THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

A multi-scale experimental and modelling program for estimating groundwater recharge in the Surat Basin

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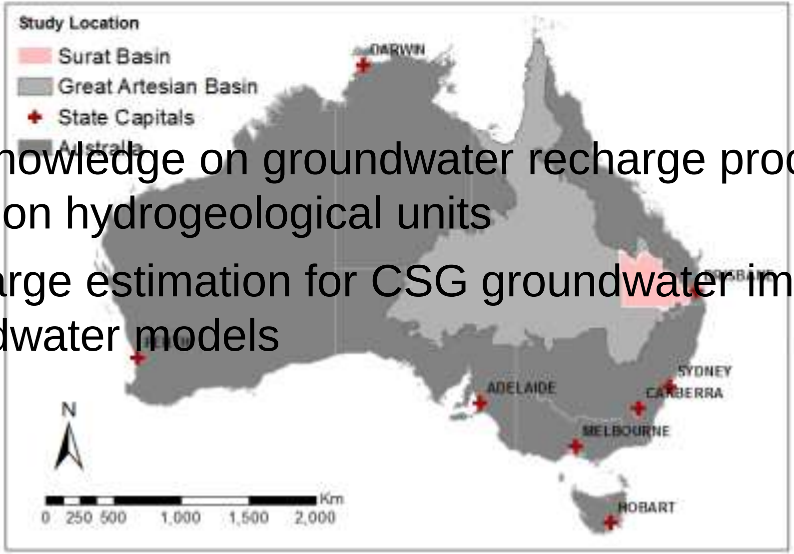
Background

- Surat Basin is a part of the larger Great Artesian Basin, and a major water resource in the semi-arid interior
- Groundwater resources are highly utilised by multiple sectors
  - Additional volumes of water being extracted to produce gas
- Limited knowledge about groundwater recharge processes, their space and time variability and how to upscale them

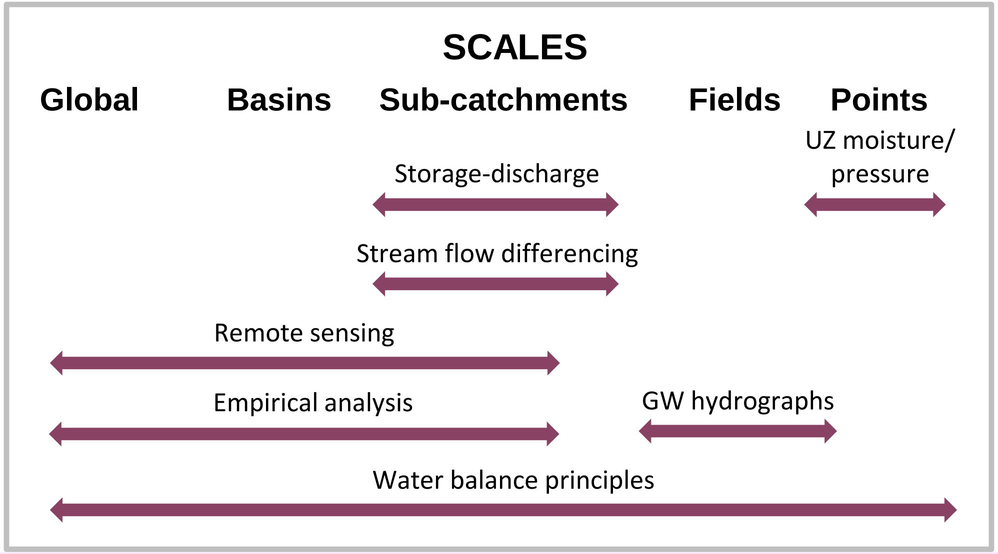
Project aims:

- Develop new knowledge on groundwater recharge processes and pathways across 3 common hydrogeological units
- To inform recharge estimation for CSG groundwater impacts assessment and regional groundwater models

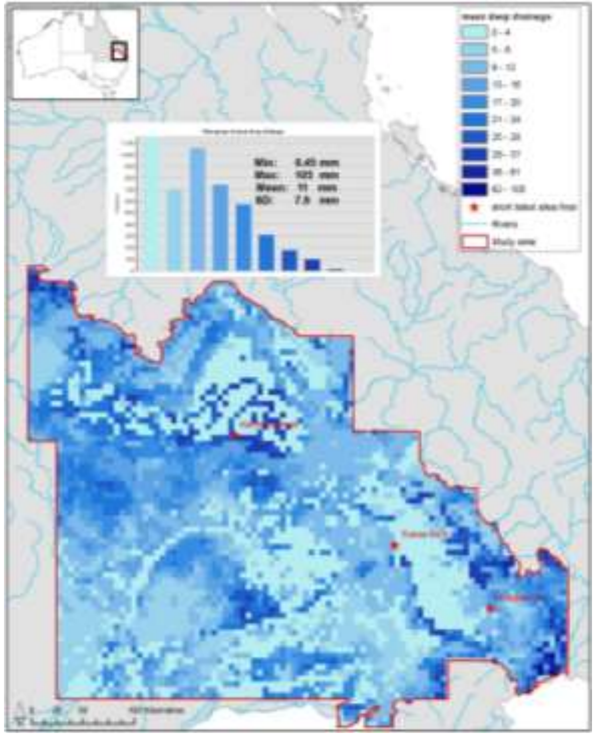


Multi-scale approach

- Multi-scale recharge research program, including:
  - Monitoring field sites (current and to be established)
  - Remote sensing
  - Upscale and integration of results

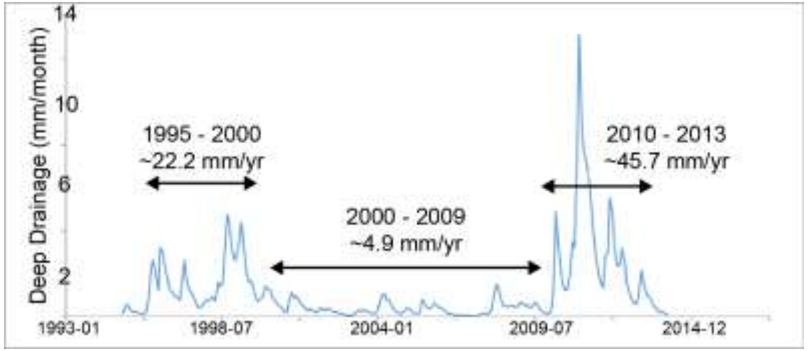


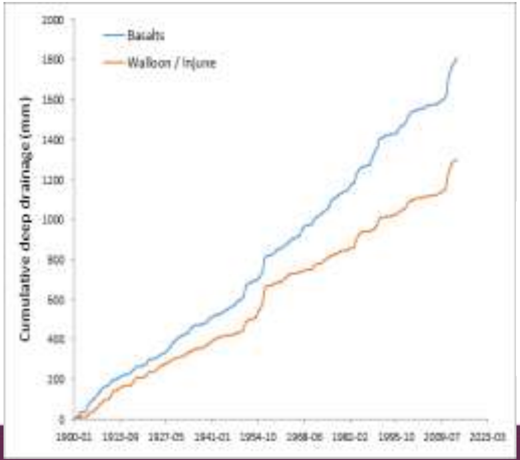
AWAP Broad Scale Deep Drainage Modelling



Mean annual deep drainage 1900 – 2014, varies from ~ 1 to 100 mm (AWAP - Raupach et al 2009).

Influence of ENSO on deep drainage





Difference in deep drainage between Main Range Volcanics and Walloon Coal Measures

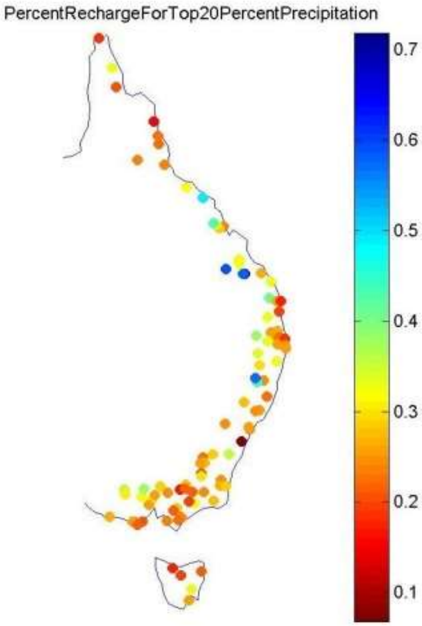
Variation in recharge across small catchments

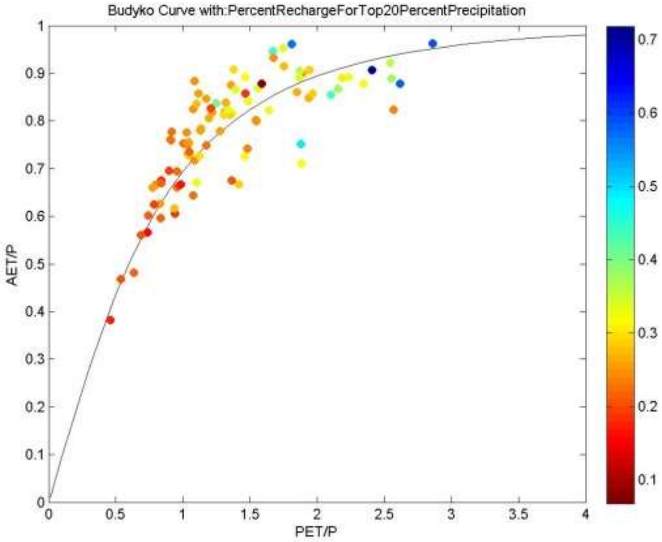
- Recharge estimated in Main Range Volcanics (Tertiary fractured basalts) using surface and groundwater hydrographs
  - Sites are close by and have similar climatic and geologic conditions
- Recharge values generally low (0 – 3% rainfall)
  - Estimates vary by order(s) of magnitude between wet and dry years
  - Spatial variation – geological heterogeneity and regional flow paths?
- Local scale estimates smaller than broad scale deep drainage

Method Used	Locations	Resolution	Time Period	Recharge (mm/year)
Water Table Fluctuation	Main Range Volcanics	A few metres	1993-2011	6 - 37
Storage-Discharge	Swan Creek	Small catchments	1999-2014	0 - 10
	Emu Creek		1999-2014	0 - 8
	Spring Creek		1999-2014	0 - 50
	Condamine River		1999-2014	1 - 27

Details presented at poster session: “Recharge estimation across the headwaters of the Condamine Basin using storage-discharge relationships”

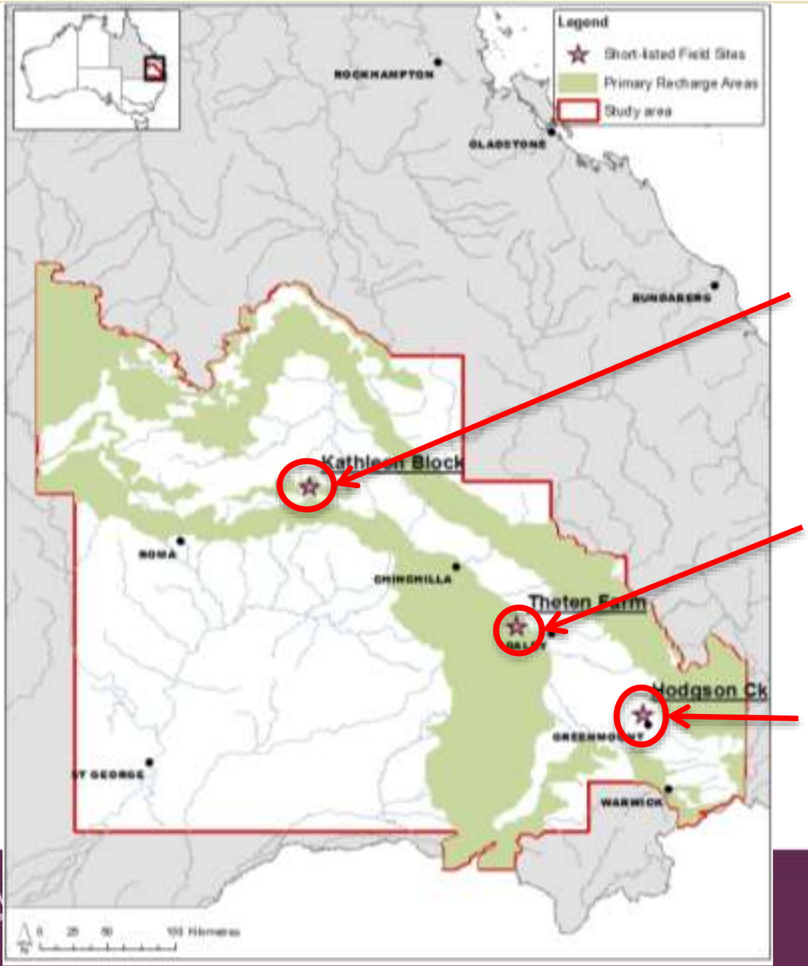
Importance of wet years to recharge in E Australia





In drier regions, 50 – 70 % of recharge occurs in the wettest 20 % of years

Three experimental field sites



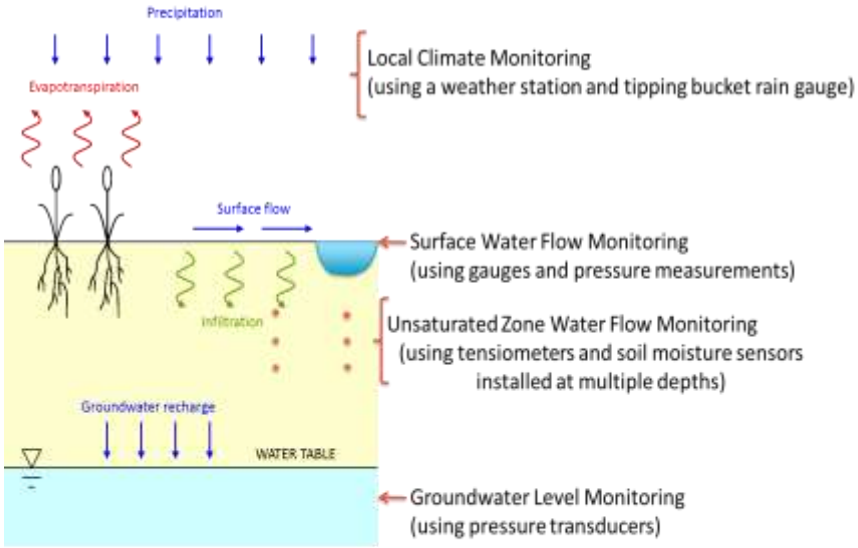
Kathleen Block: Gubberamunda Sandstone

Theten Farm: western edge of Condamine Alluvium

Hodgson Creek: Main Range Volcanics and Walloon Coal Measures

Experimental program

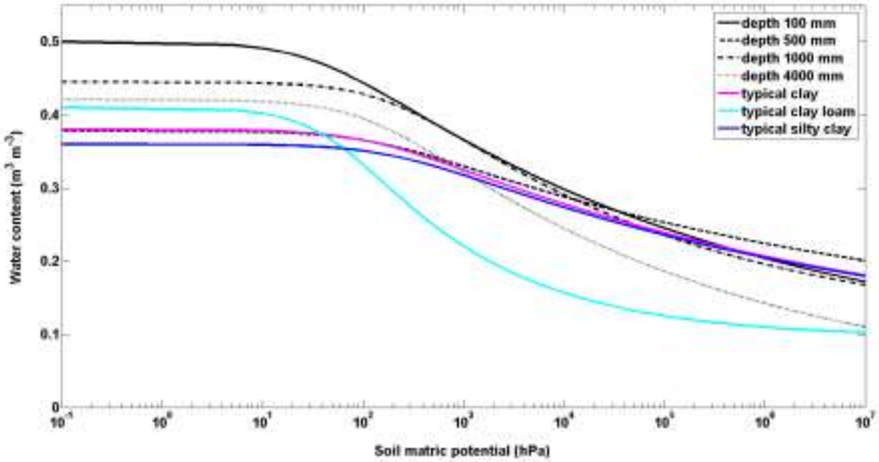
- Localised vs diffuse recharge pathways
- Preferential flow paths through cracked soils



Schematic of types of monitoring equipment to be employed

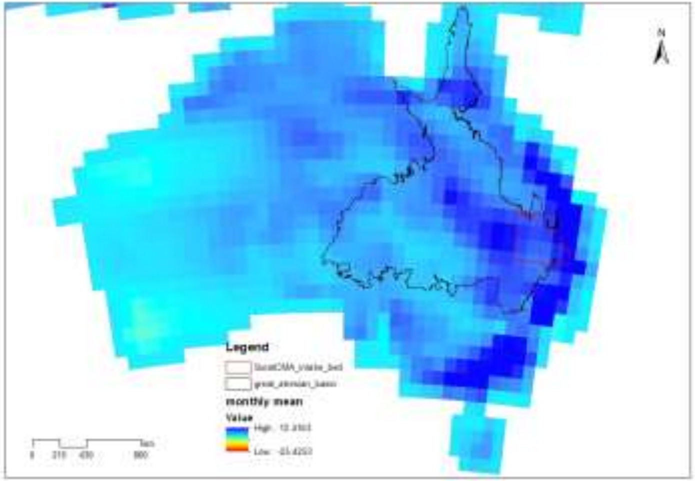
Deep drainage analysis at Theten Farm

- Experimental farm site has extensive monitoring network:
  - 19 bores (7 with logging equipment)
  - 15 soil moisture probes with 8 sensors extending to 4 m
  - Weather station
- Empirical data analysis and unsaturated zone modelling
- Water retention curves determined through
  - Inverse modelling
  - Hydraulic test
  - In-situ monitoring

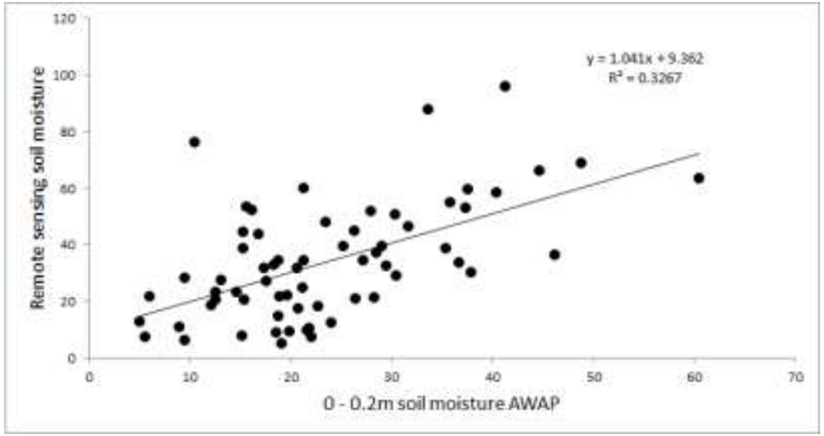


What's next?

- Importance of localised vs diffuse recharge processes
- Importance of storm events and wet years
- Expanding and refining remote sensing techniques
  - Translation of shallow drainage estimates to groundwater recharge
- Regionalisation of recharge estimates



Mean monthly terrestrial water storage value - GRACE



Comparison of AWAP and remote sensing soil moisture estimates