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Pegram
& Associates

Challenges of Hydrological Research in a developing country

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Why is this Meeting important?

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Good data are becoming scarce and costly

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Good data are becoming scarce and costly

1. Risk of Flood & Famine require planning
2. Impossible to go back in time to 're-gauge'
3. Our models depend on data, not just imagination
4. With a changing climate we cannot depend only on past data, it has to be current

Therefore, we must continue monitoring the forcing variables

Some of our products

- PEGRAIN daily rainfall network model for DWA
- Soil Moisture & Evapotranspiration: K5/2024
- SA Flash Flood Guidance: K5/2068

&

- Possible future daily rainfall on networks:
K5/1984

What data do I need?

- Daily raingauge network
- Streamflow hydrograph (continuous)

These are **real** data and are the most difficult to get hold of consistently

What data do I need?

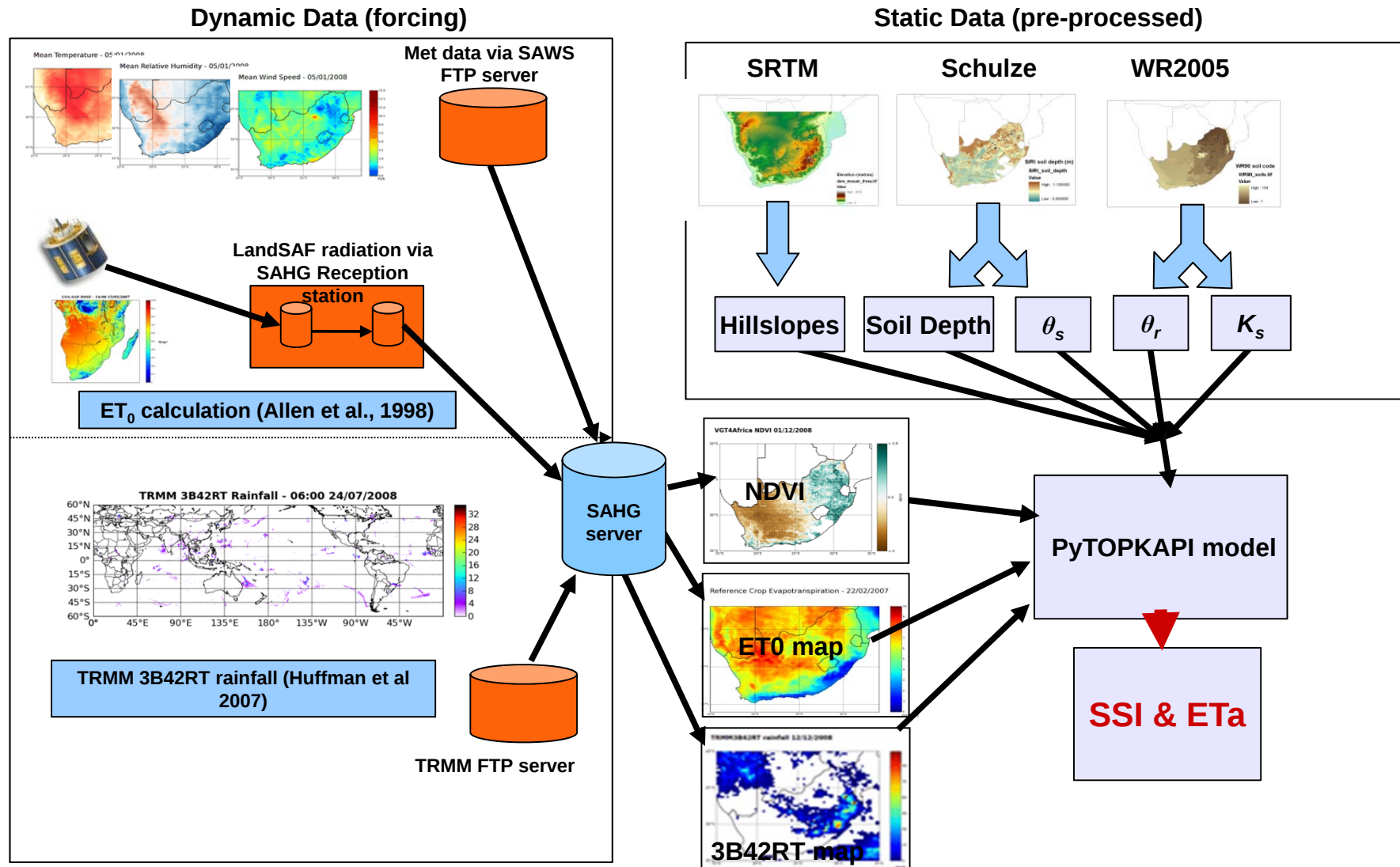
- Daily raingauge network
- Streamflow hydrograph (continuous)
- Topographical, vegetation, soil properties
- Regional Circulation Model rain & pressure
- 3-hour TRMM real time
- Ingredients for ET: wind speed, temperature, humidity, radiation
- Remote sensing estimates for validation of SM products – probes are not yet deployed

Estimating Soil Moisture & ETa

There are 3 ways I know of estimating Soil Moisture:

- Direct sampling (probes, grab samples)
- Remote sensing (ERS, ASCAT, SMOS)
- Physical modelling (hydrological and meteorological)

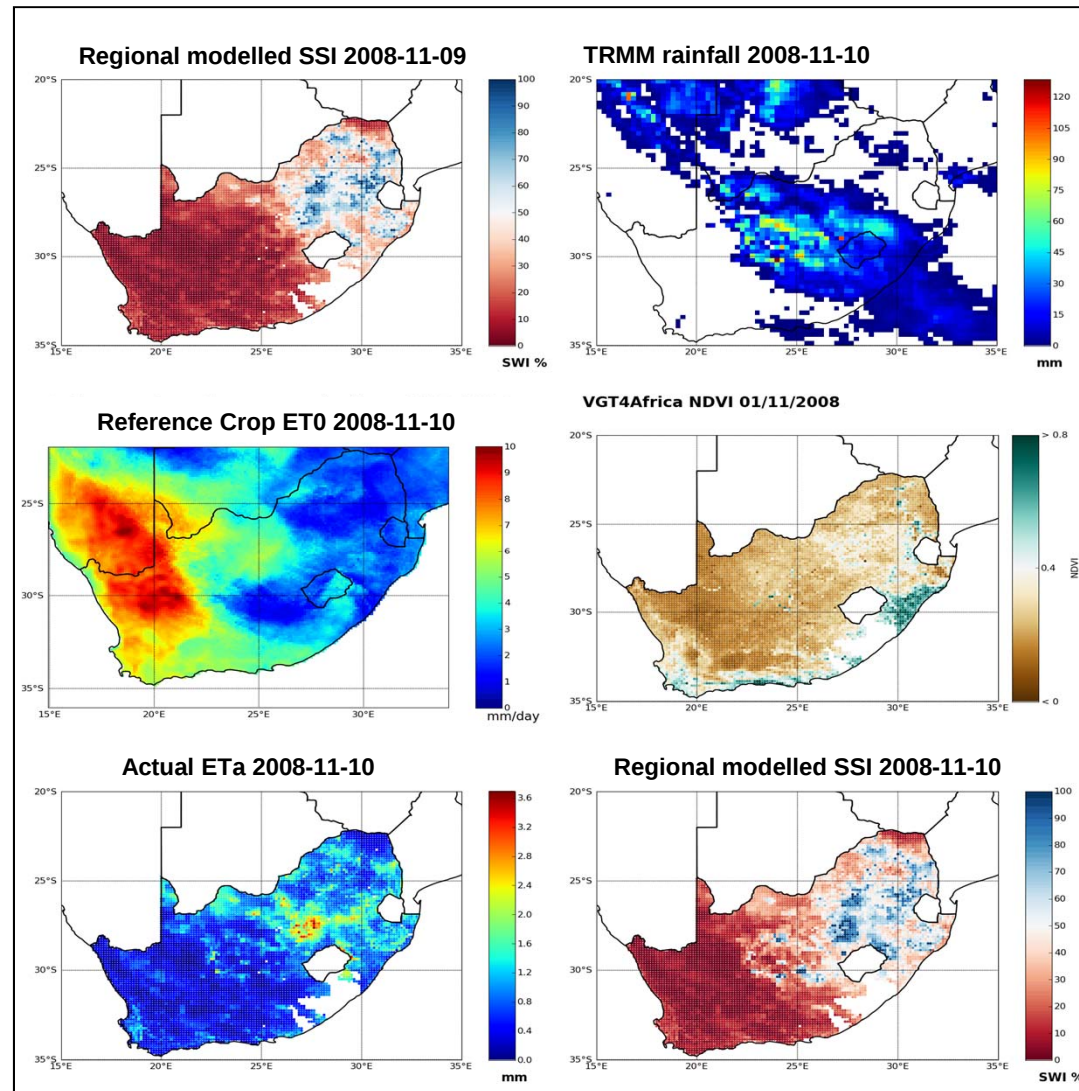
Data streams to model SSI & ETa



How we get ETa hence SSI

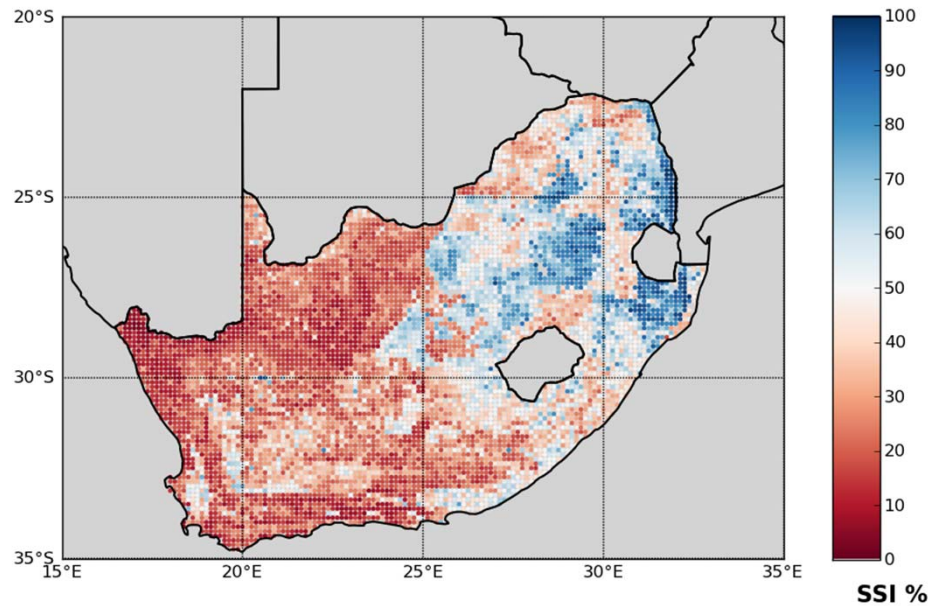
at 3-hour
intervals

here
shown as
over a day

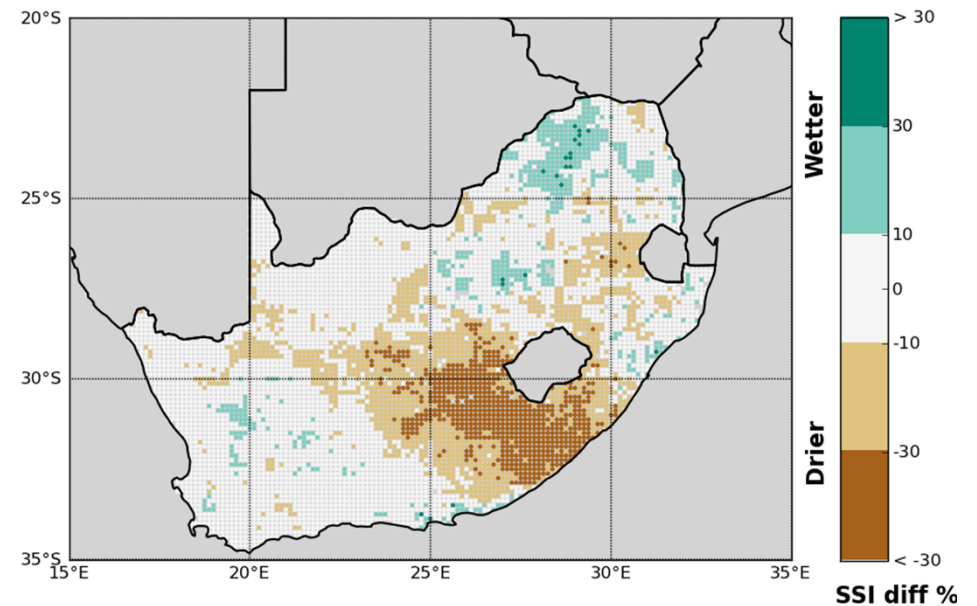


Product: Agric. Res. Council Umlindi

Monthly mean Soil Saturation Index (Nov 2011)



SSI difference map (Nov 2011 minus Nov 2010)



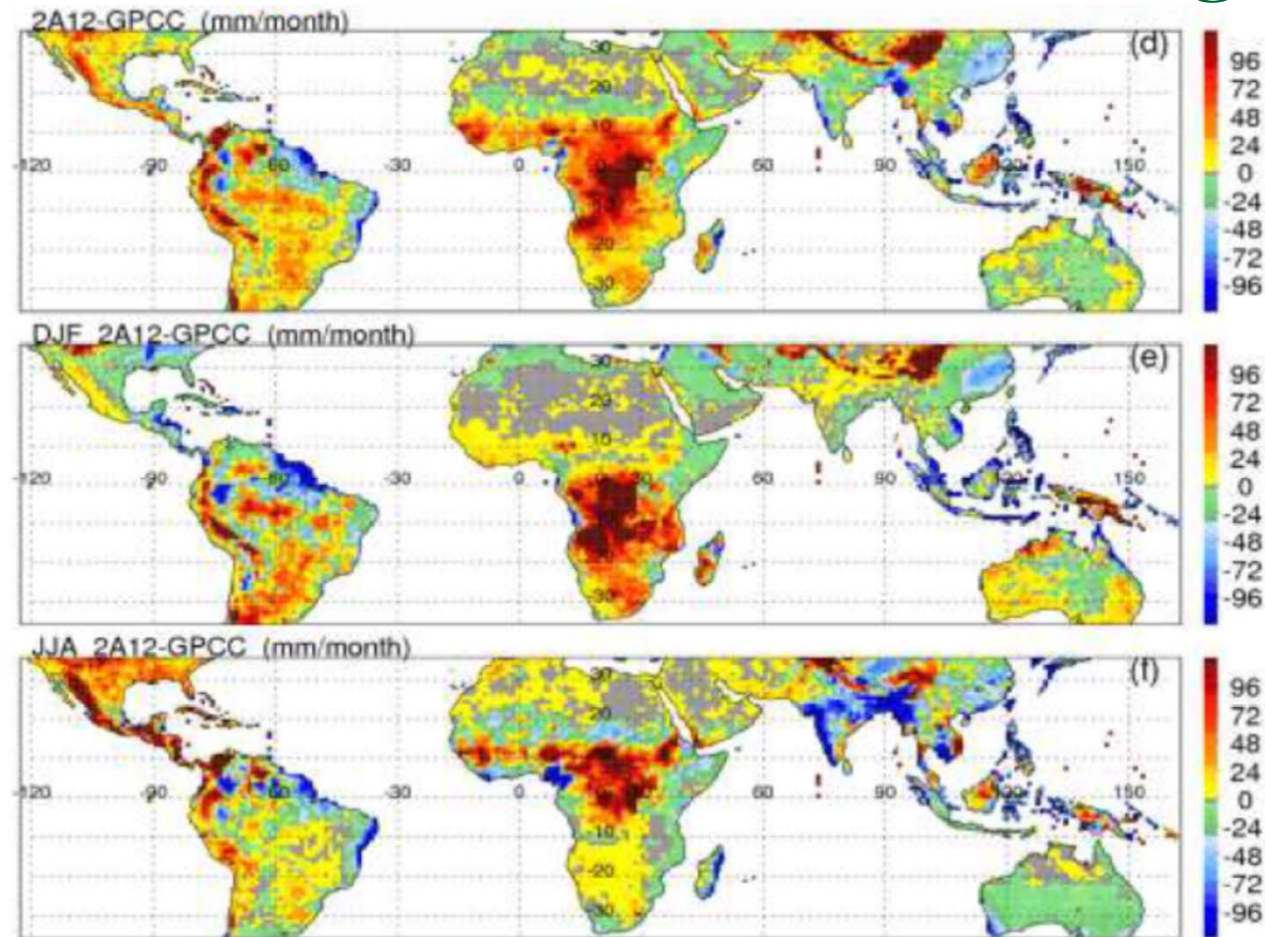
How good are these products?

- We need to validate
- Or at least perform model inter-comparison (done)
- We need data to do the first

Where does that leave us?

- The 150 Hydra probes bought by SAWS [2006!] for SM ground-truthing are still in a shed ...
- Our pricey SAWS raingauge network is **dying**, shall we rely on remote sensing?
- If so, we desperately need to soon get TRMM corrected, specially while we still have gauges
- We need to be able to validate our Hydrological models – when will DWA repair their data portals? [I can't get S/F data]

Global Mean Monthly rainfall Differences: TRMM ~ Gauges



Ground “Truthing” over Africa: 1° scale

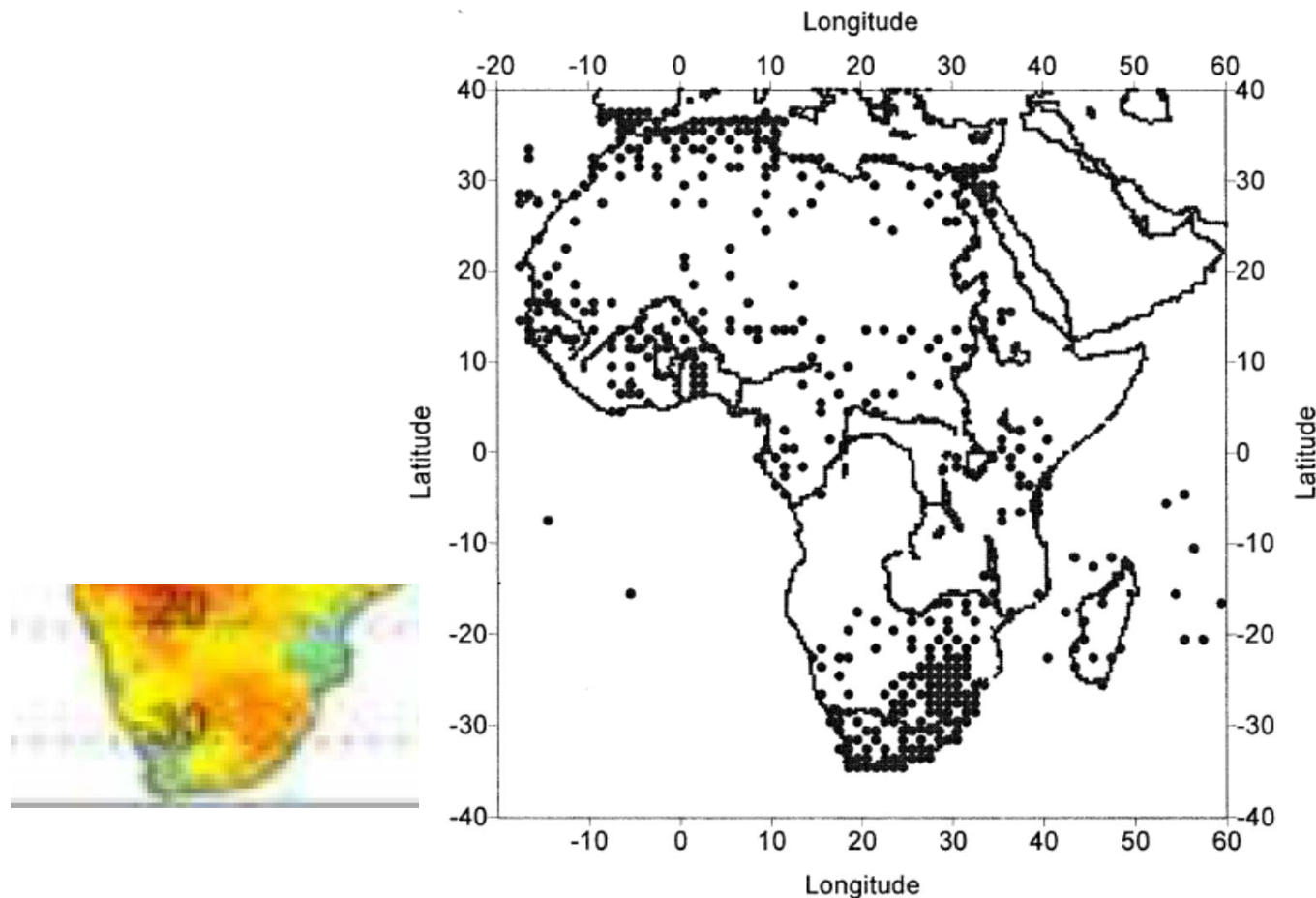
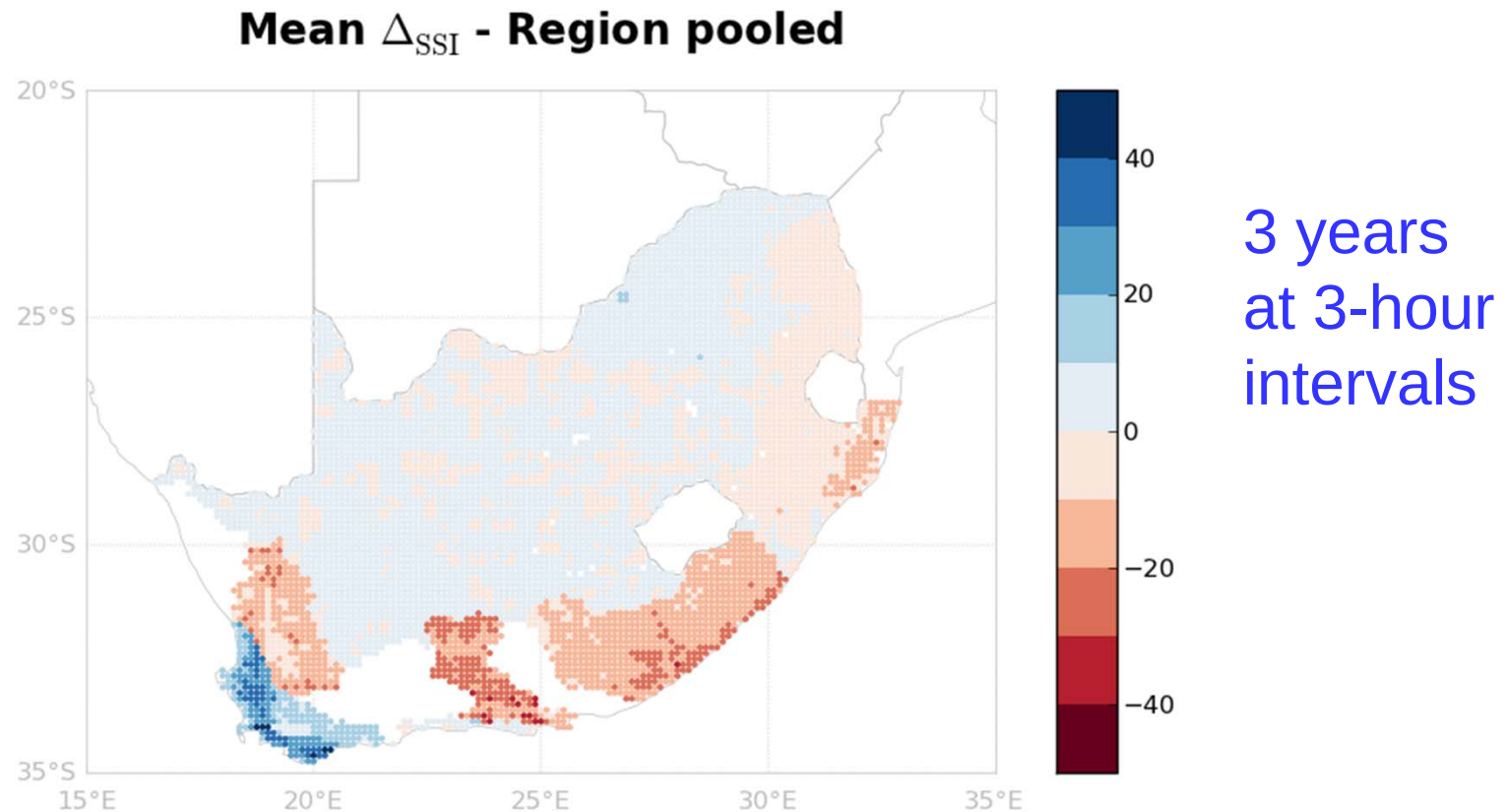


FIG. 1. GPCC rain gauge distribution over Africa (Jan 2000). The dots represent grid cells in which at least one rain gauge is present in a 1.0° lat × 1.0° lon box.

Correcting SSI from (i) raw TRMM to (ii) conditioned with DWA daily gauges

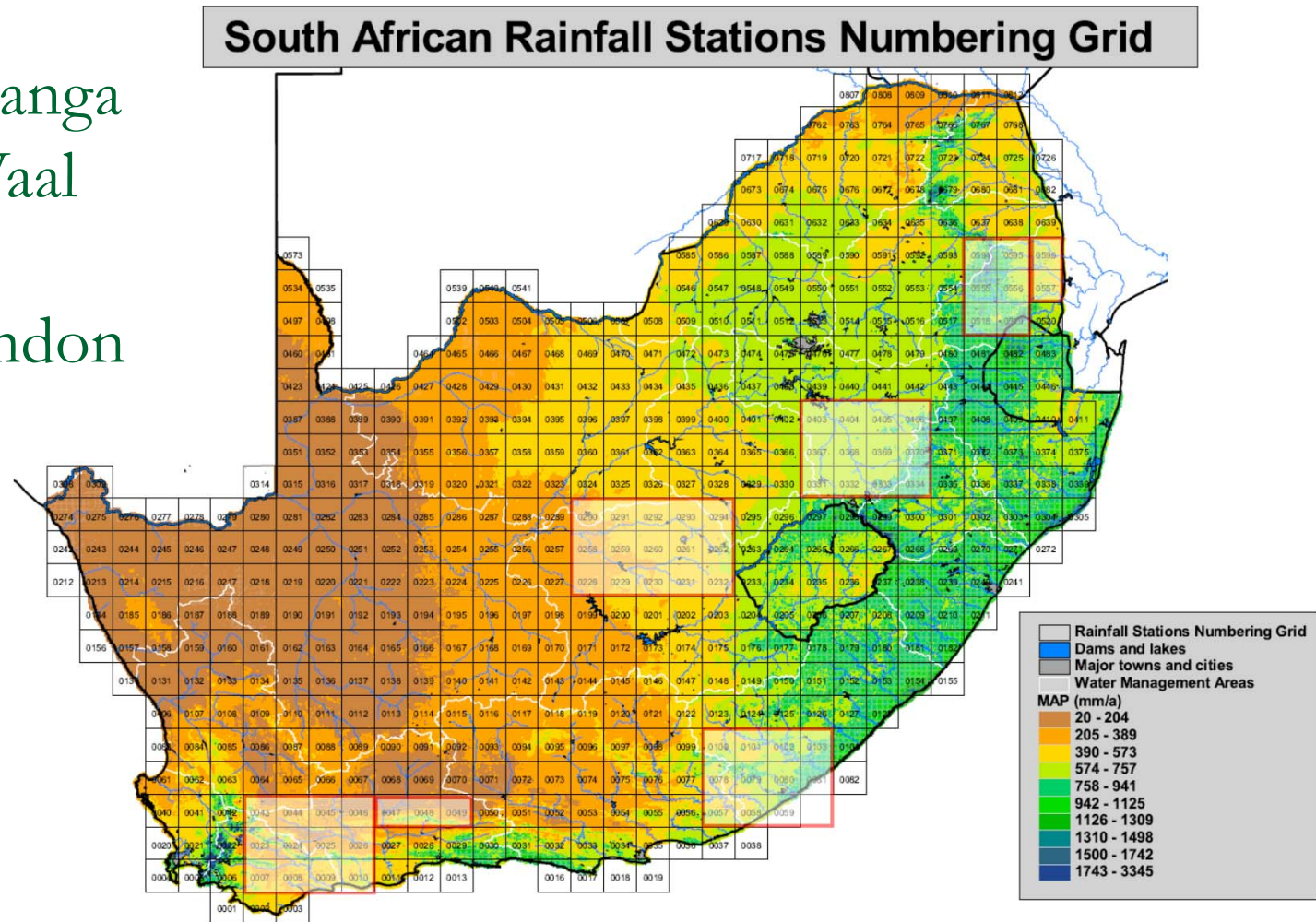


What about the future?

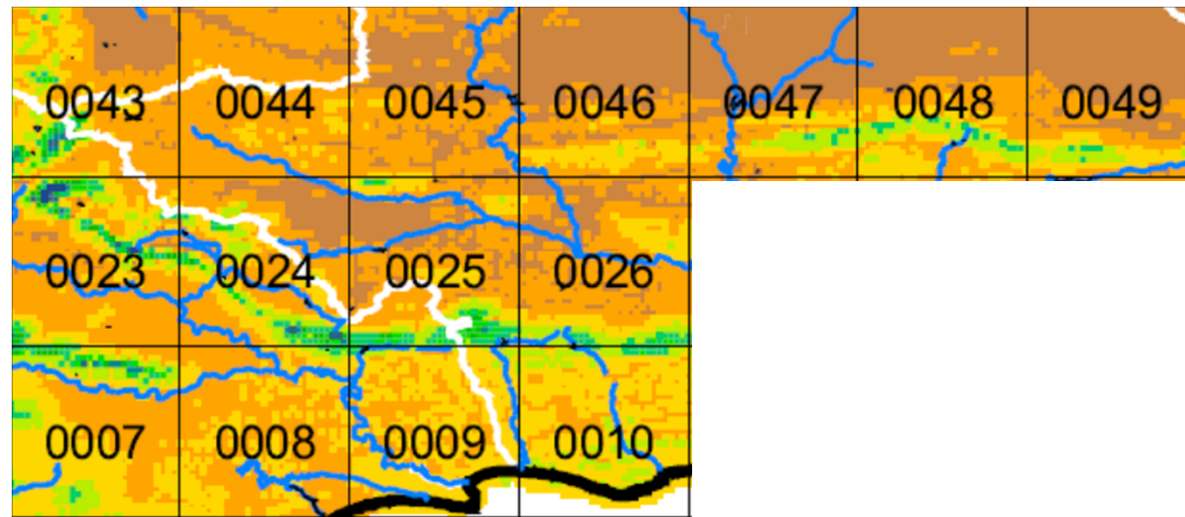
- Let's look at the rainfall in the Cape in 2 periods:
- Jan 1990 to July 2000 [Lynch data-base]
- Aug 2000 to April 2008 [SAWS from UCT]

The MAP map & 5 selected regions

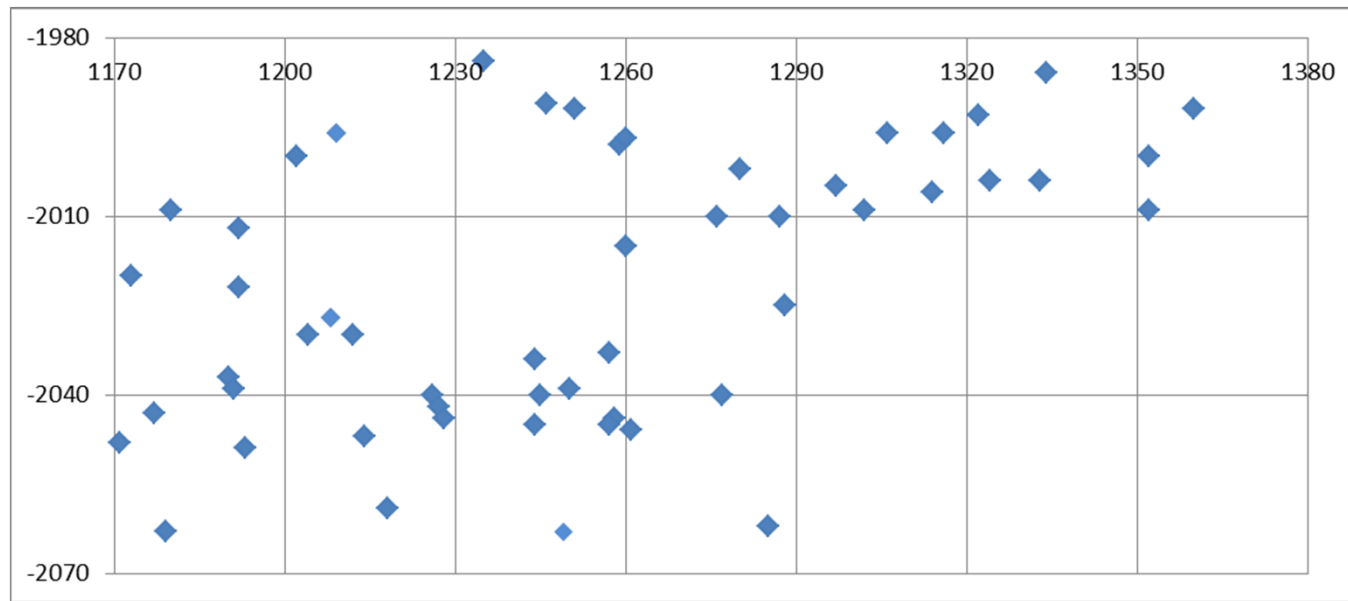
Mpumalanga
Upper Vaal
OFS
East London
Cape



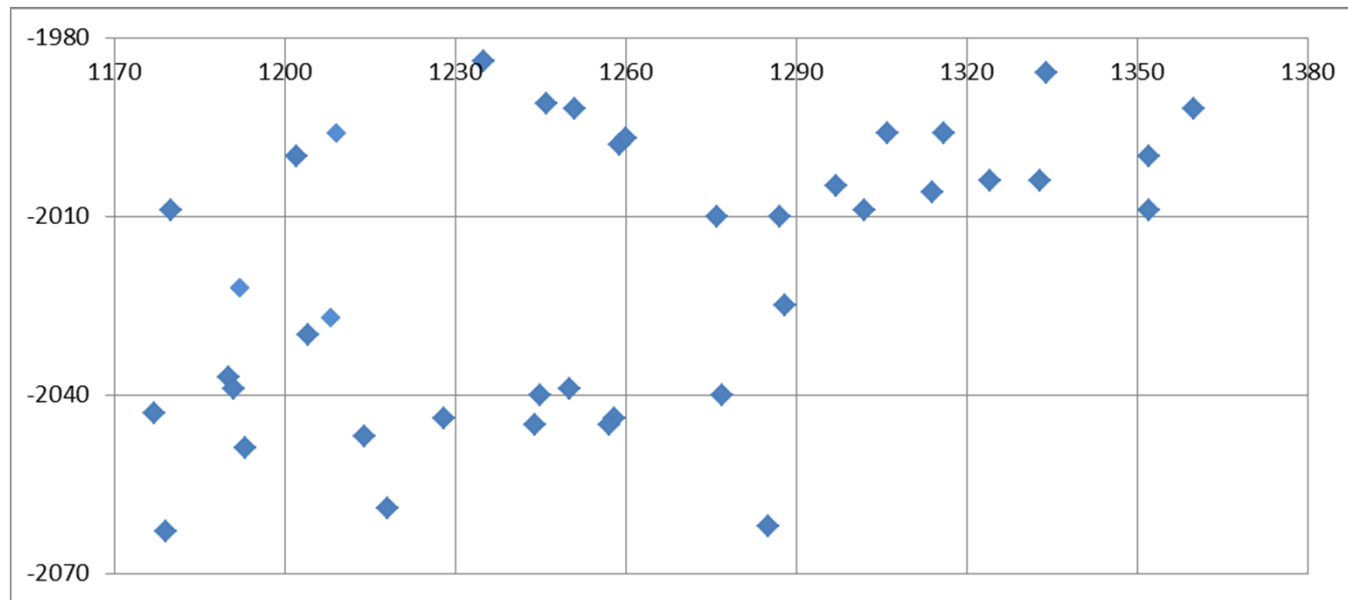
The Cape region – SAWS 0.5° blocks



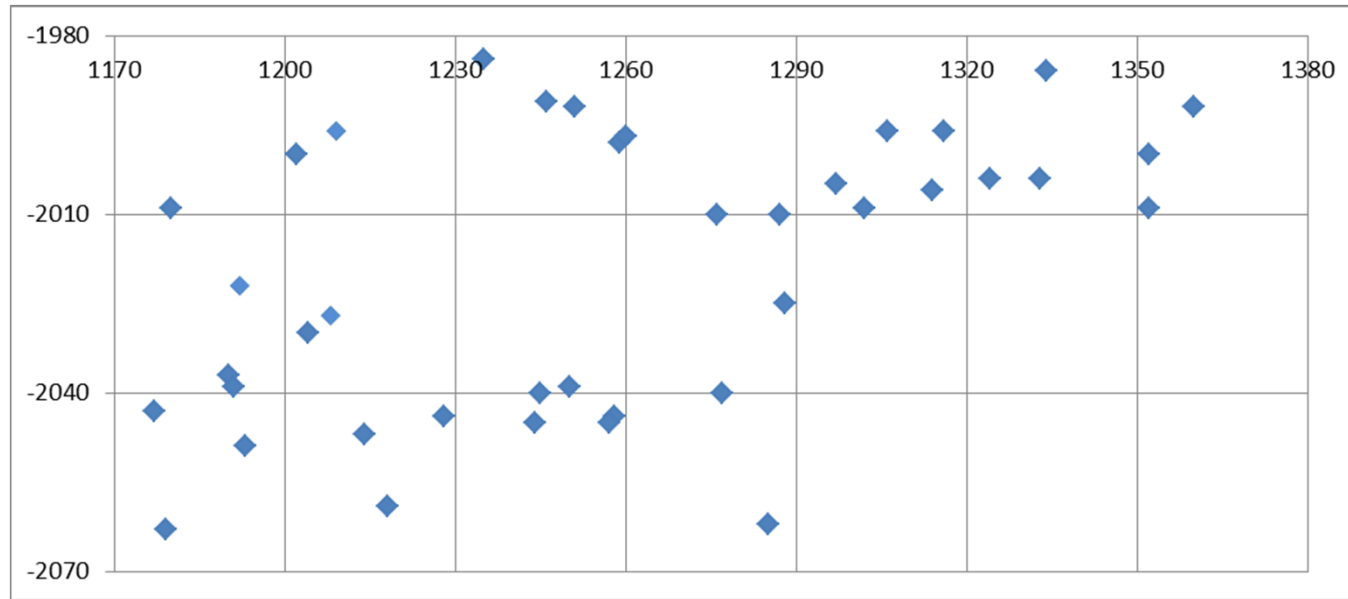
Gauge sites 1990 to 2000



Gauge sites 2000 to 2008



Gauge sites 2000 to 2008

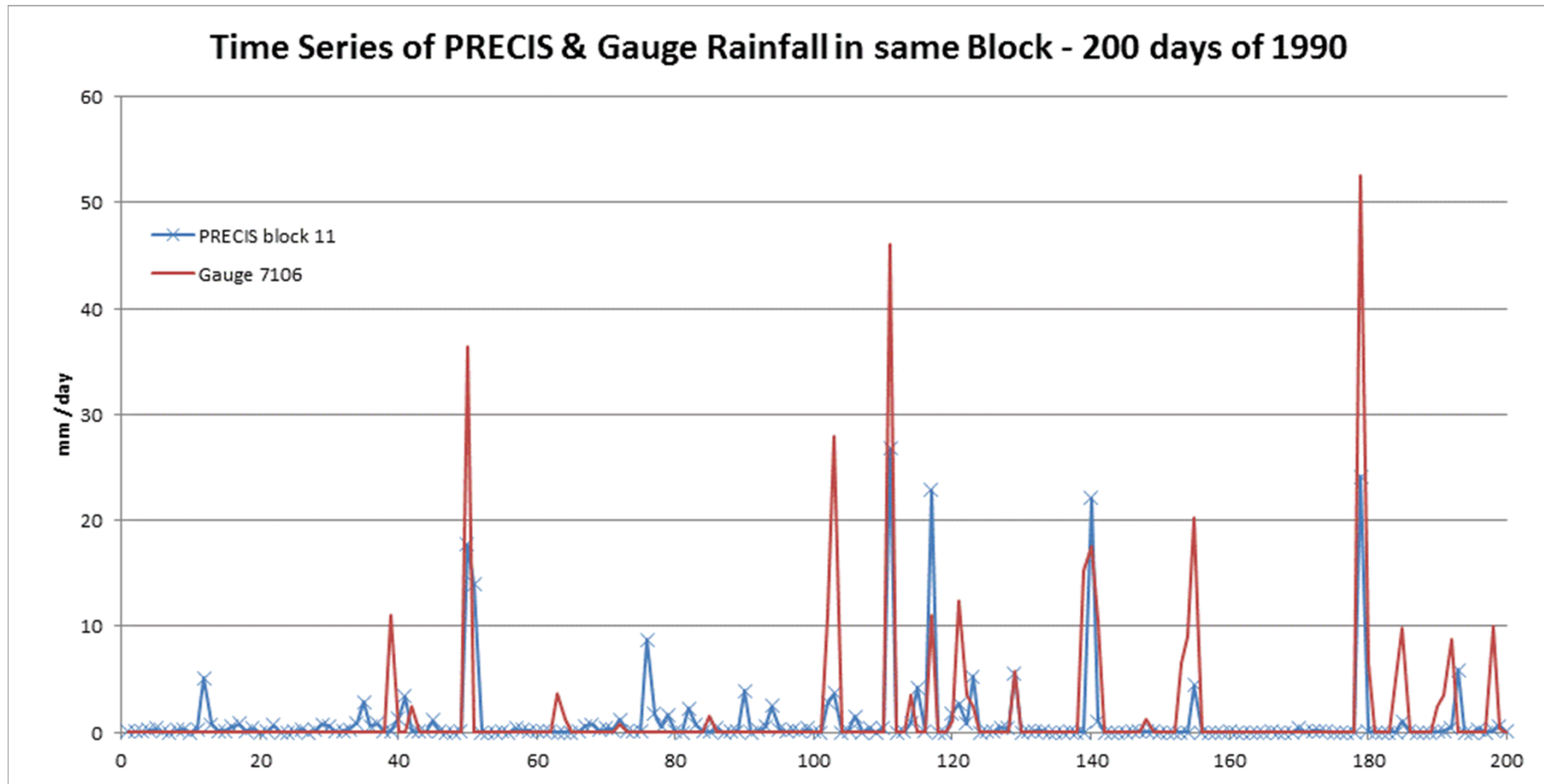


Survivors – the Cape lost 13 out of 53 – over all 5 regions 36%

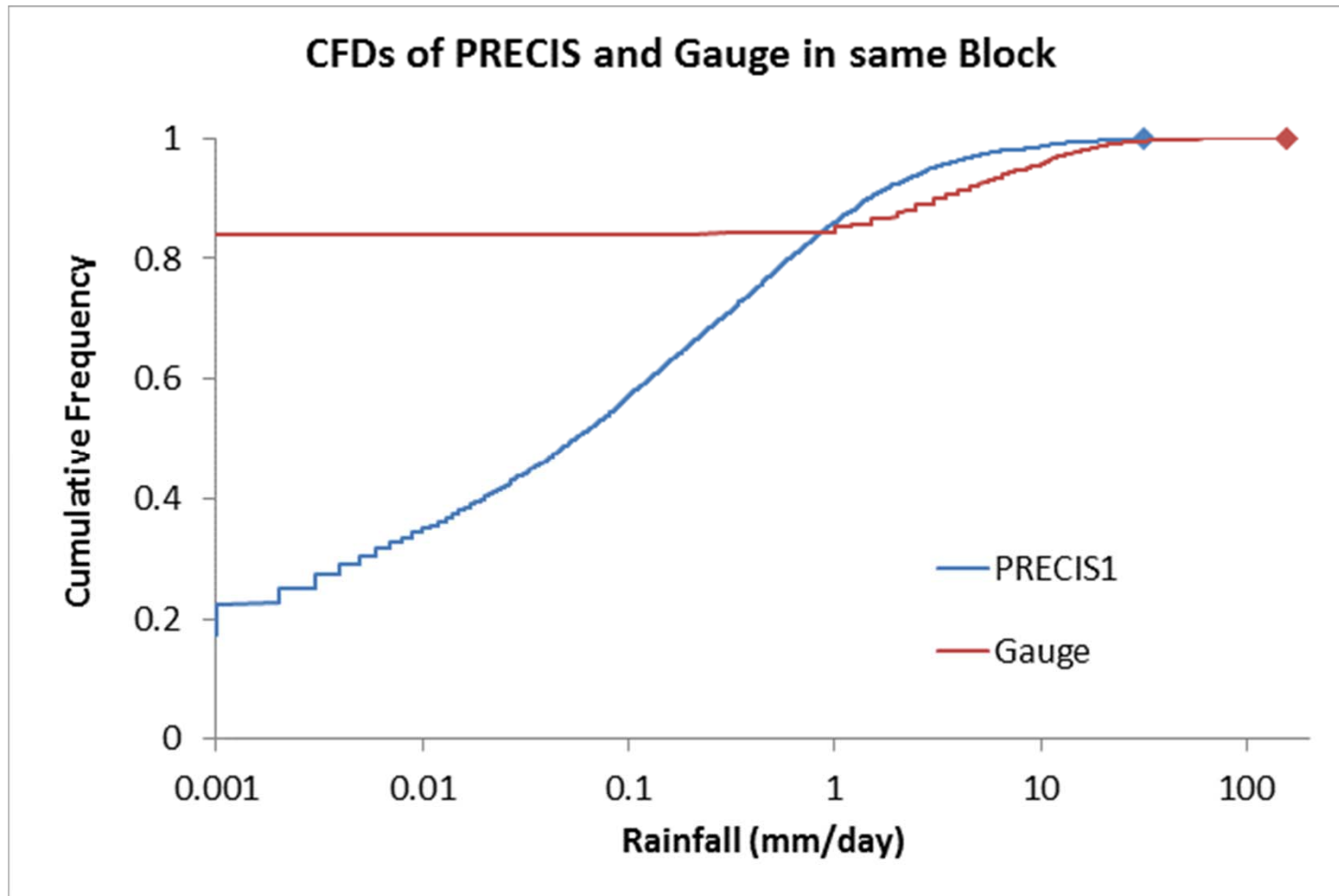
OK we have *some* gauge data

- What about appropriate RCM data?
- We obtained some PRECIS data from UCT's CSAG
- Let's compare it with gauges

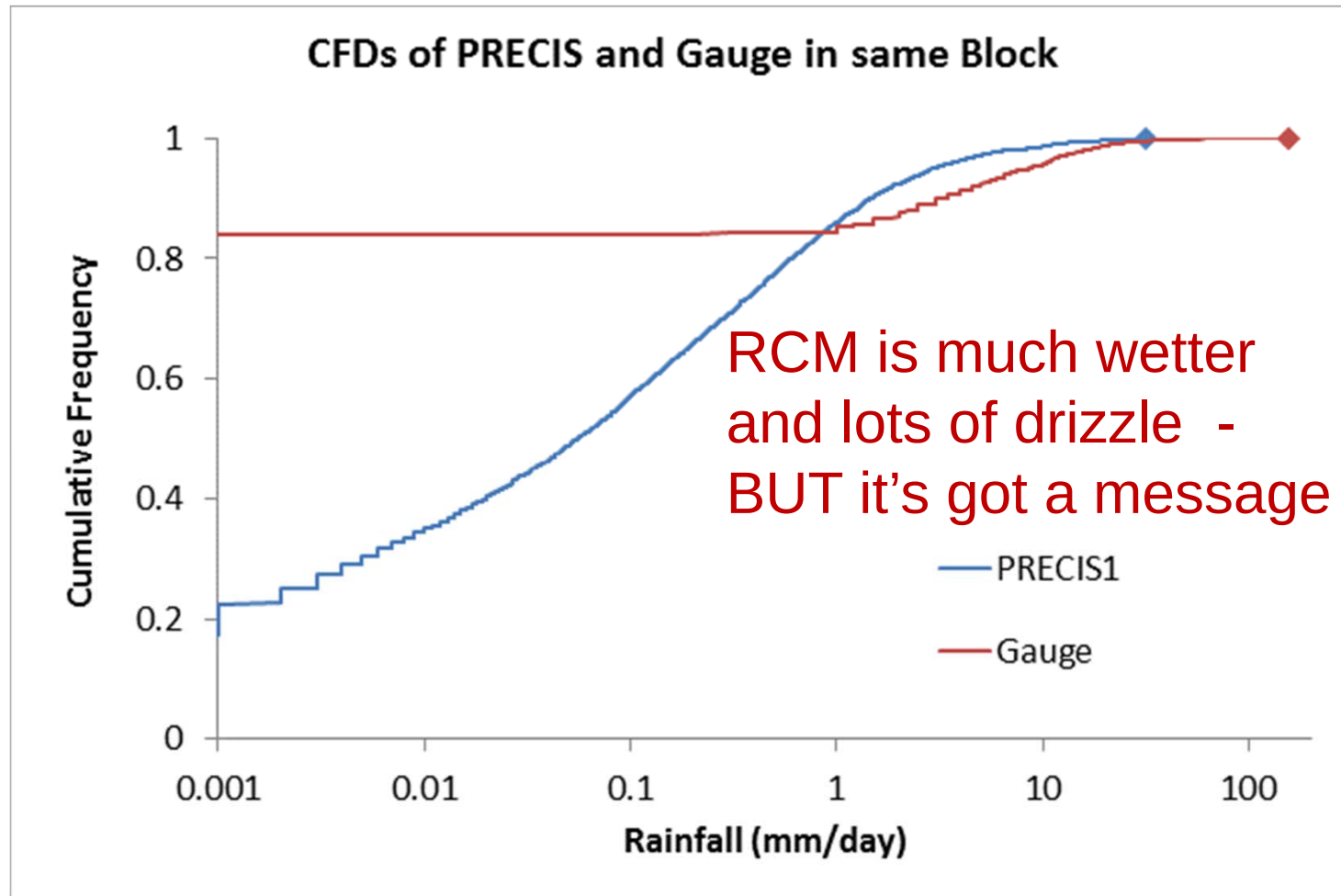
Compare Rainfall Time Series



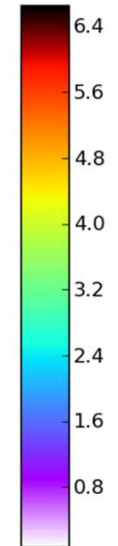
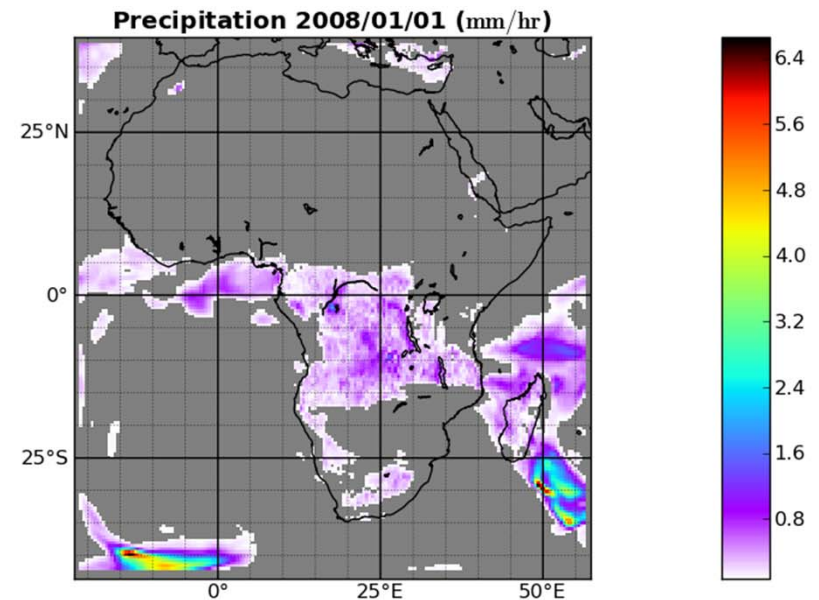
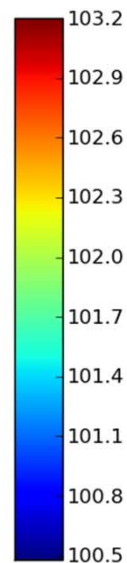
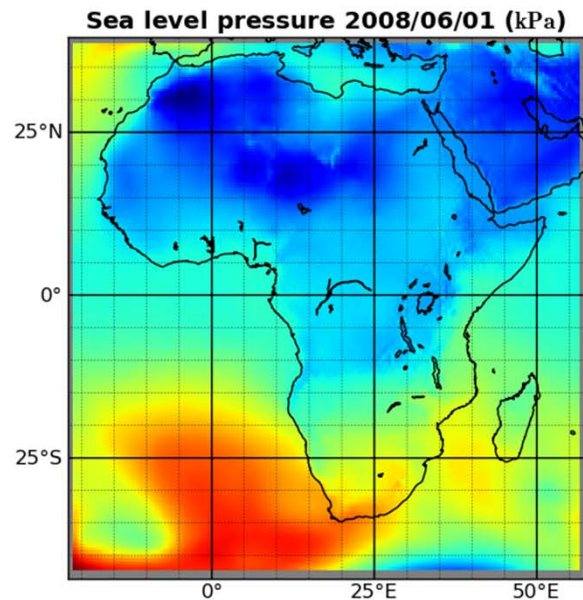
Compare ranked frequency distributions



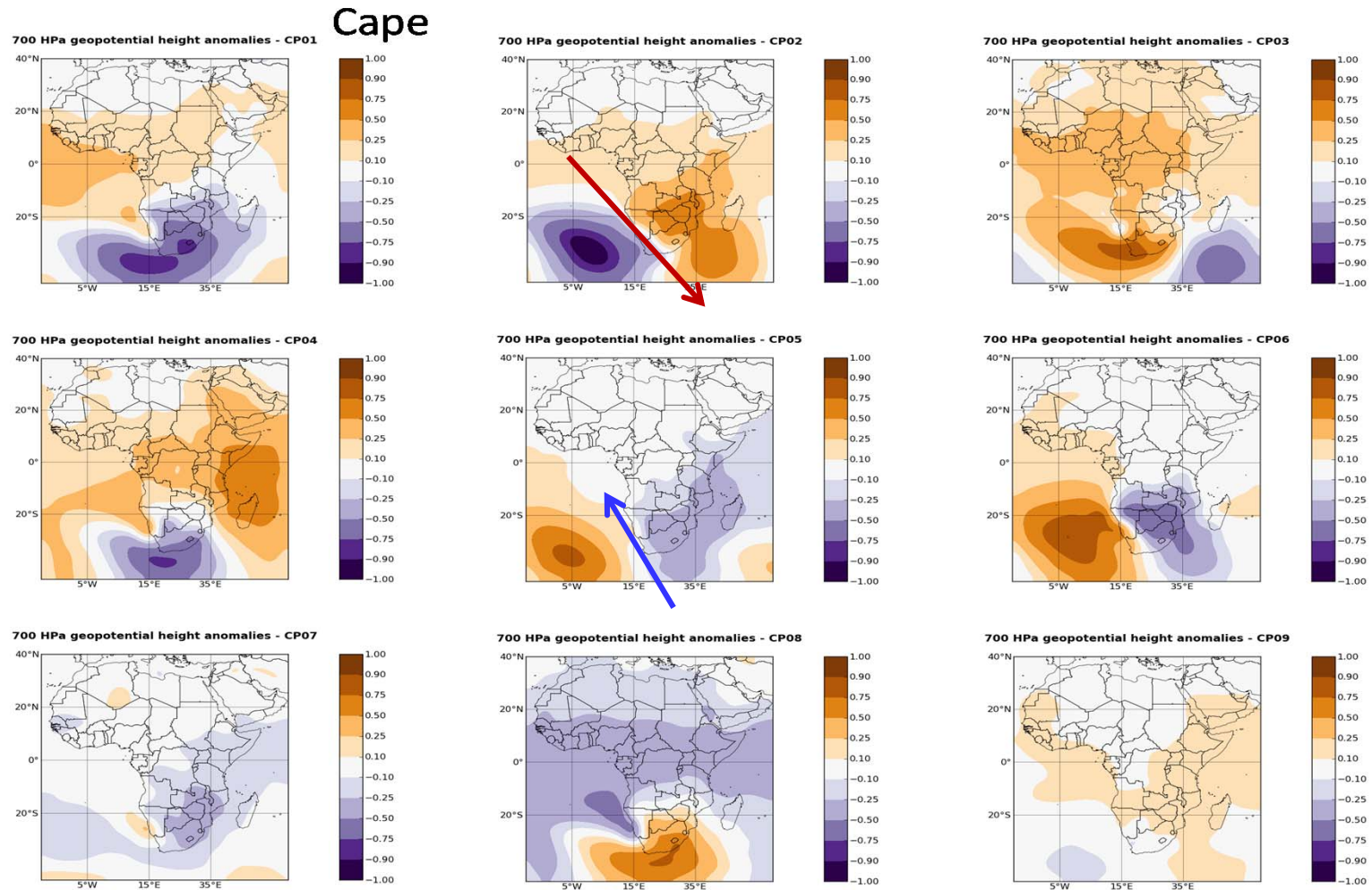
Compare ranked frequency distributions



PRECIS 'data' – currently 1990 – 2008 both daily Pressure and Rainfall

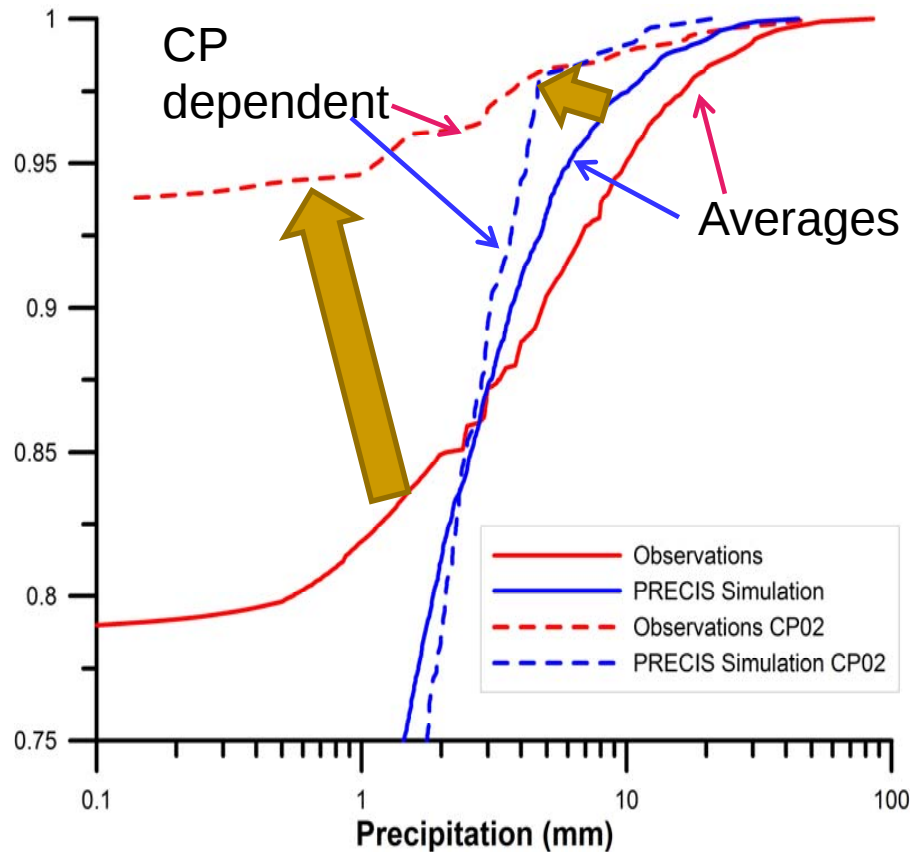


RCM CPs optimised on Cape Wetness



Compare RCM & Gauge in 2 periods

Observations = Gauge Block Averages; Simulations = RCM Modelling

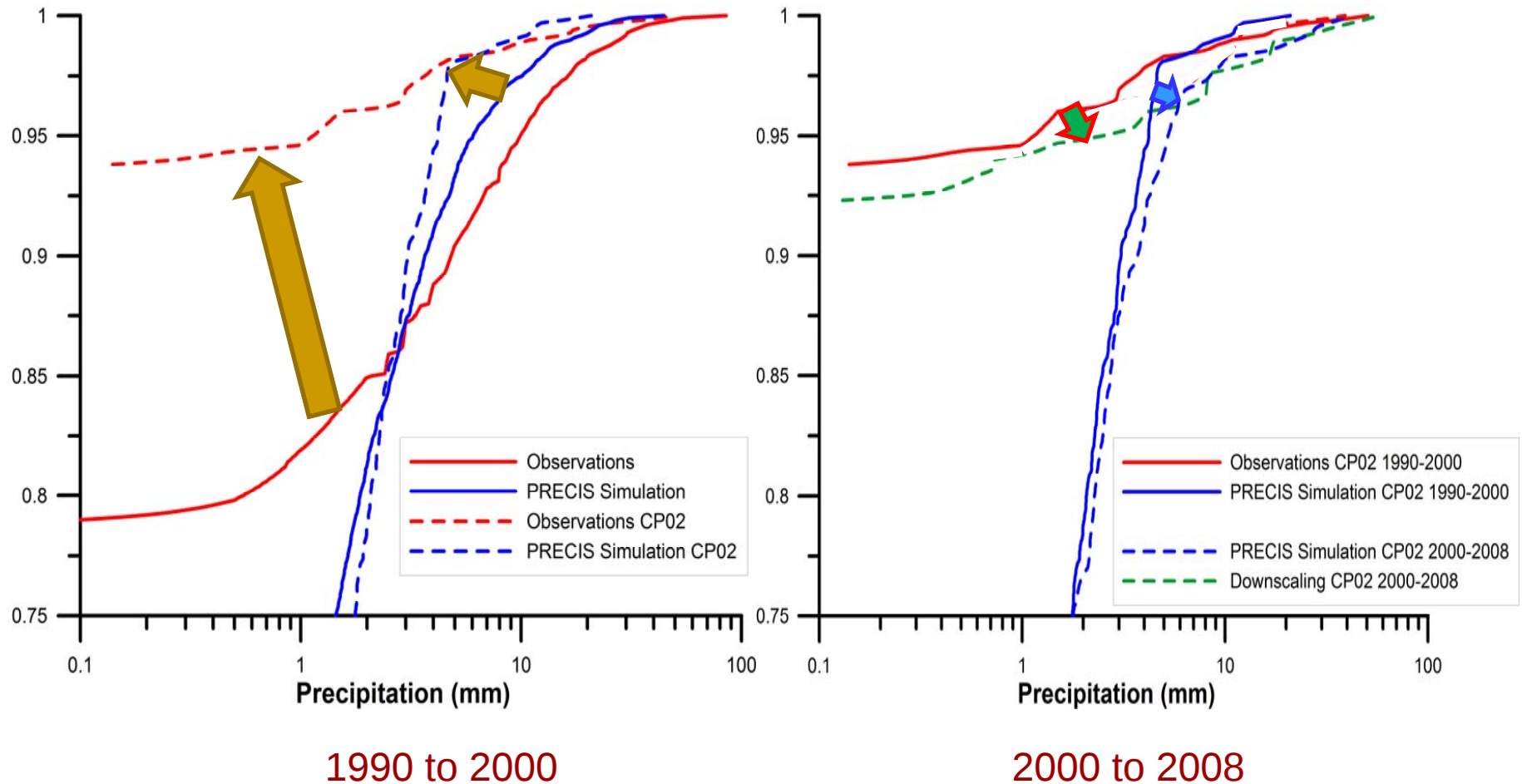


1990 to 2000

2000 to 2008

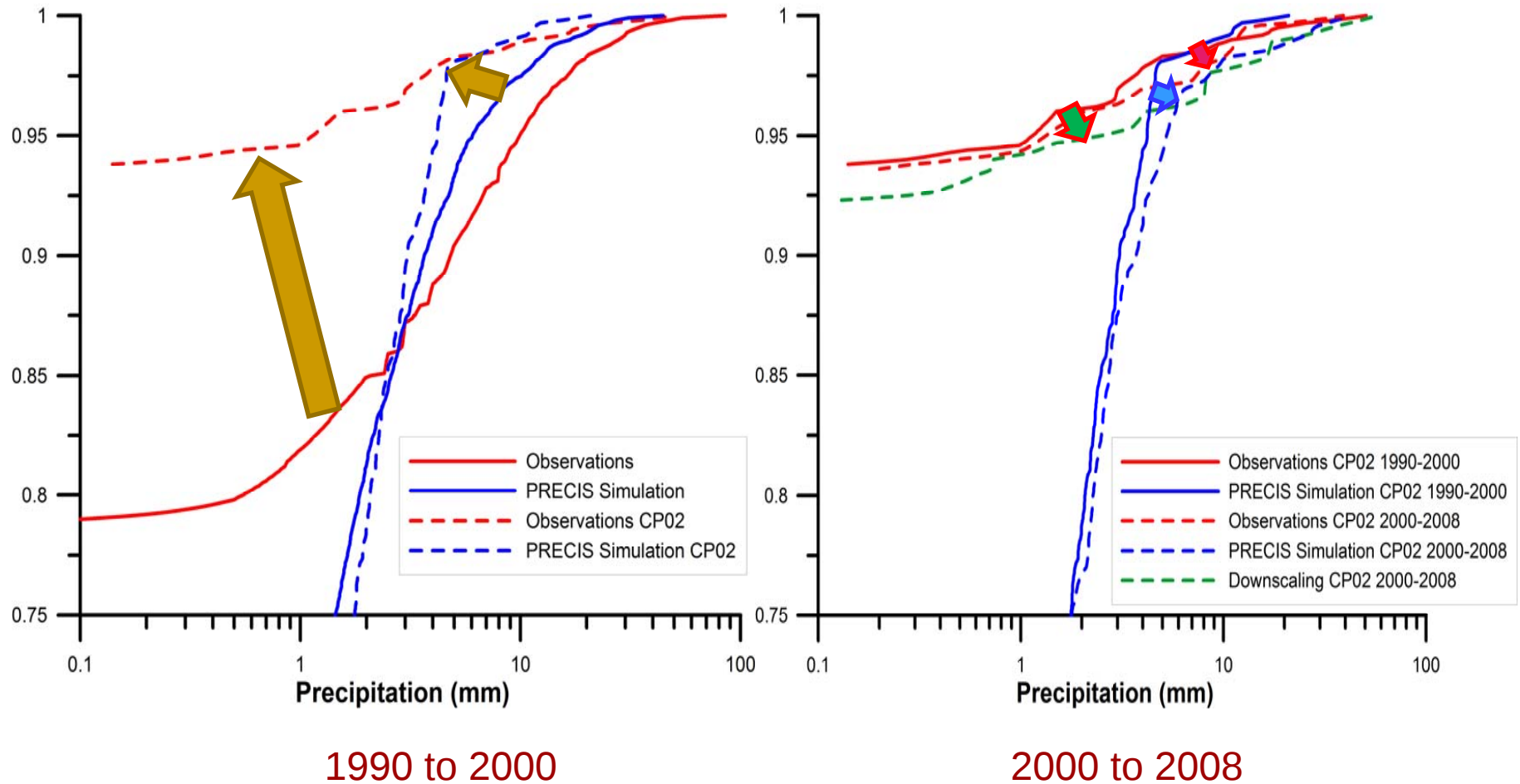
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Conclusion

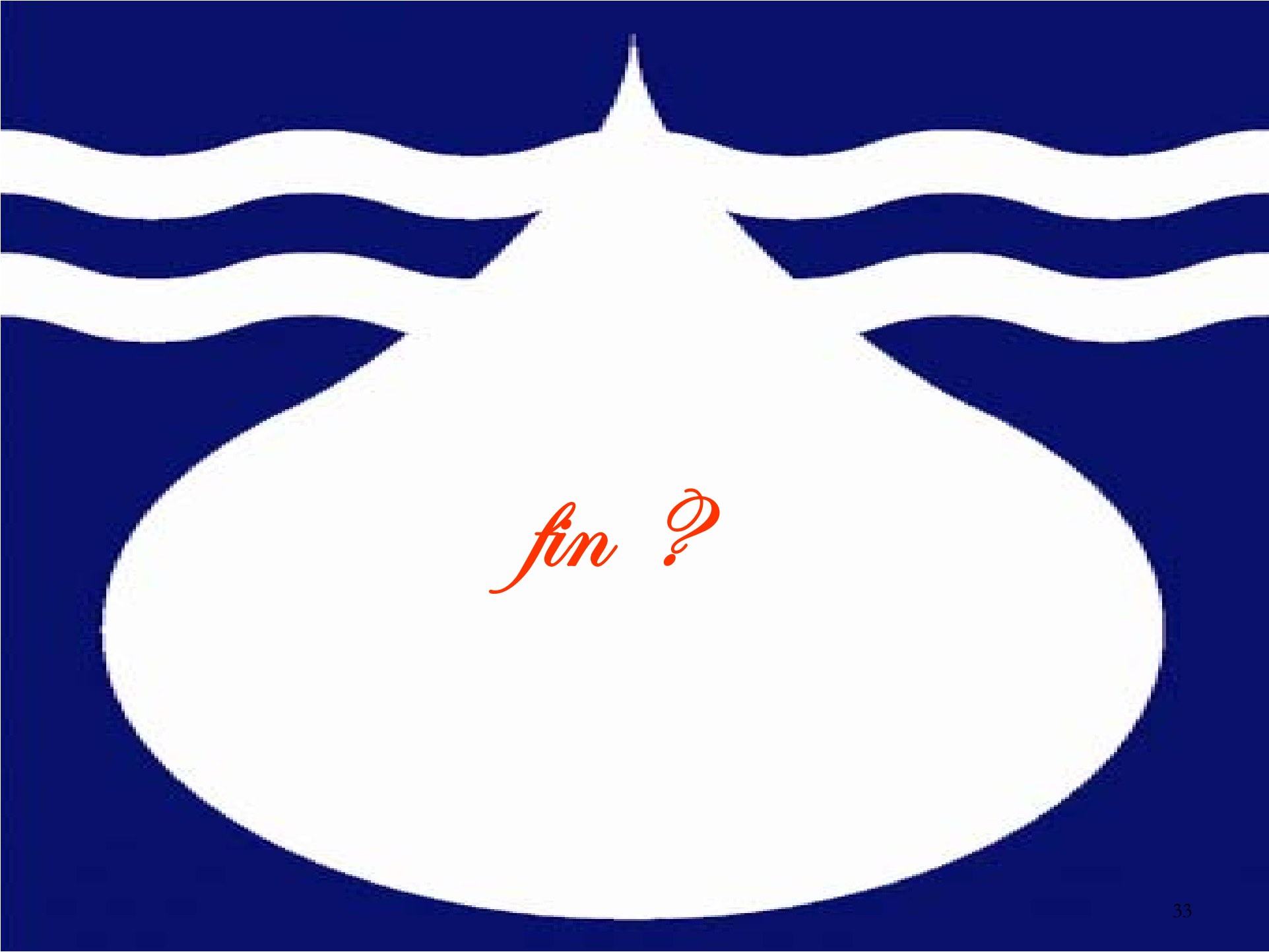
Modelling without data for validation is phantasy
and a self congratulatory exercise

therefore

We need free, good and readily available DATA
to realistically plan our Water Resources Future

For RSA, it is asking too high a price to ask us to
pay for limited access to diminishing resources

Please fix it



fin ?