NARClIM Climate Projections, NARCliM2.0 Overview
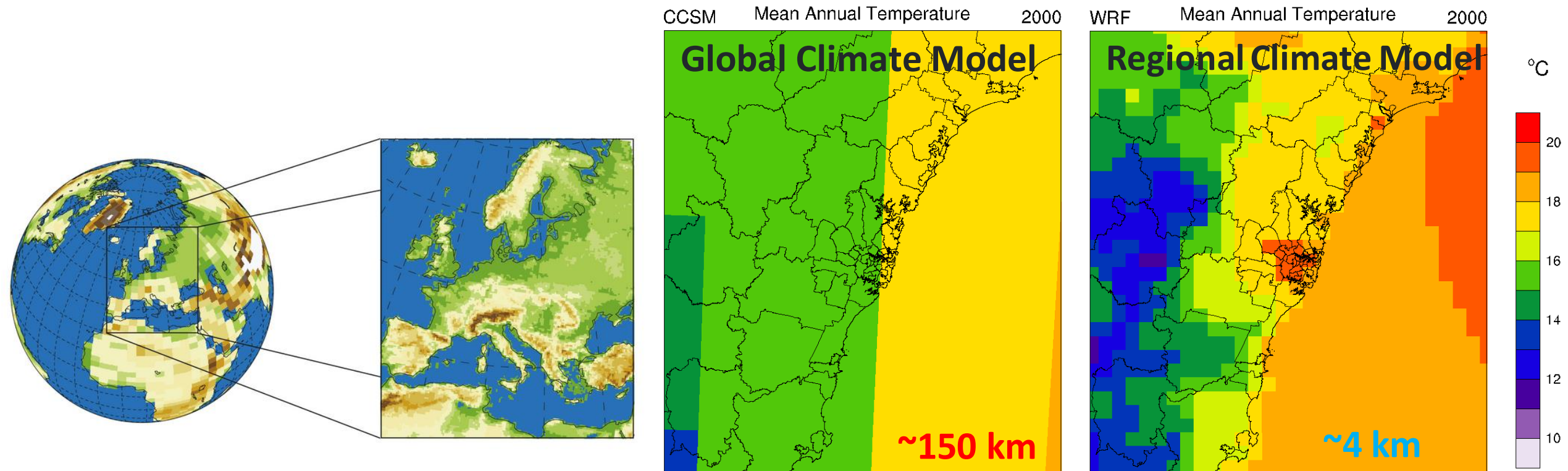
Giovanni Di Virgilio, Senior Team Leader & Principal Scientist

Climate Research, Climate and Atmospheric Science, SEID

2nd November 2022

Presentation Overview

1. Why NARCliM? Brief overview of NARCliM modelling

2. Introducing NARCliM2.0 next gen regional climate models

3. NARCliM2.0's improved simulation of the Australian climate: potential benefits to you

Why NARCliM?

CCSM Mean Annual Temperature 2000

Global Climate Model

~150 km

WRF Mean Annual Temperature 2000

Regional Climate Model

~4 km

°C

- ▪ Details of topography, land use and coasts can greatly affect local climate.
- ▪ These details cannot be resolved by Global Climate Models.
- ▪ Improved resolution + regional focus of Regional Climate Models enhances risk assessments, adaptation planning.

Overview of NARCliM Modelling
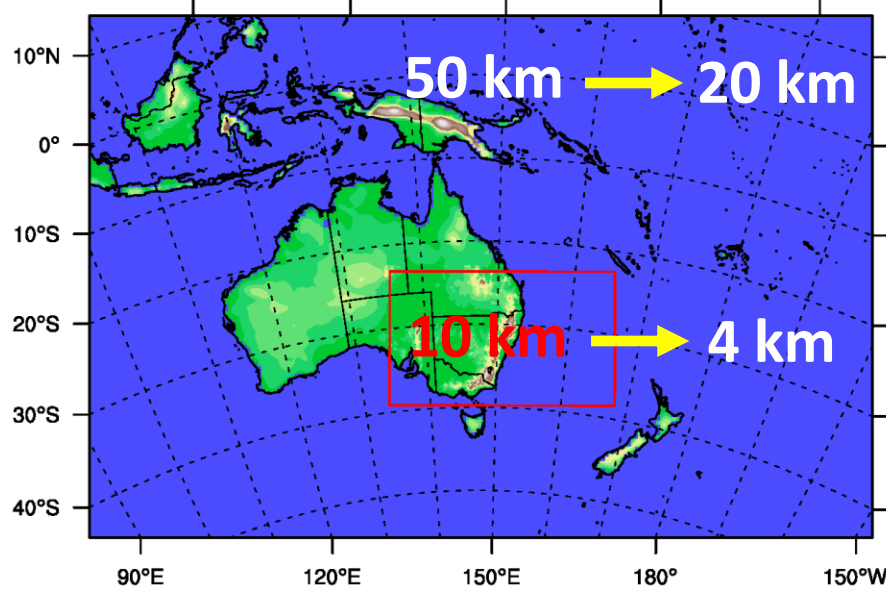
NSW GOVERNMENT

- NARCliM (NSW Australian Regional Climate Modelling): regional climate modelling projects: robust climate projections for impact assessment, planning.

- **Collaboration**: NSW DPE, UNSW, Murdoch University, ACT, SA, WA Governments.

Configuration	NARCliM1.0	NARCliM1.5	NARCliM2.0 Simulating Now
Release date	2014	2020	2023
Years simulated	1990 to 2009, 2020 to 2039, 2060 to 2079	1951 to 2100	1951 to 2100
Grid resolution of Australasia and NARCliM domains	50 km and 10 km	50 km and 10 km	**20 km and 4 km**
Vertical levels	30	30	**45**
Global climate models	4 CMIP3 GCMs: CGCM3.1, CSIRO-Mk3.0, ECHAM5, MIROC3.2	3 CMIP5 GCMs: ACCESS1.3, ACCESS1.0, CanESM2	**5-6 CMIP6 GCMs: ACCESS-ESM1-5 EC-Earth3-Veg NorESM2-MM MPI-ESM1-2-HR UK-ESM1-0-LL**
Regional climate models	3 RCMs per GCM (WRF3.3)	2 RCMs used in NARCliM1.0 (WRF3.6.0.5)	**2 NEW RCM configurations per GCM** (WRF4.1.2)
Future emission scenarios	SRES A2	RCP4.5 and RCP8.5	**SSP126** and **SSP370**
Reanalysis-driven simulations	NCEP: 1950 to 2009	ERA-Interim: 1979 to 2013	**ERA5**: 1979 to **2020**

NARClM2.0 User-centric Regional Climate Modelling Design
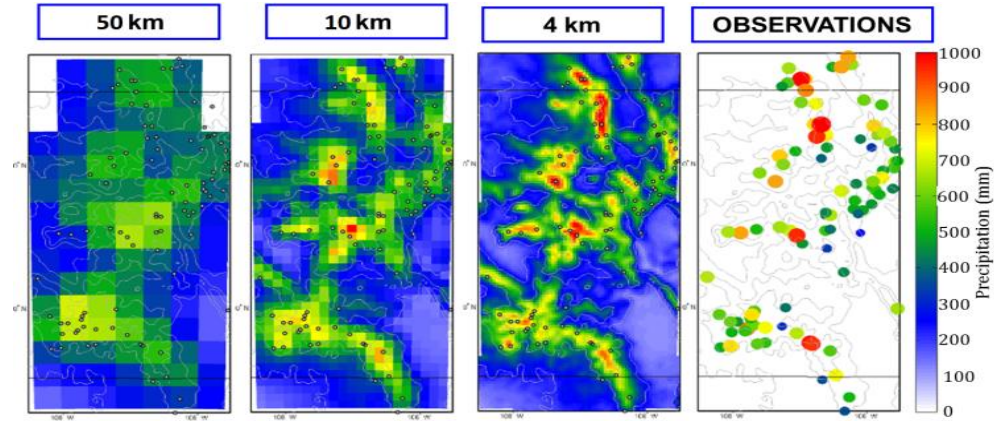
1. Higher resolution simulations

- Outer domain = **20 km** (versus 50 km)

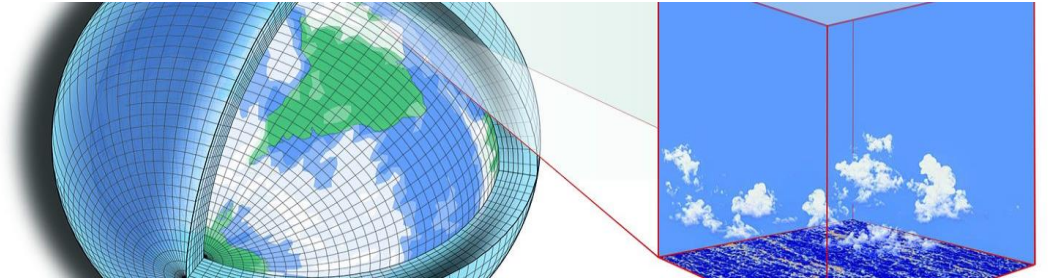- Inner domain = **4 km** (versus 10 km)

2. Improved simulation of precipitation, temperature

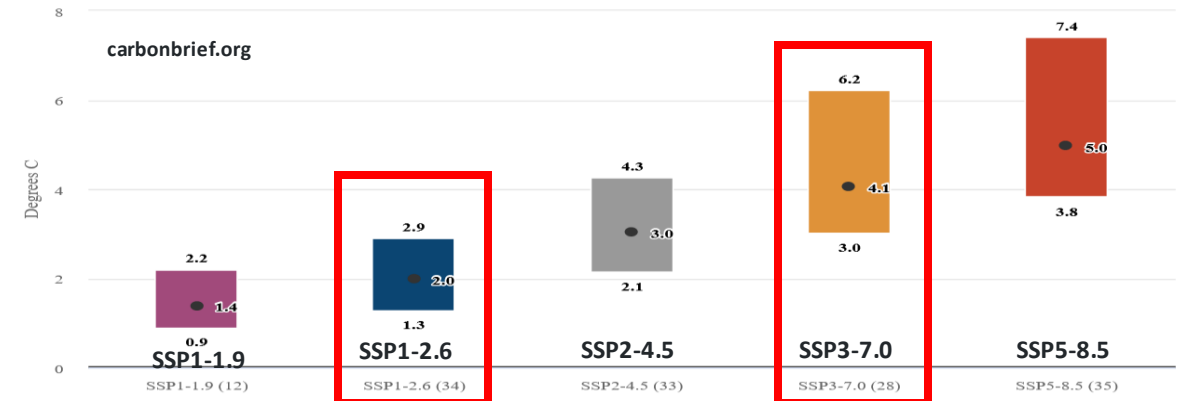## 3. Improved simulation of climate extremes, climate modes (e.g. El Nino, La Nina)

4. Capture the breadth of the climate change space


5. SSP-RCPs: SSP1.26, SSP3.70

Warming by scenario in current CMIP6 model runs
For currently available runs, from 1880-1900 to 2090-2100.

carbonbrief.org

One key challenge: robust scientific design e.g. selection of CMIP6 Global Climate Models to run NARCliM2.0 regional climate projections

CMIP6 Global Climate Models vary in performance; also good models are related: **unknown for Australia pre-NARCliM2.0** (Di Virgilio et al. 2022)

GCM Overall Score (lower is better)

6
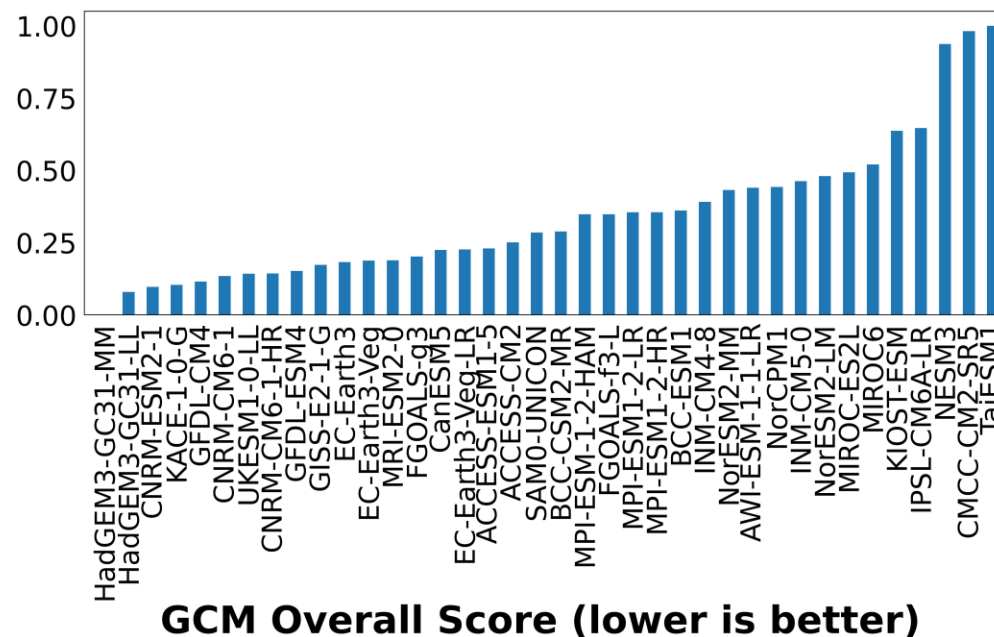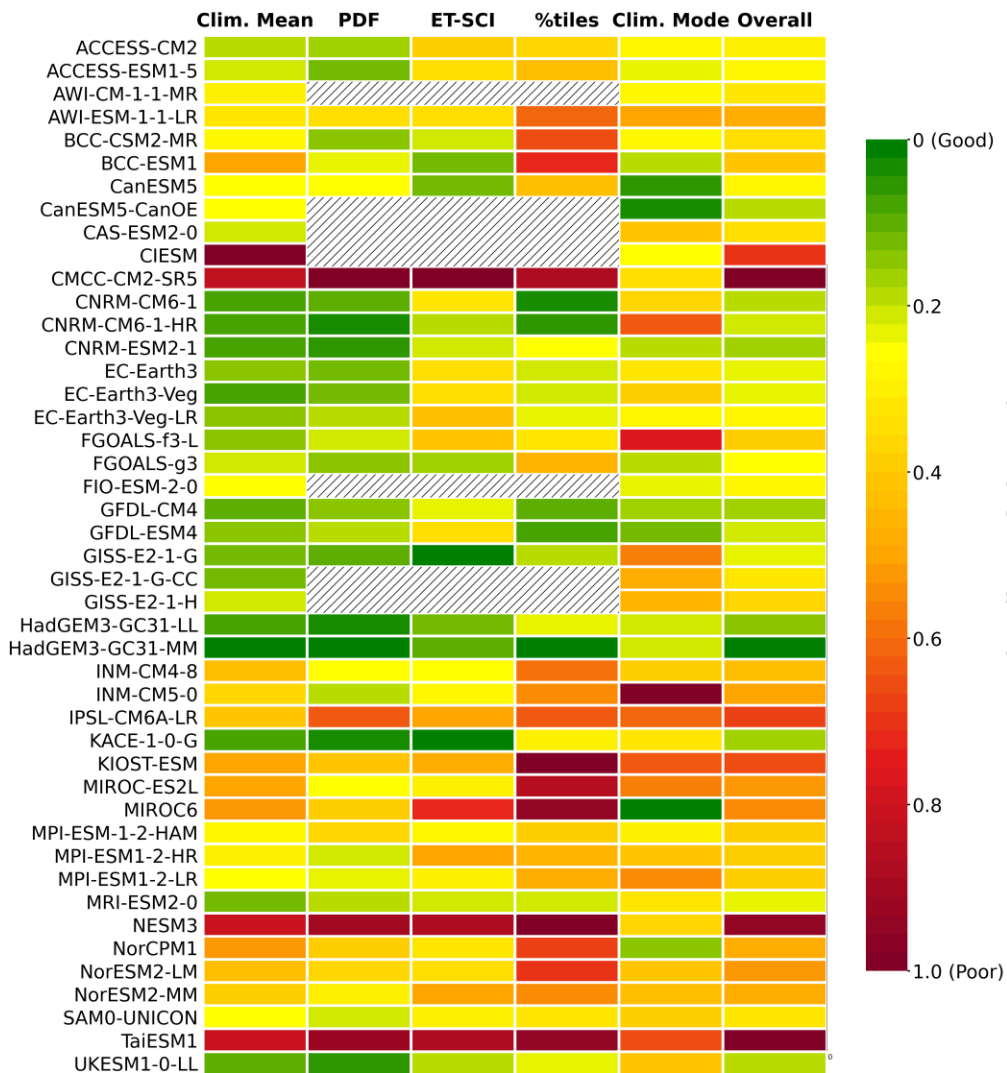
Shortlisted CMIP6 GCM Climate Change Signals & Independence
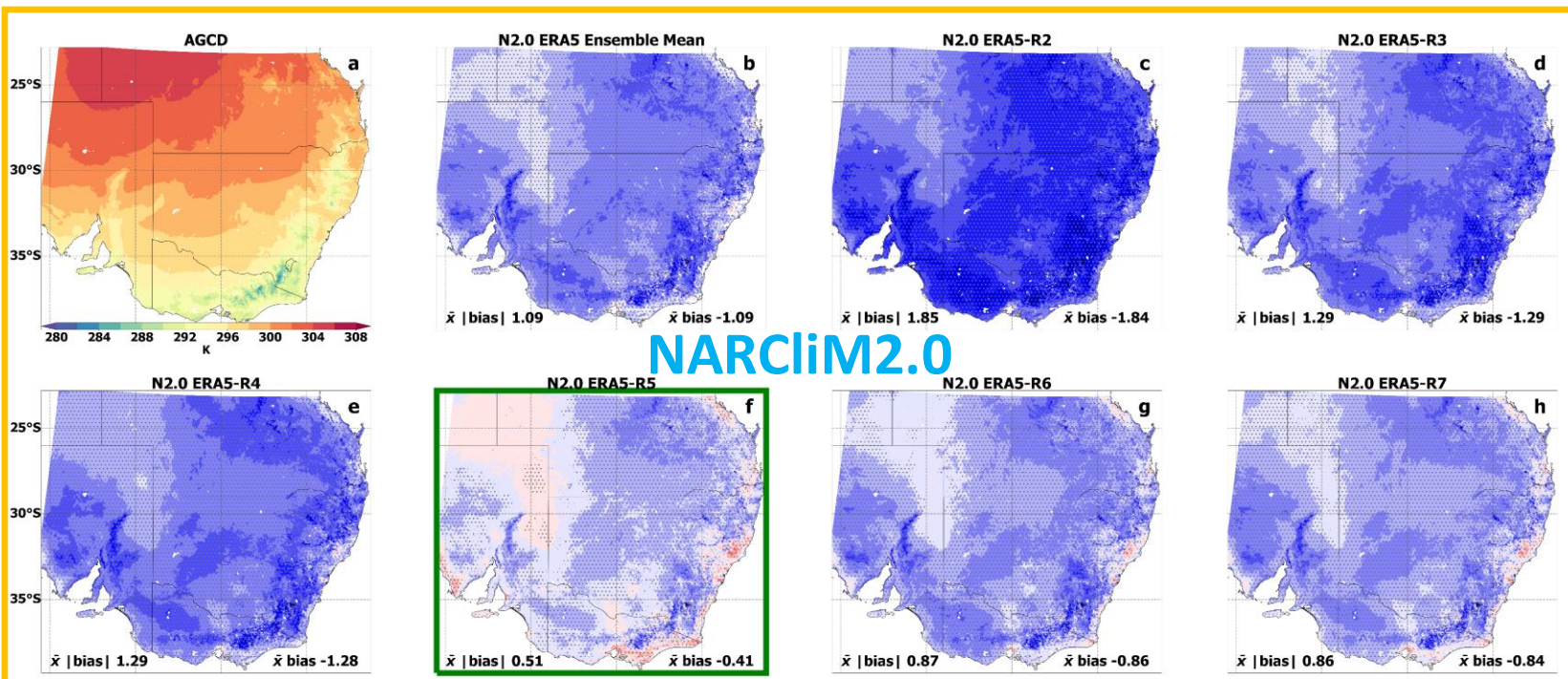

CMIP6 SSP370 climate change signals (Australia)
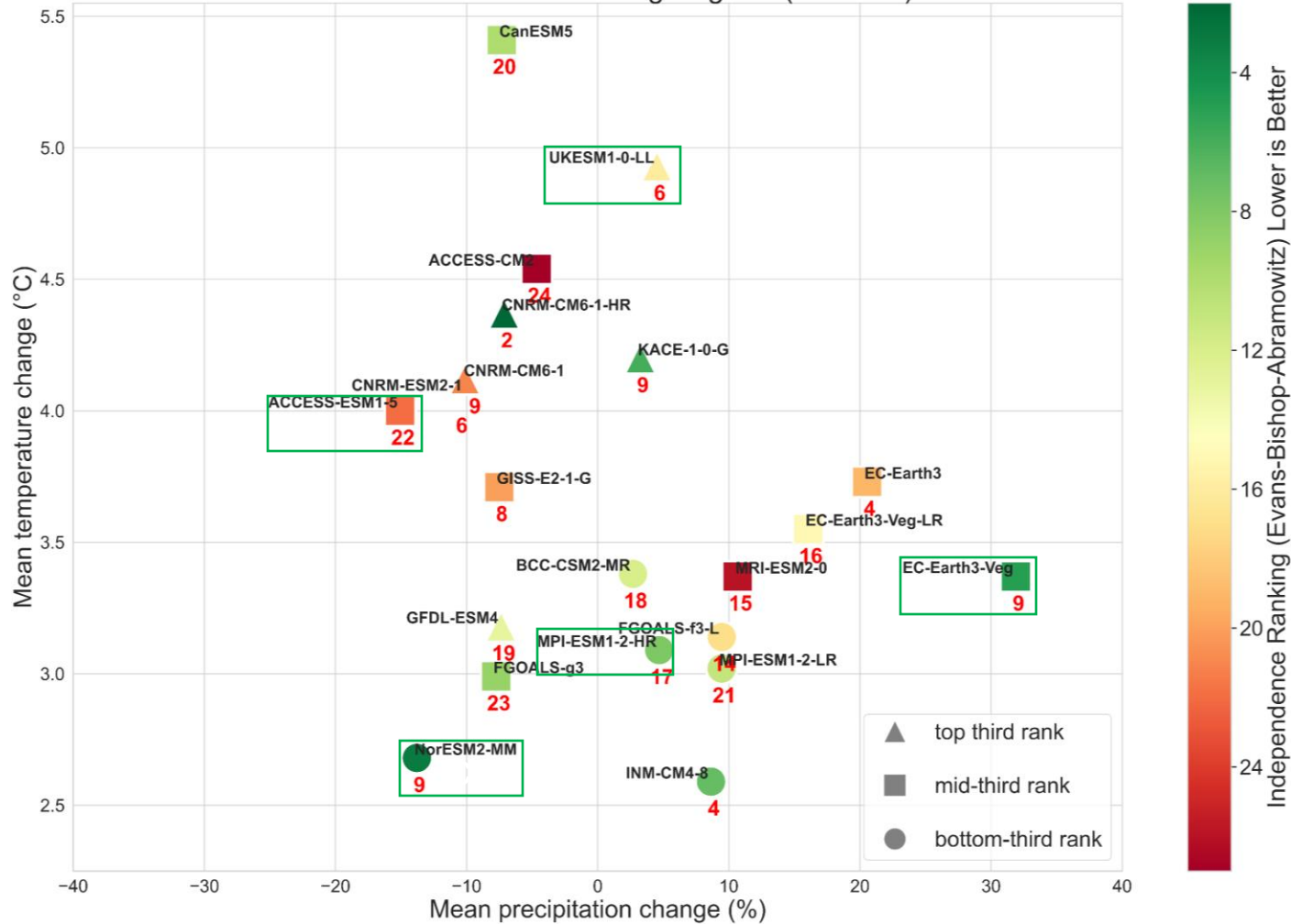
CMIP6 GCM evaluation:
I) GCM Accuracy
II) GCM Independence
III) Climate diversity

N2.0 CMIP6 evaluation published in:
Di Virgilio et al. 2022; *Earth's Future*

NARCliM2.0 Improved Simulation of Present-day Climate: Potential Benefits to End-users?
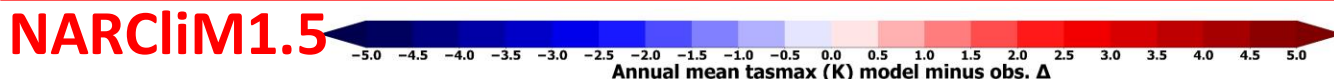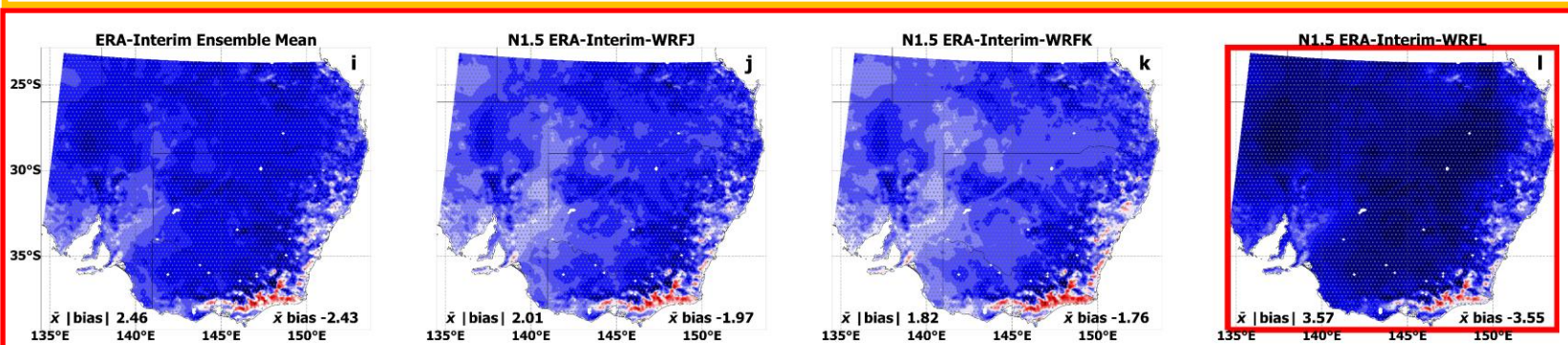

Improvements in the simulation of the Australian climate

- E.g. 75% improvement in simulation of maximum temperature

Practical outcome of that improvement?

- Maximum temperature has major socioeconomic impacts: enable enhanced climate risk planning

Concluding Remarks

Ensure Quality – finish NARCliM2.0 simulations: daily, continuous quality assurance / quality control of simulation outputs is vital – e.g. CMIP6 GCMs are new, **risks are high.**

Communications – comprehensive information to broad user spectrum, across government and society; build understanding on how to use NARCliM2.0 data effectively for climate impact /adaptation planning.

How can we help each other? – end-users need robust regional climate data: e.g. conservation planning, coastal zone management, flood: **only regional climate projections like NARCliM2.0 provide the local scale data needed for decision-making.**

Accessing NARCliM1.0 and NARCliM1.5 Data

Dr Giovanni Di Virgilio

Senior Team Leader & Principal Scientist

Climate and Atmospheric Science, NSW Department of Planning and Environment (NSW DPE)

John Spencer/DPE