Investigating the linkages between Indo-Pacific Ocean SST, Z_{500} climate variability and Tasmanian seasonal streamflow

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Content of presentation

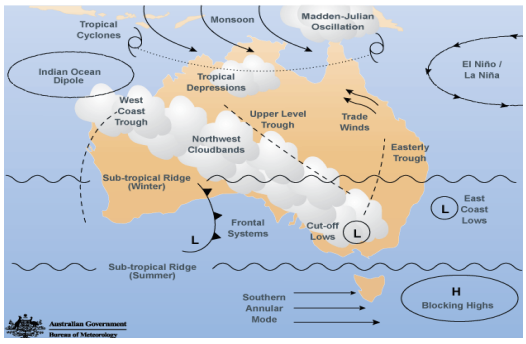
- Background
- Data Collection
- Methodology (Statistical Analysis)
- Contribution (identification of influential zone)

Background

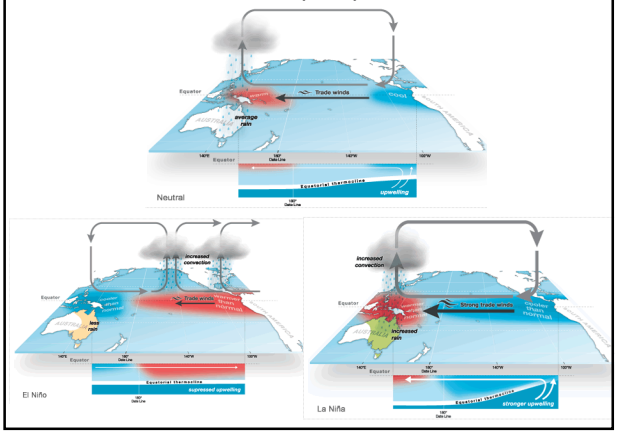
- Streamflow of Australian rivers are more variable than elsewhere in the world.
- Tasman rivers show different characteristics than mainland Australian rivers particularly south Australian rivers.

That's why improved long-lead forecasting is more required for Tasman river basin flood management.

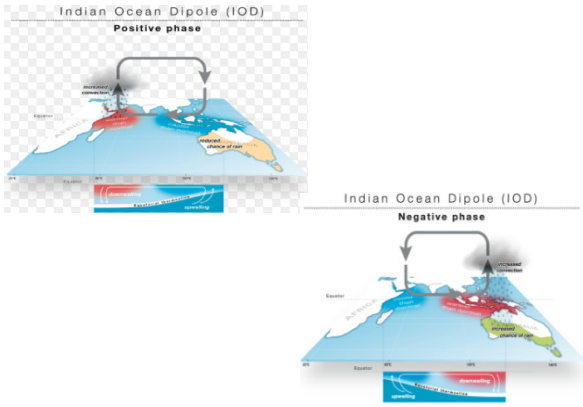
Climate drivers that govern over Australian rainfall and streamflow



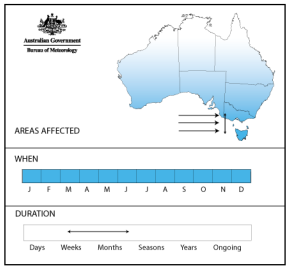
El Niño Southern (ENSO) Oscillation



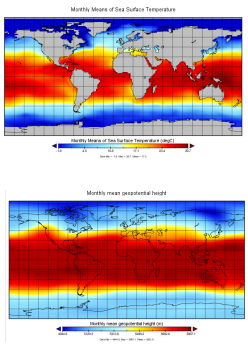
Indian Ocean Dipole (IOD) Modes



- Southern Annular Mode (SAM) highly affect Tasman rainfall/streamflow.
- It normally termed as "Roaring Forties" rainfall pattern of Australia.



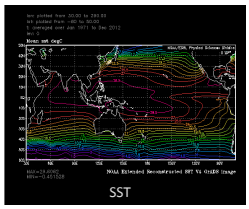
- These ocean-atmospheric oscillation governs by various climate drivers.
- Among the climate drivers sea surface temperature (SST) and geopotential height (HGT) are the most researched for rainfall/streamflow analysis.



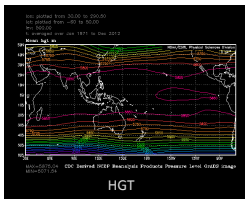
Data collection

Climate data collection

- SST and HGT data obtained from National Oceanic and Atmospheric Administration (NOAA)'s Earth System Research Laboratory (ESRL) Physical Sciences Division.
- Data range exist between longitudes 30°E to 70°W and latitudes 60°S to 50°N in gridded format.
- Data length is 42 years (1971~2012).



SST



HGT

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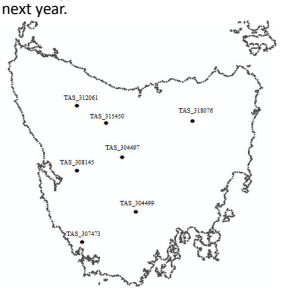
Streamflow data collection

Seven (7) Tasman unimpaired streamflow station data are acquired from Bureau of Meteorology (1971 – 2012) based on Tasman water year i.e. February – January of next year.



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Methods

- Statistical Singular Value decomposition (SVD) method is used to find a correlation between climate drivers and Tasman streamflow (TSF) with different seasonal conditions.
- SVD method is widely used to identify covariance between two spatially distributed climate datasets
- SVD modes contained better ability to explain more squared covariance between the two climate fields comparing to other similar statistical techniques such as canonical correlation and combined principal component analysis.

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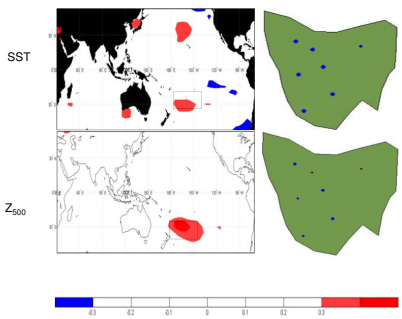
Results Coefficient correlation

Station ID	Correlation Coefficient |r|								
	SST					Z_{500}			
	Summer	Autumn	Winter	Spring		Summer	Autumn	Winter	Spring
TAS_304499	-0.46	-0.43	-0.54	-0.55		-0.49	-0.29	-0.58	0.60
TAS_312061	-0.52	-0.42	-0.55	-0.61		-0.57	-0.25	-0.60	0.63
TAS_318076	-0.36	-0.12	-0.26	-0.35		-0.14	0.04	-0.10	0.17
TAS_308145	-0.48	-0.55	-0.62	-0.54		-0.27	-0.36	-0.44	0.42
TAS_315450	-0.43	-0.49	-0.57	-0.50		-0.25	-0.33	-0.43	0.41
TAS_307473	-0.52	-0.54	-0.63	-0.56		-0.33	-0.37	-0.48	0.46
TAS_304497	-0.44	-0.45	-0.55	-0.54		-0.44	-0.29	-0.54	0.57

Heterogeneous correlation map

longitudes 175°W to 140°W and latitudes 25°S to 35°S



December-February or summer season/region linkage heading

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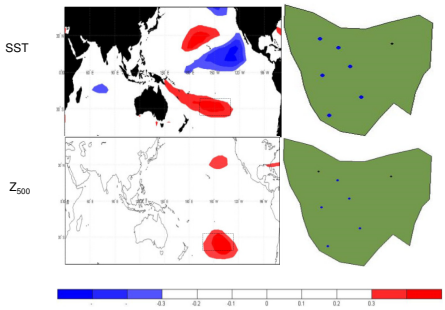
Heterogeneous correlation map

longitudes 175°W to 140°W and latitudes 25°S to 35°S



March-May or autumn season

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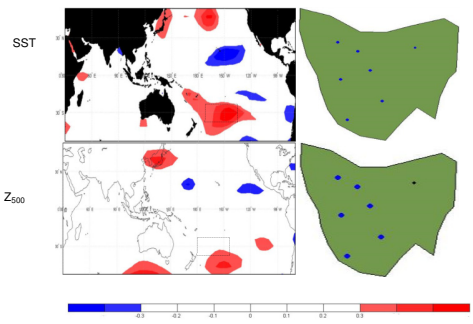
Heterogeneous correlation map

longitudes 175°W to 140°W and latitudes 25°S to 35°S



June-August or winter season

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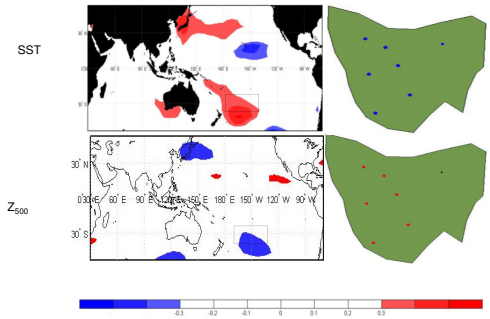
Heterogeneous correlation map

longitudes 175°W to 140°W and latitudes 25°S to 35°S



September-November or spring season

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Conclusion

- Current study speculated a region around longitudes 175°W to 140°W and latitudes 25°S to 35°S which remained persistent and positively/negatively correlated with seasonal TSF for over 40 years of analysis.
- The persistent region may be helpful for regional water management policy for multiple sectors.
- It will be helpful to produce more effective Tasmanian flood forecasting model. This will ensure better basin-wise hydrology estimates and enhanced flood preparation.

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Research extension

Forecasting Features (under development) for 6 months and 9 months lag