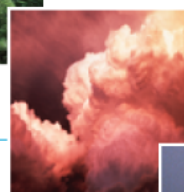


Australian CMIP5 activities

www.cawcr.gov.au



Tony Hirst

Earth System Modelling Program, CAWCR

21 October 2011



Australian Government
Bureau of Meteorology

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



Outline



- Coupled modelling for CMIP5
 - CSIRO Mk3.6
 - Established global AOGCM
 - CMIP5 long term only
 - ACCESS
 - New global AOGCM/ESM
 - Initially CMIP5 long term AOGCM
 - Other CMIP5 suites later
- Regional modelling for CORDEX



- **Features**

- **Atmosphere:** Grid T63 (1.875° x 1.875°); 18 levels - hybrid σ, p
 - **Ocean:** MOM2.2 code; Grid 0.94°NS x 1.875°EW; 31 levels
 - Interactive aerosol treatment – sulphate, black carbon, organic carbon, mineral dust and sea salt
-
- CMIP5 long-term simulations – partnership with QCCCE (J. Syktus contact)
-
- Output now published on ESG – NCI is the primary node

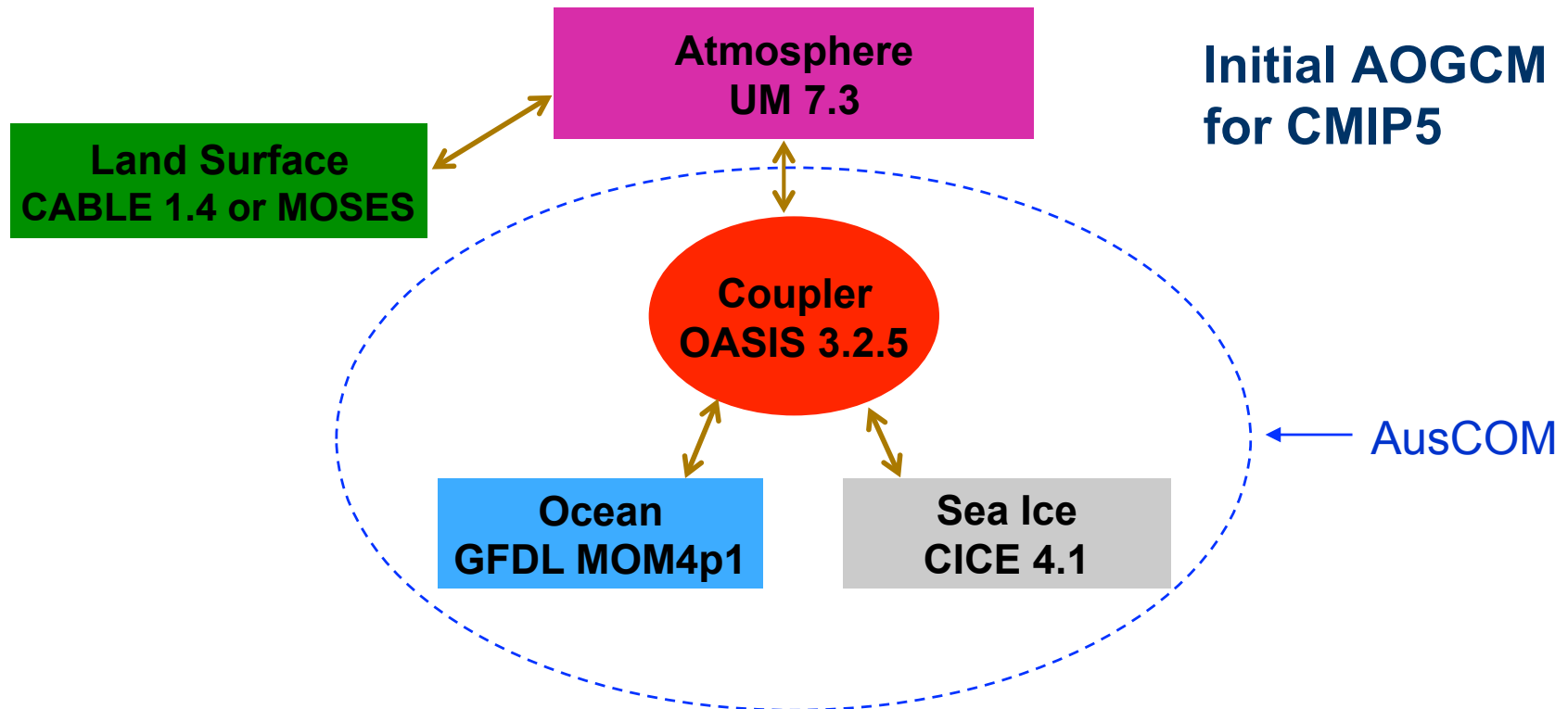
CSIRO-Mk3.6: Long-term experiments

Experiment	Length	Ens.
Control	500 yr (160 yr spin up)	1
Historical	1850-2005	10
AMIP	1979-2009 (30 yr spin up)	10
Mid-Holocene	100 yr (300 yr spin up)	1
RCPs 2.6, 4.5, 8.5, 6.0	2006-2100 (<i>RCPs 4.5 & 8.5: 3x 2100-2300</i>)	10
1%/yr CO ₂ to 4x	140	1
AGCM + control SSTs	30	1
AGCM + control SSTs + 4x CO ₂	30	1
4x CO ₂	150 + 5	1+11
AGCM + control SSTs + AA	30	1
AGCM + control SSTs + SA	30	1
Historical (natural)	1850-2012	10
Historical (GHGs)	1850-2012	10
Historical (anthropogenic)	1850-2012	10
Historical (all except ozone)	1950-2012	10
Historical (all except AA)	1850-2012	10
Historical (AA)	1850-2012	10
Historical (Asian aerosols)	1850-2012	10

Australian Community Climate and Earth System Simulator (ACCESS)

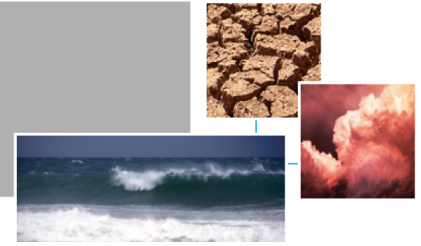


- To be a community model, meeting a variety of needs, with a strong University contribution



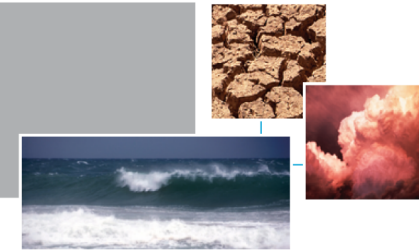
- **Atmosphere and land surface:** N96 – 1.875° lon x 1.25 ° lat; 38 levels
- **Ocean and sea ice:** 1° x 1° grid, enhanced tropical, high latitudes; 50 levels

ACCESS coupled system



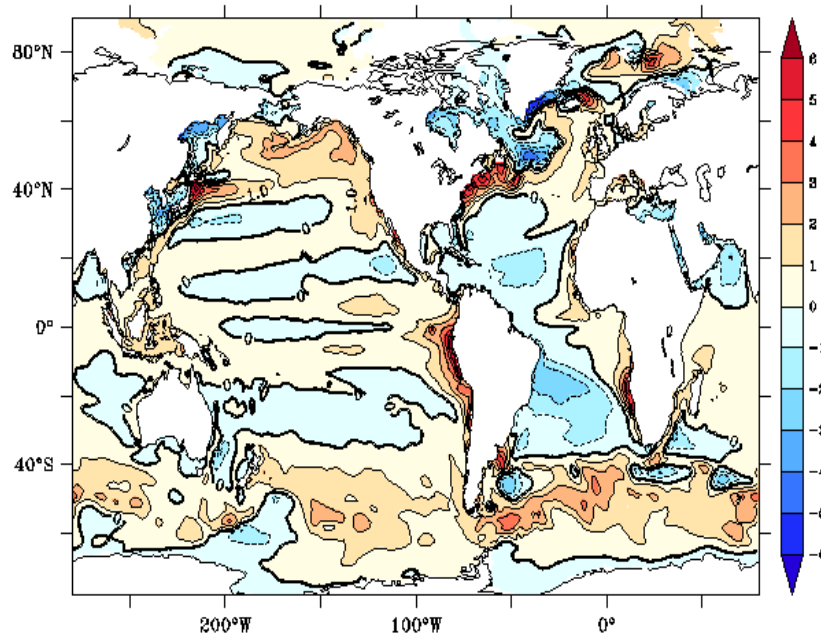
- **Version 1 (“HG2+M”)**
 - Atmosphere – HadGEM2(r1.1) settings
 - Land surface – MOSES
- **Version 2 (“HG3+M”)**
 - Atmosphere – proto-HadGEM3 settings + modifications
 - Land surface – MOSES
- **Version 3 (“HG3+C”)**
 - Atmosphere – proto-HadGEM3 settings + modifications
 - Land surface – CABLE
- **(“HG2+C” version – technical problems)**
- **Numerous lengthy (~200 years) control simulations**
 - Late 20th century and CMIP5-conforming preindustrial forcings
 - Extensive evaluation

Model sea surface temperature (SST) bias

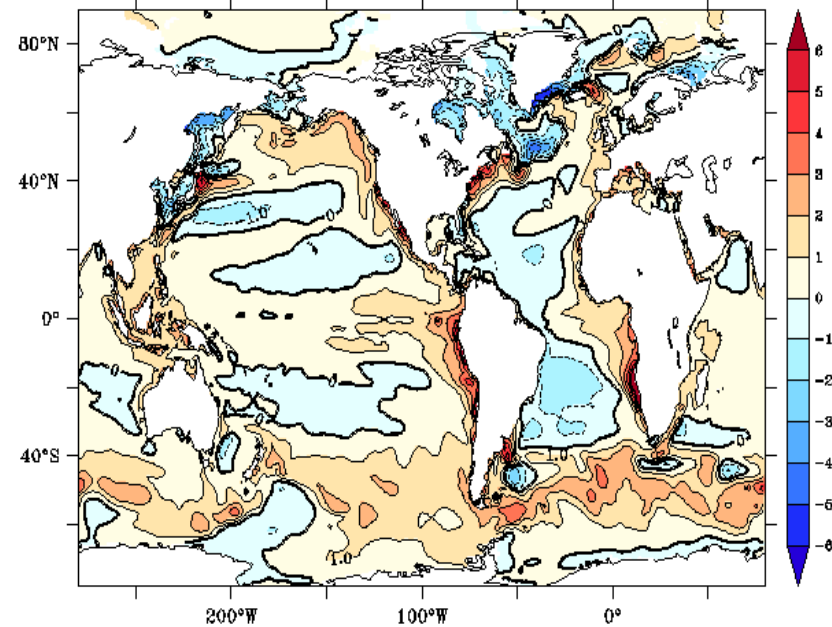


Model – Observed SST difference (years 151-200) °C

HG3+C



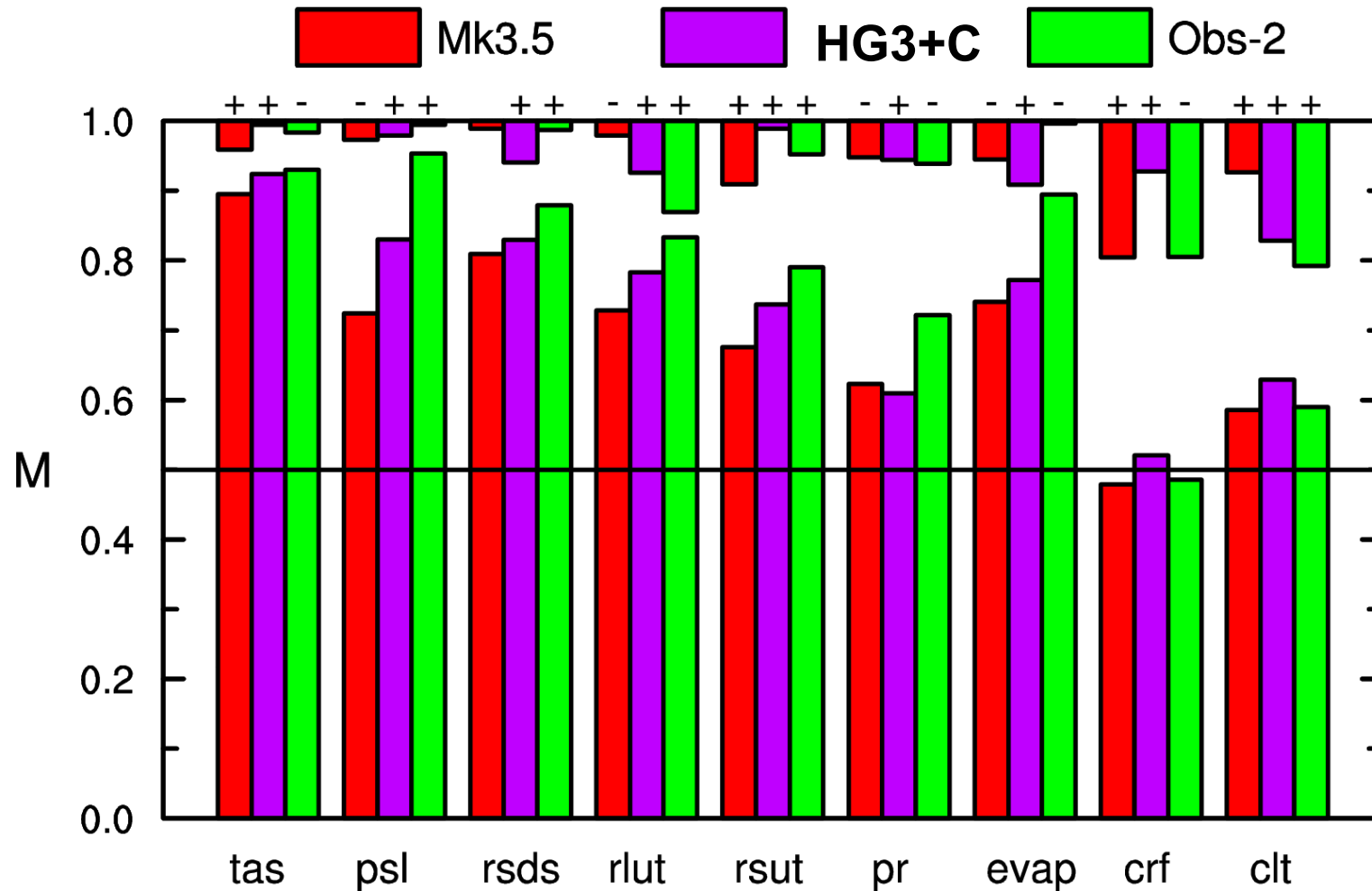
HG2+M



Summary assessment of seasonal climatological fields



Skill scores for individual variables (model years 101-200)



Summary assessment of seasonal climatological fields (model years 101-200)



Mean of skill scores for individual variables
(model years 101-200)

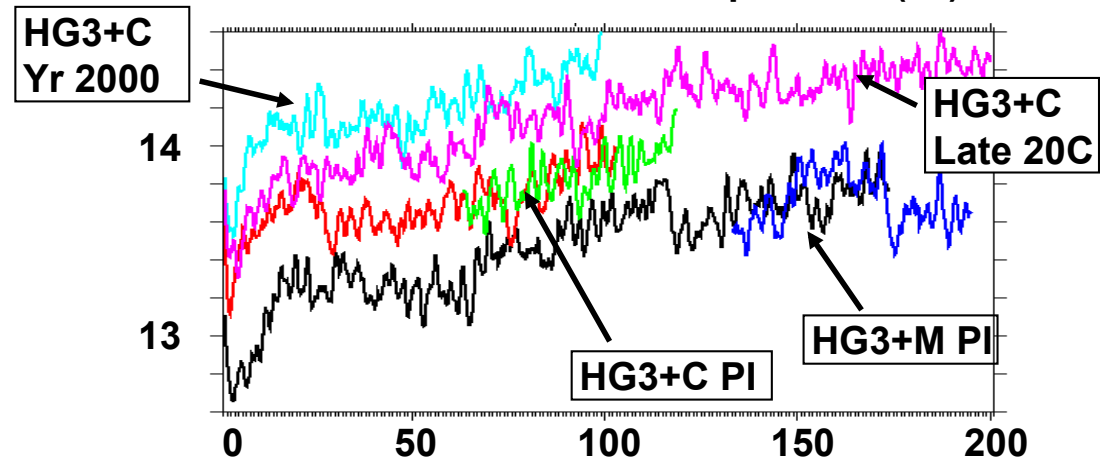
	Globe 9 variables	Aust 3 variables	Aust ann precip	
	<u>score</u>	<u>score</u>	<u>score</u>	<u>mm/d</u>
HG2+M	747	712	486	1.07
HG3+M	745	714	585	1.40
HG3+C	737	691	622	1.37
Mk3.5	696	629		
CMIP3 (high)		713		
OBS-2	786	815		
				BoM 1.36

Preindustrial versus late 20th century

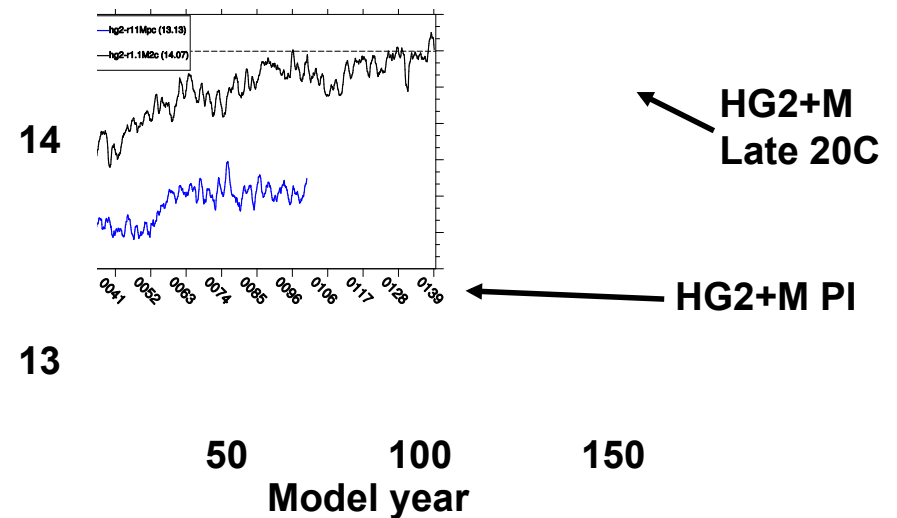


- Simulations for HG3+M and HG3+C

Global mean surface air temperature (°C)



- Simulations for HG2+M



Current suitability for CMIP5



- Versions broadly comparable in terms of quality of late 20th century solutions.
- HadGEM3 cases (HG3+M, HG3+C)
 - Preindustrial to late 20th century surface temperature difference small
 - May result from particularly strong model sensitivity to aerosols
 - Is this an issue – careful analysis
- HG2+M
 - Preindustrial control spin-up done (~300 years) - ready to go
- Commence full “core” set of CMIP5 long-term simulations with HG2+M version (this week)
- Commence trial CMIP5 historical simulations with HG3+C (and HG3+M)

Further plans for CMIP5 for ACCESS

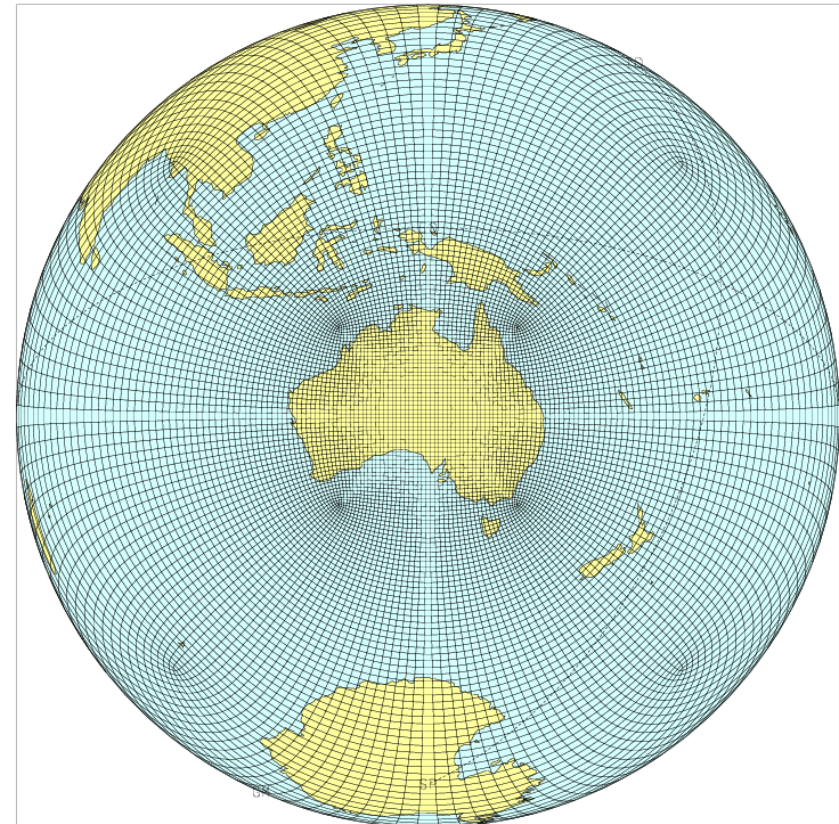


- Publish 'core' long-term experiments with HG2+C (& possibly HG3+C)
- Perform expanded set of experiments from 'Tier 1' and 'Tier 2' set
 - Choose following consultation with stakeholders
- CFMIP
- Transpose AMIP
- CMIP5 ESM
- CMIP5 decadal prediction
- Potential – CMIP5 atmospheric chemistry
- Potential if Univ. collaboration – PMIP

CAWCR CORDEX activities



- Focus on contributing for the following CORDEX domains
 - Australasia (lead by J Evans, UNSW)
 - Africa (in collaboration with CSIR, South Africa)
 - East Asia
 - West Asia
- Conformal Cubic Atmospheric Model (CCAM) simulations
 - Global quasi-uniform grid (i.e., a single simulation for all domains)
 - Variable resolution grid and standard physics options
 - Variable resolution grid and experimental physics options
- Experiments for the Australasian domain with the MetOffice HadGEM3-RA will be developed in the future



Example of CCAM's variable resolution global grid



- **Access to CMIP5 data**
 - Currently ~11TB are available (excluding CSIRO-Mk3.6) at local ESG node (NCI).
 - Most data has been downloaded using 'wget' scripts, NOT the Bulk Data Mover (BDM) software.
 - Need faster access (i.e. BDM) for data replication.
- **CMIP5 data analysis**
 - Using a work flow managing software to do pre-processing of GCM output for further detailed analysis.
 - Most of the analysis for AR5 is likely to be done at CAWCR and the CoE.
 - Coordination of CMIP5 model analysis at CAWCR and the CoE established.
 - Large number of projects are aiming to analyse CMIP5 data. Some special focus on Australian model(s).

Summary



- CSIRO Mk3.6: Extensive ensemble CMIP5 (long term) experiments now completed and results are published on ESG.
- ACCESS: Core CMIP5 (long term) simulations getting underway now.
- Expanded ACCESS participation in CMIP5 and related projects, as additional capabilities develop
- Active Australian participation in CORDEX by several regional models.
- CMIP5 analysis activities coordinated and gaining momentum



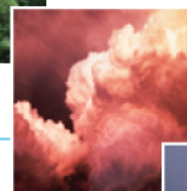
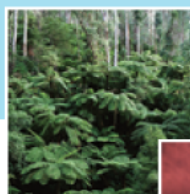
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Tony Hirst
Deputy Research Program Leader
Earth System Modelling Programme

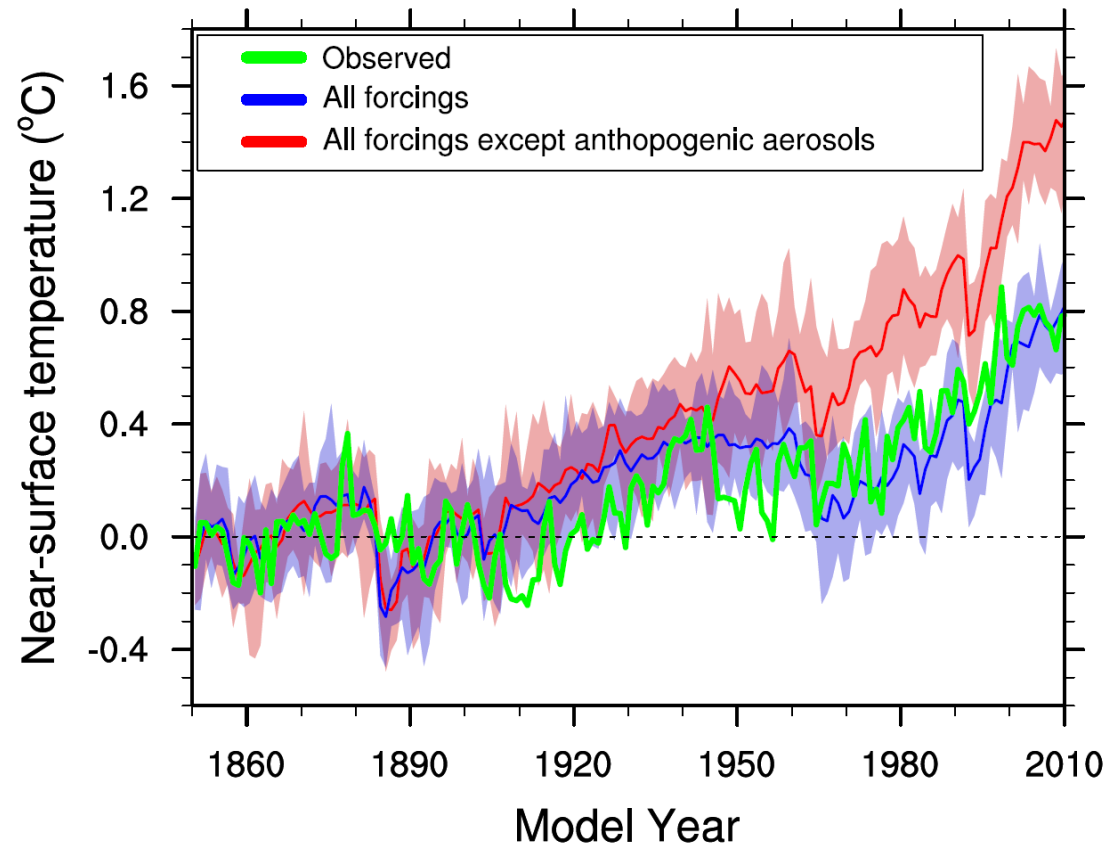
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CSIRO-Mk3.6 simulations - global-mean temperature change



Observed and CSIRO-Mk3.6.0 simulated temperature changes



- Global-mean surface air temperature change simulated by CSIRO Mk3.6, with all forcings and all forcings except anthropogenic aerosols.
- Observed from from HadCRUT3 (Brohan et al. 2006).