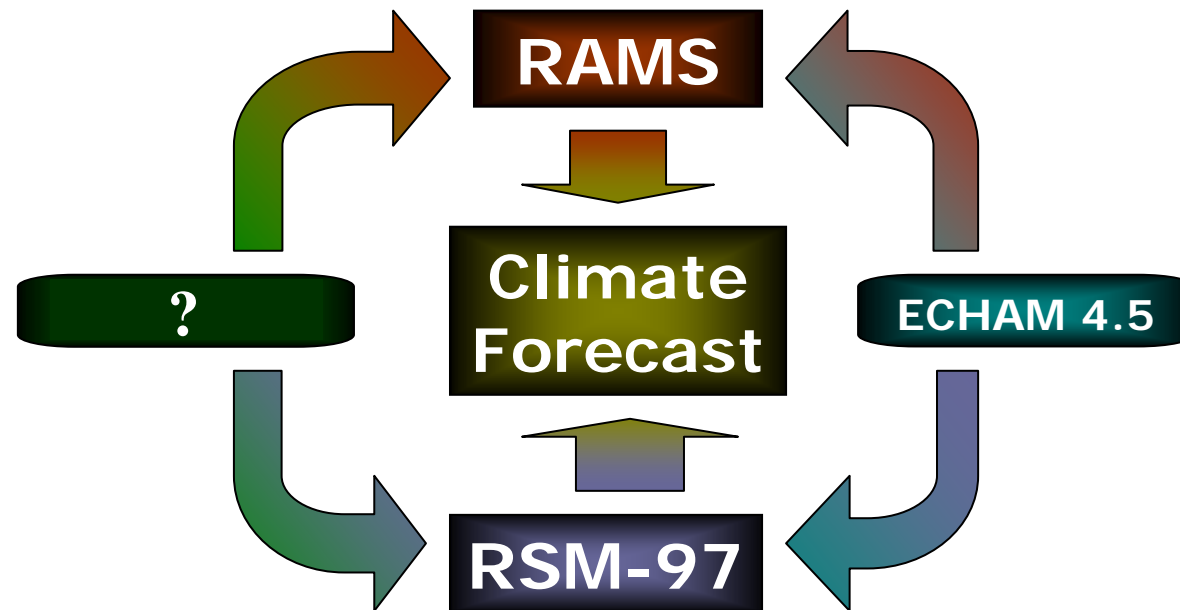
ECHAM4.5 - RSM97
Precipitation Anomalies: 1971-91 JAN-APR
Anomaly Correlations



Nested grid over Northeast
(RSM in ECHAM)

Forecast Models

Forecast System Expansion do use also other global/regional models → *Super-ensemble*



Prediction over Northeast Brazil by **Empirical** and **Numerical** Modeling Methods: Comparison of skills

Empirical:

27 stations; data 1921-57 => training; 1958-89 => verification

Fcast: pre-season rainfall; SST& wind in Atlantic; SST in Pacific; data up to January to predict the March-June rainy season)

Numerical:

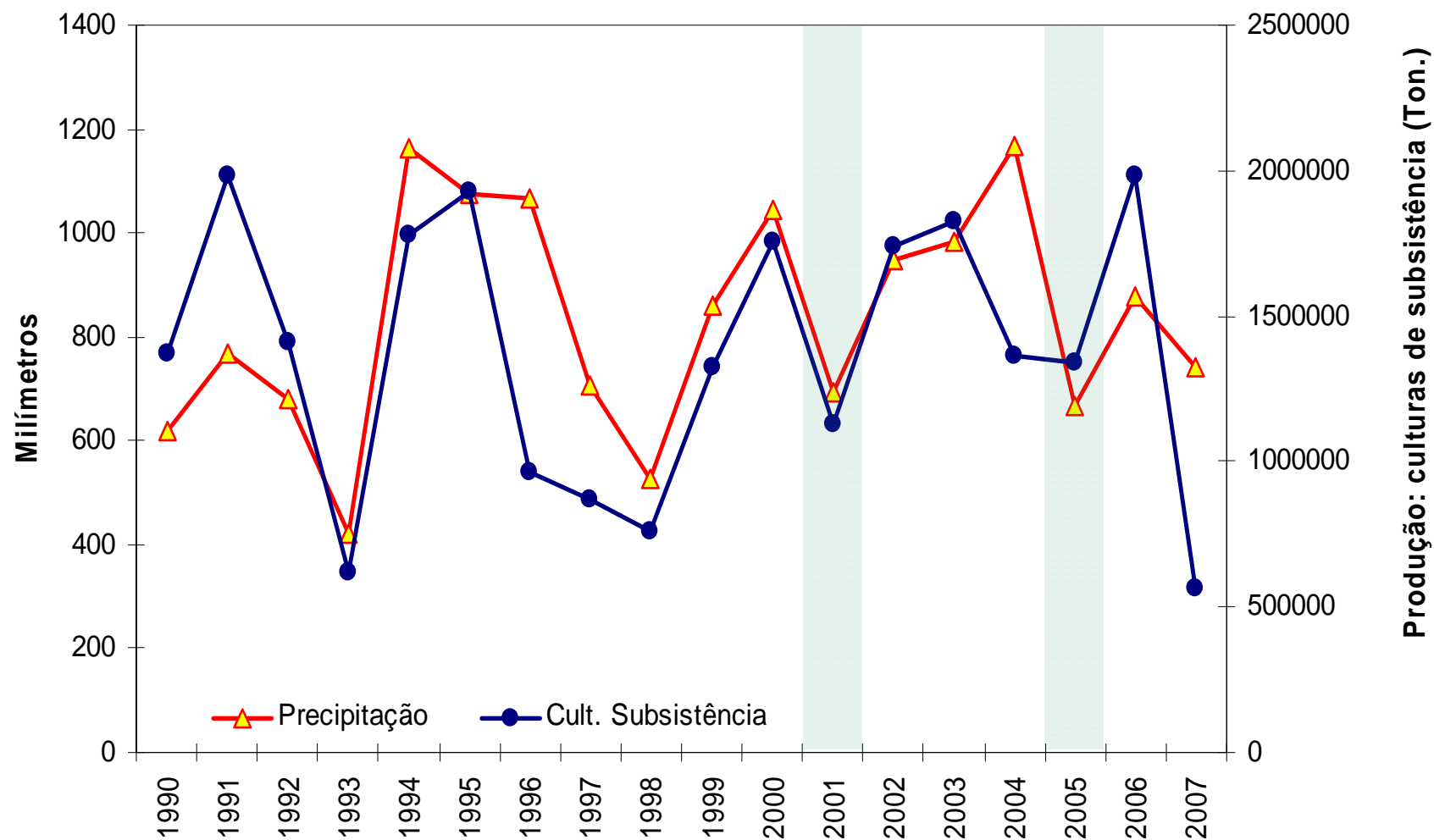
ECHAM4.5 runs for 32 years in common with Empirical

correlation of the two time series: +96% (common period 1968-99)

Forecast: January to June SST - runs for March to June

RESULTS: **Empirical** method explains **53%**
Numerical explains **37%** of variance

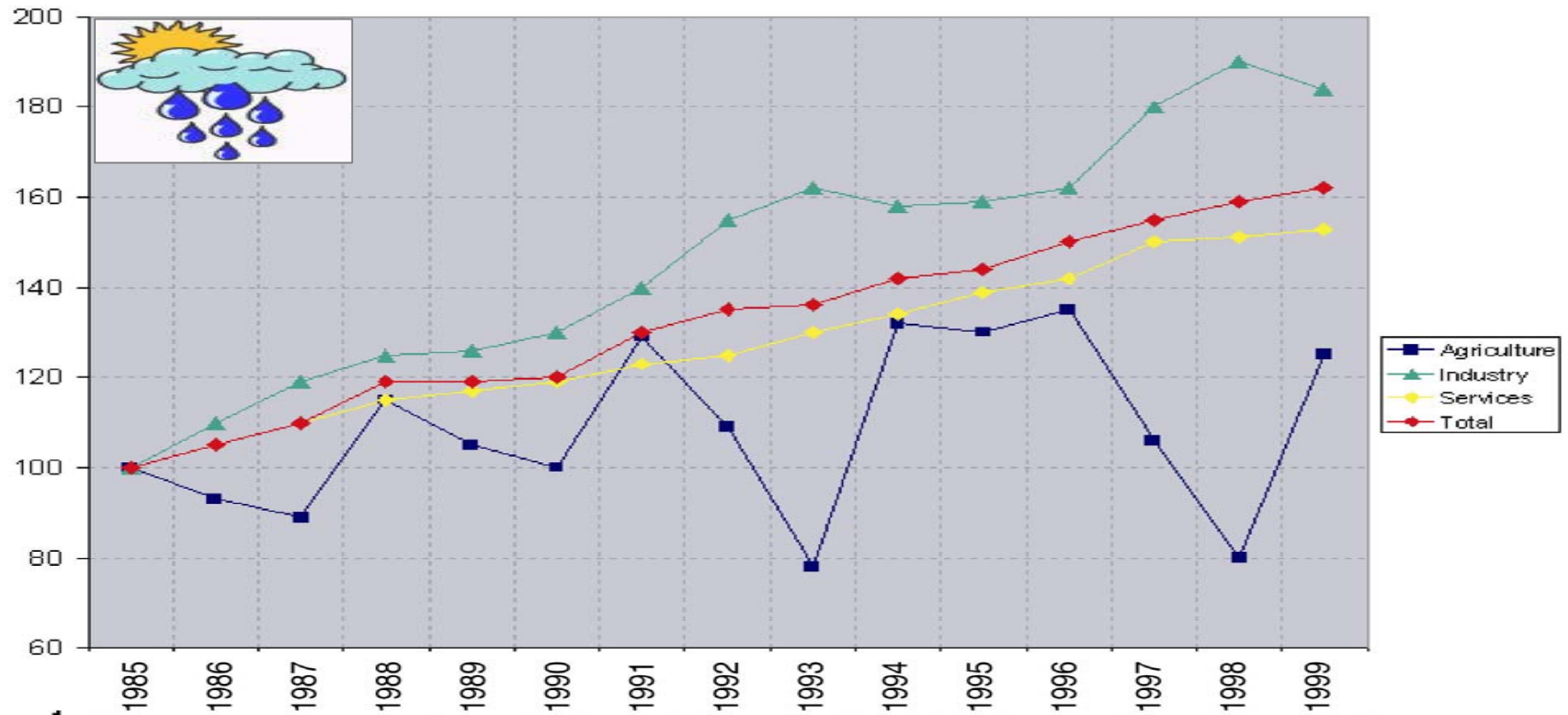
Ceará: Grain production x Precip



Fonte: FUNCEME e IPECE.

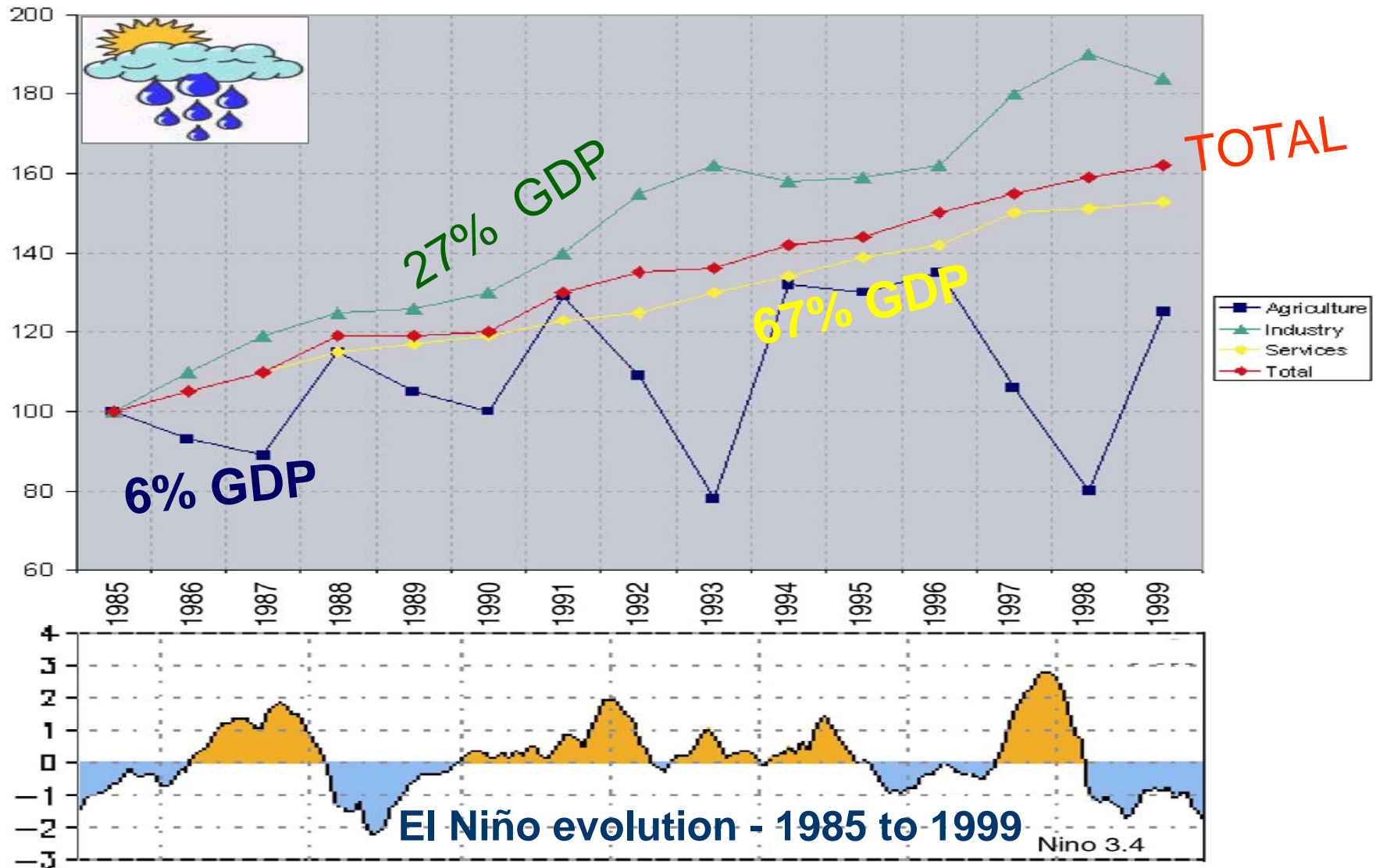
Ceará, Brazil, economics:

evolution of gross domestic product - GDP



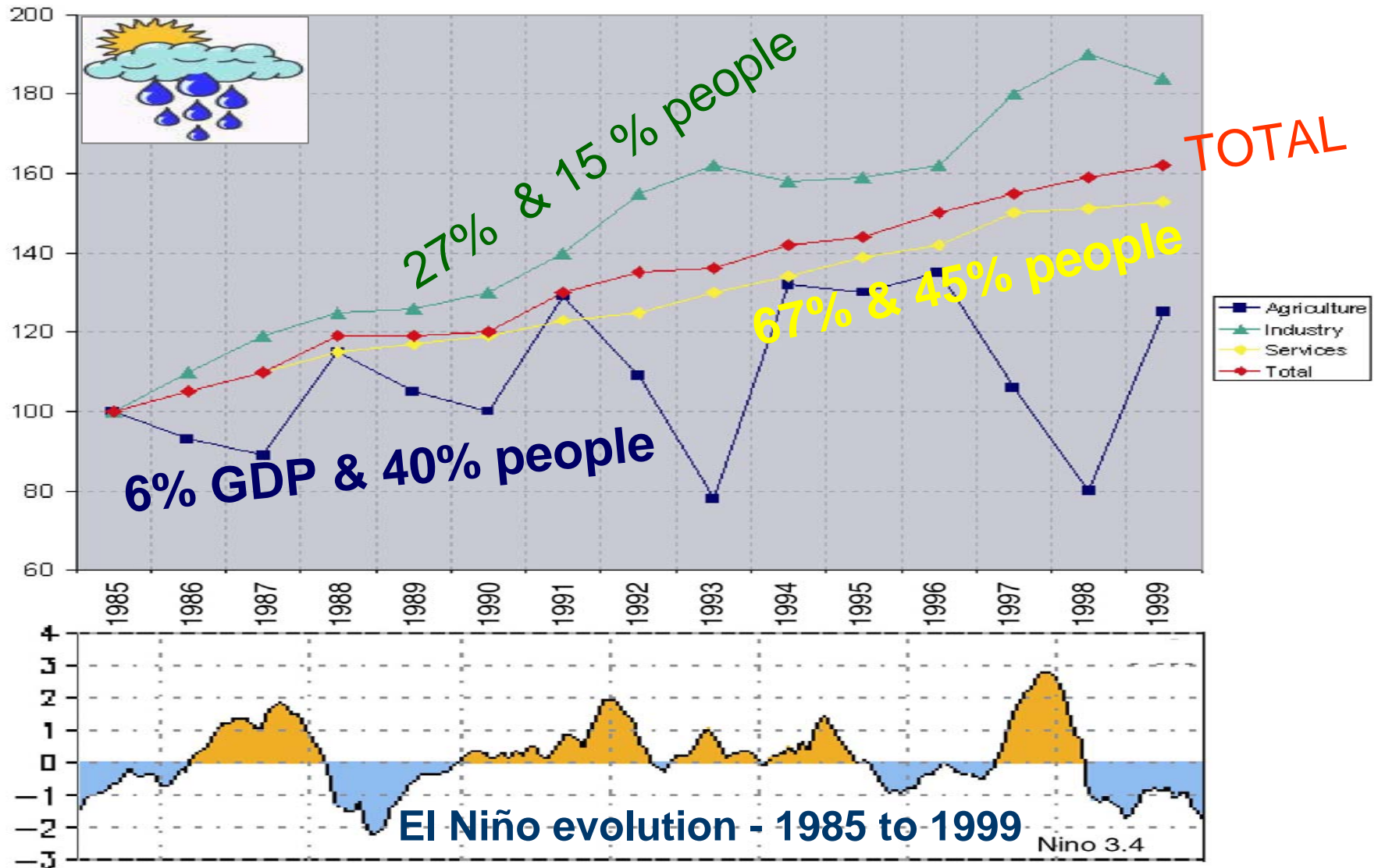
Ceará, Brazil, economics:

evolution of gross domestic product - GDP



Ceará, Brazil, economics:

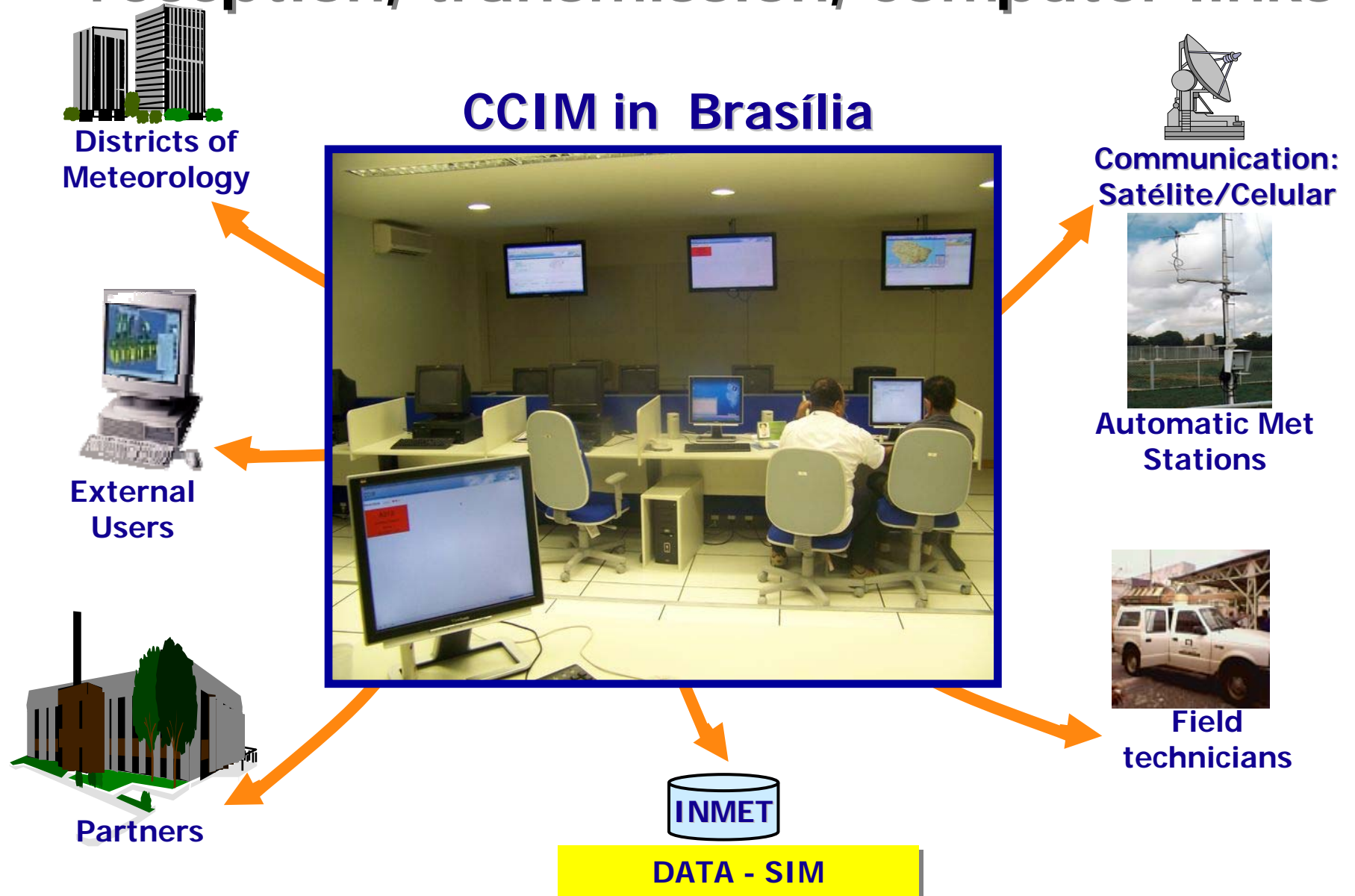
evolution of gross domestic product - GDP



Thank you!
Gracias!

Antonio Divino Moura
diretor.inmet@inmet.gov.br

24 h x 7 days/w Center to Control data reception, transmission, computer links



Data Access

<http://www.inmet.gov.br/sonabra/maps/automaticas.php>

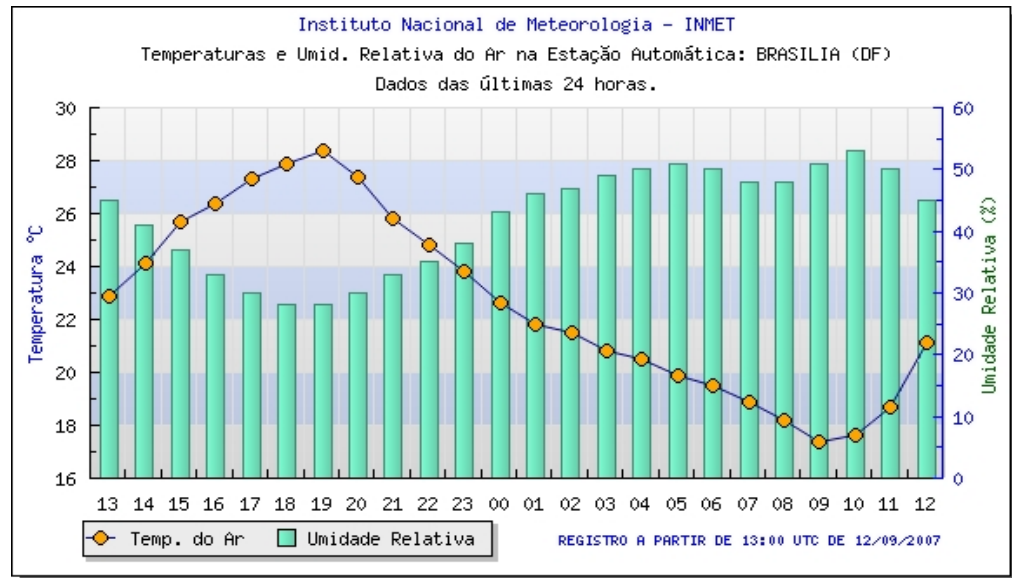
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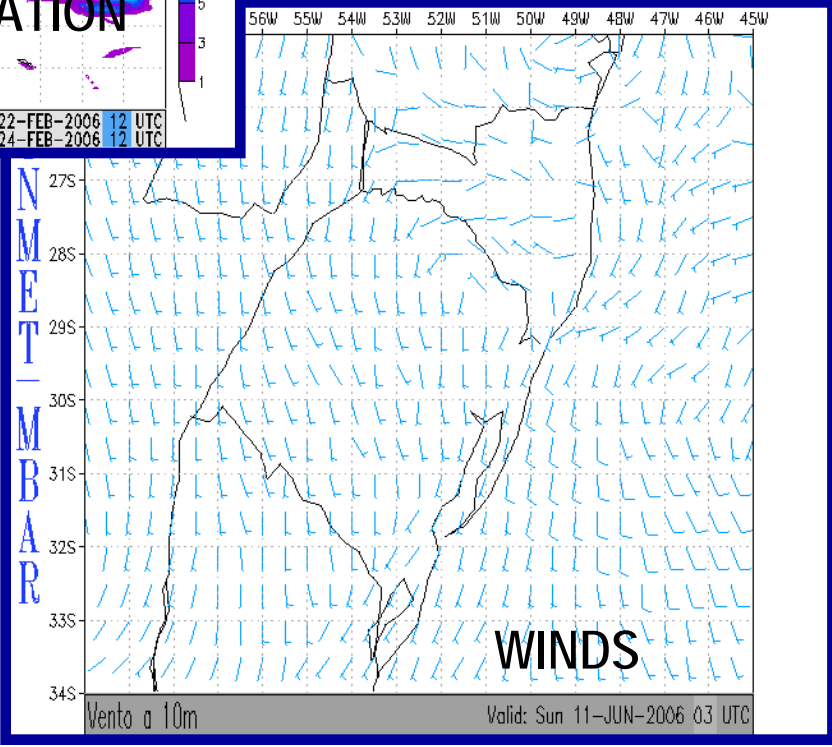
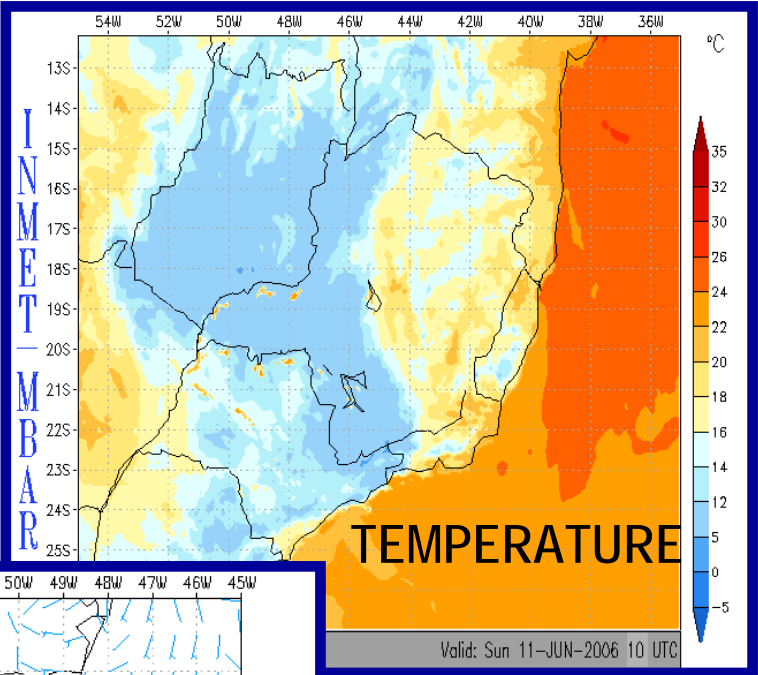
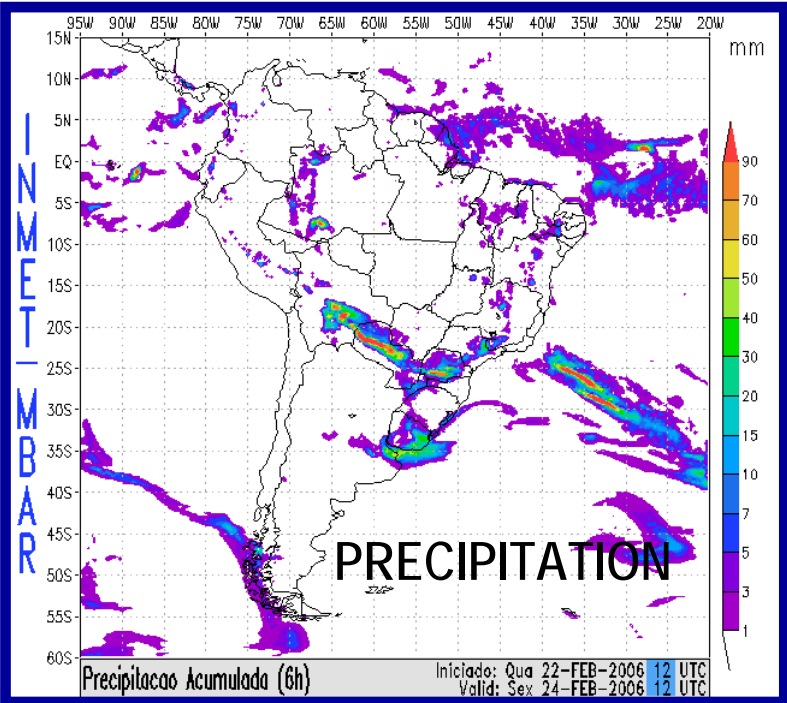
Consulta Dados da Estação Automática: BRASILIA (DF) Fechar

Observação: Estes são dados brutos e sem consistência com o único objetivo de deixar os dados disponível. Uma nova versão apresentará os dados depois de verificação de consistência.

Data Inicial: 13/09/2007		Data Final: 13/09/2007		Pesquisar		Download de Dados											
Data	Hora	Temperatura (°C)	Umidade (%)	Pto. Orvalho (°C)	Pressão (hPa)	Vento (m/s)	Radiação	Chuva									
UTC	Inst.	Máx.	Mín.	Inst.	Máx.	Mín.	Vel.	Dir.	Raj.	(kJ/m²)	(mm)						
13/09/2007	00	22.6	23.8	22.6	43	43	3.8	9.3	8.6	888.3	888.2	887.9	4.4	91°	7.8	-3.54	0.0
13/09/2007	01	21.8	22.7	21.8	46	47	4.3	9.8	9.4	888.6	888.6	888.2	4.6	95°	9.5	-3.54	0.0
13/09/2007	02	21.5	21.9	21.5	47	47	4.6	9.7	9.8	888.7	888.7	888.5	5.3	100°	8.1	-3.54	0.0
13/09/2007	03	20.8	21.5	20.7	49	50	4.7	9.8	9.9	888.6	888.8	888.5	4.3	90°	7.7	-3.54	0.0
13/09/2007	04	20.5	21.0	20.4	50	50	4.9	9.6	9.8	888.0	888.6	887.9	4.0	94°	7.2	-3.54	0.0
13/09/2007	05	19.9	20.6	19.7	51	52	5.0	9.4	9.7	887.3	887.9	887.3	4.4	100°	7.5	-3.54	0.0
13/09/2007	06	19.5	20.0	19.5	50	51	4.9	8.8	9.4	887.2	887.3	887.2	5.2	100°	9.7	-3.54	0.0
13/09/2007	07	18.9	19.6	18.8	48	50	4.7	7.6	8.7	887.1	887.3	887.1	5.6	87°	10.6	-3.54	0.0
13/09/2007	08	18.2	18.9	18.2	48	48	4.8	7.1	7.6	887.5	887.5	887.1	4.8	84°	9.8	-3.54	0.0
13/09/2007	09	17.4	18.2	17.4	51	51	4.8	7.1	7.2	888.2	888.2	887.5	4.6	90°	9.3	-3.54	0.0
13/09/2007	10	17.6	17.6	17.0	53	53	5.1	7.8	7.8	889.0	889.0	888.2	4.7	88°	8.2	121.9	0.0
13/09/2007	11	18.7	18.8	17.6	50	53	5.0	7.9	8.2	889.8	889.8	889.0	5.3	93°	9.8	769.5	0.0
13/09/2007	12	21.1	21.1	18.5	45	50	4.5	8.7	8.7	890.2	890.2	889.8	5.1	82°	9.1	1692.	0.0
13/09/2007	13	22.1	22.4	20.7	41	45	4.0	8.2	8.6	890.4	890.6	890.2	5.7	73°	10.0	2464.	0.0
13/09/2007	14	24.3	24.3	21.9	36	41	3.6	8.2	8.5	890.1	890.5	890.1	4.7	89°	9.9	2987.	0.0
13/09/2007	15	25.0	25.7	23.8	33	35	3.2	7.4	8.3	889.3	890.1	889.2	4.9	67°	8.8	3251.	0.0
13/09/2007	16	26.7	26.7	25.0	30	32	3.0	7.7	7.9	888.4	889.3	888.4	4.9	97°	10.0	3238.	0.0
13/09/2007	17	26.7	27.3	26.0	30	31	2.9	7.5	7.9	887.3	888.3	887.3	4.5	70°	8.5	3025.	0.0
13/09/2007	18	27.1	27.7	26.4	29	30	2.8	7.4	7.8	886.5	887.2	886.4	4.1	96°	7.8	2593.	0.0
13/09/2007	19	27.6	27.6	26.5	29	29	2.7	7.1	7.5	886.0	886.5	886.0	3.9	99°	6.6	1732.	0.0
13/09/2007	20	26.7	27.3	26.6	28	29	2.8	6.9	7.2	886.2	886.2	885.9	3.0	106°	6.6	1087.	0.0
13/09/2007	21	25.3	26.7	25.3	31	31	2.8	6.7	6.6	886.4	886.4	886.2	2.5	112°	6.3	262.7	0.0
13/09/2007	22	24.5	25.3	24.4	33	33	3.1	7.1	6.7	886.9	886.9	886.4	2.9	100°	5.6	-1.50	0.0
13/09/2007	23	23.5	24.5	23.5	34	34	3.3	6.9	7.1	887.4	887.4	886.9	3.6	103°	6.1	-3.54	0.0



MBAR (7Km x 7Km)



Detailed
3-day
weather
prediction