Science Snapshot
Using Earth Observation in Water Resources Assessment

Albert van Dijk
Research Team Leader
Environmental Earth Observation

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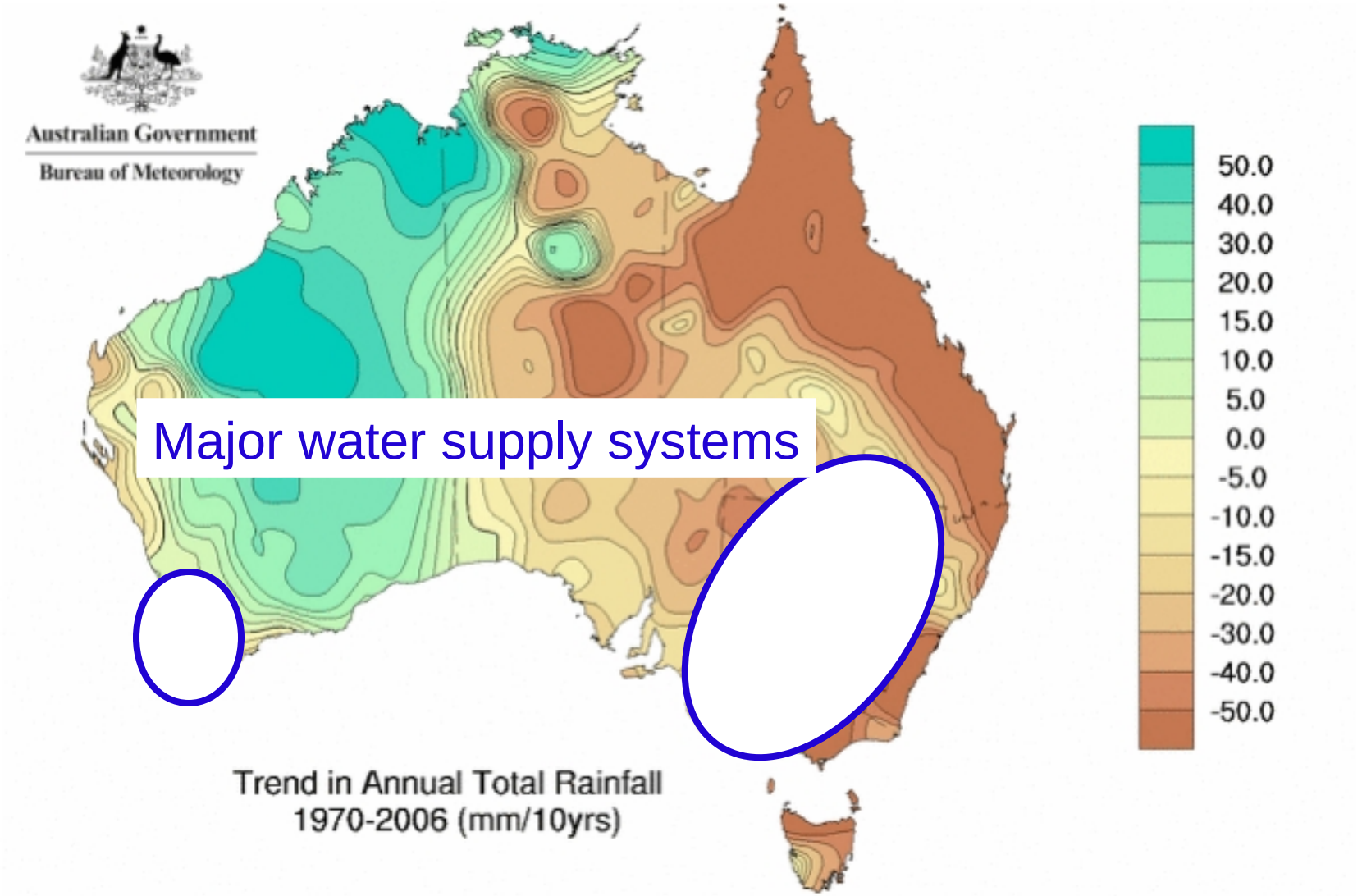
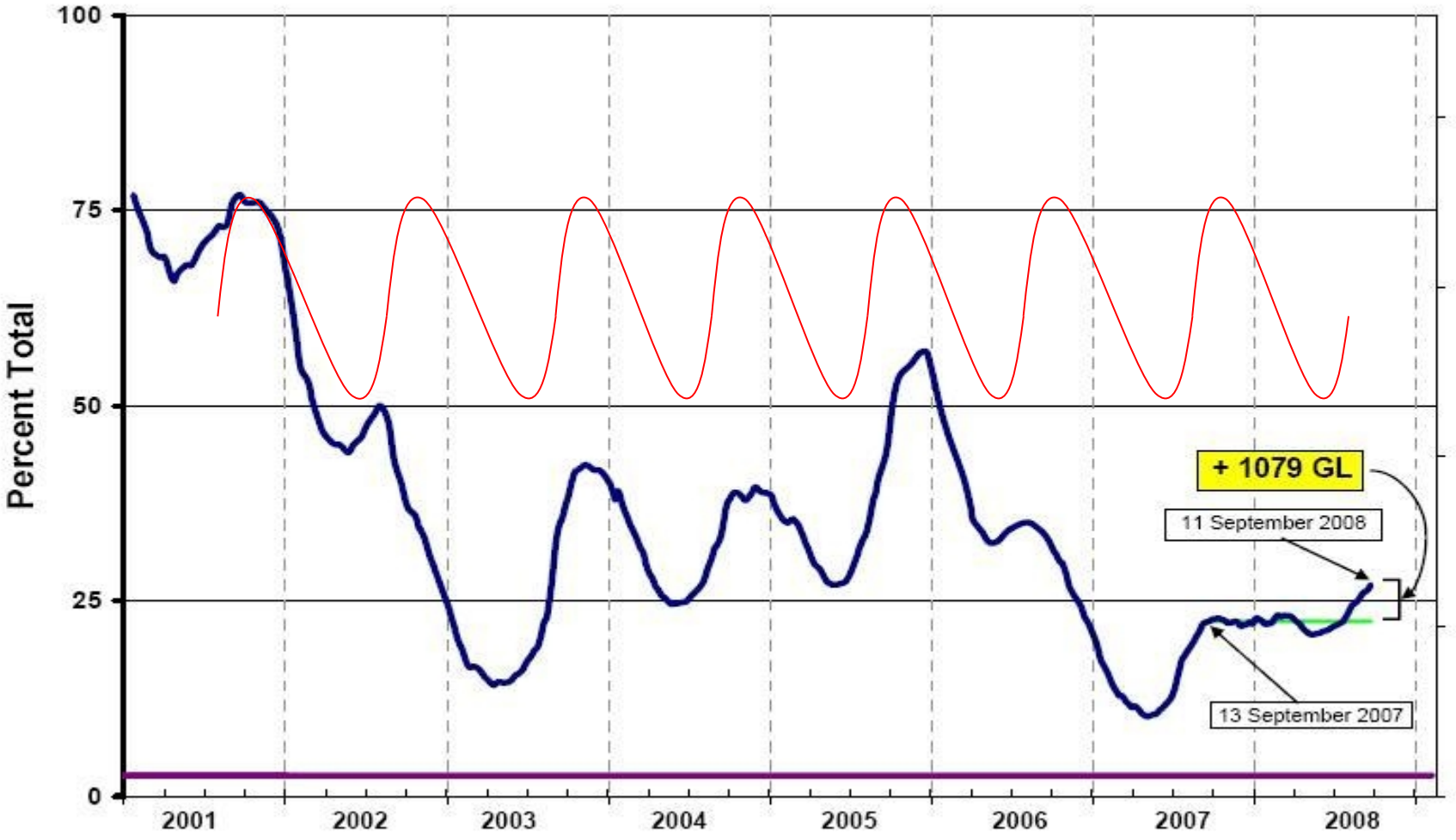
Trend in annual rainfall

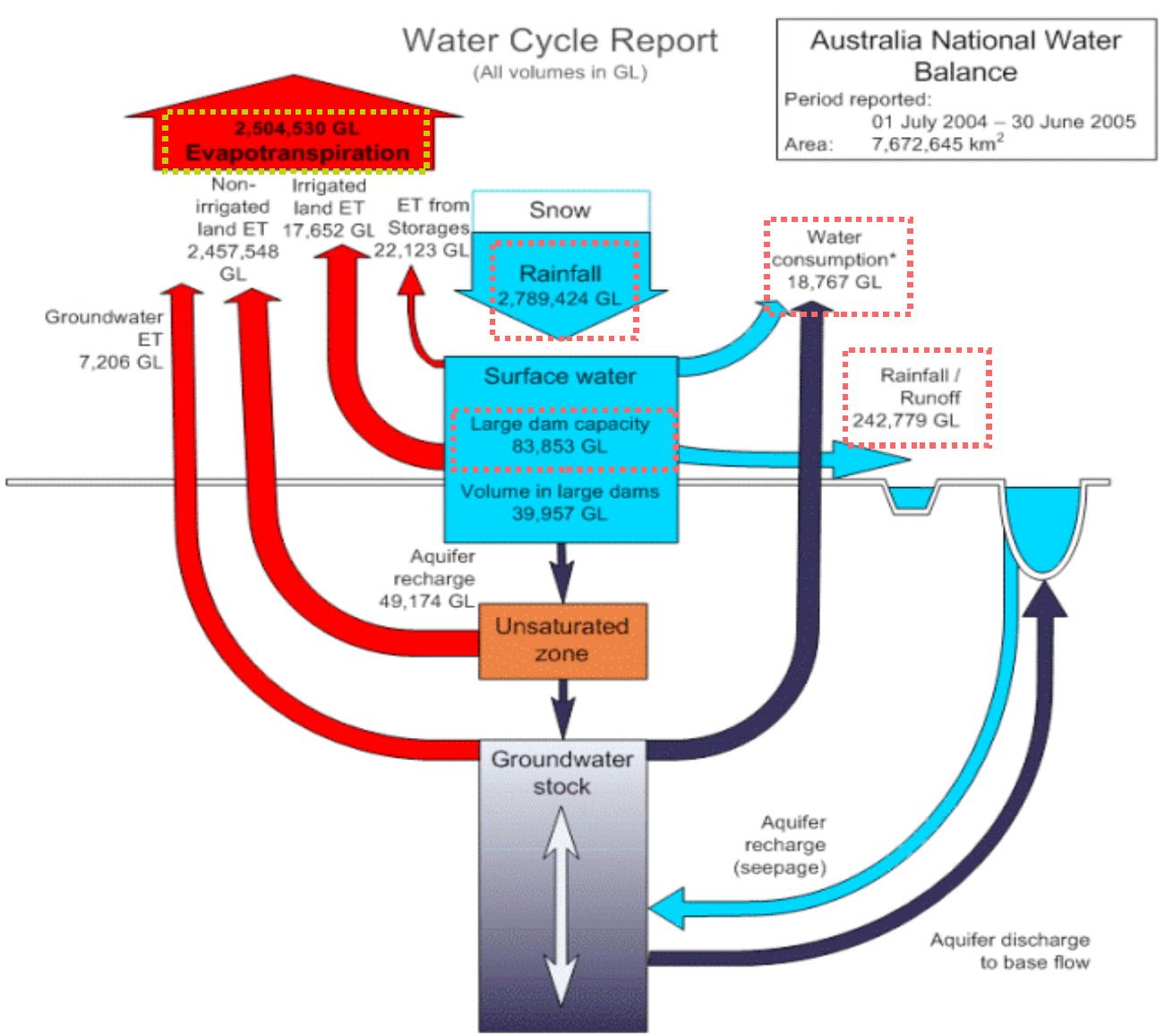


Issued: 20/06/2007

Water storage volumes in the MDB system.

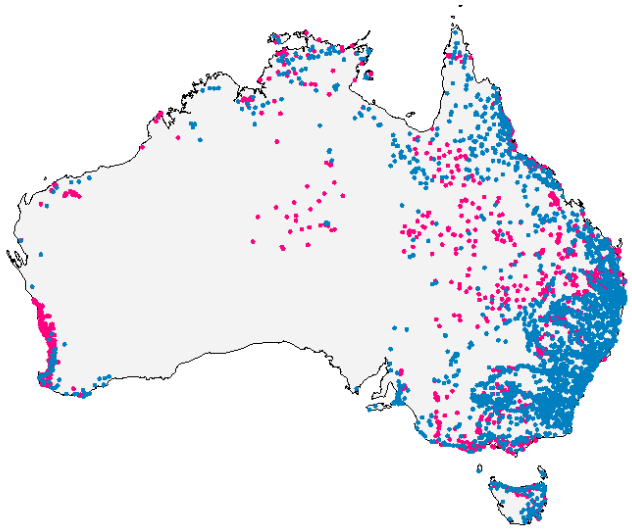


Continental Water Balance (04-05)

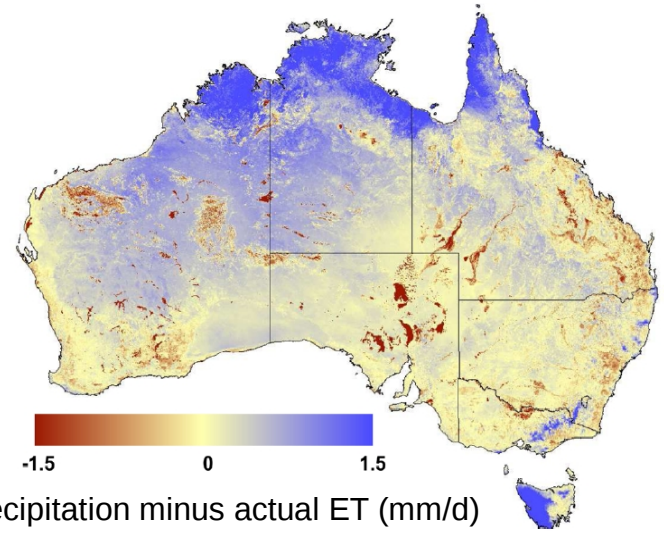


Value proposition

- In the absence of good information, good decisions are unlikely to occur
- To date, water management decisions have been based on the sparse on-ground measurement network
- Earth observation is revolutionising water information, providing an entirely new level of understanding and detail



On-ground surface and groundwater measurement network



Precipitation minus actual ET (mm/d)

Remotely sensed water balance

Guerschman, Van Dijk, and others, Journal of Hydrology 2009

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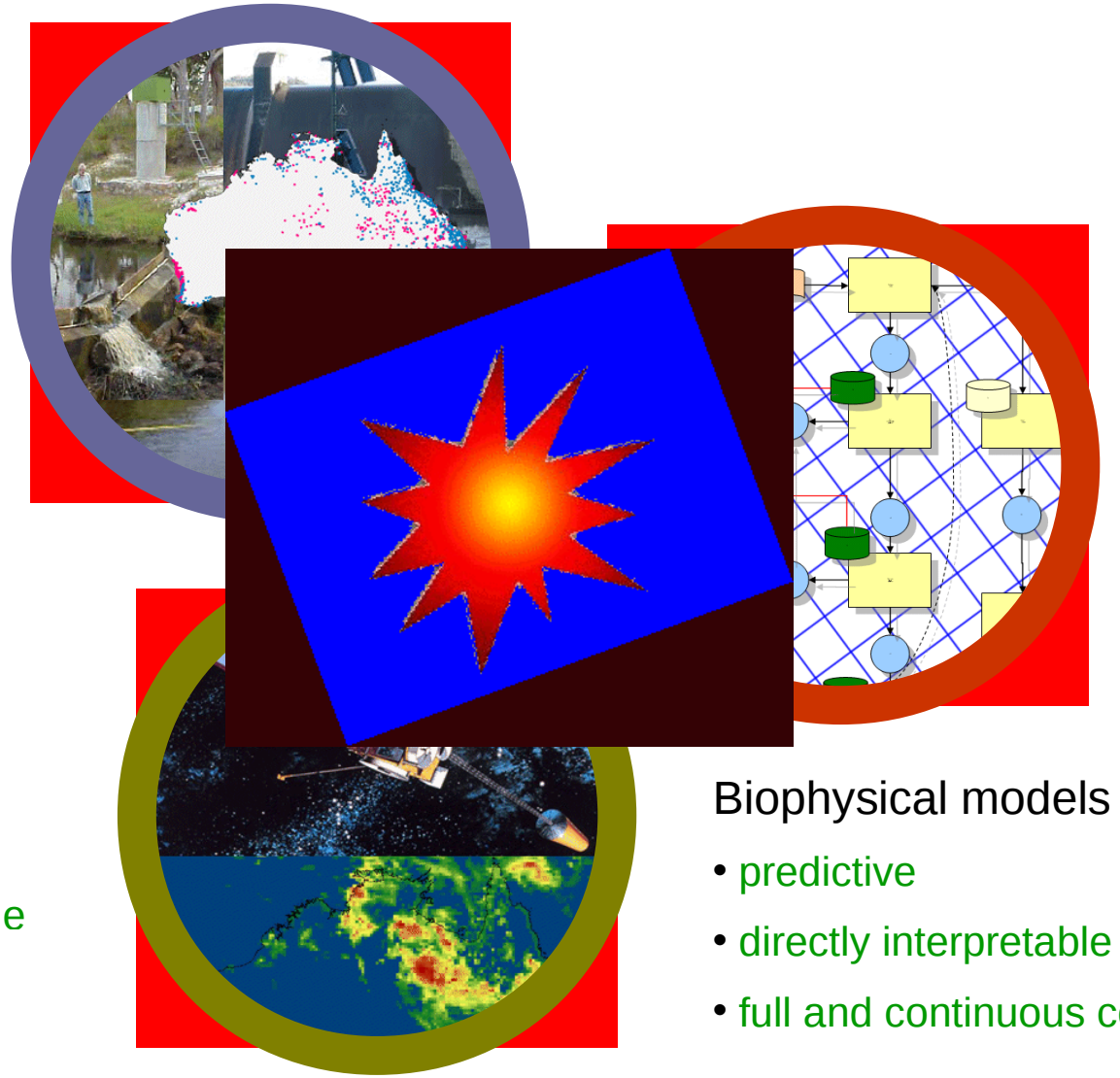
Objective: combining the best of three worlds

On-ground observations

- *relatively* direct



Satellite observations

- full and frequent coverage

Biophysical models

- predictive
- directly interpretable
- full and continuous coverage

Approach: multiple constraints

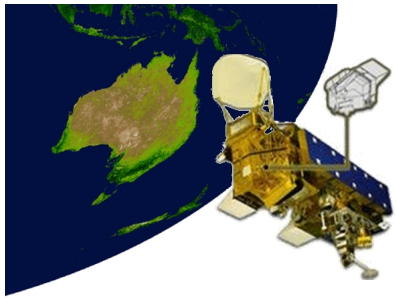
- **Multiple lines of evidence**
  If different aspects of reality can be reproduced, our confidence is increased

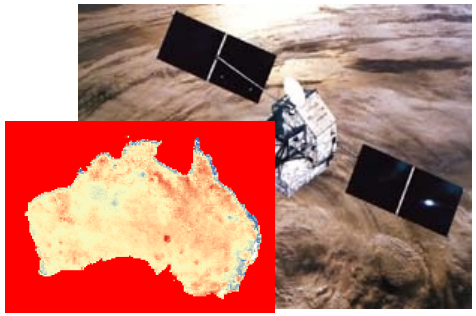
- **Evaluation and benchmarking**
  What uncertainty should we assign to model estimates?
  Are modifications and additions demonstrable improvements?

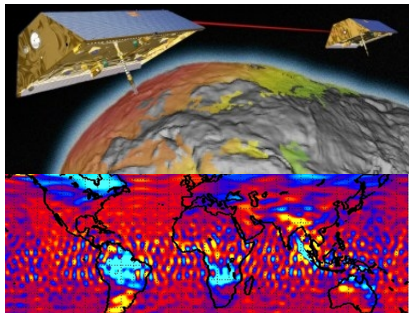
- **Model-data fusion**
  Statistically merging model and observations allowing for the uncertainty in both

But using many observations does increase onus on:

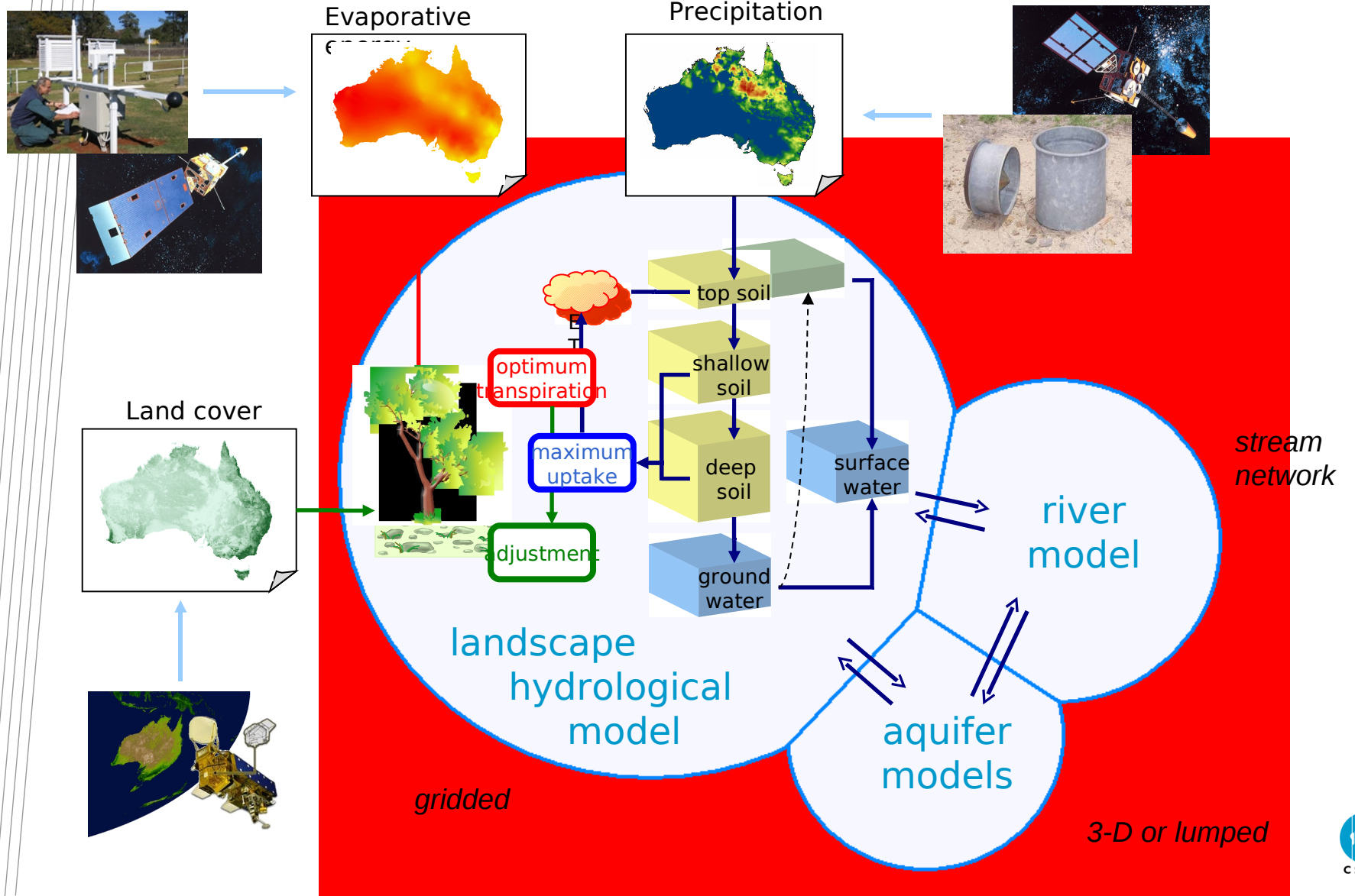
- **Model parsimony**
  The simplest theory (model) that still adequately explains all observations - Occam's Razor



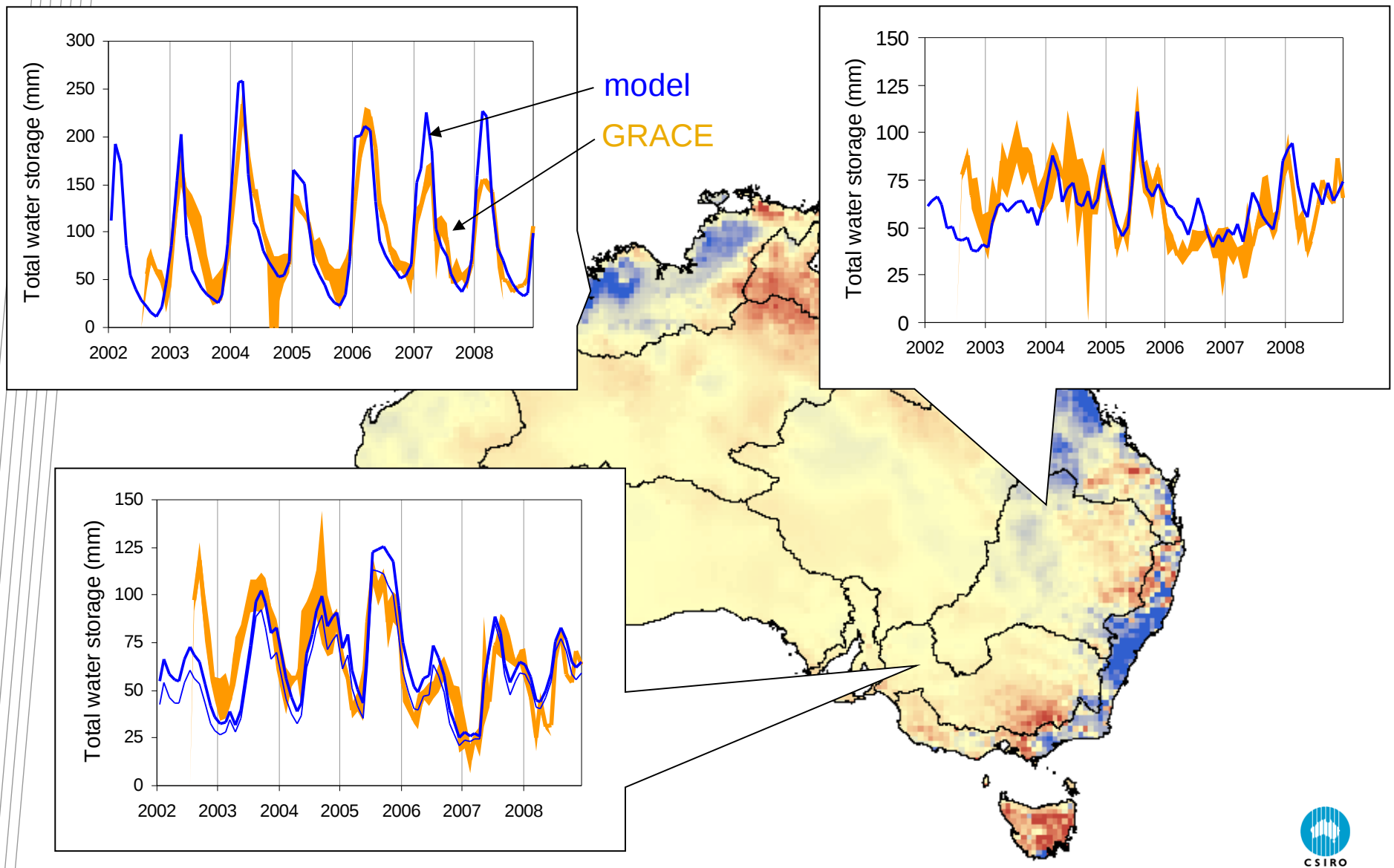




Result:
Australian water observation system (prototype)

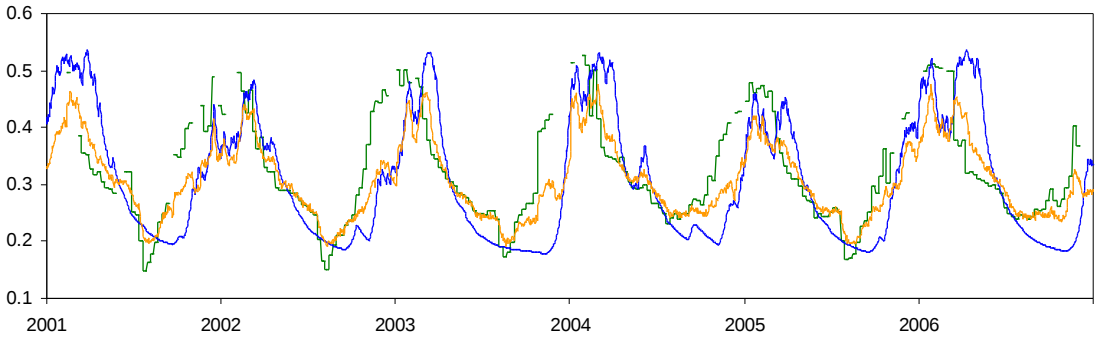


Evaluation: GRACE total water storage

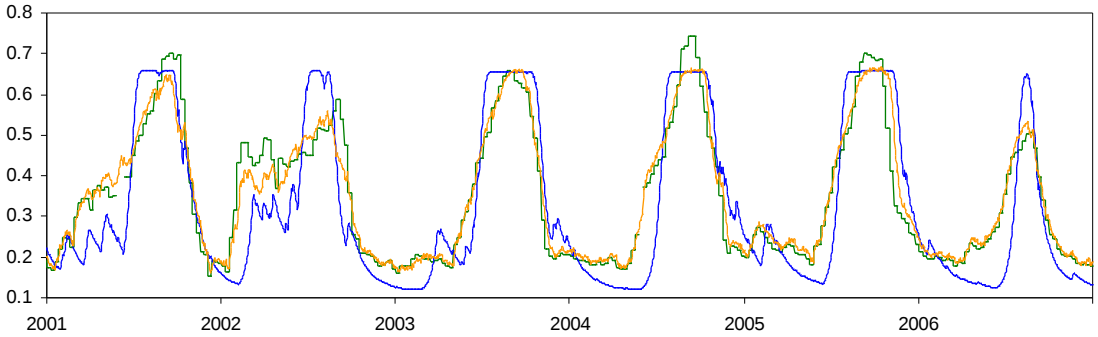


Model-data fusion: MODIS vegetation cover

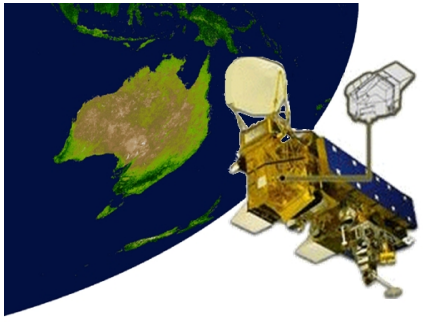
Howard Springs savanna



Kyeamba grassland



--- satellite greenness observations
--- model without data-assimilation
--- model with assimilation of satellite observations



Van Dijk and Renzullo, MODSIM 2009, EGU 2009

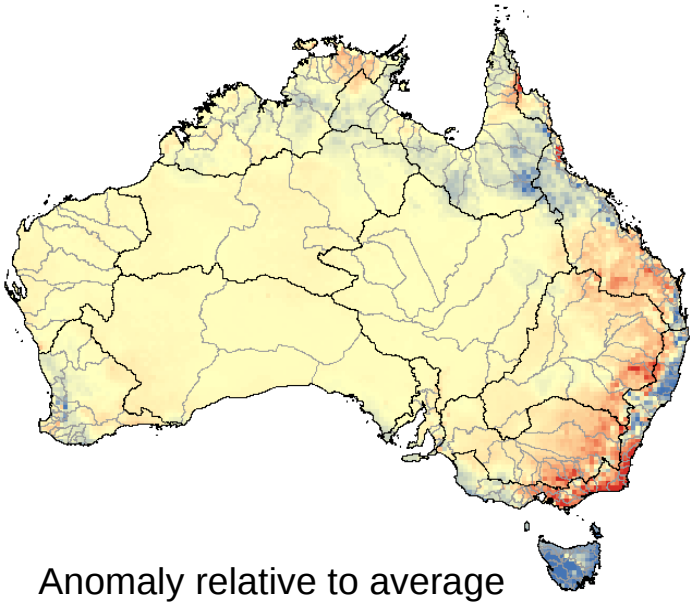
Conclusions and outlook

- Remote sensing (RS) can dramatically increase the resolution and accuracy - and so utility - of water balance estimation
- Successful use of RS requires blending with on-ground observations and biophysical models
- Using a wide range of observations increases confidence and allows characterisation and reduction of uncertainty, but requires model parsimony

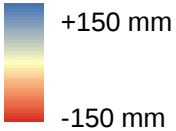
Outlook

- Components of the system are being transferred to the Bureau of Meteorology
- Application outside Australia
- Same approach being applied to similar processes (carbon, biomass and erosion)

Estimated combined soil and ground water storage (September 8, 2009)



Anomaly relative to average total storage (1980-2008)



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