

International Expert Symposium - "Coping with Droughts"
Building a Community of Practice on Drought Management Tools
19th – 21 th November 2014, Santiago, Chile

Drought Monitoring and Forecasting in the State of Ceará

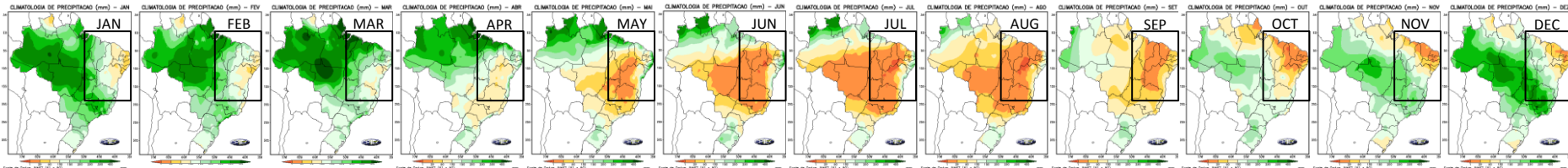
Meiry Sakamoto
Eduardo Martins
FUNCEME

Research Institute for Meteorology and Water Resources

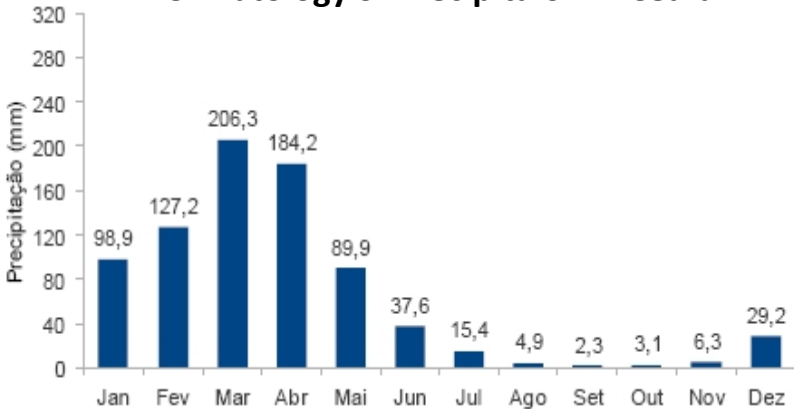


GOVERNO DO
ESTADO DO CEARÁ
*Secretaria de Ciência, Tecnologia
e Educação Superior*

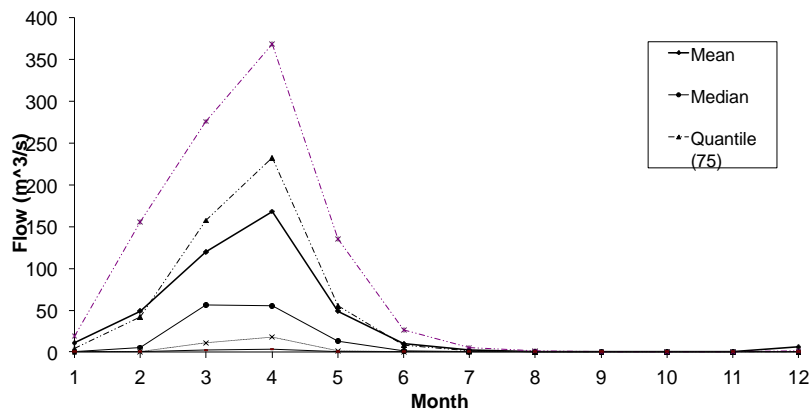
Monthly Climatology of Precipitation



Climatology of Precipitation in Ceará



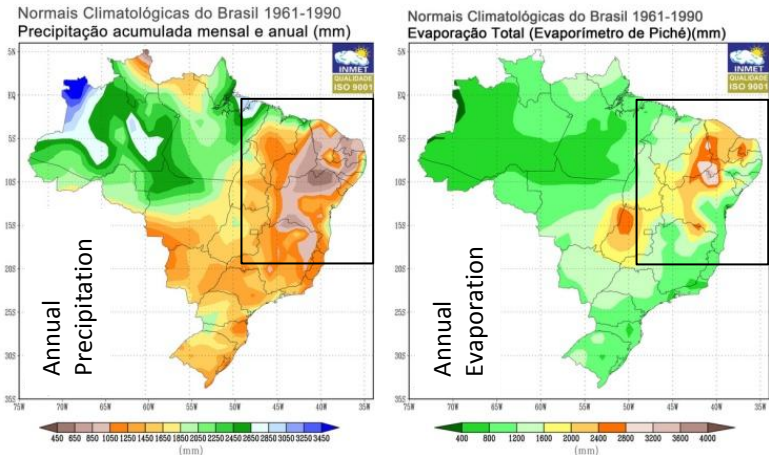
Seasonality of Orós Inflow



Seasonality of rain determined by N-S migration of the ITCZ

Rain Start: ITCZ reaches Southernmost (February)

Rain End: ITCZ migrates North of Equator (June-July)



Shallow soils, cristaline embasement which can frequently be seen at the surface, higher evaporation, a highly concentrated rainfall regime

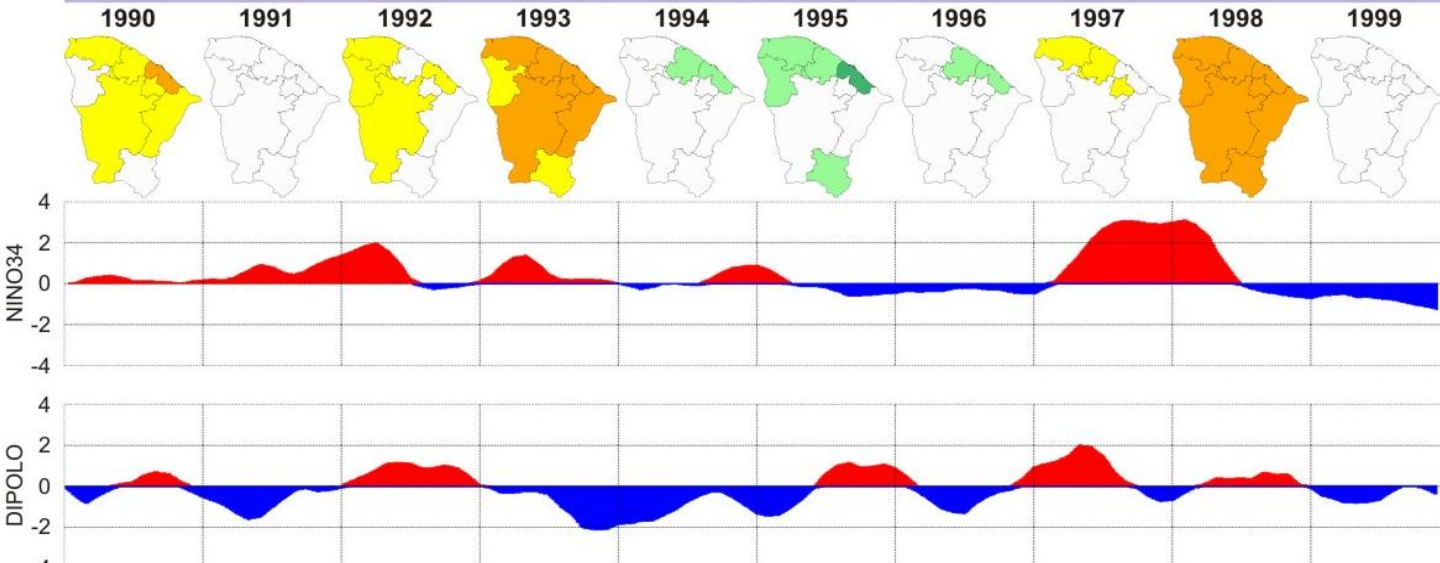


Ephemeral rivers: run during few months of the first semester

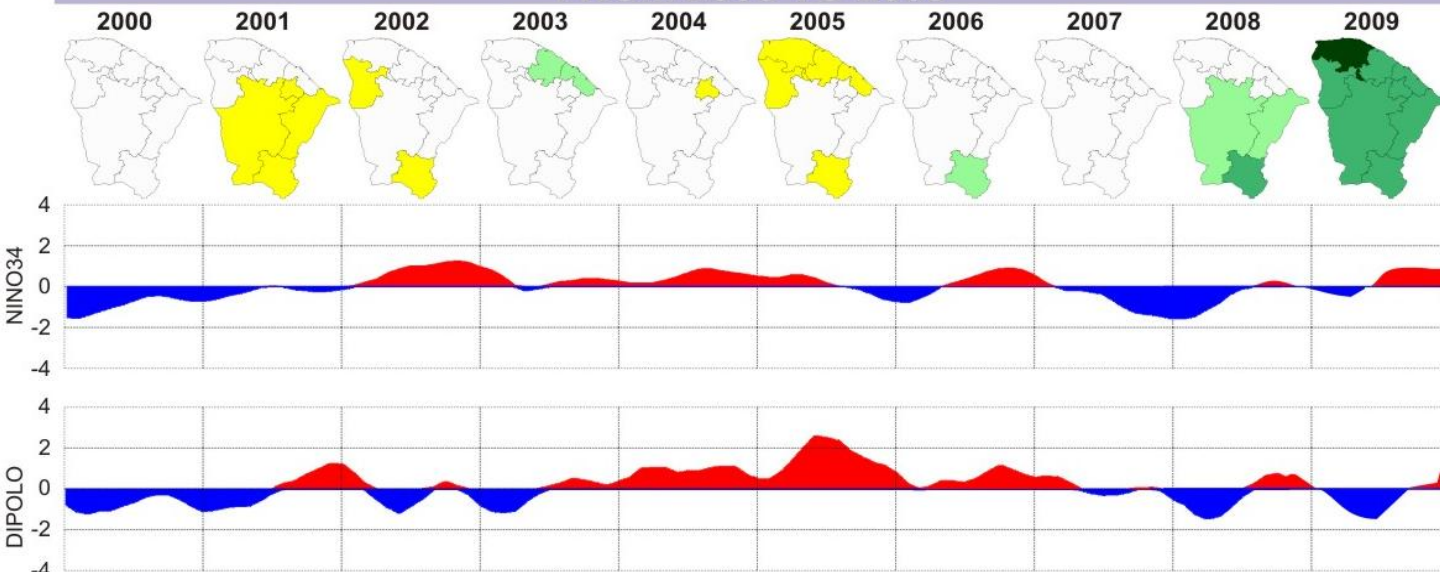


High Variability of Rainfall

FROM 1990 TO 1999



FROM 2000 TO 2009

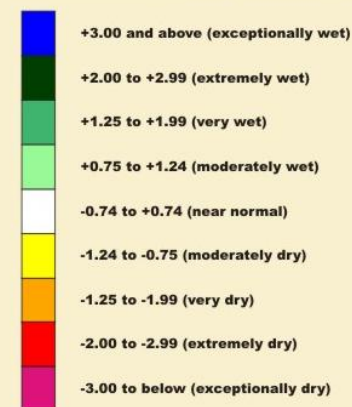


Regions

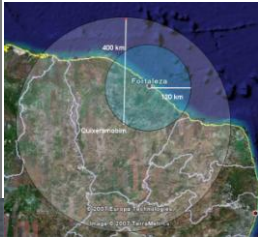
REGIONS OF THE STATE OF CEARÁ



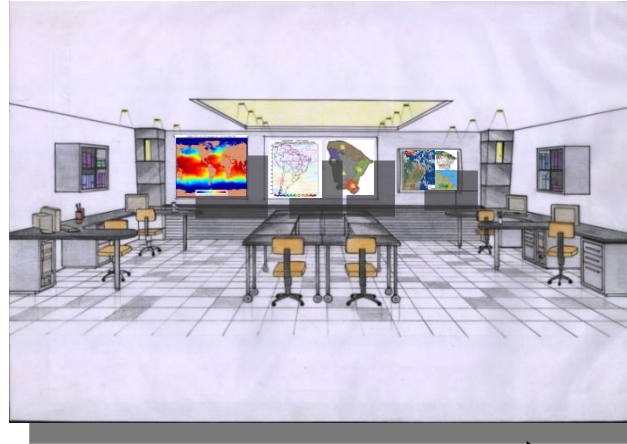
STANDARDIZED PRECIPITATION INDEX



FUNCEME Monitoring Center



S Band and X Band
Meteorological Radars
(FUNCEME)



METEOSAT Satellite Reception
(FUNCEME)



149 Reservoirs Data
(COGERH)



Tropical Atlantic Buoys Data
(Pirata Project)



550 Raingage Stations
(FUNCEME)

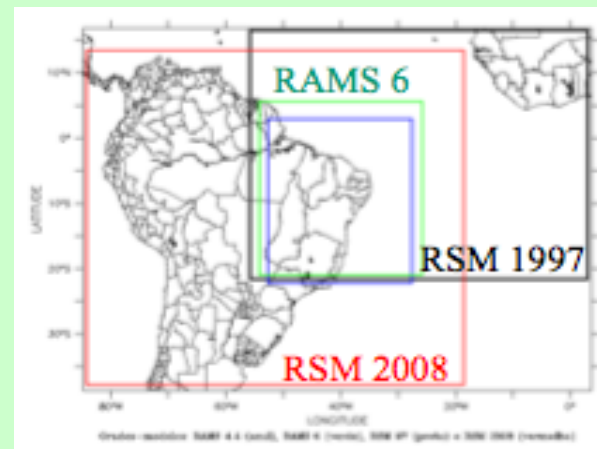


Meteorological DCPs
(84 stations)
(FUNCEME)



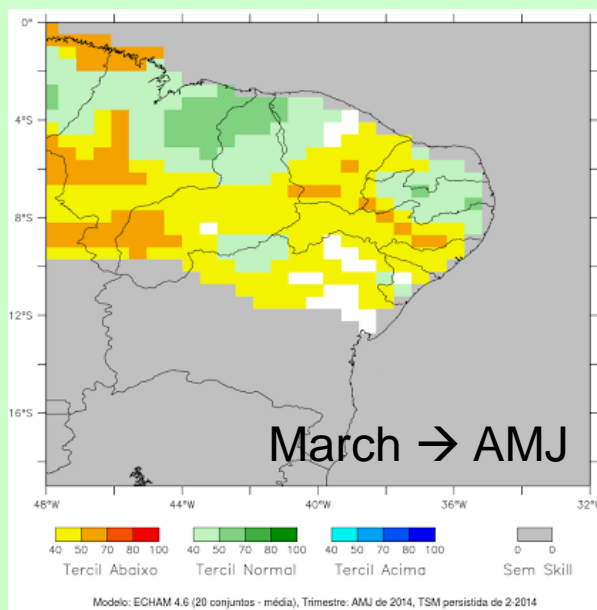
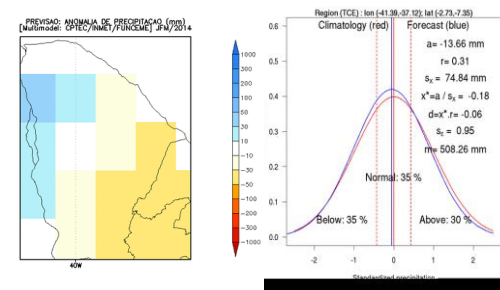
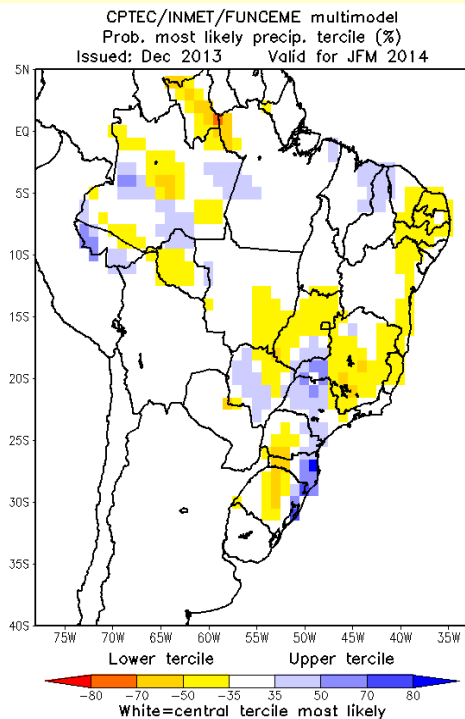
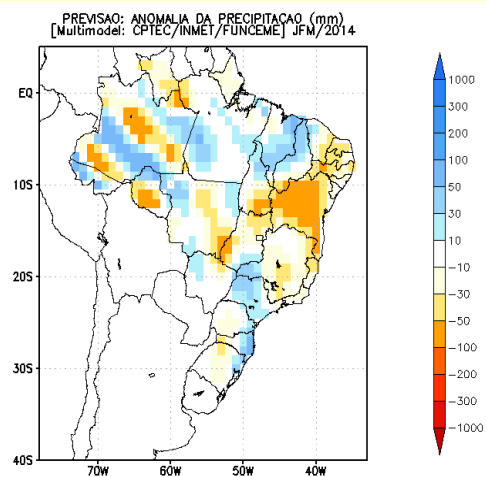
Climate Forecast System

4 Regional Climate Models (dynamical/statistical) + 1 (WRF 3.5) → MRM

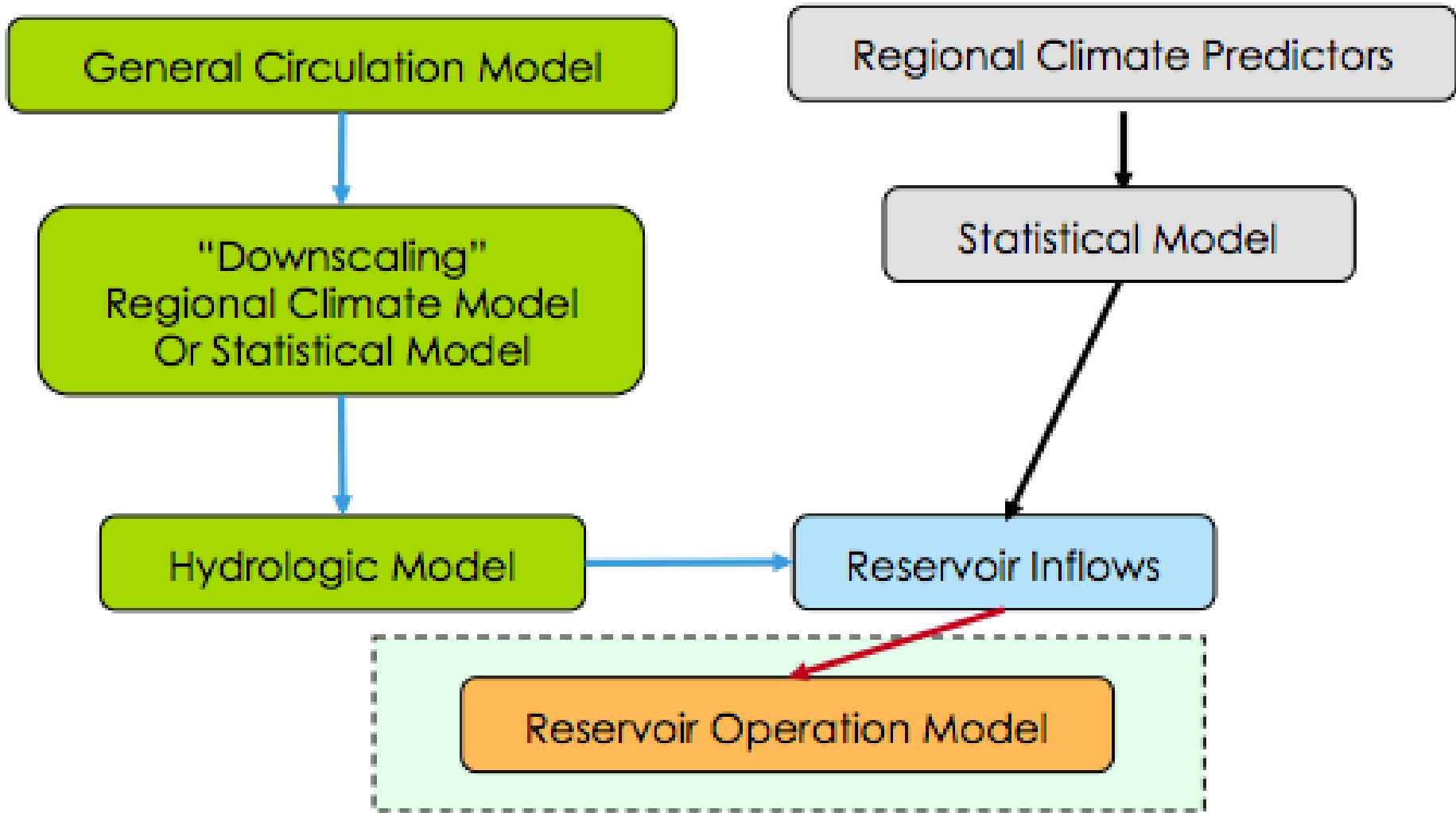


The state climate forecast includes:
 1. Global Climate Models ECHAM 4.6, CFSv2 +1 (CAM3)

Multi-ensemble: CPTEC/INPE (3GCMS), INMET & FUNCEME (ECHAM4.6)



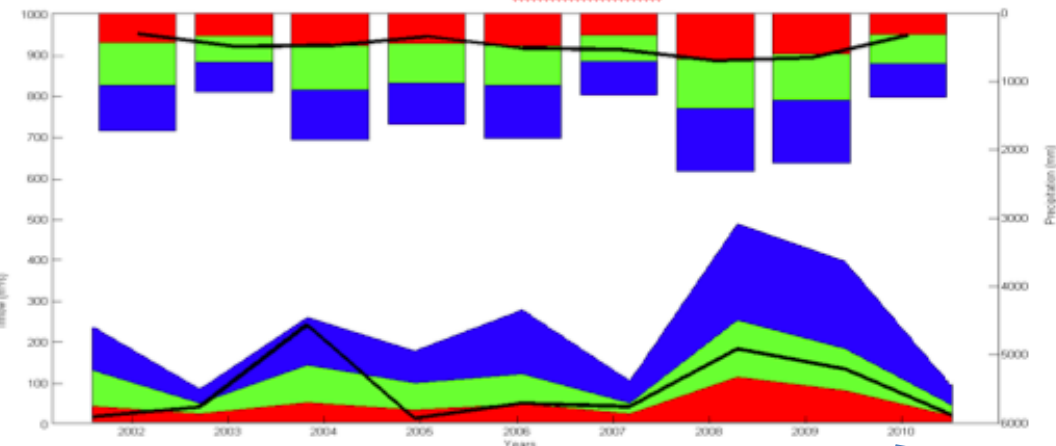
RESERVOIR INFLOW FORECASTS & WATER ALLOCATION





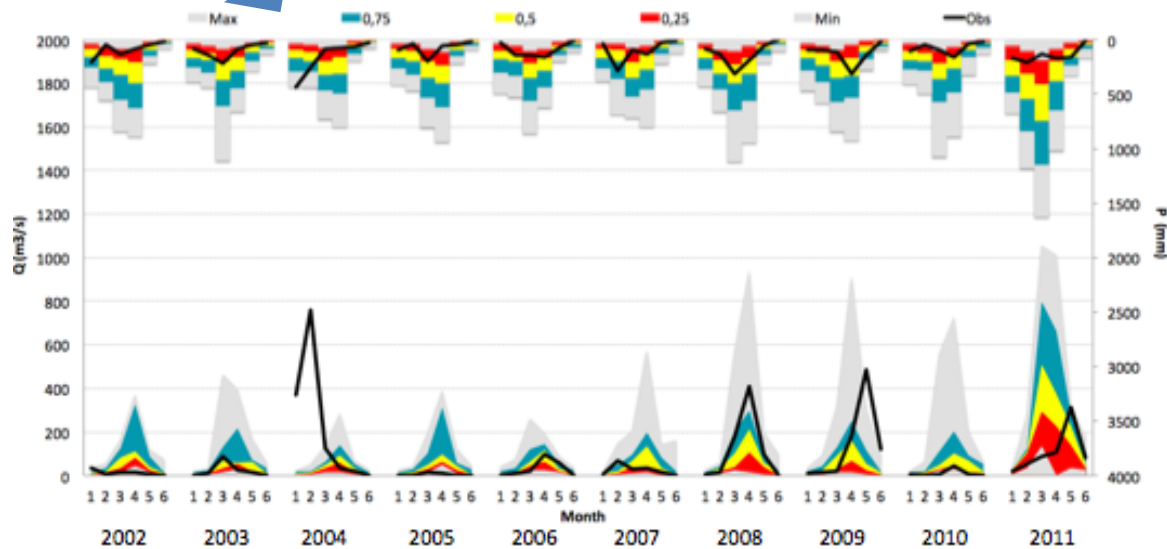
RESERVOIR INFLOW FORECASTS – DYNAMICAL MODELS

ORÓS Reservoir



OROS Reservoir

RSM – issued from Dec to Apr each Year
Precipitation, Inflow (forecast statistics and observed values)



Demand/Supply Scenarios Runs

SIGA - Integrated System for Management of Water Allocation

SIGA - C:\Users\funceme\Desktop\para o siga\Coema\Coema\coremas.siga

Arquivo Editar Exibir Ferramentas Ajuda

Novo Projeto Abrir Projeto Fechar Projeto Salvar Projeto Salvar Como... Carregar... Salvar... Executar Executar Todos Resultados Análise...

Módulos

Operação de Sistemas

Cenários

Método de Execução

- Simulador (Regras)
- Simulador - Janelas (Regras)
- Otimizador (Regras)
- Simulador (Prioridades)
- Simulador - Janelas (Prioridades)

Intervalo de tempo

Data	Hora
Início 14/04/2014	0
Final 14/04/2014	0

Cenário 04 - Cenário 01 - Cenário 02 - Cenário 3 - Cenário 4 - Cenário 5 - Cenário 6 - Cenário 7 - Cenário 8 - Cenário 9 - Cenário 10 - Cenário 11

Rede:



GCMS RESULTS FOR NE BRAZIL

Precipitation

Evapotranspiration

Aridity Index



1971-2000



2041-2070

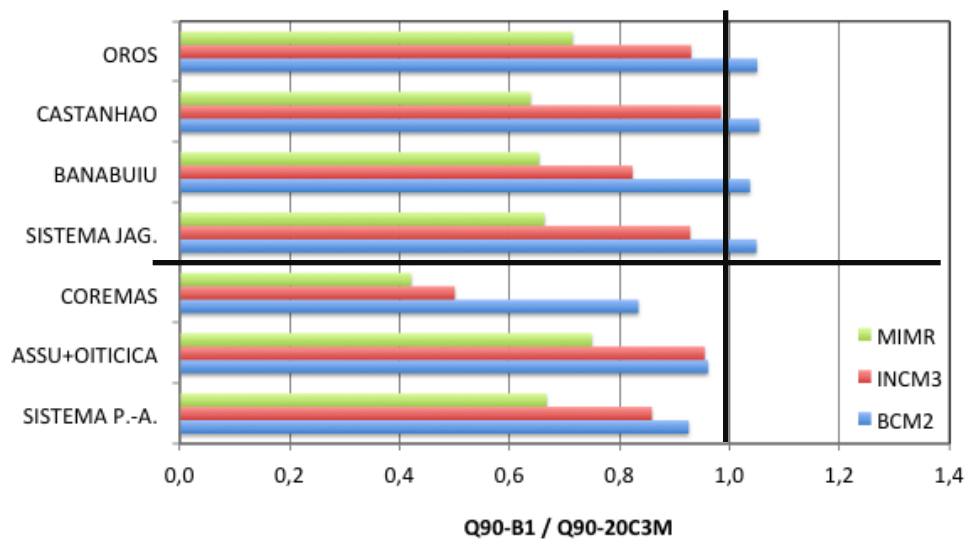
Precipitação: ■ 0 - 300 mm; ■ 300 - 600 mm; ■ 600 - 900 mm; ■ 900 - 1200 mm; ■ 1200 - 1500 mm; ■ 1500 - 1800 mm; ■ 1800 - 2100 mm; ■ 2100 - 2400 mm; ■ > 2400 mm.

Evapotranspiração Potencial: ■ 1300 - 1500 mm; ■ 1500 - 1700 mm; ■ 1700 - 1900 mm; ■ 1900 - 2100 mm; ■ > 2100 mm

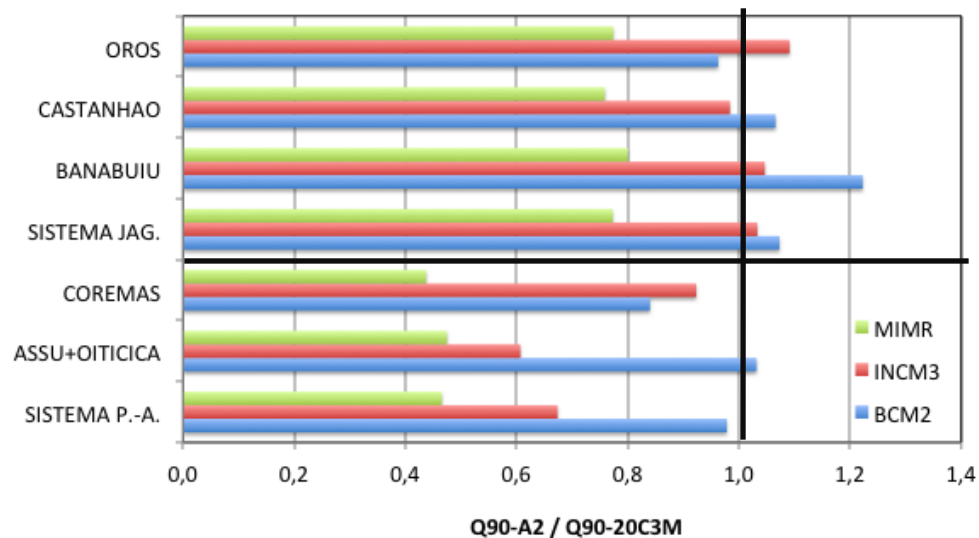
Índice de Aridez: Árido ■ 0,05 - 0,20; Semi-árido ■ 0,20 - 0,50; Sub-úmido Seco ■ 0,50 - 0,65; Sub-úmido Úmido ■ 0,65 - 1,00 e Úmido ■ > 1,00.

WATER ALLOCATION IMPACTS

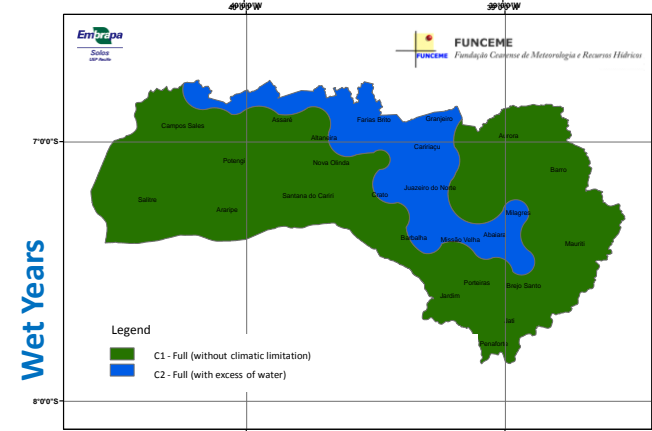
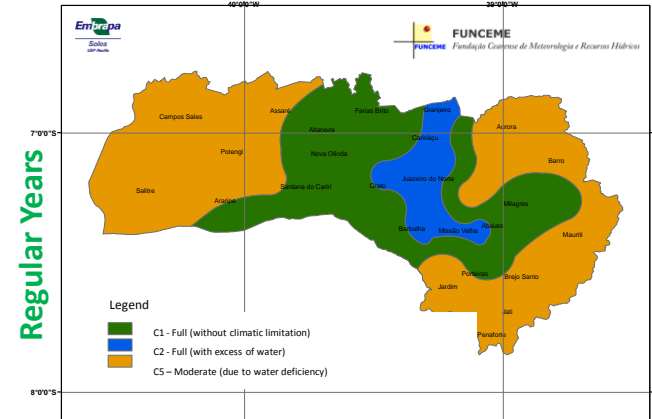
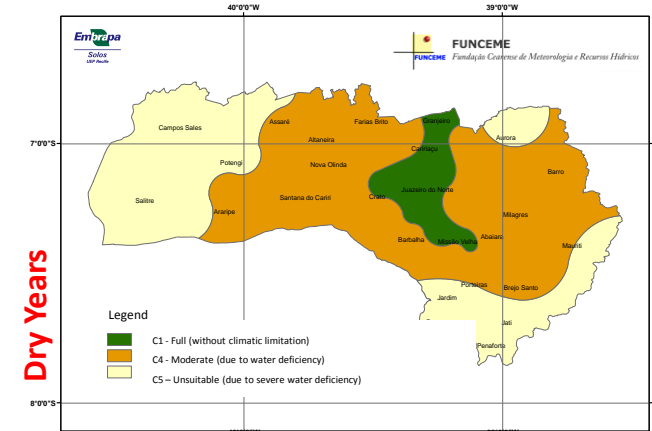
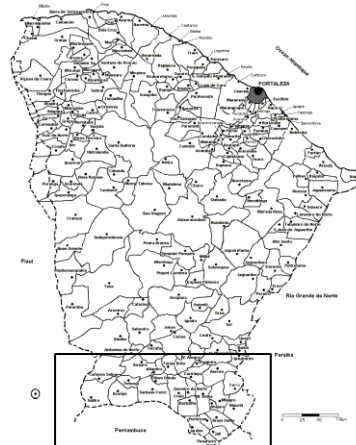
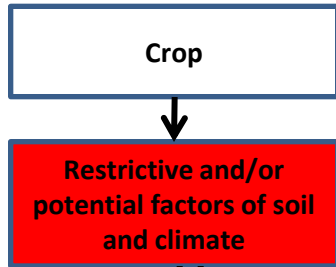
B1



A2

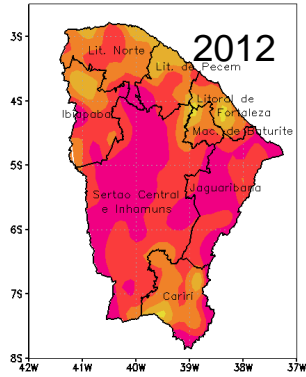


Pedoclimatic Suitability

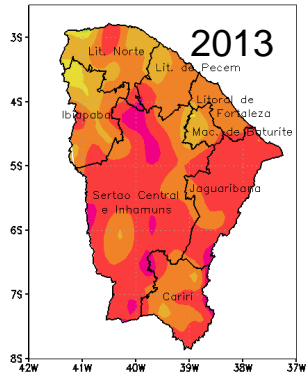


Drought Impact on Rainfed Agriculture

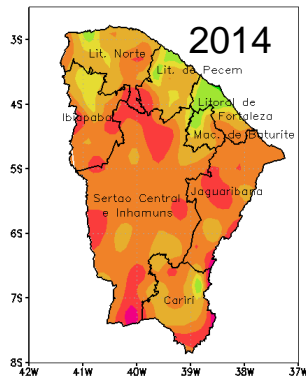
Total Duration of Dry Spells (days) - Jan to May



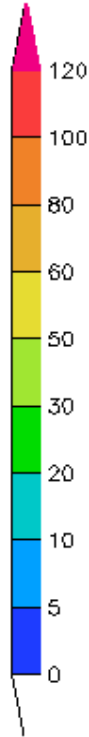
102 days



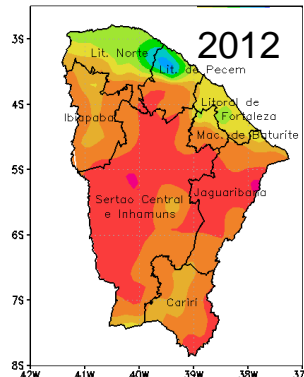
92 days



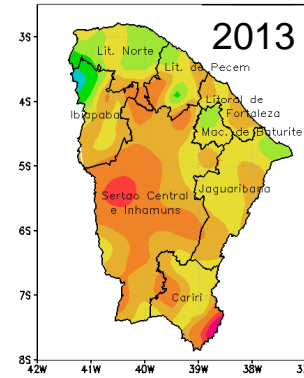
77 days



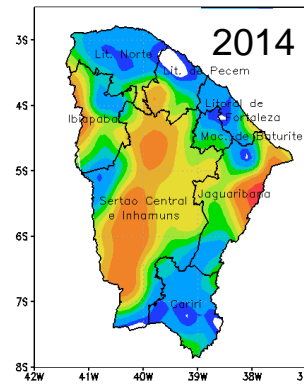
Crop Loss (%) - Jan to May



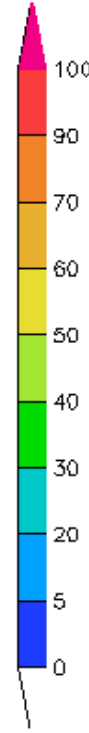
73%



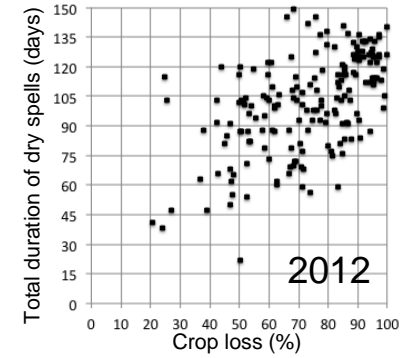
64%



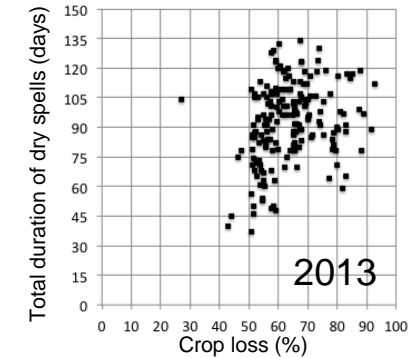
29%



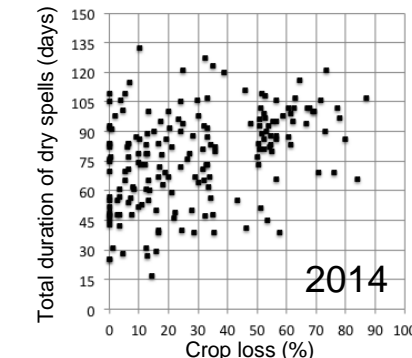
Total Duration of Dry Spells x Crop loss - Jan to May



2012

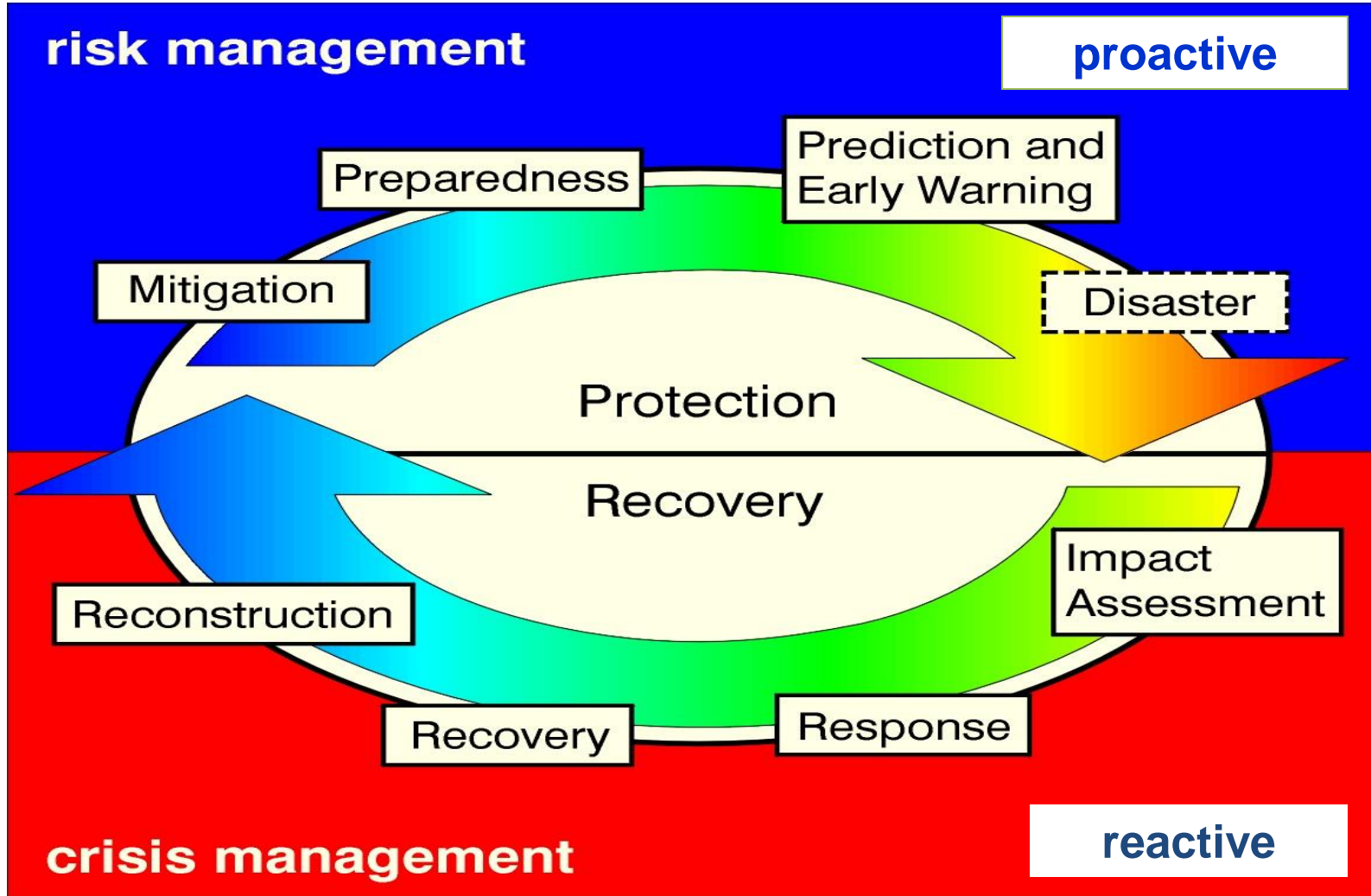


2013

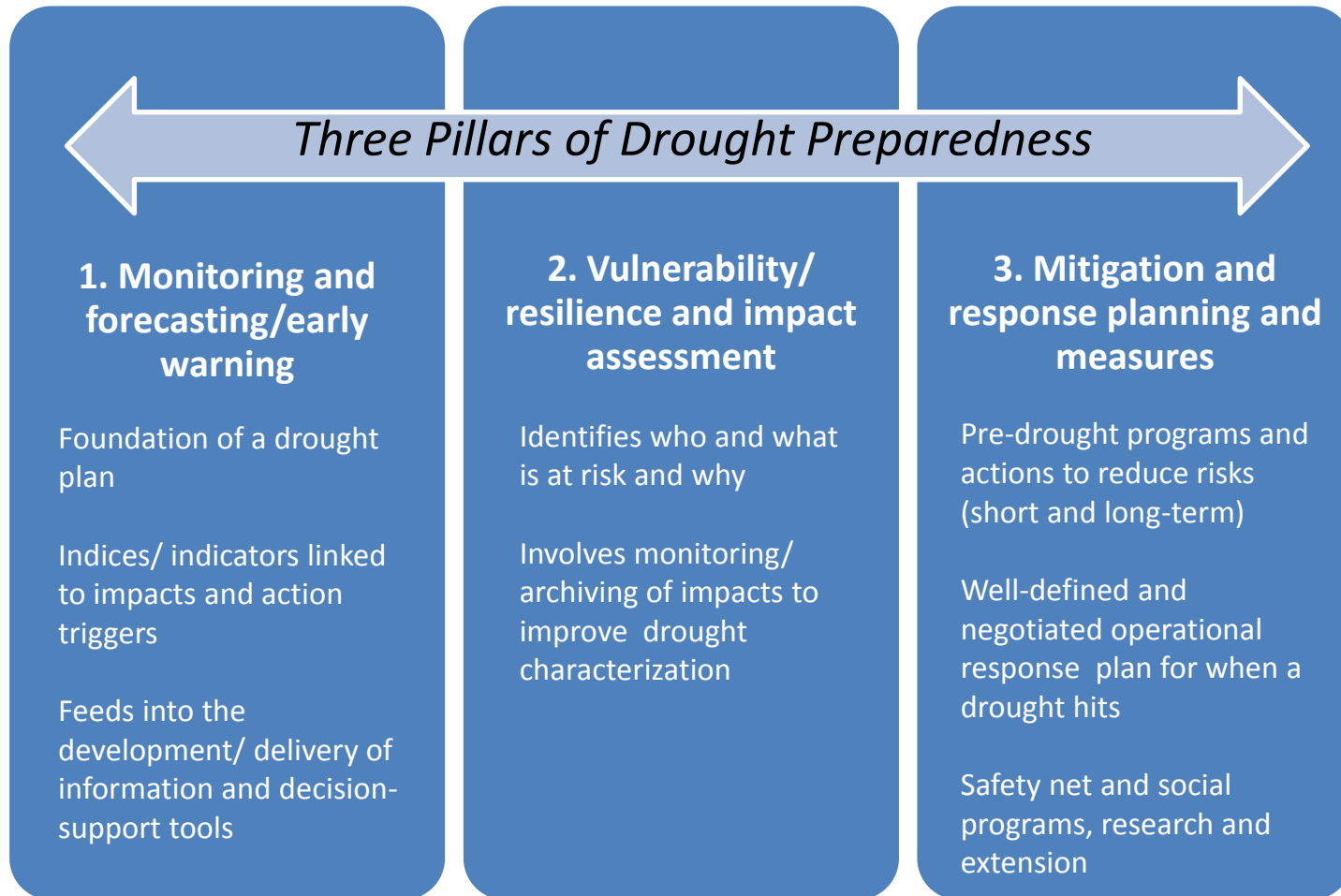


2014

Risk management increases coping capacity, builds resilience.



Crisis management treats the symptoms, not the causes.



Northeast Drought Monitor

INTEGRATION OF DATA BANK

AGRICULTURE

STATE MET SERVICES/ EMATERS

INMET/
 CONAB+CEMAD
 EN

MAPA

METEOROLOGY

INTEGRATION OF DATA BANK

ANA

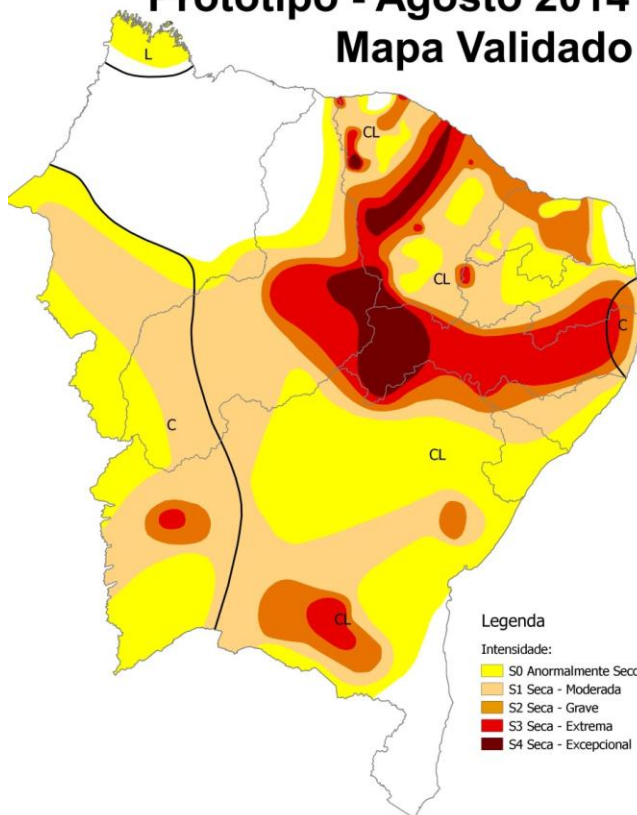
CEMADEN

CPTEC

INMET

STATE MET SERVICES

**Monitor de Secas do Nordeste
 Protótipo - Agosto 2014
 Mapa Validado**



- 5 categories of drought
- Initial frequency: **monthly**
- **Integration of data:** meteorological, hydrological and agricultural
- Participatory and collaborative tool
- **Local validation**

Category	Percentile	Description	Possible Impacts
S0	30 %tile	Abnormally dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered
S1	20 %tile	Moderate drought	Some damage to crops, pastures; streams, reservoirs, or wells low, some water shortages developing or imminent; voluntary water-use restrictions requested
S2	10 %tile	Severe drought	Crop or pasture losses likely; water shortages common; water restrictions imposed
S3	5 %tile	Extreme drought	Major crop/pasture losses; widespread water shortages or restrictions
S4	2 %tile	Exceptional drought	Exceptional and widespread crop/pasture losses; shortage of water in reservoirs, streams, and wells creating water emergencies

ANA

CEMADEN

CPTEC

STATE WATER AGENCIES

WATER RESOURCES

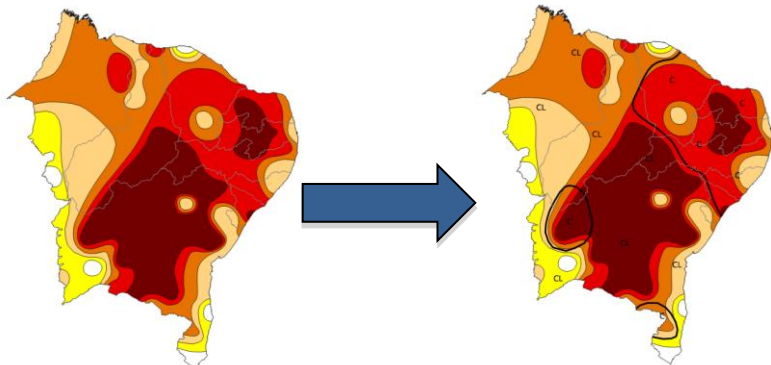
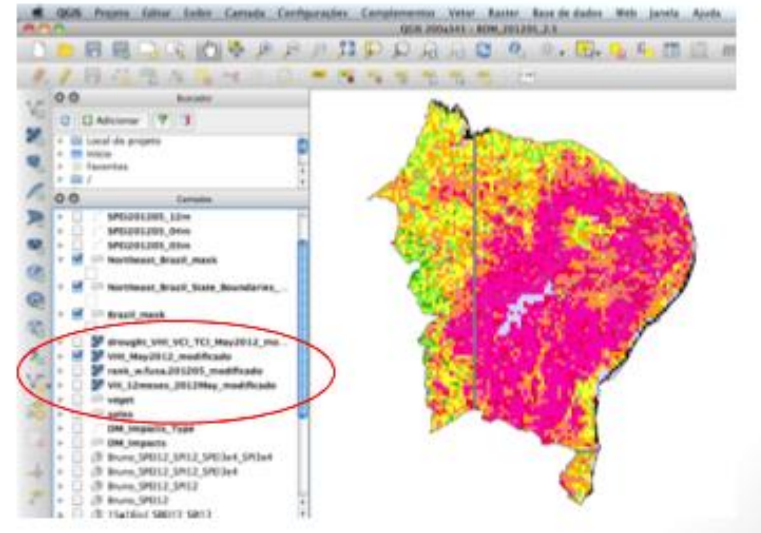
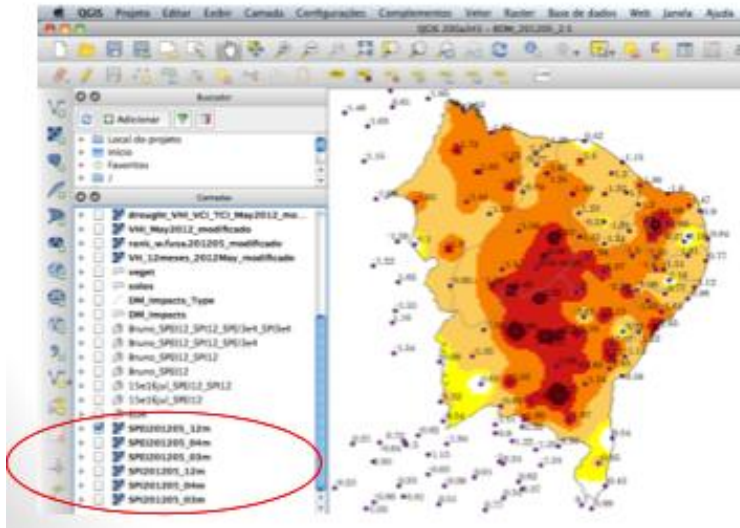
INTEGRATION OF DATA BANK

Main Indicators (12, 4 and 3 months):

- SPEI (Standardized Precipitation Evapotranspiration Index)
- SPI (Standardized Precipitation Index)

Information to support decision:

- Soil moisture (Calculated Soil Moisture Ranking Percentile – Monthly CPC/NOAA)
- Vegetation Index (Vegetation Health Index – VHA – NESDIS/NOAA)
- Precipitation (accumulated and anomaly)

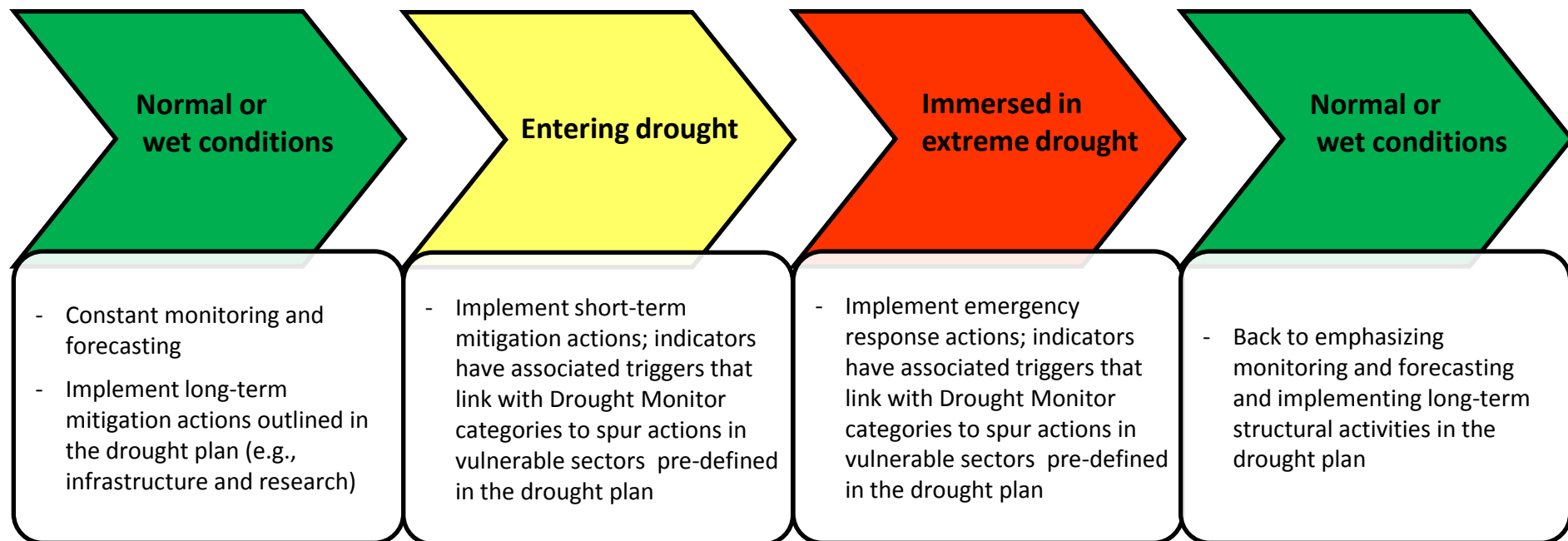


Map generated with
 SPEI12+ SPI12 +
 SPEI 3 and 4 + SPI 3 and 4

Map generated with SPEI12+
 SPI12 + SPEI 3 and 4 + SPI 3
 and 4 + impact indicators



Planning for drought preparedness and how public policy actions and contingency are triggered by the categories indicated in the Monitor



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Thank you!



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