

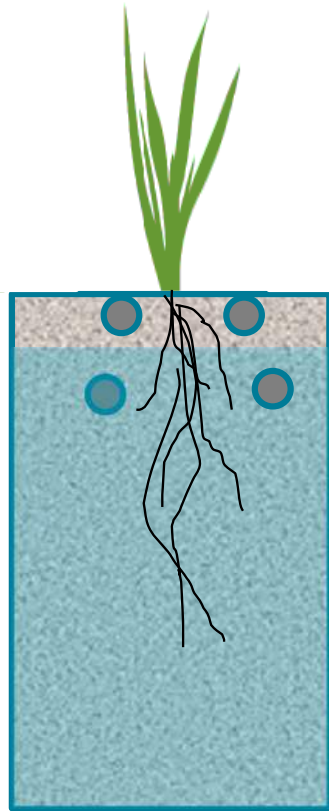


Reflections on modelling near-surface soil water conditions to inform management opportunities

Kirsten Verburg, Ketema T. Zeleke, Sarah M. Rich, John C. Broster, Chao Chen, Tao Luo, Neil I. Huth, Dean P. Holzworth, Therese M. McBeath, Phil L. Eberbach, Tony D. Swan, James Holding, Greg Condon, Kirrily Condon



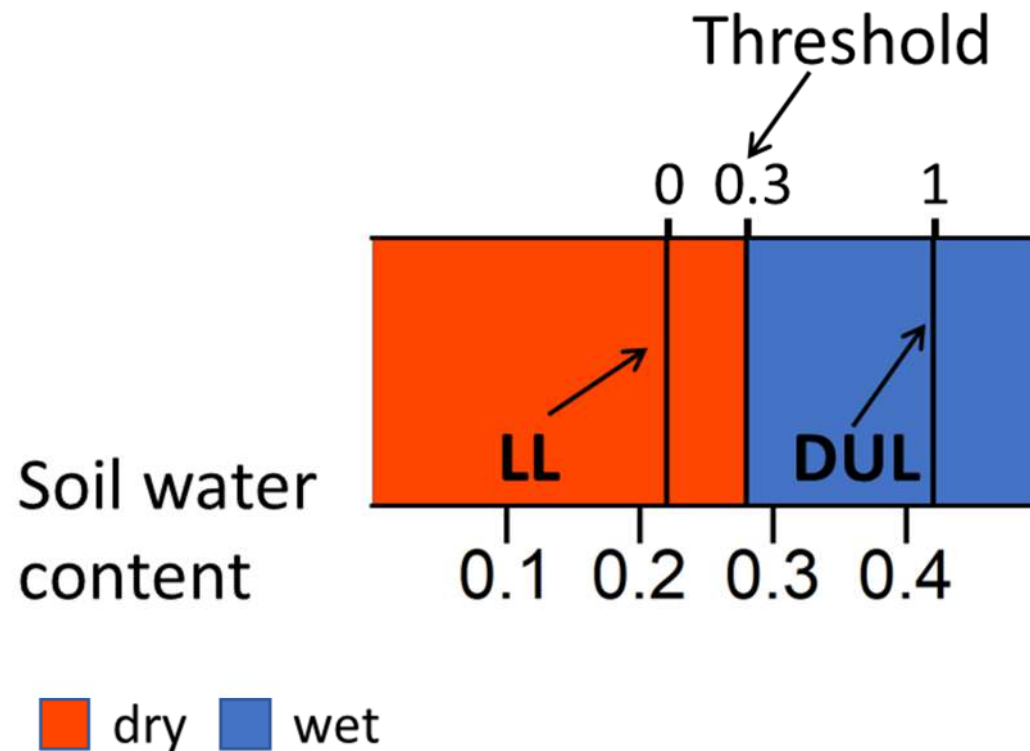
Near-surface soil water conditions can affect fertiliser availability

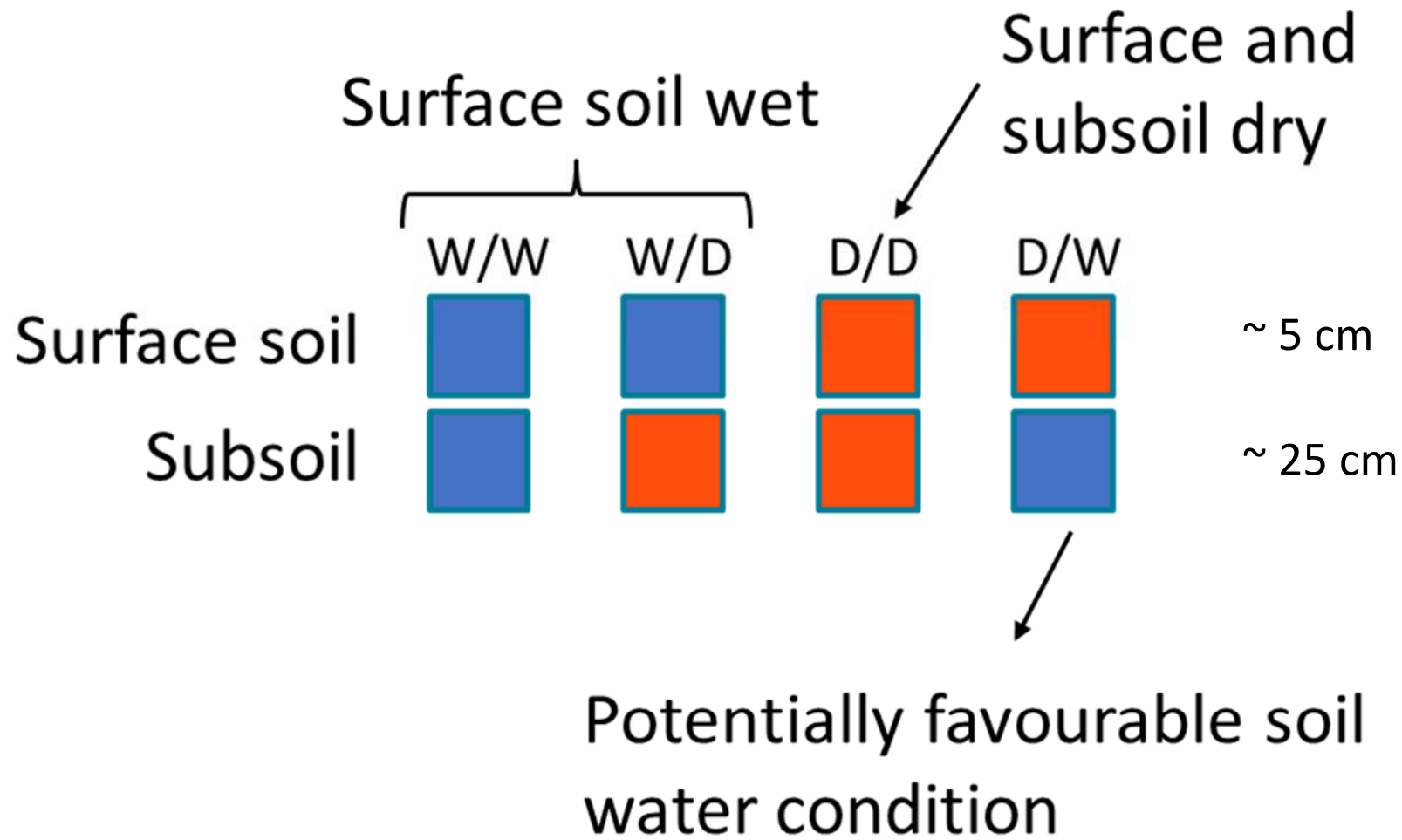


Deep placed P may be better crop accessible in wetter conditions of the subsoil

e.g., Dunsford, Uddin – Session 10b; Agron Conf 2022

Understanding of near-surface soil water conditions can inform the management opportunity

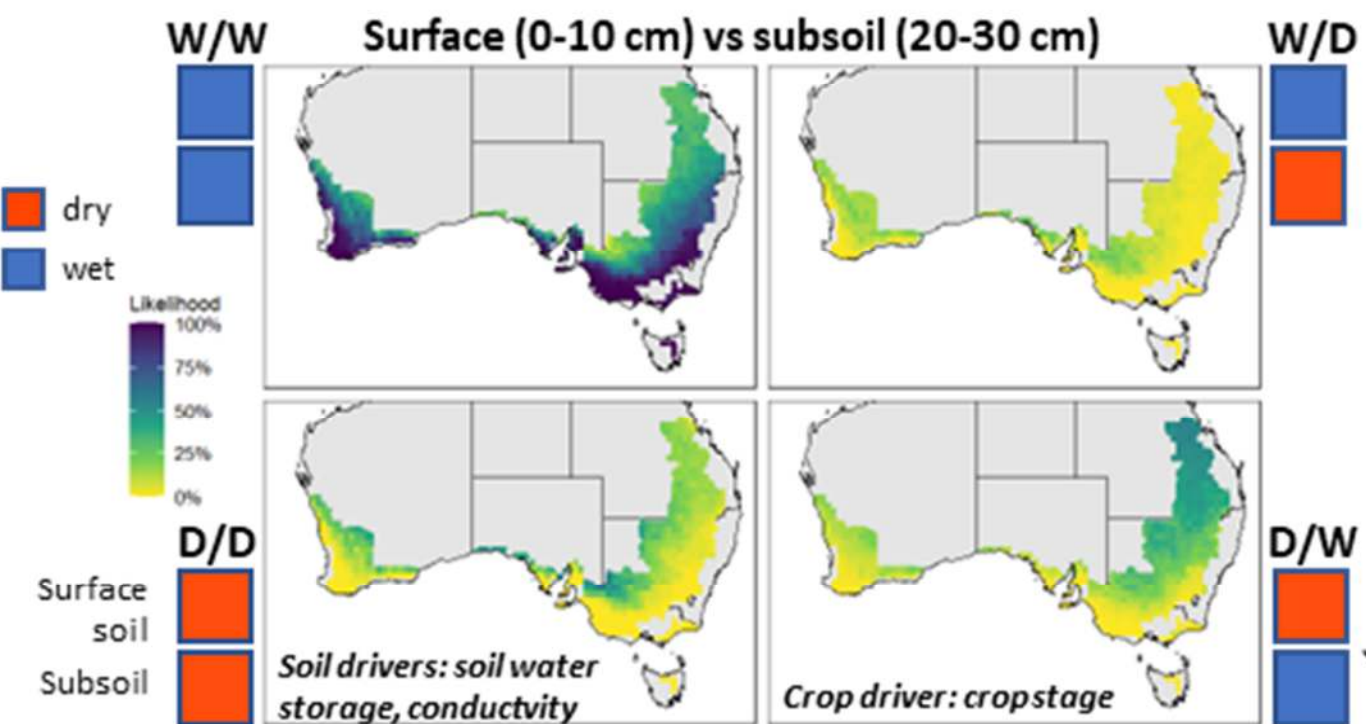




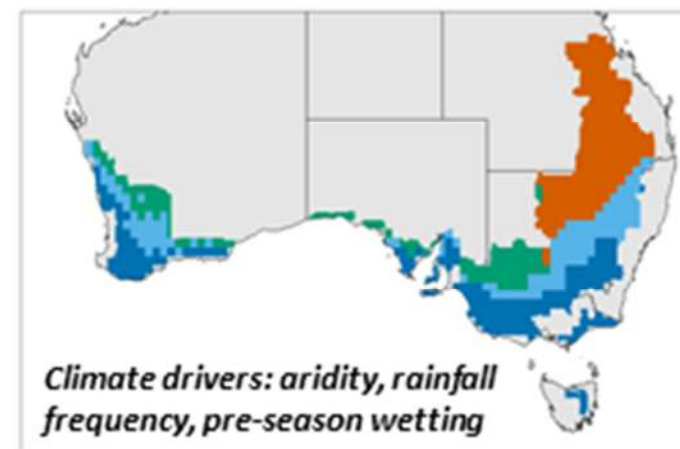
Identifying soil and climate drivers of soil water conditions favourable for deep phosphorus placement for wheat in Australia using spatial modelling

Kirsten Verburg^{a,*}, Roger D. Armstrong^b, Jody S. Biggs^c, Nigel S. Wilhelm^d,
 Rebecca E. Haling^a, Graeme Sandral^{e,1}, Shihab Uddin^e, Sean D. Mason^f, Therese M. McBeath^g

Likelihood of soil water conditions

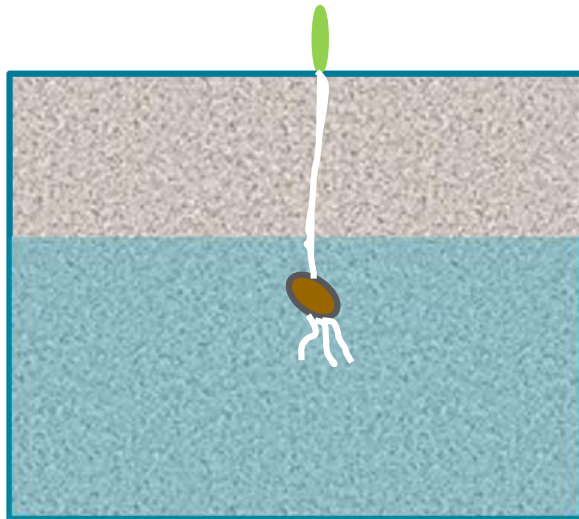


Regional differences Identified through clustering



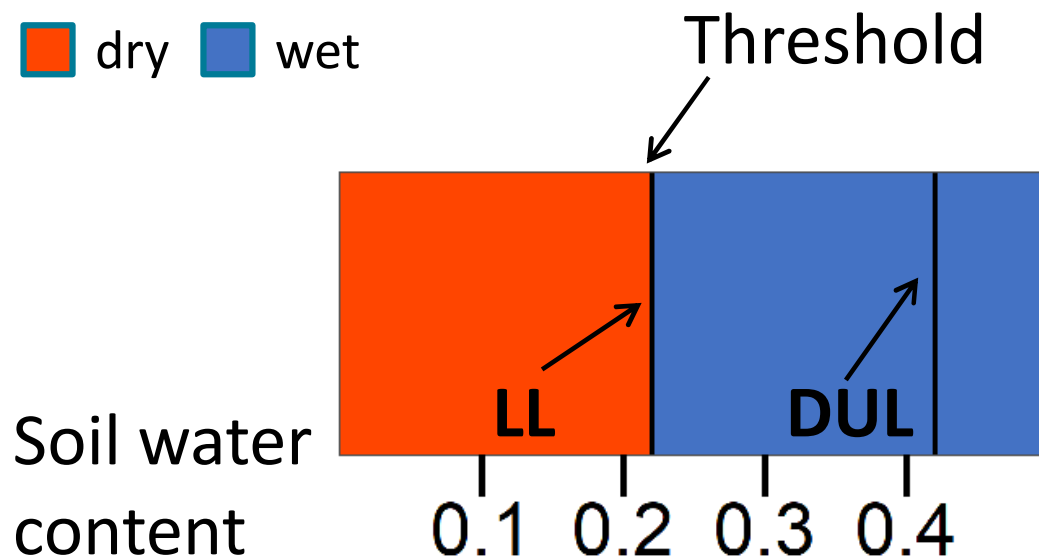
Hypothesis: D/W favourable for response to deep P

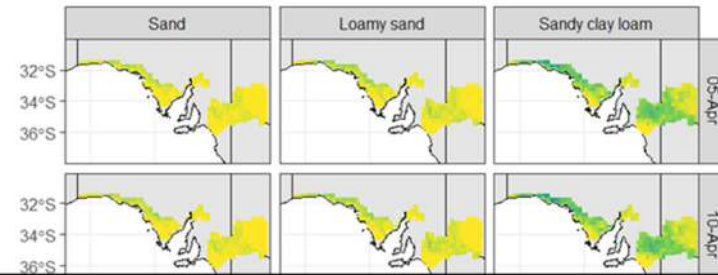
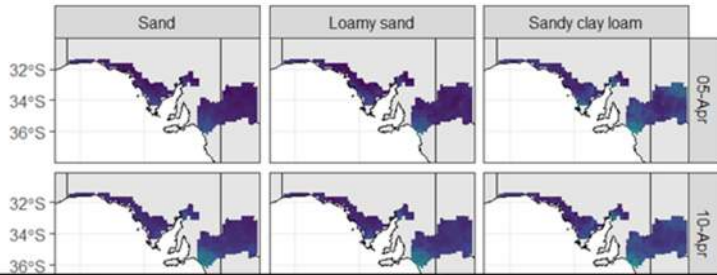
Near-surface soil water conditions affect seed germination



*With early dry sowing,
sowing deeper may prevent
delay in germination and
ensure timely emergence*

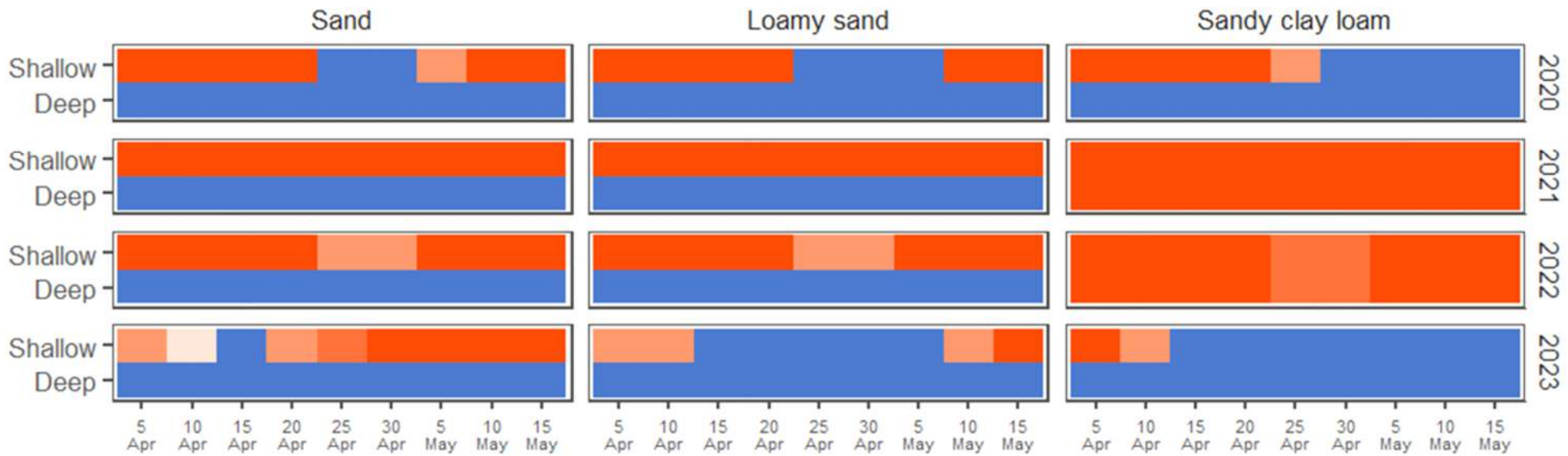
Understanding of near-surface soil water conditions can inform the management opportunity



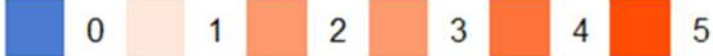


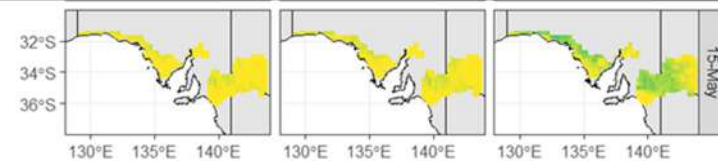
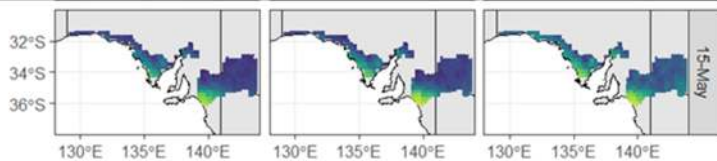
sowing
5 vs 15 cm

Waikerie SA



Sowing dates

Number of dry days in first 5 days after potential sowing date: 



Pushing boundaries

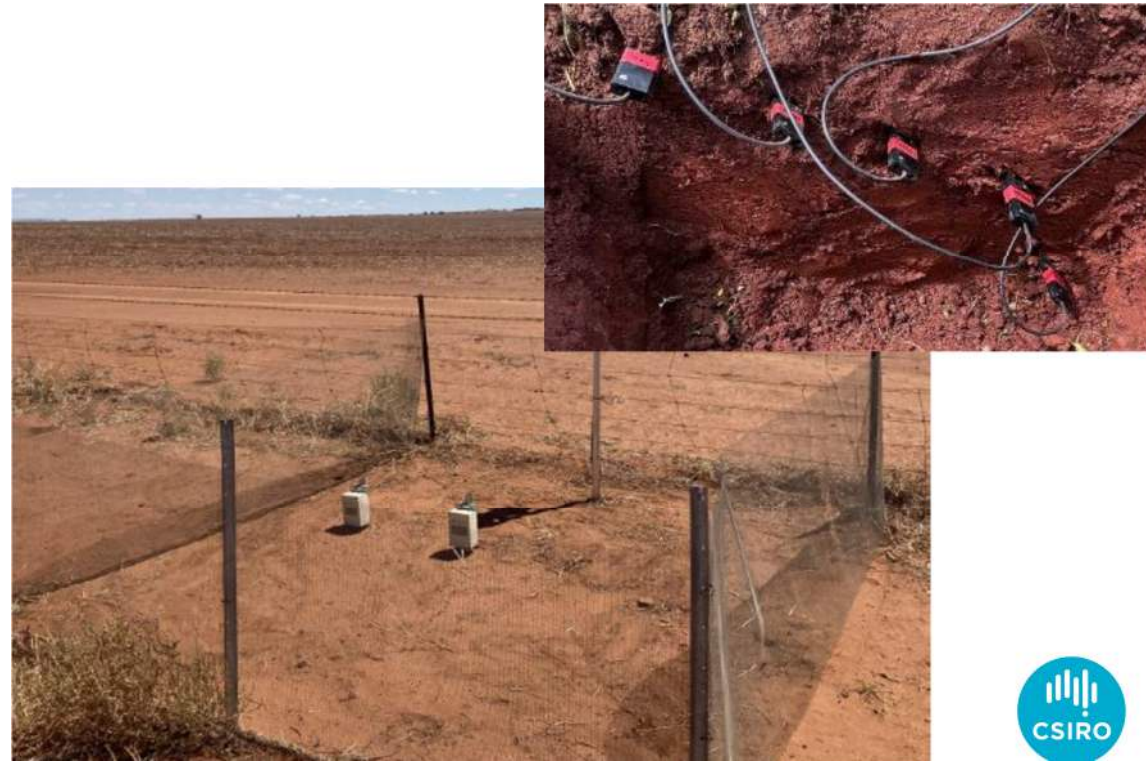
- Shallower depths
- Fallow timing
- Fallow management (residues, weeds) can also be a factor
- More detailed evaluation of model performance required
- Experimental findings and observations are key!
 - Model verification
 - Field conditions

Instrumented fallow experiments

12 Stripper-draper header stubble trials in S NSW
6, 16 and 26 cm or 15 cm

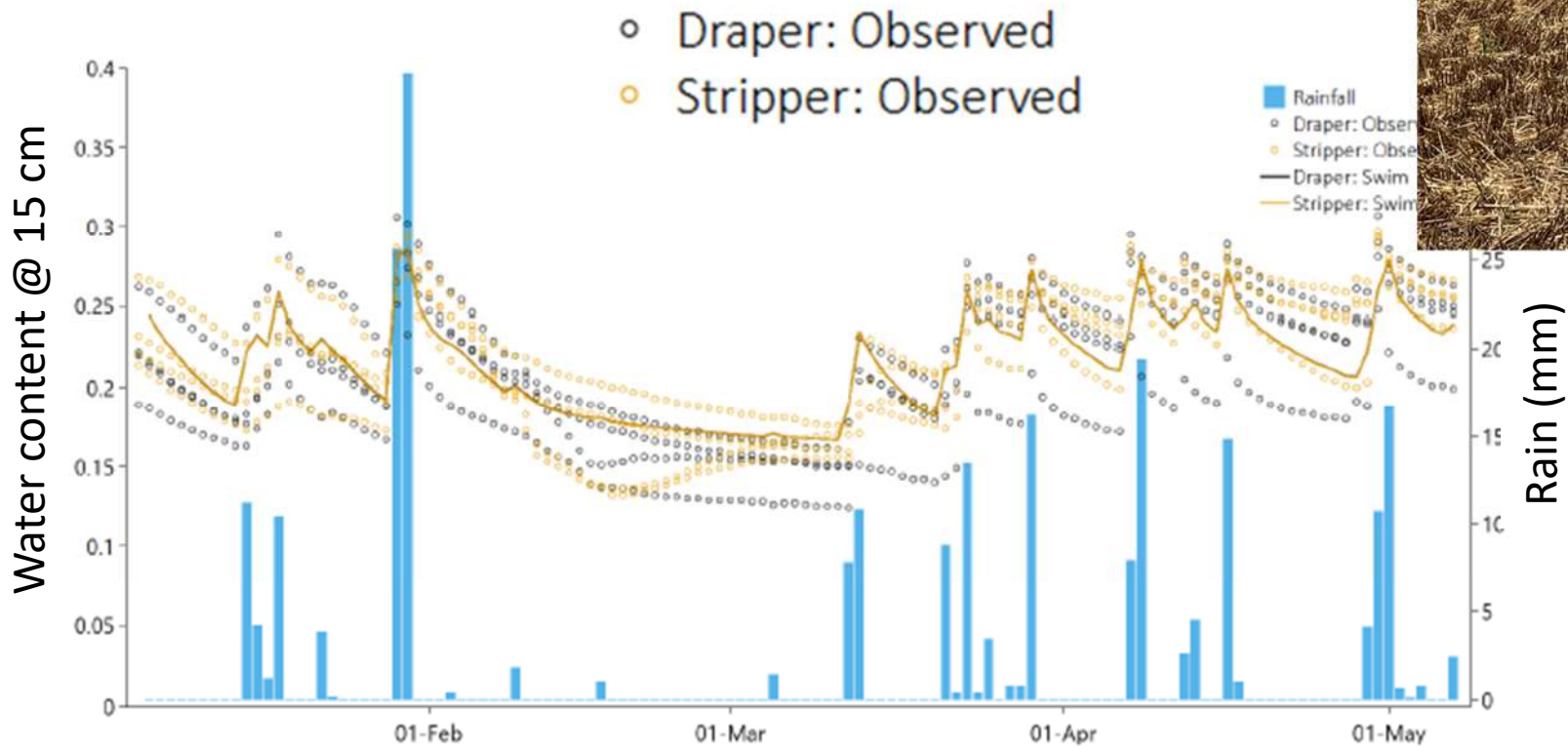


6 bare soil experiments WA and SA
5, 10, 15, 20, 30, 50 cm



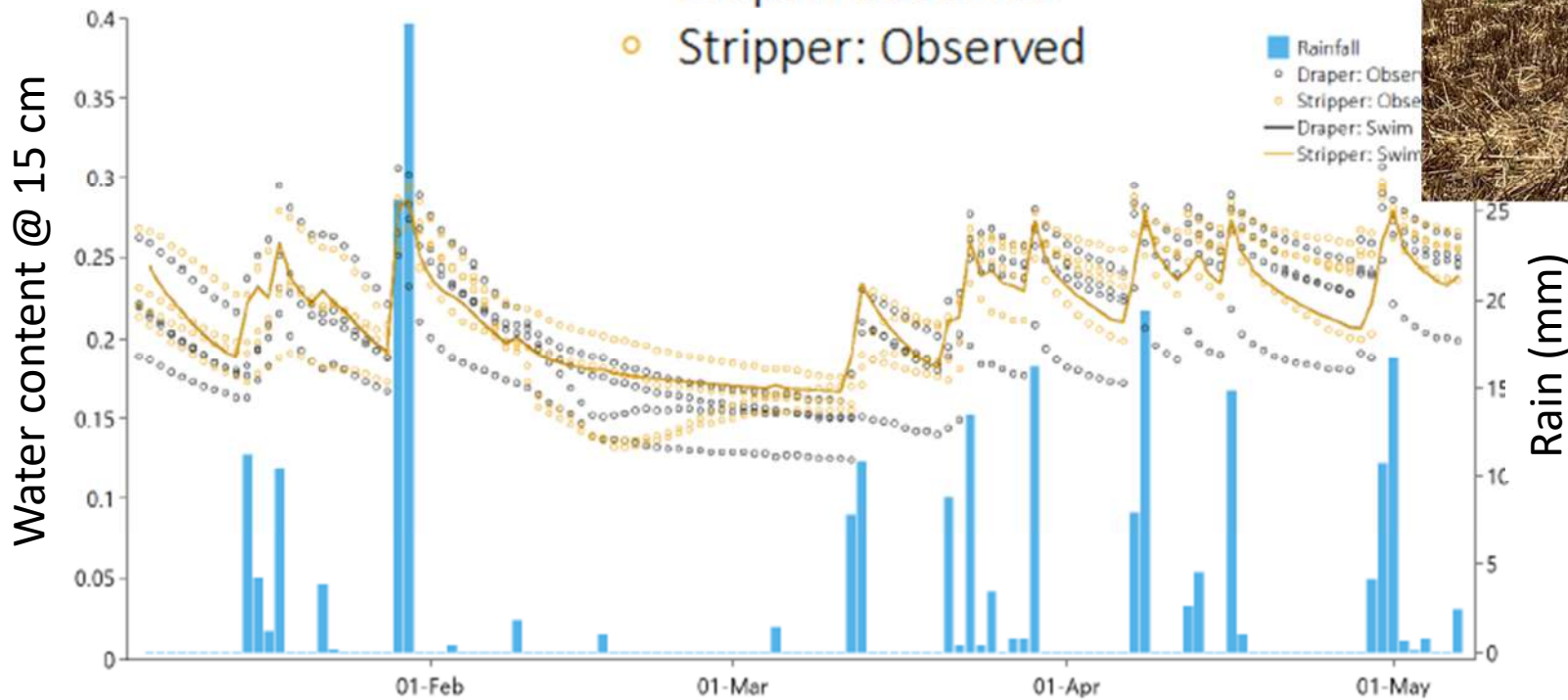
Experimental findings and challenges

- Large (spatial) variability
- No significant treatment differences stripper vs draper stubbles



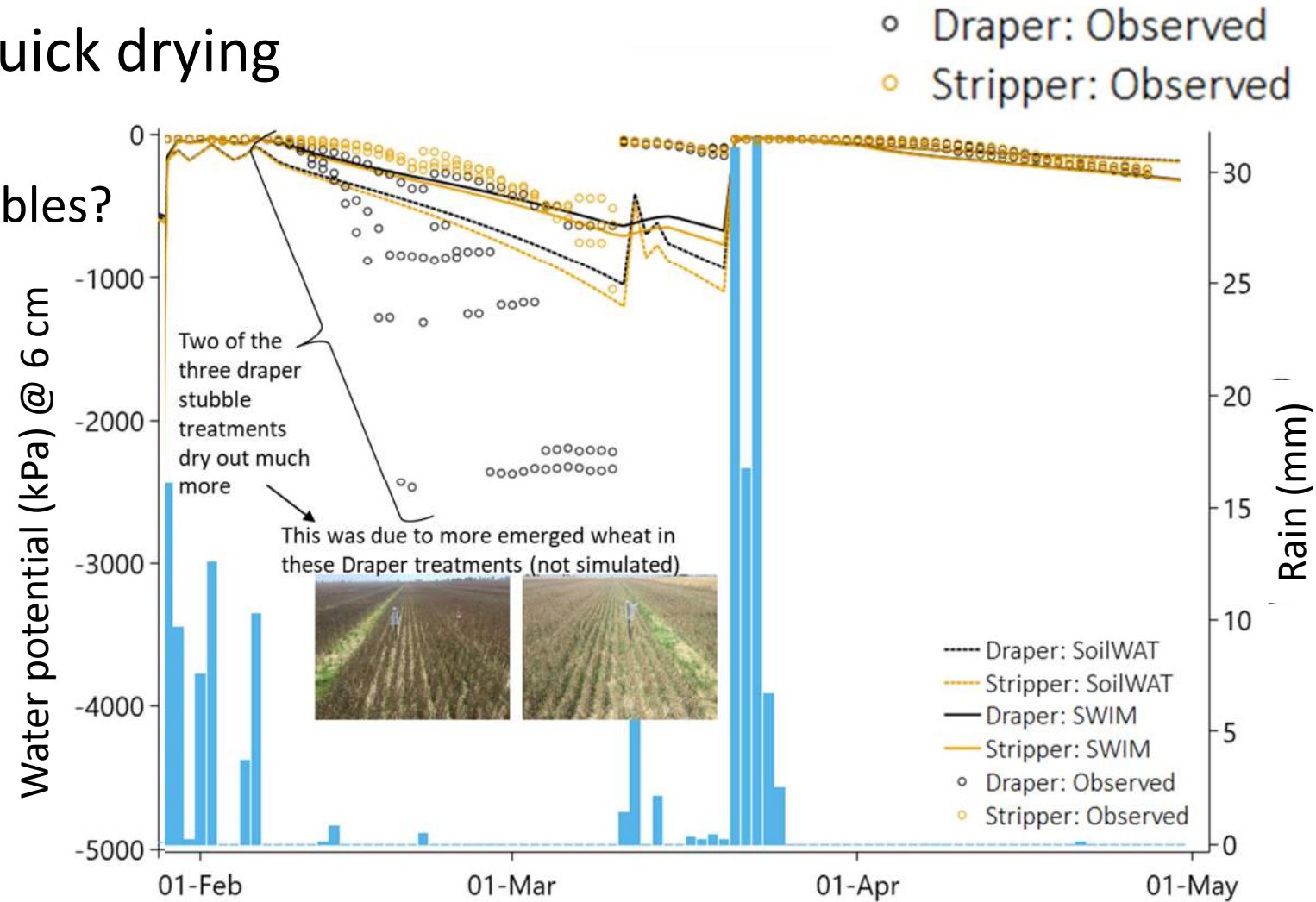
Experimental findings and challenges

- High stubble loads and wet conditions
 - Limited effects at 15 cm depth



Experimental findings and challenges

- Temporary weeds – quick drying
 - Jan-Feb
 - More under draper stubbles?



Experimental findings and challenges

- Spatial variability
- High stubble loads
- Temporary weeds

Override stubble
configuration effects



Part of the system!

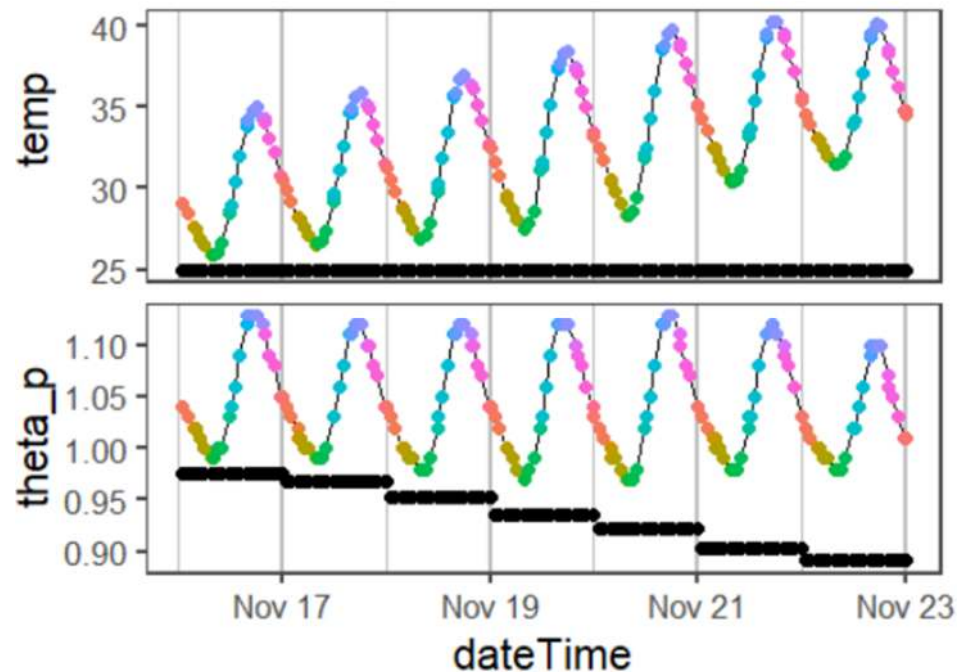
Challenge for model verification

- Not tested low stubble loads during dry summer fallow
- Experimental design for practice testing or model testing?

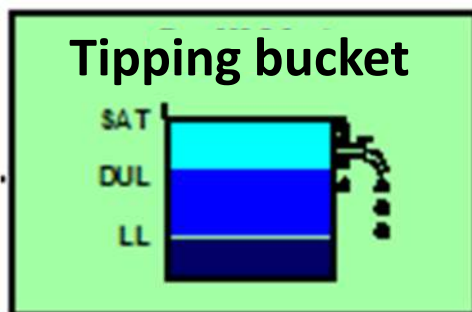
Technical challenges

- Probe installation
- Sphere of influence of soil moisture probes
- Temperature sensitivity of soil moisture probes
 - Real problem are temperature changes in time

- *Some probes provide automatic correction – evaluate that it is not overcorrecting*

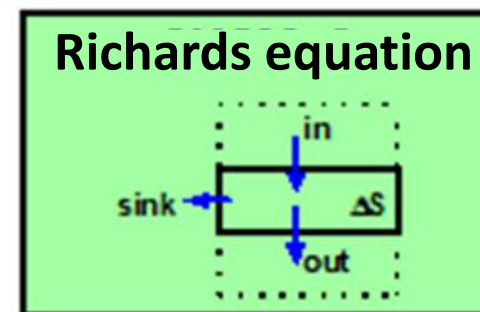


Model verification tips & tricks



- SoilWat

- 1st layer = 10 cm
- Daily time step challenging for rapid, sub-daily processes
- Check diffusivity parameters to ensure upward flow is sensible



- SWIM3

- Thin layers are better
- Sub-daily time step, but enter rainfall with its intensity
- Tendency to simulate shallow drying fronts; current work evaluating vapour flow conductivity

In summary,

- Simulation analyses require a simple conceptualisation to extract the 'essence' of a question or problem
- The wet-dry conceptualisation allows analysis of management practices that are affected by contrasting soil water conditions.
- However, for the case of deep sowing, this requires closer attention to accuracy of model predictions
- 'Field factors' such as spatial variability in soil type, residue cover, etc, and role of temporary weeds – need to be considered and may override any potential benefits



Thank you

on behalf of the author team

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Australia's National Science Agency



Want to know more?



<https://github.com/APSIMInitiative>



APSIM Initiative

53 followers Dean.Holzworth@csiro.au



<https://www.apsim.info/>

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