



Impacts and Achievements of the MTSRF

Copy of abstract and presentation given at the
2010 Annual Conference of the
Marine and Tropical Sciences Research Facility (MTSRF)
http://www.rrrc.org.au/news/2010_conference.html

Showcasing the Australian Government's investment
in the MTSRF for improved sustainability of the
North Queensland region, and Australia

18-20 May 2010
Pullman Reef Hotel & Casino
Cairns, North Queensland



Abstract

[MTSRF Project Number 2.5ii.1](#)

Observed and projected climates in the tropical rainforest region of North Queensland

Ramasamy Suppiah, Debbie Abbs, Janice Bathols and David Kent
CSIRO, Marine and Atmospheric Research, Aspendale

Temperature has increased while rainfall has decreased slightly in the tropical rainforest region of North Queensland. The rainfall decrease is slightly stronger in the southern part north Queensland, but such a decline is not statistically significant. The relationship between the Southern Oscillation Index (SOI) and rainfall is positive, but shows significant fluctuations on decadal time scales. Extreme rainfall events during the wet season are linked to large-scale circulation features over Western Pacific and the Australian region.

Probabilistic based projections using simulations of 23 climate models indicate that for a medium emissions scenario the 50th percentile regional average annual temperature increase by 2030 is 0.8°C with a range of uncertainty of 0.6 to 1.1°C. Greater warming is projected for 2050 and 2070. Rainfall changes are more uncertain with some models suggesting some increases and others suggesting decreases across the area average. For medium emissions scenario the 50th percentile regional average rainfall change for 2030 is -1% with a range of uncertainty of -8 to +5%. Changes by 2050 and 2070 are dependent on emissions scenarios and show larger ranges. For 2050, the ranges of uncertainty for regional average rainfall change for the A1FI scenario span the range -16 to +11%. The corresponding range for 2070 is -25 to +17%. Southern and central parts of the study area show strong increases in potential evaporation due to greater warming and a slight decrease in rainfall. Increases of 2 to 4% by 2030 and 3 to 6% by 2050 are projected for the A1B emission scenario. However, increases in potential evaporation of 4 to 8% by 2050 and 6 to 12% by 2070 are projected for A1FI emission scenario.

In recent years, CSIRO has developed story-line based climate change projections for Australia. A brief introduction on new scenario procedures and changes in tropical cyclone characteristics under enhanced greenhouse conditions will also be presented.



Australian Government

Department of the Environment, Water, Heritage and the Arts



Marine and Tropical Sciences Research Facility

Observed and projected climates in the tropical rainforest region of north Queensland : Project 2.5ii.1

Ramasamy Suppiah, Debbie Abbs, Janice
Bathols, Mark Collier and David Kent

CSIRO Marine and Atmospheric Research, Melbourne





Outline of the talk

Observed Temperature and Rainfall

Temperate Trends

Rainfall Fluctuations

Monsoon Rainfall Variability and Extremes

Daily Rainfall Variability over Cape York and Rainforest region

Climate Change Projections

Temperature

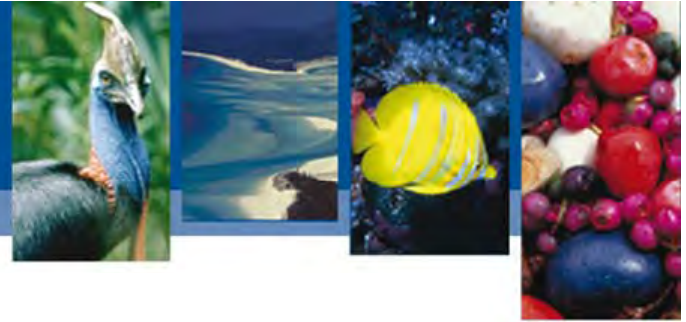
Rainfall

Potential Evaporation

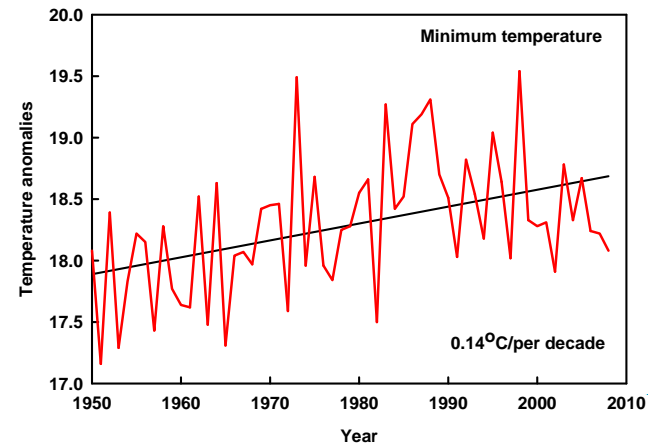
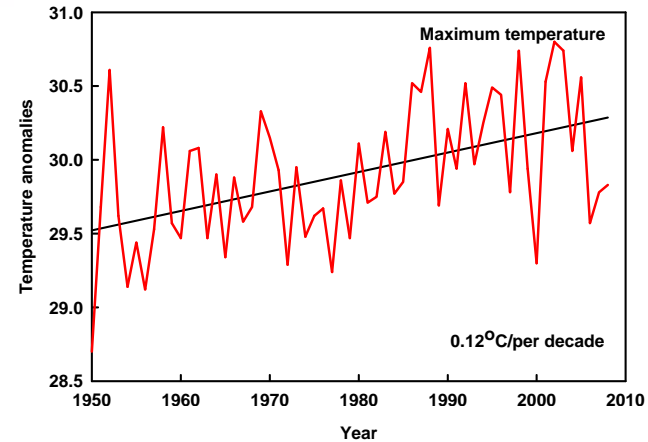
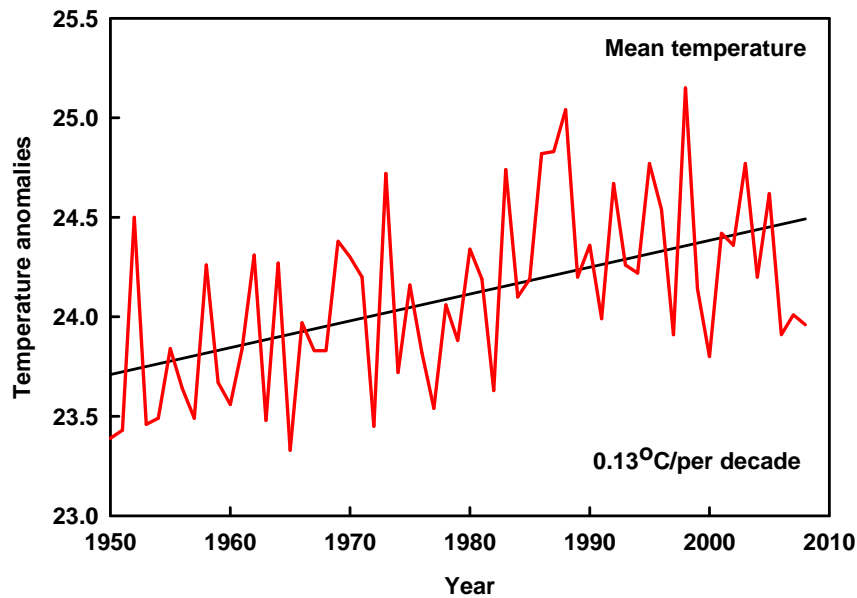
Conclusions



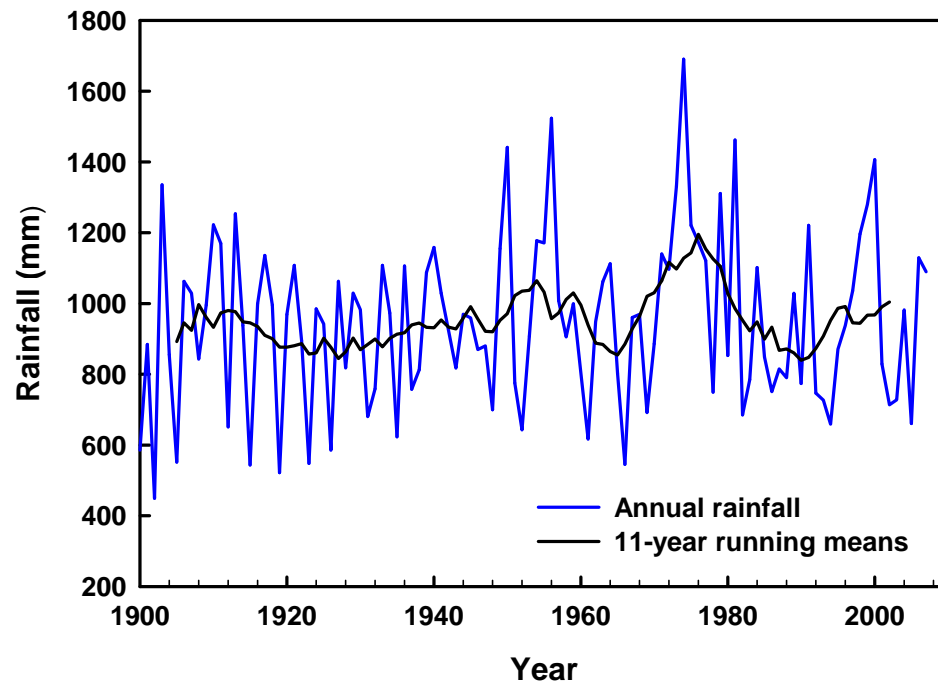
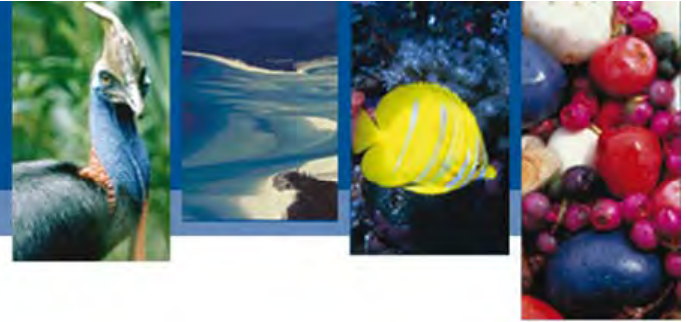
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Temperature in the region shows an
Increase with strong year-to-year
variability

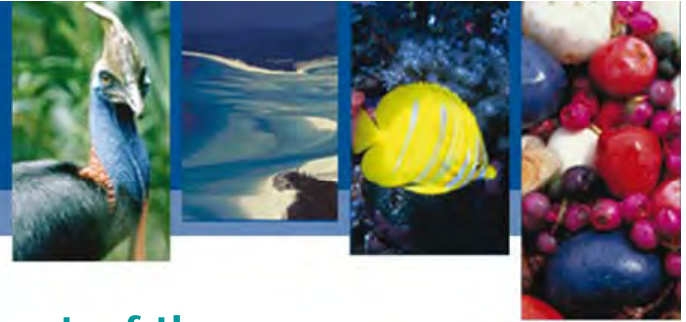


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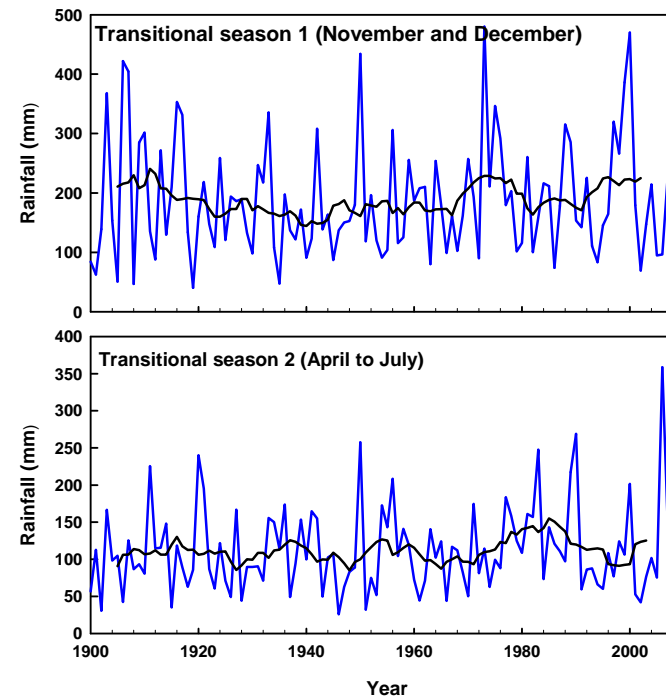
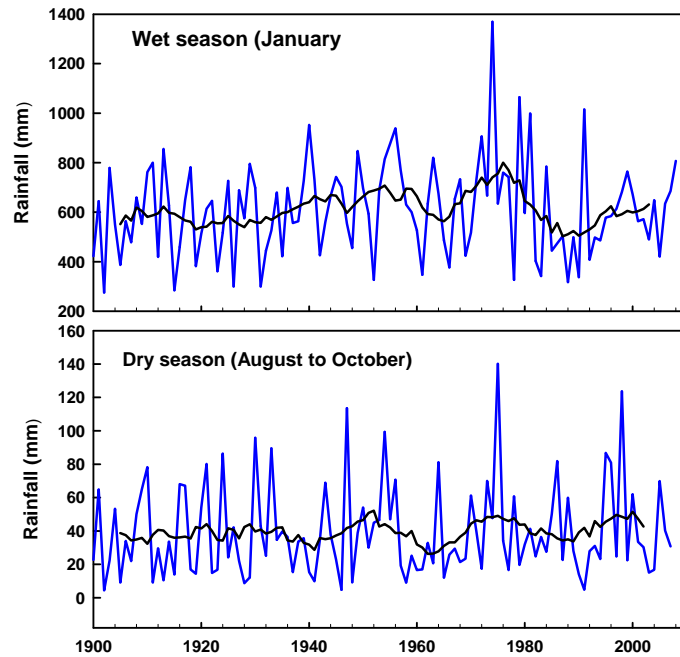


Rainfall in the tropical rainforest region shows strong year-to-year variations, but not clear trend



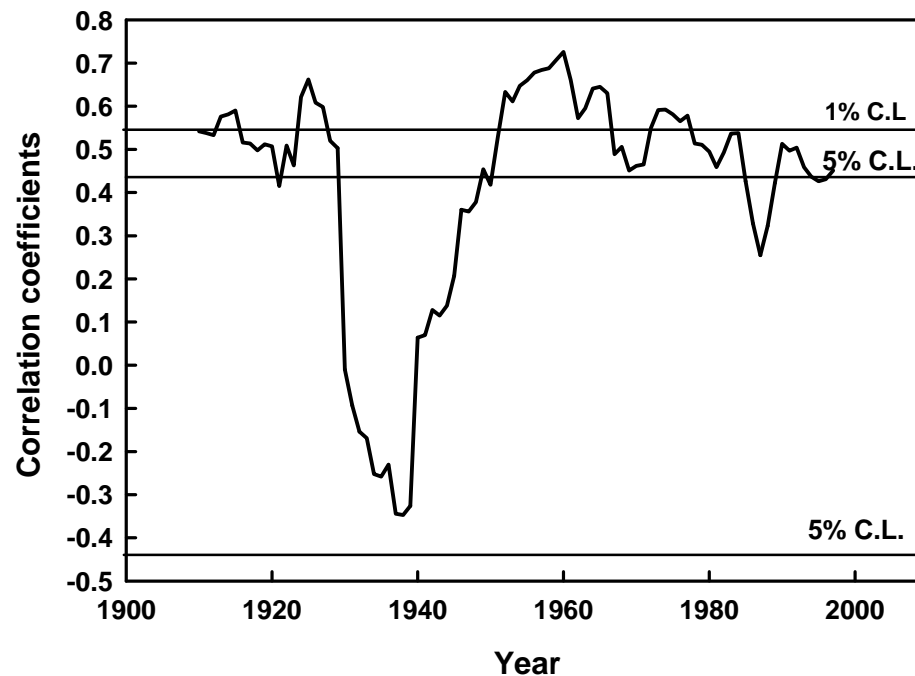


Wet and Transitional 1 dominate most of the interannual variability

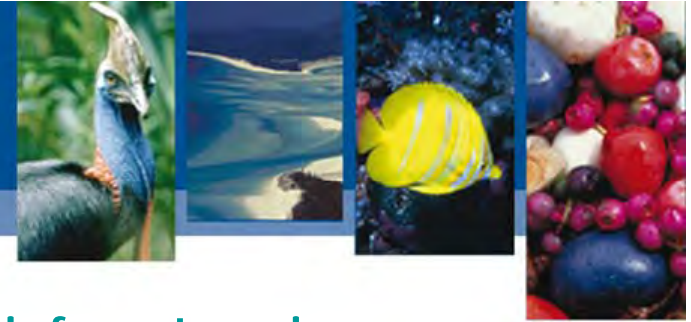




Relationship between the Southern Oscillation Index and Tropical rainforest region rainfall



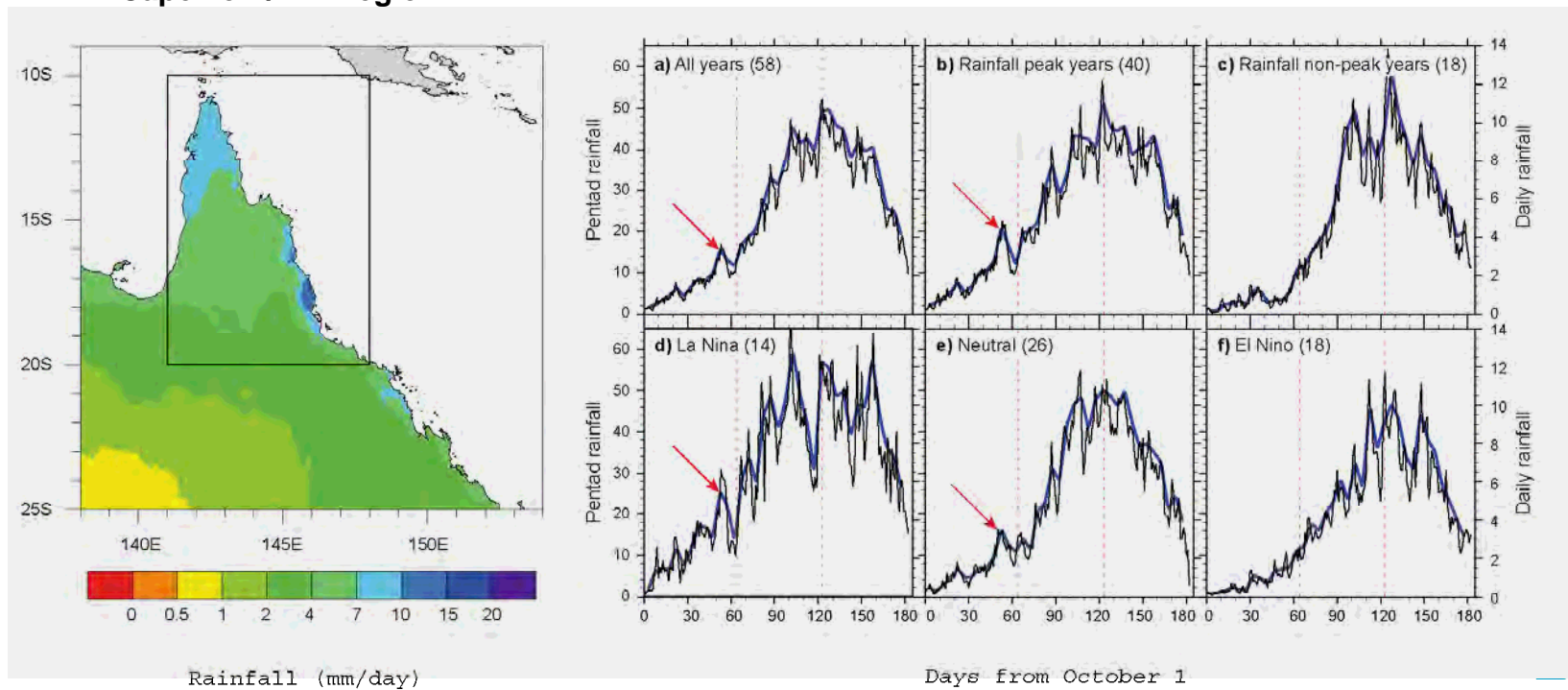
The ENSO has strong
Influence on the climate
of the region, but the link
shows strong decadal
variations

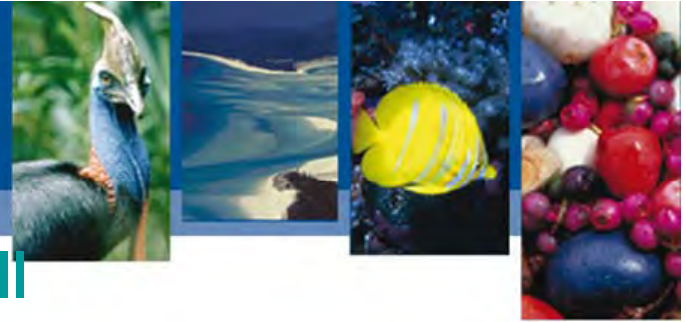


Daily rainfall variability in the tropical rainforest region

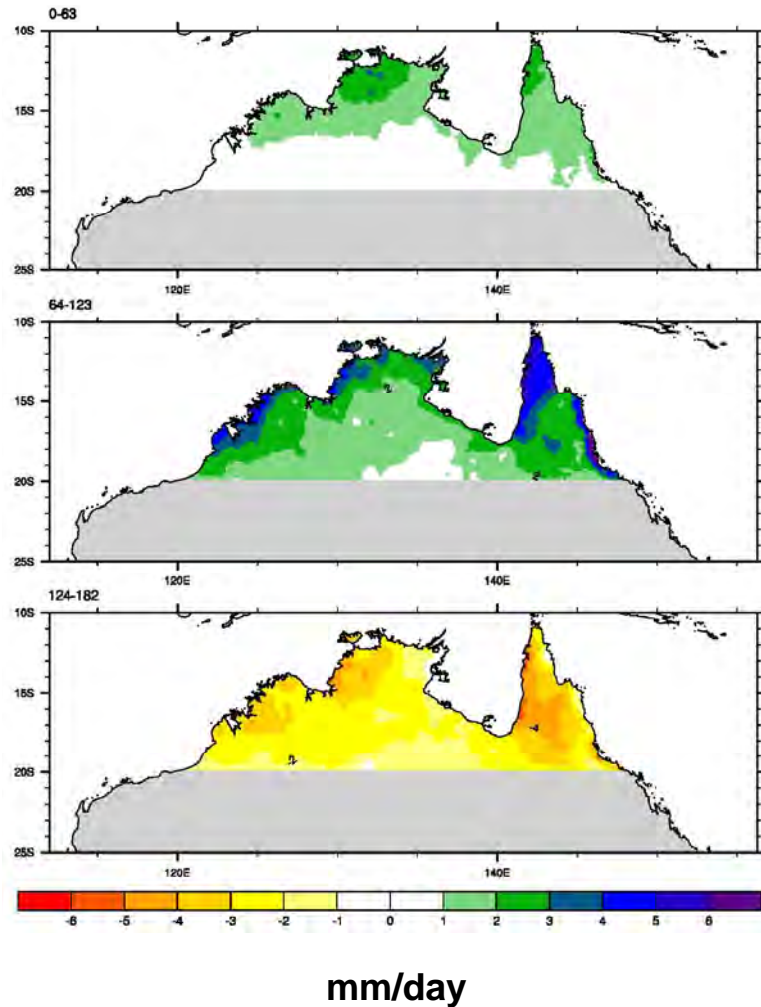
A sustain crease in rainfall after the peak

Cape York/TRF region





Linear trend in daily rainfall

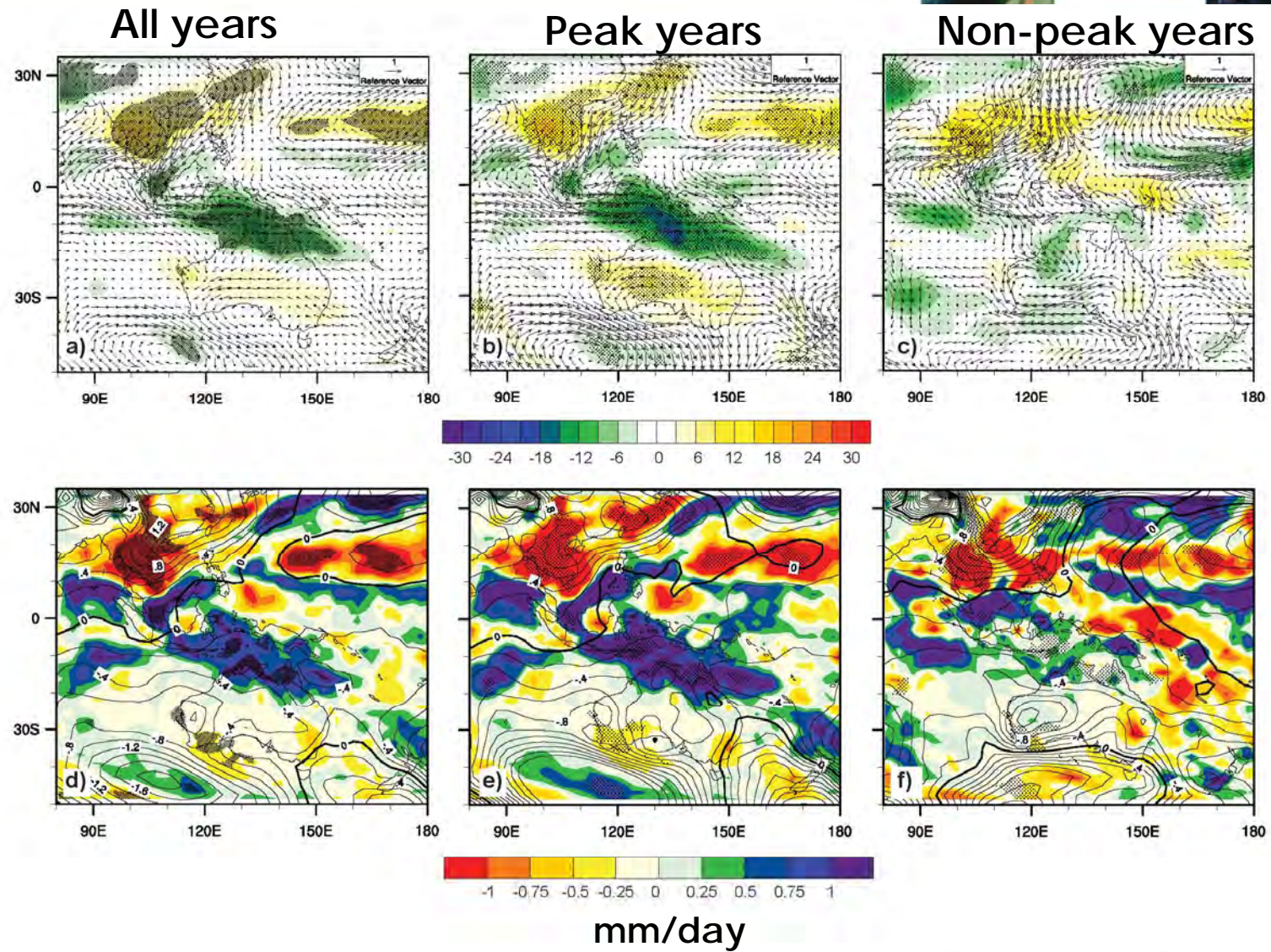


October-November, slight increase

December-January, strong increase

February-March Decrease

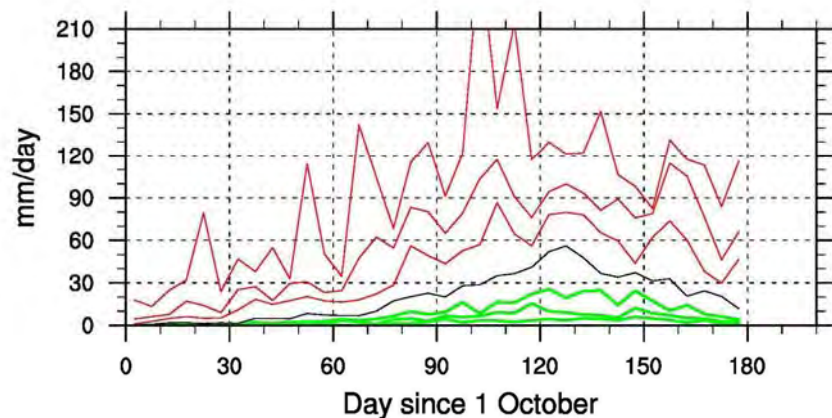
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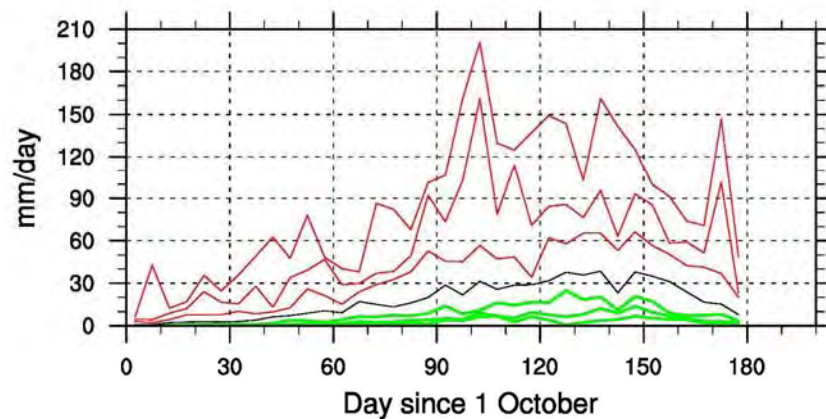
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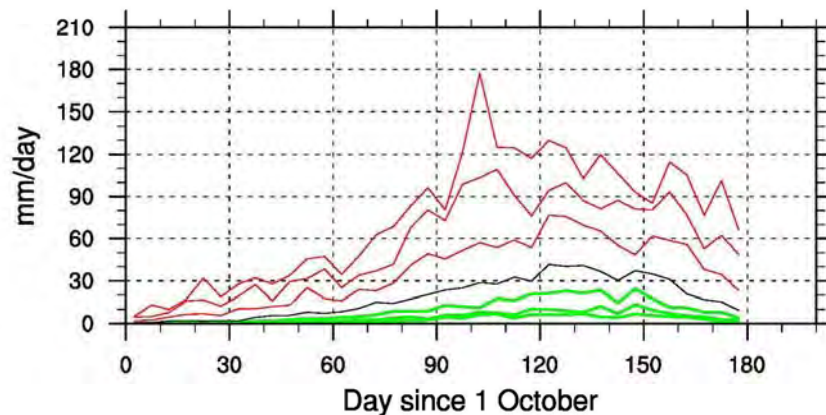
1950-1978



1979-2006



1950-2006

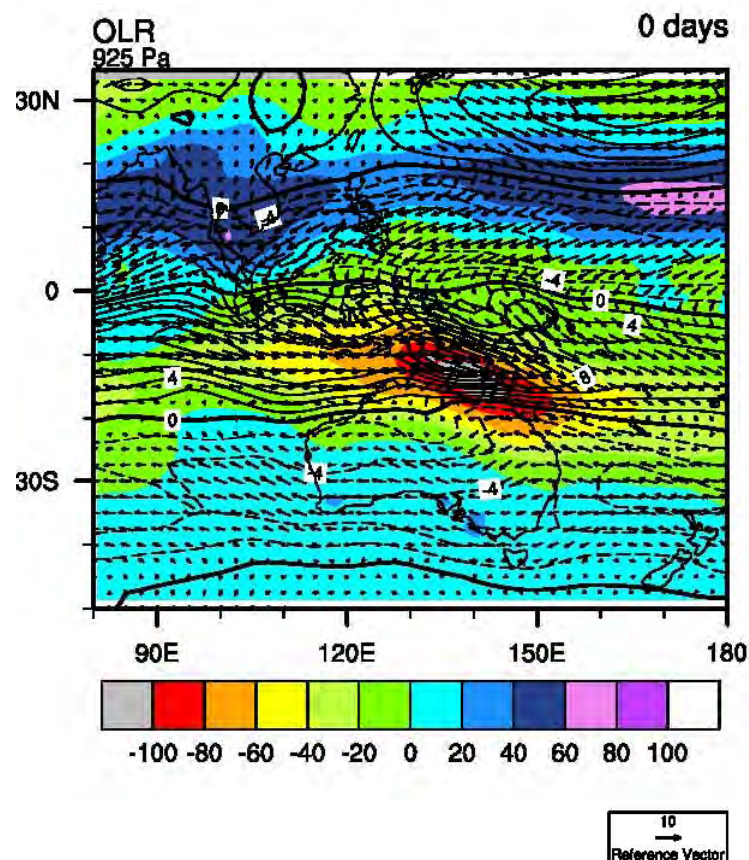
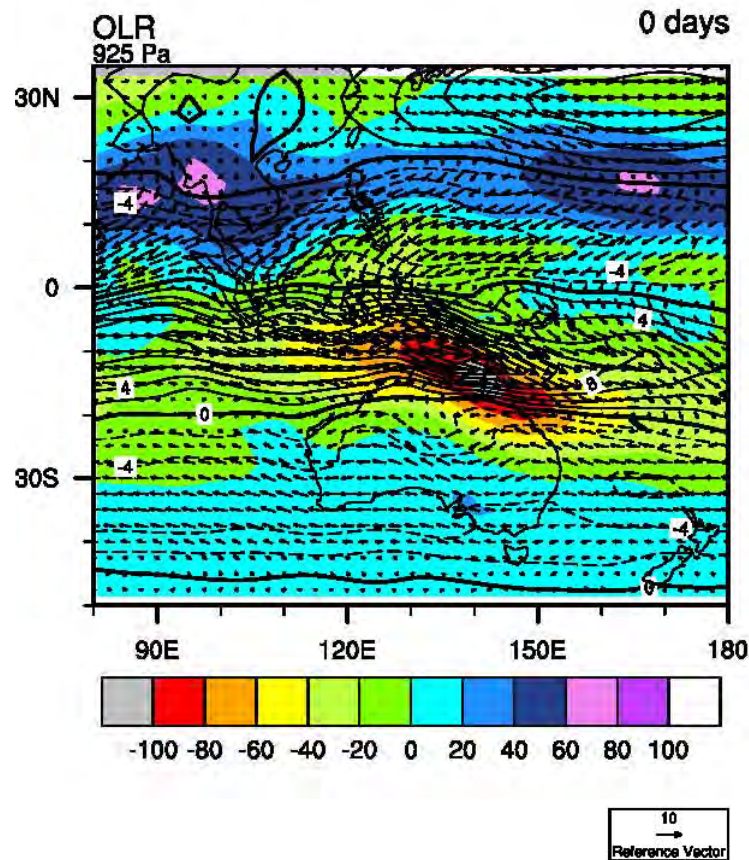


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OLR and Winds, 90th minus 10th percentile rain events 1951-1979

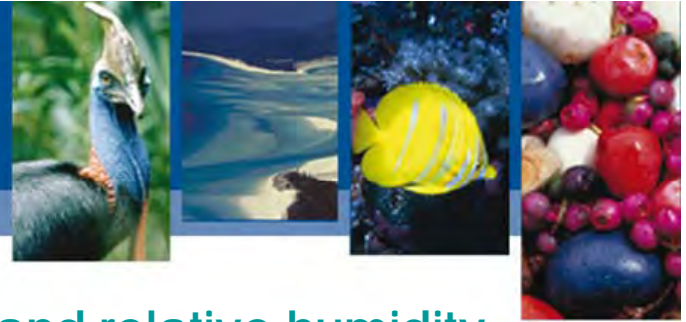
OLR and Winds, 90th minus 10th percentile rain events 1979-2007



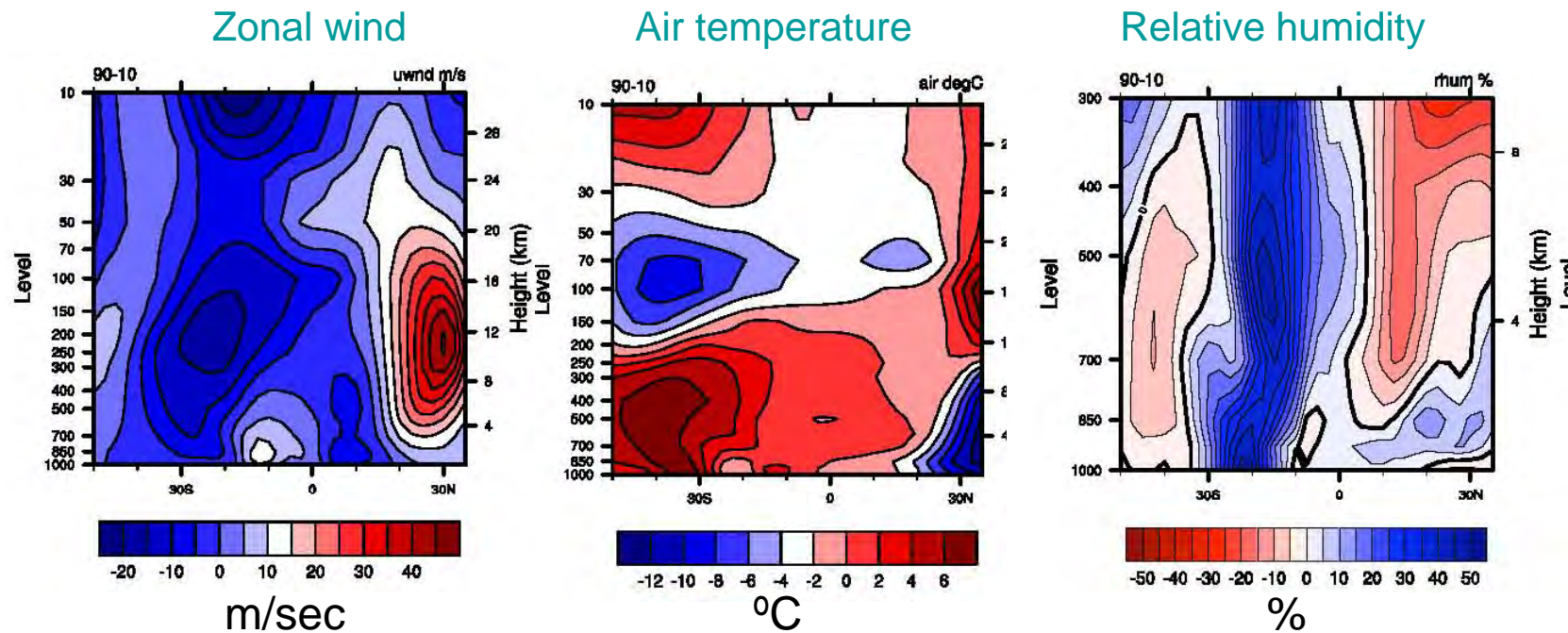
OLR Anomalies W/m^2



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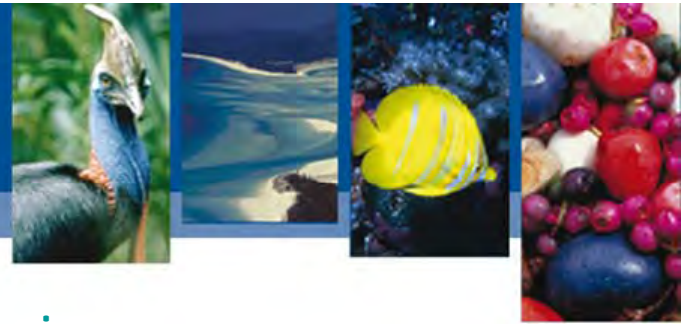


Differences in zonal wind, air temperature and relative humidity averages along longitudes 141-148°E based on 90th and 10th percentile rainfall events at Cape York- TRF region

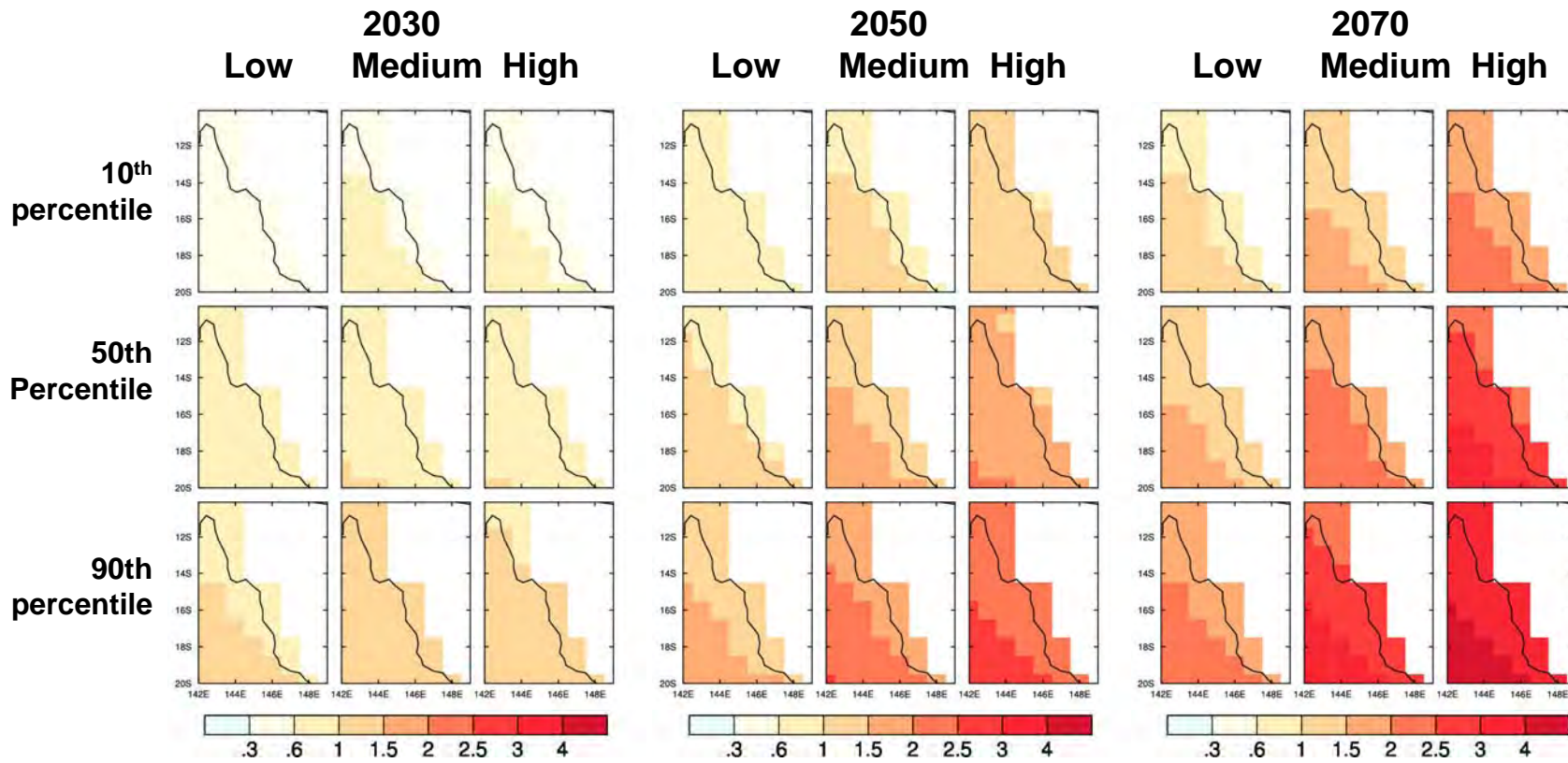


Stronger than average Westerly winds at Cape York
Higher than average Air temperature and below average relative humidity over southern Australia





Projected 10th, 50th and 90th percentiles increases in annual temperature (°C) for low, medium and high emission Scenarios for 2030, 2050 and 2070



Temperature increase (°C)



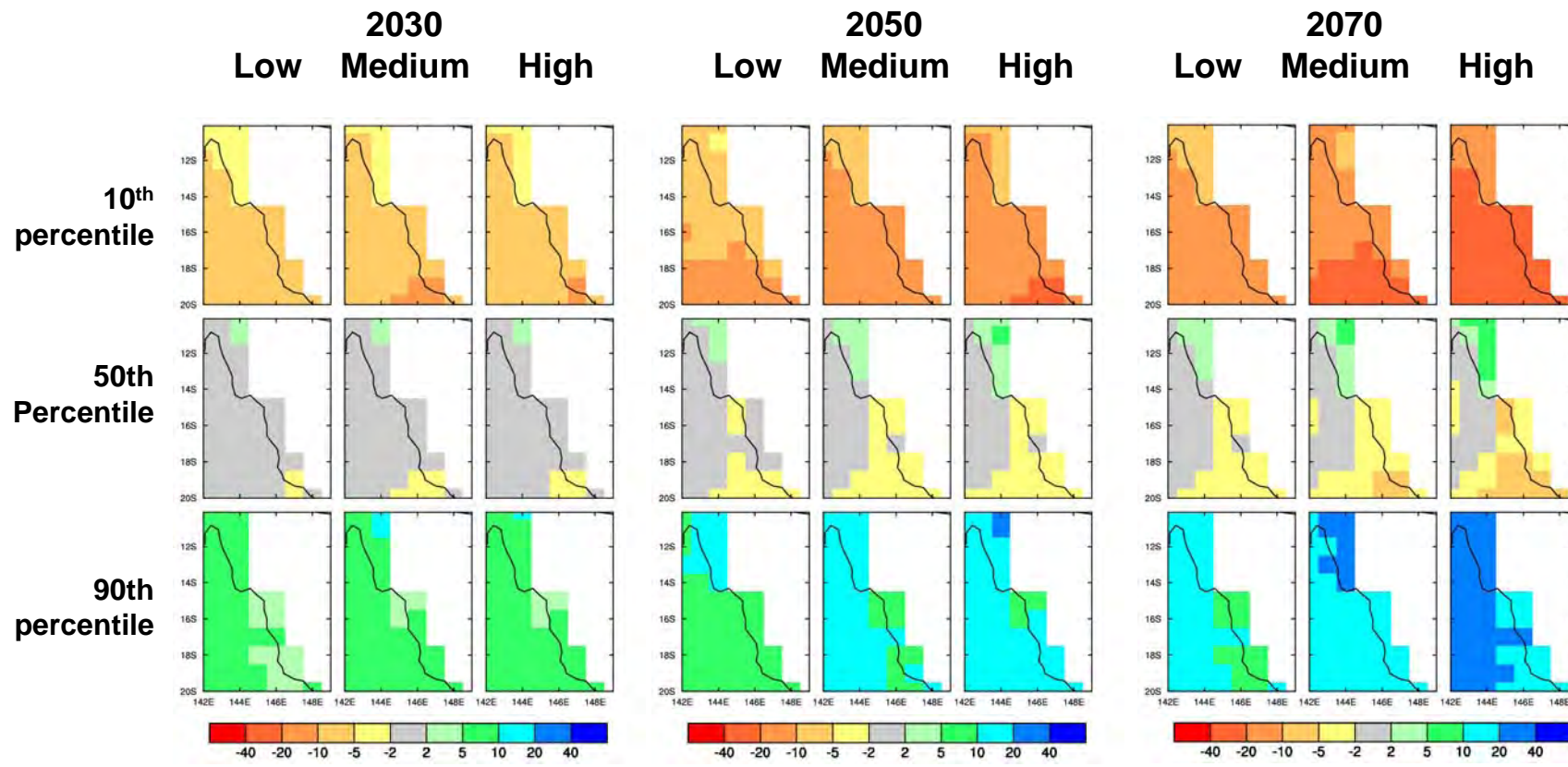


Projected temperature changes for the rainforest region

- By 2030 annual average warming of 0.8 °C (0.6 to 1.1 °C)
- By 2050 annual average warming of 1.3 °C (0.7 to 2.2 °C) for low and high emissions
- By 2070, annual average warming of 1.9 °C (0.9 to 3.5 °C) for low and high emissions.
- Temperature increase among seasons do not show much difference

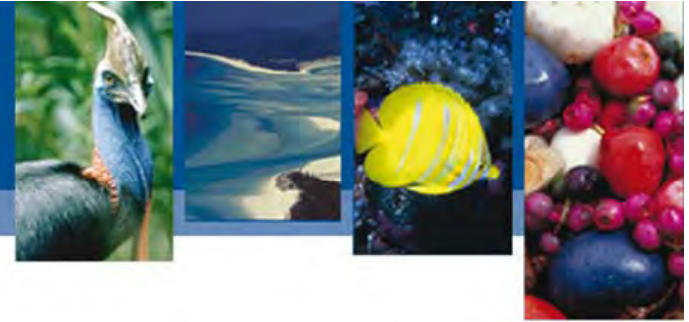


Projected 10th, 50th and 90th percentiles changes of annual rainfall (%) for low, medium and high emission scenarios for 2030, 2050 and 2070



Rainfall change (%)





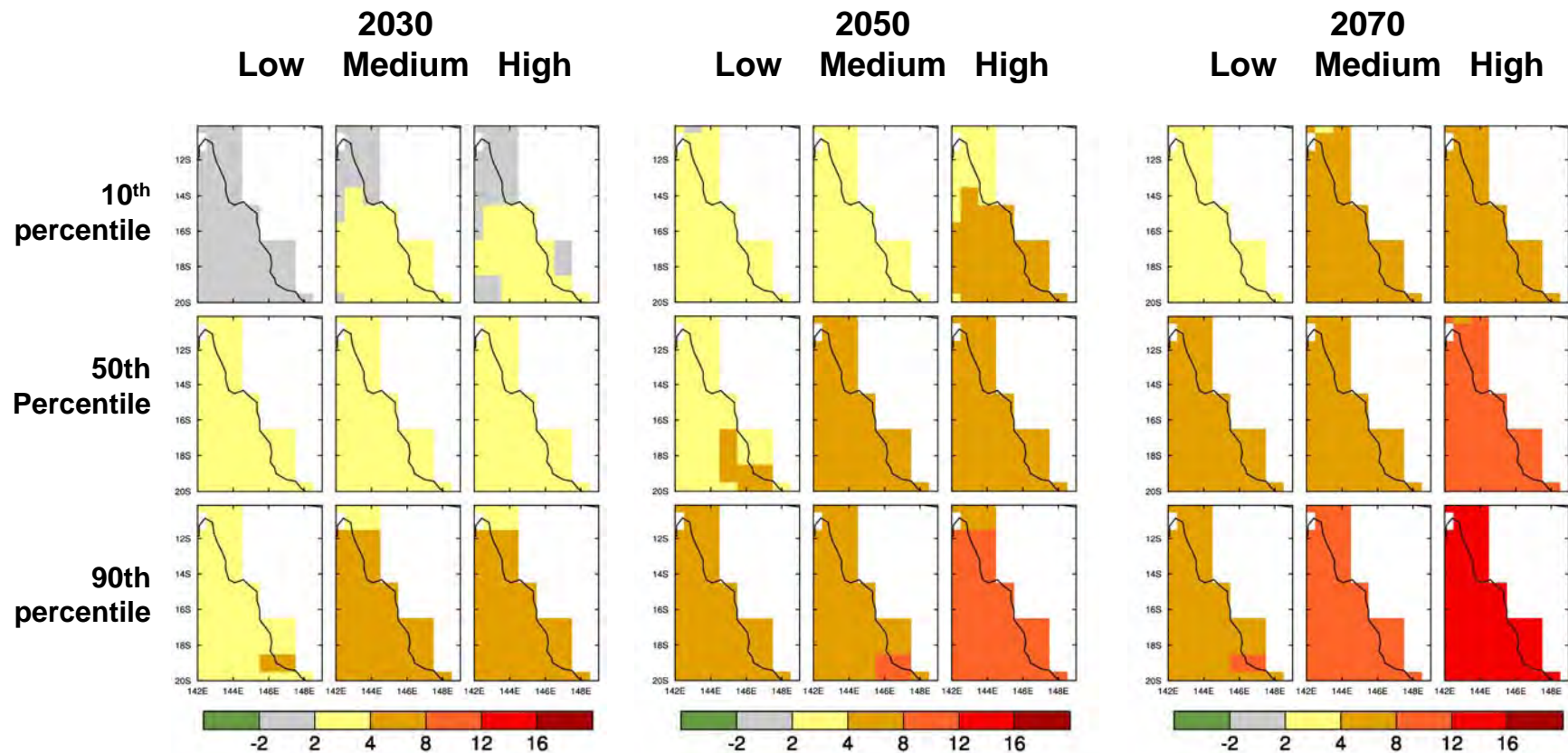
Projected rainfall changes for the rainforest region

- By 2030 annual average rainfall change of -1% (-8 to +6%)
- By 2050 annual average rainfall change of -2% (-16 to +11%)
 - for high emission scenario
- By 2070, annual average rainfall change of -3% (-26 to +18%)
 - for high emission scenario.
- Rainfall changes show increases and decrease and more
 - Complex
- There is a tendency for increasing rainfall intensity under climate change conditions



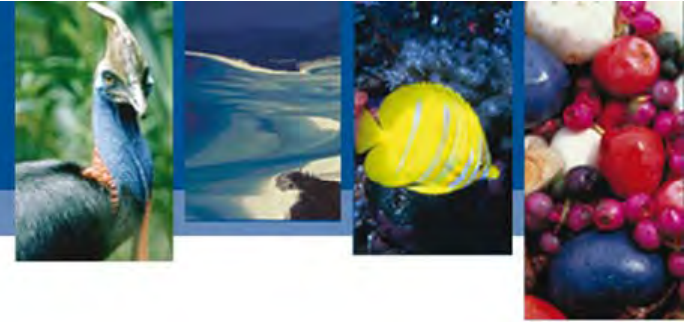


Projected 10th, 50th and 90th percentiles changes of annual potential evaporation (%) for low, medium and high emission scenarios for 2030, 2050 and 2070



Potential evaporation change (%)





Projected changes in potential evaporation for the rainforest region

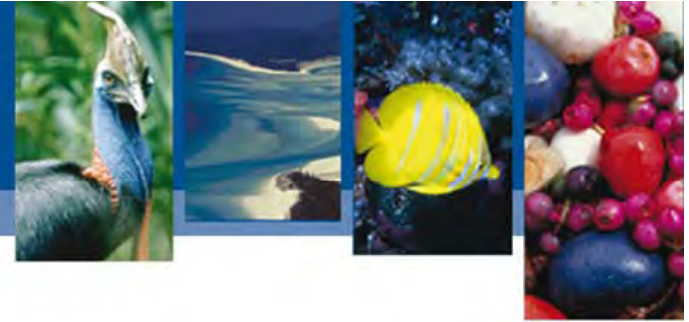
- By 2030 annual average change of +3% (0 to +6%)
- By 2050 annual average of +6% (+3 to +10%) for low
– and high emissions
- By 2070, annual average of +8% (+3 to +14%) for low
– and high emissions.



Tropical Cyclones

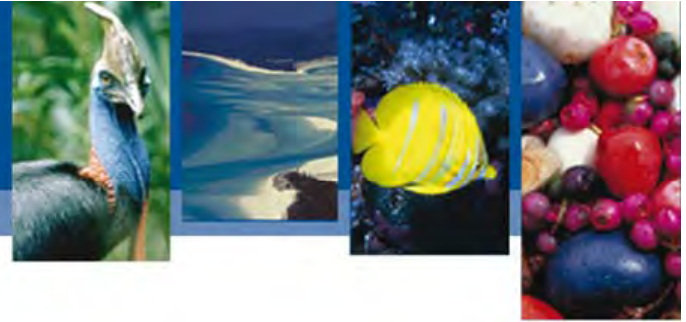
- Large uncertainty exists associated with tropical cyclone characteristics.
- Globally intensity increase of 2-11% by 2100
- Globally average frequency increase by 6-34% with robust decrease in Southern hemisphere by 2100.
- Increase in tropical cyclone duration.
- Large variations between individual basins.
- However, decrease in tropical cyclone activity in southern hemisphere
- Increases of the order of 20% in the severe storm precipitation





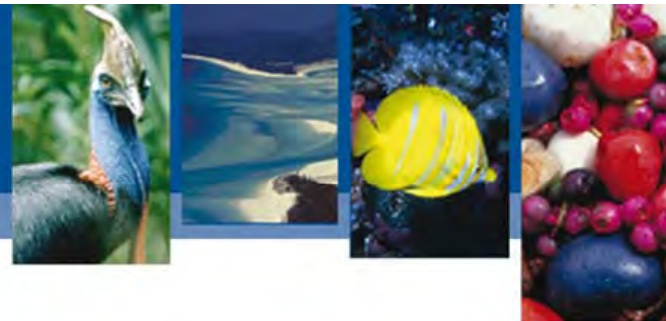
Ocean Properties will Change

- Sea surface temperature will increase
 - 2030: 0.7 °C (0.4 to 1.0 °C)
 - 2070: 1.3 °C (0.6 to 2.0 °C) for low emissions and 2.3 °C (1.0 to 3.0 °C) for high emissions
- Sea level rise
 - 2030: 13-20 cm, relative to 1990
 - 2070: 49-89 cm , relative to 1990
 - Significant uncertainty about rate of polar ice melt
- Increased ocean acidity.



Recent Developments in Scenario Constructions





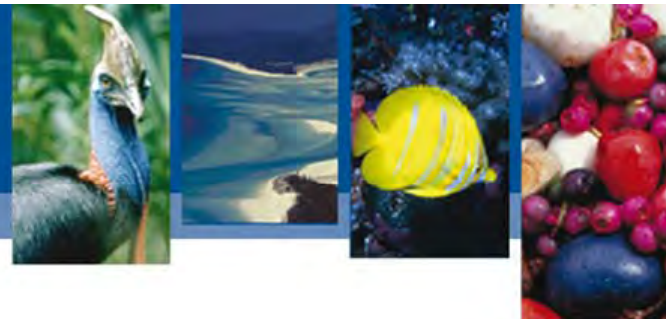
Story-line based climate change projections

Climate Futures for region centred on 17.5°S, 146.5°E

2030 A1B

		TAS - Annual (K)			
		Slightly Warmer < 0.50	Warmer 0.50 to 1.50	Hotter 1.50 to 3.00	Much Hotter > 3.00
PR - Annual (% change)	Much Drier < -15.00	No evidence	No evidence	No evidence	No evidence
	Drier -15.00 to -5.00	No evidence	Very unlikely 2 models GFDL-CM2.0 UKMO-HadGEM1	No evidence	No evidence
	Little Change -5.00 to 5.00	Very unlikely 1 model PCM	Likely 20 models	No evidence	No evidence
	Wetter 5.00 to 15.00	No evidence	Very unlikely 1 model CGCM3.1(T63)	No evidence	No evidence
	Much Wetter > 15.00	No evidence	No evidence	No evidence	No evidence

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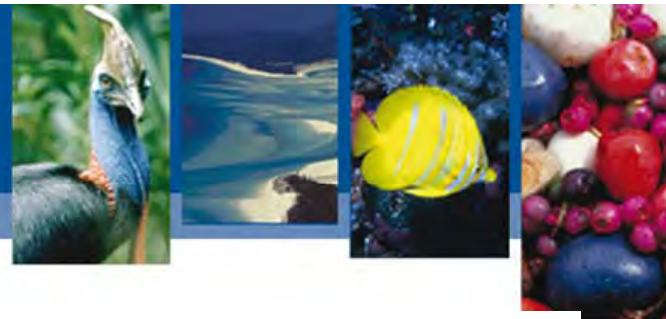


Climate Futures for region centred on 17.5°S, 146.5°E

2050 A1Fi

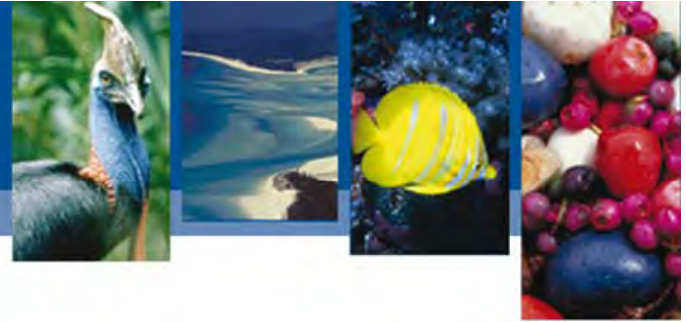
		TAS - Annual (K)			
		Slightly Warmer < 0.50	Warmer 0.50 to 1.50	Hotter 1.50 to 3.00	Much Hotter > 3.00
PR - Annual (% change)	Much Drier < -15.00	No evidence	No evidence	Very unlikely 1 model GFDL-CM2.0	Very unlikely 1 model UKMO-HadGEM1
	Drier -15.00 to -5.00	No evidence	No evidence	Unlikely 7 models	Very unlikely 1 model ECHAM5/MPI-OM
	Little Change -5.00 to 5.00	No evidence	No evidence	Unlikely 5 models	Very unlikely 2 models CNRM-CM3 MIROC3.2(hires)
	Wetter 5.00 to 15.00	No evidence	Very unlikely 2 models ECHO-G PCM	Unlikely 3 models	Very unlikely 1 model MIROC3.2(medres)
	Much Wetter > 15.00	No evidence	No evidence	Very unlikely 1 model CGCM3.1(T63)	No evidence





Climate Futures for region centred on 17.5°S, 146.5°E

		2070 A1Fi			
		TAS - Annual (K)			
		Slightly Warmer < 0.50	Warmer 0.50 to 1.50	Hotter 1.50 to 3.00	Much Hotter > 3.00
PR - Annual (% change)	Much Drier < -15.00	No evidence	No evidence	Very unlikely 1 model FGOALS-g1.0	Unlikely 7 models
	Drier -15.00 to -5.00	No evidence	No evidence	No evidence	Unlikely 4 models
	Little Change -5.00 to 5.00	No evidence	No evidence	No evidence	Unlikely 5 models
	Wetter 5.00 to 15.00	No evidence	No evidence	Very unlikely 1 model PCM	Very unlikely 2 models CGCM3.1(T47) GISS-ER
	Much Wetter > 15.00	No evidence	No evidence	Very unlikely 1 model ECHO-G	Unlikely 3 models



Thank you

