

# APEC Climate Symposium 2011

*Harnessing and Using Climate Information for Decision Making*

**Honolulu, 17-20 October 2011**



## Scenarios for drought and extreme winds over New Zealand

**James Renwick**

Anthony Clark, Brett Mullan, Alan Porteous, Abha Sood,  
Trevor Carey-Smith, Georgina Griffiths

**NIWA, New Zealand**

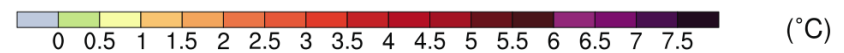
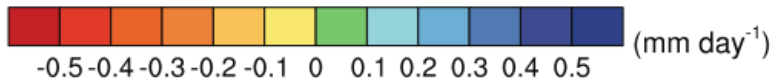
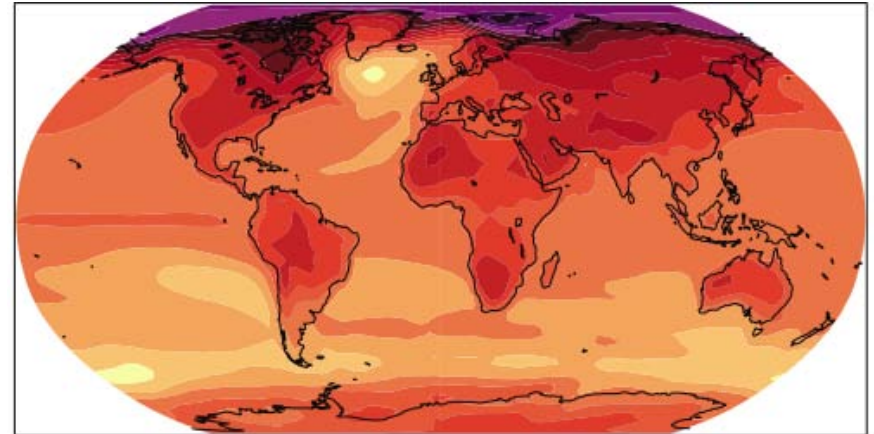
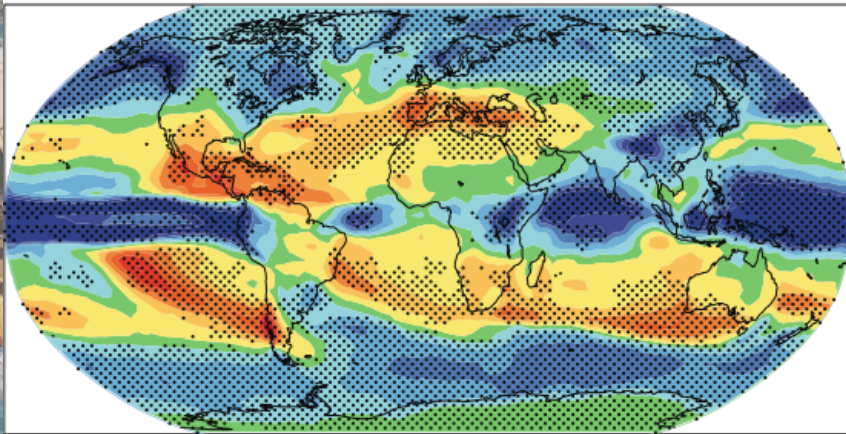
*[j.renwick@niwa.co.nz](mailto:j.renwick@niwa.co.nz)*

# Large scale change

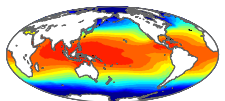
a) Precipitation

A1B: 2080-2099

b) Temperature

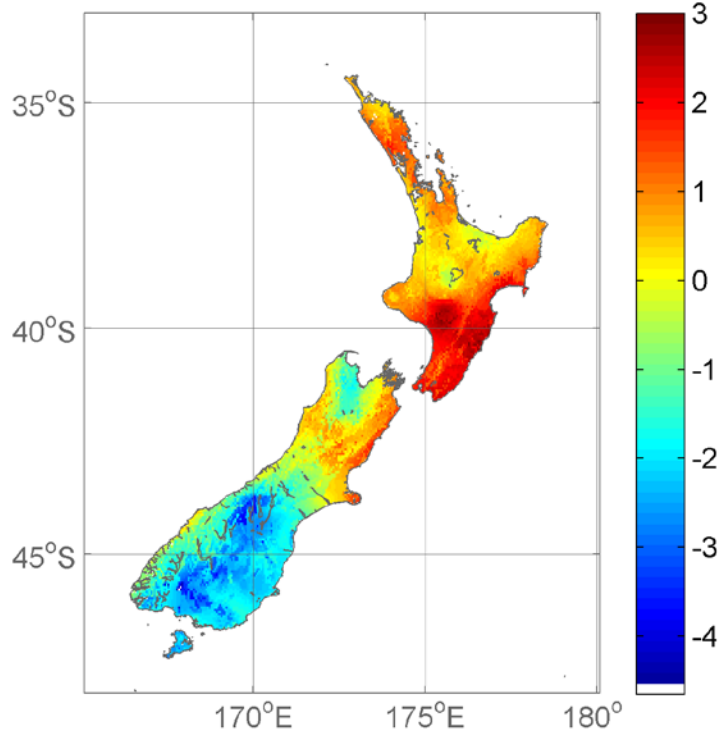


- Drying over north, wetter in southwest
- Warming at ~70% global rate
  - More in north → westerlies increasing (winter)



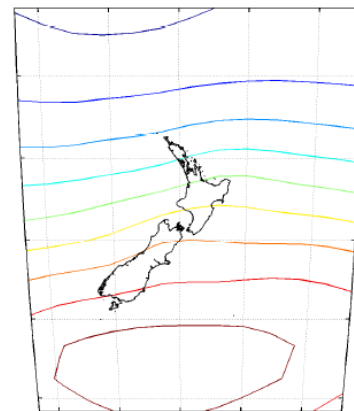
# Drought: Statistical downscaling

08-Aug-2010: Maximum temperature ( $^{\circ}\text{C}$ ) Anomaly

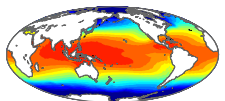
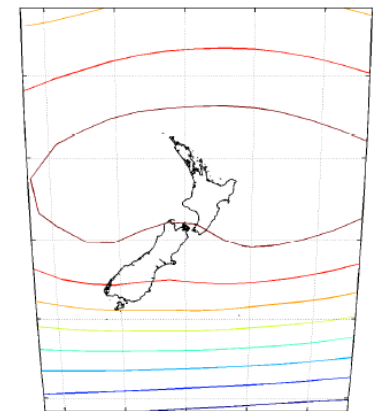


- VCSN grid
- PLS regression
  - MSLP,
  - temperature

Component 1

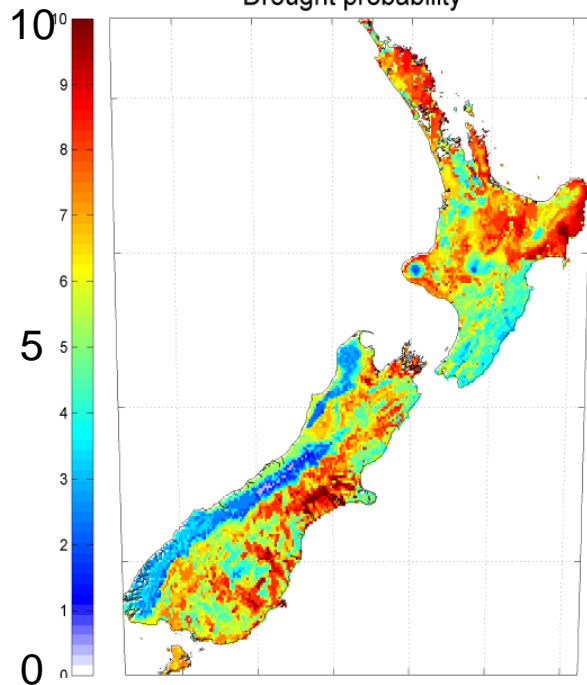


Component 2

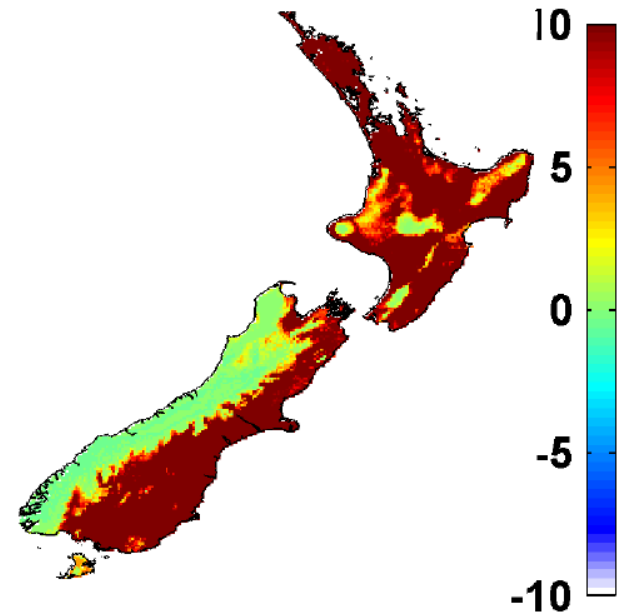


# Drought probability

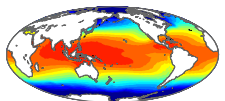
**Present day**  
Drought probability



**Median 100-yr change (A1B)**

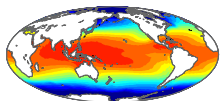


- Soil moisture < 10%ile, at least one month
  - At least a doubling, in east and north



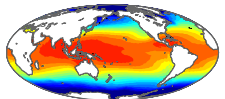
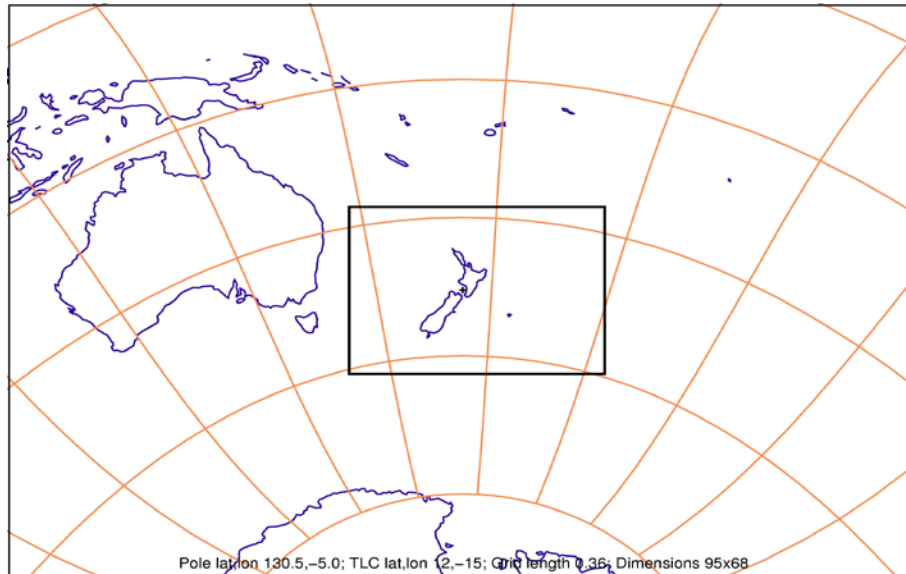
# Implications

- Drought already expensive
  - Summer 2007/08 drought \$2.8bn
- Preparation for a drier climate
  - Water management, irrigation
  - Transformational land-use change
    - Working with Government and agriculture sector
    - Talking with farming groups around the country
    - Much more adaptation research needed

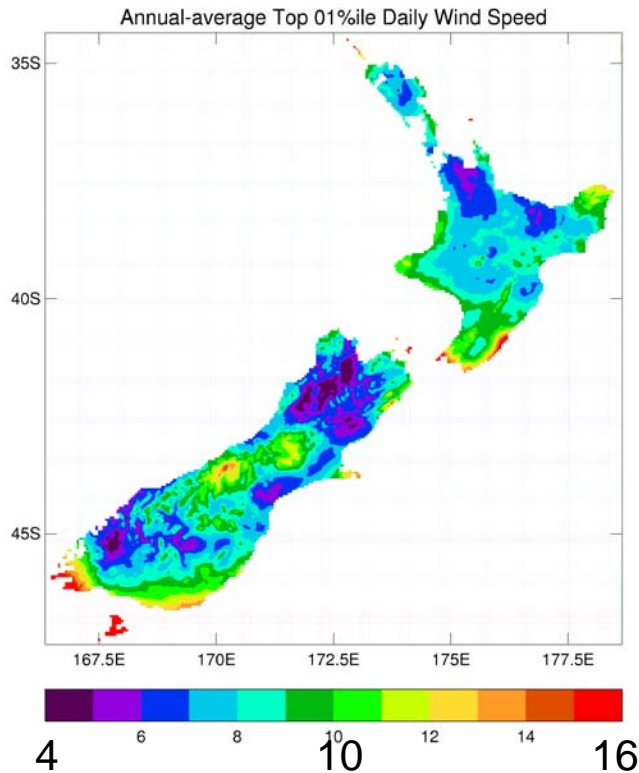


# Wind: Dynamical downscaling

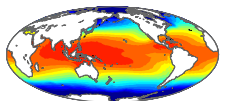
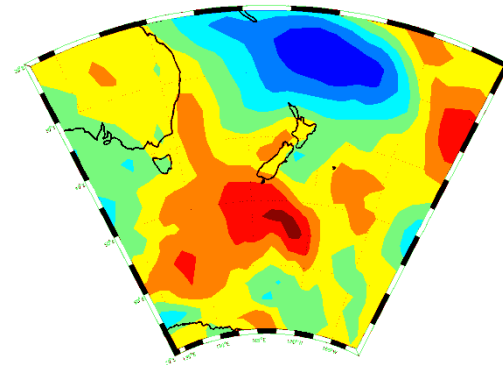
- Will New Zealand climate become stormier?
- Mean winds, storm tracks, storm intensity
- Hadley Centre model, GCM and RCM



# Extreme winds

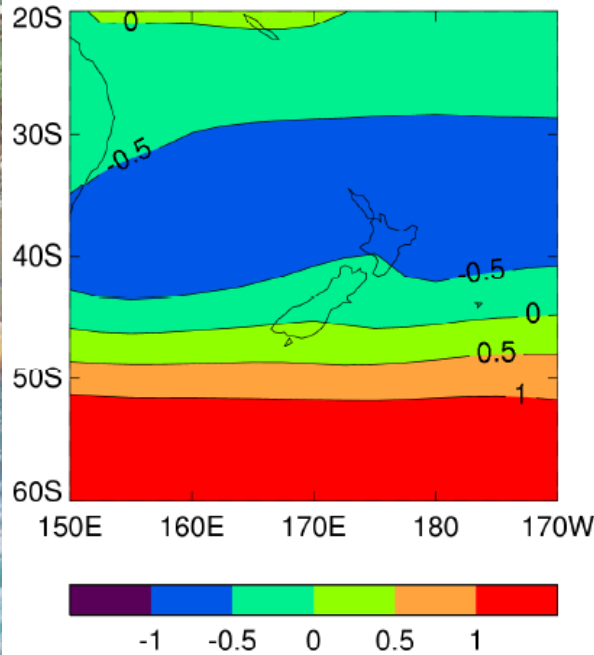


- Strongest winds at ends of both main islands
- Max 99%ile around 15m/s
- Where increases likely, they are small (<1m/s)



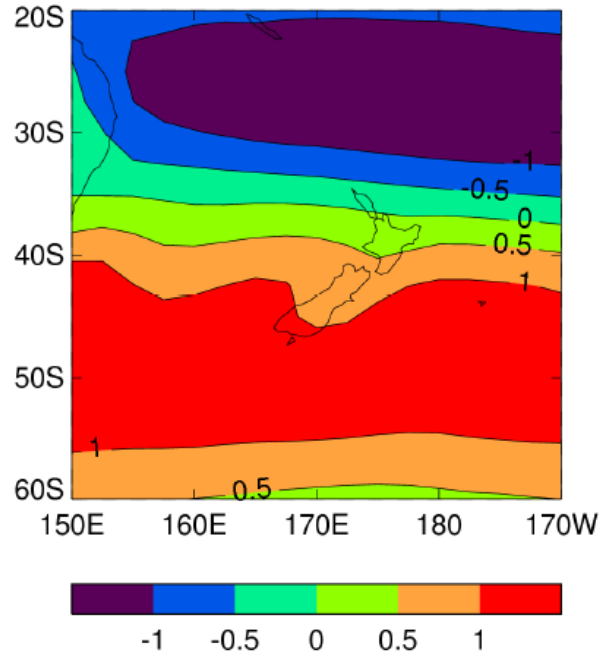
# Large scale changes

19-model-avg uas: DJF Change  
1961-2000 to A1B 2081-2100



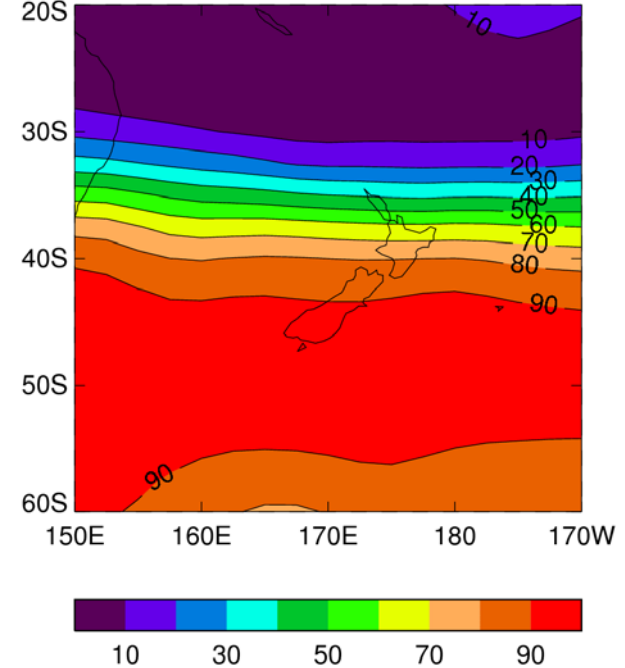
$\Delta\bar{U}$ , summer

19-model-avg uas: JJA Change  
1961-2000 to A1B 2081-2100



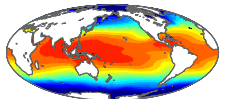
$\Delta\bar{U}$ , winter

Prob(Increase in Westerly Days): JJA



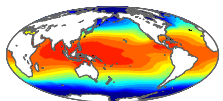
p(more westerly days)

- Increase in westerlies
  - Especially in the south, in winter



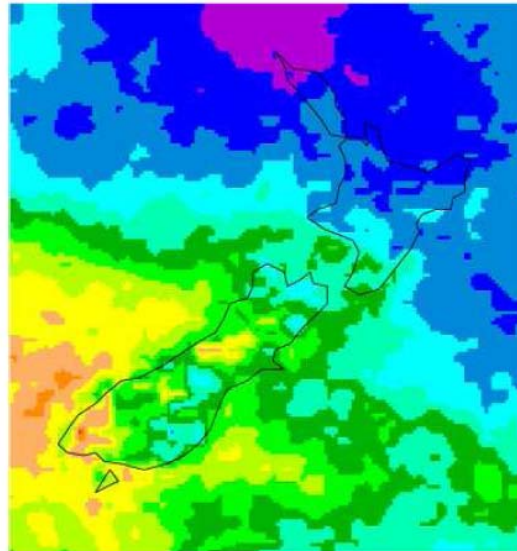
# Storms

- Poleward shift in storm tracks over all
  - Decreased frequency over North Island in winter
  - But, increased frequency over Tasman Sea in summer
- Decreased cyclone intensity over New Zealand
  - But increased south of the country
    - Stronger zonal pressure gradient over South Island?

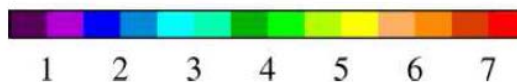


# Convection - CAPE

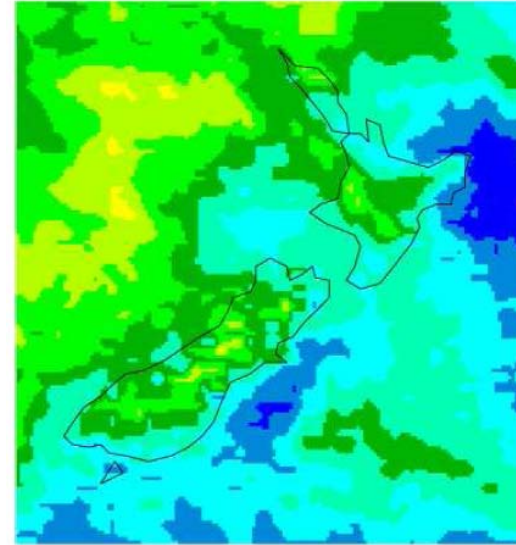
JJA - CAPE



Recurrence ratio of the 99th %



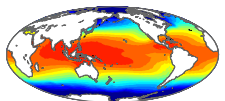
DJF - CAPE



Recurrence ratio of the 99th %

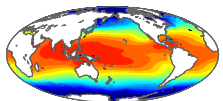


- Significant increases in high CAPE cases
  - 3-6 x increases, from RCM runs
  - More risk of strong convection



# Implications

- Changes in extreme winds
  - Increases in winter, decreases in summer
  - More Tasman Sea storms in summer
- Increased high CAPE events
- Working with users on implications
  - Forestry and energy sectors
    - Identify current risk, likely future changes
    - Help develop adaptation plans



# Summary

- Focus on changes in extreme events
  - Risk management approach
- Working with users
  - Identify assets, identify risks
  - Changing risk profiles
  - Adaptation options
- More work needed on science, and uptake

