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Teleconnection pathways of ENSO and the IOD: what drives cool season variations in extratropical Australian rainfall?

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The effect of ENSO on Australian rainfall

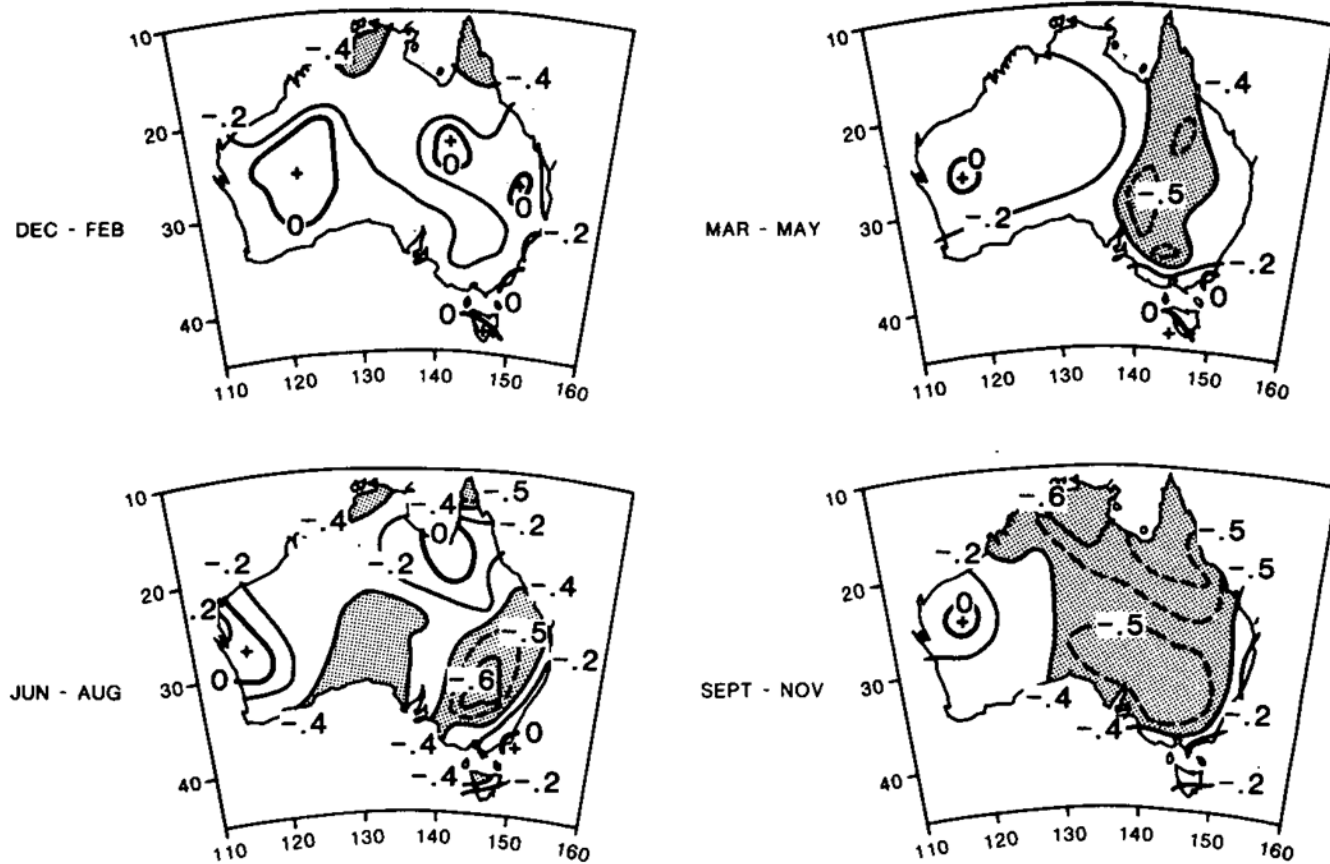


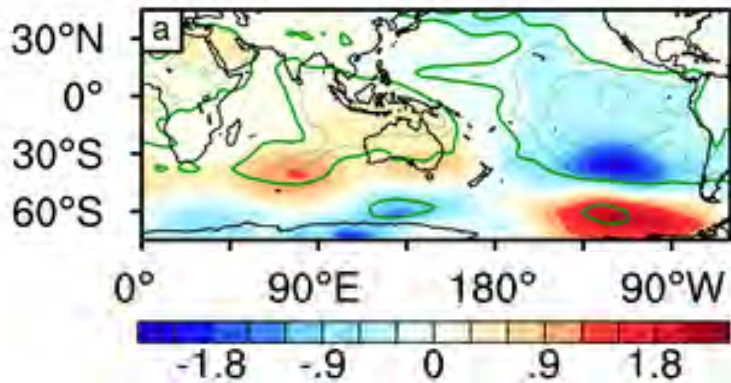
FIG. 2. Simultaneous correlations between Darwin pressure and district rainfall for the four seasons, December–February, March–May, June–August, September–November. Data from 1932–74.

McBride and Nicholls (1983)

How ENSO affects Australian rainfall

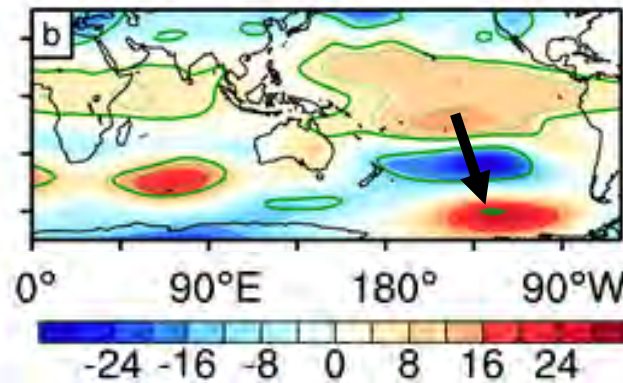
JJA regressions onto NINO3.4

Sea Level Pressure



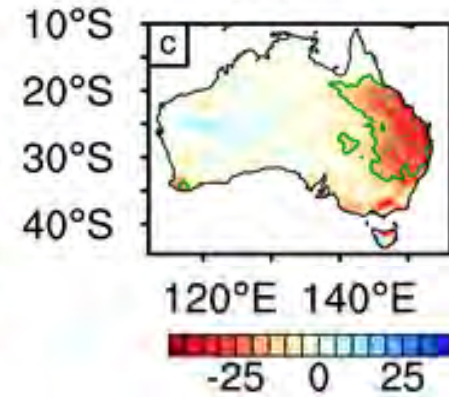
hPa °C⁻¹

200hPa Geopotential Height



m °C⁻¹

Rainfall

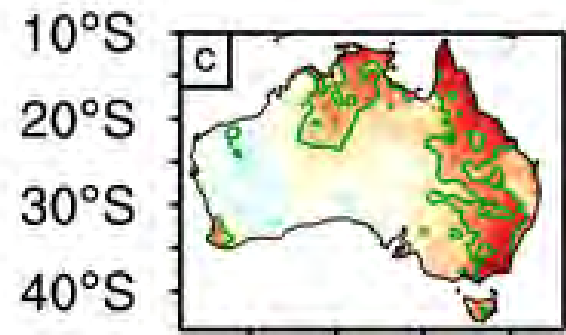


mm °C⁻¹

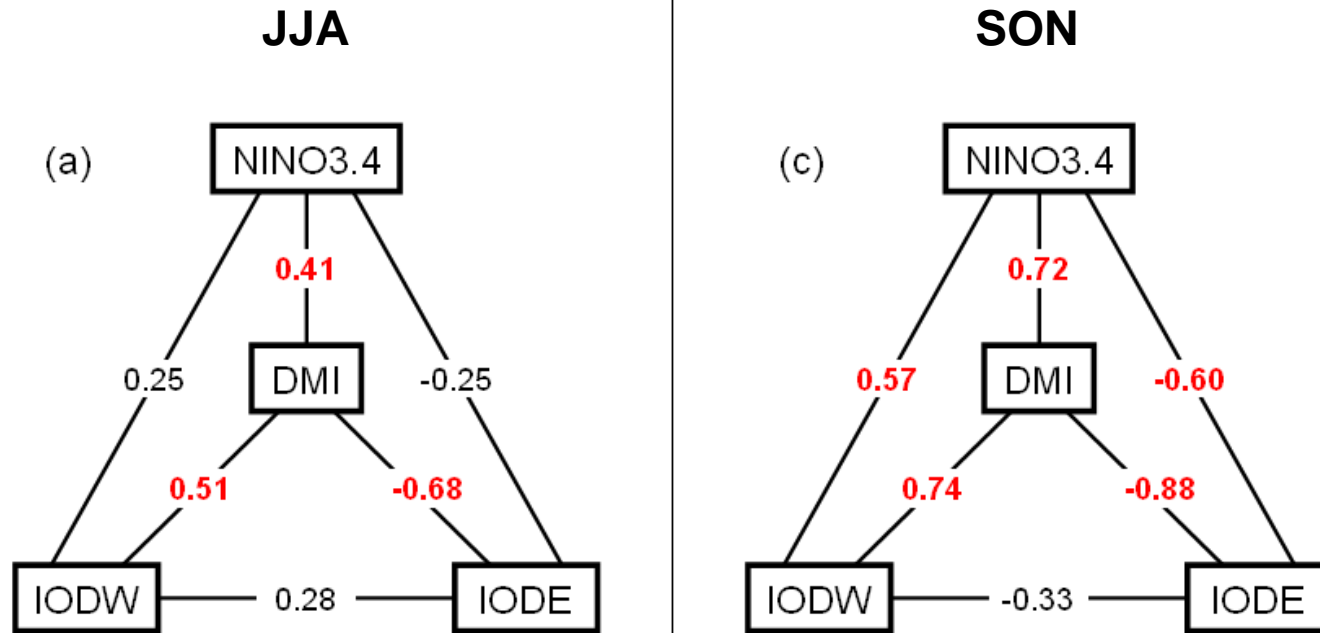
- Tropical sea surface temperature induces a deep baroclinic response through convection
- Anomalous divergence associated with convection excites equivalent-barotropic Rossby waves
- This can not explain the southern Australian rainfall response during spring

SON

NINO3.4 - Rainfall



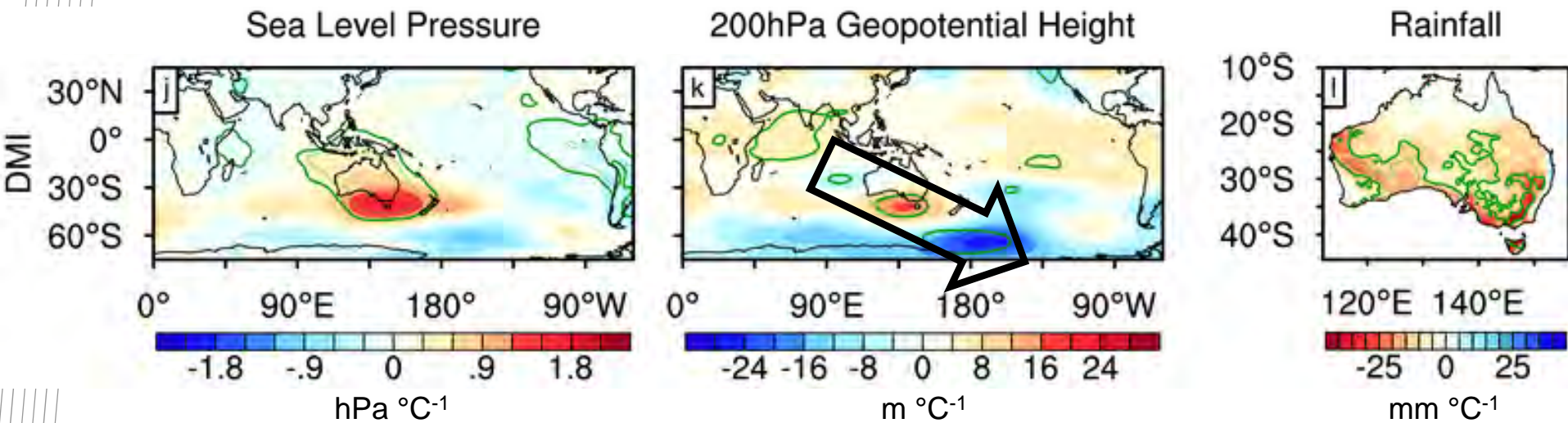
Relationships within the tropics



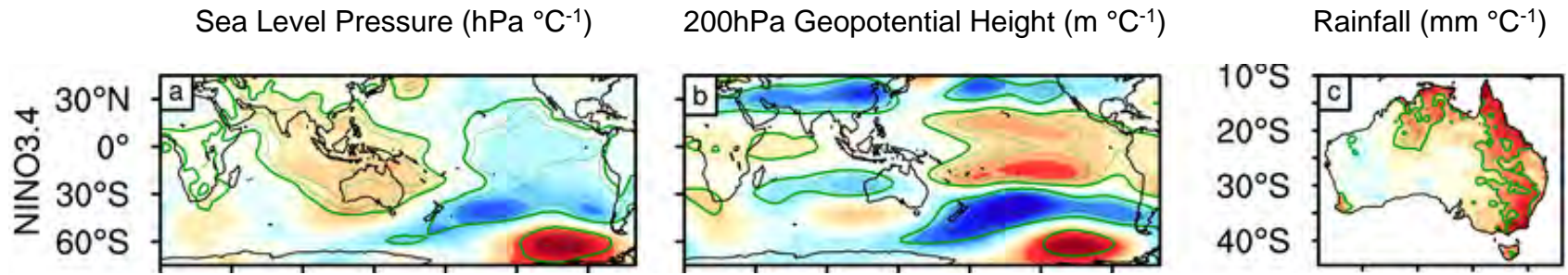
- Weak relationships in JJA
- Very strong correlations in SON season – hard to distinguish between processes

Indian Ocean Dipole in JJA

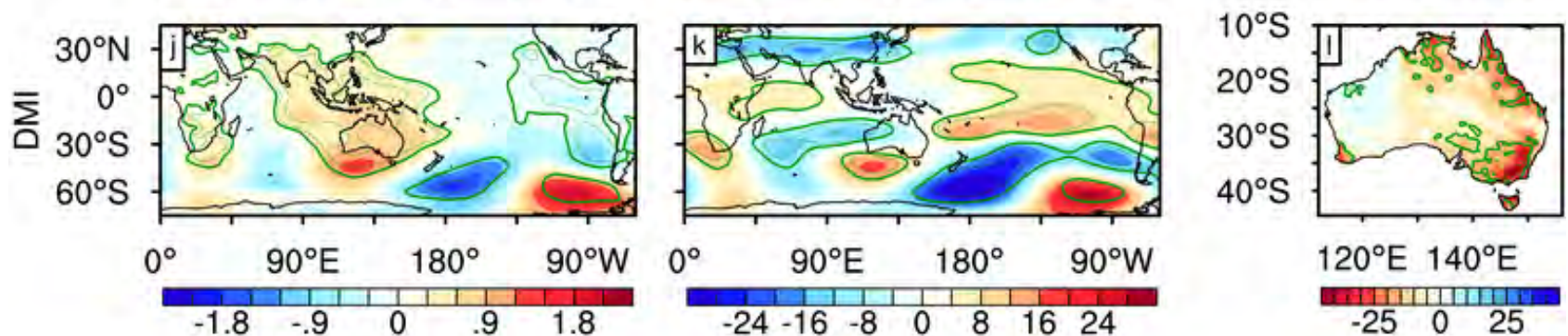
- During JJA there is a signal from the Indian Ocean that projects onto southern Australian rainfall
- This Rossby wave train seems to originate from the eastern pole of the IOD



Teleconnections in SON

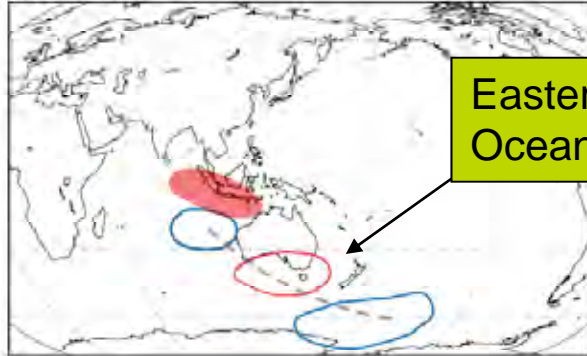


- In SON the effects are much stronger and harder to distinguish.
- IOD western pole has a greater influence
- An ENSO-southern Australia rainfall signal is observed, if we extract the DMI from the NINO3.4 much of the southern portions disappear



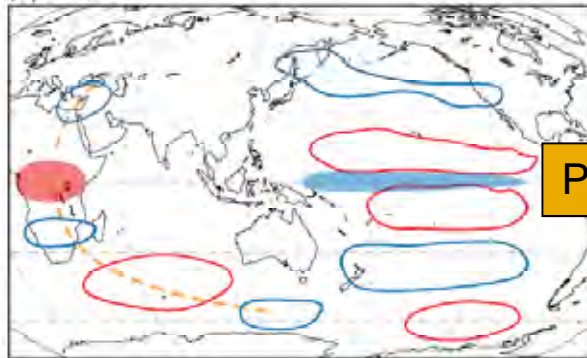
Wave train schematic

(a) JJA, IOD



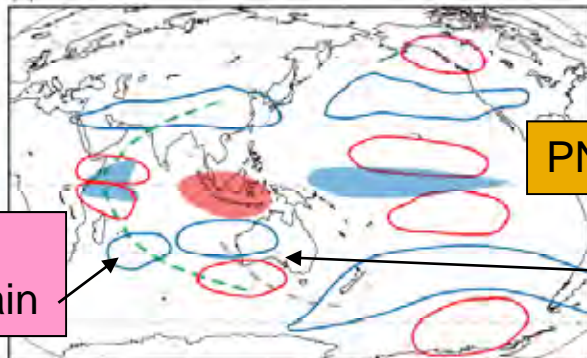
Eastern Indian Ocean wave train

(b) JJA, ENSO



PNA/PSA

(c) SON, IOD and ENSO



PNA/PSA

Western Indian Ocean wave train

Eastern Indian Ocean wave train

Cai, W., P. van Rensch, T. Cowan and H. H. Hendon, 2011.

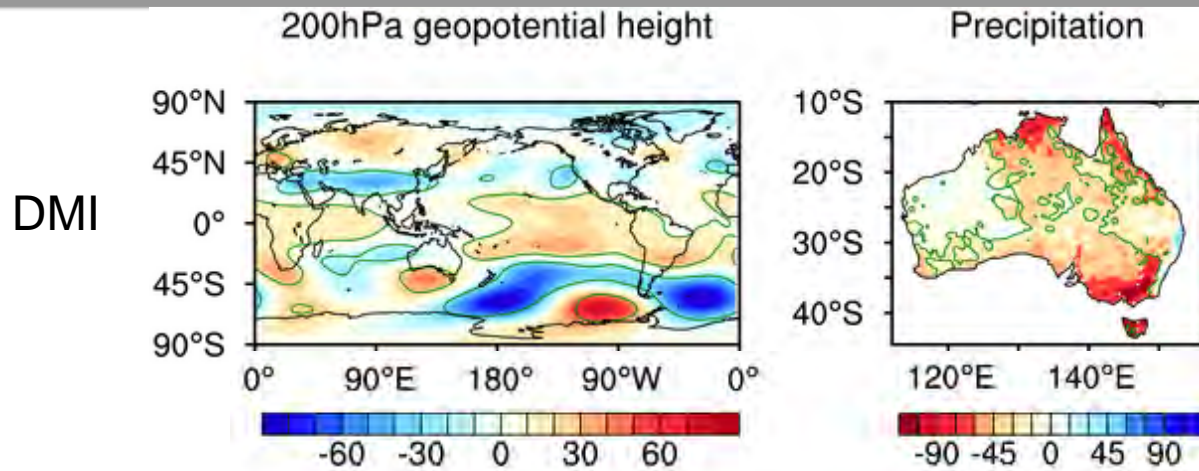
Teleconnection Pathways of ENSO and the IOD and the Mechanisms for Impacts on Australian Rainfall,

Journal of Climate, In press, doi: 10.1175/2011JCLI4129.1

Almost there...

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Asymmetry of the IOD teleconnection in SON



We have reached the end

- ENSO teleconnects to the extratropics through equivalent-barotropic Rossby wave trains originating in the Indian Ocean during SON
- During winter the western pole of the IOD seems to be unrelated to Australian rainfall
- The IOD shows an asymmetry with its teleconnection where positive events have a greater rainfall effect than negative events