



World Meteorological Organization

Weather • Climate • Water

An introduction to climate monitoring  
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*Australian Bureau of Meteorology*

# Why do we need climate monitoring?

An almost infinite range of applications; some examples:

- Assessment of observed climate change
- Using seasonal rainfall deficits to give early warning of potential crop failures, water shortages or high fire risk
- Using information on extreme daily rainfalls to inform flood warnings downstream

Information demands (e.g. timeliness) vary greatly depending on applications

# Climate monitoring – covering a very wide range of timescales and variables

- Long-term climate change over periods of decades to centuries
- Seasonal to interannual climate variability
- Events on short (e.g. daily) timescales (especially extreme events)

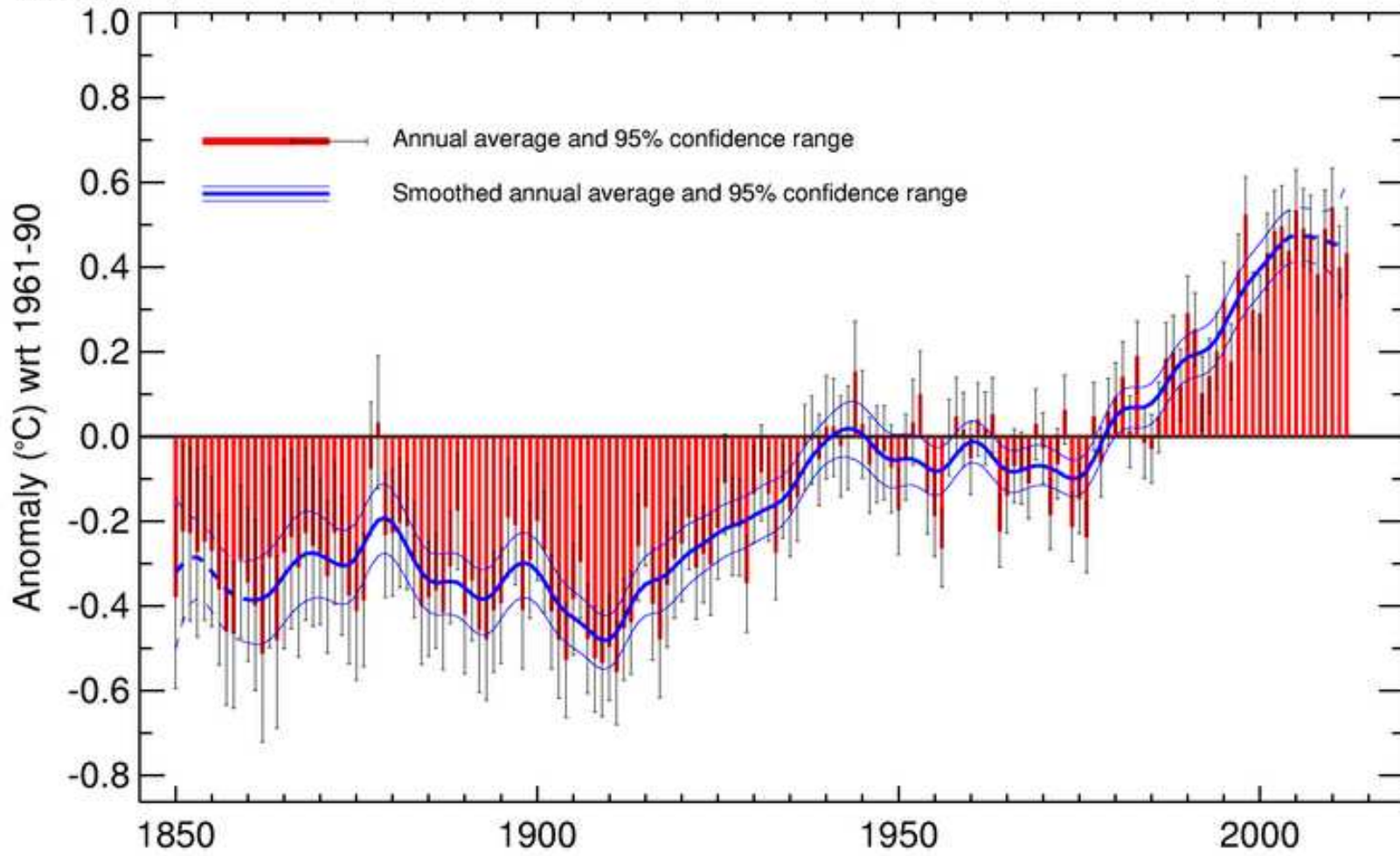
Many variables of potential interest – temperature and precipitation the best-monitored at present

No clear distinction between ‘climate’ and ‘weather’ timescales

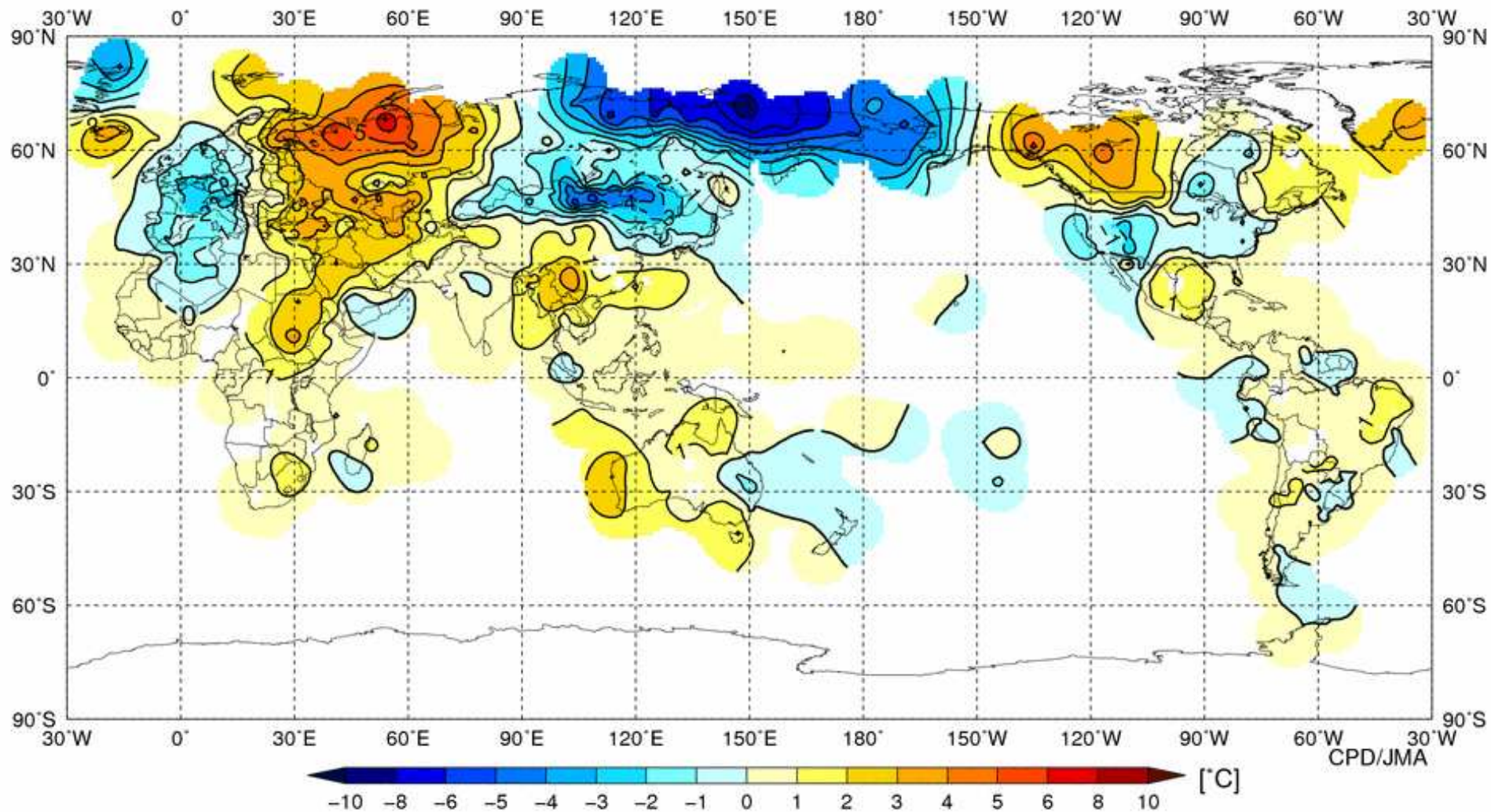
# To what extent do we try to summarise things in a single number?



Global average temperature 1850-2012  
Updated from Morice et al. 2012

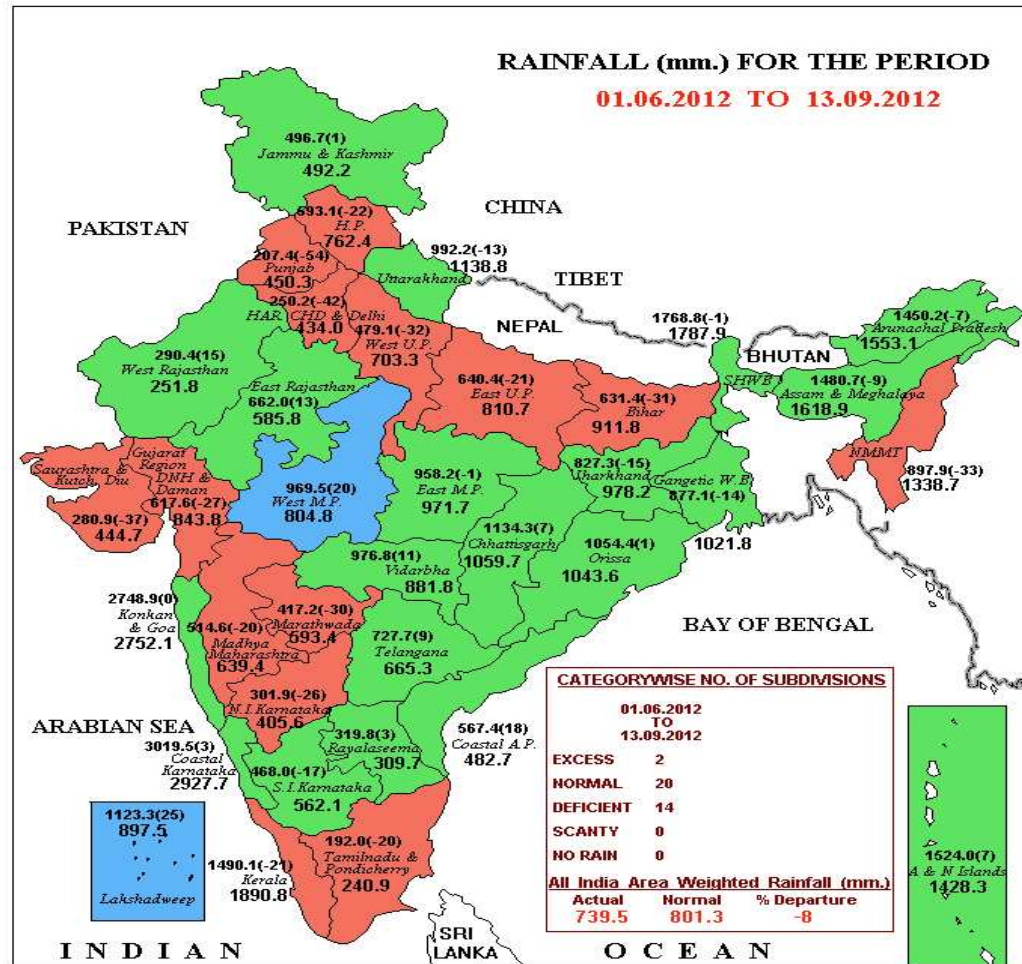


# Global temperature anomalies – February 2013



# Indian monsoon season rainfall (2012)

## भारत मौसम विज्ञान विभाग INDIA METEOROLOGICAL DEPARTMENT



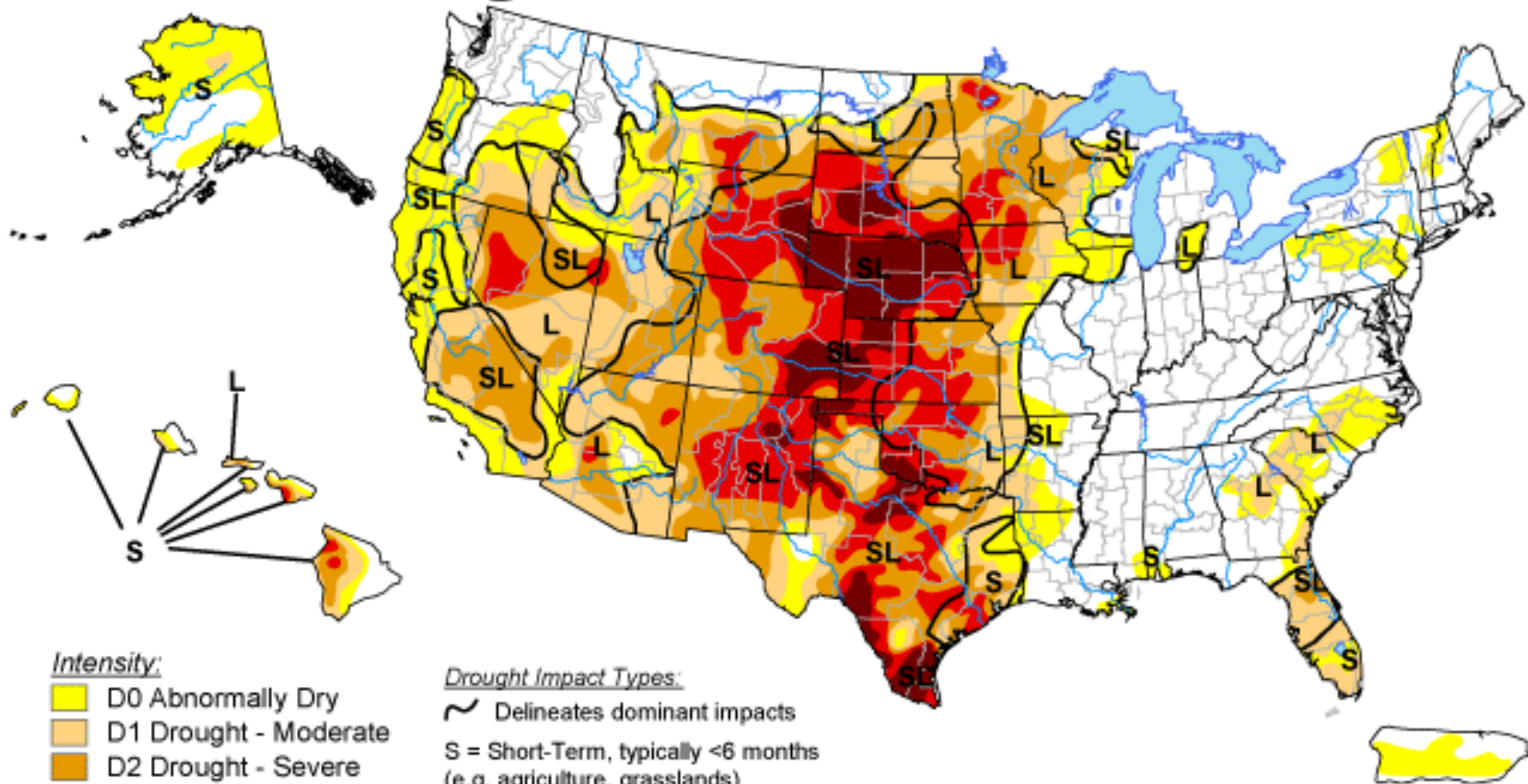
LEGEND: ■ EXCESS (+20% OR MORE) ■ NORMAL (+19% TO -19%) ■ DEFICIENT (-20% TO -59%)  
■ SCANTY (-60% TO -99%) ■ NO RAIN (-100%) ■ NO DATA

**NOTES:**






- [a] Rainfall figures are based on operational data.
- [b] Small figures indicate actual rainfall (mm.), while bold figures indicate Normal rainfall (mm.)  
Percentage Departures of Rainfall are shown in Brackets.

# U.S. Drought Monitor


April 2, 2013  
Valid 7 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
- S = Short-Term, typically <6 months  
(e.g. agriculture, grasslands)
- L = Long-Term, typically >6 months  
(e.g. hydrology, ecology)

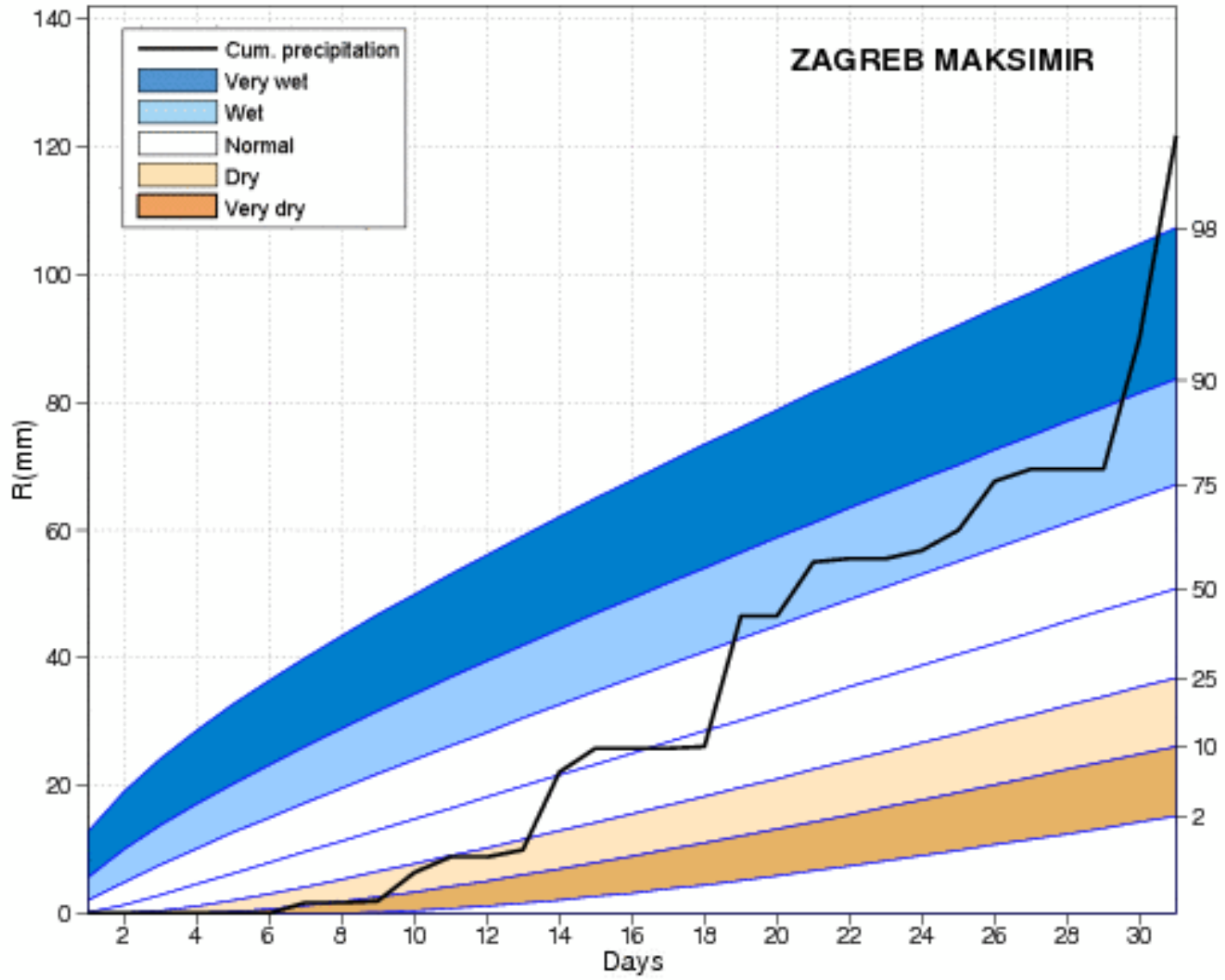
*The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.*

<http://droughtmonitor.unl.edu/>



**Released Thursday, April 4, 2013**  
**Author: Rich Tinker, NOAA/NWS/NCEP/CPC**

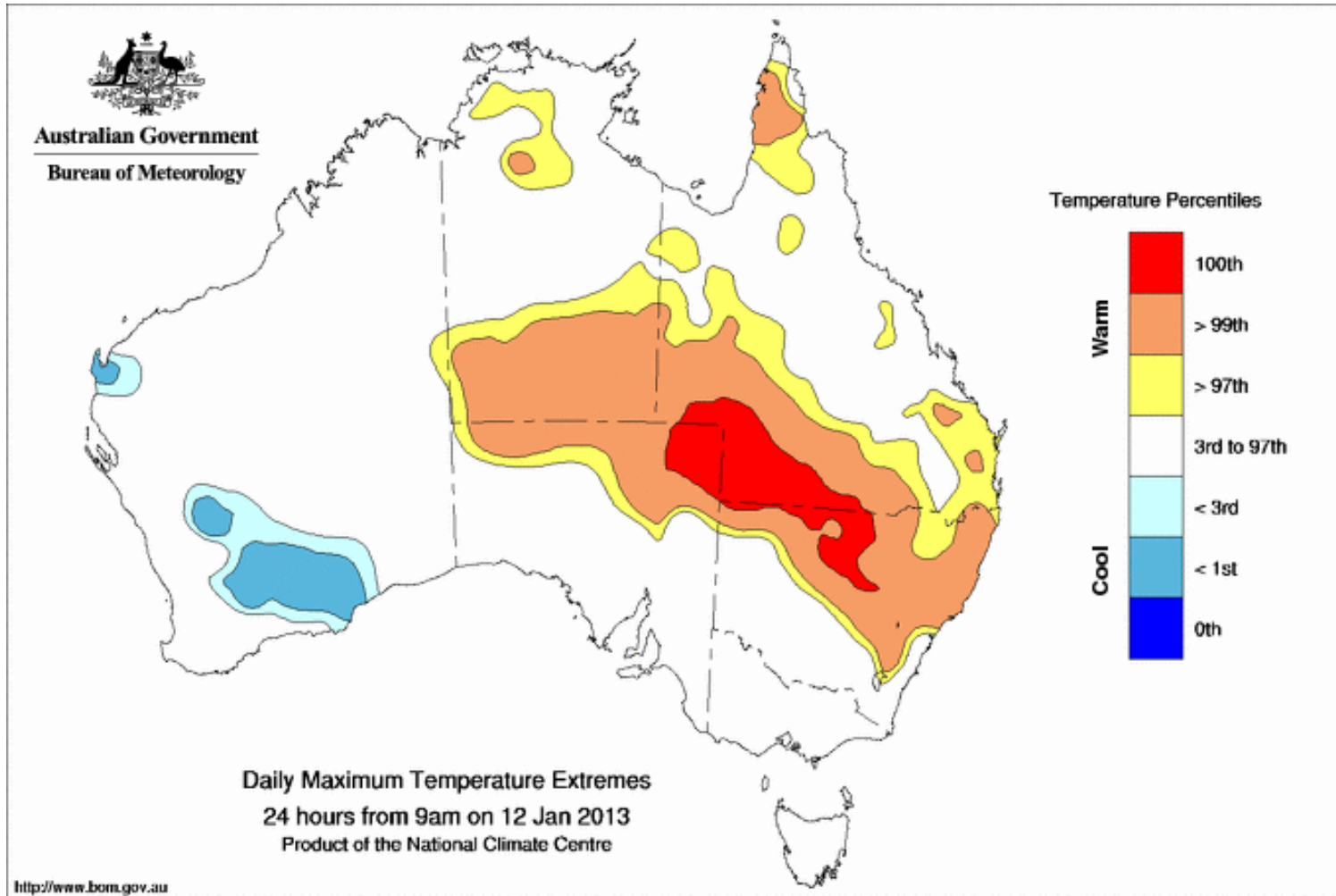
03 2013







**Australian Government**  
**Bureau of Meteorology**



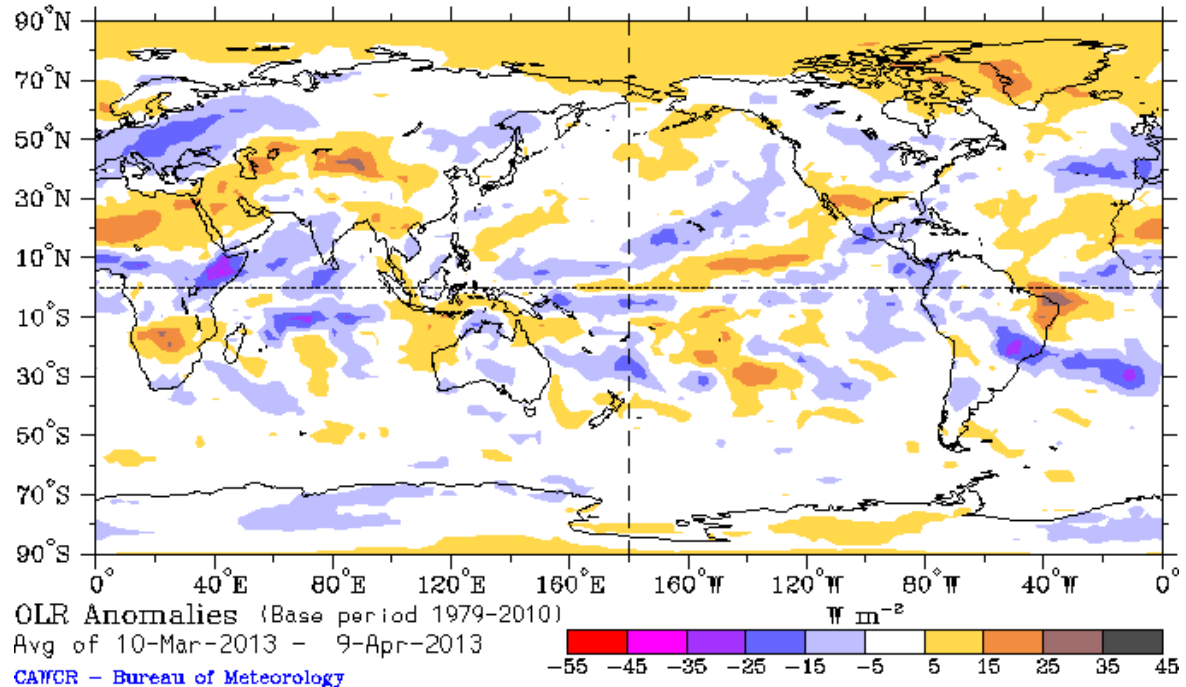
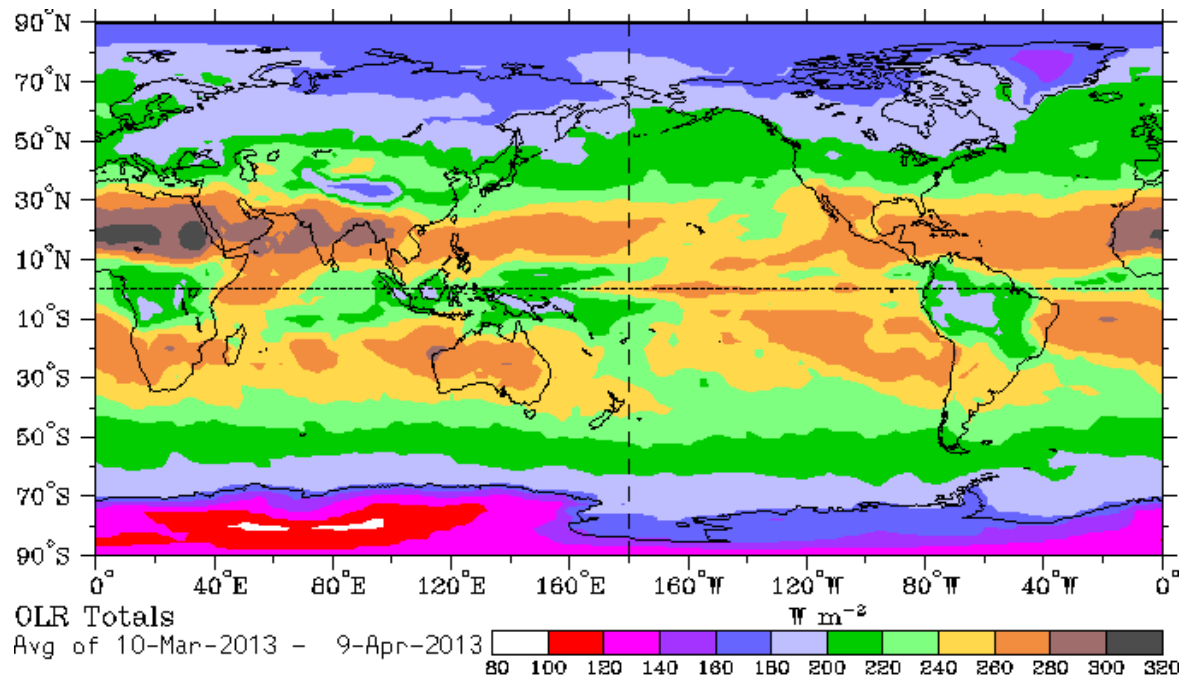
**Daily Maximum Temperature Extremes**  
**24 hours from 9am on 12 Jan 2013**  
Product of the National Climate Centre

<http://www.bom.gov.au>

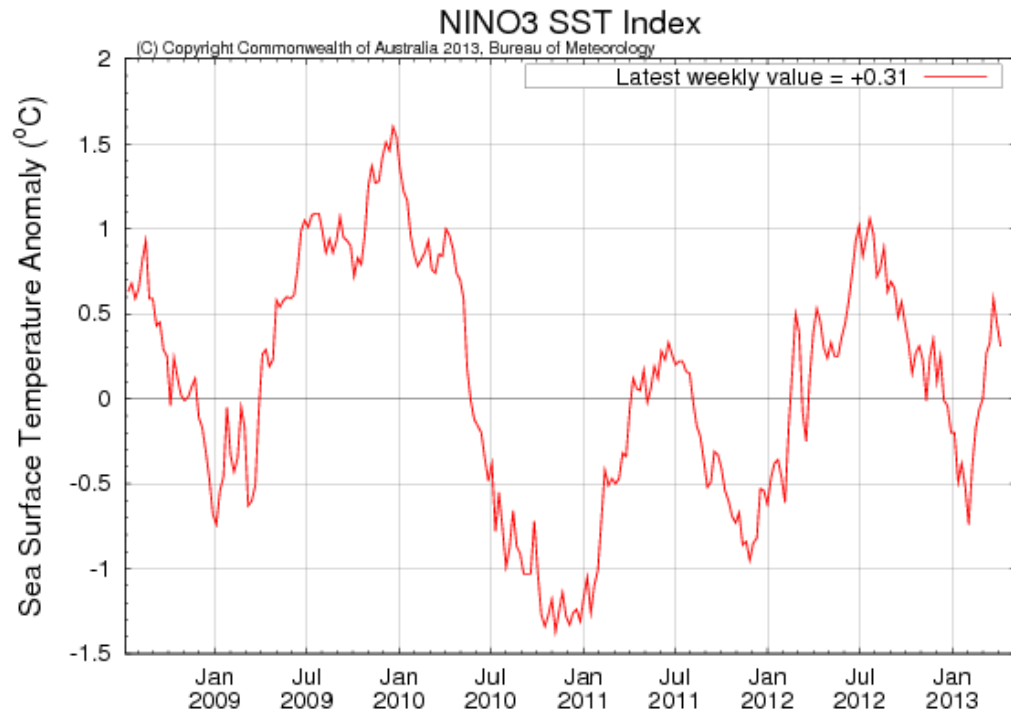
© Commonwealth of Australia 2013, Australian Bureau of Meteorology

Issued: 22/02/2013

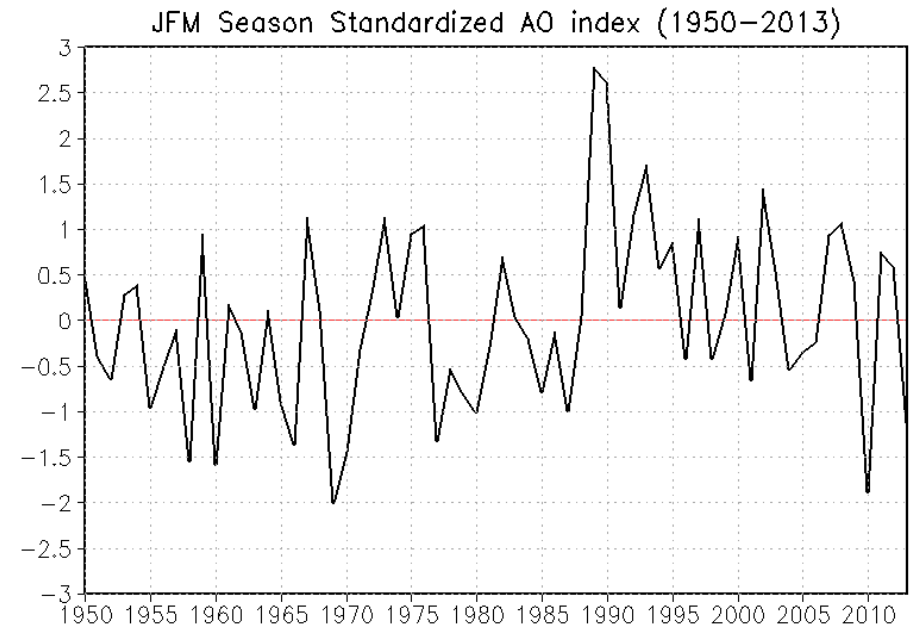
# More than the 'traditional' variables are of interest



# Indicators of key drivers of the climate system also of great interest



El Niño-Southern Oscillation

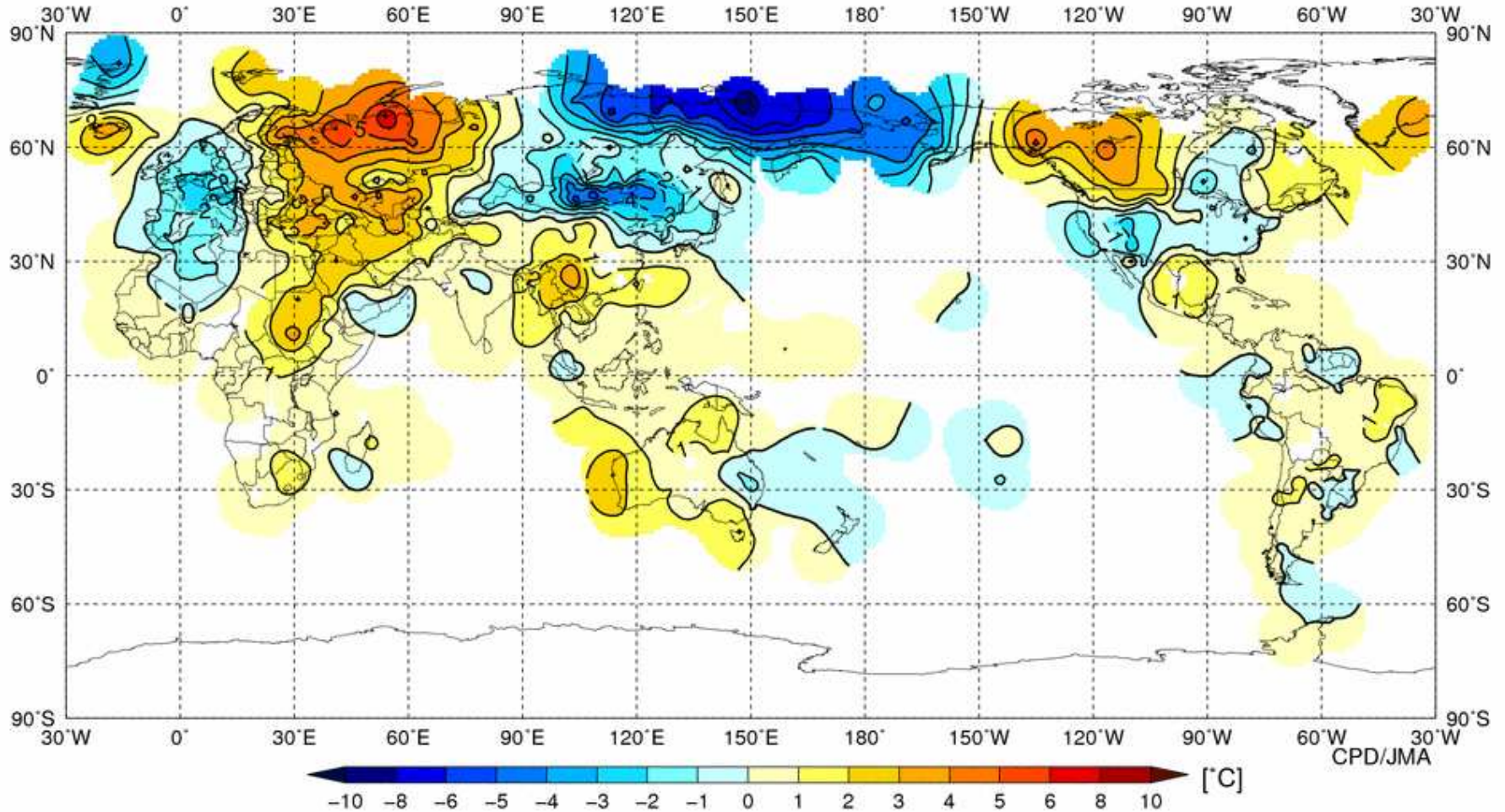


Arctic Oscillation

# Some issues for climate monitoring

- Availability and quality of underlying data
- Timeliness of data (important for some applications, but not others)
- Long-term consistency of data
- Generating large-scale analyses from various forms of source data
- Capacity to operate analysis systems
- How to visualise data with wide range of climatological values

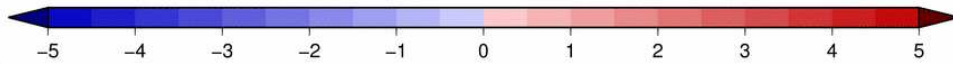
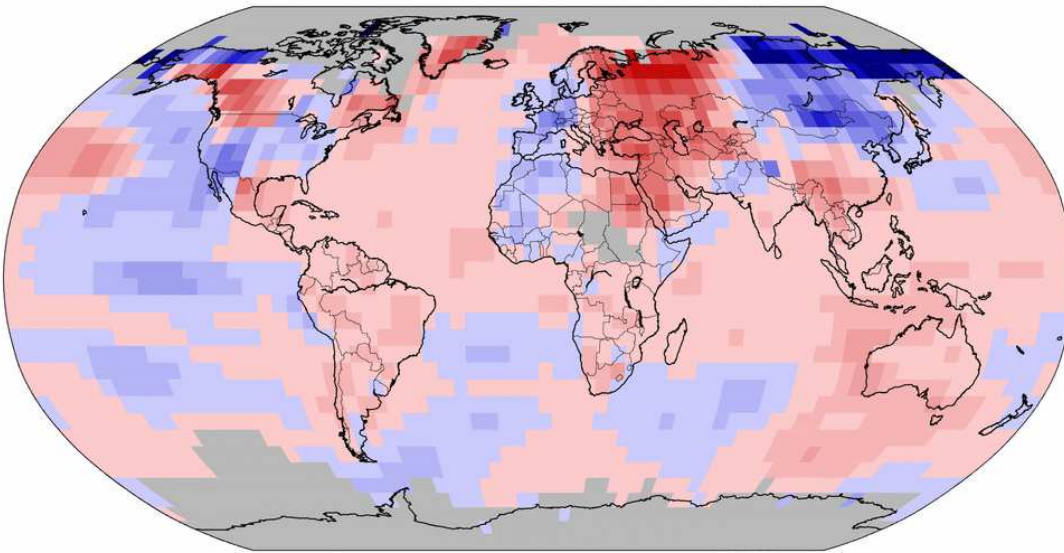
# What do we need to generate a product like this?



- Calculate station monthly mean from daily data
- Calculate long-term normal for station
- Calculate difference between monthly mean and normal

# The difference that a different base period can make

Land & Ocean Temperature Anomalies Feb 2013  
(with respect to a 1981–2010 base period)  
Data Source: MLOST version 3.5.3

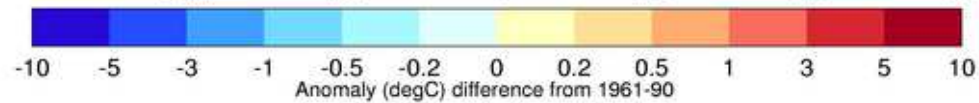
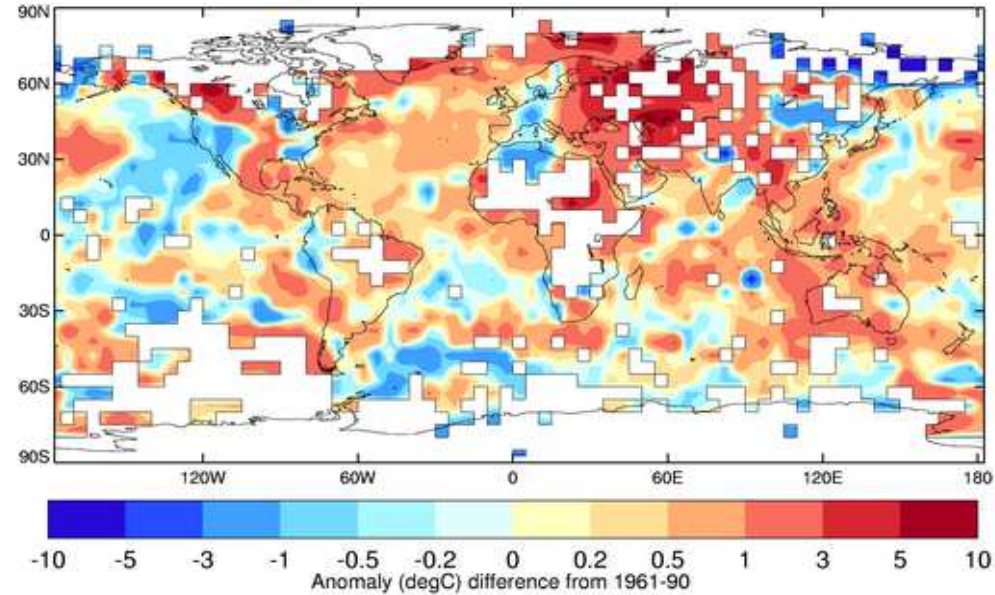


NOAA's National Climatic Data Center

Degrees Celsius

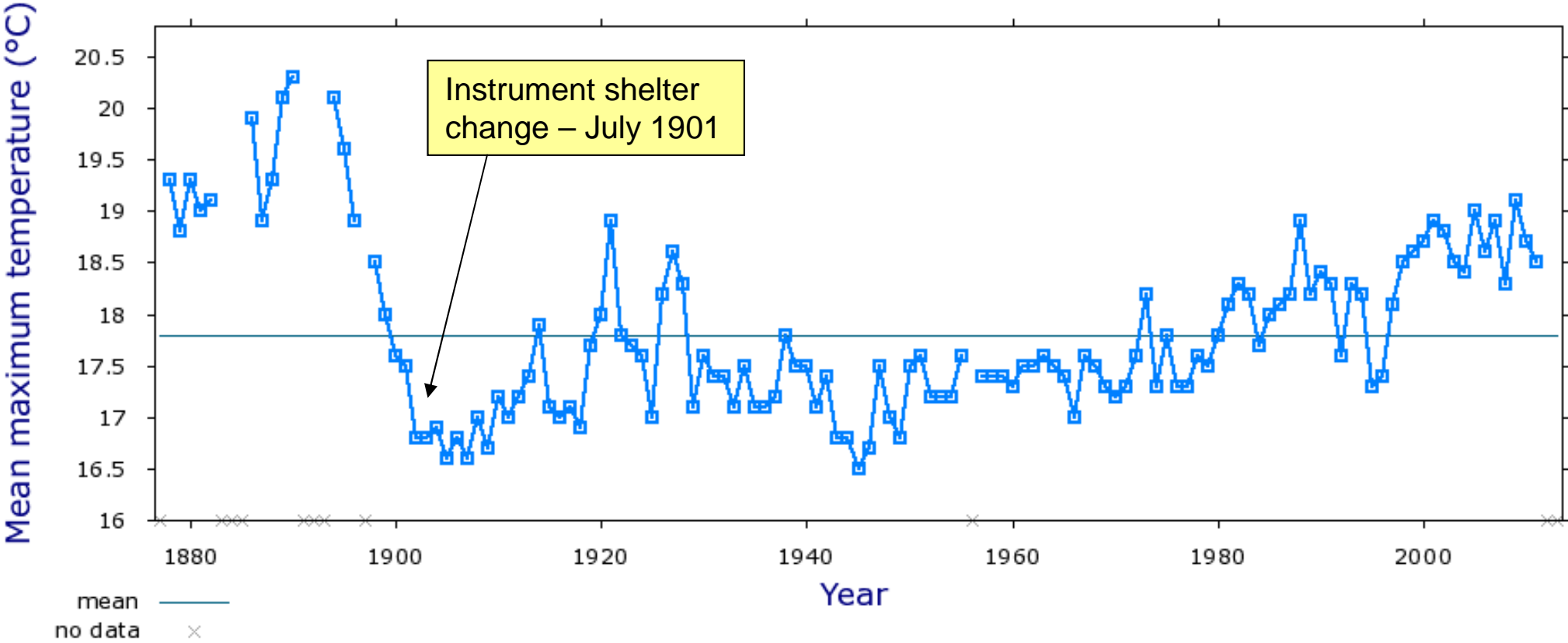
Please Note: Gray areas represent missing data  
Map Projection: Robinson

Met Office  
Surface Temperature Anomalies (degC, w.r.t. 1961-90)  
2013 February



# Why long-term consistency is important

Gabo Island Lighthouse (084016) Annual mean maximum temperature

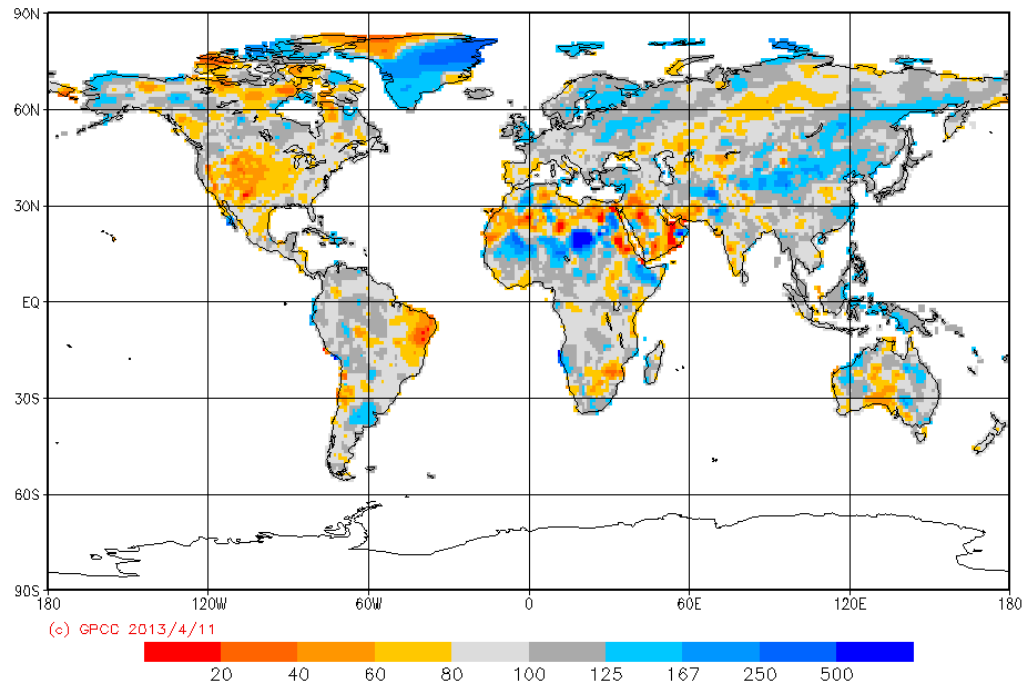


Note: Data may not have completed quality control  
Observations made before 1910 may have used non-standard equipment

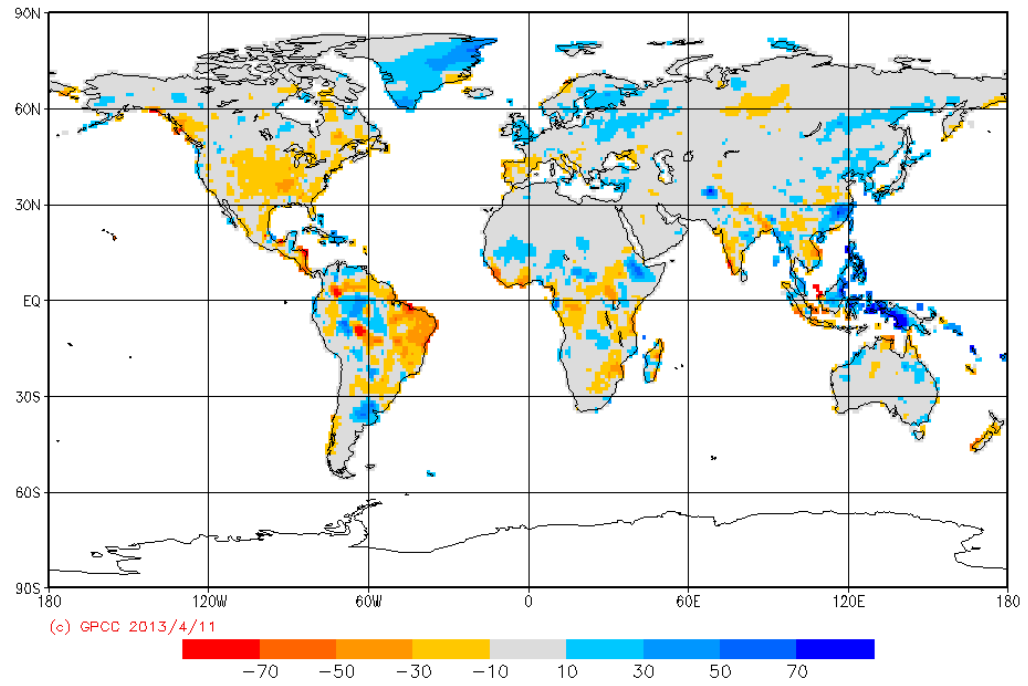
Climate Data Online, Bureau of Meteorology  
Copyright Commonwealth of Australia, 2011

# Different forms of visualisation – 2012 global precipitation

GPCC Monitoring Product Gauge-Based Analysis 1.0 degree  
precipitation percentage of normals 1951/2000 for year (Jan – Dec) 2012  
(grid based)



GPCC Monitoring Product Gauge-Based Analysis 1.0 degree  
precipitation anomaly for year (Jan – Dec) 2012 in mm/month  
(deviation from normals 1951/2000) (grid based)



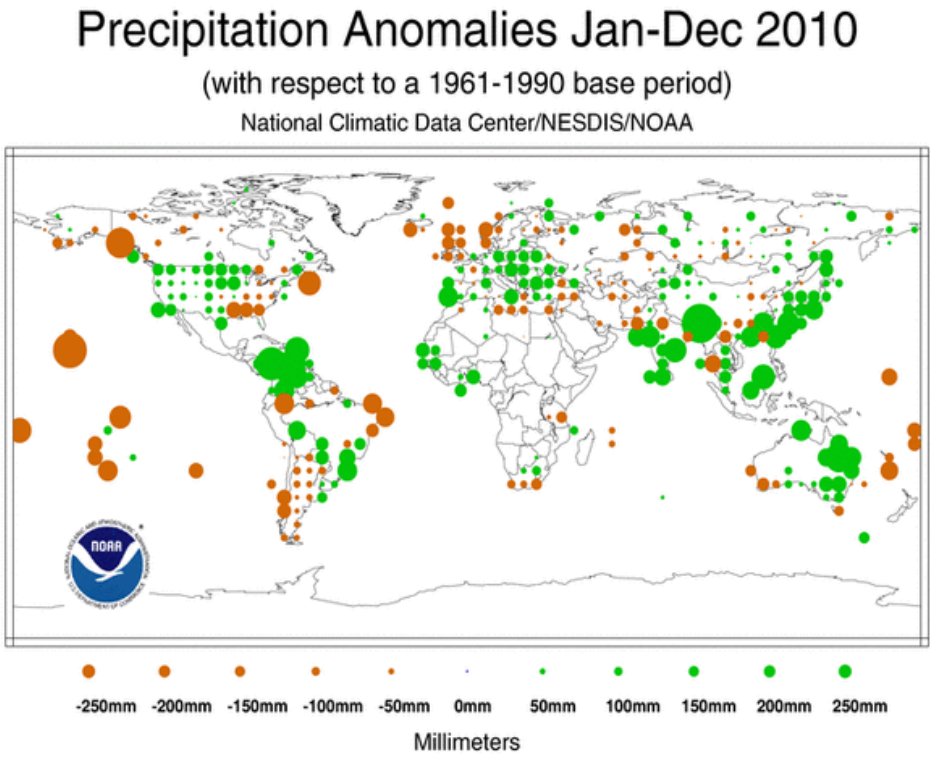
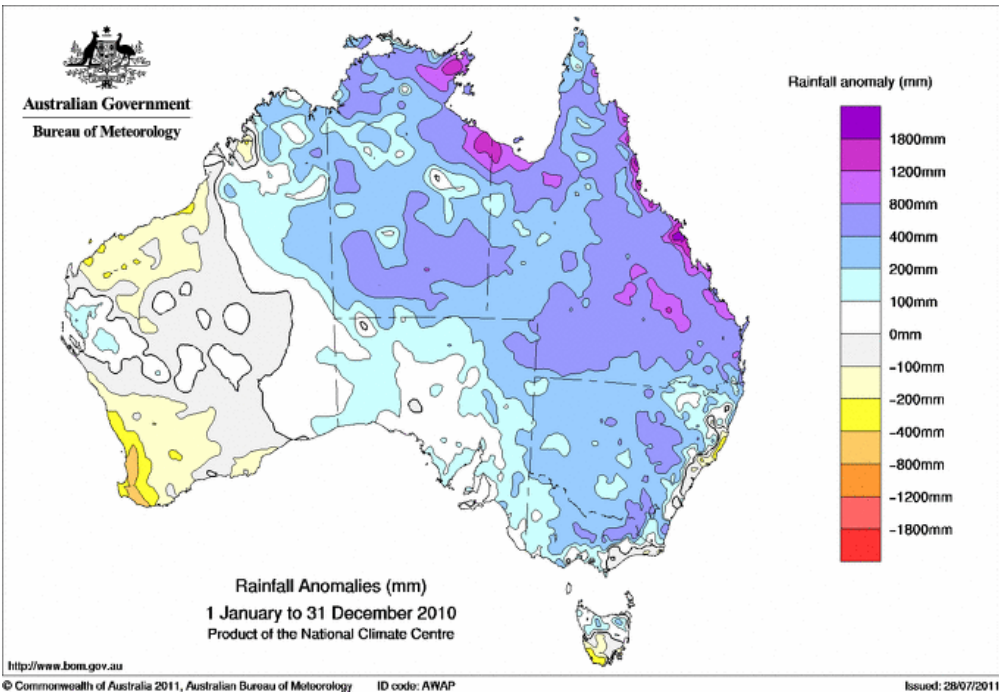


# Some different types of data sets

- Global/regional data sets (often sourced from GTS data, e.g. CLIMAT, SYNOP)
- National data sets drawn from national databases
- Data sets based on wholly or partly on remote sensing

These data sets do not always give consistent results!

# Scale resolution driving a difference between national and global products





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Thank you for your attention