

Supporting Information for "Austral Winter External and Internal Atmospheric Variability between 1980 and 2014"

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Contents of this file

1. Figures S1 to S6

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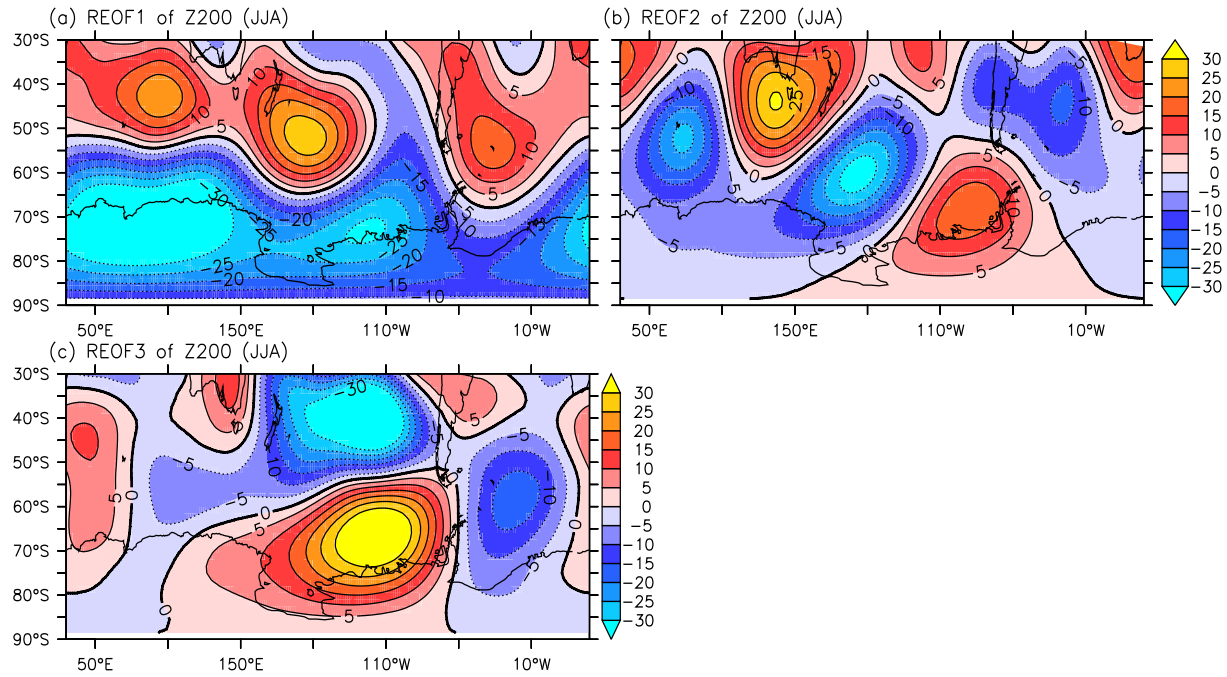


Figure S1. Spatial patterns of rotated EOF (REOF) for (a) REOF-1 (b) REOF-2 and (c) REOF-3 calculated using austral winter seasonal mean geopotential height anomalies at 200hPa (Z200). Z200 is taken from ERA Interim. They explain 30.2%, 12.9% and 12.0% of the total variance.

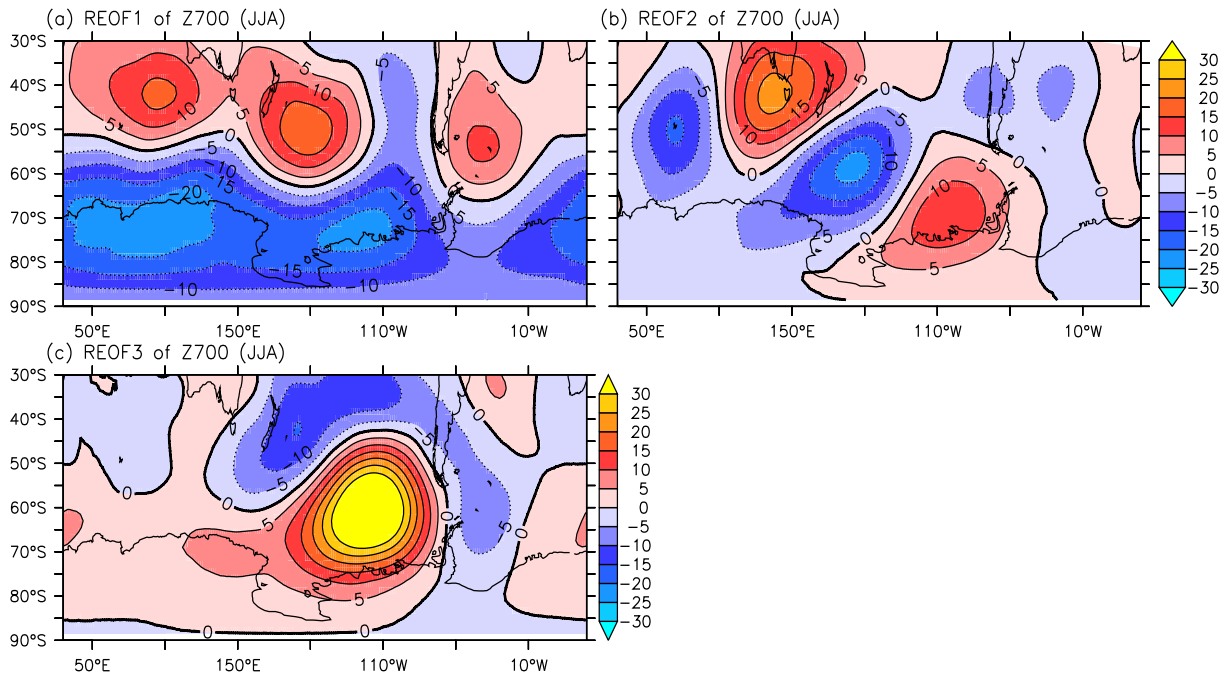


Figure S2. Spatial patterns of rotated EOF (REOF) for (a) REOF-1 (b) REOF-2 and (c) REOF-3 calculated using austral winter seasonal mean geopotential height anomalies at 700hPa (Z700). Z700 is taken from ERA Interim. They explain 30%, 17.1% and 10.6% of the total variance.

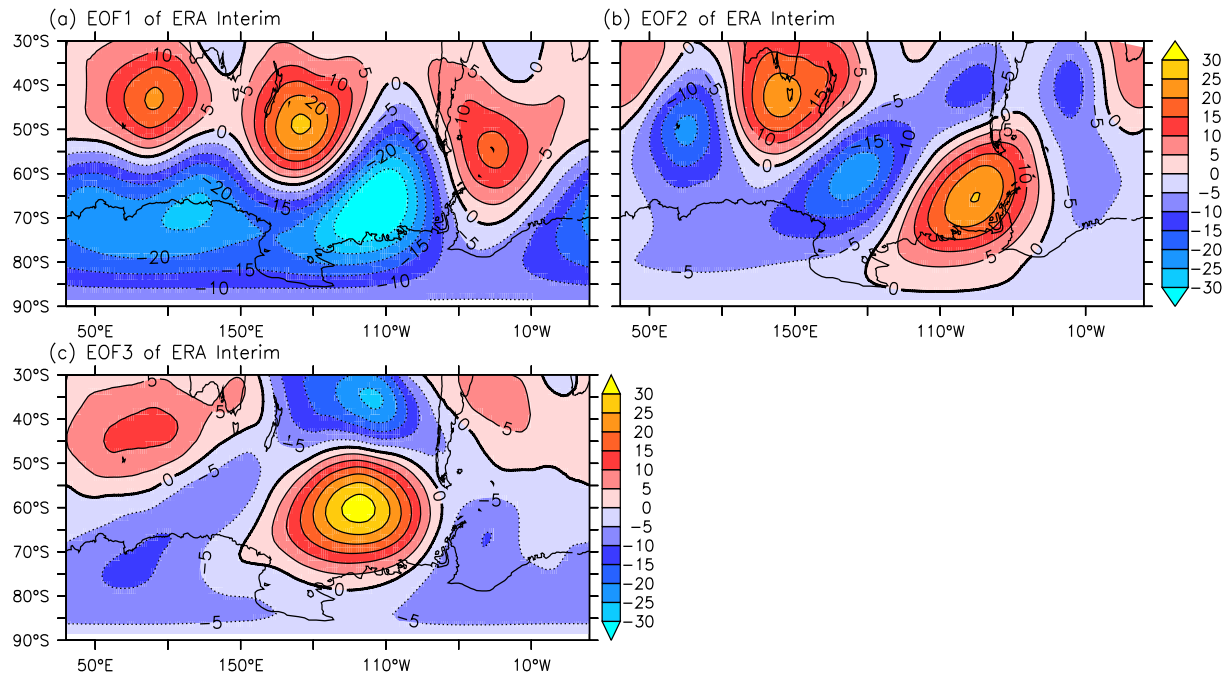


Figure S3. Spatial patterns of (a) EOF-1 (b) EOF-2 and (c) EOF-3 calculated using austral winter seasonal mean geopotential height anomalies at 500hPa (Z500). Z500 is taken from ERA Interim. They explain 33.6%, 14.5% and 13.2% of the total variance.

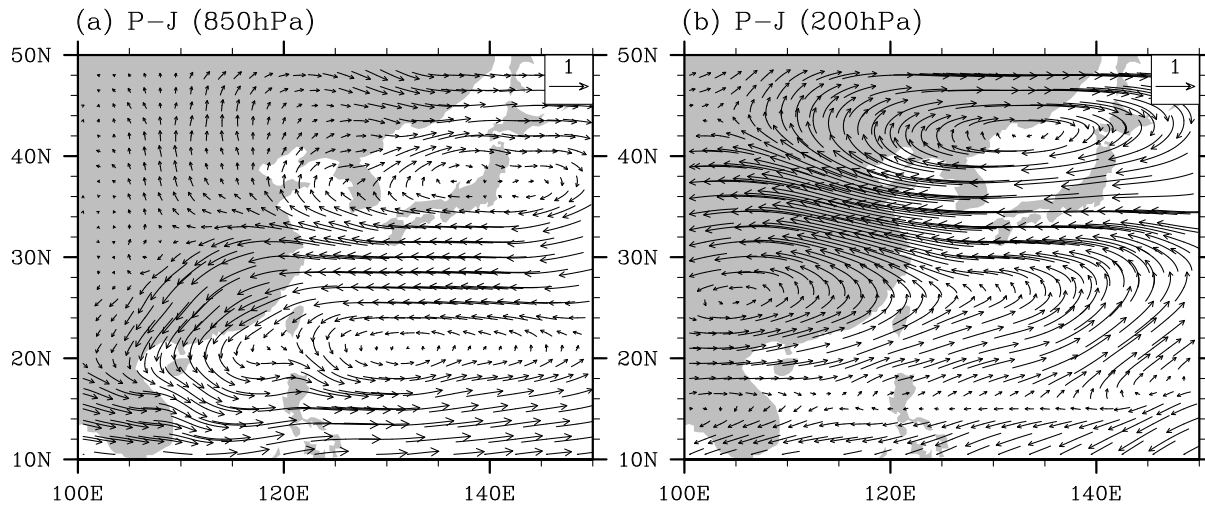


Figure S4. Spatial patterns of the first multivariate EOF (MV-EOF) mode for 850 hPa winds (a) and 200 hPa winds (b) from ERA Interim [Dee *et al.*, 2011]. This mode is defined as the Pacific-Japan pattern by Sun *et al.* [2010]. Readers are referred to Sun *et al.* [2010] for more information on the calculation of this mode.

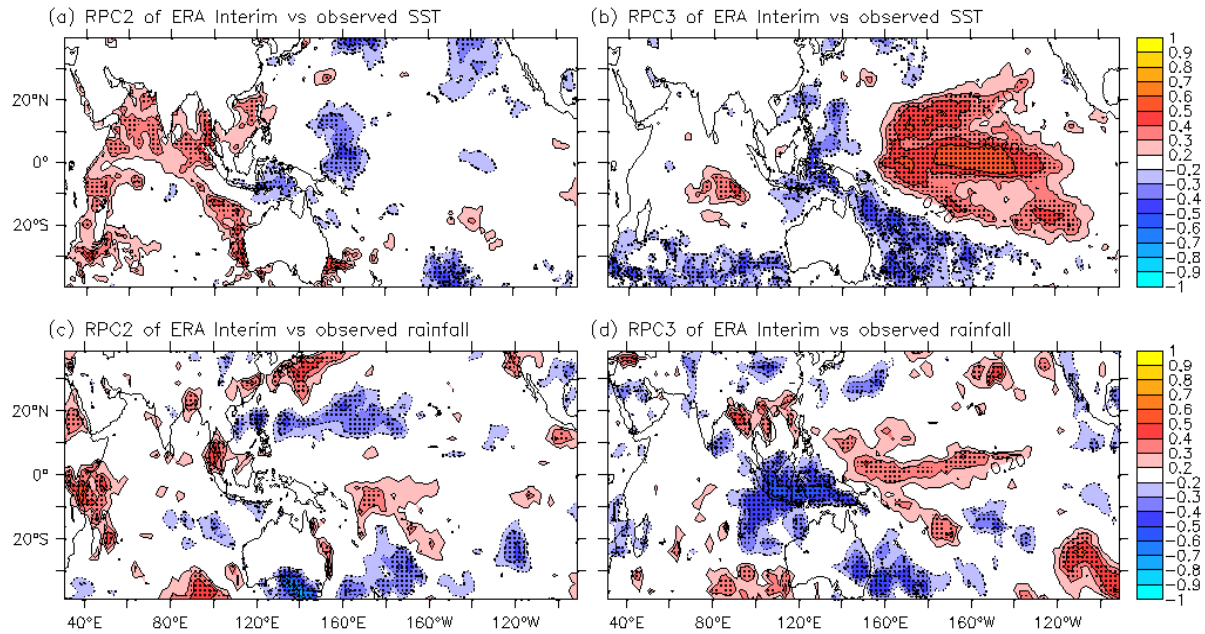


Figure S5. Correlation between the time series associated with (a and c) REOF-2 of ERA Interim and (b and d) REOF-3 of ERA Interim with observed (a and b) SST [Dee *et al.*, 2011] and (c and d) precipitation [Adler *et al.*, 2003]. Dots in each panel show that correlation is significantly different from zero at the 95% confidence level according to Student-t test.

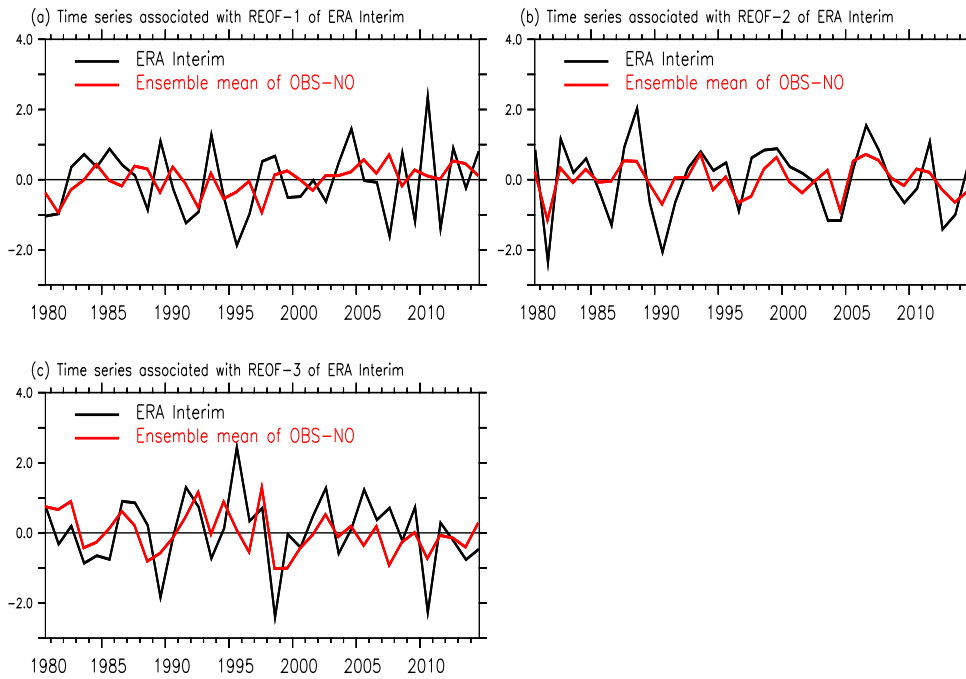


Figure S6. The corresponding time series associated with (a) REOF-1 (b) REOF-2 and (c) REOF-3 of ERA Interim calculated from ERA Interim (dark lines) and the ensemble mean of experiment OBS-NO (red lines), which are derived by projecting 500hPa geopotential height anomalies (Z_{500}) from the ensemble mean of experiment OBS-NO onto the spatial patterns of the first three REOFs from ERA Interim. The correlation between the two series is 0.08 in (a), 0.74 in (b) and 0.47 in (c). In both (b) and (c), the correlations are significantly different from zero at the 95% confidence level.