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Climate Change Impacts for the Oil and Gas Industry

Debbie Abbs

Centre for Australian Weather and Climate Research
A partnership between CSIRO and the Bureau of Meteorology
CSIRO Marine and Atmospheric Research

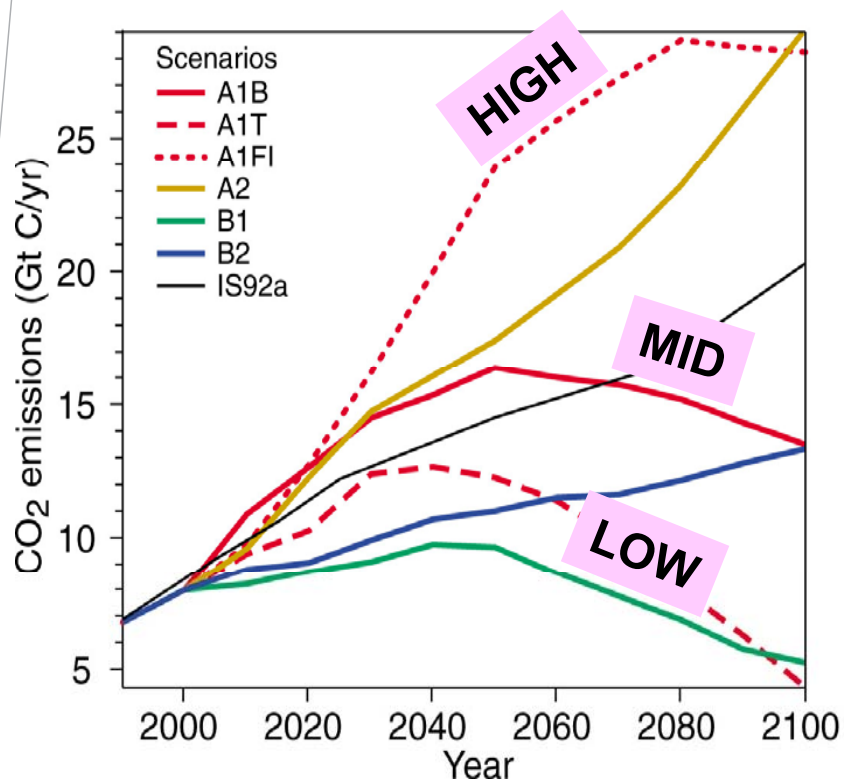
National Research
FLAGSHIPS
Climate Adaptation



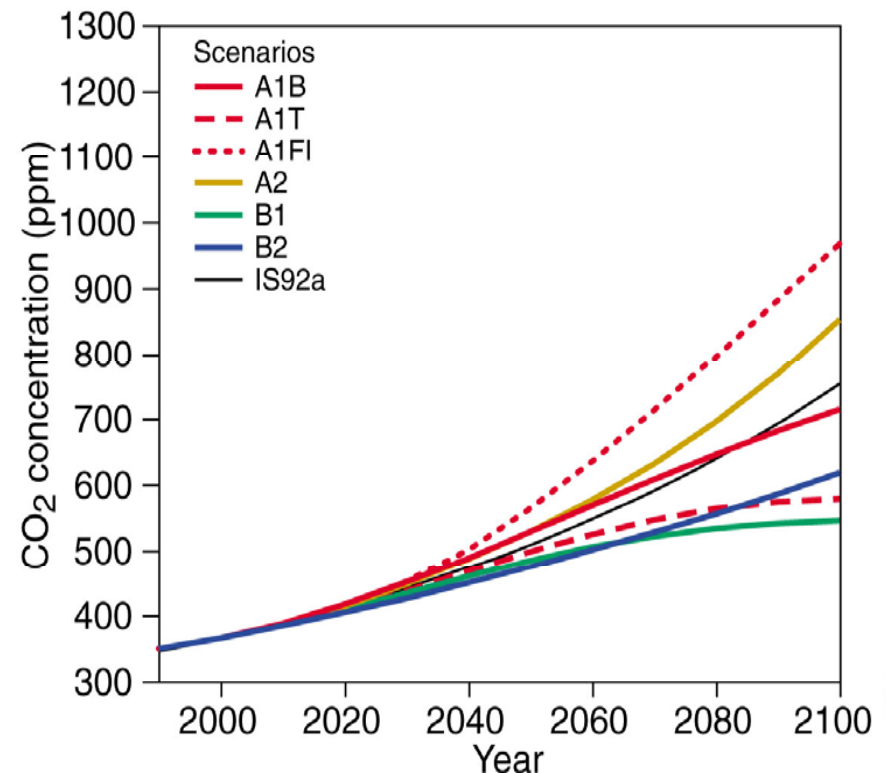
Climate Change Uncertainty

- Projections contain uncertainty due to 3 sources
 1. Climate Sensitivity
 2. Emissions Uncertainty
 3. Spatial Patterns differ amongst different models

(a) CO₂ emissions

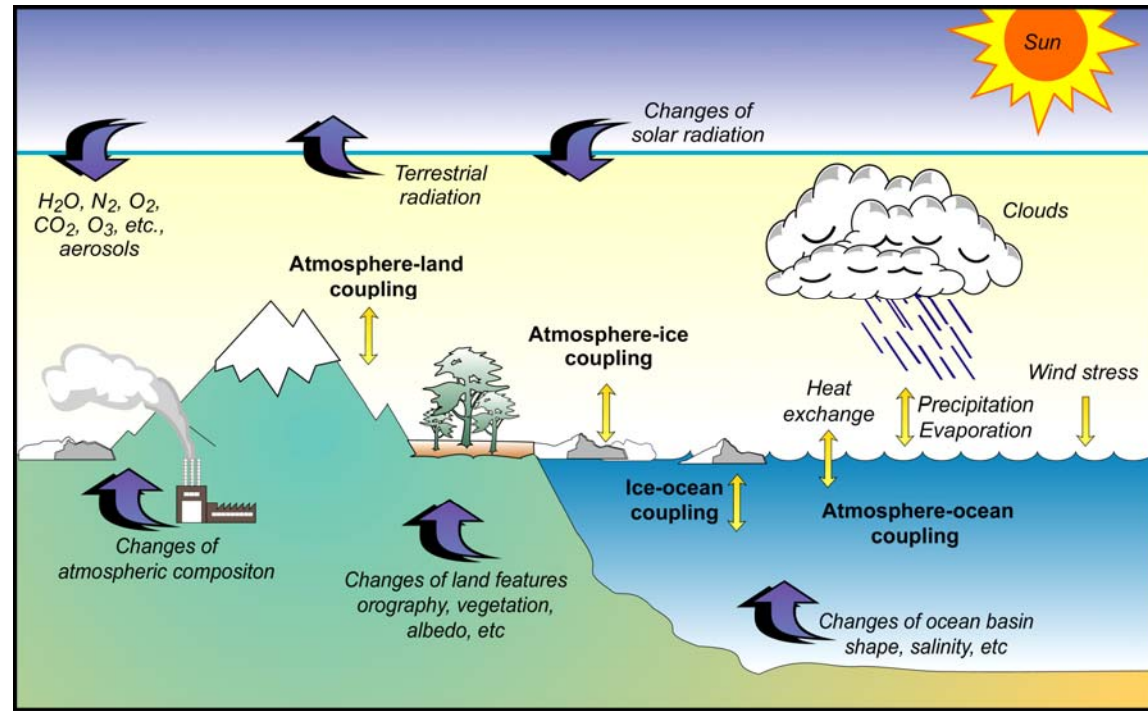
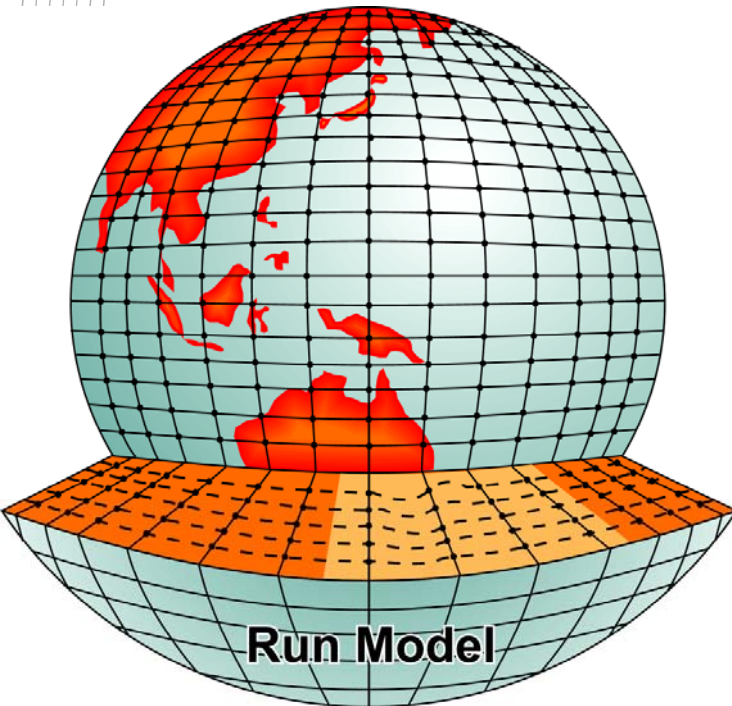


(b) CO₂ concentrations

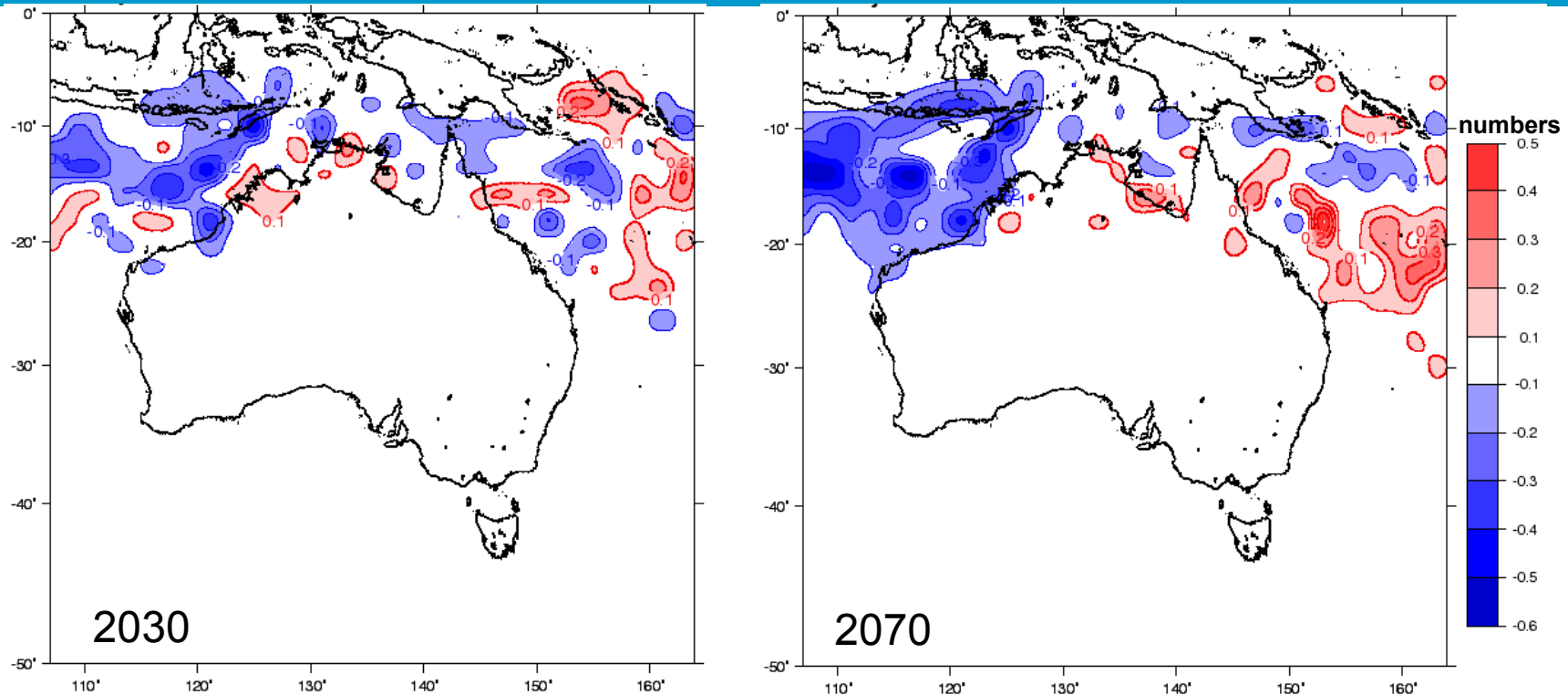


What is an atmospheric model?

- Complex computer program
- Incorporates equations representing:
 - physical processes and
 - dynamics, that drive ocean/atmosphere/land surface interactions
- Reproduces the way in which climate behaves from day to day, and season to season



Tropical Cyclone Changes for Australia



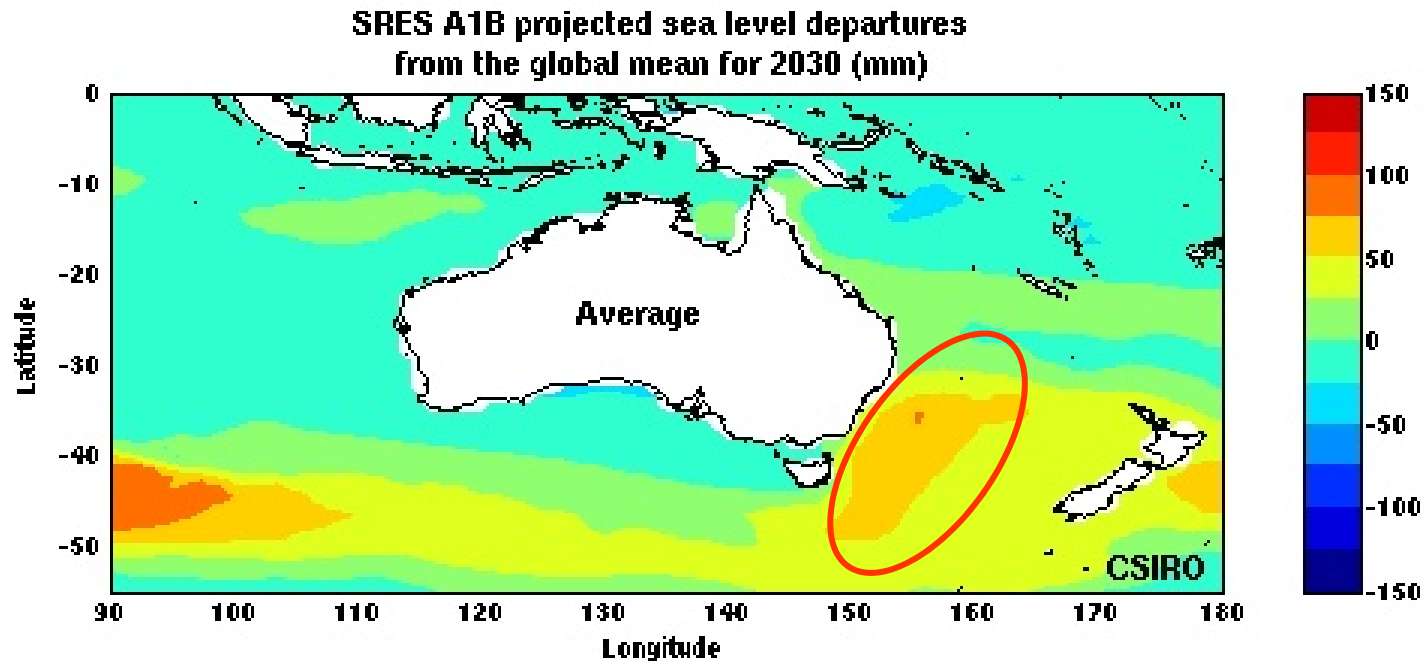
Decreased TC activity (44%) off WA
Decrease in long-lived TCs

Increased TC activity off Qld
Increase in long-lived TCs

More intense storms - 85% of all storms Cat 4&5
Poleward shift (0.7°) in formation region

- impacts on extreme waves, inundation (storm tide & riverine)
- design criteria, port/community operations, lost-production days

Sea Level Rise and the Tasman Sea



- 1961-2003 Global SLR = 1.8 mm/year
- 1993-2003 Global SLR = 3 mm/year
- 20th Century Aust. SLR ~ 1.2 mm/year
- Projected Global SLR = 18-59 cm (2100)
- Maybe an extra 10-20 cm from ice sheets
- Strengthening of EAC
- Tasman Sea warming → enhanced SLR
- Possible impacts on East Coast Lows → flooding, extreme wave events

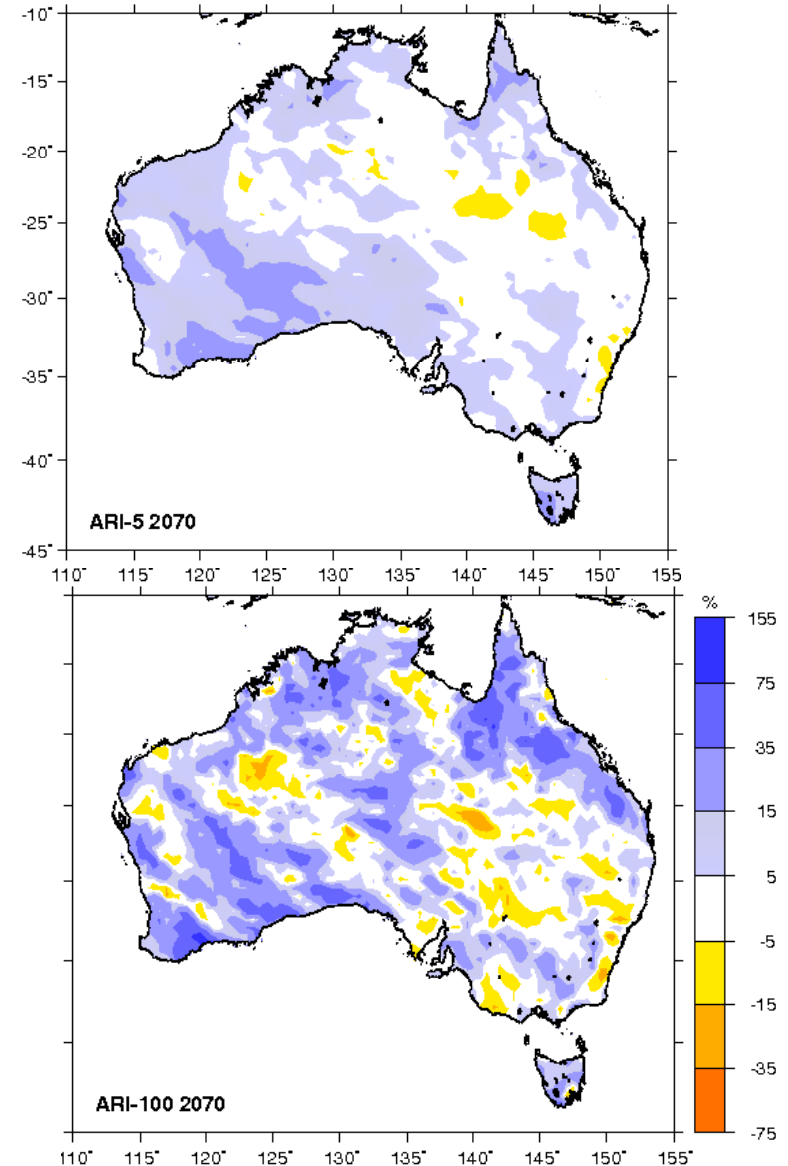
Rainfall and Temperature Extremes

Darwin: Number of days over 35°C
(median change)

current	2030	2070 (low)	2070 (high)
10.8	44.0	89.4	226.8

Refrigeration requirements for LNG
OHS implications

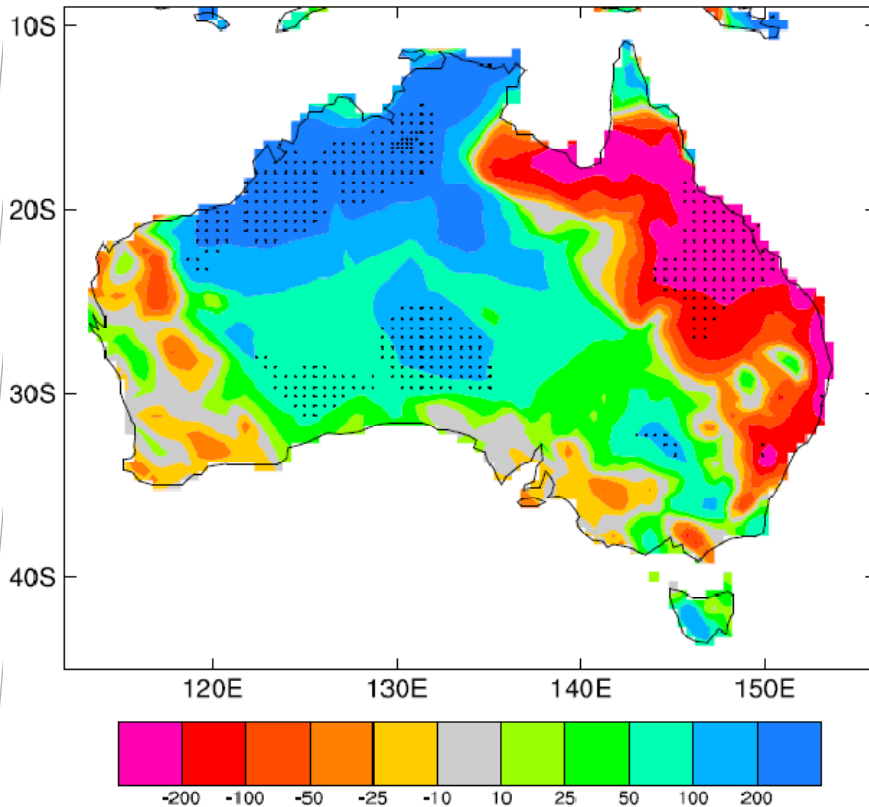
Fluids in pipes, corrosion,
chemical reactions?



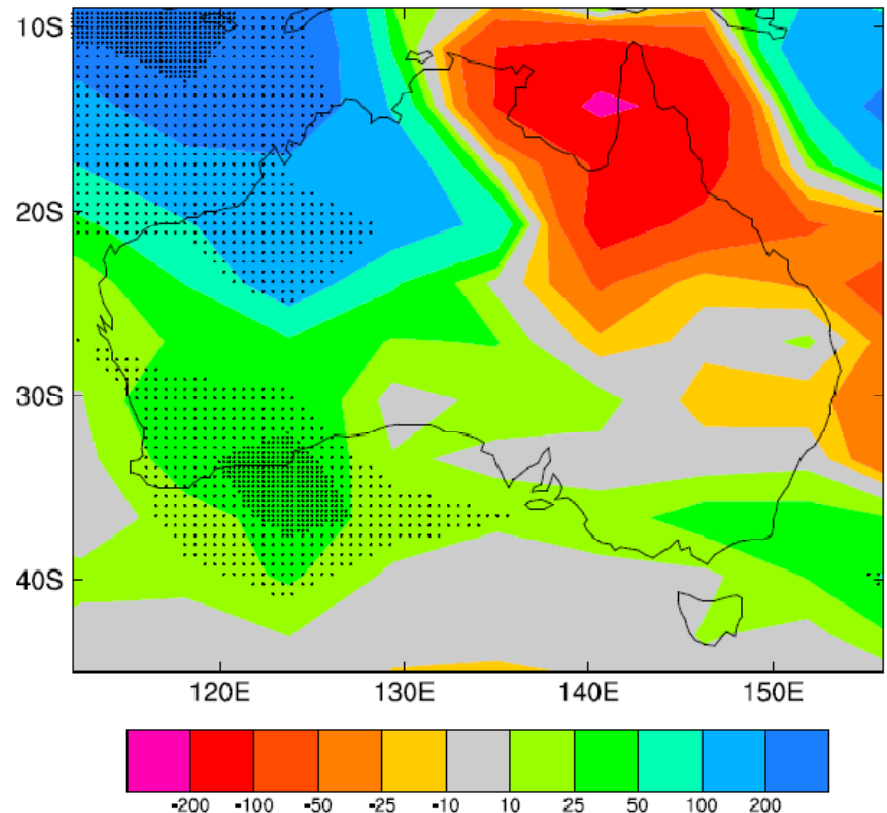
Asian aerosols and Australian rainfall trends

Dec - Feb seasonal rainfall trends in mm/century

(a) 1951-1996 observed DJF rainfall trend (CRU TS 2.1)



(d) 1951-1996 DJF rainfall trend from ALL minus AXA



Debbie Abbs
CMAR/CAWCR

Phone: (03) 9239 4660
Email: deborah.abbs@csiro.au

www.csiro.au

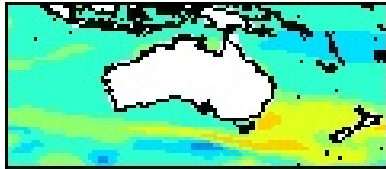
Thank you

Contact Us

Phone: 1300 363 400 or +61 3 9545 2176
Email: enquiries@csiro.au Web: www.csiro.au



BCCR



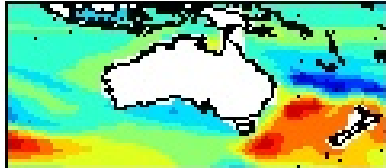
CSIRO Mk3.0



CSIRO Mk3.5



ECHO-G



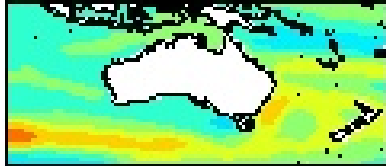
FGOALS



GFDL 2.0



GFDL 2.1



GISS AOM



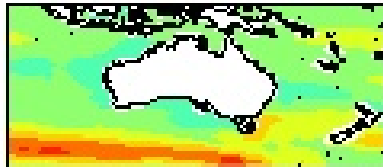
GISS E-H



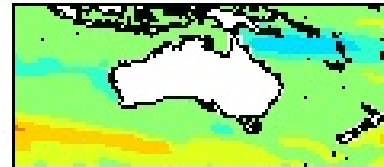
GISS E-R



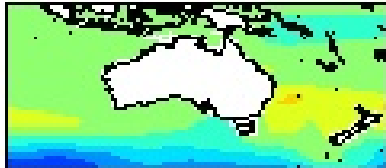
HadCM3



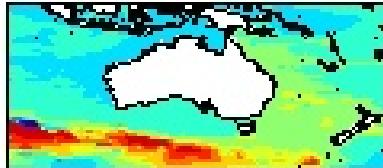
HadGEM1



IPSL



MIROC hi



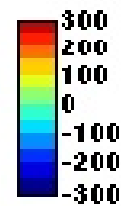
MIROC Med



MPI

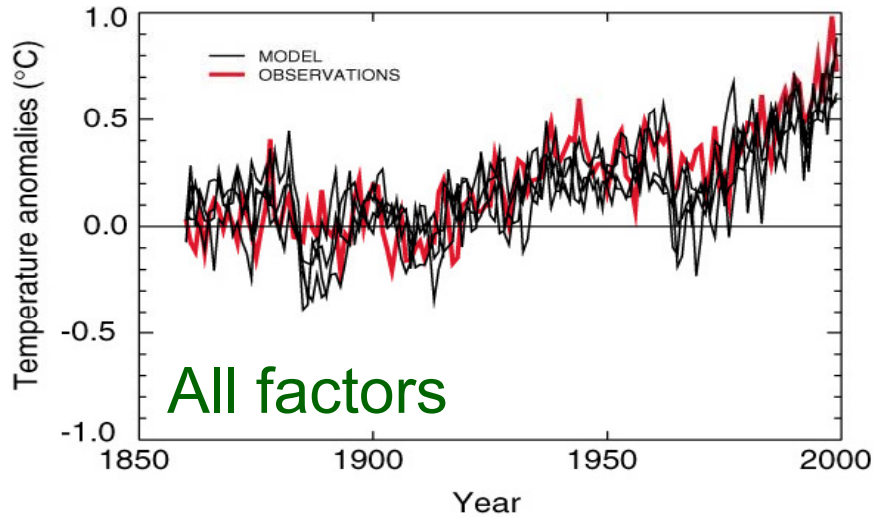


MRI



Colourbar for small plots

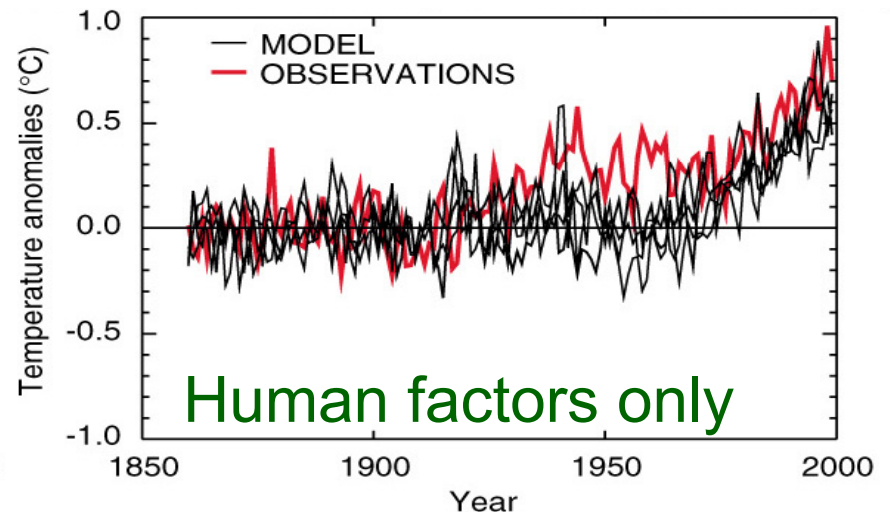
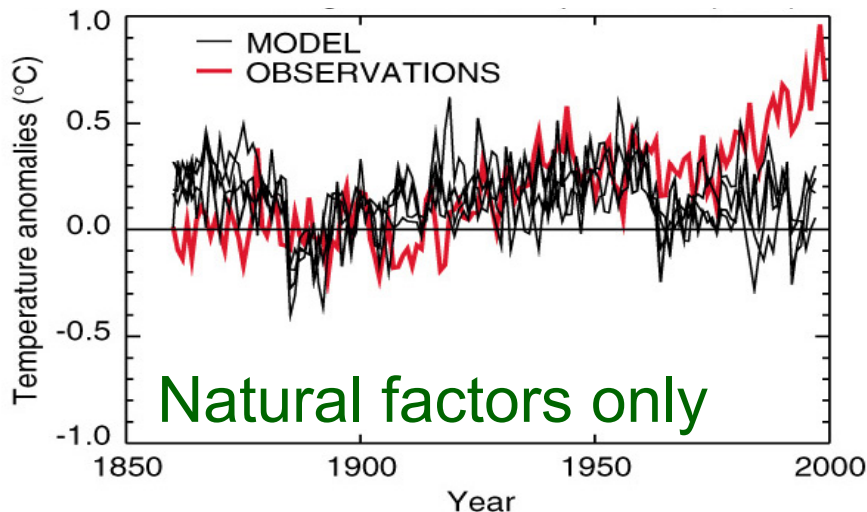
“Most of the observed warming over the last 50 years is likely to have been due to the increase in greenhouse gas concentrations”



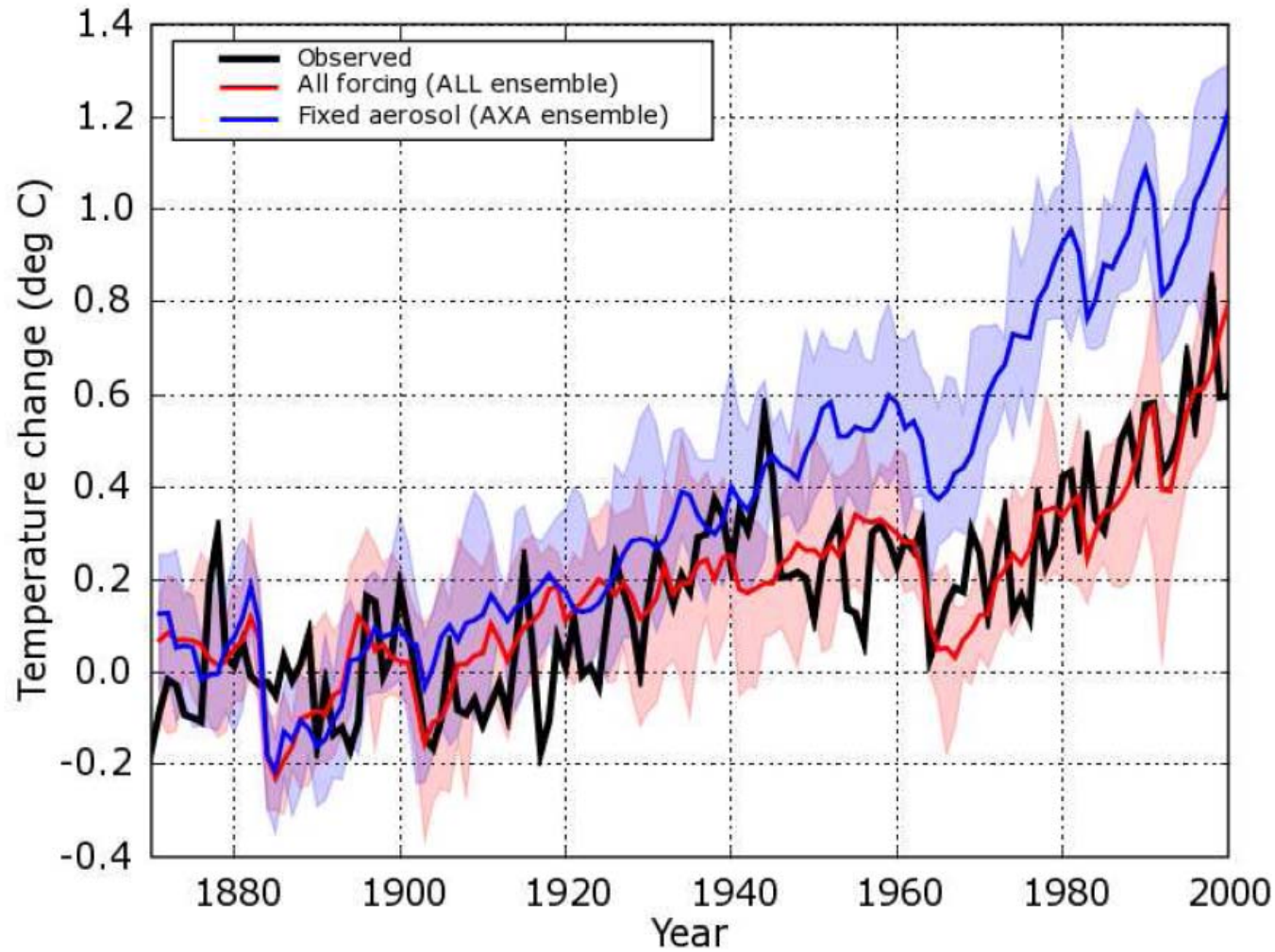
Global-average surface temperature (°C)

Model (black)

Observations (red)



The ALL ensemble gives a better simulation of global-mean temperature change after 1950



Near-surface temperature change relative to 1871-1900 mean. Observations are from HadCRUT2 (Jones and Moberg, 2003; Rayner et al., 2003)