Local soil moisture – rainfall correlation at varying spatial scales

C.M. Holgate\textsuperscript{1,2}, A.I.J.M. Van Dijk\textsuperscript{1}, J.P. Evans\textsuperscript{3,4}, A.J. Pitman\textsuperscript{3,4}

\textsuperscript{1} Fenner School of Environment and Society, Australian National University
\textsuperscript{2} ARC Centre of Excellence for Climate System Science, UNSW Australia
\textsuperscript{3} ARC Centre of Excellence for Climate Extremes, UNSW Australia
\textsuperscript{4} Climate Change Research Centre, School of Biological, Earth and Environmental Sciences, UNSW Australia
Background

• PhD: what role does L-A coupling play in Australian rainfall & drought?

• Initial study: where & when coupling detectable.

• Which technique?
Correlation assumes 1D mechanism

- Covariance of co-located, gridded SM & P
Study aims

• Does a SM-P relationship exist under the 1d assumption?
• Is the relationship robust at varying spatial scales?
# Data

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<thead>
<tr>
<th>Variable</th>
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<th>Spatial resolution</th>
<th>Temporal resolution</th>
<th>Period</th>
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<td>Precipitation</td>
<td>AGCD</td>
<td>0.05°</td>
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</tr>
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Methodology

• Spearman-rank correlation
  – Daily average SM and next-day P
  – 1979-2015

• Analyse seasons individually

• Consider only first days of rain, where consecutive rain days recorded

• Choice of spatial scale?
Choice of spatial scale

- Daily data + 1d assumption
  - Constrain grid scale to distance air parcel may be transported across landscape in single day
- Surface wind speed \( \sim 4 \text{ms}^{-1} \) most common
1d assumption flawed?

4 ms$^{-1}$ x 7 h ≈ 100 km ≈ 1$^\circ$
Choice of spatial scale
Correlation of $SM_i$ and $P_{i+1}$ ($1^\circ$)

**Summer**
- Significant, positive

**Autumn**
- Coloured = significant
- Hatch = ignore (N<15)

**Winter**
- Significant, positive

**Spring**
- Significant, negative
Correlation at different spatial scales

- **Summer**
  - 0.05°: Low sample sizes at small scale
  - 0.5°: Similar pattern to 1°
  - 2.5°: Interesting negative relationship

- **Winter**
Differences as function of scale

Correlation magnitude higher at smaller scale

Two-thirds of cells with higher correlation at smaller scale
Summary

1. Upholding coupling 1d assumption requires:
   - Careful data filtering
   - Accounting for sample size issues

2. Significant relationship found:
   - Positive in northern & central Australia
   - Negative in south/southeast (austral winter)

3. Scale-dependent correlations:
   - Implications for modelled coupling
Thank you

chiara.holgate@anu.edu.au