Local soil moisture – rainfall correlation at varying spatial scales

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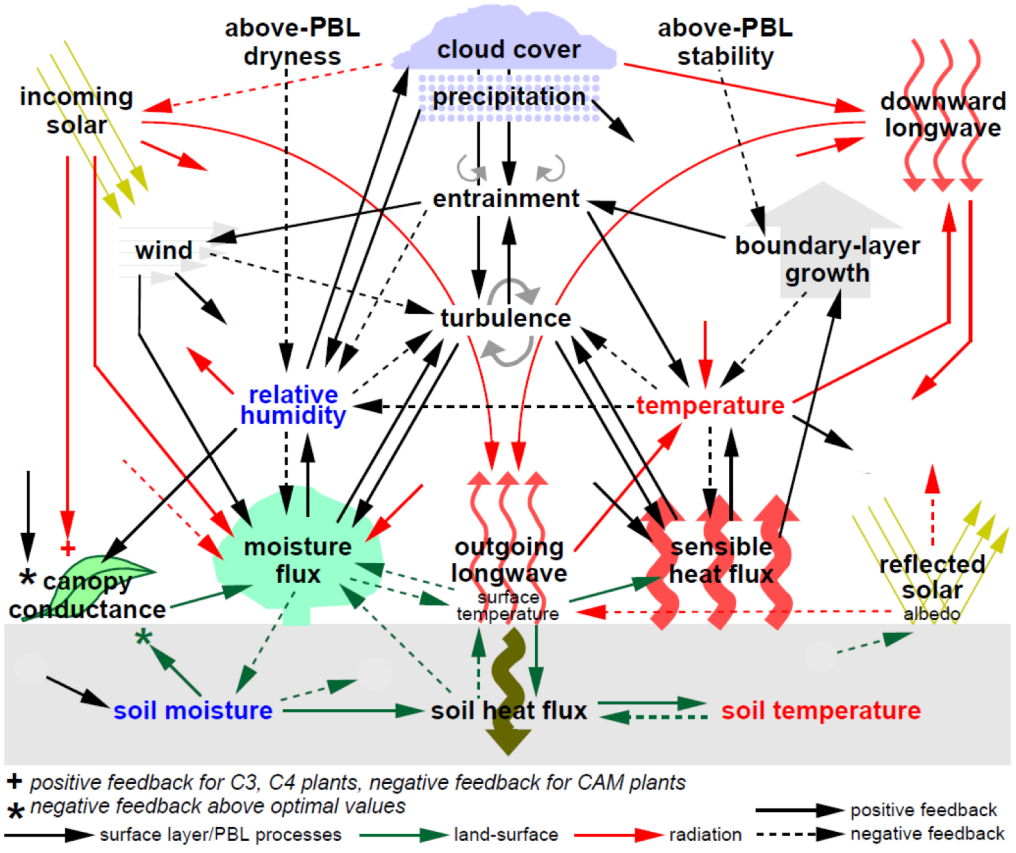
Background

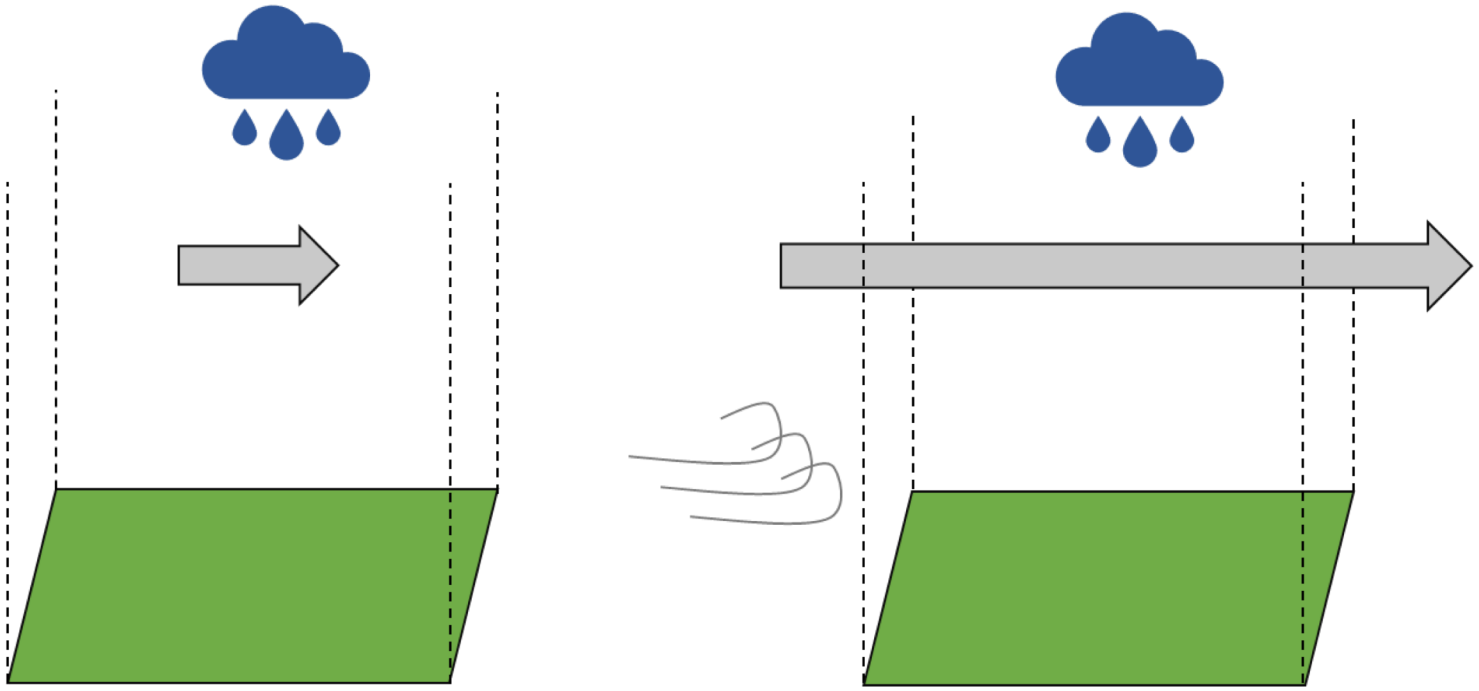
- PhD: what role does L-A coupling play in Australian rainfall & drought?
- Initial study: where & when coupling detectable.
- Which technique?



Ek, 2005

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

Variable	Source	Spatial resolution	Temporal resolution	Period
Precipitation	AGCD	0.05°	Daily	1901 – 2016
	MSWEP v2.2	0.1°	3-hourly	1979 – 2016
Soil moisture	WaterDyn	0.05°	Daily	1911 – 2016
	CCI	0.25°	Daily	1979 – 2015
Wind speed	ERA-I	0.75°	6-hourly	1979 – 2015

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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?

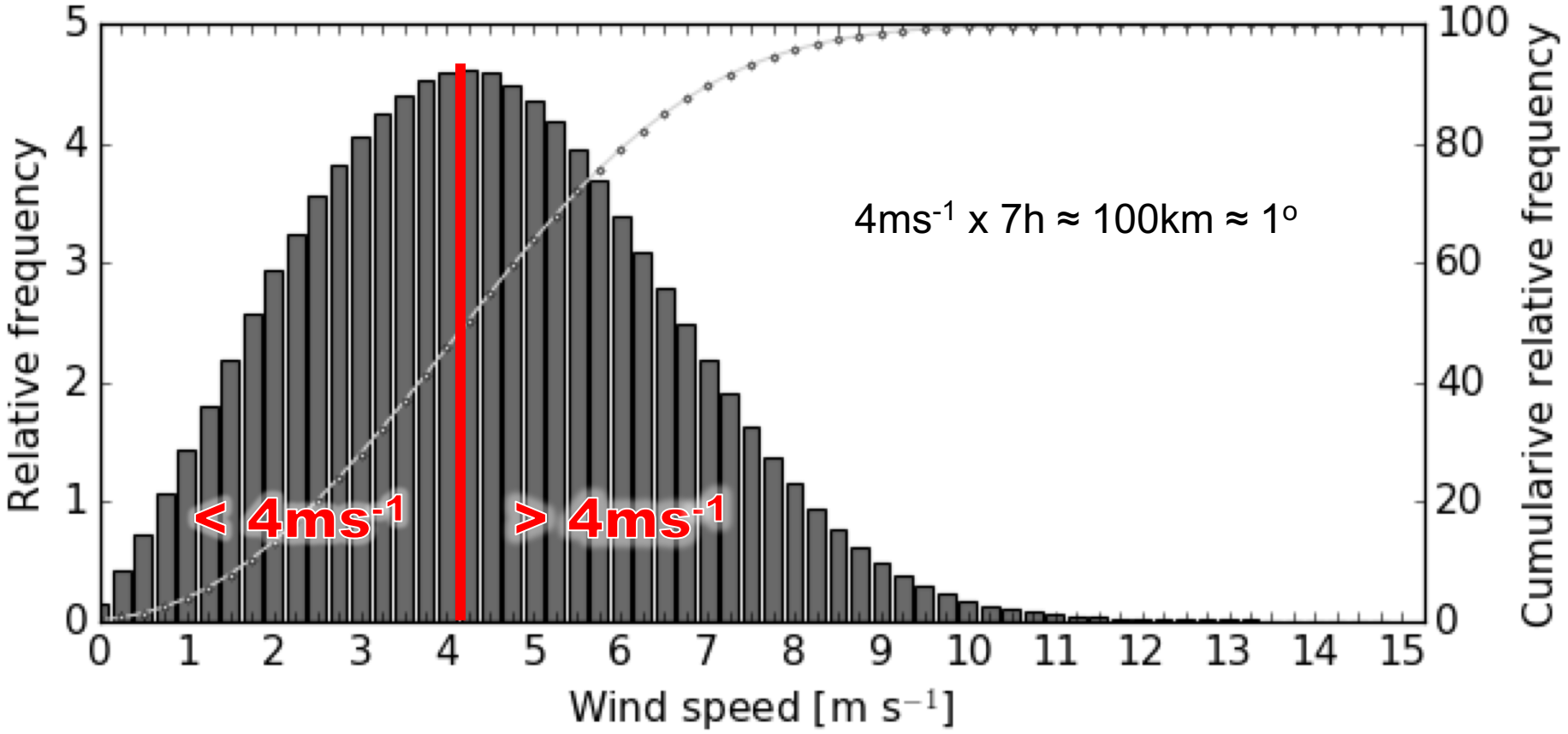
Choice of spatial scale

- Daily data + 1d assumption

  →Constrain grid scale to distance air parcel may be transported across landscape in single day

- Surface wind speed ~4ms^{-1} most common

1d assumption flawed?



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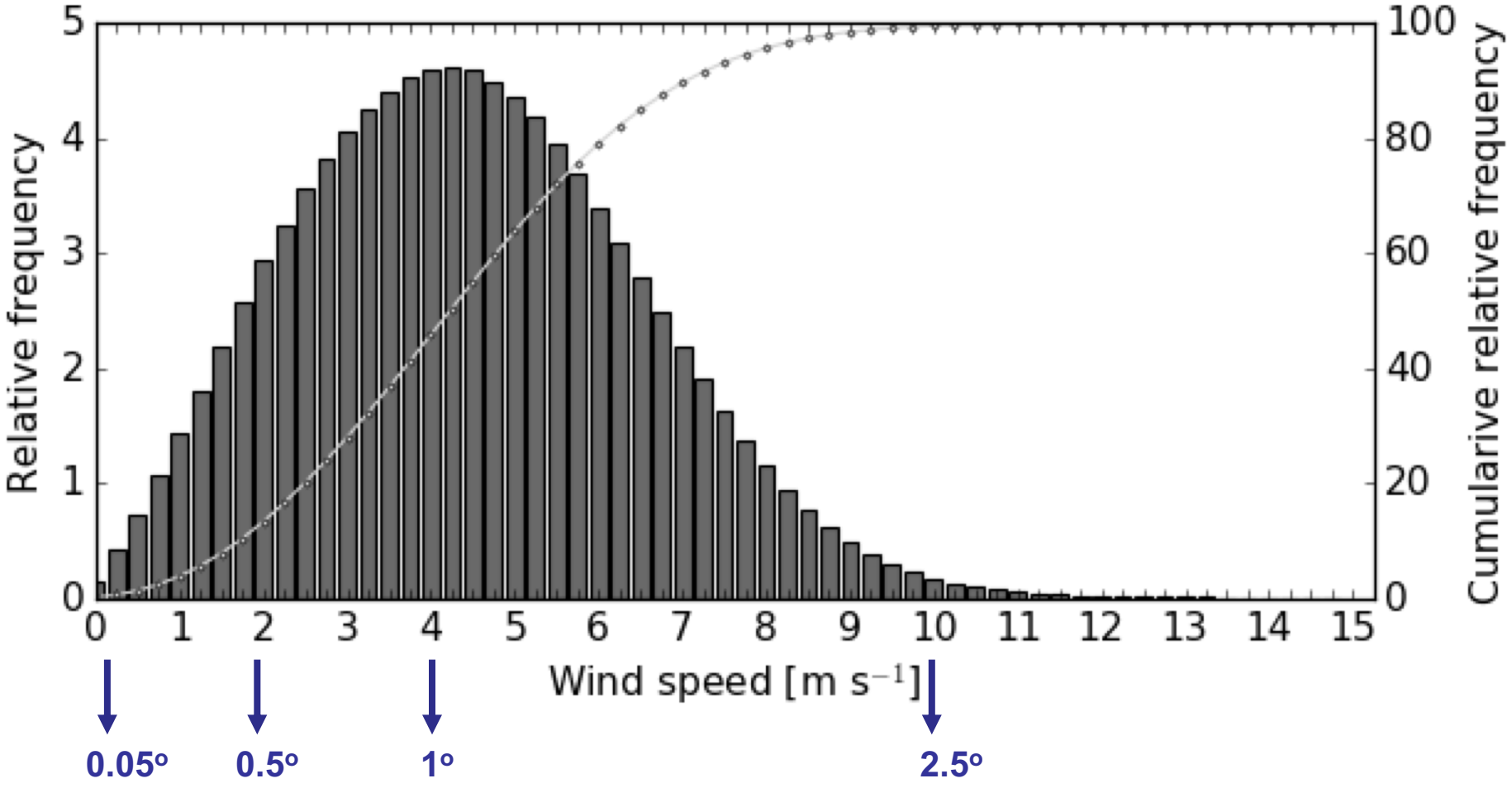
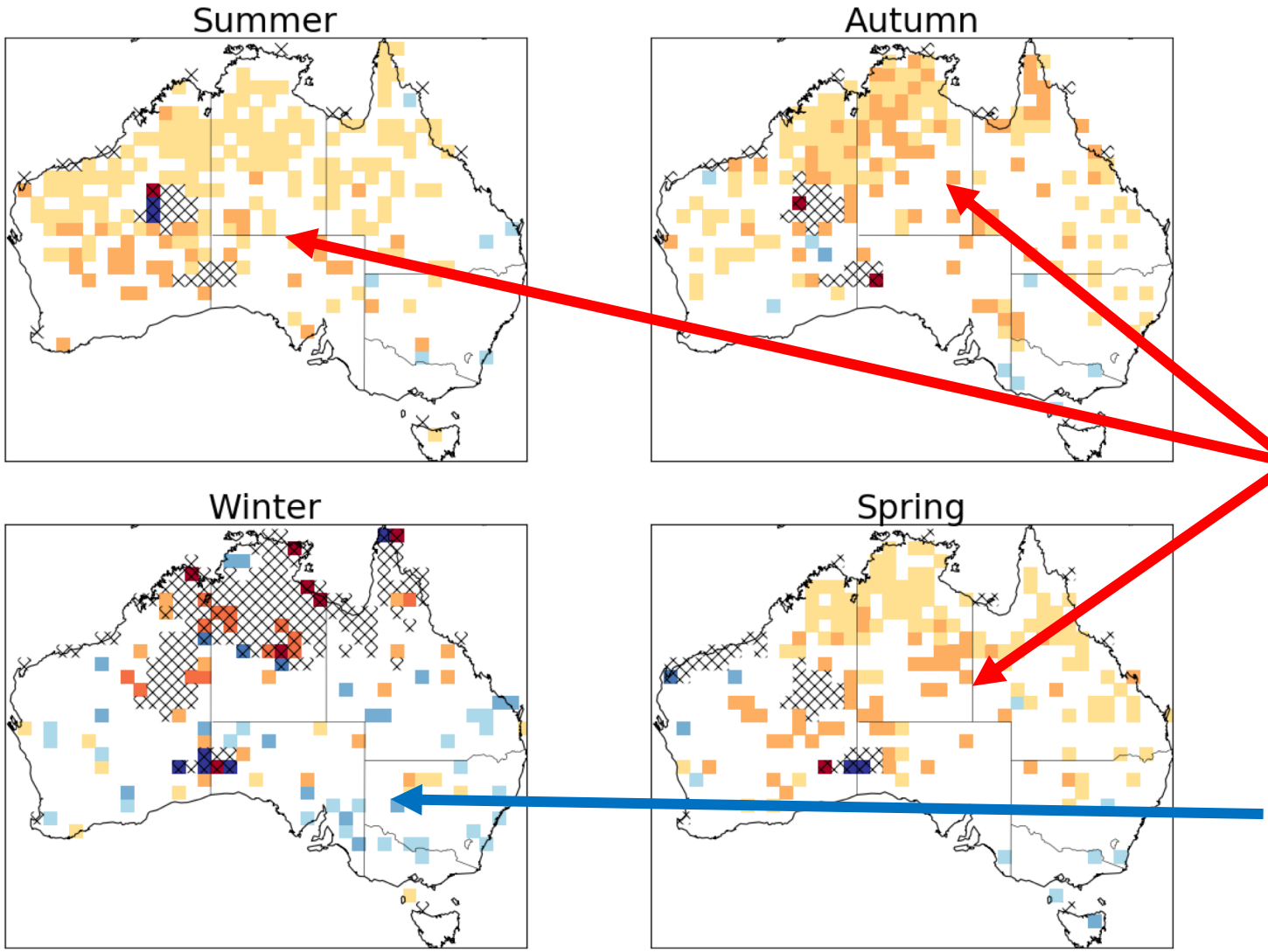


Correlation of SM_i and P_{i+1} (1°)



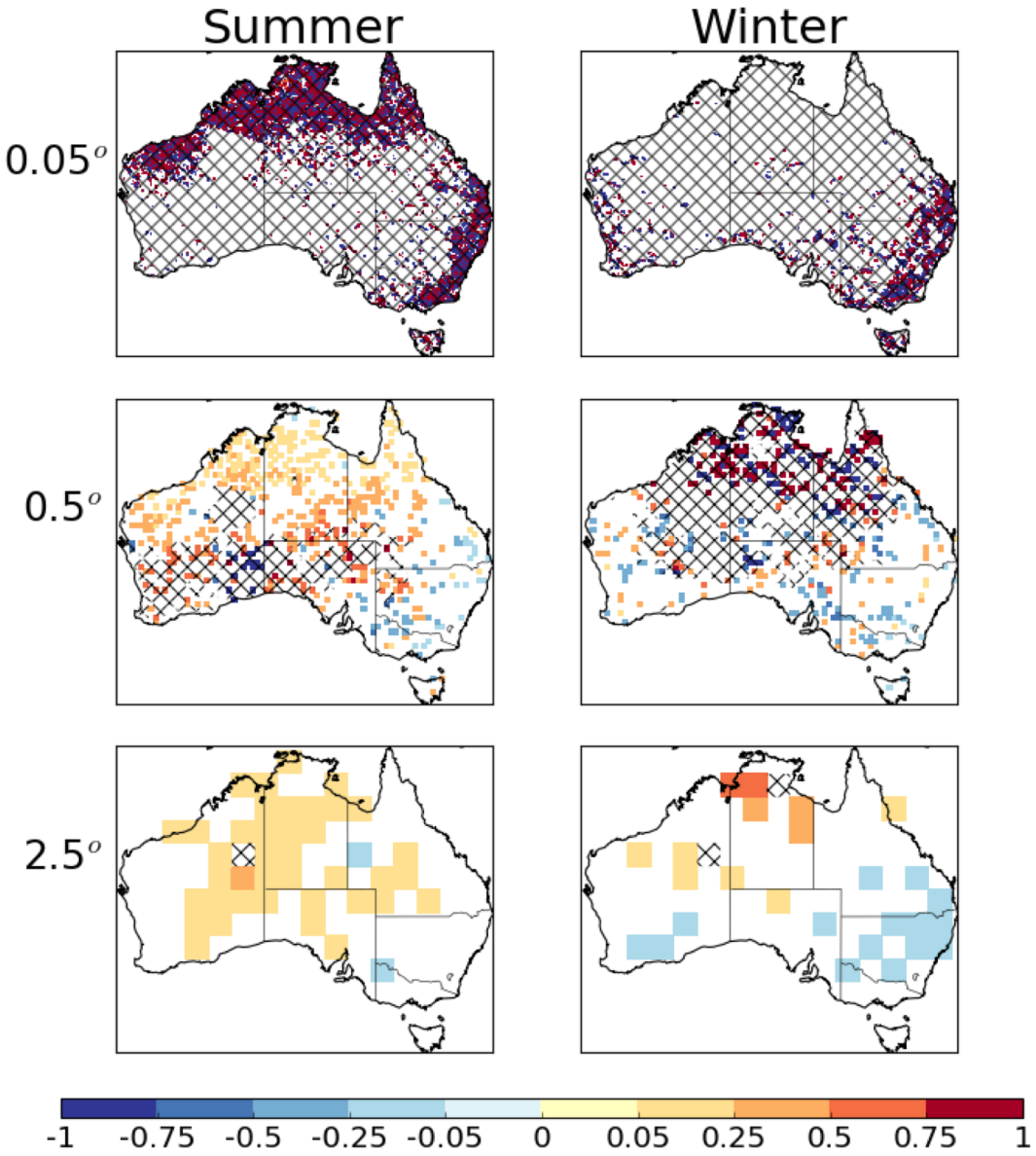
Coloured = significant

Hatch = ignore (N<15)

Significant, positive

Significant, negative

Correlation at different spatial scales

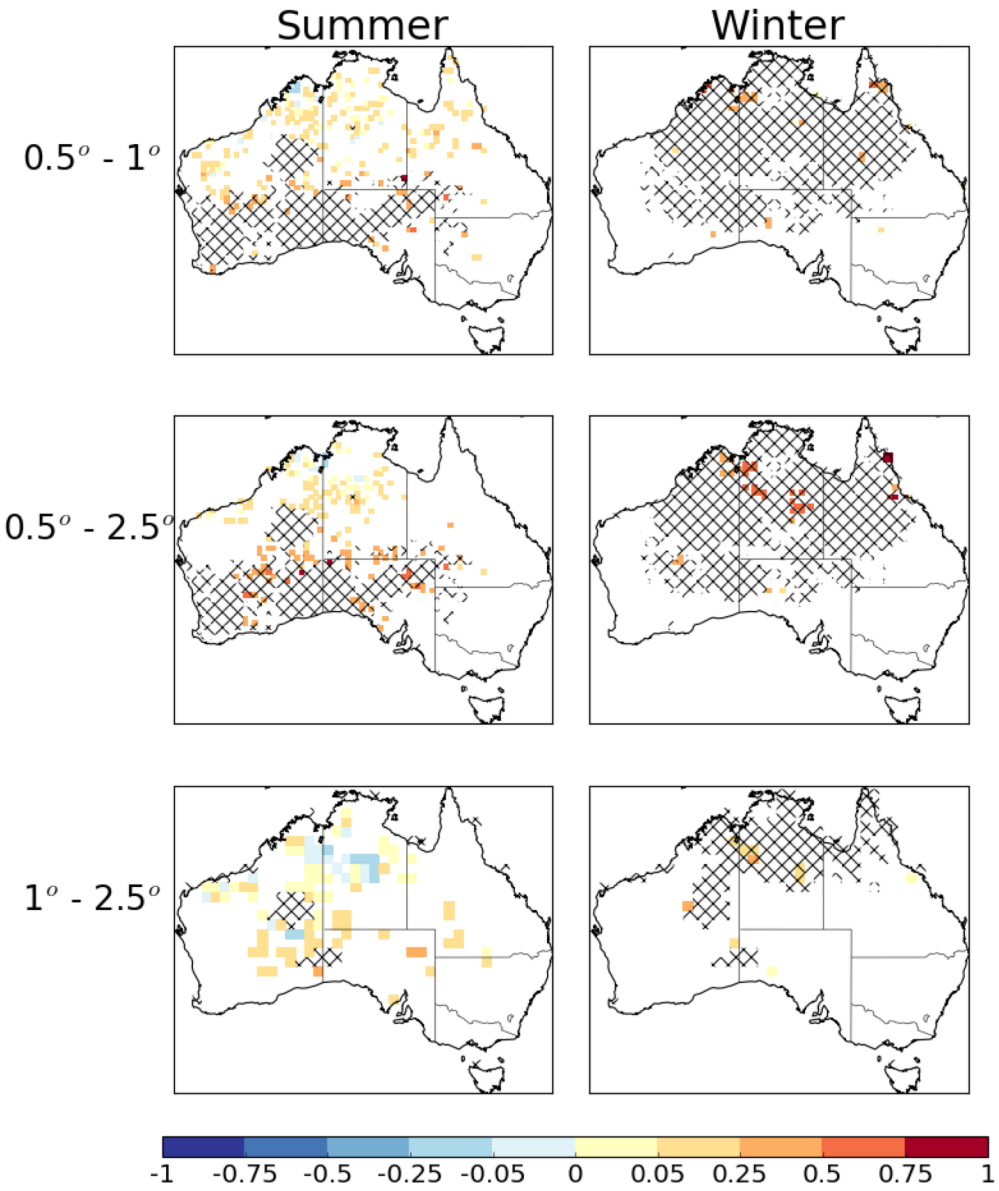


Low sample sizes at small scale

Similar pattern to 1°

Interesting negative relationship

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

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