

Extremes and CEOP: *Some initial thoughts*

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Background

Some of CEOP's key features include:

- Focus on a particular period
- 'Ready' access to a variety of information

CEOP's scientific effort is concerned with the water cycle:

- Fluxes and reservoirs over land
- Monsoon circulations

Perhaps it is a good opportunity to consider extremes:

- A critical issue
- CEOP's key features should allow for an efficient effort
- Some work is already being conducted

OBJECTIVE AND FOCUS

An original GEWEX Hydrometeorology Panel Objective:

- What feedback mechanisms affect the water cycle and how do these influence wet and dry periods?

A 'Working Version' Objective for consideration in CEOP 2:

- To advance our understanding of extremes including their occurrence, characteristics, evolution and inter-connections

The focus is primarily on:

- Drought
- Extended period of precipitation (of order 1 - few days)
- ...

Extremes and CEOP

Focus on extremes during CEOP

Approach:

- **Determine the occurrence of extremes**
- **Examine some of these extremes individually**
- **Relate to each other as well as to the overall water cycle**

Benefits:

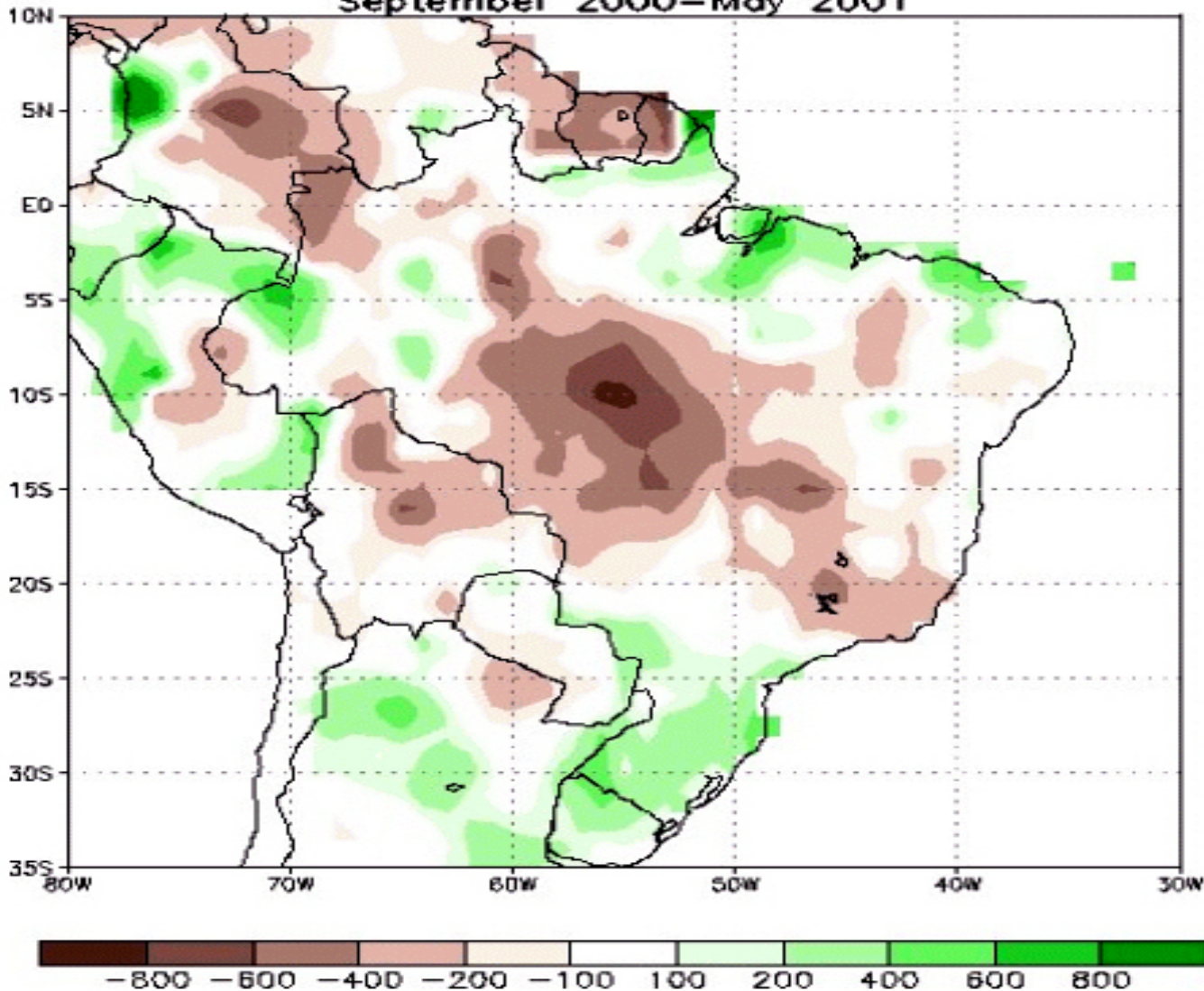
- **Efficient process since using many of same datasets**
- **Hands-on experience with carrying out such studies**

RECENT EXTREMES

A Few Illustrations

Into summer 2001

Precipitation Anomalies (mm)
September 2000–May 2001



Prolonged dry period

95% of energy in
Brazil is hydropower:
Power shortages!

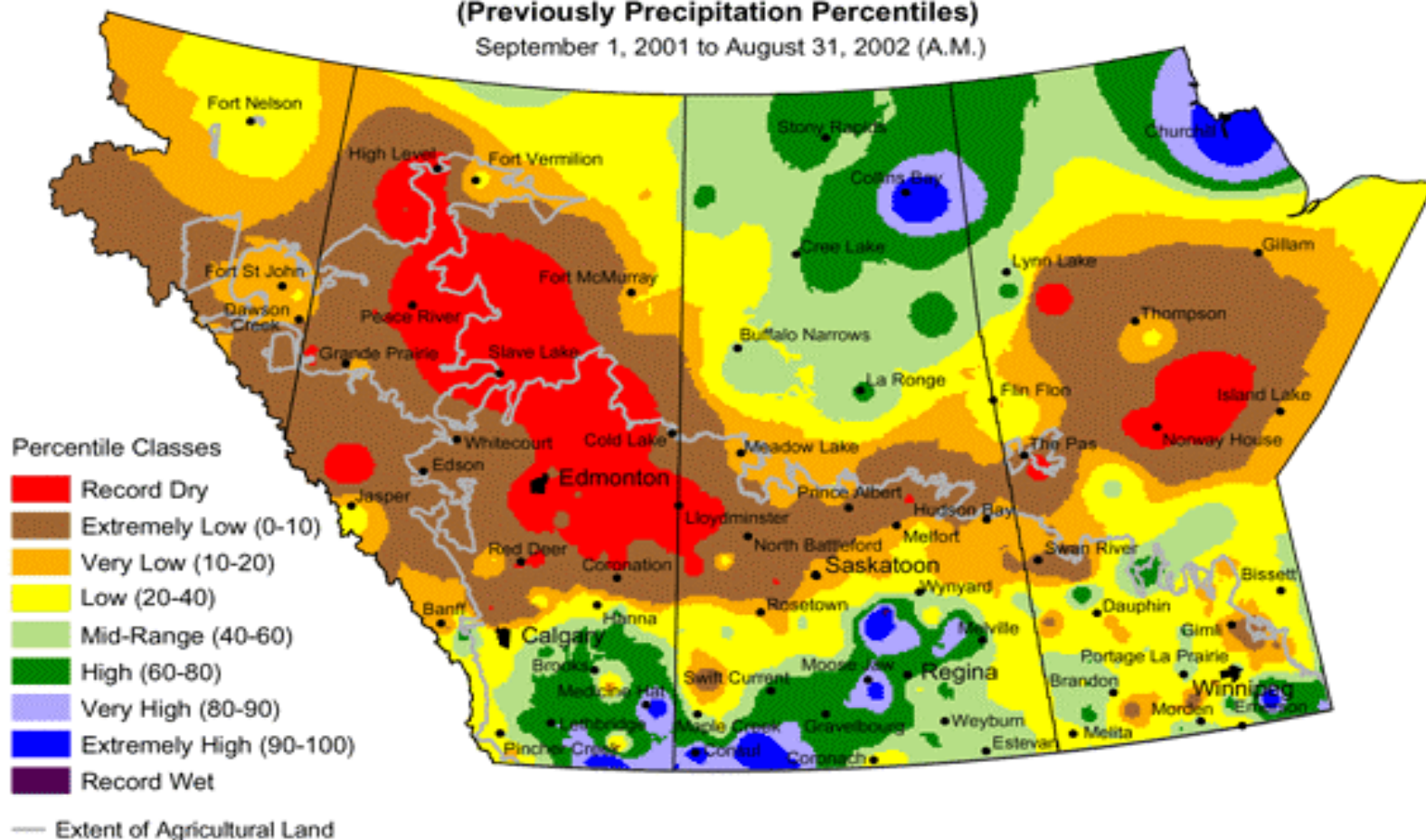
CANADIAN PRAIRIES

2002

Current Precipitation Compared to Historical Distribution

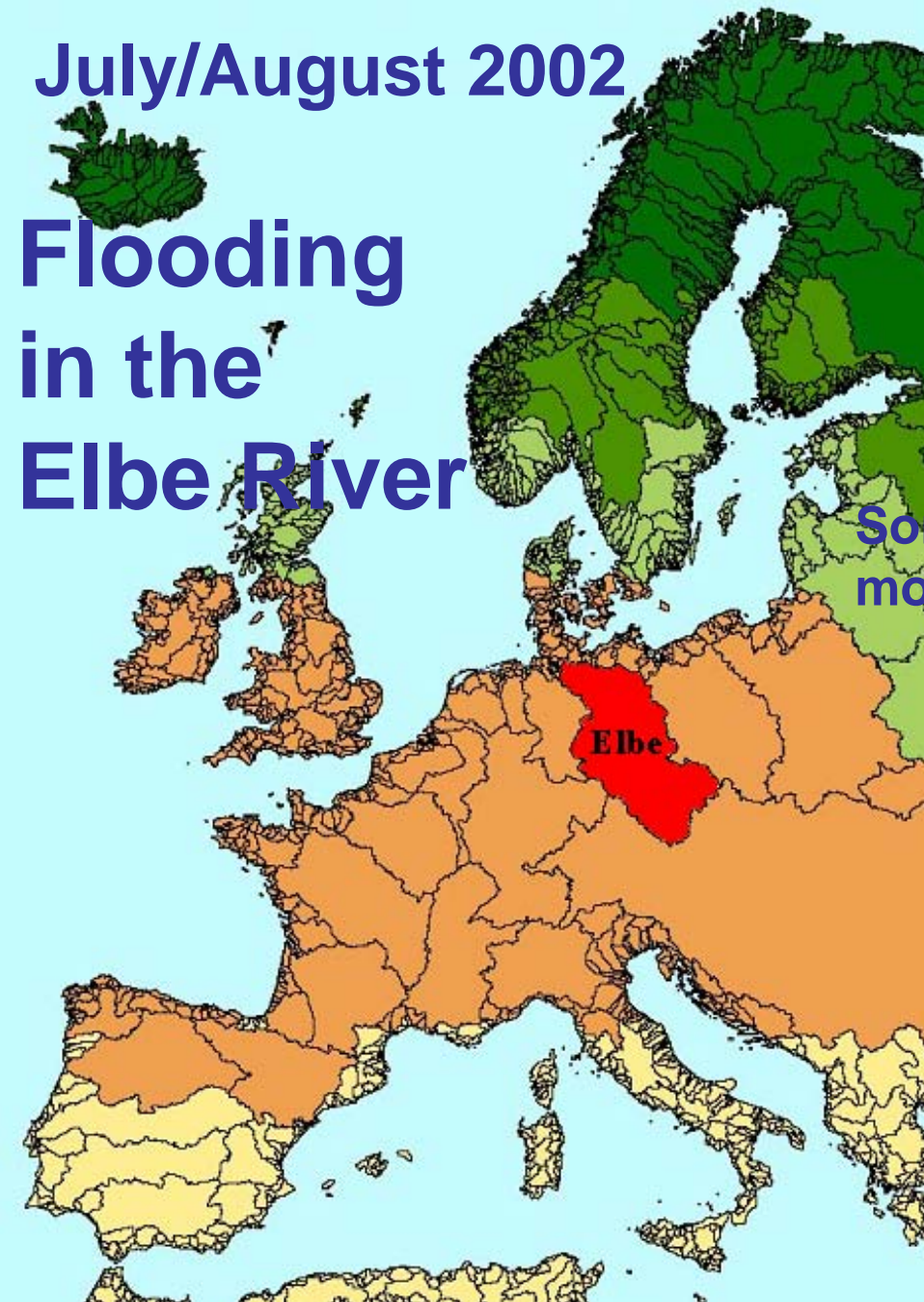
(Previously Precipitation Percentiles)

September 1, 2001 to August 31, 2002 (A.M.)



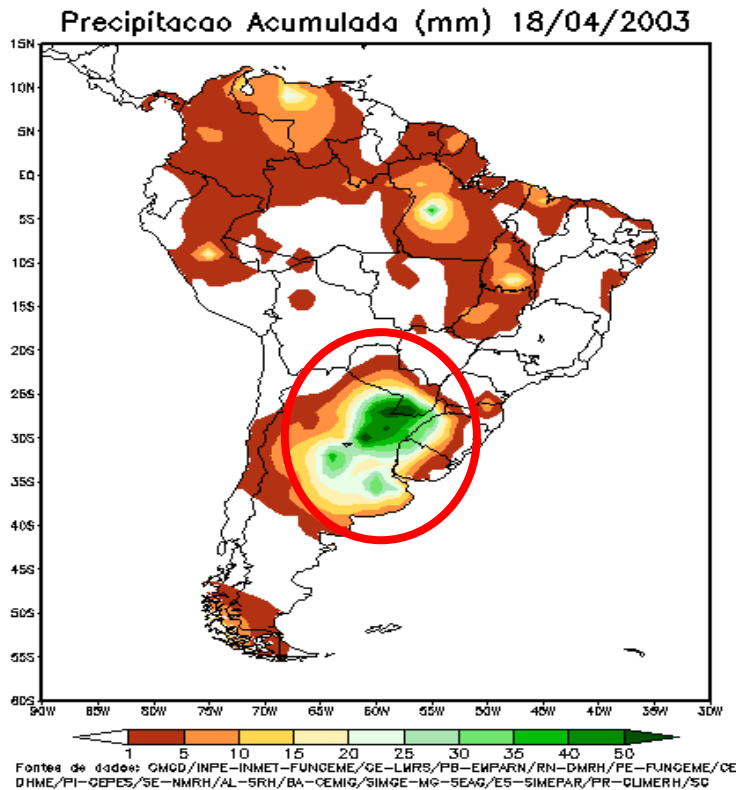
July/August 2002

Flooding in the Elbe River



Some stations had 300% of
monthly rain within 24 h





2003

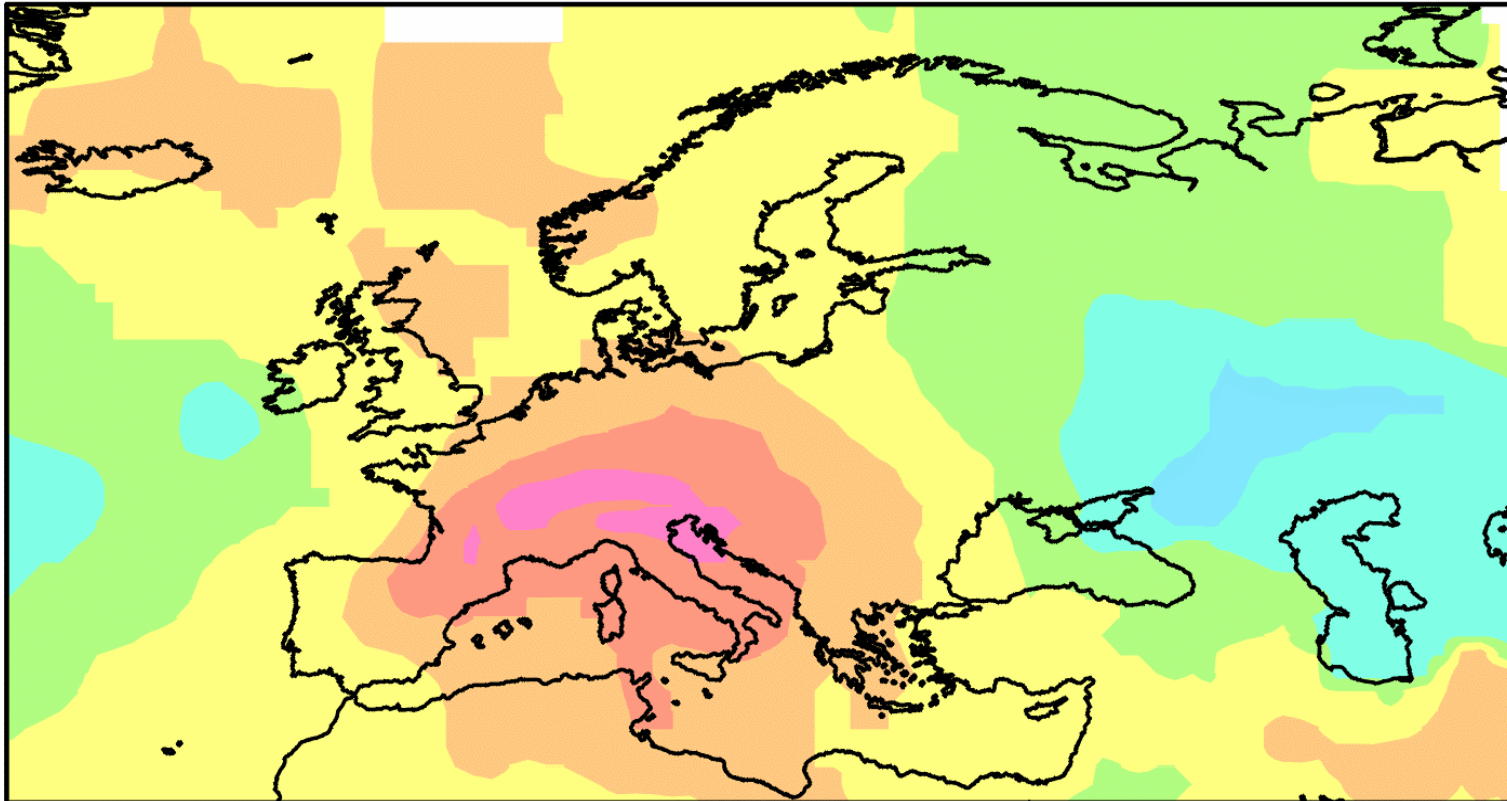
**Forecast of extreme rainfall and floods in
Santa Fe-Argentina**

**Eta/CPTEC 40 km
April 15 2003**

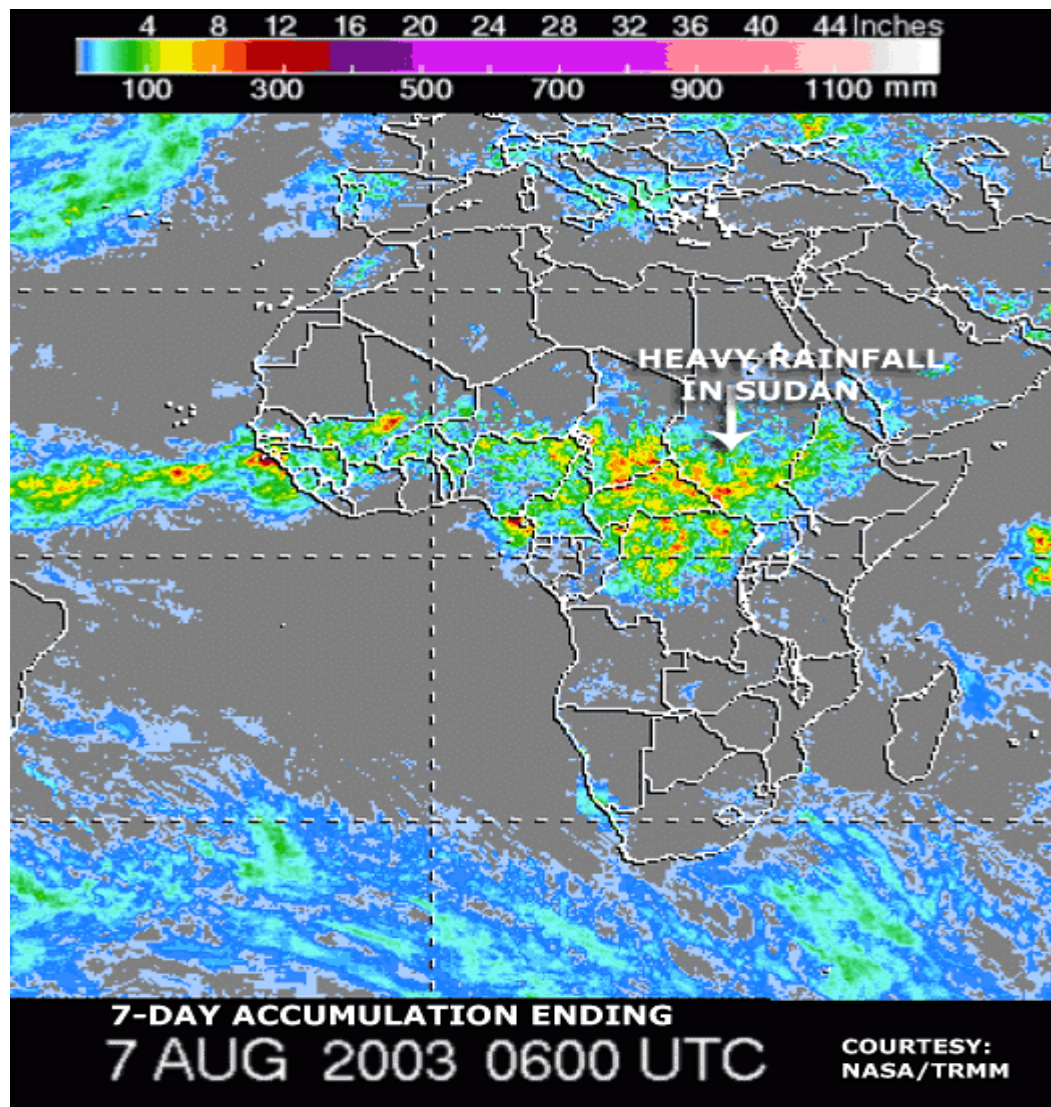


President Duhalde said that "there is no system that can anticipate events that happen every 400 years".

Heat Wave (June – August 2003)



AFRICAN FLOODS 2003



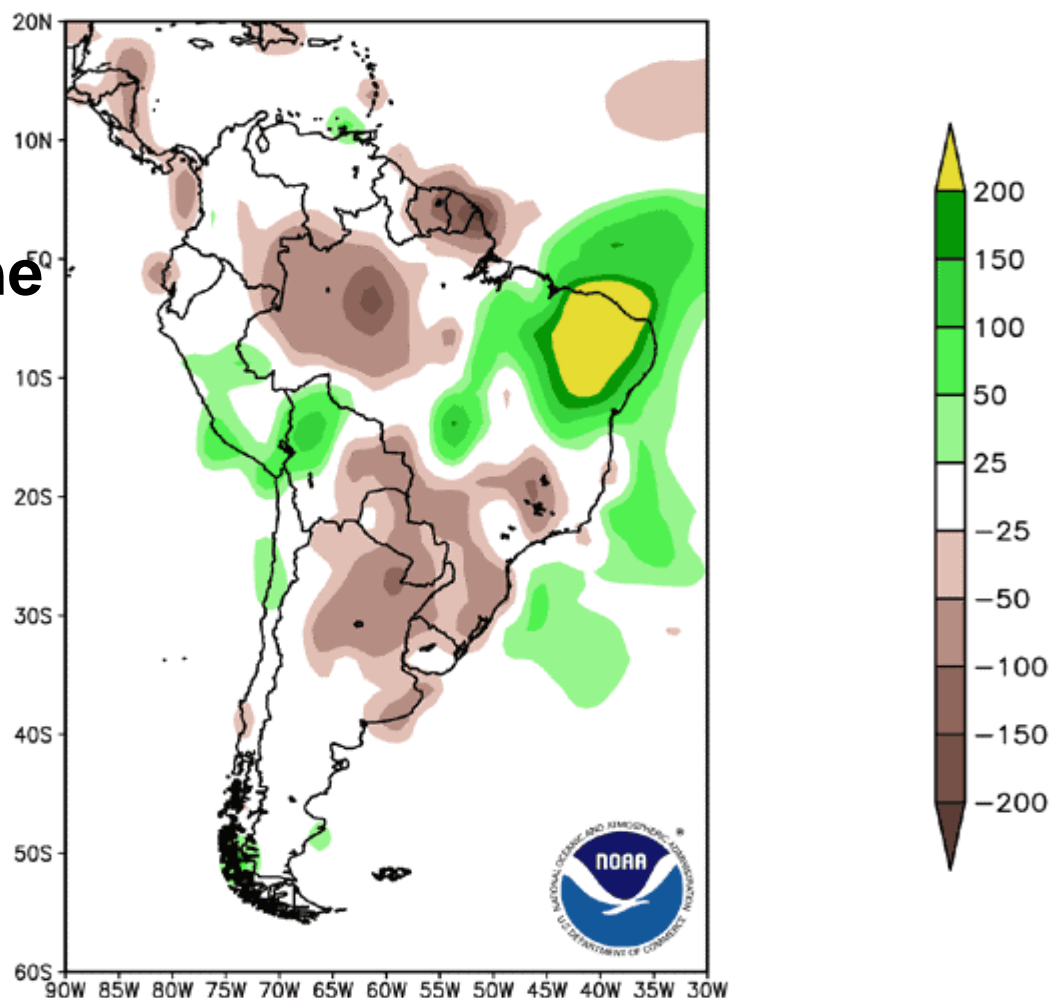
**Worst flooding
in 70 years in some
regions**

BRAZIL

January 2004

CAMS Precipitation Anomalies (millimeters) for Jan 2004
Base Period is 1979–1995

**Some regions
experienced the
heaviest rains
since 1910**

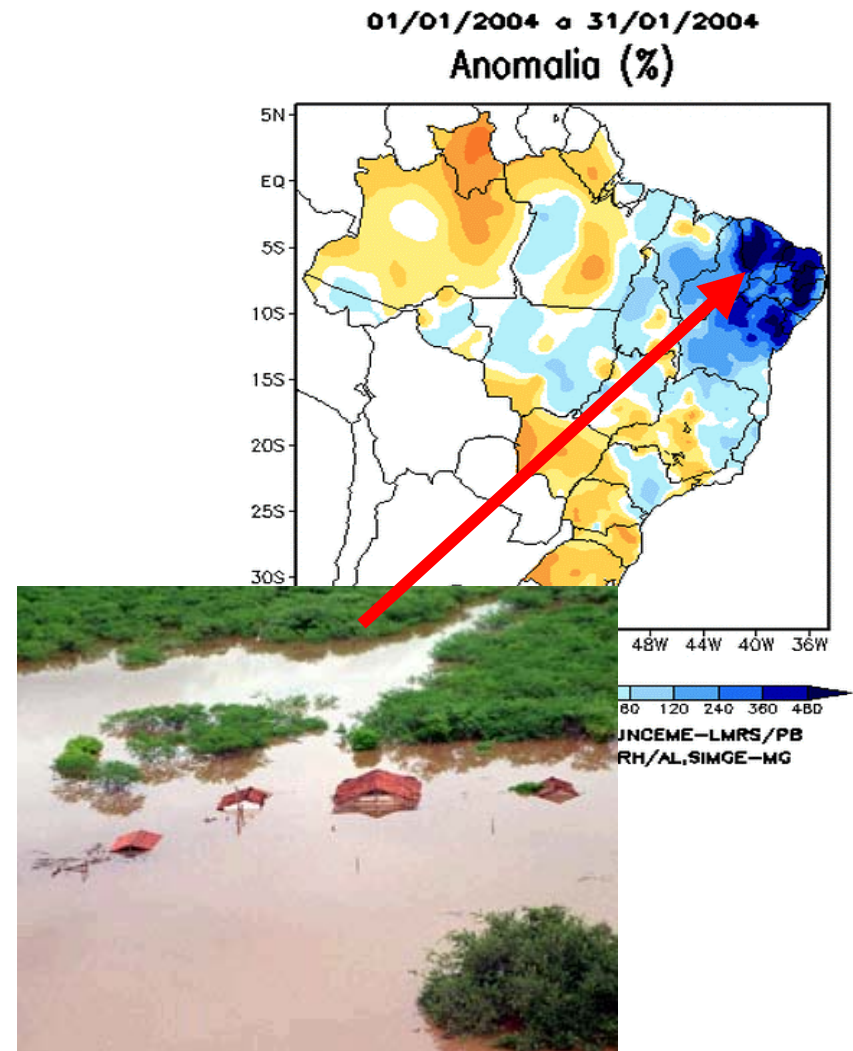


2001 versus 2004 in NE Brazil

Dry summer 2001 in NE Brazil

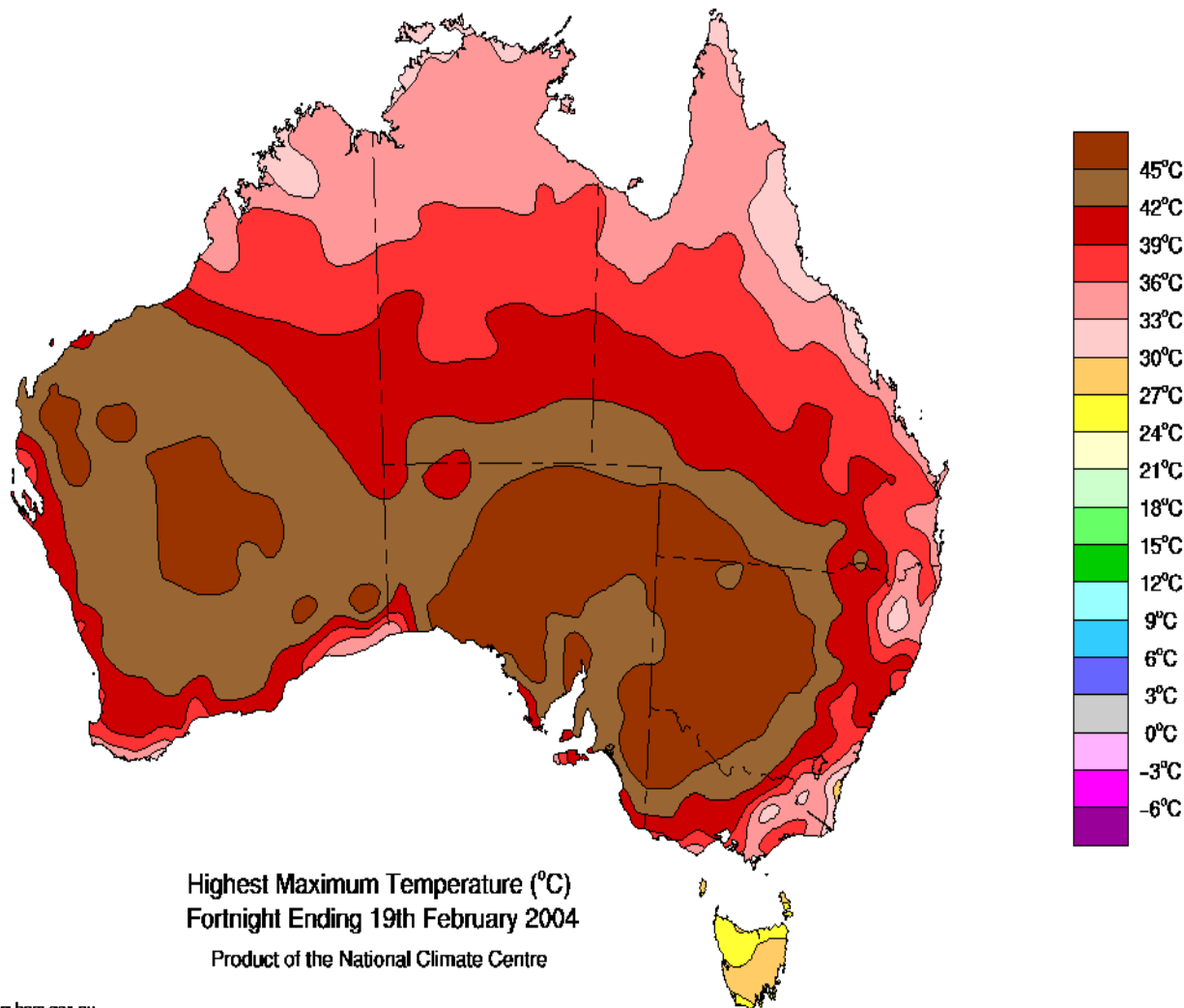


600% of rainfall above the normal in NE Brazil during January 2004



AUSTRALIAN HEAT WAVE

February 2004

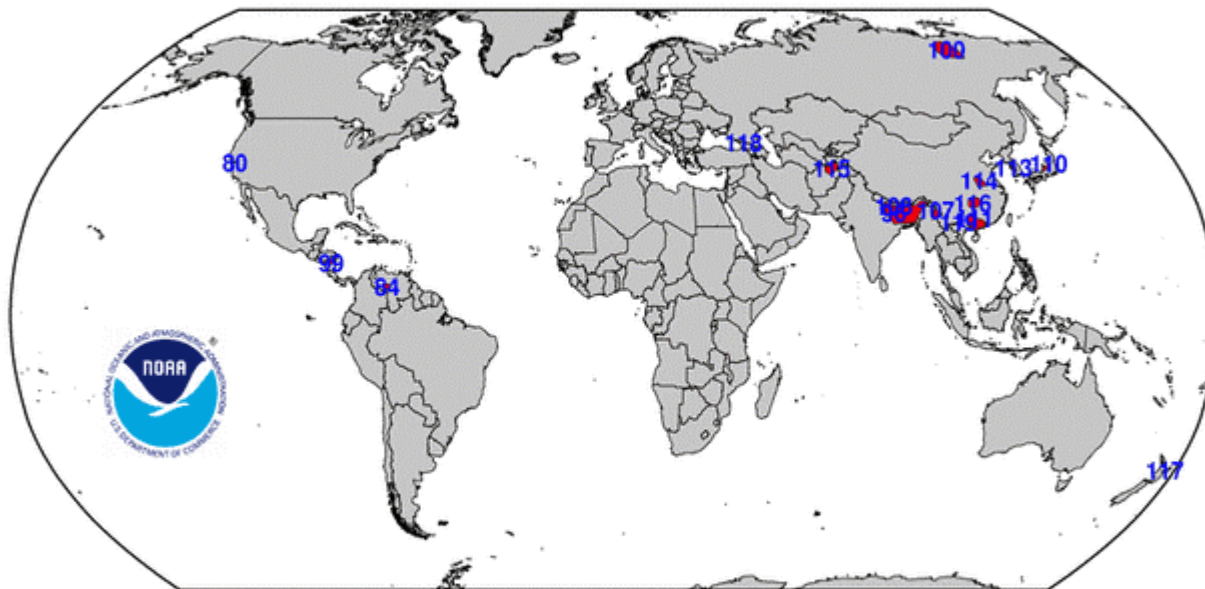


One of the most
intense heat waves
in a century

ASIAN FLOODS

July 2004

Areas Affected by Flooding
For The Week Ending July 24, 2004



Data provided by Dartmouth Flood Observatory

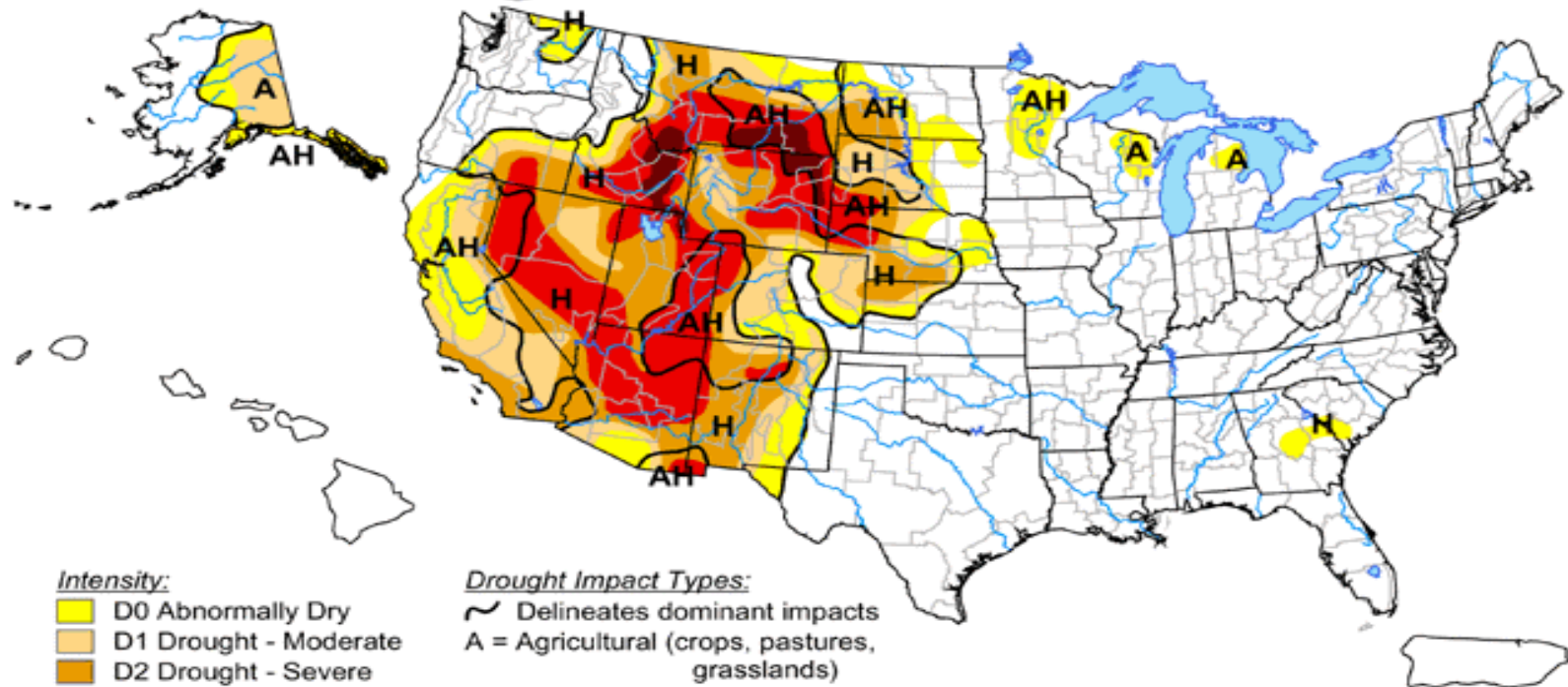
See <http://www.dartmouth.edu/~floods/Archives>
for a description of numbered flood events

US DROUGHT

August 2004

U.S. Drought Monitor

August 31, 2004
Valid 8 a.m. EDT



Intensity:

- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

Drought Impact Types:

- Delineates dominant impacts
- A = Agricultural (crops, pastures, grasslands)
- H = Hydrological (water)
- (No type = Both impacts)

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

<http://drought.unl.edu/dm>



Released Thursday, September 2, 2004

Author: David Miskus, JAWF/CPC/NOAA



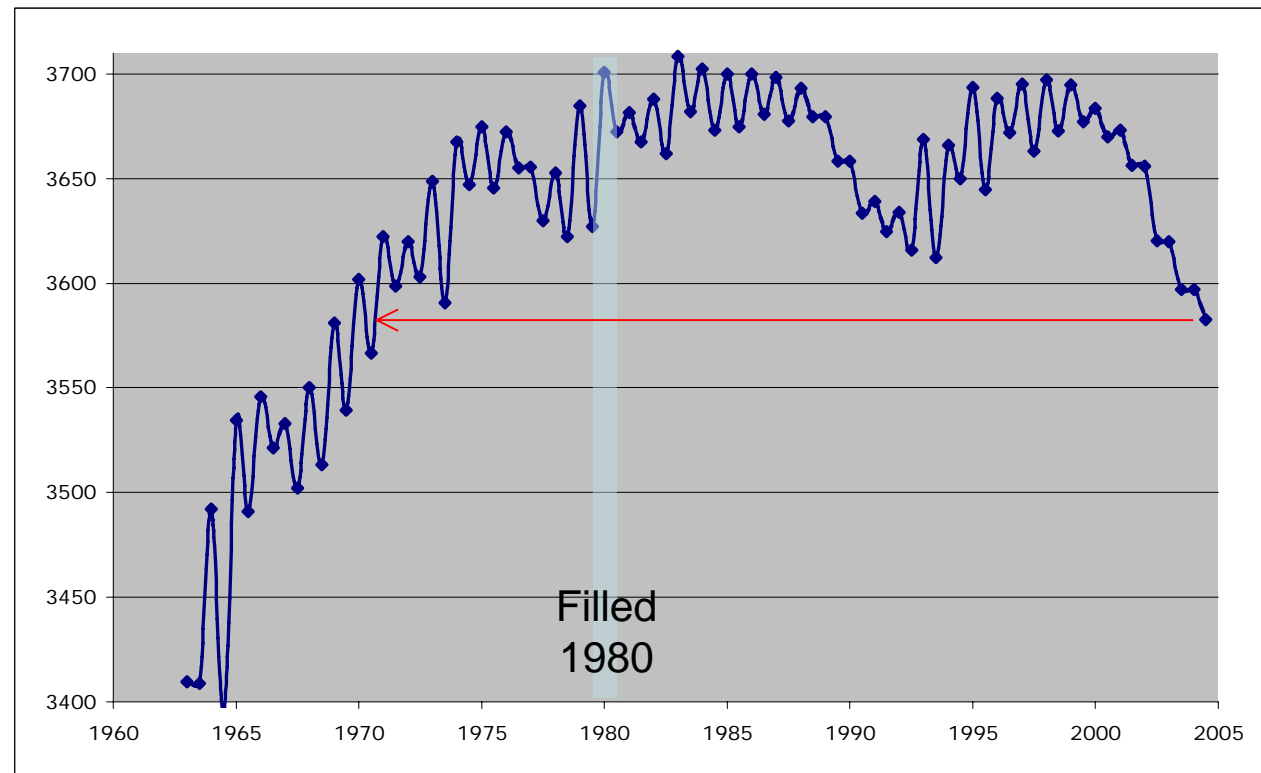
Severe Hydrological deficits

- *Lake Powell is at 40% capacity*
- *Lake levels have dropped ~ 120 feet*
- *Reservoirs above Lake Powell are currently at 60% of capacity*
- *Net flow of water for WY 2004 to date is 58% of average.*

Glen Canyon Dam

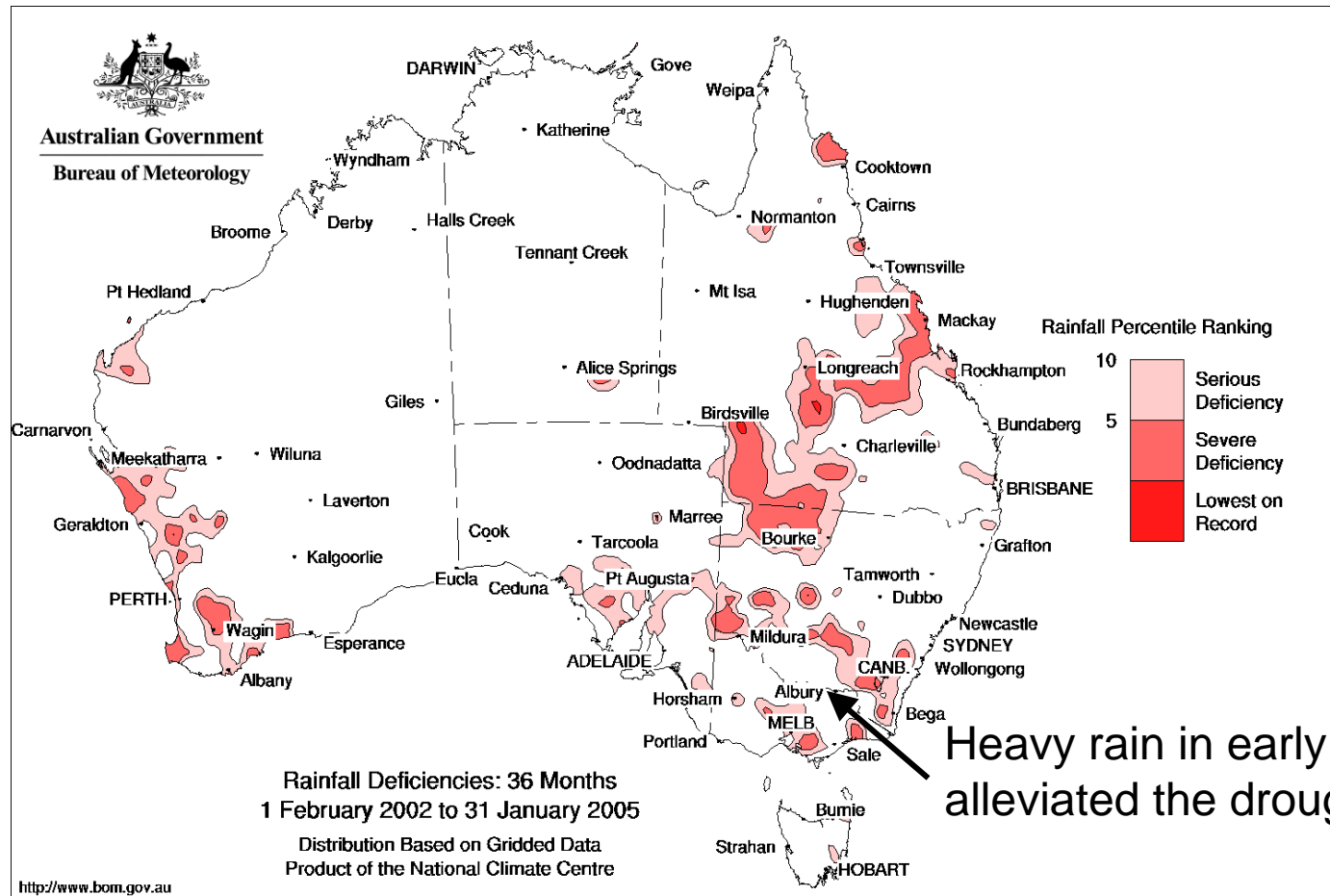


Lake Powell Water Level (ft)



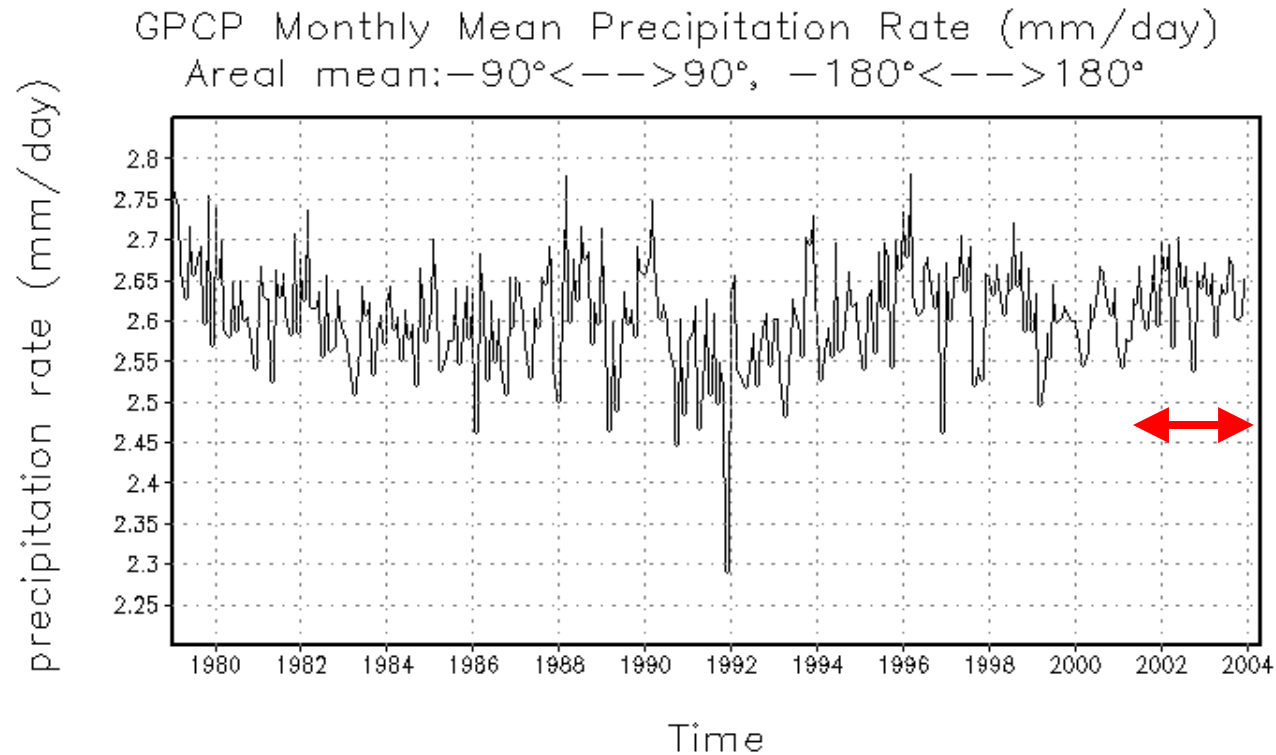
AUSTRALIAN DROUGHT

Feb 2002 – Jan 2005 Rainfall



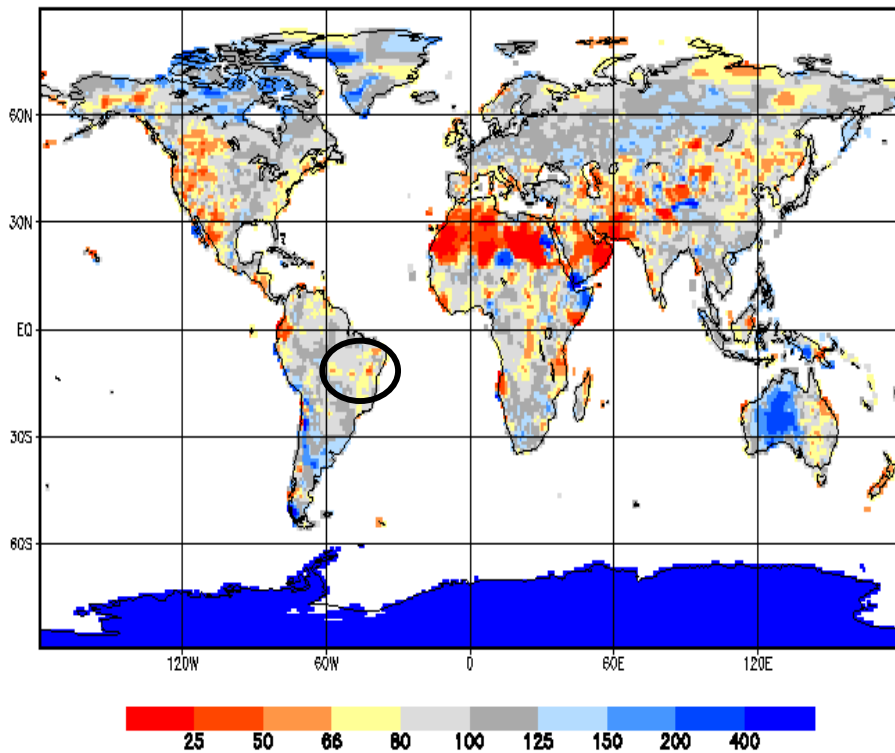
GLOBAL SYSTEM AND EXTREMES

GLOBAL PRECIPITATION



2001

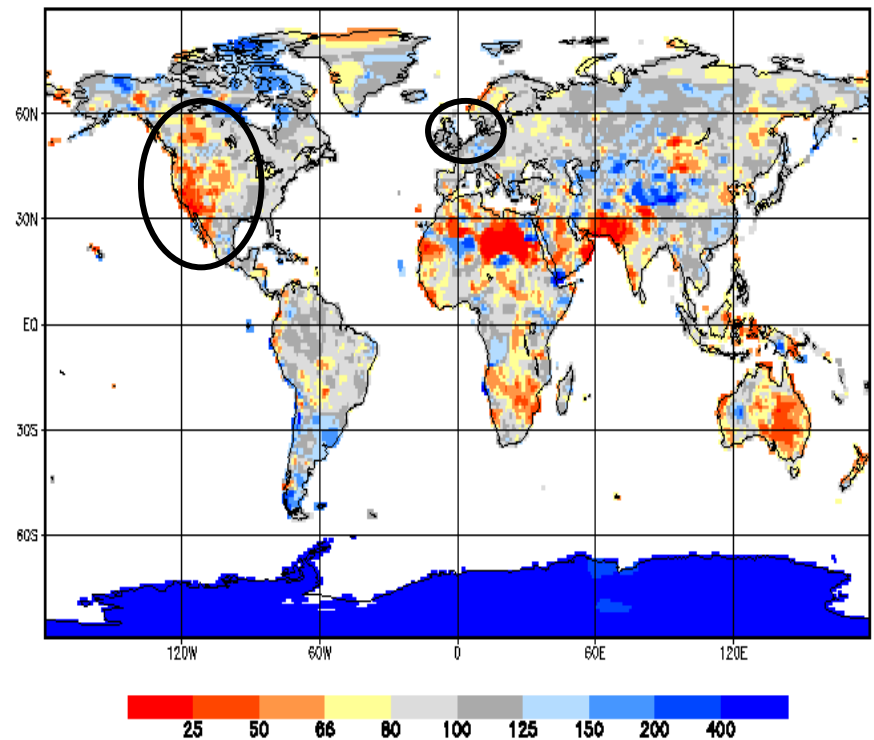
GPCC Monitoring Product Gauge-Based Analysis 1.0 degree
precipitation percentage of normals 61/90 for year (Jan - Dec) 2001



GPCC

2002

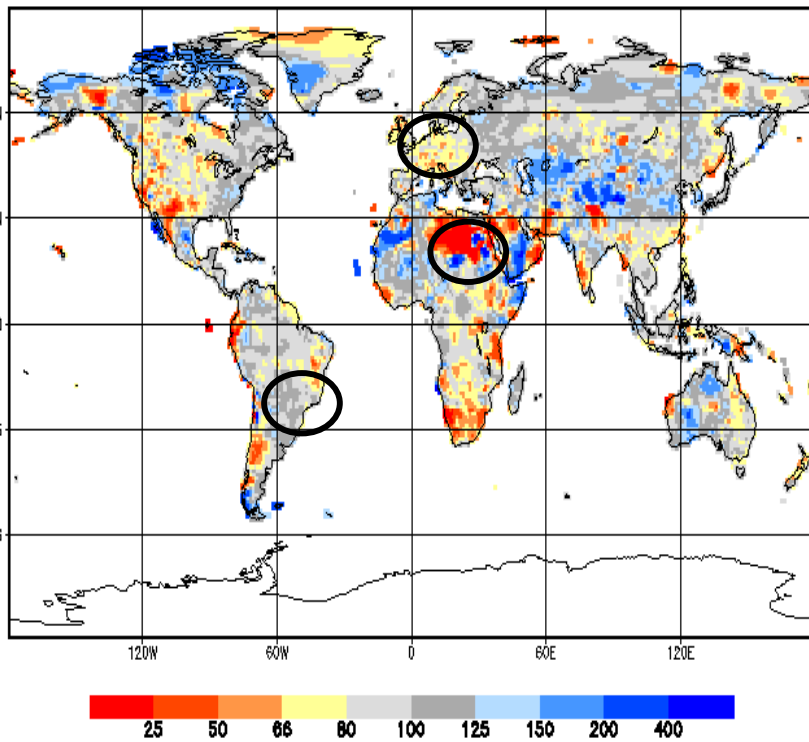
GPCC Monitoring Product Gauge-Based Analysis 1.0 degree
precipitation percentage of normals 61/90 for year (Jan - Dec) 2002



GPCC

2003

GPCC Monitoring Product Gauge-Based Analysis 1.0 degree
precipitation percentage of normals 61/90 for year (Jan - Dec) 2003

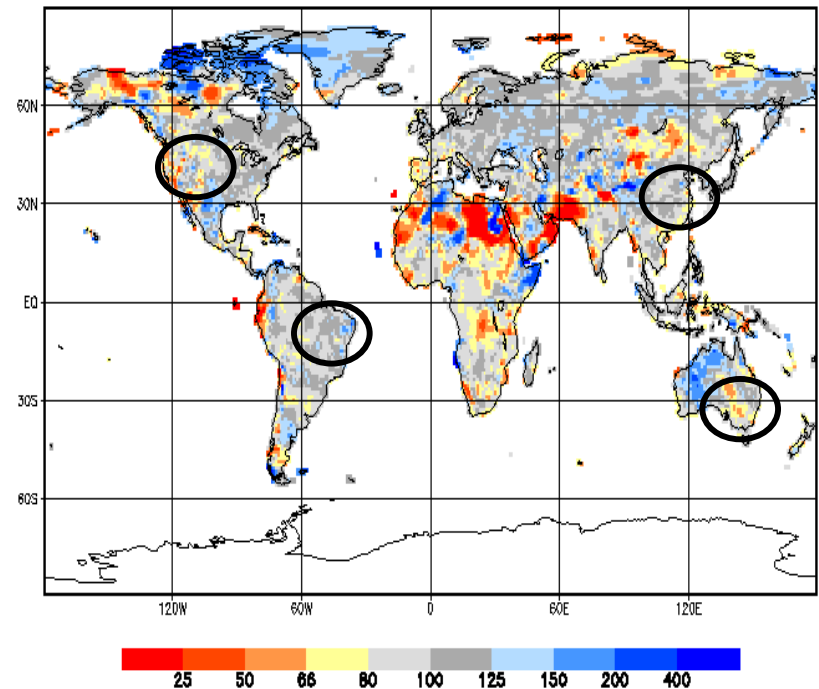


GPCC

2004

Nov/03 – Nov/04

GPCC Monitoring Product Gauge-Based Analysis 1.0 degree
precipitation percentage of normals 61/90 for year (Dec - Nov) 2003/2004



GPCC

SPECIFIC ISSUES

CEOP period

The following represent issues that could be addressed within a ‘very ambitious’ effort:

- **What extremes occurred during CEOP over the world?**
- **What are the characteristics of these extremes?**
- **What key factors led to, sustained, and ended these extremes and controlled their ‘structure’?**
- **Were similar factors responsible for the same type of extreme in different regions, as well as their ‘structure’?**
- **To what degree were the extremes inter-connected?**
through ocean/atmosphere/land surface/other patterns for example
- **From the point of view of extremes, how typical and/or unusual is the CEOP period and why?**

CURRENT STUDIES

Some of the extremes that occurred in CEOP 1 are currently being studied.

Note: This list is certainly not complete!!

- Canada (drought)
- US (drought)
- Brazil (drought in 2001 and flooding in 2003)
- Europe (drought and extended wet period)
- Australia (recent drought)
- Asia (numerous studies underway)
- ...

And:

- The CEOP 2 observational period will certainly bring more extremes!

MOVING AHEAD ...

‘Working Objective’: To advance our understanding of extremes including their occurrence, characteristics, evolution and inter-connections

Develop a feasible science/implementation plan: Components include:

- Occurrence & characteristics of extremes (and ones in phase 2) including ‘data mining’
- Encourage: participation of groups examining extremes
interactions between those studying similar phenomena
maximum use of available, common information
- Complement other activities underway within CEOP
- Possibly focus on a few extremes at least initially
- Etc.

In general, make the plan specific and achievable

*The Break-out session will
help to move this along*

Plan Elements

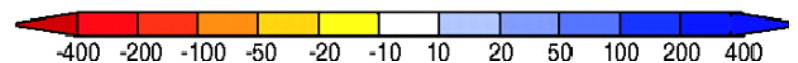
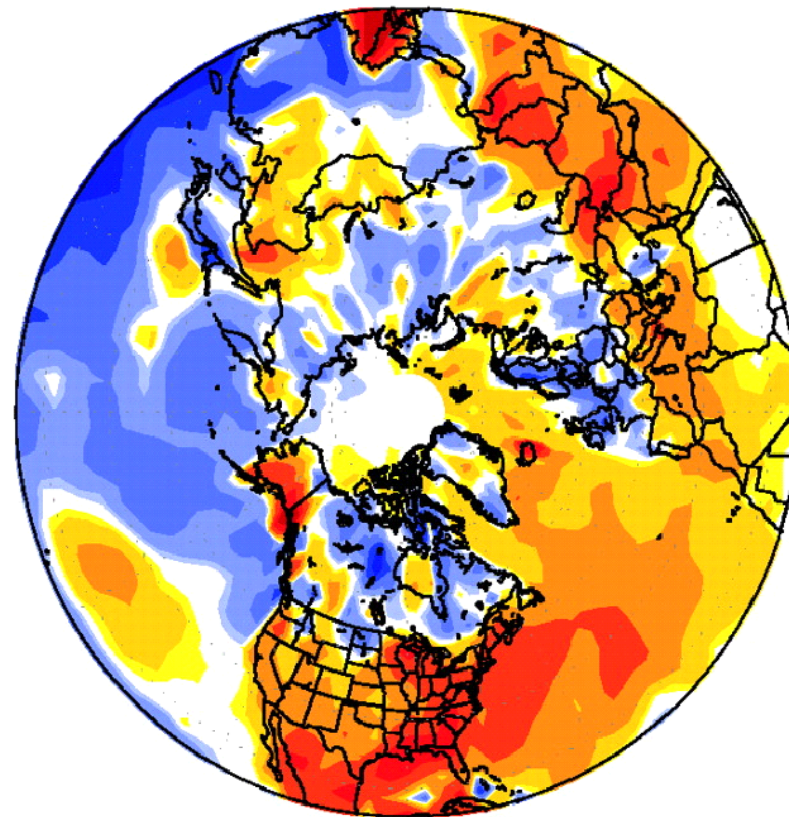
- Objective (to be refined)
To advance our understanding of extremes including their occurrence, characteristics, evolution and inter-connections
- Current Status
uncoordinated efforts on extremes
probably little use of CEOP information
- Roadmap
occurrences: update (available information, mining)
identify specific cases: do them & communicate
common factors: group similar phenomena
inter-connections: need global perspective, update

RECENT DROUGHTS

(Hoerling and Kumar, 2003)

- Drought caused widespread destruction in from 1998-2002
 - Impacting areas in Canada, United States, Australia, Africa, China, and Scandinavia
- 20% of Earth's land mass was under drought conditions in 2002
- The sea surface temperature pattern was 'conductive' to droughts in different regions ...

1998-2002 Precipitation Anomalies



Anomaly (mm)

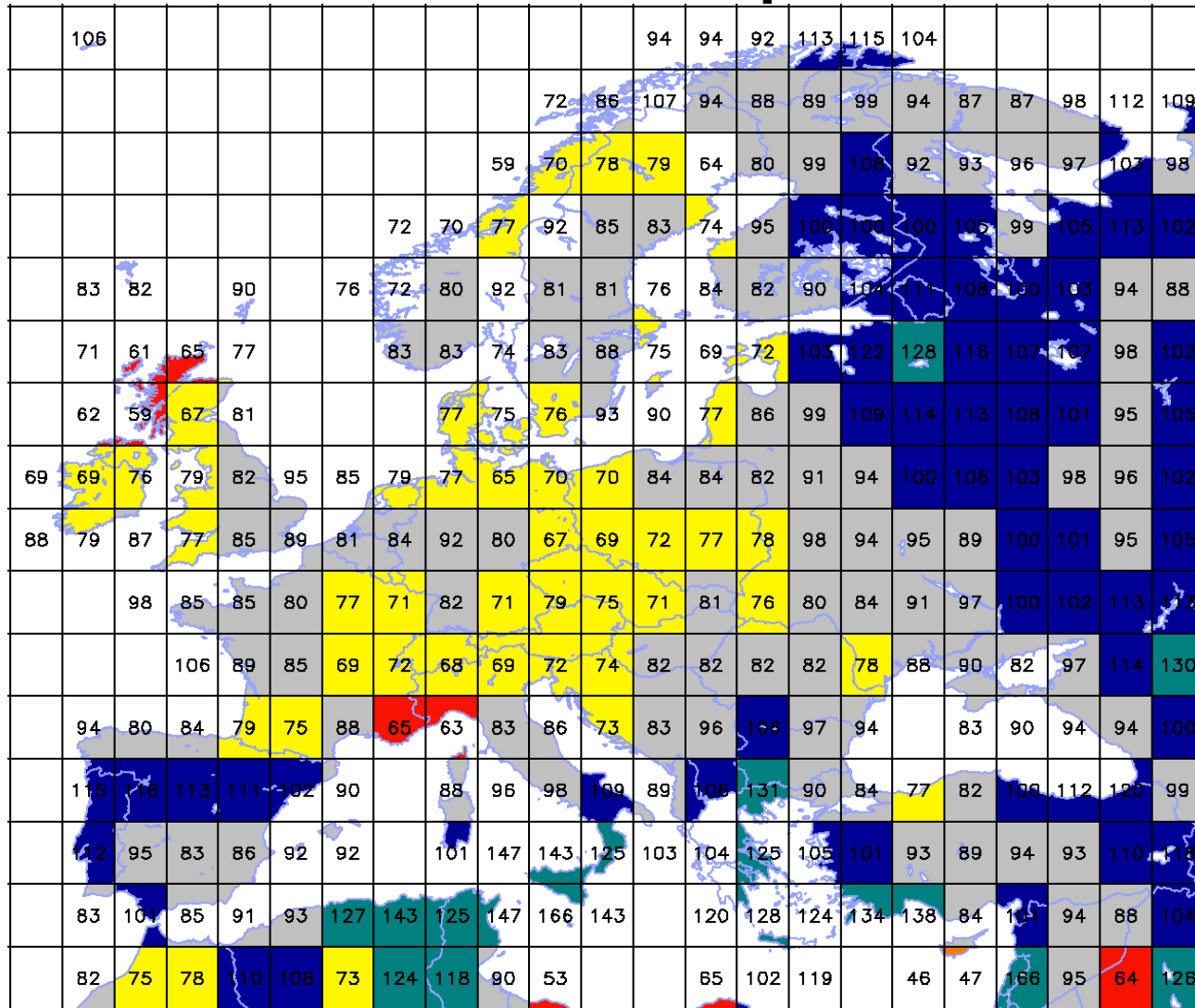
FOCUS

The focus is primarily on:

- **Drought:**
- **Extended wet period: precipitation for 1 to several days and affecting basins $\geq 10^5 \text{ km}^2$**

EUROPE

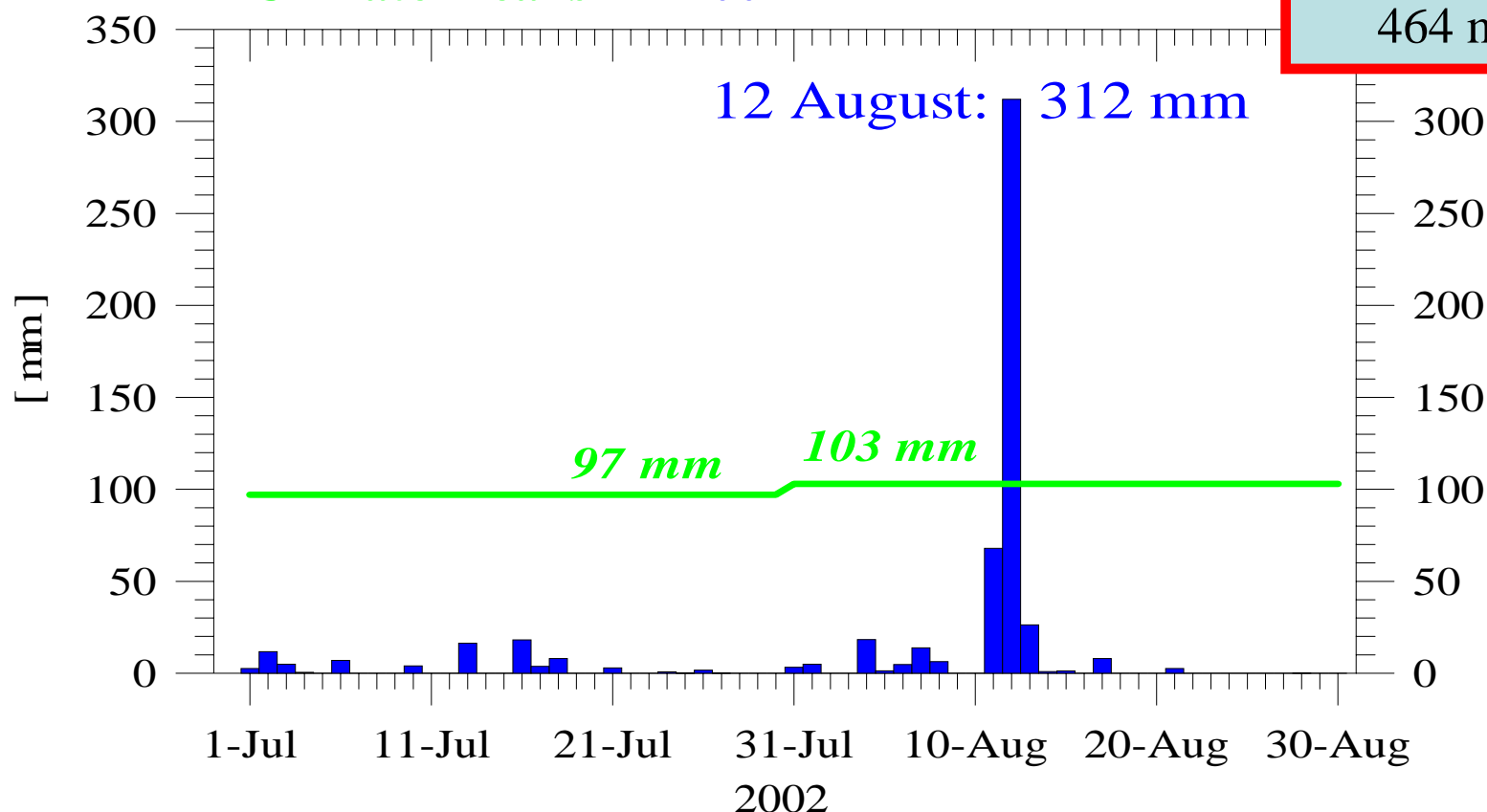
2003 Precipitation



Recent Elbe flooding event in central Europe:
More than 300% of the mean **monthly** August precipitation
measured at some stations within **24 hours** !

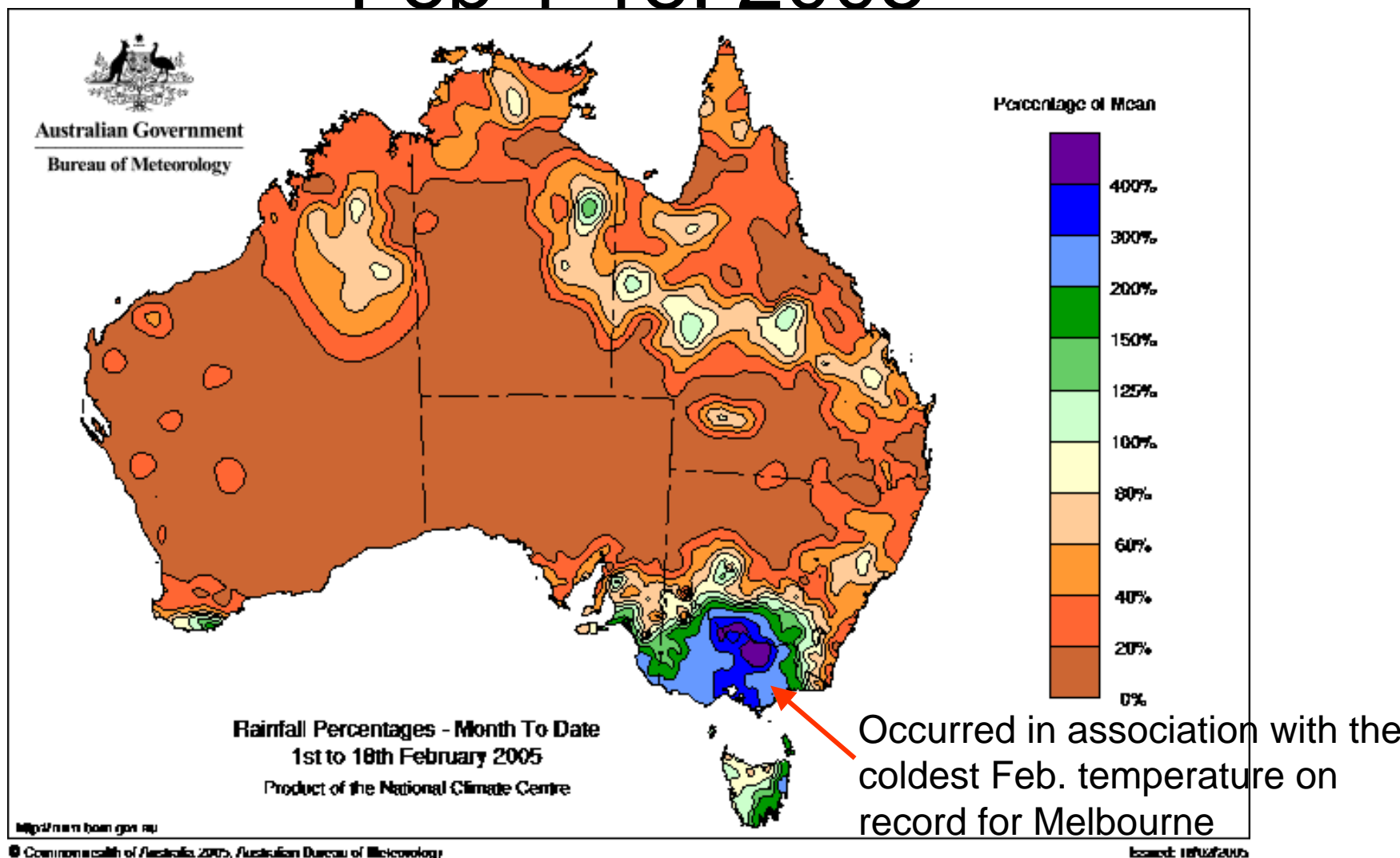
Daily Precipitation July/August 2002
Station Zinnwald, Germany

Climate means **2002**

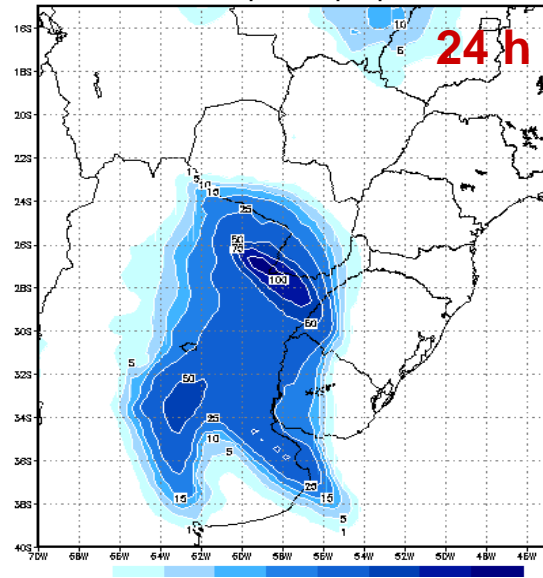


Rainfall

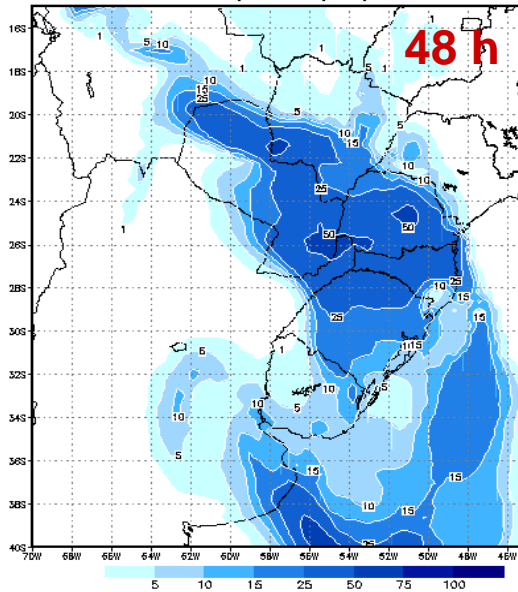
Feb 1-18, 2005



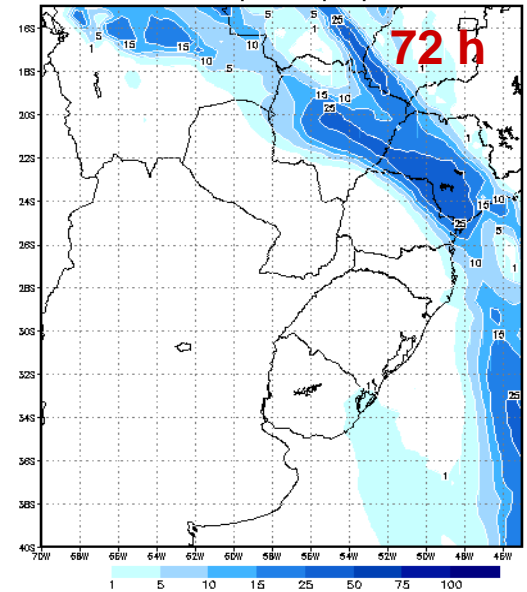
FCT +24h valida para 18/04/2003 12UTC



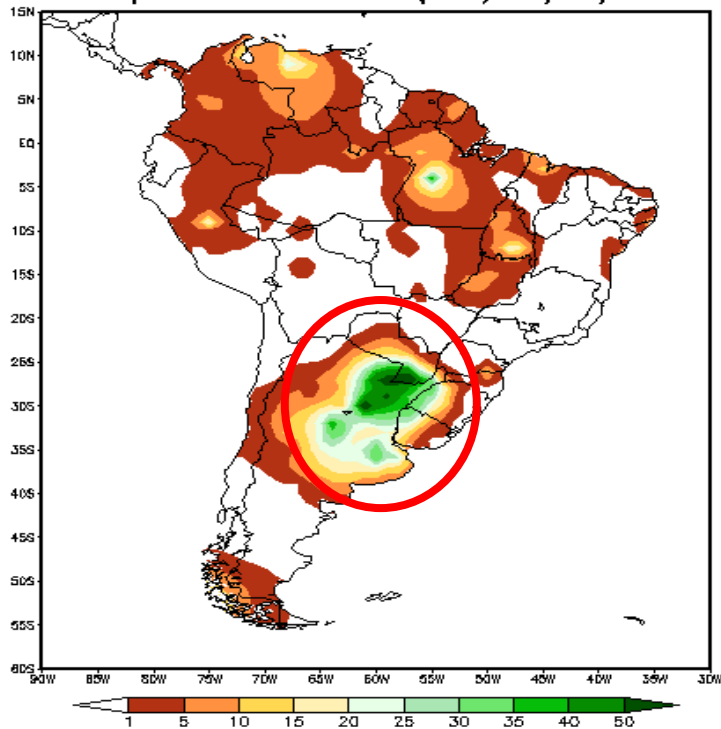
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FCT +72h valida para 18/04/2003 12UTC



Precipitacao Acumulada (mm) 18/04/2003



2003

**Forecast of extreme rainfall and floods in
Santa Fe-Argentina**

**Eta/CPTEC 40 km
Case of April 15 2003**

Fontes de dados: CMOD/INPE-INMET-FUNCME/CE-LWRS/PB-EWPAR/RN-DMRH/PE-FUNCME/CE
DHME/PI-CEPES/SE-NMRH/AL-SRH/BA-CEMIG/SIMGE-MG-SEAG/ES-SIMEPAR/PR-CUMERH/SC



Children Hospital in the city of Santa Fe during the flood of the Rio Salado in April 2003



Even graveyards are under water in Santa Fe



Barranquitas town in Santa Fe during the flood of the Rio Salado in April 2003

.. BBC's Peter Greste reports that nobody, not even the weather forecasters, had predicted the floods which occurred after heavy storms on Monday.

..President Duhalde said that "there is no system that can anticipate events that happen every 400 years".

Rainfall

Feb 1-18, 2005

