

Climate change scenarios for the Tropical rainforest region of north Queensland

Ramasamy Suppiah
Climate Change Impact and Risk Group
CSIRO Marine and Atmospheric Research

Thanks to Ian Smith and Louis Wilson for their contribution



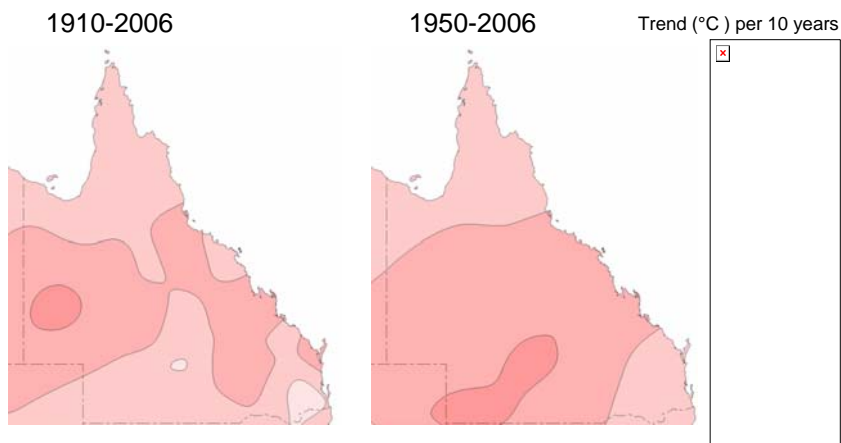
CSIRO Marine and Atmospheric Research

Project 2.5ii.1 Regional climate projections for tropical rainforests

- Key variables identified (year 1)
 - Temperature
 - Rainfall
 - Length of the wet season
 - Cloud base height
 - SST?
- Initial analysis of climate model output of AR4 model database (year 1)
- 15 km CCAM simulation: 30 year control run (year 1)_
- 15 km CCAM simulation, probably A2 or A1B (year 2)
- Version of OzClim developed for delivery of all model data (year 2 and year 3) – will include some reef relevant output, e.g., temperature, rainfall, SST, etc.

CSIRO Marine and Atmospheric Research

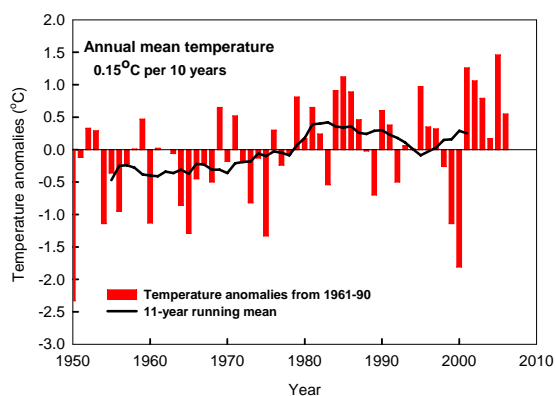
Trend in mean temperature 1910-2006 and 1950-2006



Source: Bureau of Meteorology

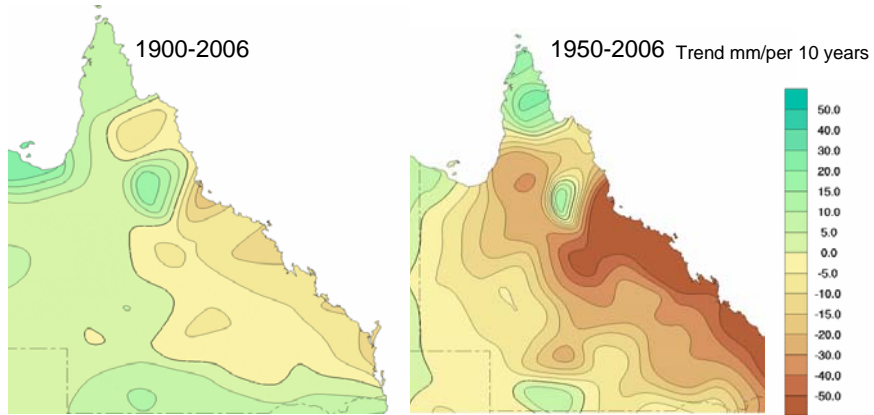
CSIRO Marine and Atmospheric Research

Annual mean temperature anomalies in the QLD Tropical Rainforest region, 14.5-19.5S, 143.5-148.8E



CSIRO Marine and Atmospheric Research

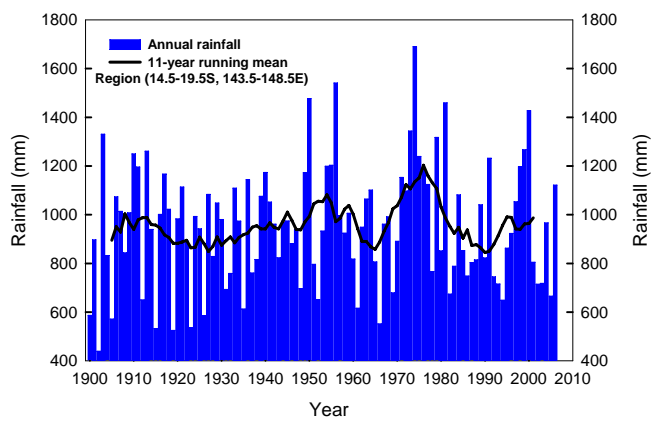
Annual rainfall trends in Queensland



Source: Bureau of Meteorology

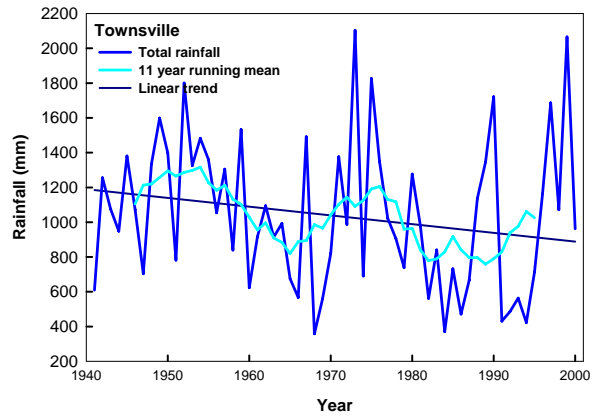
CSIRO Marine and Atmospheric Research

Annual rainfall variability in the QLD Tropical Rainforest region, 14.5-19.5S, 143.5-148.8E



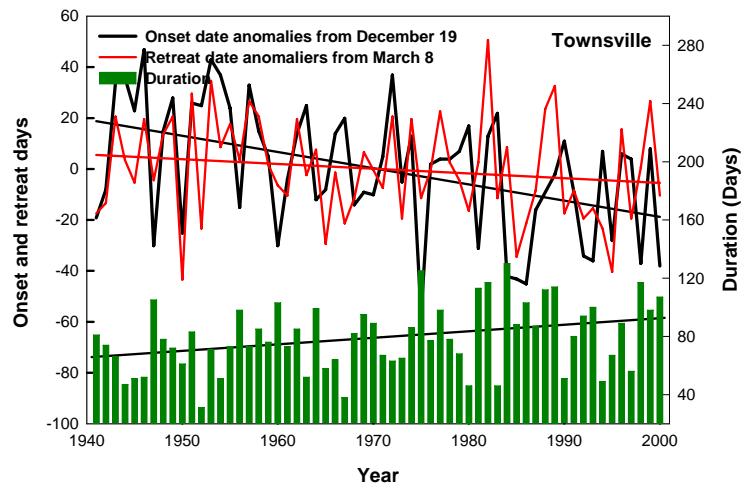
CSIRO Marine and Atmospheric Research

Wet season (September 1 to April 30) rainfall variability in Townsville



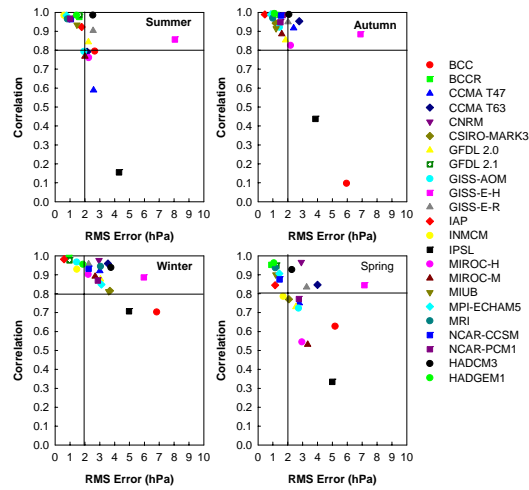
CSIRO Marine and Atmospheric Research

Onset, retreat and duration of the rainy season in Townsville



CSIRO Marine and Atmospheric Research

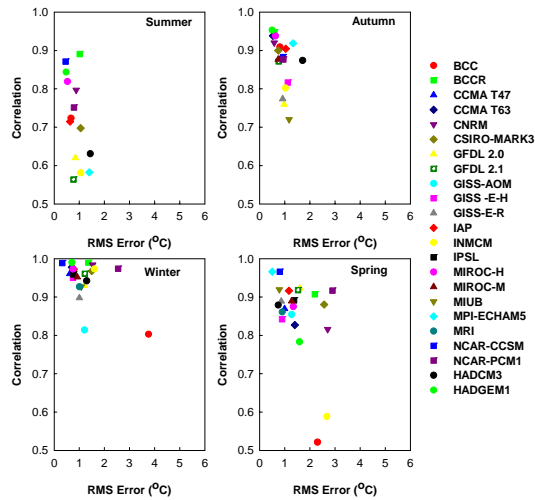
Pattern correlation and RMS Error for MSLP over Australia



CSIRO Marine and Atmospheric Research

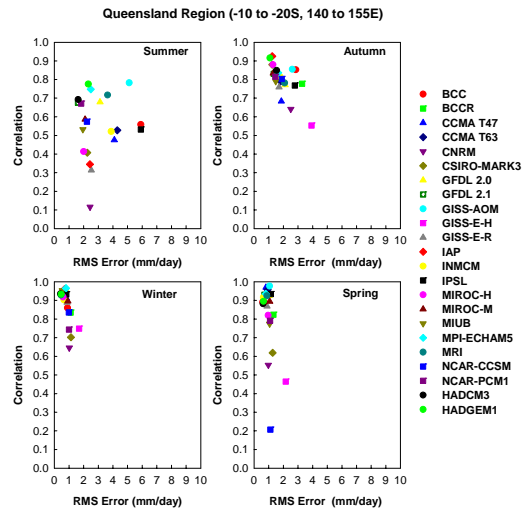
Pattern correlation and RMS Error for temperature for the MTSRF region

Queensland Region (-10 to -20S, 140 to 155E)



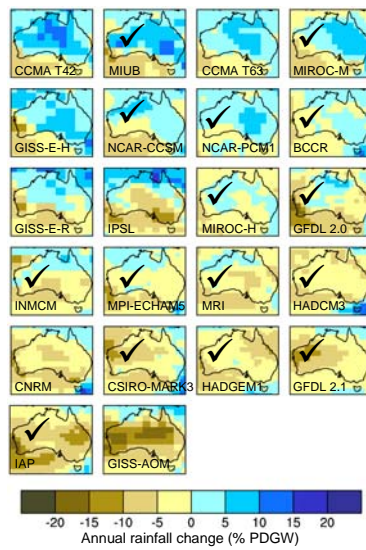
CSIRO Marine and Atmospheric Research

Pattern correlation and RMS Error for rainfall for the MTSRF region



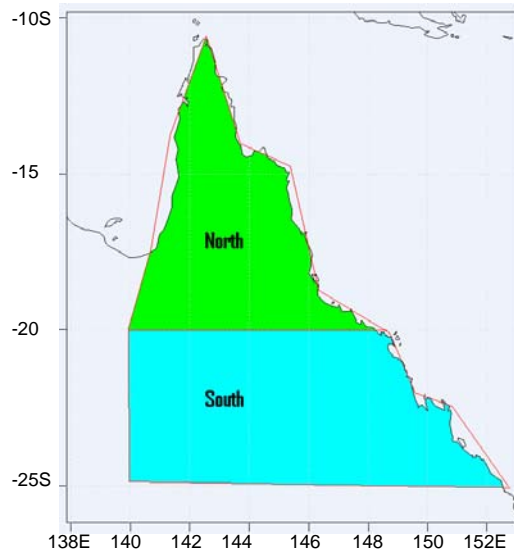
CSIRO Marine and Atmospheric Research

Selected 15 models for producing climate change projections for the MTSRF region



CSIRO Marine and Atmospheric Research

Queensland – Sub regions for climate change projections



CSIRO Marine and Atmospheric Research

Range of warming (°C) by 2030 and 2070 for each Queensland region for SRES scenarios

2030

Regions	Annual	Summer	Autumn	Winter	Spring
All regions	0.5 to 1.6	0.4 to 1.6	0.4 to 1.6	0.5 to 1.6	0.5 to 1.6
North	0.5 to 1.4	0.4 to 1.5	0.4 to 1.5	0.5 to 1.5	0.5 to 1.5
South	0.5 to 1.7	0.5 to 1.7	0.5 to 1.7	0.5 to 1.7	0.6 to 1.8

2070

Regions	Annual	Summer	Autumn	Winter	Spring
All regions	1.1 to 4.8	1.0 to 5.0	1.0 to 4.8	1.1 to 5.0	1.2 to 5.0
North	1.0 to 4.4	0.9 to 4.5	0.9 to 4.6	1.1 to 4.6	1.1 to 4.4
South	1.1 to 5.2	1.0 to 5.3	1.0 to 5.1	1.2 to 5.3	1.3 to 5.4

CSIRO Marine and Atmospheric Research

Range of rainfall changes in percentage by 2030 and 2070 for each Queensland region for SRES scenarios. Values above +20 and below -20 are rounded to the nearest 5

2030

Regions	Annual	Summer	Autumn	Winter	Spring
All regions	-9 to +7	-5 to +5	-12 to +5	-18 to +5	-14 to +7
North	-6 to +5	-4 to +5	-12 to +4	-25 to +7	-16 to +8
South	-9 to +8	-5 to +8	-13 to +7	-20 to +4	-13 to +6

2070

Regions	Annual	Summer	Autumn	Winter	Spring
All regions	-25 to +20	-14 to +16	-40 to +17	-55 to +14	-45 to +20
North	-18 to +14	-12 to +16	-35 to +12	-70 to +20	-50 to +25
South	-30 to +25	-16 to +26	-40 to +20	-65 to +11	-40 to +17

CSIRO Marine and Atmospheric Research

Conclusions

Observed temperature changes from 1950 to 2006:

Average 0.15°C per decade, Minimum 0.16 °C per decade and Maximum 0.14 °C per decade

Observed rainfall changes from 1900 to 2006:

Trends in MTSRF region rainfall since 1900 are generally negative, but weaker. The onset of the rainy season has become earlier in recent years, but retreat days do not show a clear change

CSIRO Marine and Atmospheric Research

Conclusions

AR4 Models and simulations

Twenty three global climate models were assessed and fifteen model simulations were used to construct climate change projections for the MTSRF region

Temperature and rainfall projections by 2030 and 2070

Annual warming range from 0.5 to 1.6 °C by 2030 and from 1.1 to 4.8 °C by 2070 for SRES emission scenarios

Projected annual rainfall changes are more complex. Rainfall changes are between -9 to +7% by 2030 and between -25 and +20% by 2070. A tendency for decreases dominates future rainfall changes

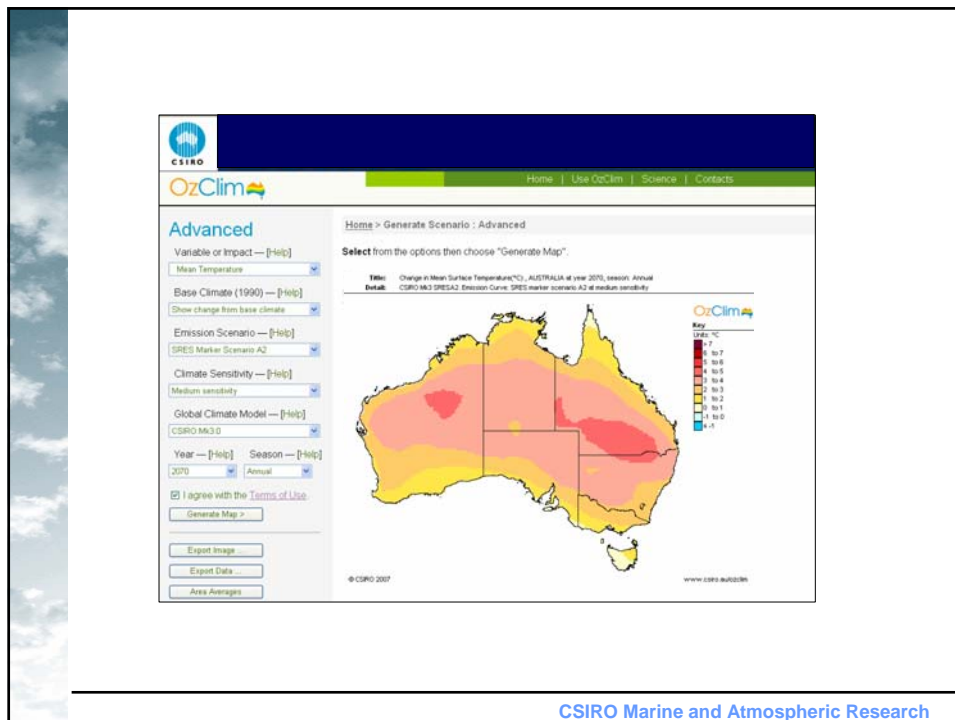
The upper limits of warming and rainfall changes are reduced by 23% by 2030 and 37% by 2070, if CO₂ concentrations are stabilised at 550 ppm by 2150 and by 29% by 2030 and 48% by 2070 at 450 ppm by 2100

CSIRO Marine and Atmospheric Research

OzClim

- PC-based climate scenario generator
- Draws results from current GCMs
- Represents uncertainty
- Combines scenario perturbation with baseline climate data
- Simple impact assessment
- Net version under development

CSIRO Marine and Atmospheric Research



CSIRO Marine and Atmospheric Research

Future directions

Further analysis on observed and simulated changes in maximum and minimum temperatures, onset, retreat and duration of the rainy season, cloud base height, humidity and solar radiation the tropical rainforest region.

High resolution (15 km) climate models simulations over MTSRF region

Further development of OZClim

CSIRO Marine and Atmospheric Research