Modelling Daily Rain-gauge Network Measurement Responses Under a Changing Climate - K5/1964

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WATER RESEARCH COMMISSION

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UNIVERSITY OF KWAZULU-NATAL

Water Research Commission Symposium 2013

LOCAL SOLUTIONS - GLOBAL IMPACT

How to stop this

… from turning to this?

A partial response

What management can we put in place?

How do we plan and design for water security in a changing environment?

At least try and make an educated guess of what the future holds

How?

What do we need?

Sequences of modelled future spatial rainfall over catchments give flows in rivers

How to do this?

Harness information from Climate Models even though they give mixed messages

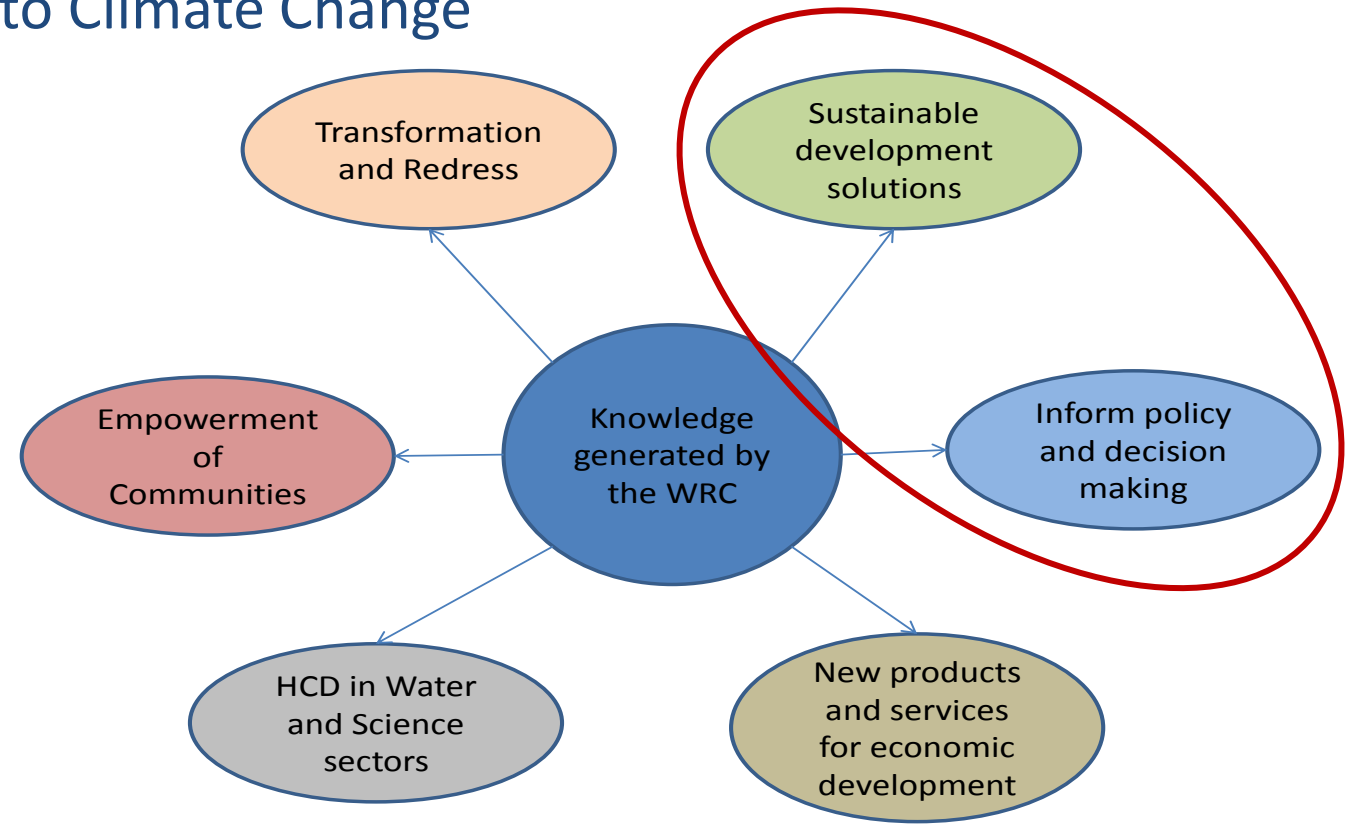
What did *we* do?

Local solutions with global impact

- GCMs and RCMs offer rainfall estimates which are typically biased
- We offer a method to remove the bias without destroying the trend or delta/shift
- Engineers and Hydrologists can use the tool to create ‘what-if’ scenarios with rain gauge estimates they are comfortable with
- Sensitivity and uncertainty analyses are by-products of the method

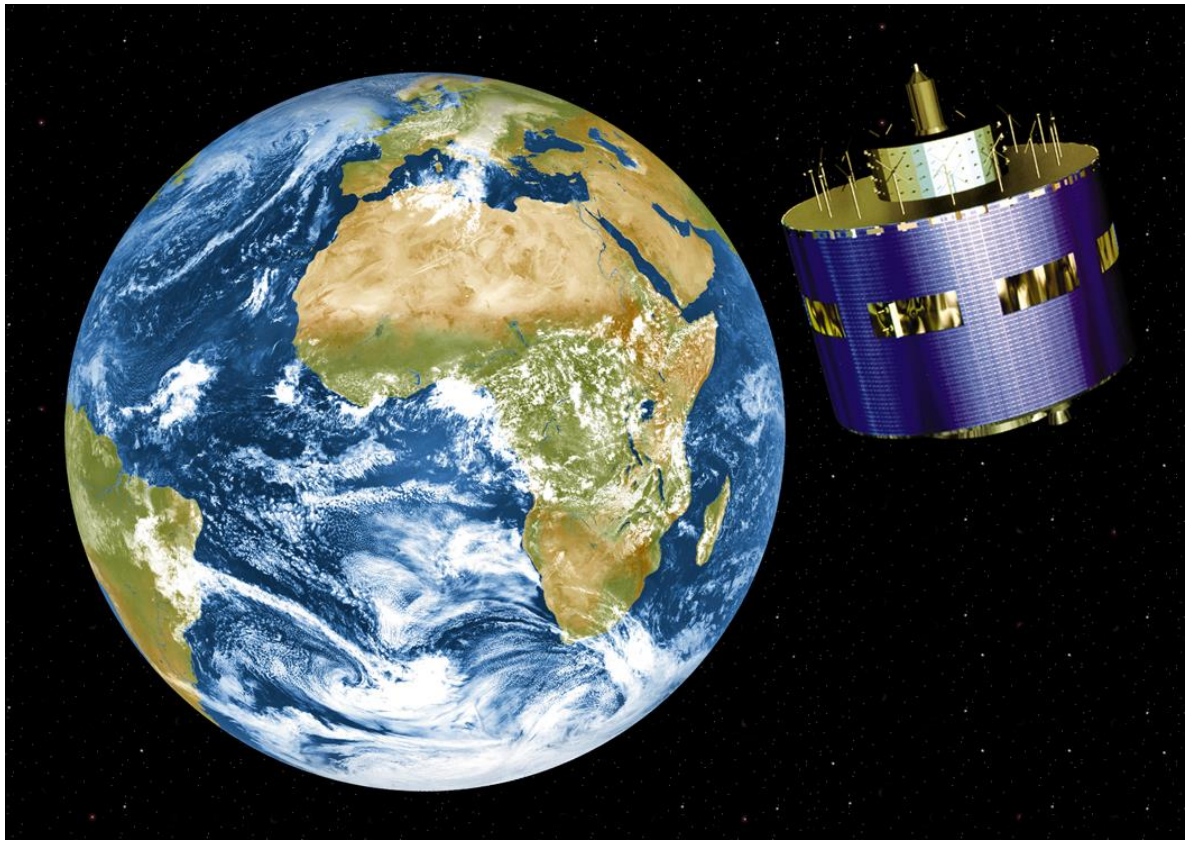
Impact

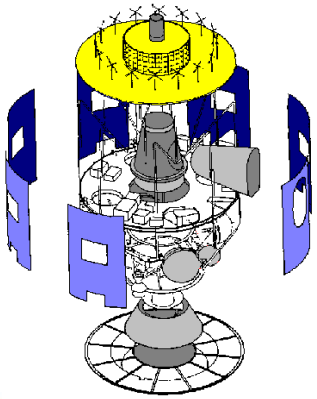
Modellers, Engineers and Decision makers will have a set of tools to better quantify changes to rainfall on the ground due to Climate Change



How to measure rainfall - Like this?

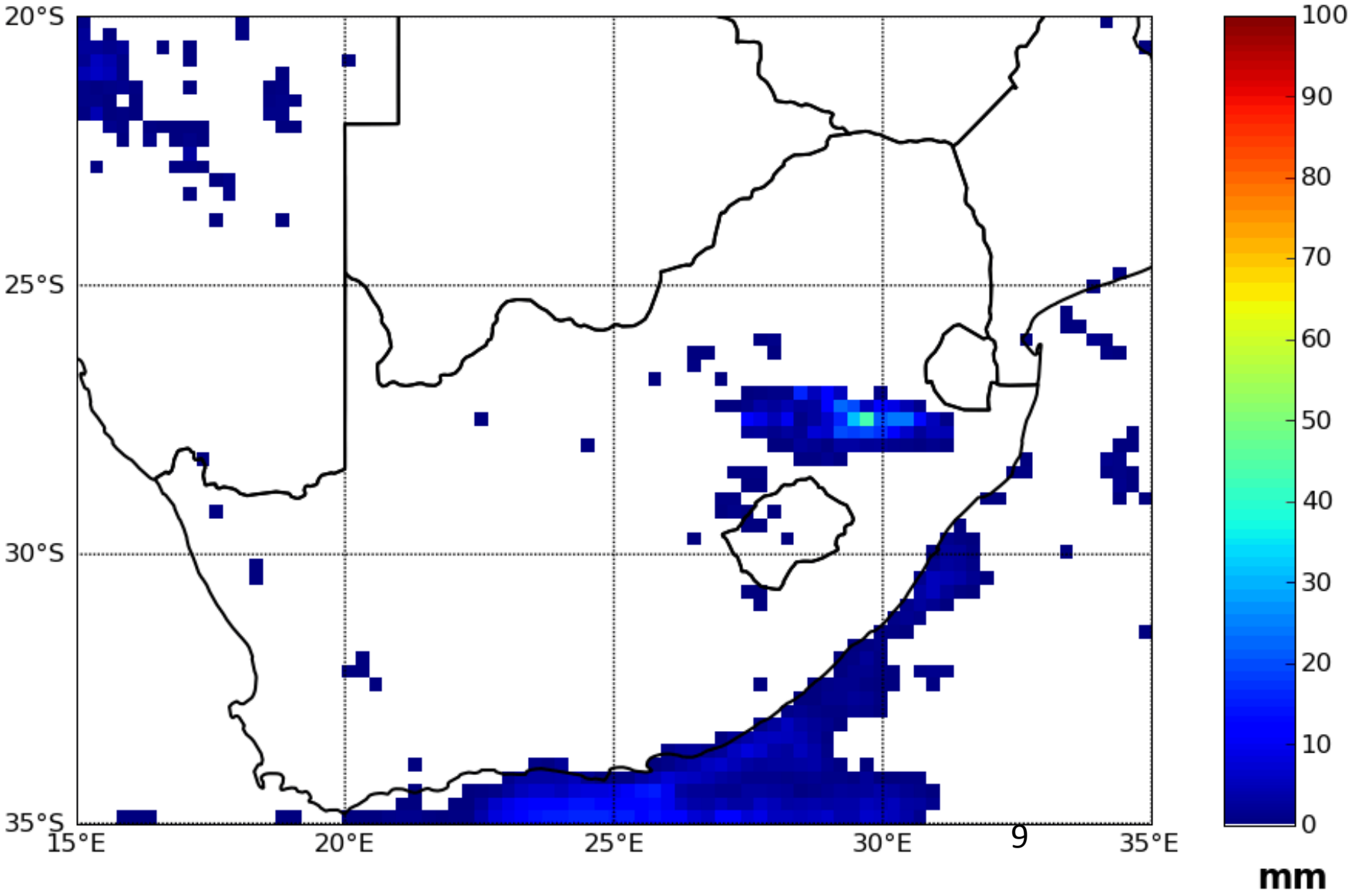
EUMETSAT'S METEOSAT





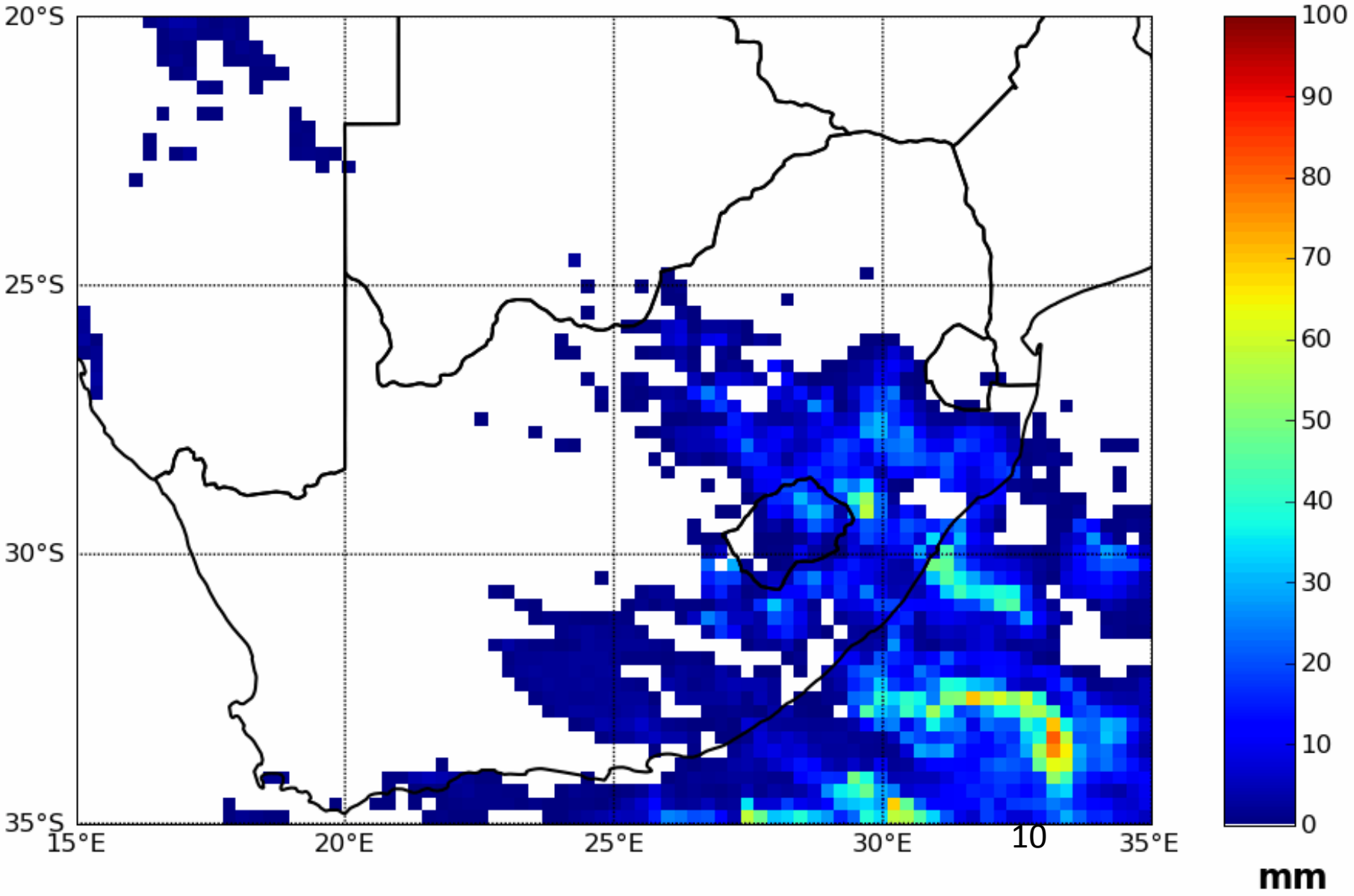
TRMM3B42RT rainfall 16/10/2008

½ scale of PRECIS

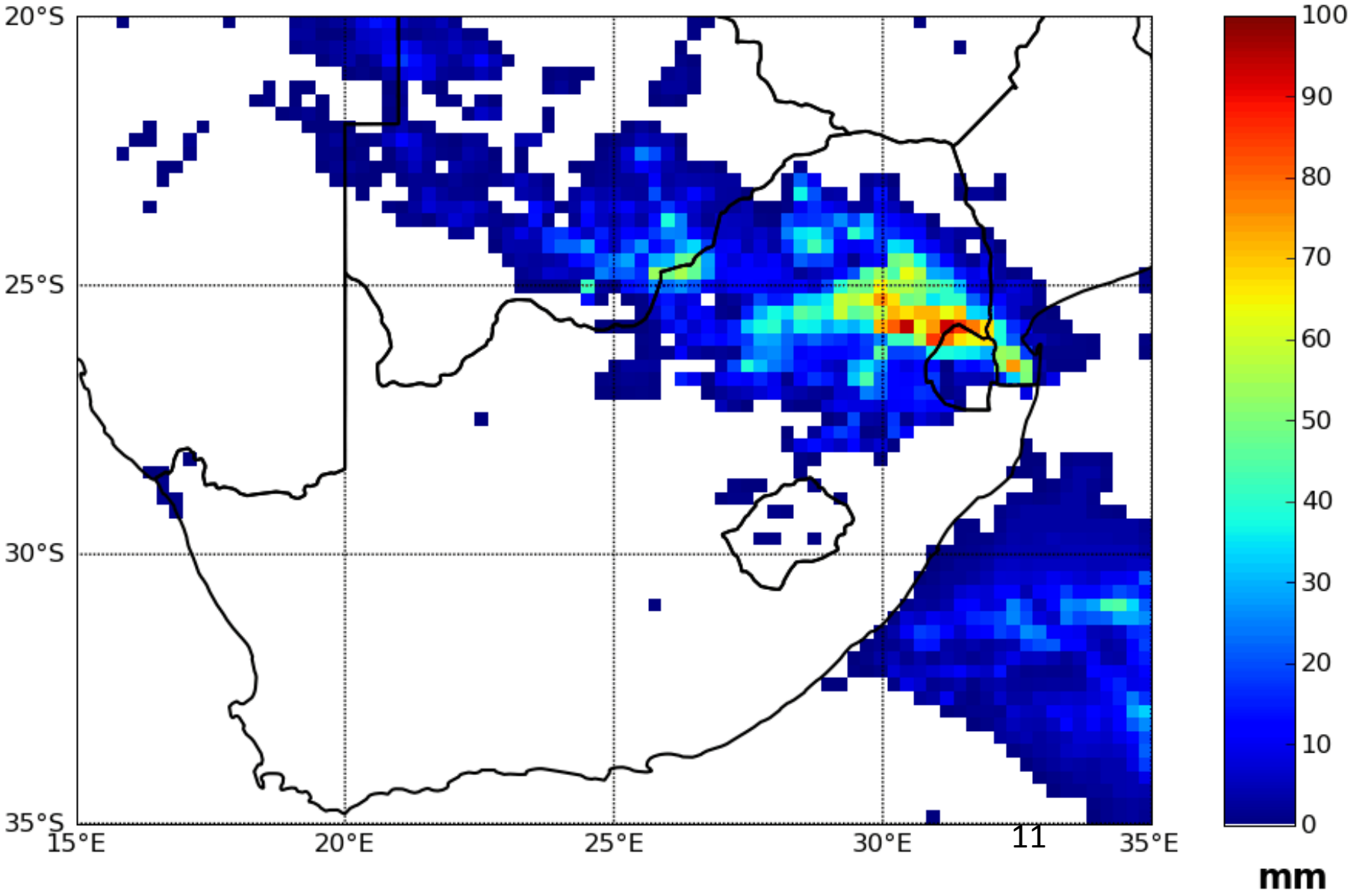


TRMM3B42RT rainfall 17/10/2008

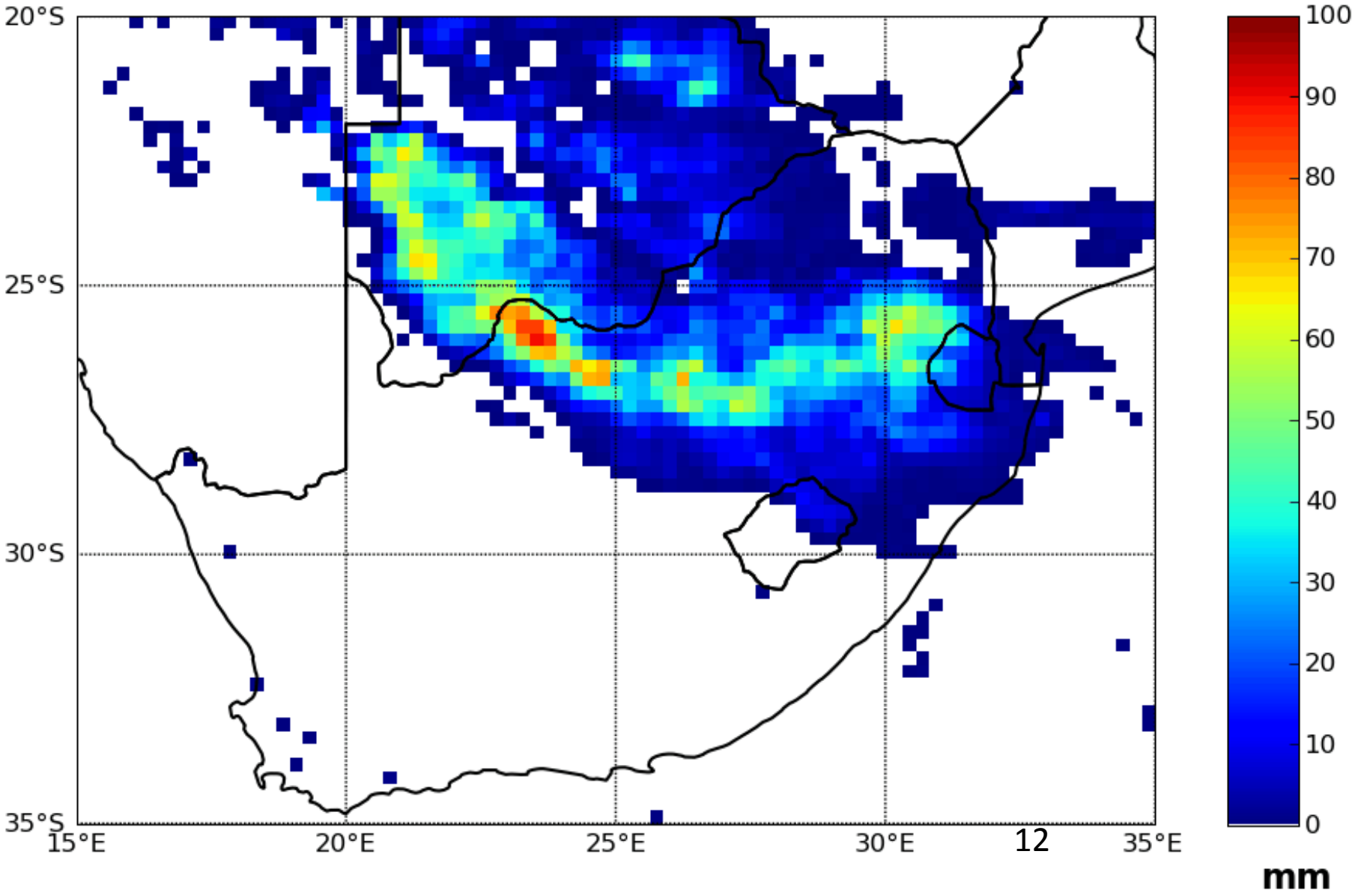
Spatial scale of TRMM ~ 25 km



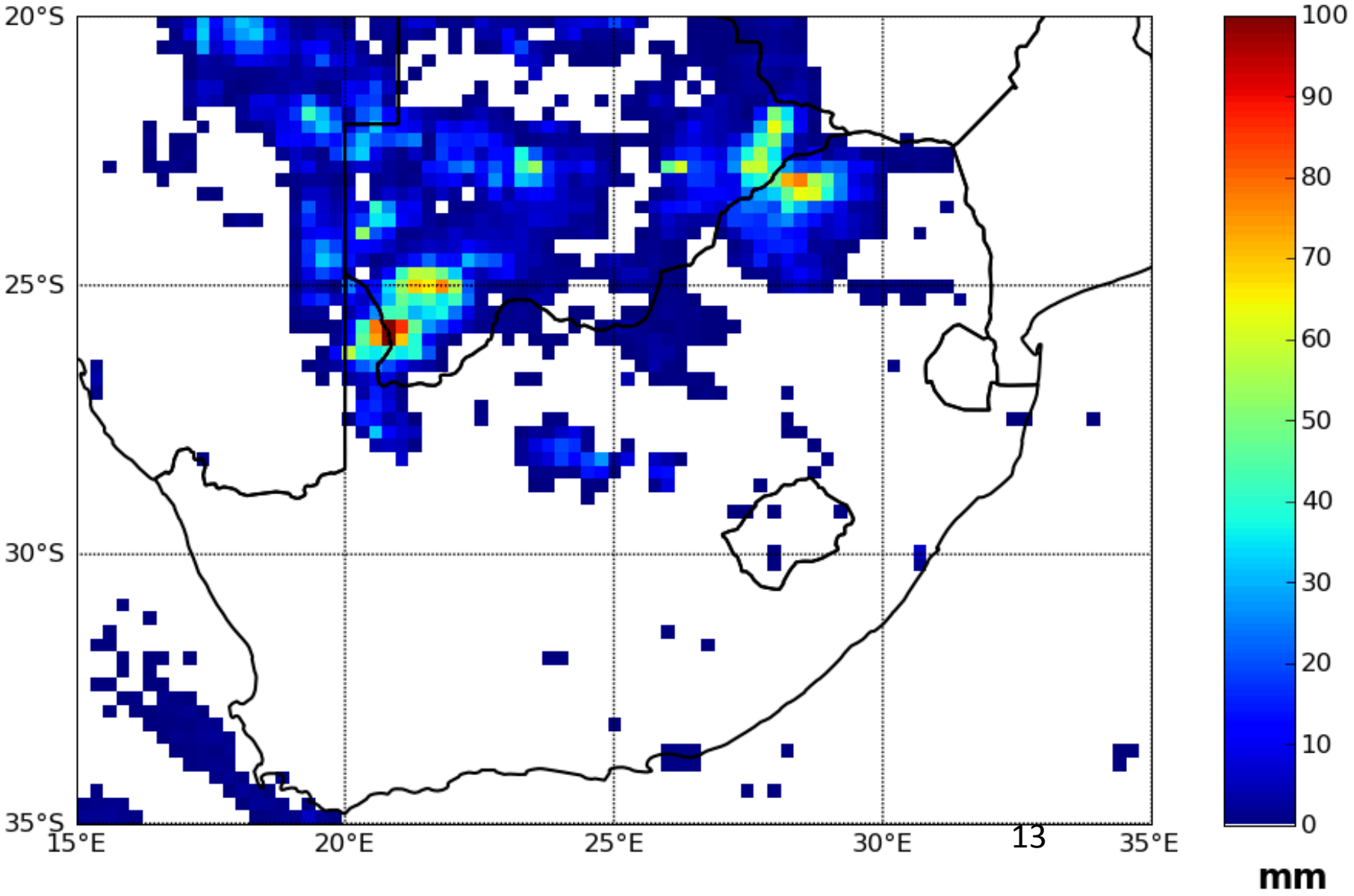
TRMM3B42RT rainfall 18/10/2008



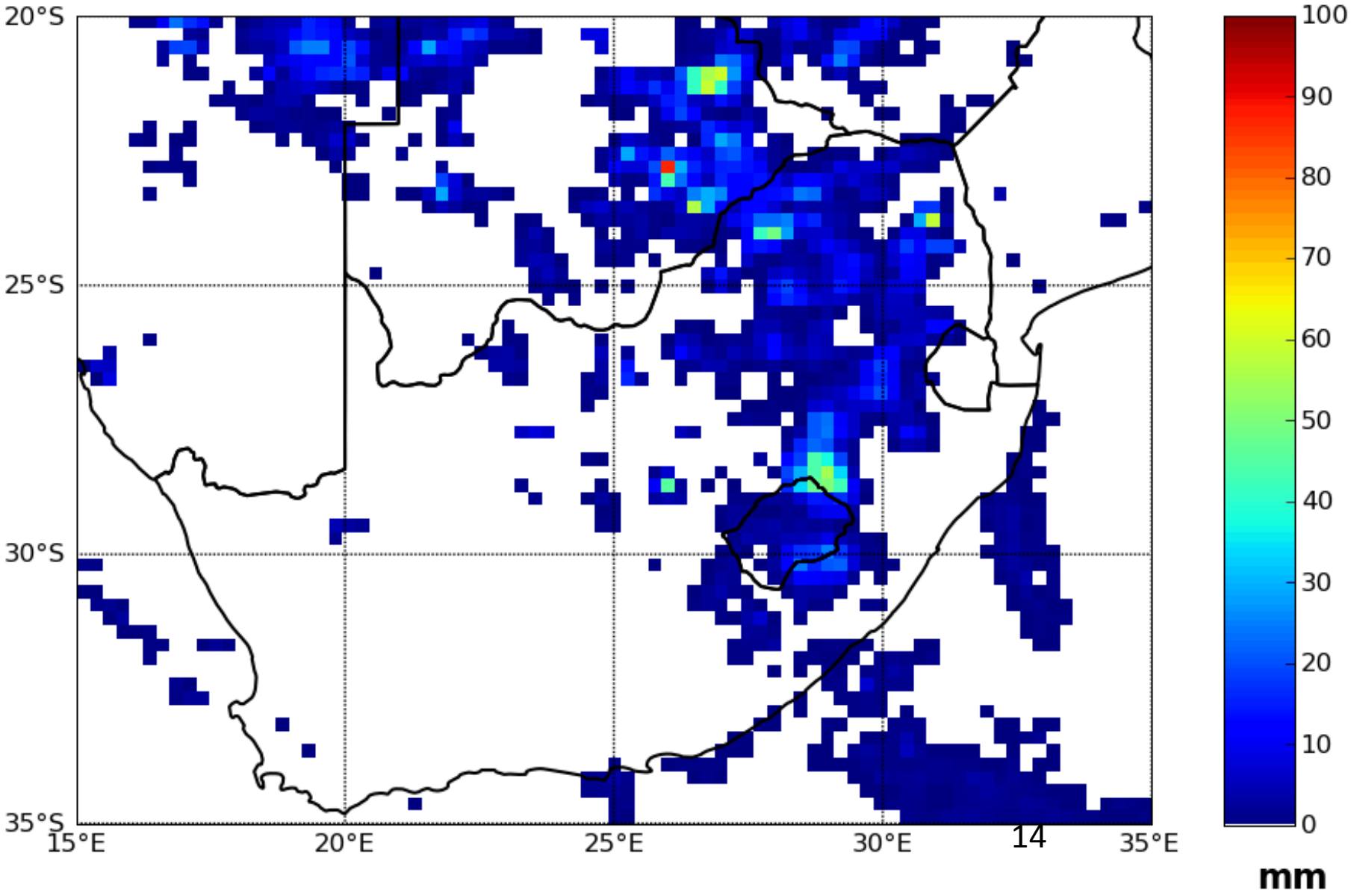
TRMM3B42RT rainfall 19/10/2008



TRMM3B42RT rainfall 20/10/2008



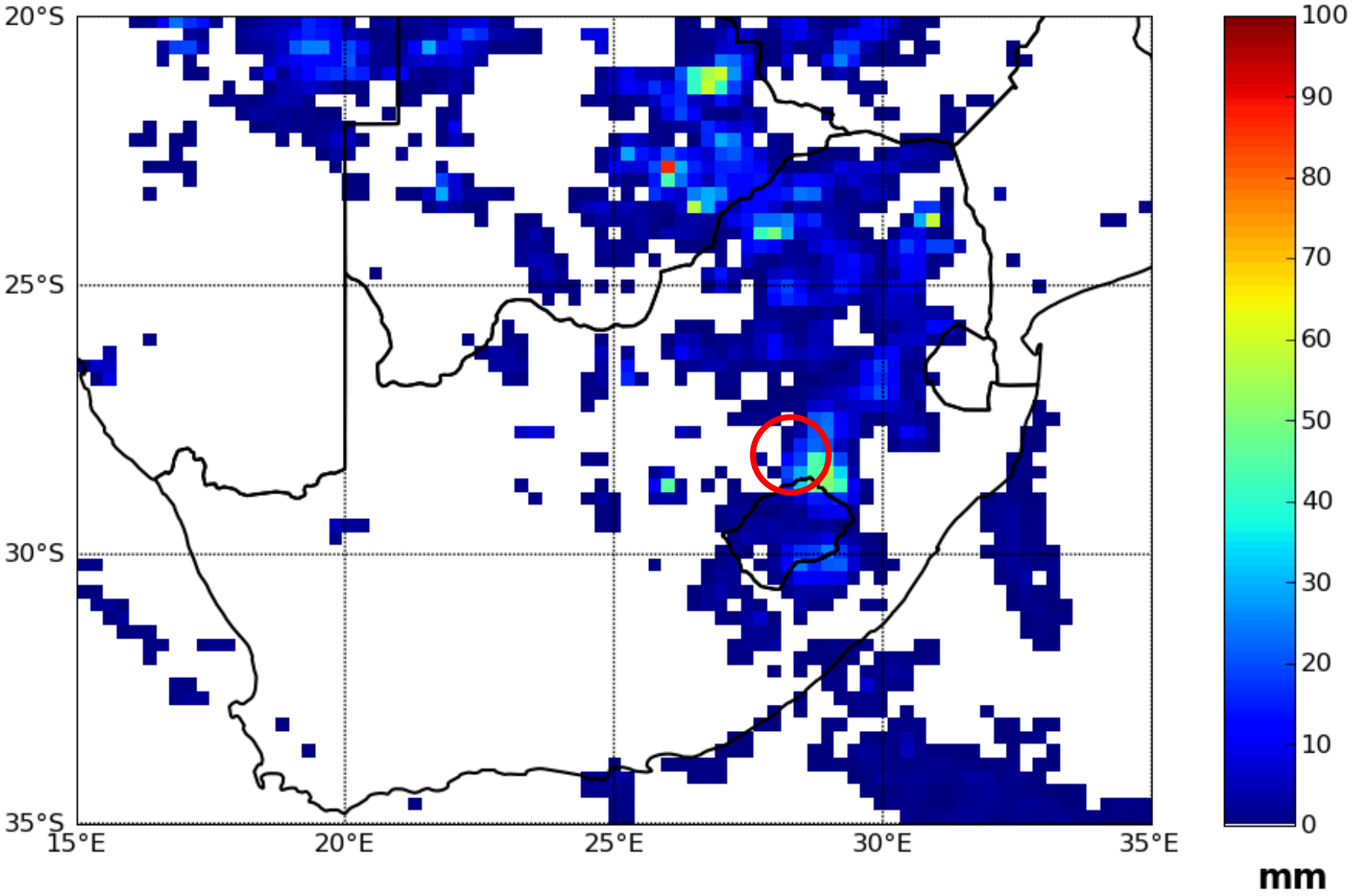
TRMM3B42RT rainfall 21/10/2008



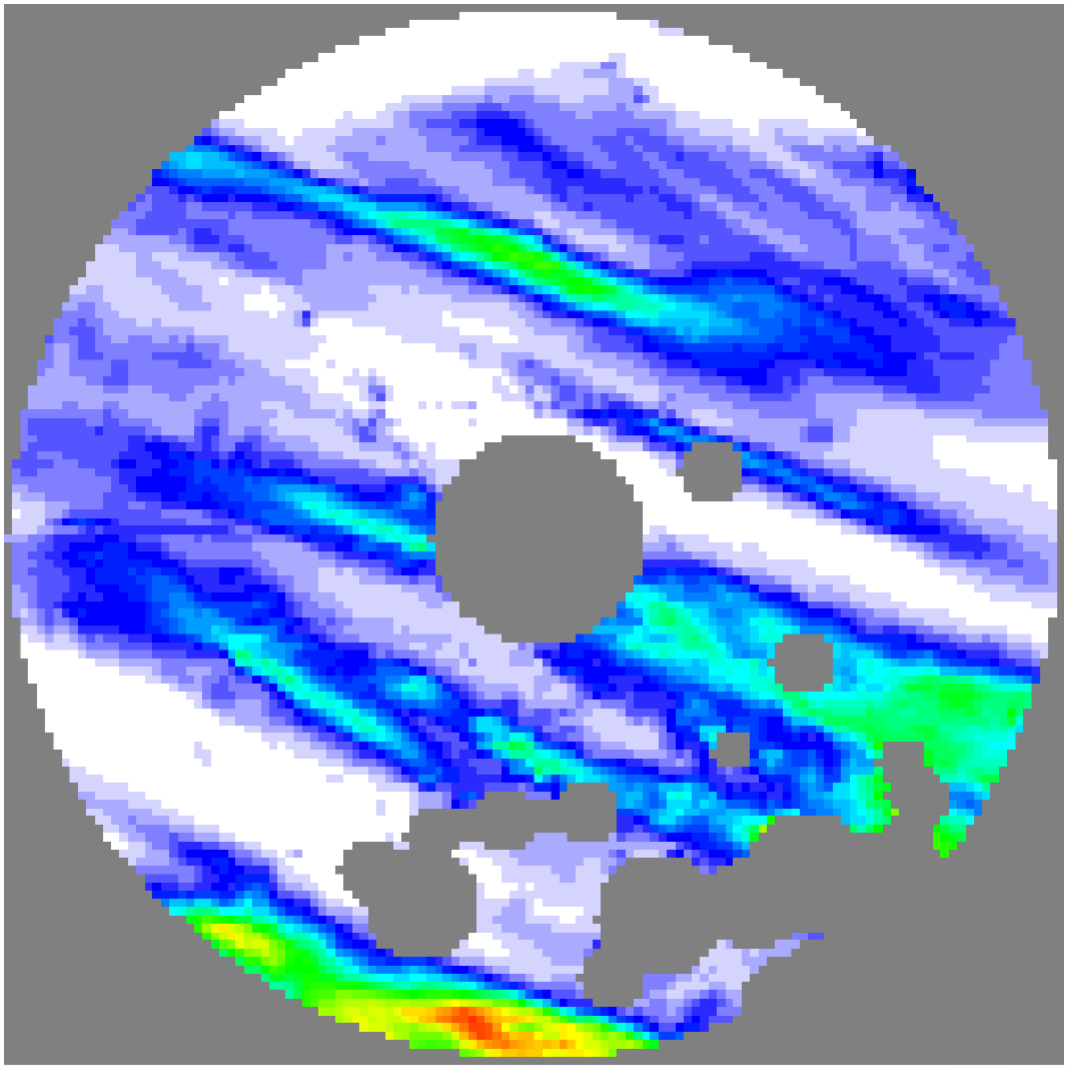
Like This? Polokwane Radar 2000

TRMM3B42RT rainfall 21/10/2008

Bethlehem radar: 128 km diameter – 1km pixels

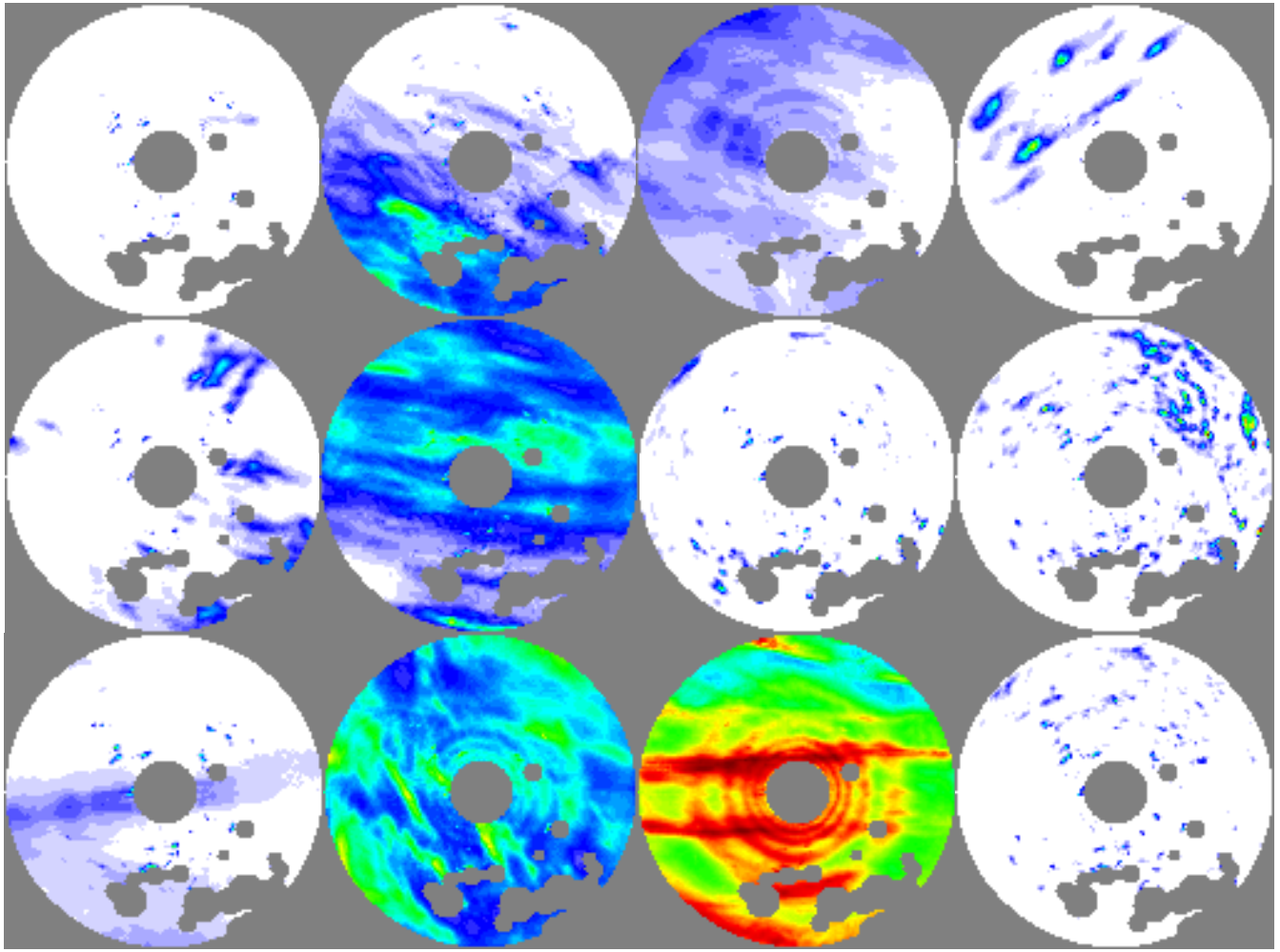


1998: Day 309



1998: Days 296 – 307

NOTE SPATIAL STRUCTURE & DEPENCENCE



Another project sponsored by the Water Research Commission

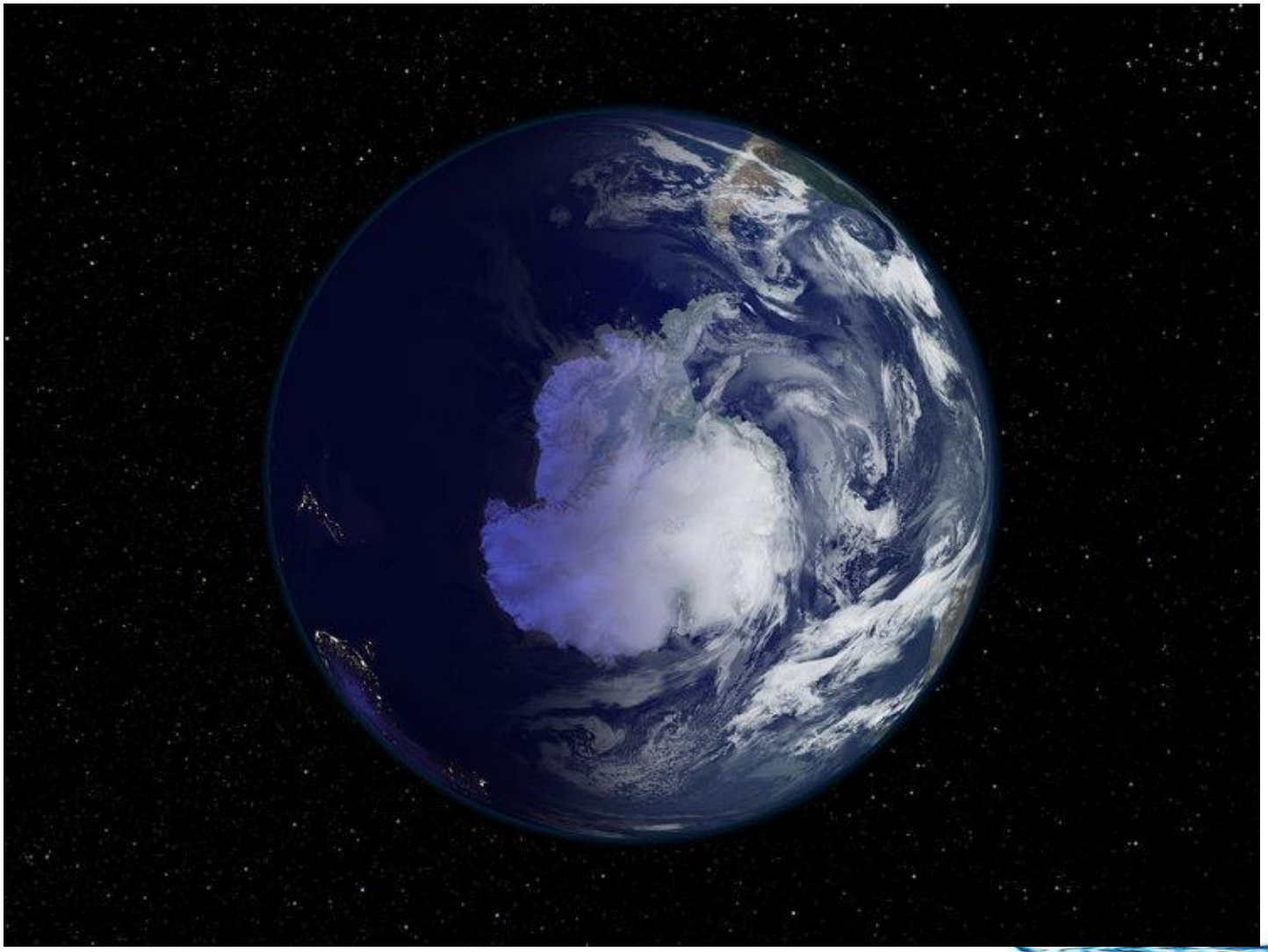
Or like this? - yeah – it's basic

127 mm Standard Raingauge

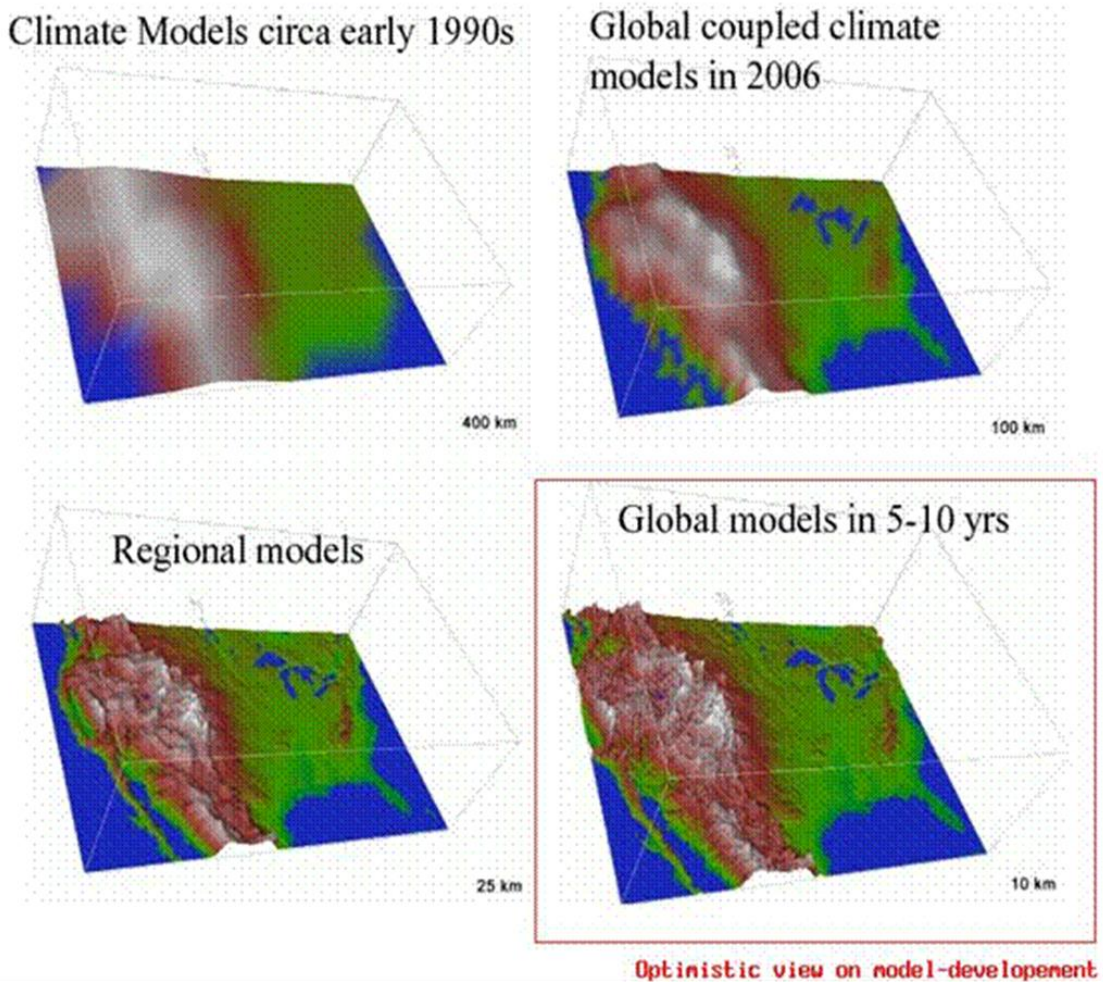
Tipping Bucket Raingauge (TBR)

What drives our weather?

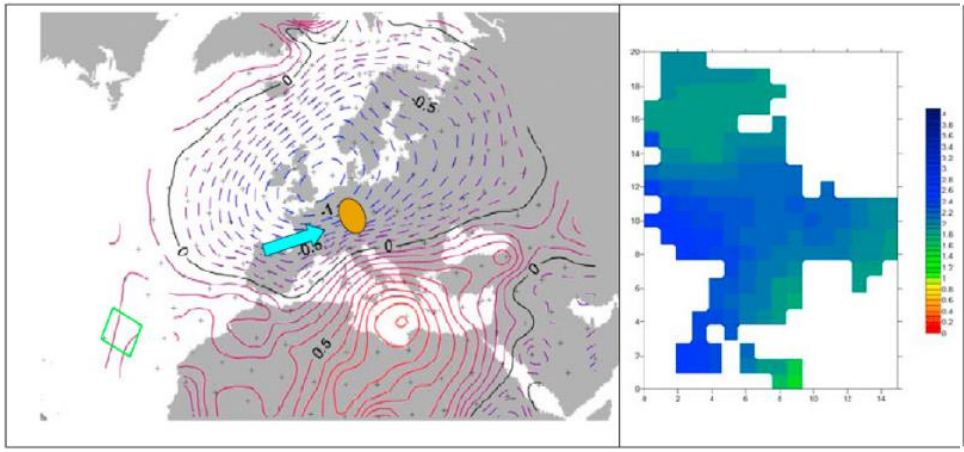
Pressure, Temperature & Spin

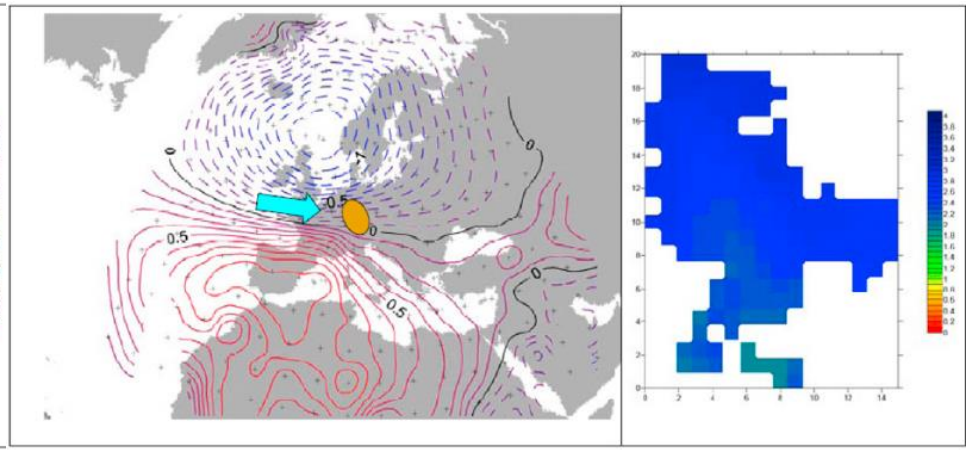


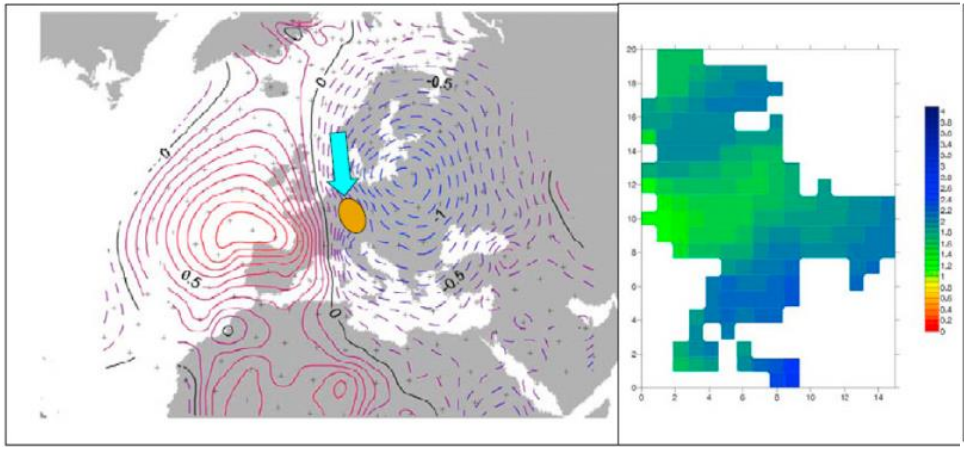
Model rainfall with GCMs: needs bias correction of amounts & spatial dependence

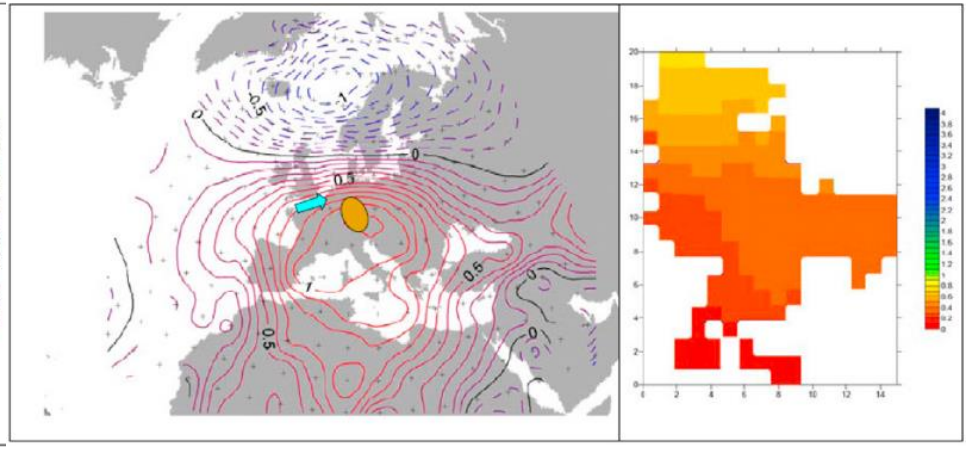


We use selected circulation patterns linked to rainfall – e.g. Rhine basin [107 500 km^2]



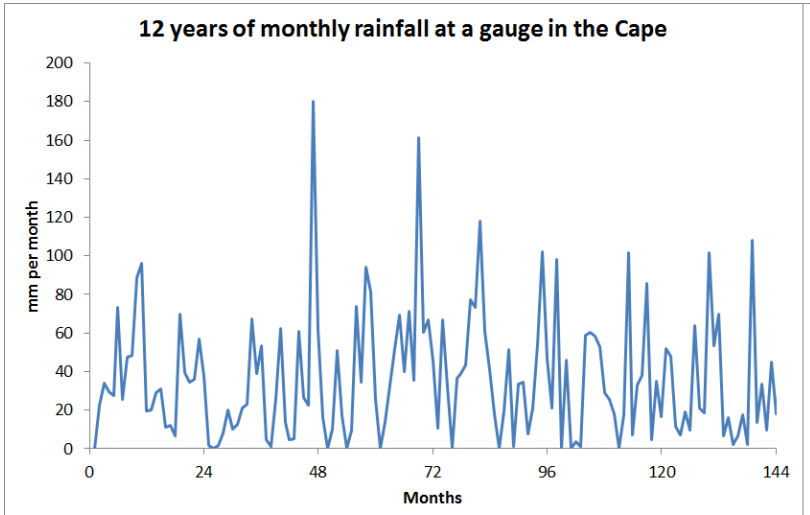


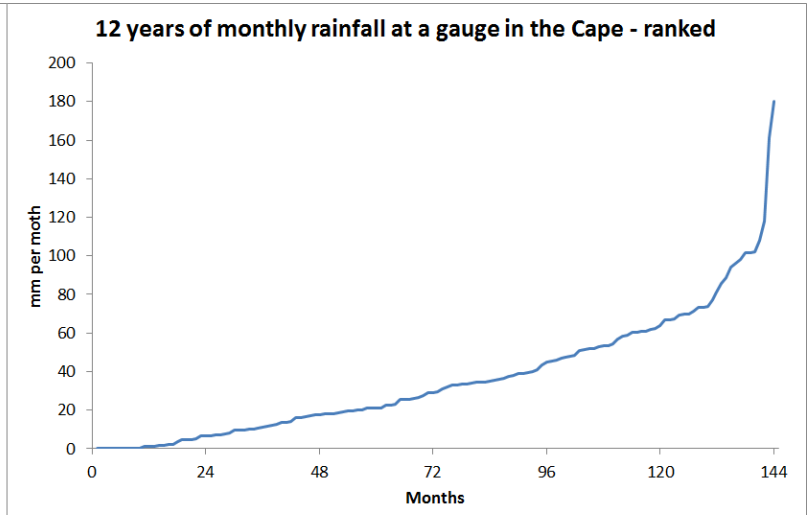


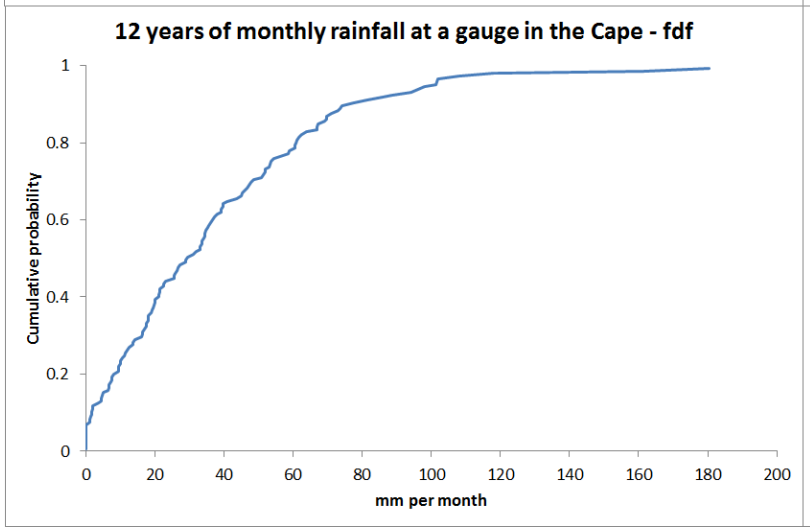


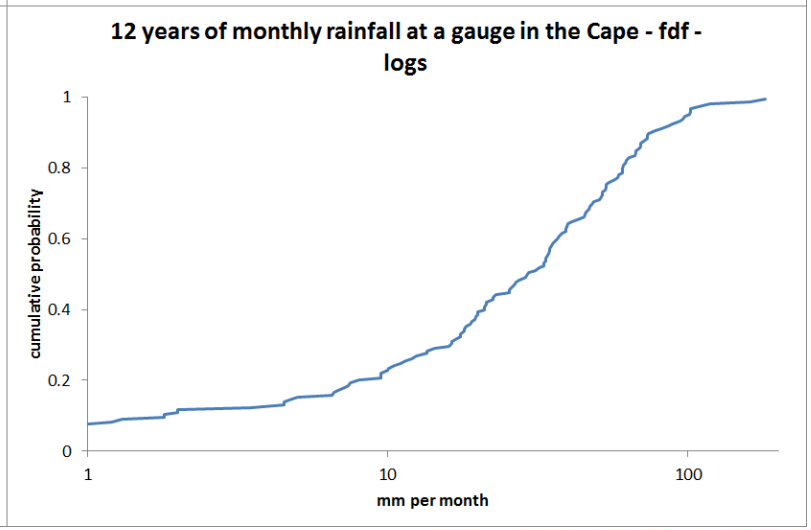
See: Bardossy & Pegram (2011) Water Resources Research

Tools: (1) time series to fdf [e.g. monthly]

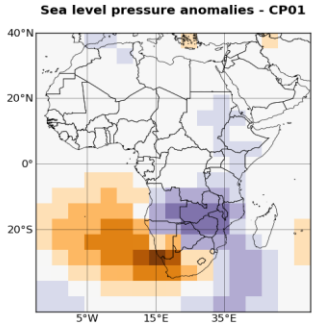


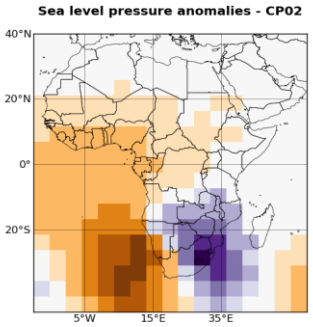


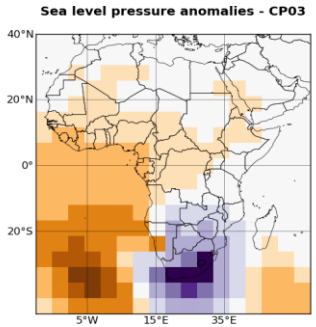


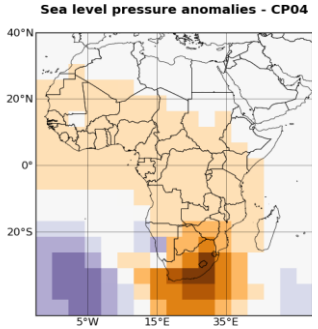


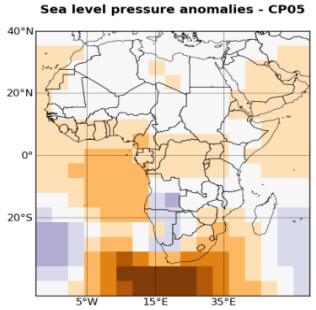
Tools (2): CP anomalies e.g. 10 in the Cape region

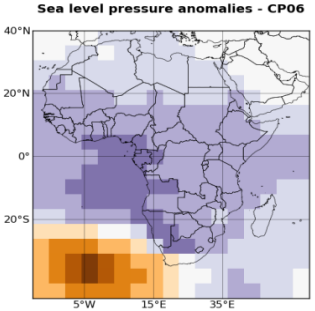


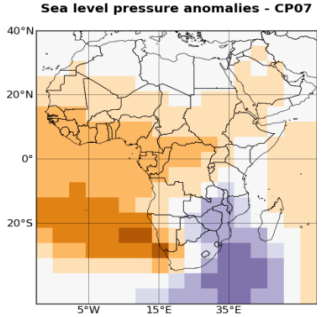


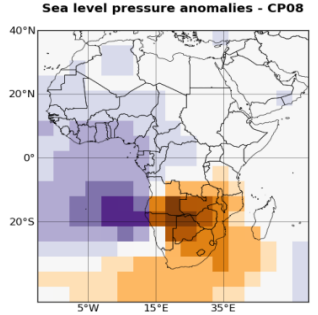


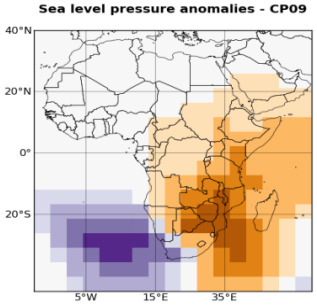


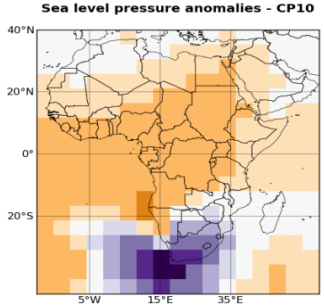


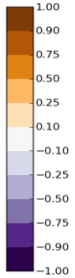




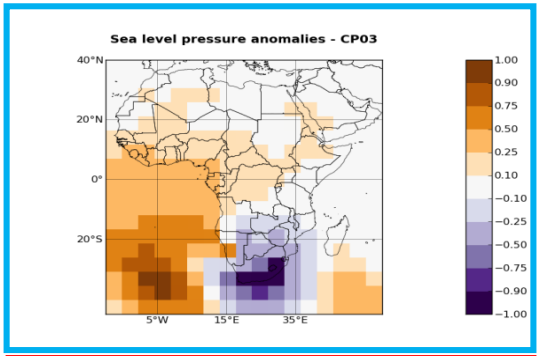








Link CP to rainfall types [daily]



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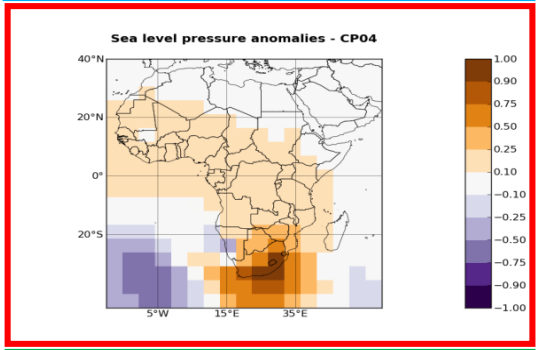

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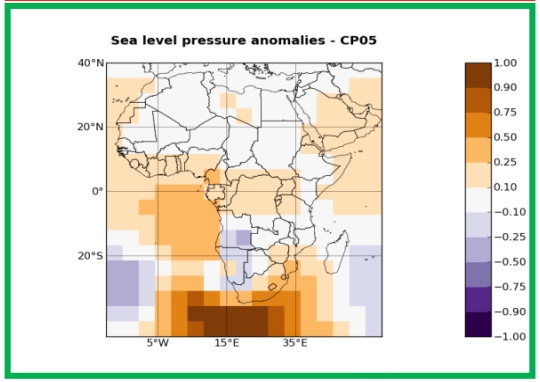

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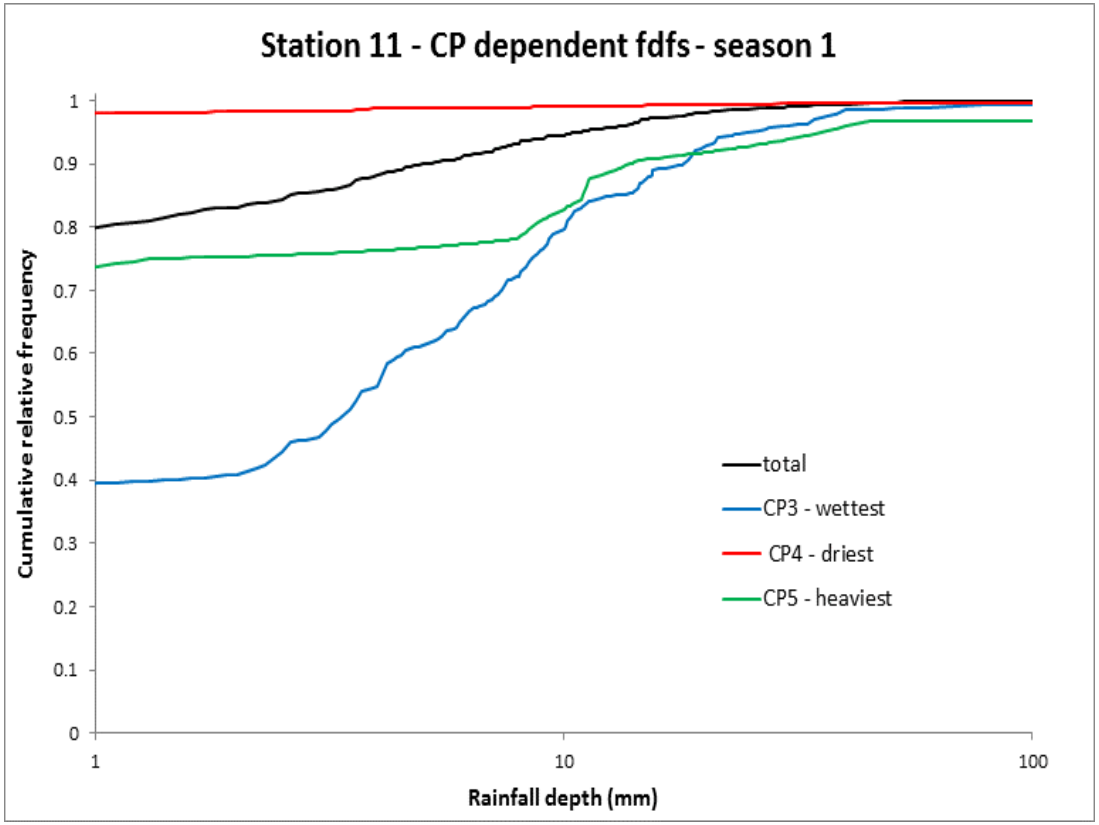
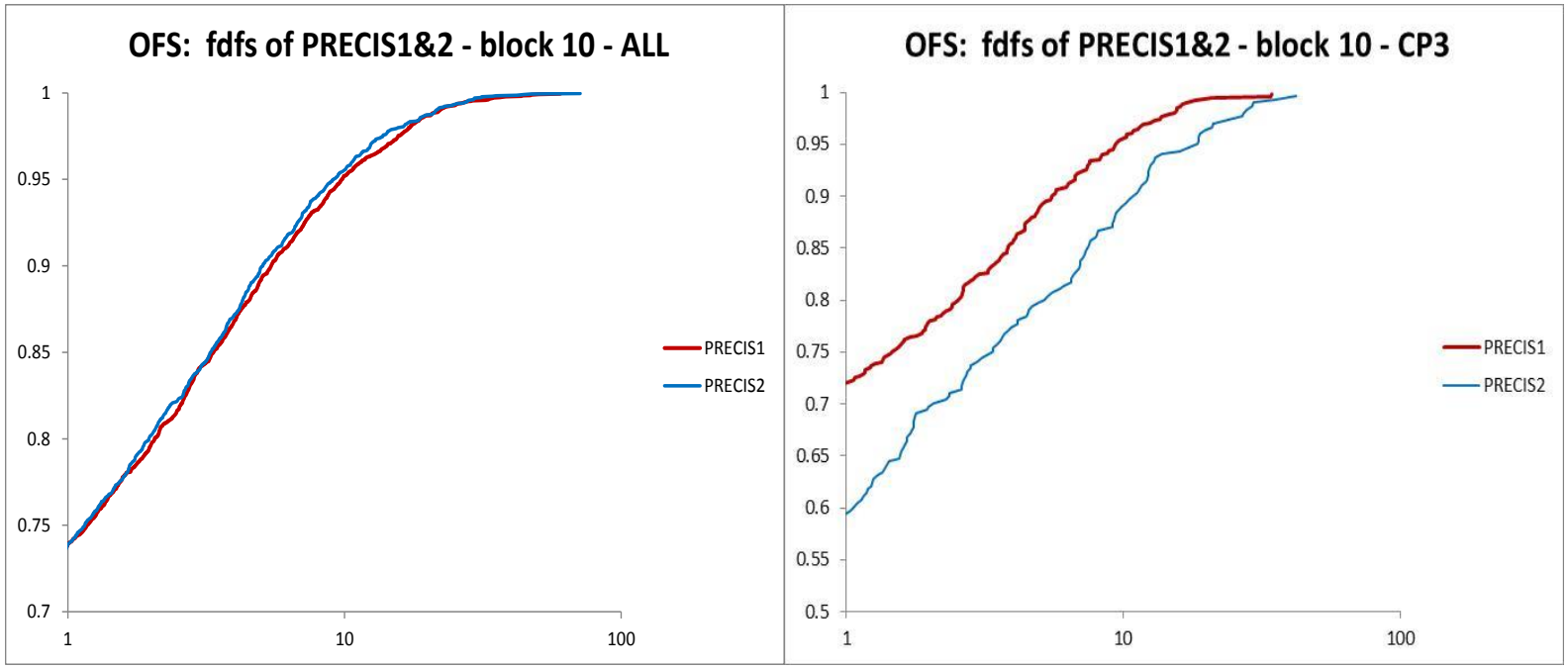
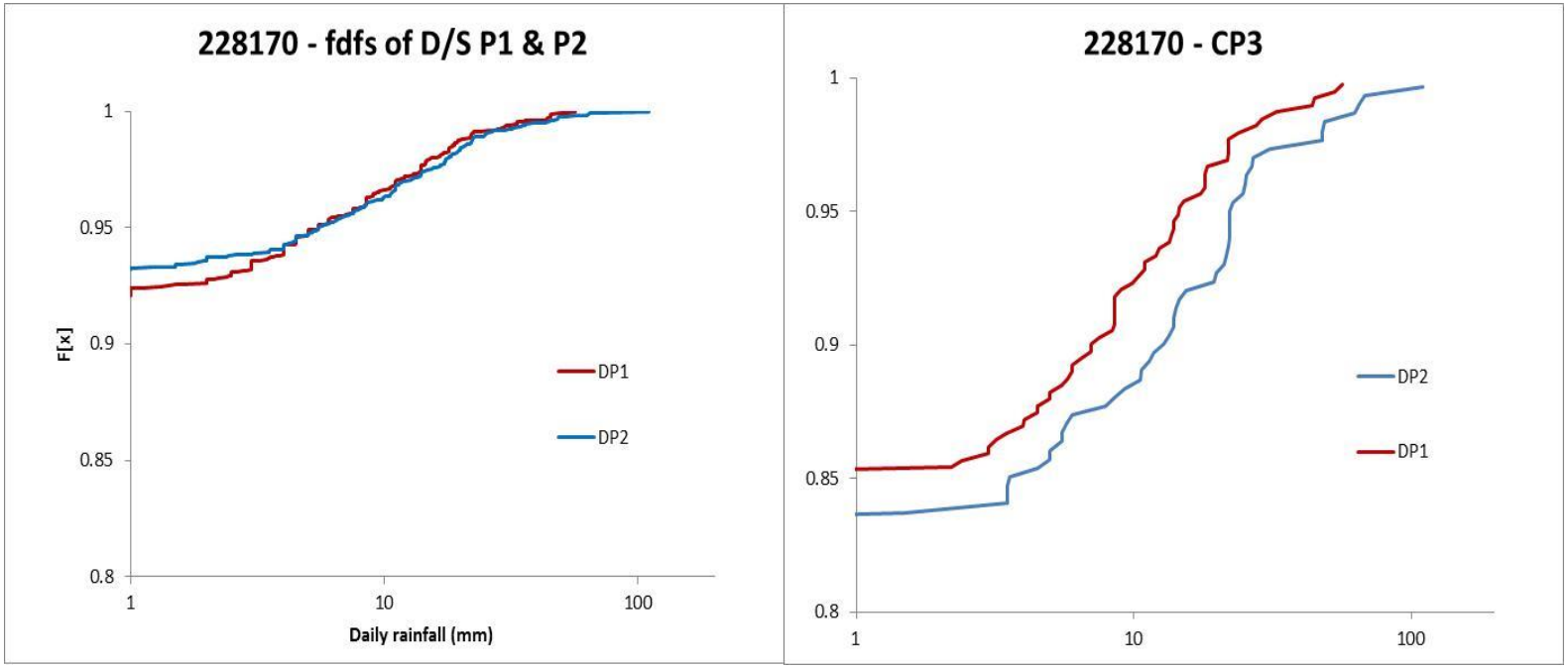


Annual & CP3-based fdf comparisons for raw PRECIS1 & 2



Annual & CP3-based fdf comparisons for downscaled PRECIS1 & 2 to a gauge



Summary

We can downscale RCM blocked rainfall to the gauge scale

We can recorrelate the downscaled to capture the observed spatial dependence [not shown here]

We can preserve the shift [delta] at the same time remove the bias

We are ready to help hydrologists to perform simulations to get a handle on uncertainty

See: WRC report K5/1964 &

Pegram & Bardossy (2013) J of Hydrology (accepted)

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