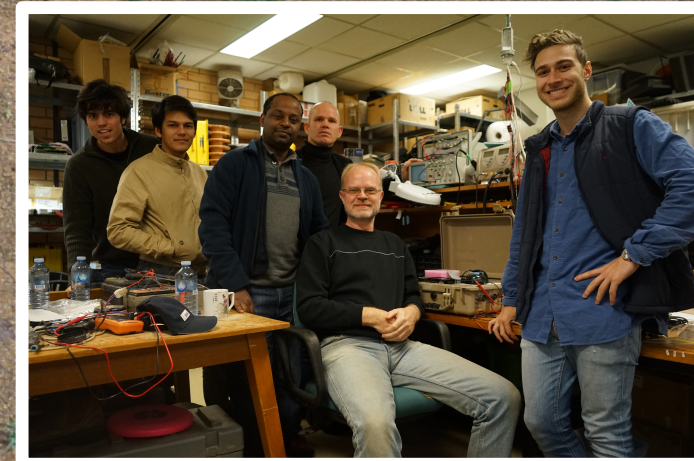


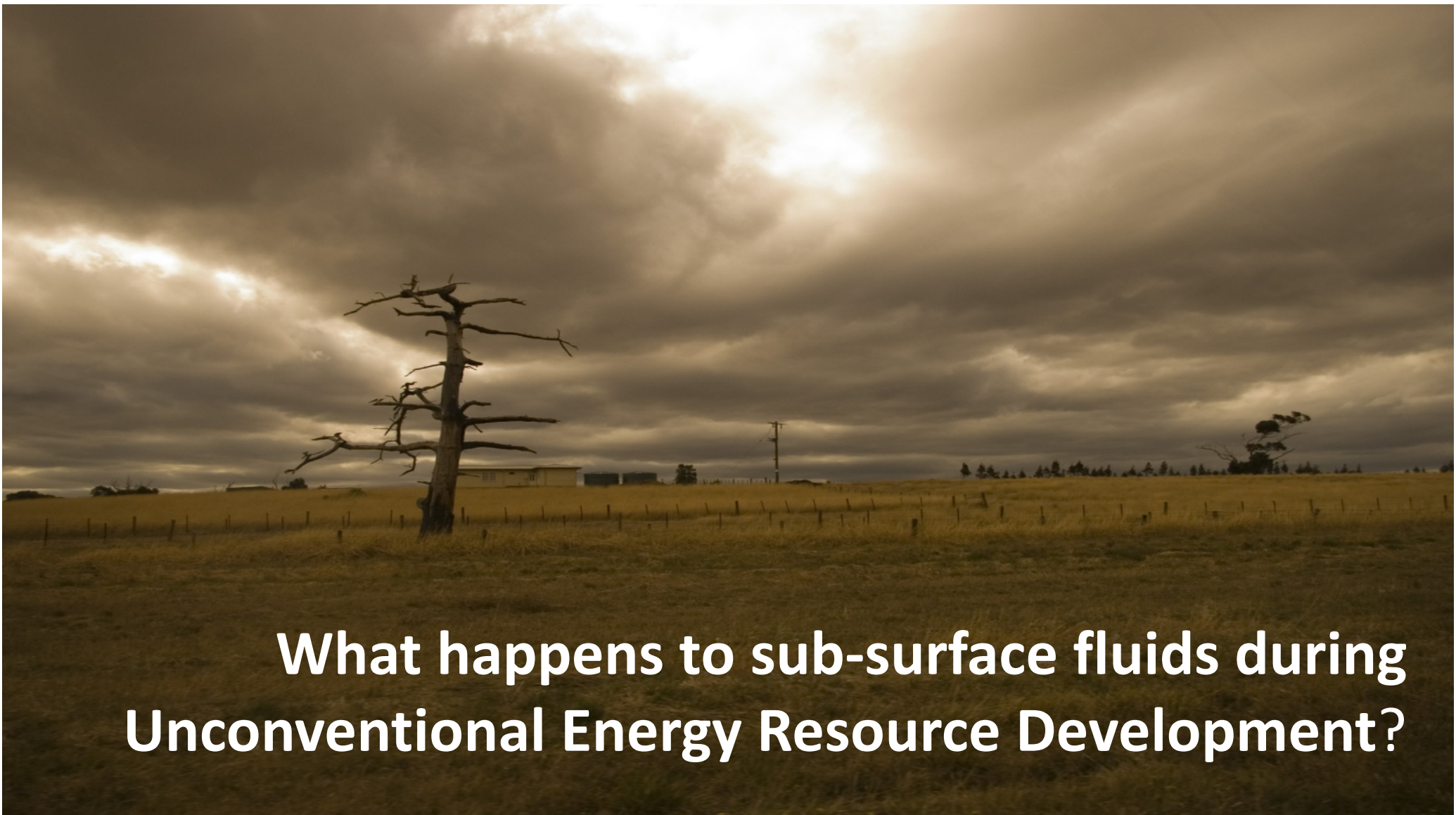
Magnetotellurics for Unconventional Resource Monitoring: Disruptive Technology or Damp Squib?

Graham Heinson and the Electrical Earth Imaging Group, University of Adelaide


ASEG-PESA-AIG Conference

24th August 2016





**What happens to sub-surface fluids during
Unconventional Energy Resource Development?**



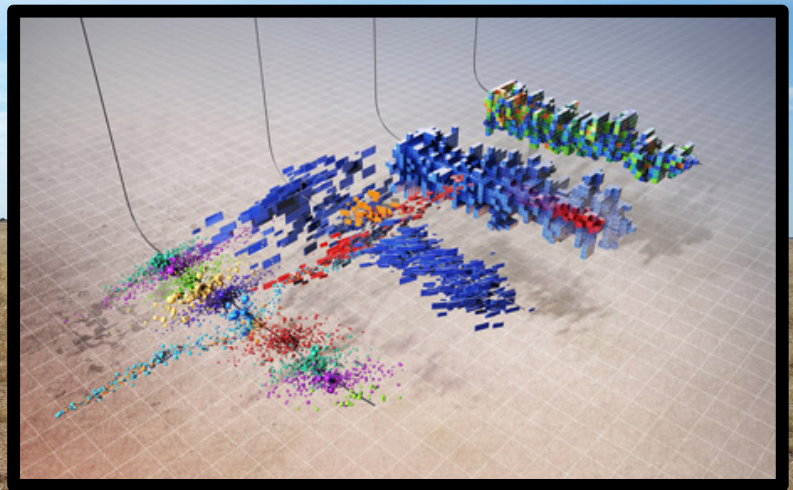
MicroSeismic
25,000+
STAGES MONITORED

ALL OTHER
SURFACE
MONITORING
COMBINED

Experience Matters

With over 25,000 stages monitored, MicroSeismic has more experience than all other surface microseismic providers combined. This translates to specialized knowledge of each basin and operational excellence. Why trust anyone else?

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INTRODUCING

DIndex™

ESTIMATE FUTURE RESERVOIR DRAINAGE VOLUME AND MAXIMIZE ASSETS

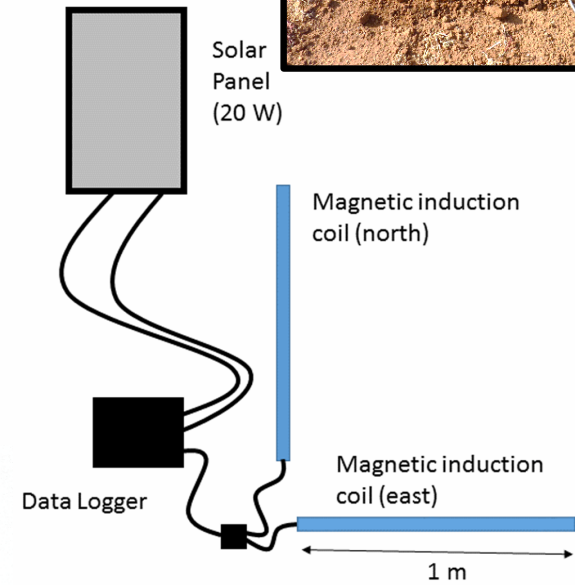
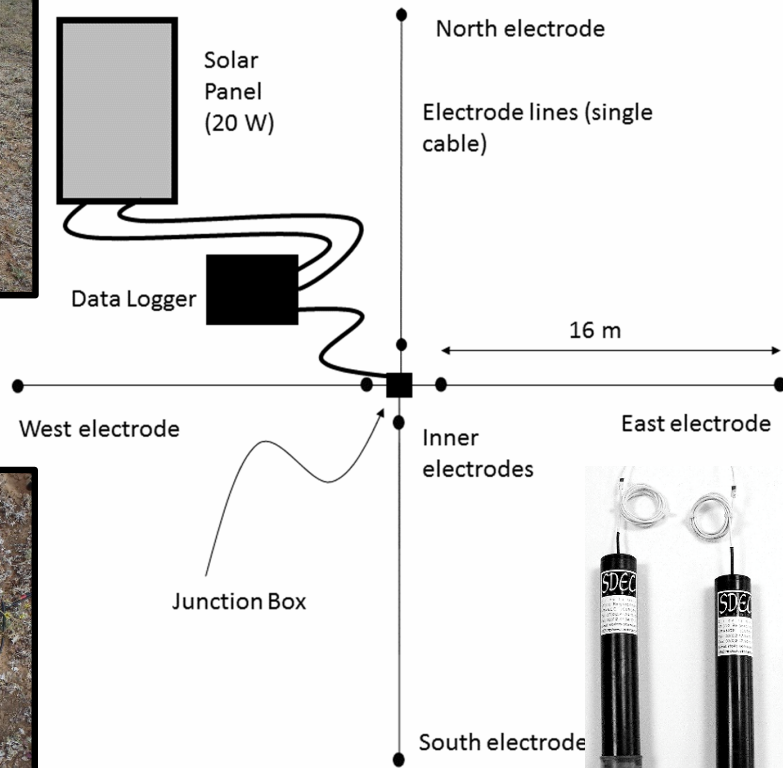
MicroSeismic's DIndex™ gives you the ability to map each well's future drainage pattern to optimize field development. Drill the minimum number of wells necessary to reach the desired reserves at exactly the ideal time.

[LEARN MORE »](#)

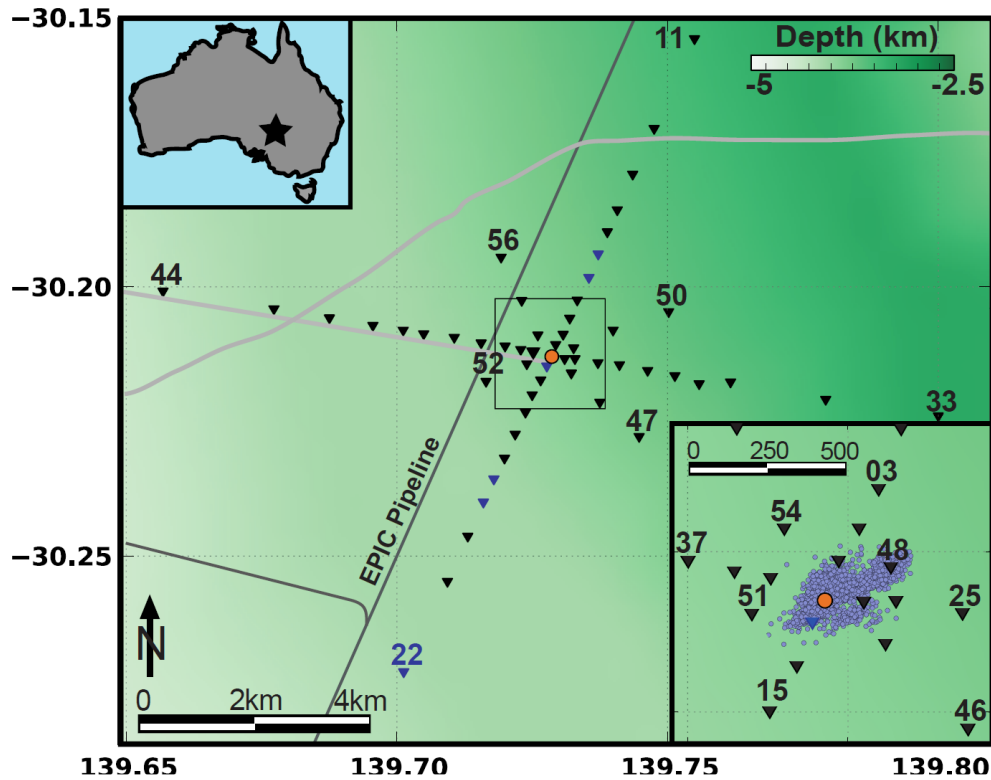


MT vs
Microseismics
(5 vs 25,000)

Monitoring equipment

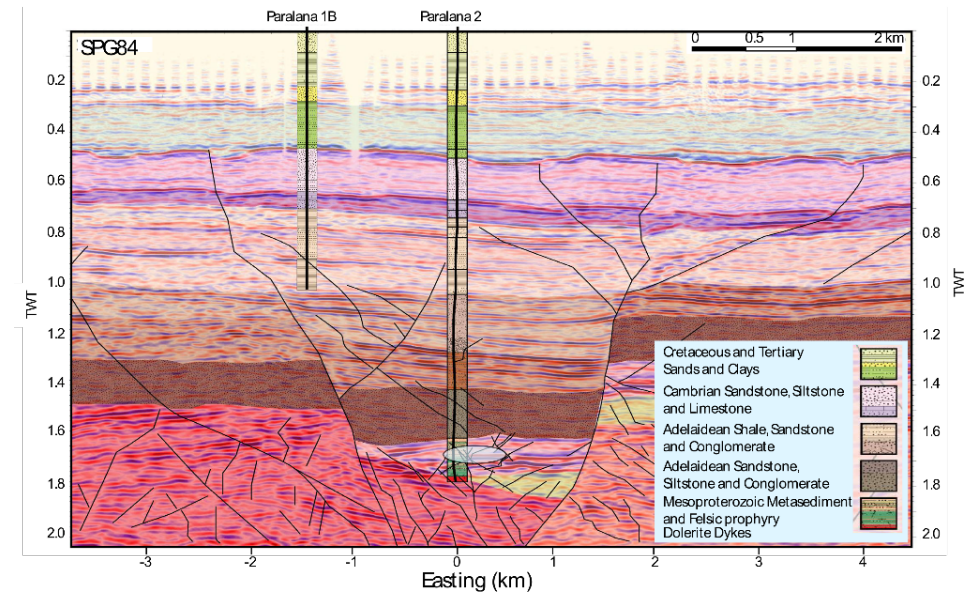


Geothermal - Paralana



About Paralana

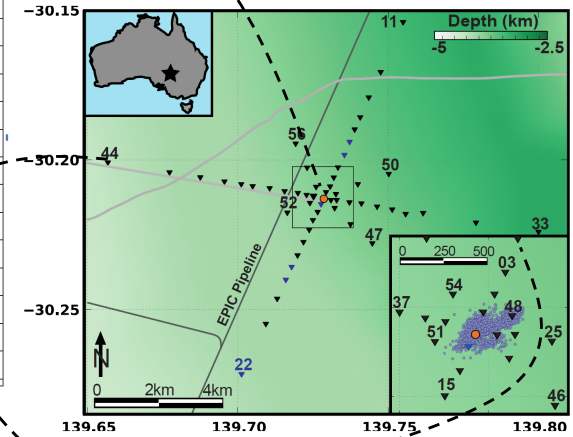
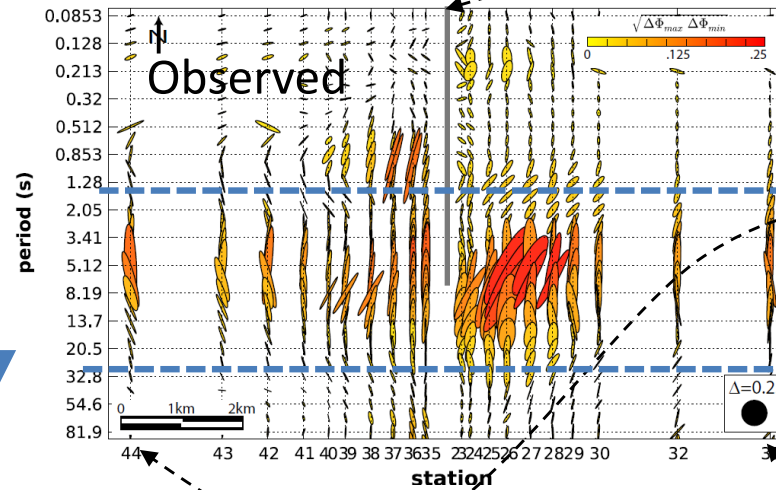
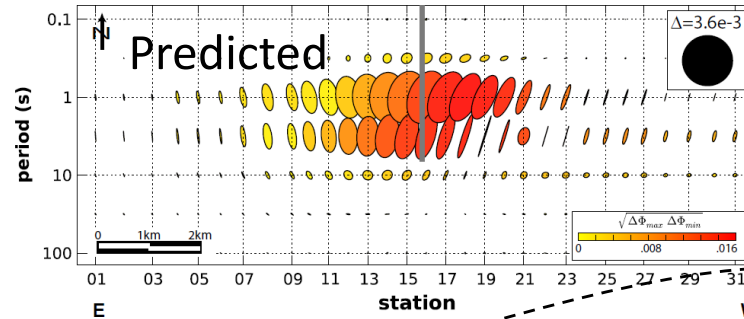
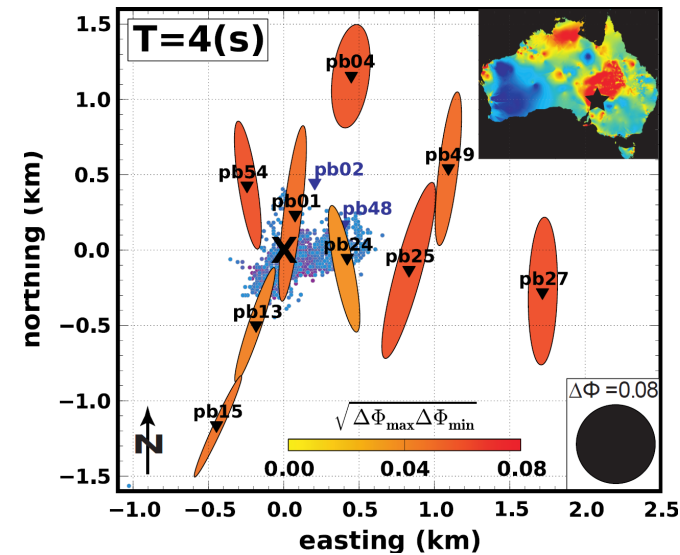
- The Paralana 2 well was stimulated with 3.1 ML of saline fluid at a depth of 3.8 km.
- This, to our knowledge, was the first time that MT had been used as a monitoring technique for a stimulation.



Geothermal - Paralana

What was found

MT responses are plotted (left) superimposed on microseismic cloud, and (right) as a function of distance and period along the west-east line. The orientation of the ellipses indicates direction of change and period-scale indicates depth.

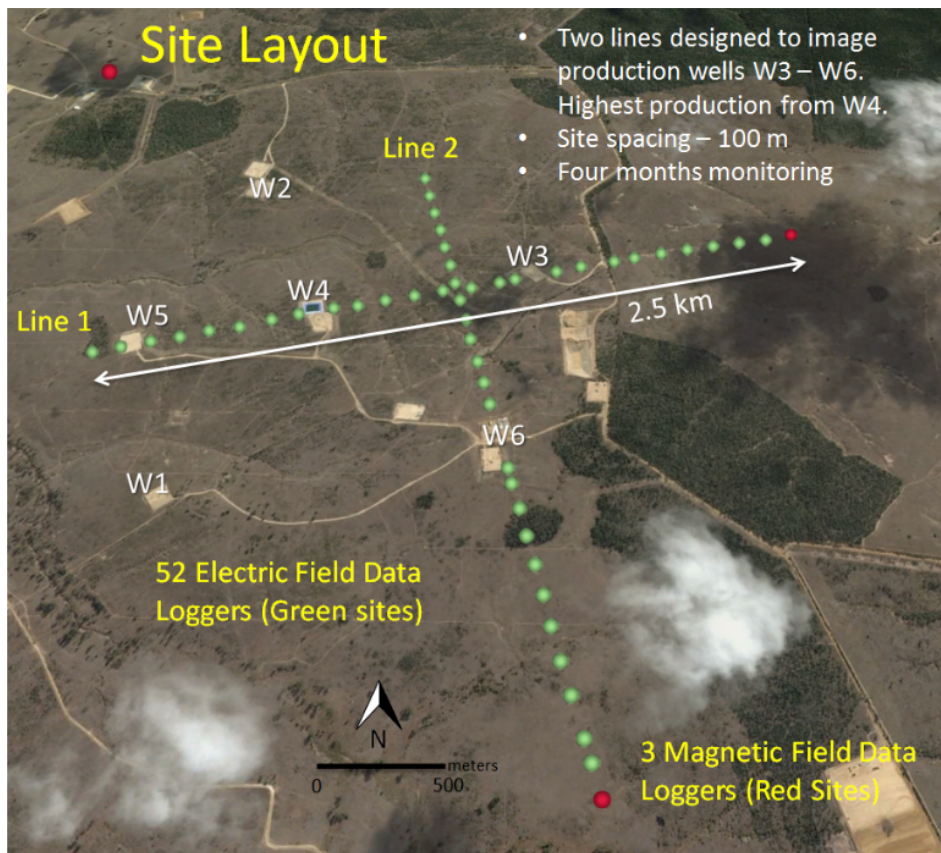


Increasing depth



2013 Minerals and Energy Category!

Coal Seam Gas

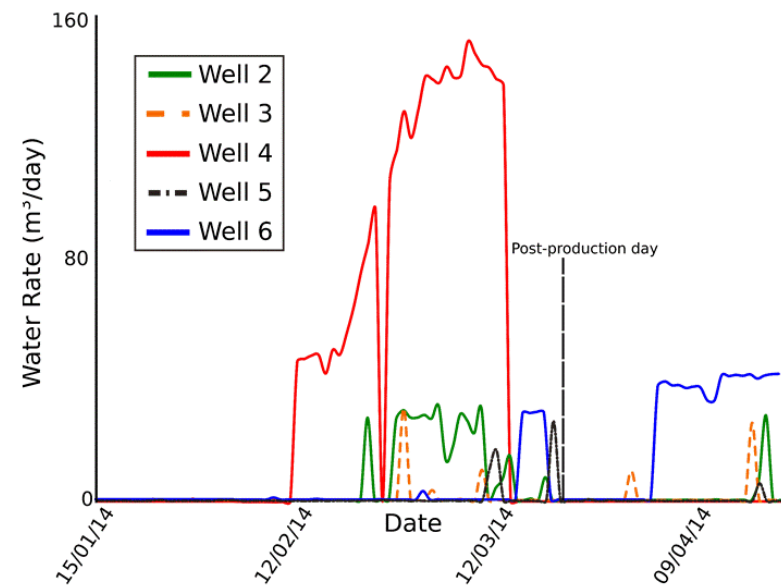


Survey

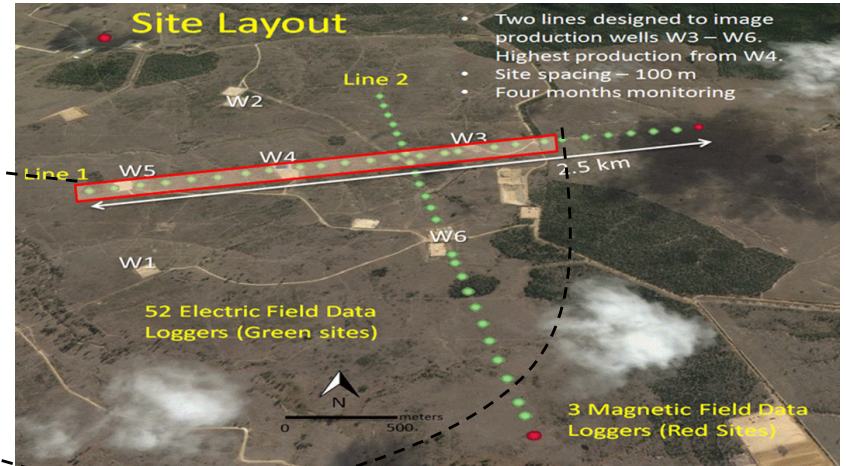
- MT at 52 sites for 3 months at 651 Hz.
- Developed new processing software to generate MT responses and create spatial 2D time-lapse and temporal site 1D models.

Why MT works

- When a CSG formation is depressurised, fluids migrate through pores and fractures. Moving fluids cause resistivity change

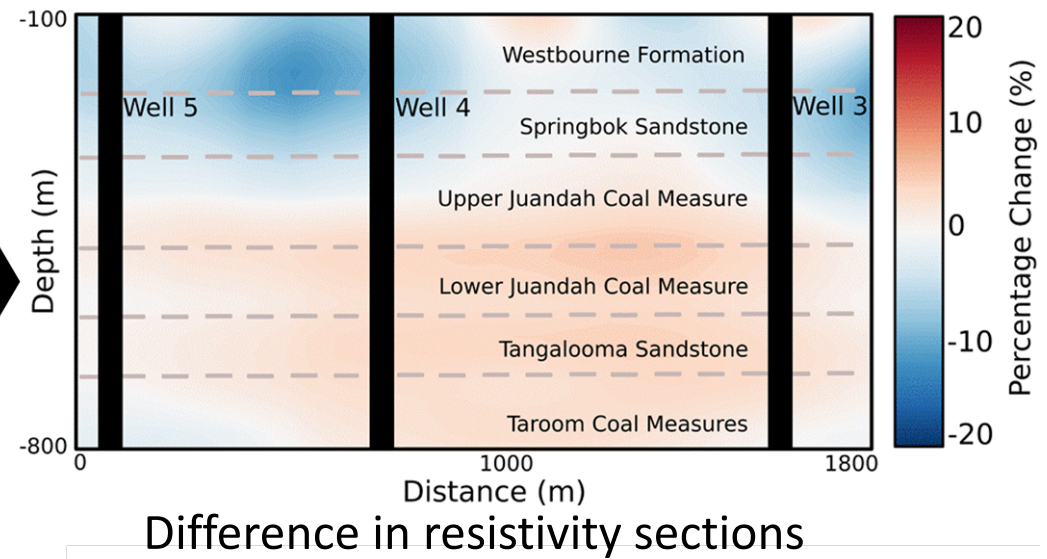
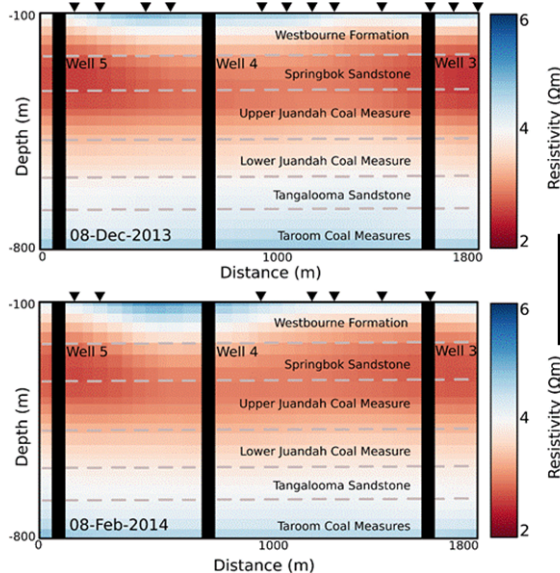


Coal Seam Gas

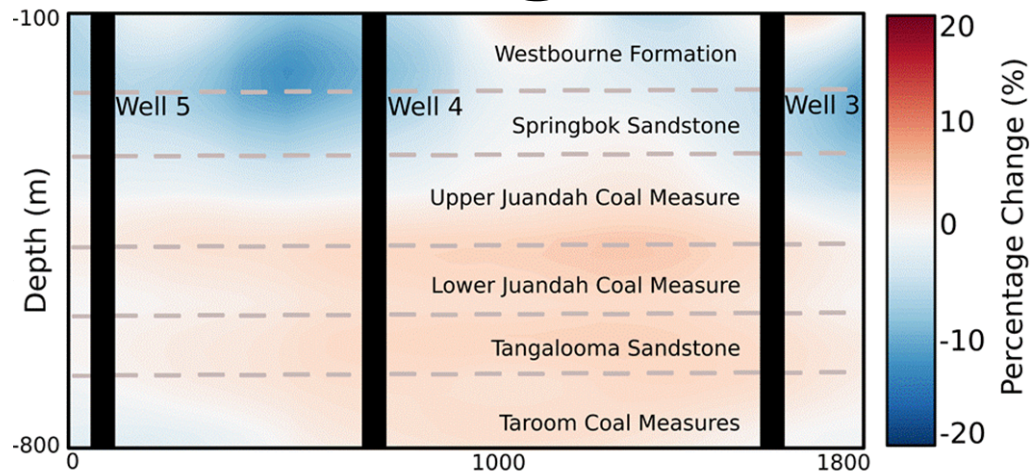
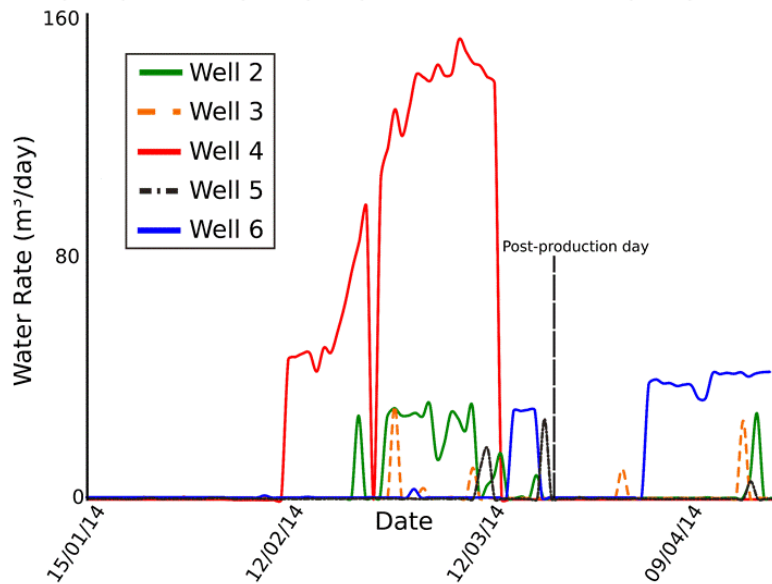


2D inversion

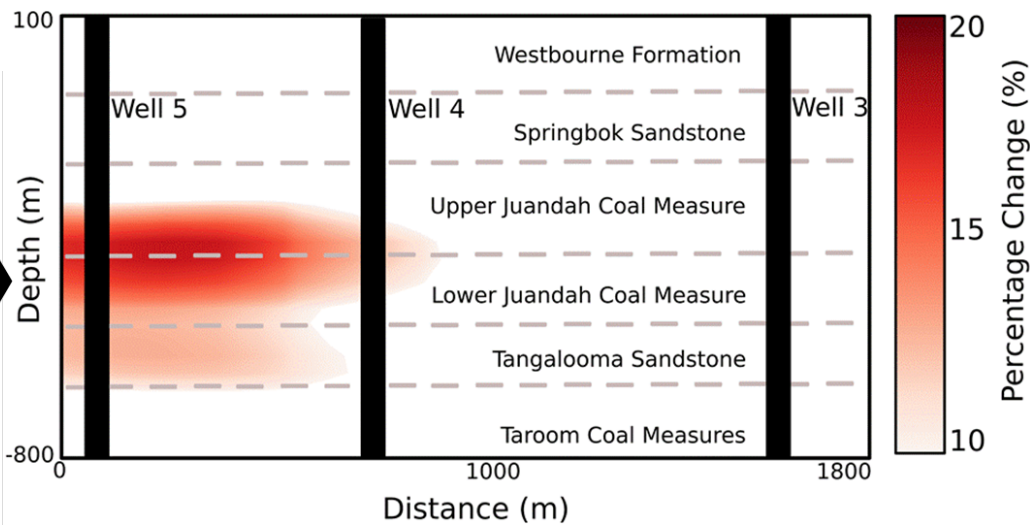
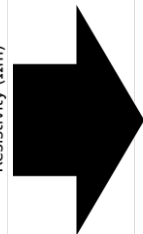
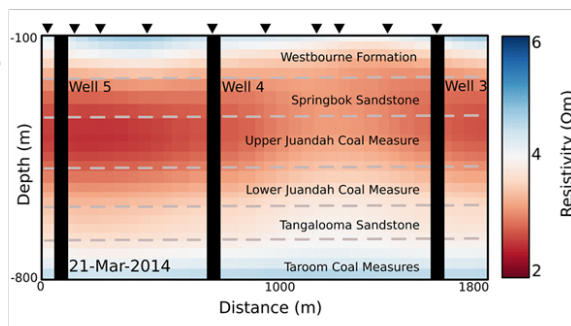
Inversion of two days prior to production



Coal Seam Gas: Spatial Change



Inversion of
day post
production



Coal Seam Gas: Temporal Change

