



UNDERSTAND | ADAPT | TRANSITION

Queensland Future Climate

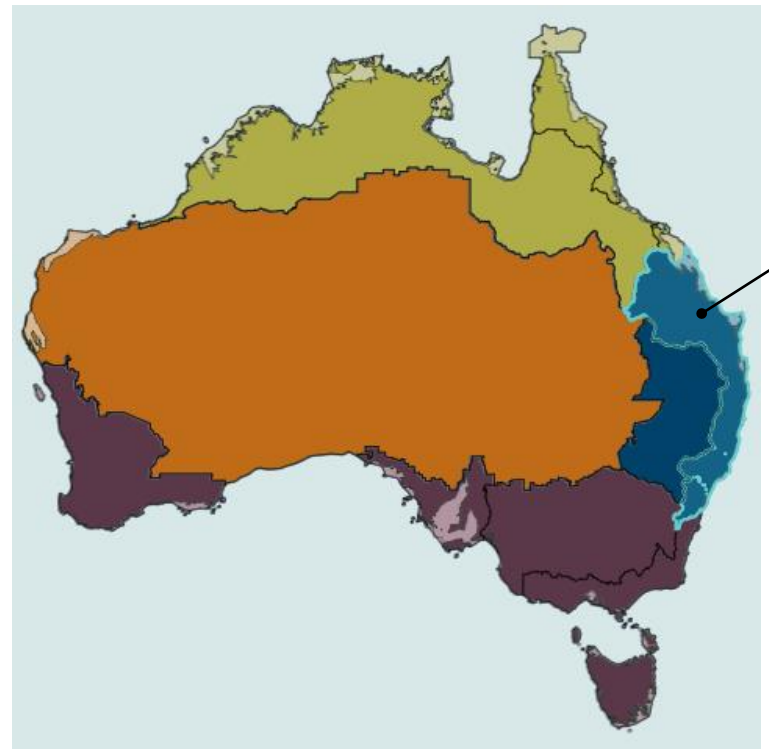
High-resolution climate projections in the Long Paddock

Dr Ralph Trancoso

A/P Jozef Syktus, Jacqui Willcocks, Dr Kenneth Wong, David Ahrens, Nathan Toombs

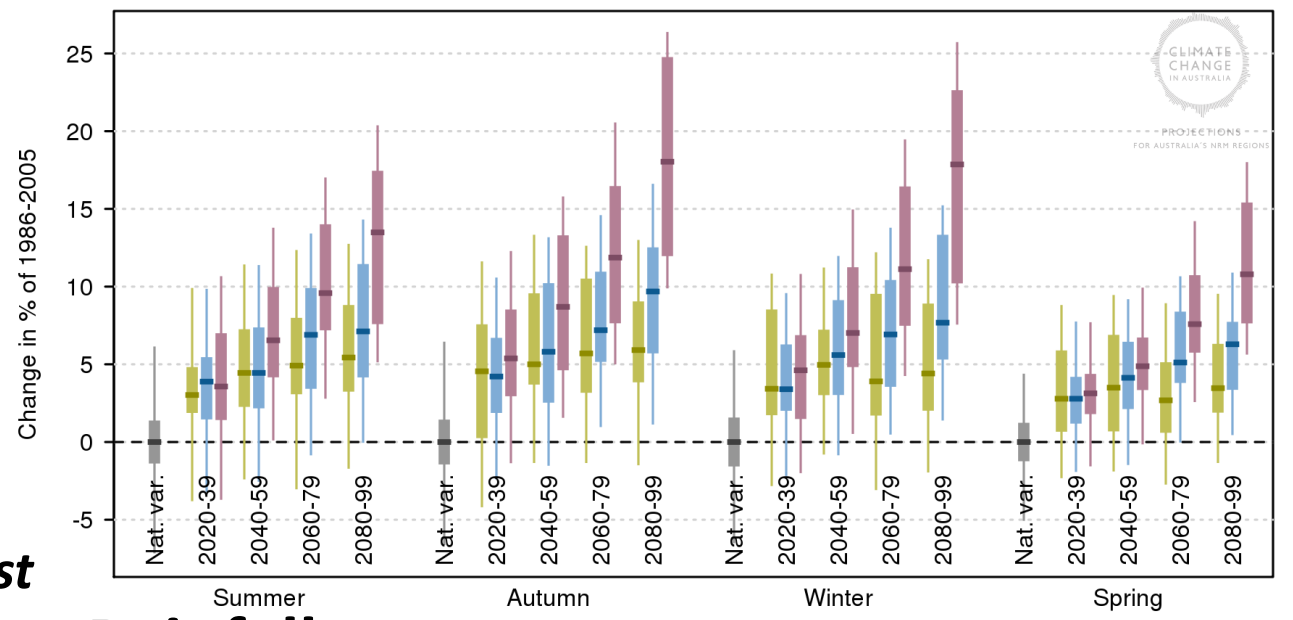


CLIMATE CHANGE IN AUSTRALIA PROJECTIONS FOR AUSTRALIA'S NRM REGIONS

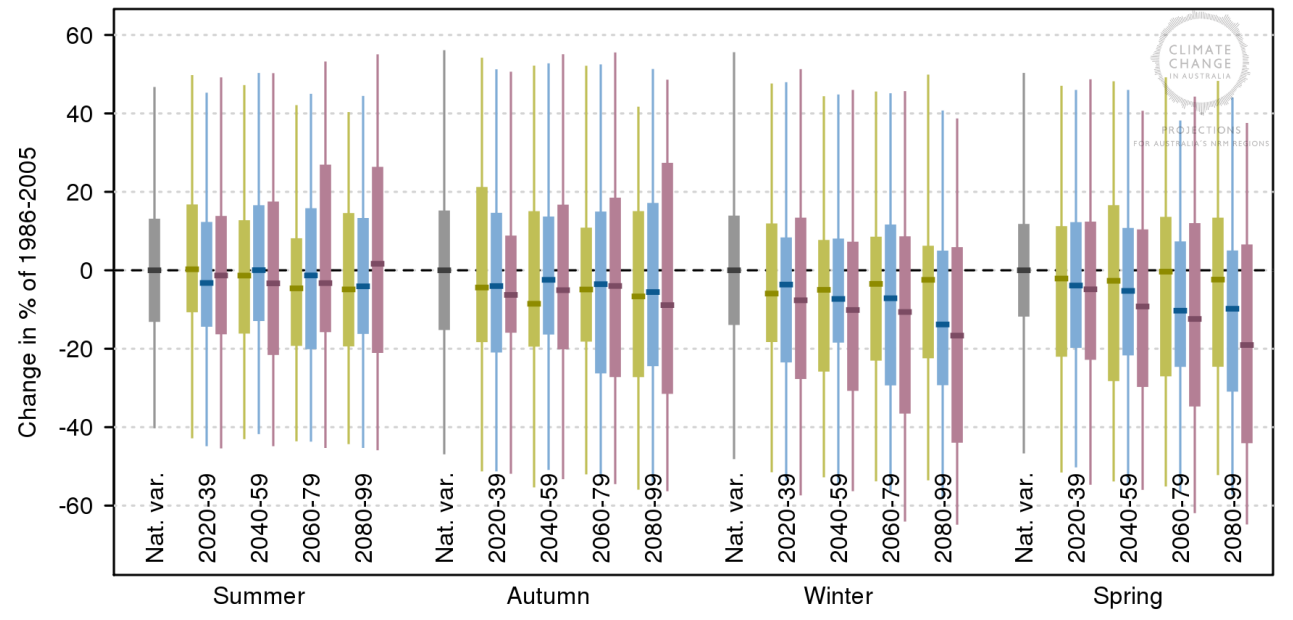


East Coast

Temperature

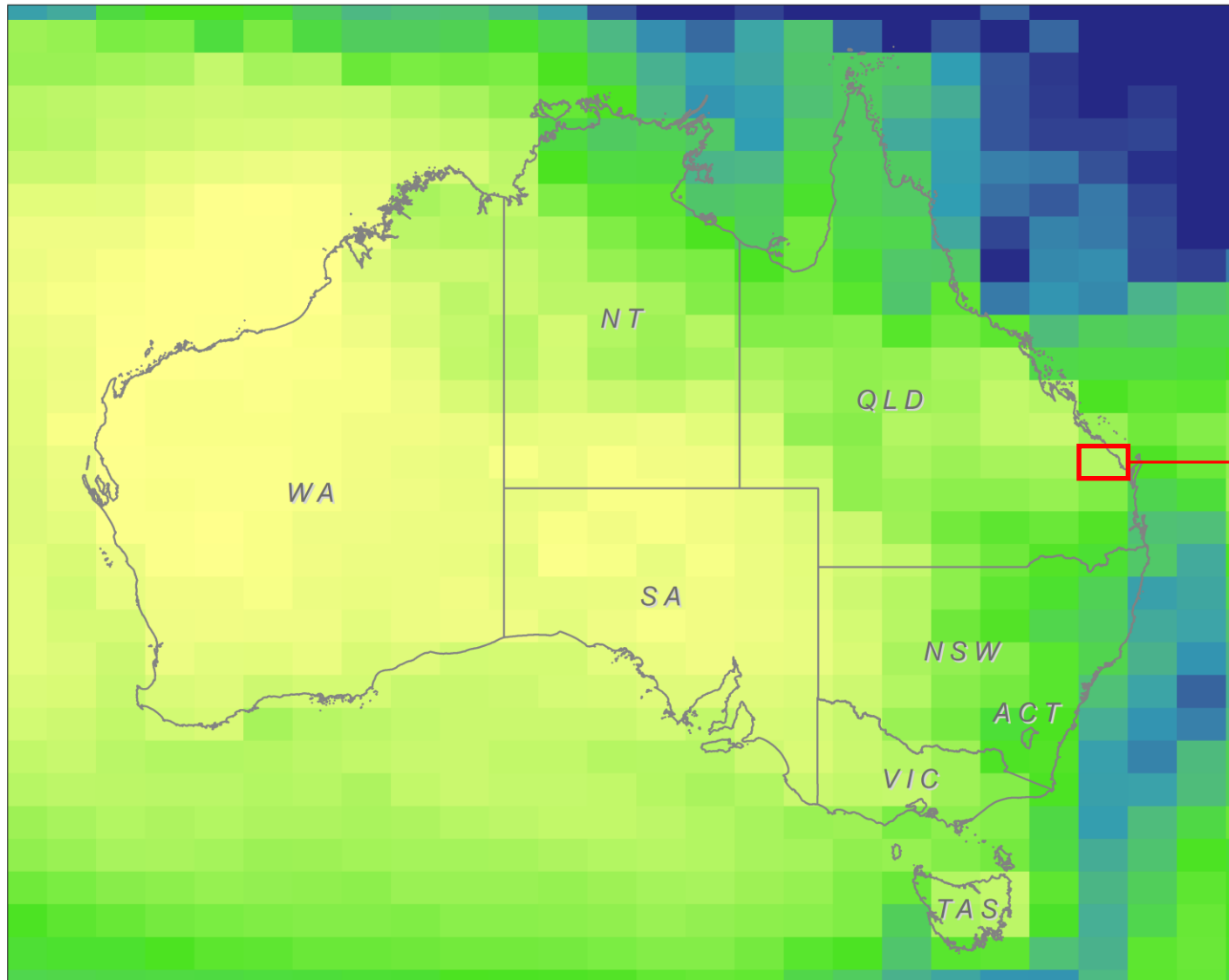


Rainfall



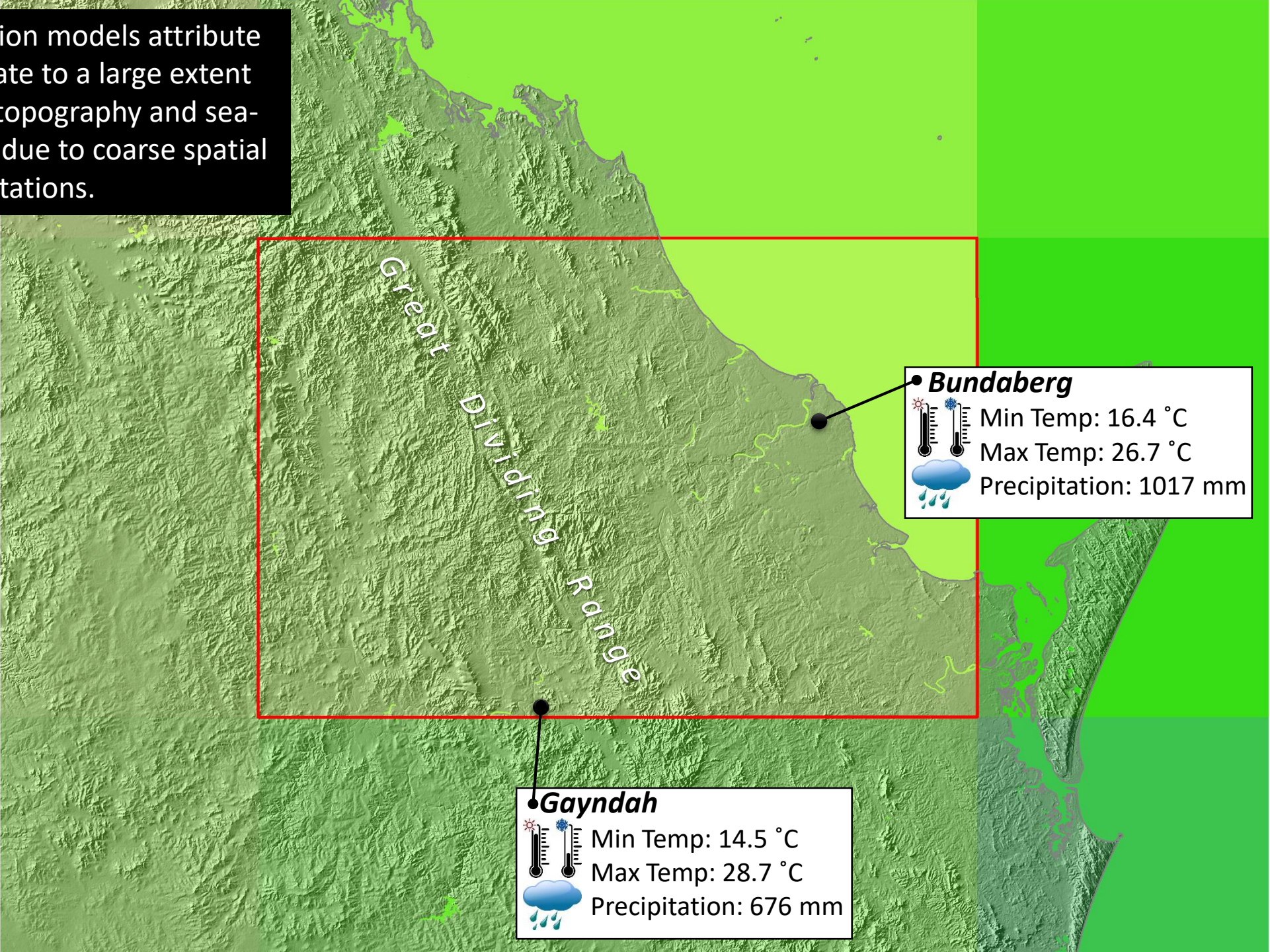
RCP2.6 (Green), RCP4.5 (blue) and RCP8.5 (purple)

Why high-resolution climate projections?



• **What's in the pixel?**

Global circulation models attribute the same climate to a large extent ignoring local topography and sea-land contrasts due to coarse spatial resolution limitations.



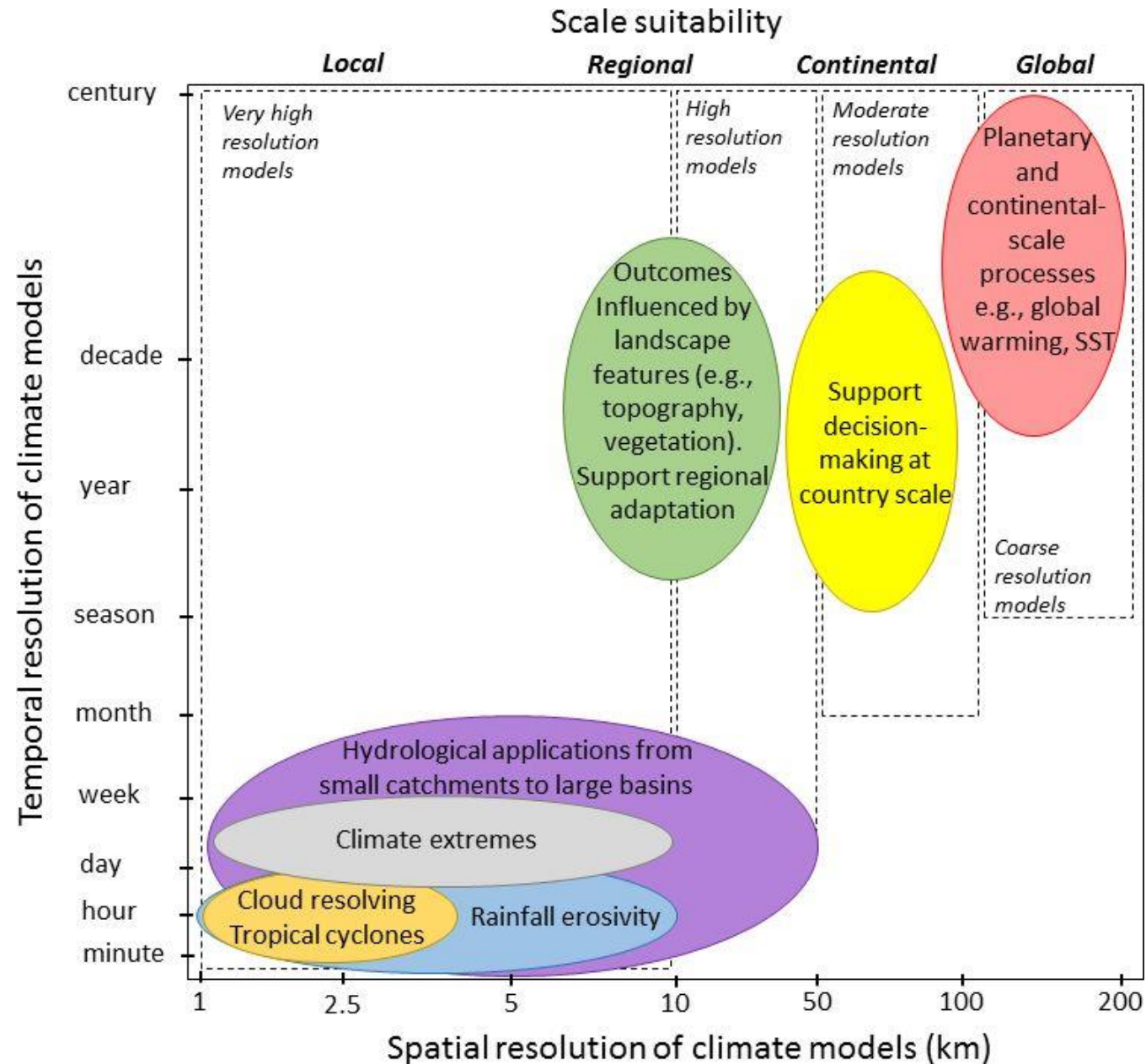
Bundaberg

Min Temp: 16.4 °C
Max Temp: 26.7 °C
Precipitation: 1017 mm

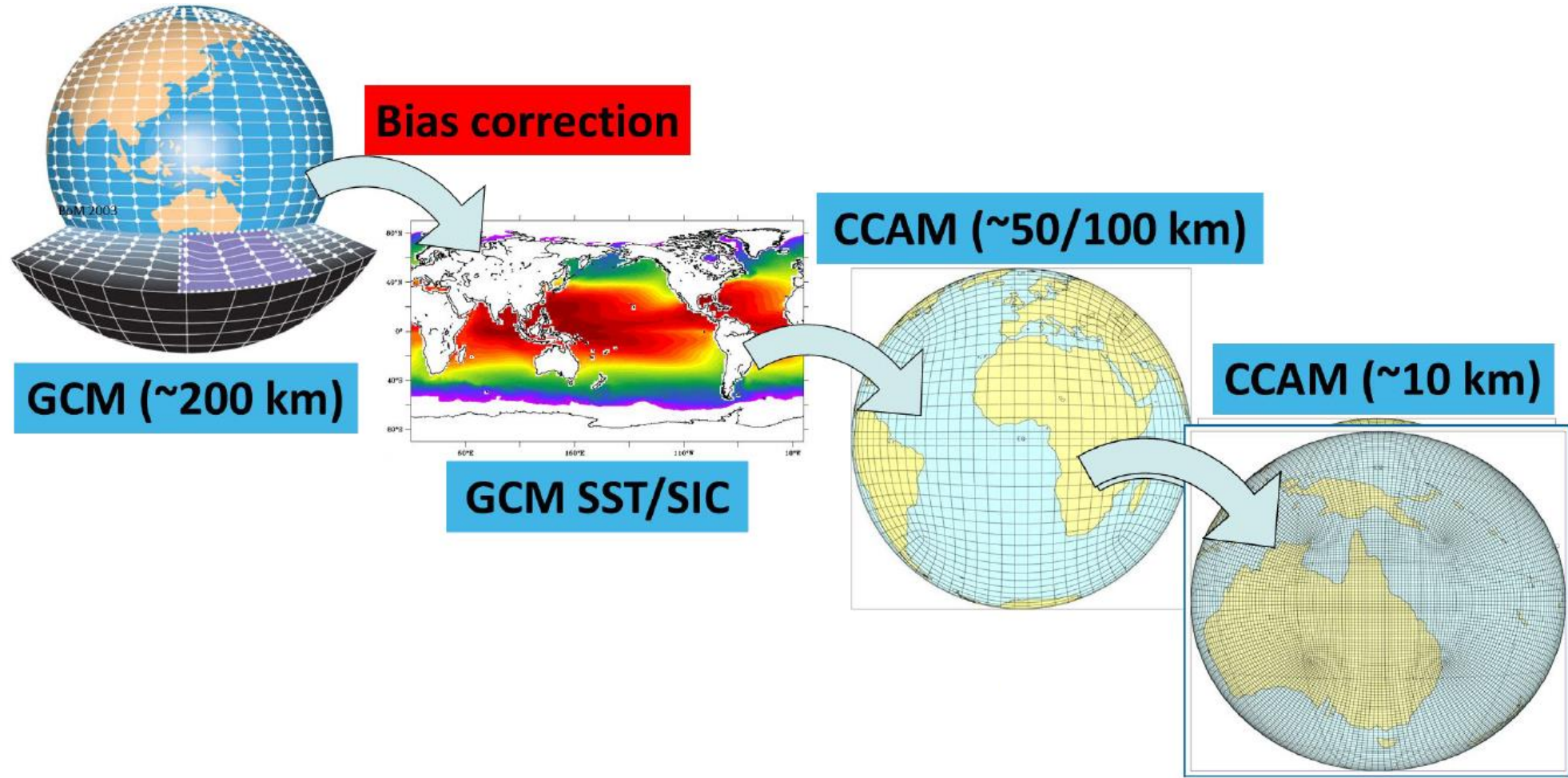
Gayndah

Min Temp: 14.5 °C
Max Temp: 28.7 °C
Precipitation: 676 mm

Why high-resolution climate projections?



Dynamically downscale of 11 CMIP5 models using CCAM

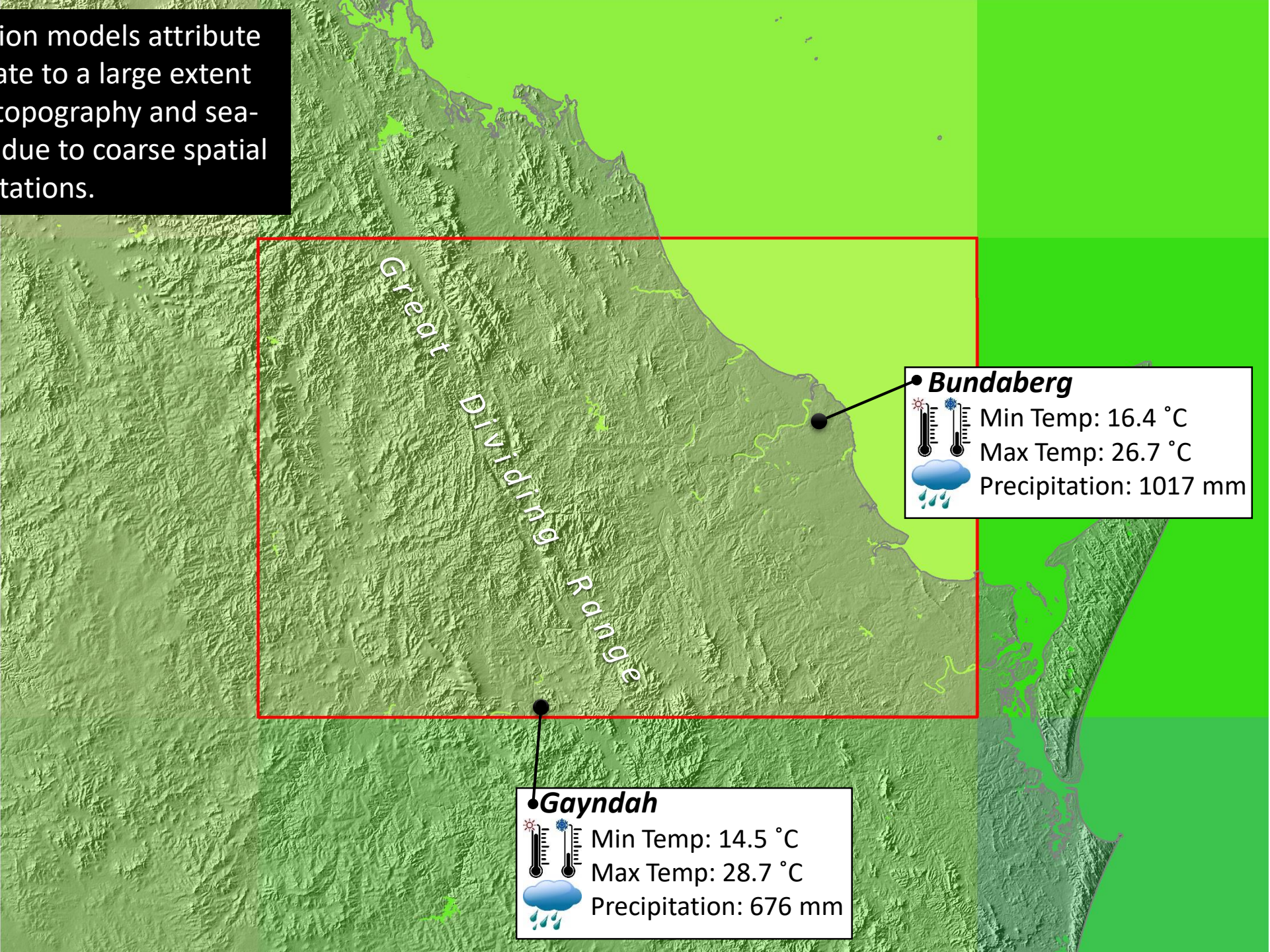


Dynamically downscale of 11 CMIP5 models using CCAM

CMIP5 model	Model name	Institution Name(s)	Country of origin
ACCESS1-0	Australian Community Climate and Earth-System Simulator, version 1.0	CSIRO & BoM	Australia
ACCESS1-3	Australian Community Climate and Earth-System Simulator, version 1.3	CSIRO & BoM	Australia
CCSM4	Community Climate System Model, version 4	NCAR	USA
CNRM-CM5	Centre National de Recherches Météorologiques Coupled Global Climate Model, version 5	CNRM-CERFACS	France
CSIRO-Mk3.6	Commonwealth Scientific and Industrial Research Organisation Mark 3.6.0	CSIRO & Qld Govt	Australia
GFDL-CM3	Geophysical Fluid Dynamics Laboratory Climate Model, version 3	GFDL NOAA	USA
GFDL-ESM2M	Geophysical Fluid Dynamics Laboratory Earth System Model with Modular Ocean Model, version 4 component	GFDL NOAA	USA
HadGEM2	Hadley Centre Global Environment Model, version 2	Met Office Hadley Centre	UK
MIROC5	Model for Interdisciplinary Research on Climate, version 5	AORI Japan	Japan
MPI-ESM-LR	Max Planck Institute Earth System Model, low resolution	Max Planck Institute	Germany
NorESM1-M	Norwegian Earth System Model, version 1 (intermediate resolution)	Norwegian Climate Centre	Norway

<https://app.longpaddock.qld.gov.au/climateFacts/>

Global circulation models attribute the same climate to a large extent ignoring local topography and sea-land contrasts due to coarse spatial resolution limitations.



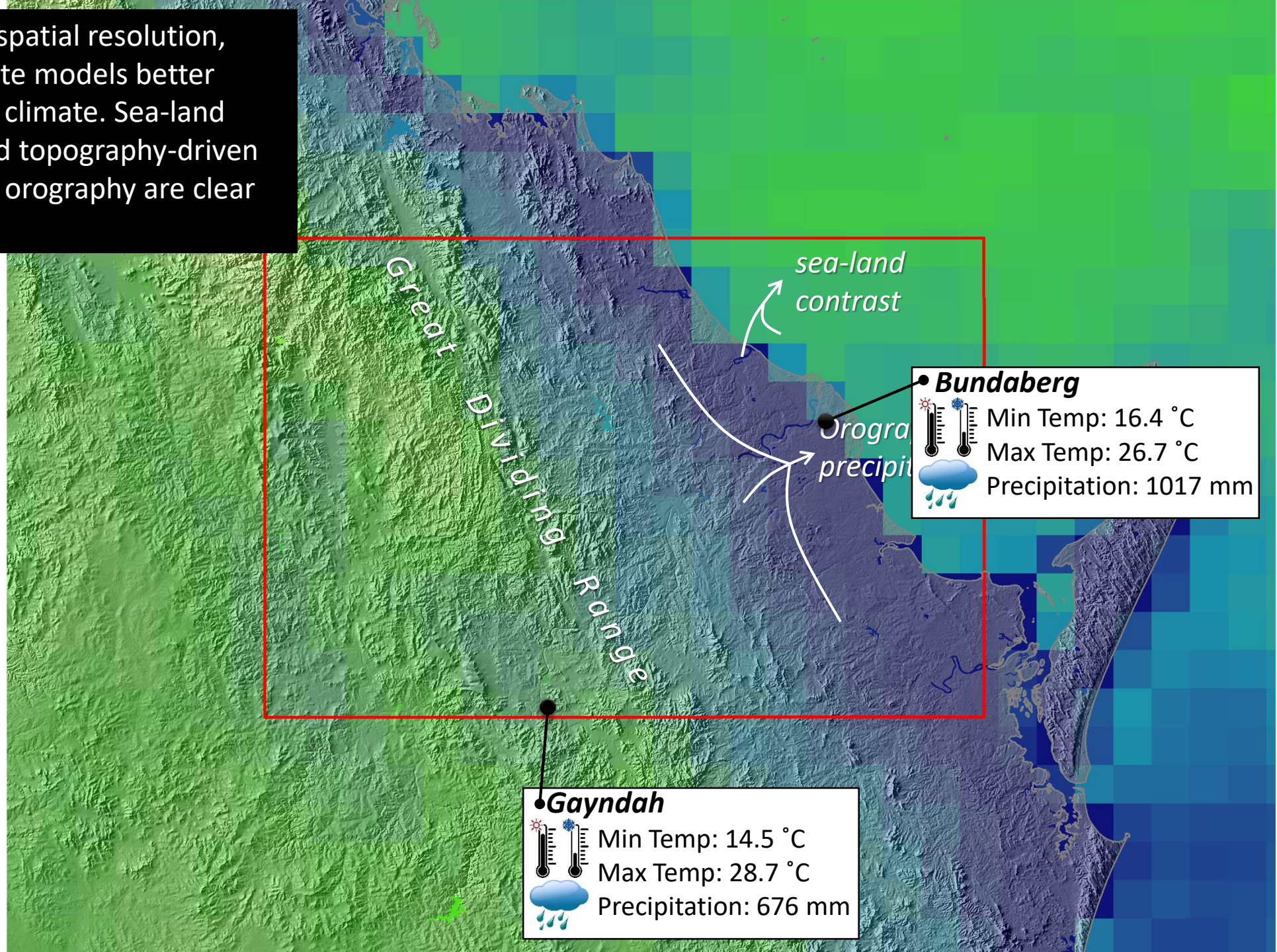
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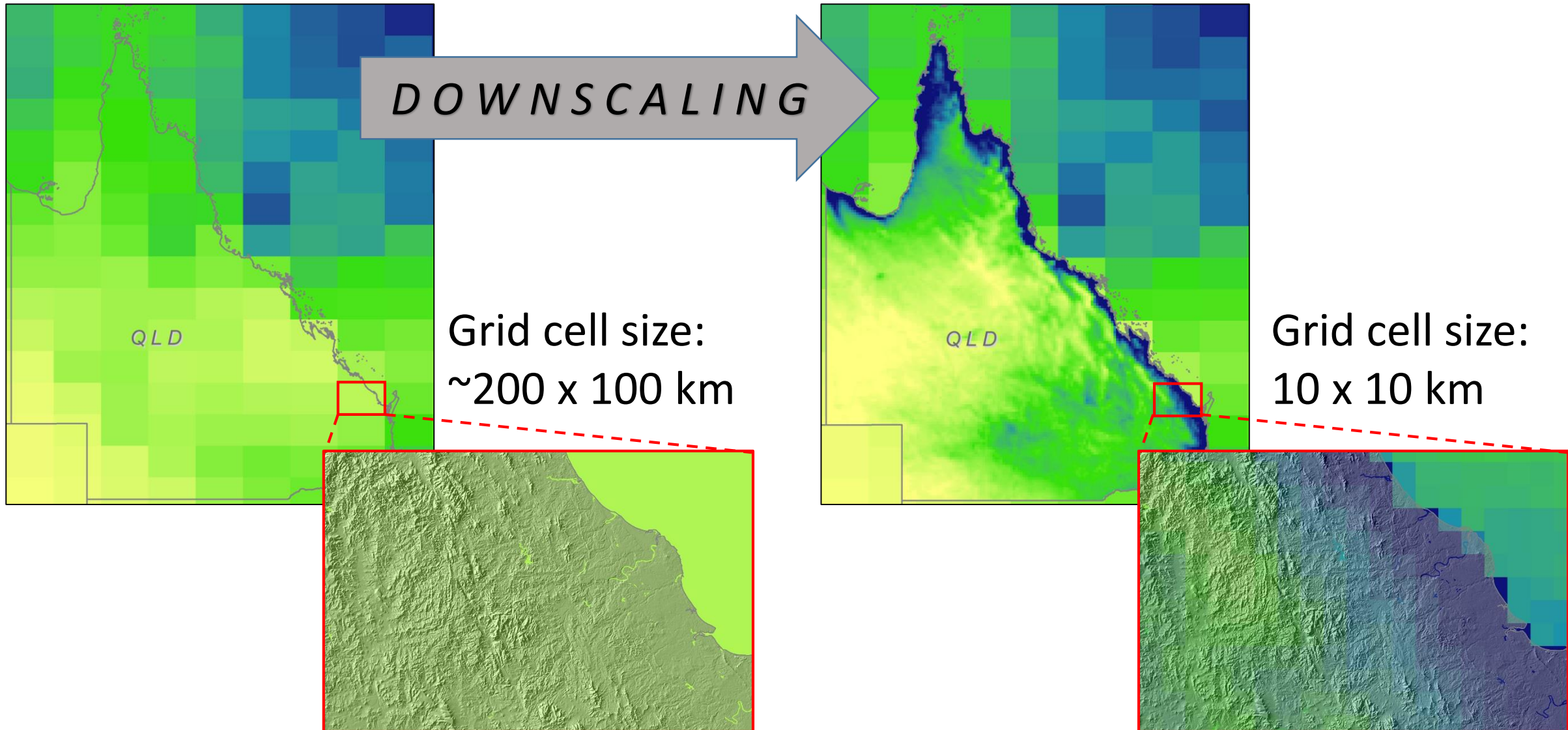
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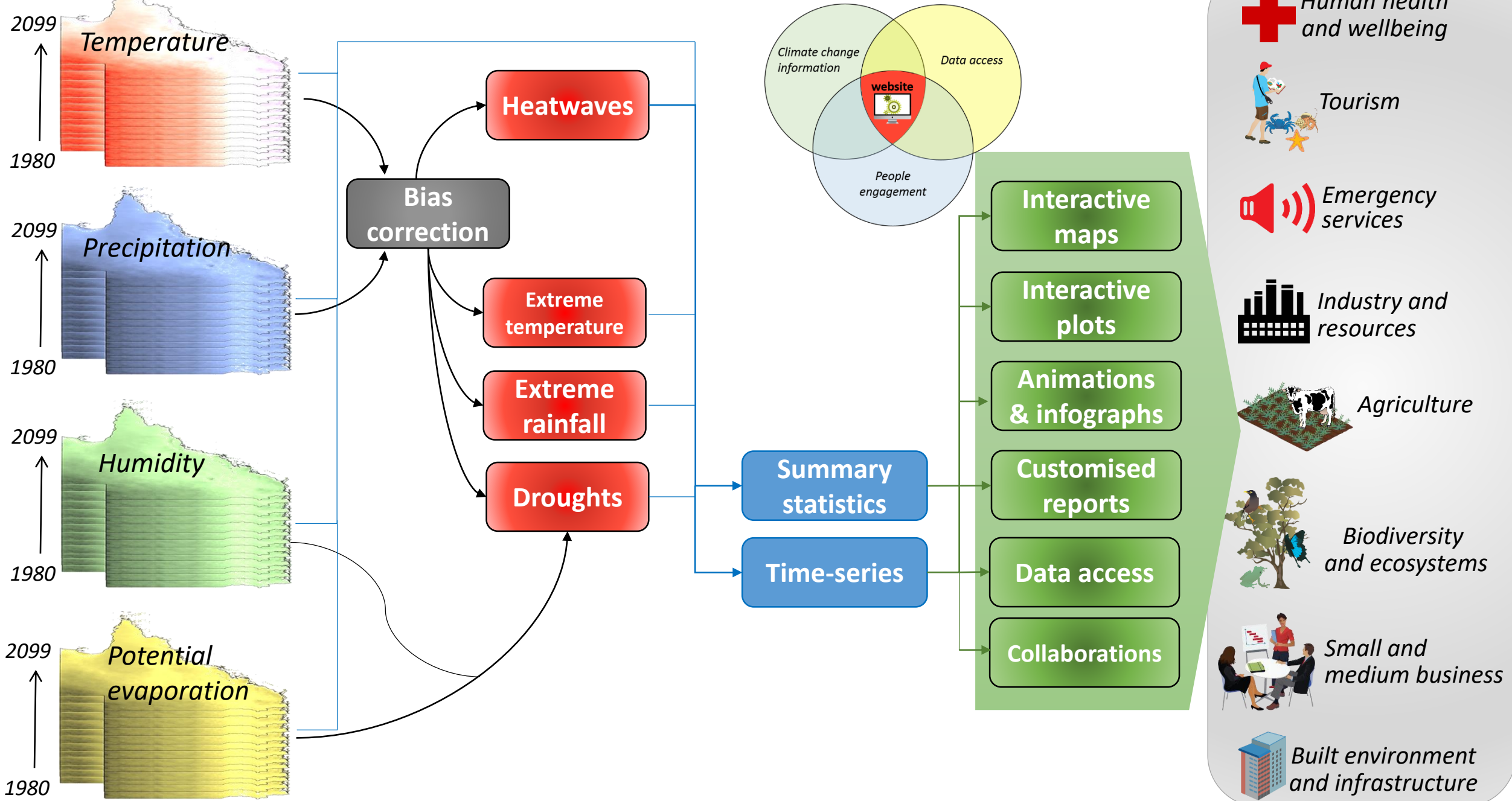
By improving spatial resolution, regional climate models better simulate local climate. Sea-land distinction and topography-driven processes like orography are clear advantages.



Improved representation of climate features such as coast-inland rainfall gradients and land-sea contrasts



Bridging the gap between regional projections and policy needs



Queensland Future Climate Dashboard

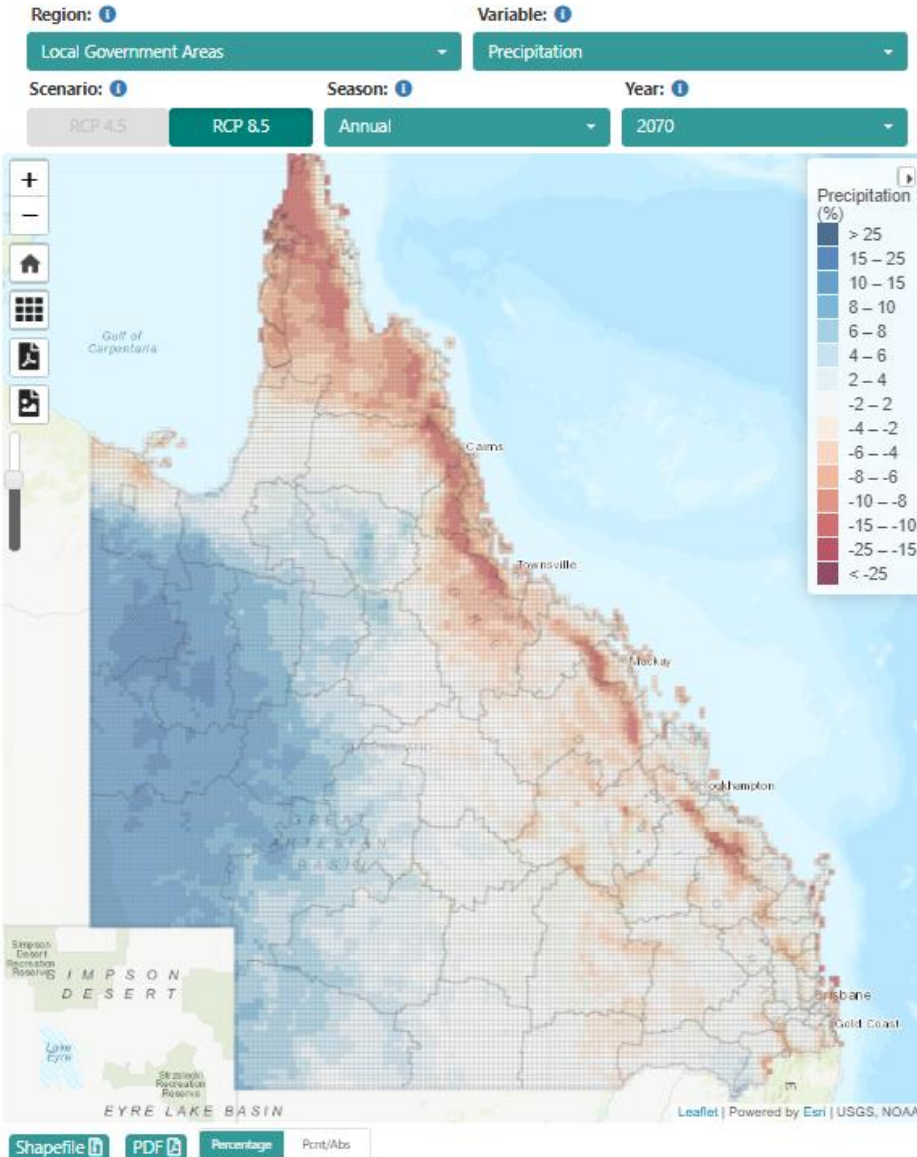
- Fully interactive online platform providing climate change simulations at regional scale;
- 6 climate themes;
- 32 variables;
- Calendar seasons as well as wet, dry and annual periods.

Queensland Future Climate Dashboard

More... >

[Mean Climate](#)
[Heatwaves](#)
[Extreme temperature indices](#)
[Extreme precipitation indices](#)
[SPI-drought indices](#)
[SPI-flood indices](#)

Queensland's climate is highly variable in space and time, ranging spatially from the wet tropics to savanna woodlands and arid deserts. The State is impacted with episodic droughts, floods and tropical cyclones. Droughts may persist for a number of years. Rainfall variability occurs at interannual, quasi-decadal, multi-decadal and centennial time scales. Understanding our climate variability and likely future climate change is crucial for adaptation and preparedness.

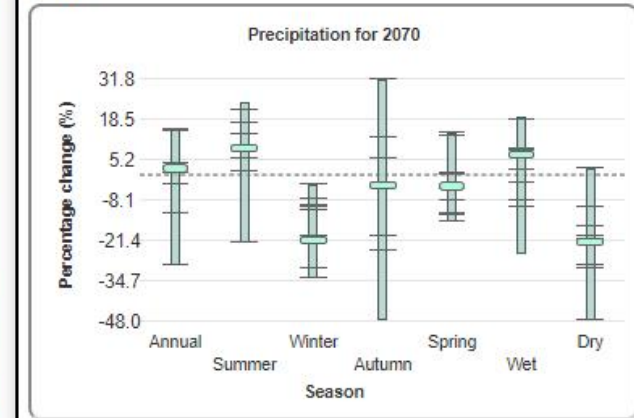


Local Government Areas
Qld

[Qld](#)
[Mean](#)
[Range](#)
[Models](#)

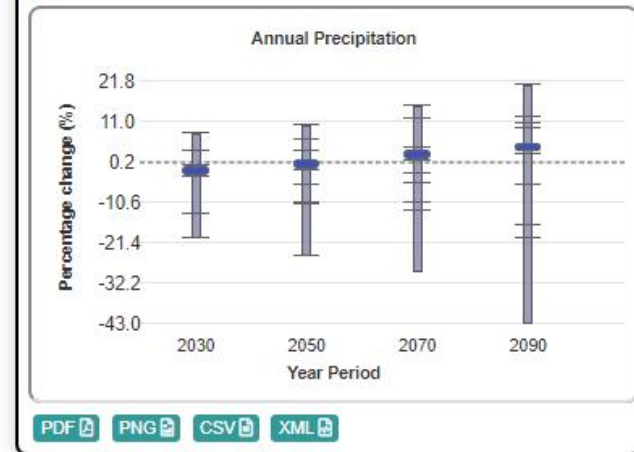
Changes across seasons for Queensland

Long-term state-wide changes in relation to reference period (1986-2005) across seasons



Changes over time for Queensland

Long-term state-wide changes in relation to reference period (1986-2005) over time



Queensland Future Climate Dashboard

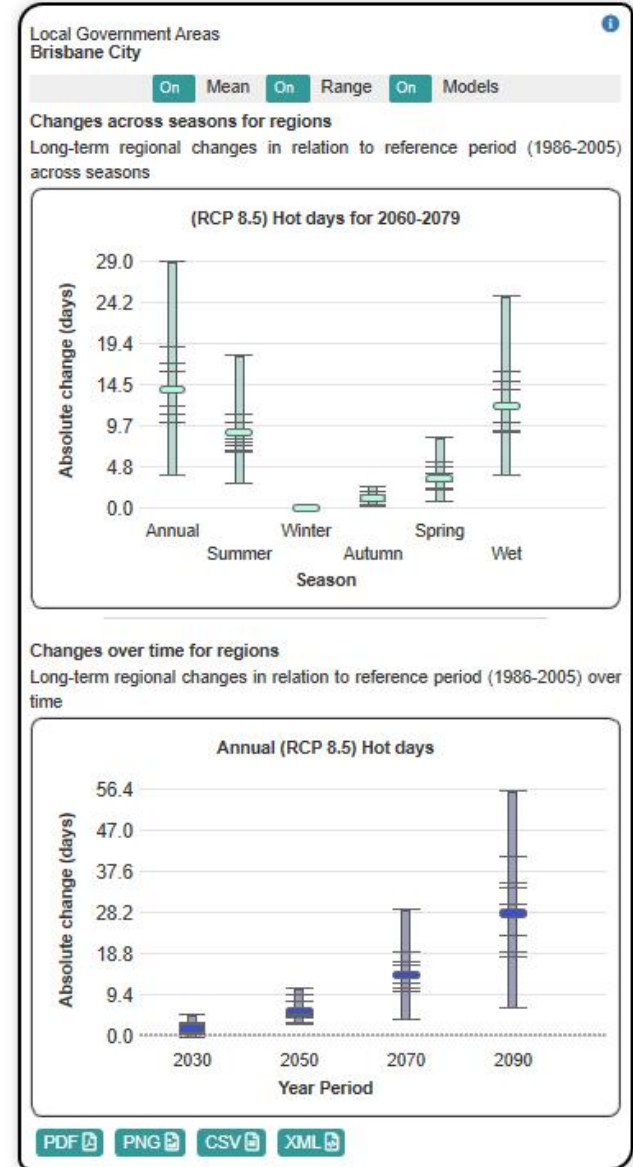
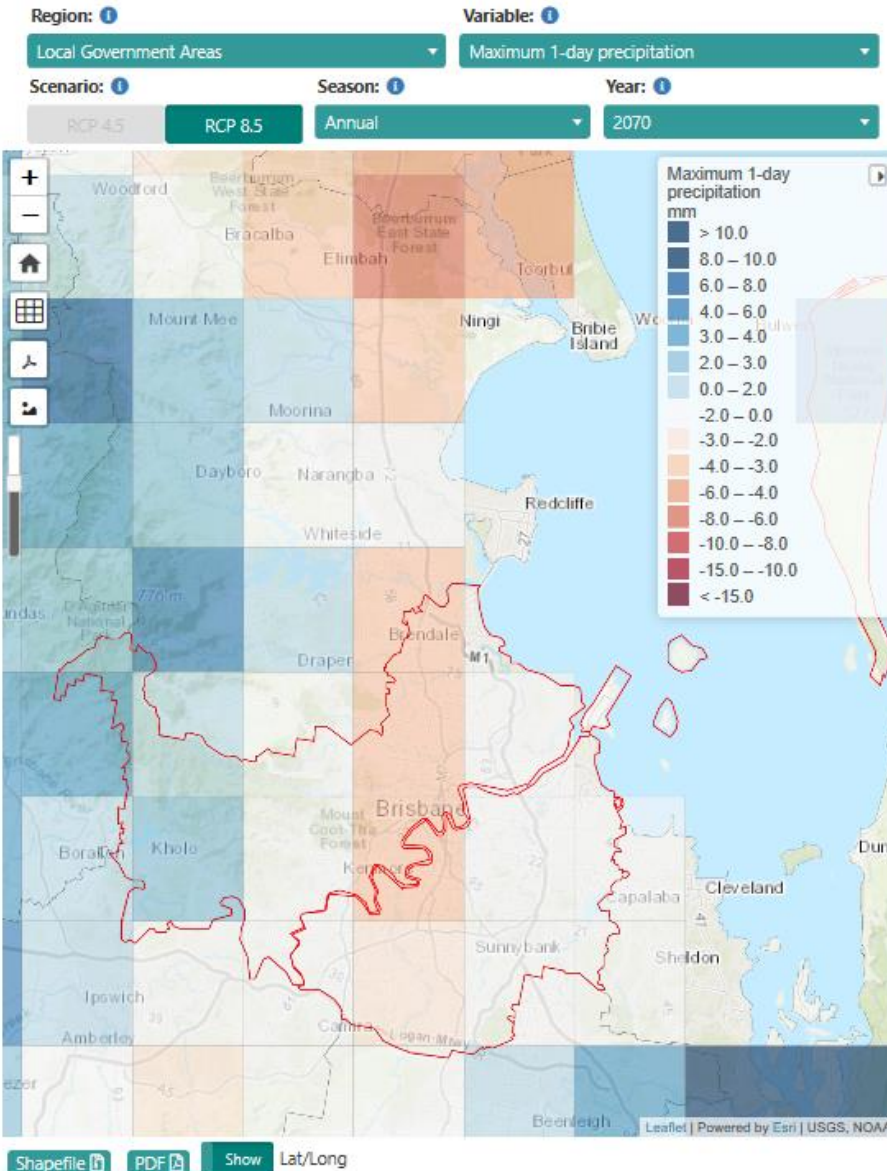
- Regionalised high-resolution climate change projections for LGAs + 4 other regional divisions;
- Support to local and regional planning, biodiversity and water management and emergency services

Queensland Future Climate Dashboard

More... »



Extreme precipitation indices are meaningful tools used by scientific community to understand changes and variability in water supply over time. The indices offer insights to inform water management, agriculture and emergency services.



Queensland Future Climate Dashboard

- Check our climate projections for your region:

<https://app.longpaddock.qld.gov.au/dashboard>

- RCP 4.5 coming soon – stay tuned!

Queensland Future Climate Dashboard

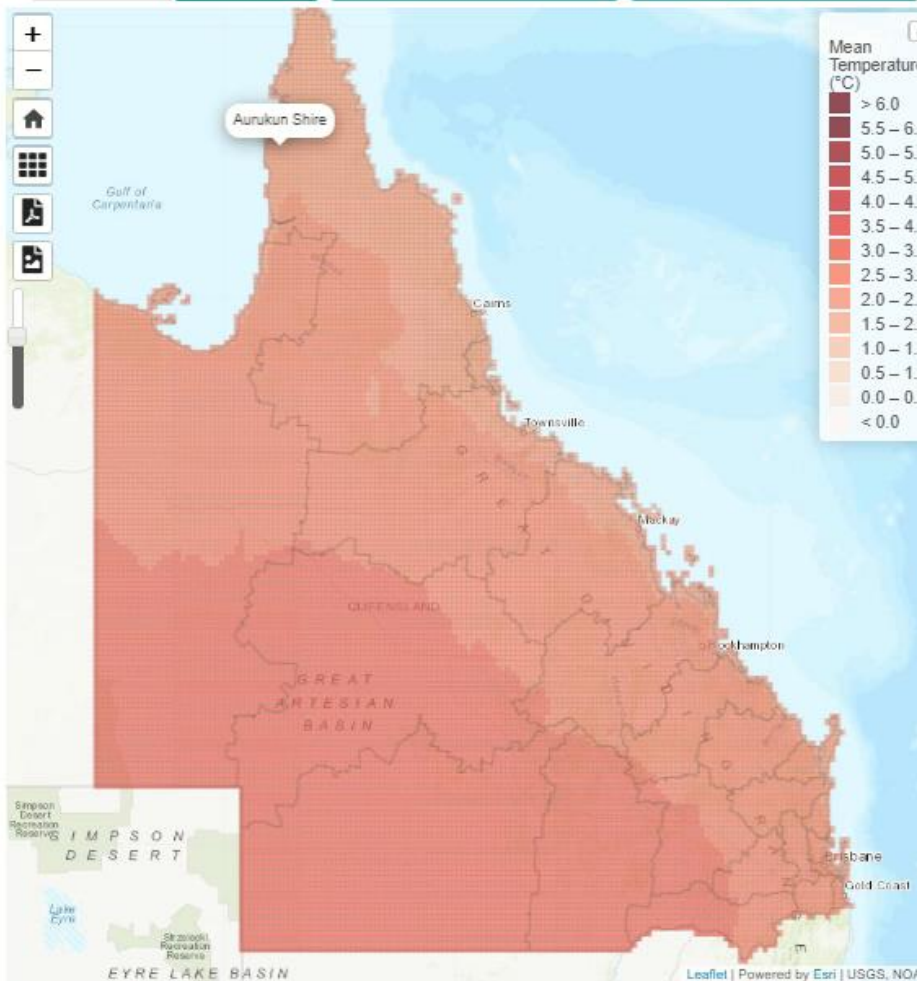
More... »

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Queensland's climate is highly variable in space and time, ranging spatially from the wet tropics to savanna woodlands and arid deserts. The State is impacted with episodic droughts, floods and tropical cyclones. Droughts may persist for a number of years. Rainfall variability occurs at interannual, quasi-decadal, multi-decadal and centennial time scales. Understanding our climate variability and likely future climate change is crucial for adaptation and preparedness.

Region: **Disaster Districts**
 Variable: **Mean Temperature**

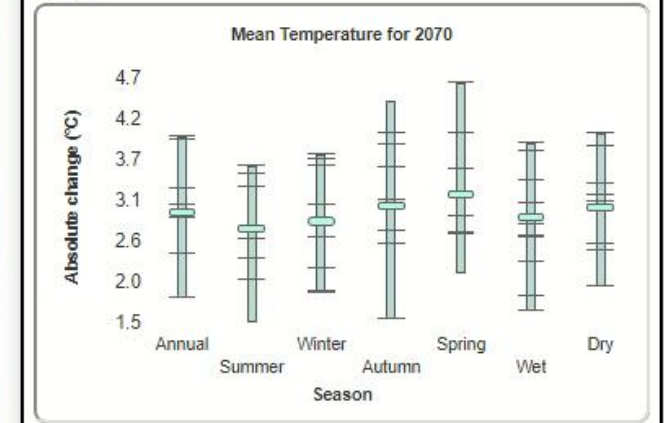
Scenario: **RCP 8.5**
 Season: **Annual**
 Year: **2070**



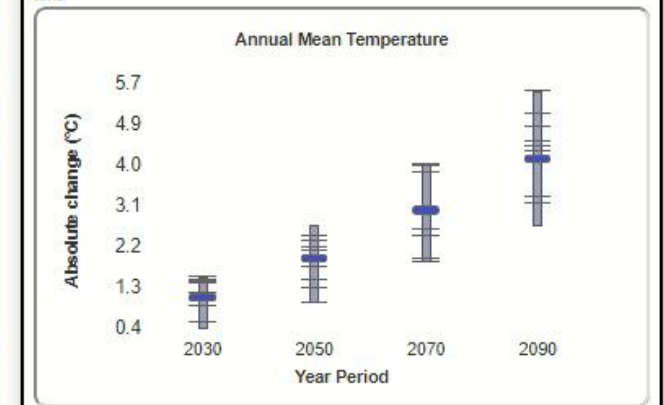
Disaster Districts Qld

Mean
 Range
 Models

Changes across seasons for Queensland
Long-term state-wide changes in relation to reference period (1986-2005) across seasons



Changes over time for Queensland
Long-term state-wide changes in relation to reference period (1986-2005) over time



[PDF](#)
[PNG](#)
[CSV](#)
[XML](#)

Access to high-resolution gridded data

Queensland Future Climate

[Home](#) / [Queensland Future Climate](#) / [Data and Information](#) / High Resolution Projections Data

High Resolution Projections Data

High-resolution climate change projections for Queensland using dynamical downscaling of CMIP5 global climate models forced under Representative Concentration Pathway 8.5 (RCP8.5), is available for download in gridded format with spatial resolution of 10 km at [Terrestrial Ecosystem Research Network \(TERN\)](#).

The future climate projections in high temporal resolution (e.g., daily scale) was aggregated into annual time-series (termed "seas_avg") as well as sixteen 20-year time-slices with changes in relation to reference period 1886-2005 (as absolute change and percentage change, termed "abs-change" and "percent-change" respectively). The data are available for calendar seasons – i.e., summer (December, January and February), autumn (March, April and May), winter (June, July and August) and spring (September, October and November). In addition, we also provide aggregated information for wet (November to April) and dry (May to October) periods as well as at annual basis. Modelled climatologies for the reference period 1986-2005 are also available (termed "climatologies").

The eleven downscaled Global Climate Models with respective links for download are listed below:

CMIP5 model name:	Model name:	Institution name(s):	Country of origin:
ACCESS1-0	Australian Community Climate and Earth-System Simulator, version 1.0	CSIRO & BoM	Australia
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NorESM1-M	Norwegian Earth System Model, version 1 (intermediate resolution)	Norwegian Climate Centre	Norway

- Visit *Queensland Future Climate* or TERN - Terrestrial Ecosystem Research Network for access to gridded data

<https://longpaddock.qld.gov.au/qld-future-climate/data-info/tern/>

<https://dap.tern.org.au/thredds/catalog/CMIP5QLD/catalog.html>

Queensland Future Climate

- **Additional resources**

Visit *Queensland Future Climate* in *The Long Paddock*:
<https://longpaddock.qld.gov.au/qld-future-climate/>

<https://app.longpaddock.qld.gov.au/climateFacts/>

Queensland Future Climate:
Understanding the data

<https://app.longpaddock.qld.gov.au/water/>

Queensland Future Climate:
Water security

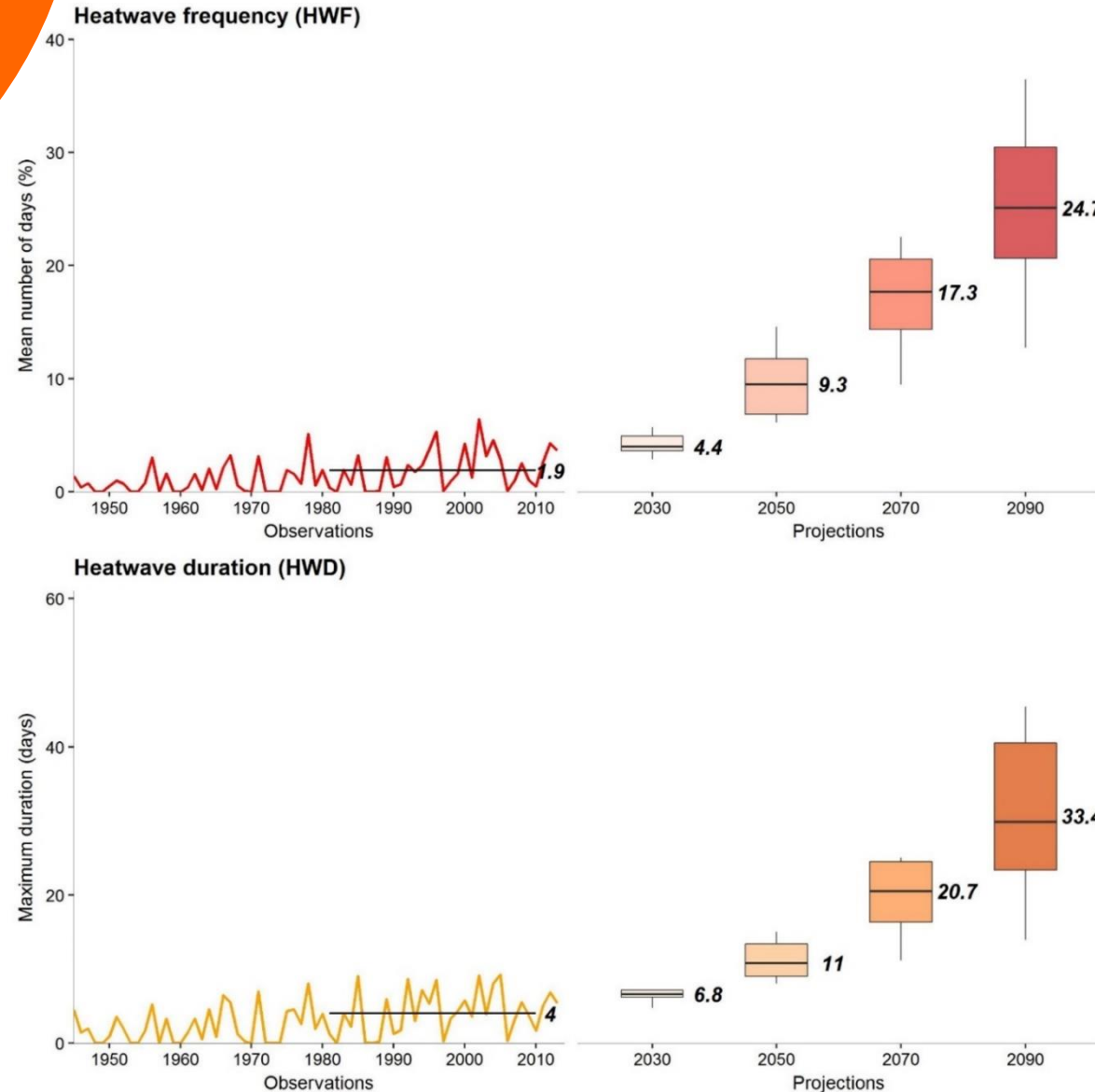
<https://app.longpaddock.qld.gov.au/heatwave/>

Queensland Future Climate:
Heatwaves

Future Heatwaves in Queensland

Providing quality data for decision making

- Putting together heatwaves observations and projections to inform adaptation policy across Queensland's regions – a summary for SEQ



More frequent

By 2050 heatwaves may be 390% more frequent in SEQ

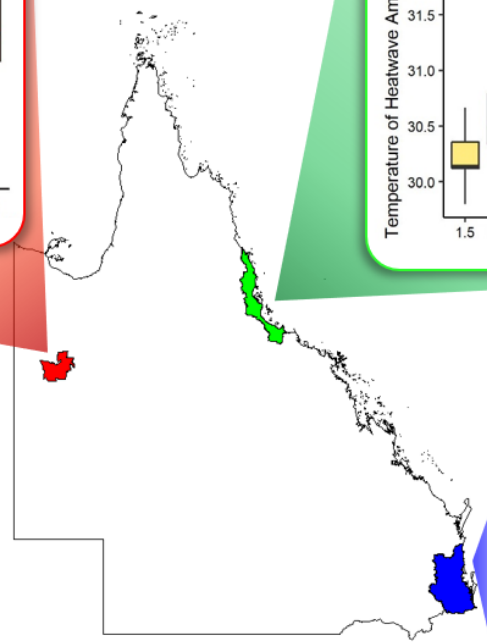
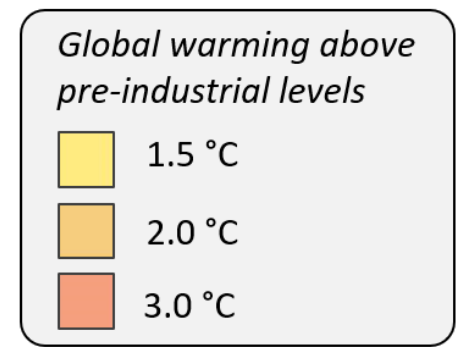
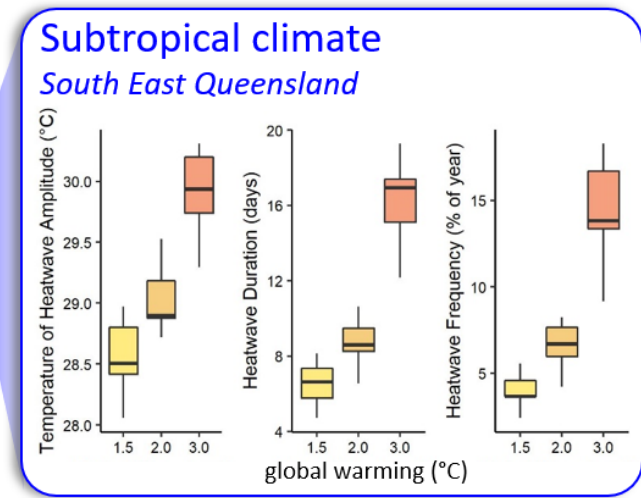
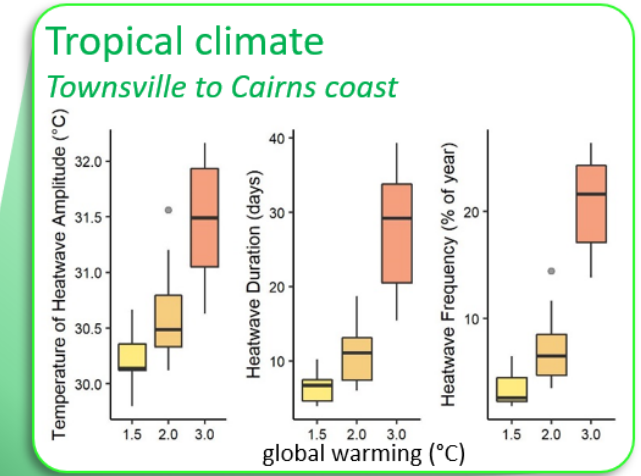
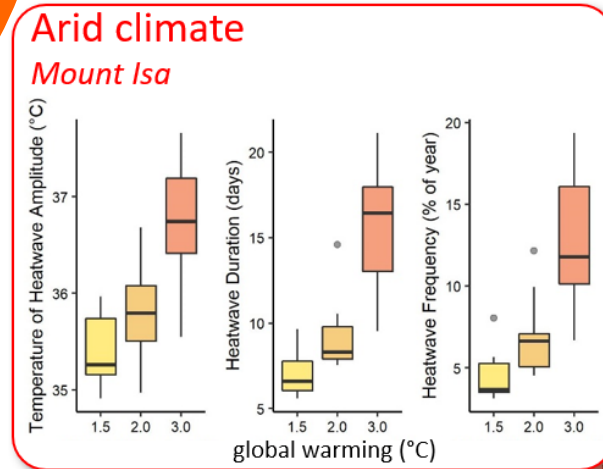
Longer lasting

By 2070 heatwaves may last 417% longer in SEQ

Future Heatwaves in Queensland

Through the lens of Paris Agreement: heatwaves under 1.5, 2.0 and 3.0 degrees of Global Warming

- Pattern-scaling future heatwaves to provide estimates per degree of Global Warming aligning with the IPCC 1.5 Degree Special Report

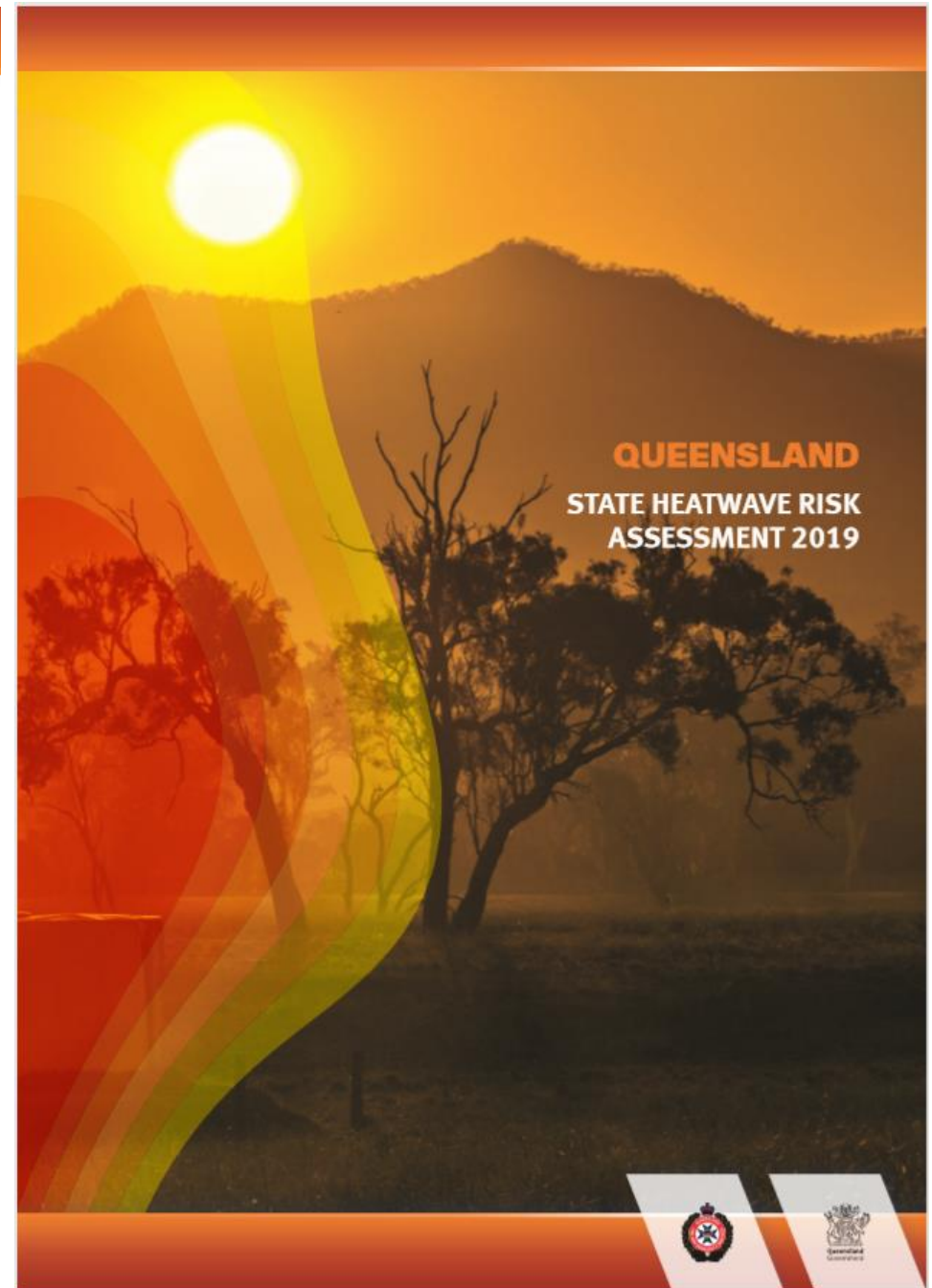


QLD State Heatwave Risk Assessment



- Foundation of heatwave risk assessments for Local and District Disaster Management Groups (LDMGs/DDMGs), and State agencies. These assessments act to inform the development of their associated risk-based disaster, and business risk management plans.
- Extensive involvement of Queensland Fire and Emergency Services, Queensland Health, Department of Environment and Health and other stakeholders.

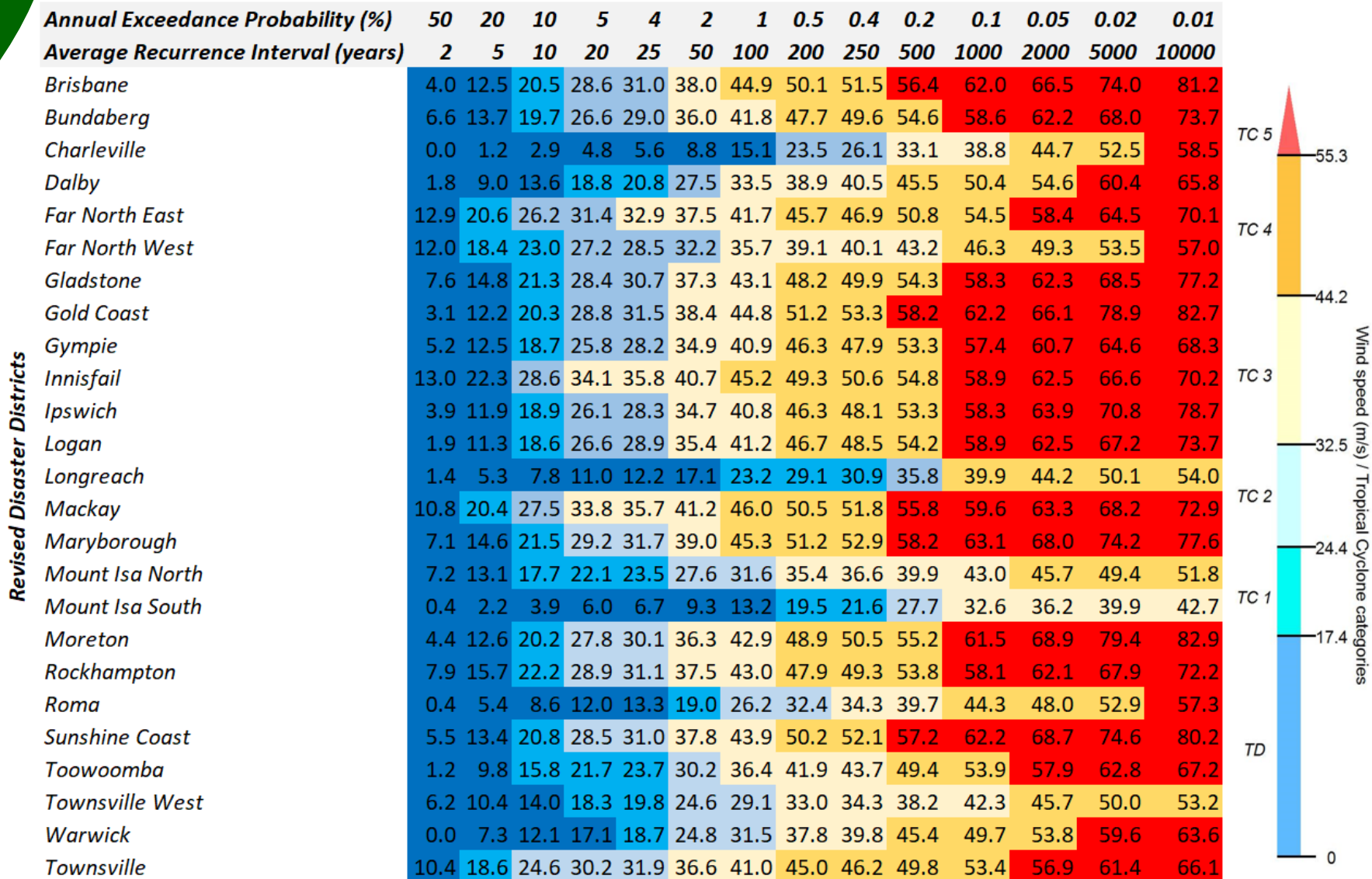
<https://www.disaster.qld.gov.au/dmp/Documents/QFES-Heatwave-Risk-Assessment.pdf>



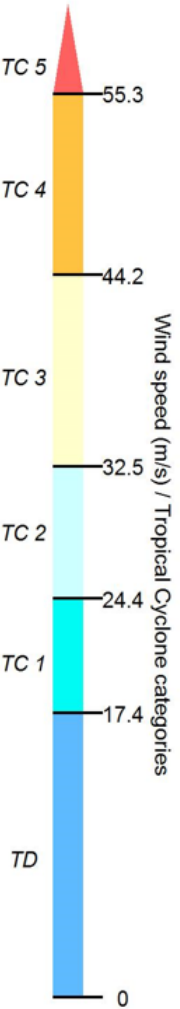
Severe Wind Hazard Assessment

Moving towards Climate Risk

Tropical Cyclones Hazard Assessment



Revised Disaster Districts

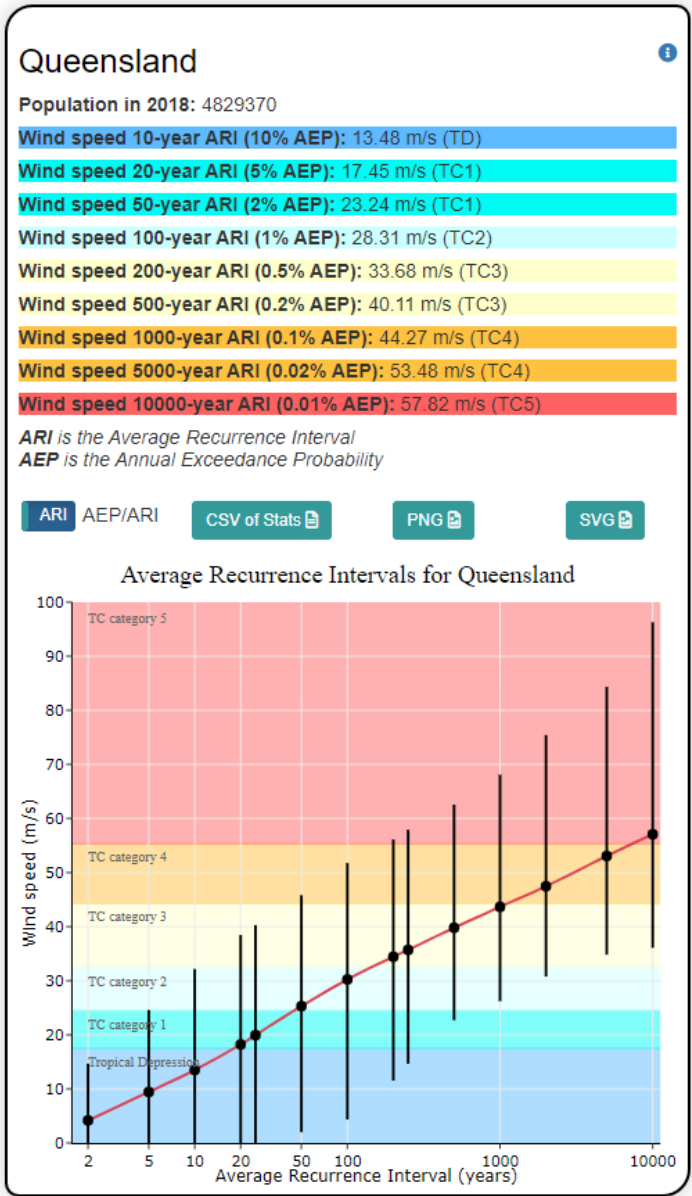
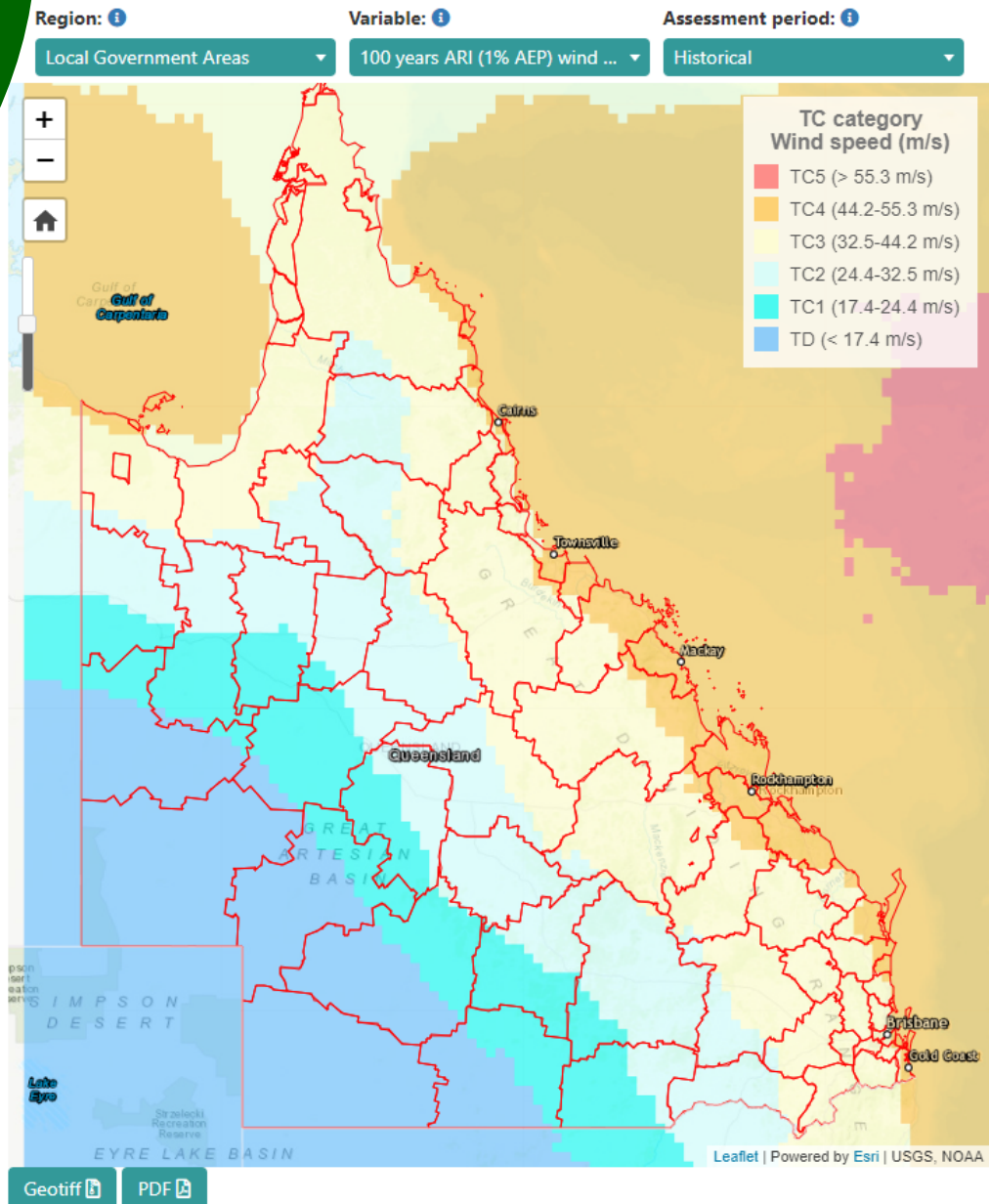


- Tropical Cyclones ARI and AEP across Queensland's Disaster Districts
- Stochastic model developed by Geoscience Australia driven by observations

Severe Wind Hazard Assessment

Moving towards Climate Risk

Tropical Cyclones Platform (under development)

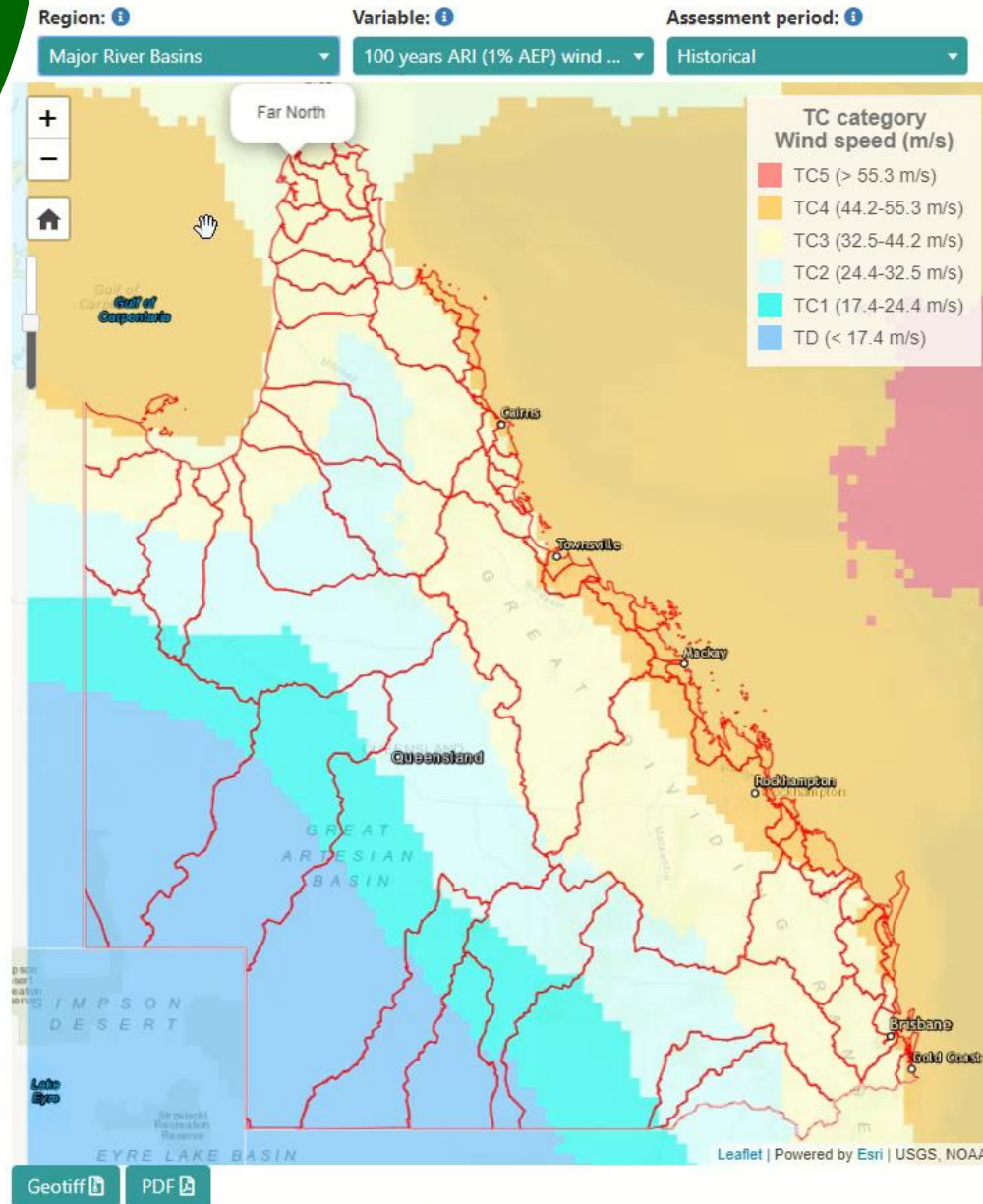


- A new web-mapping platform with Tropical Cyclone recurrence intervals across Queensland's regions
- Supporting the Severe Wind Hazard Assessment for Queensland

Severe Wind Hazard Assessment

Moving towards Climate Risk

Tropical Cyclones Platform (under development)



Queensland

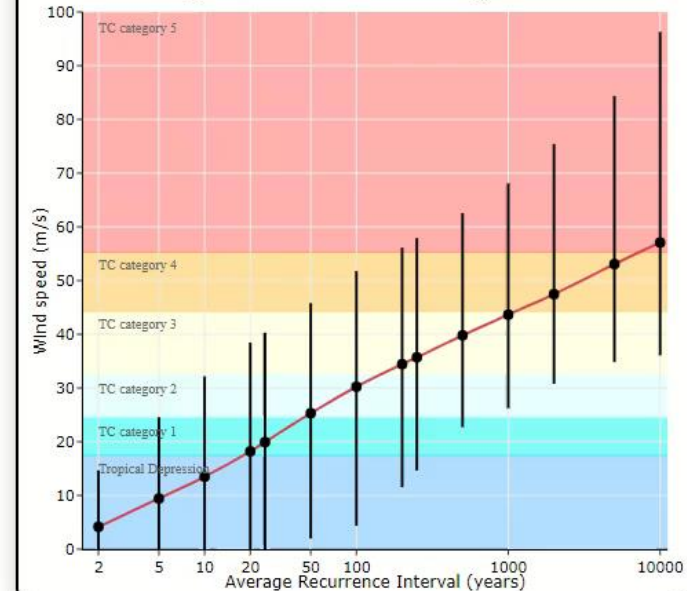
Population in 2018: 4829370

Wind speed 10-year ARI (10% AEP): 13.48 m/s (TD)
Wind speed 20-year ARI (5% AEP): 17.45 m/s (TC1)
Wind speed 50-year ARI (2% AEP): 23.24 m/s (TC1)
Wind speed 100-year ARI (1% AEP): 28.31 m/s (TC2)
Wind speed 200-year ARI (0.5% AEP): 33.68 m/s (TC3)
Wind speed 500-year ARI (0.2% AEP): 40.11 m/s (TC3)
Wind speed 1000-year ARI (0.1% AEP): 44.27 m/s (TC4)
Wind speed 5000-year ARI (0.02% AEP): 53.48 m/s (TC4)
Wind speed 10000-year ARI (0.01% AEP): 57.82 m/s (TC5)

ARI is the Average Recurrence Interval
AEP is the Annual Exceedance Probability

ARI | AEP/ARI | CSV of Stats | PNG | SVG

Average Recurrence Intervals for Queensland



- A new web-mapping platform with Tropical Cyclone recurrence intervals across Queensland's regions

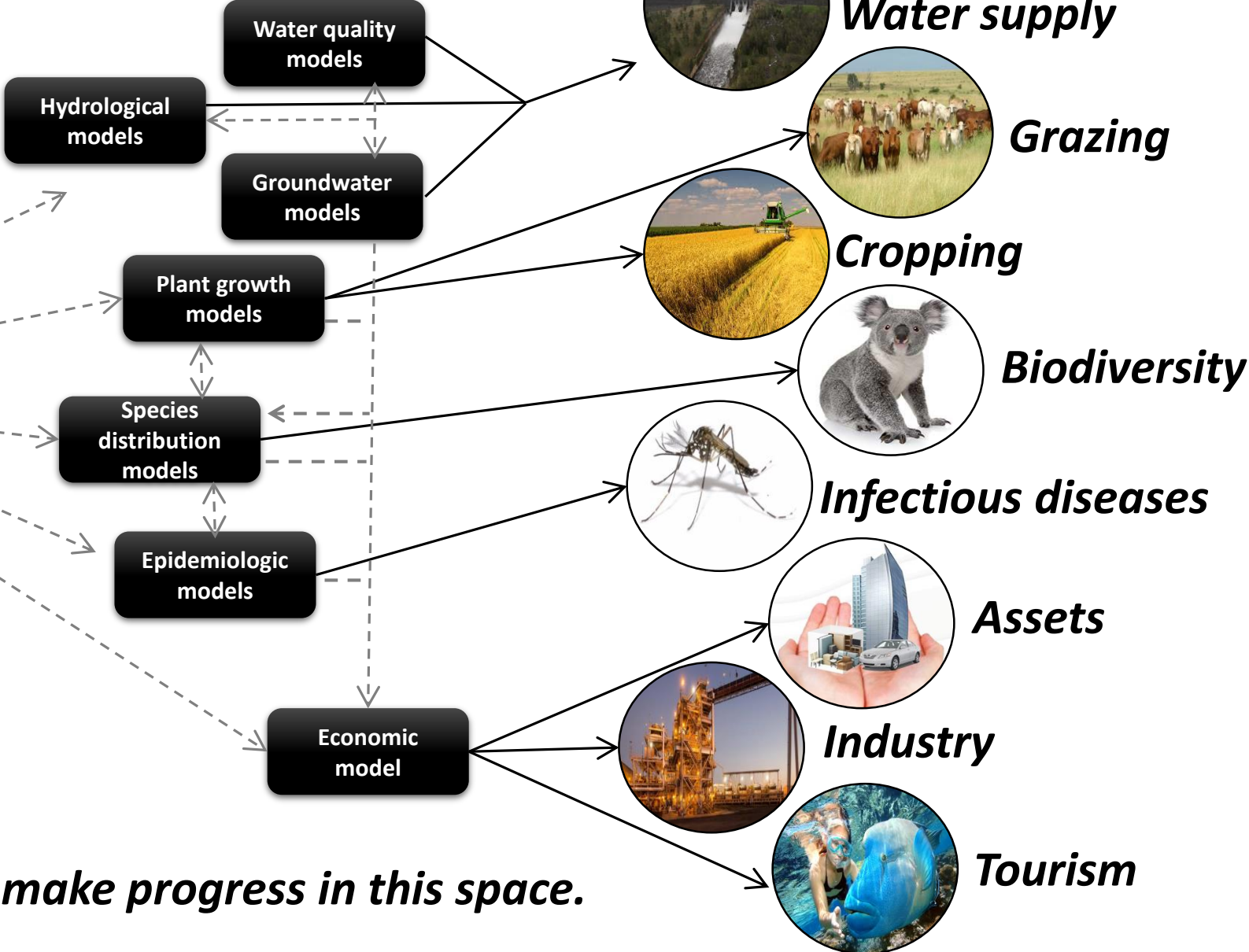
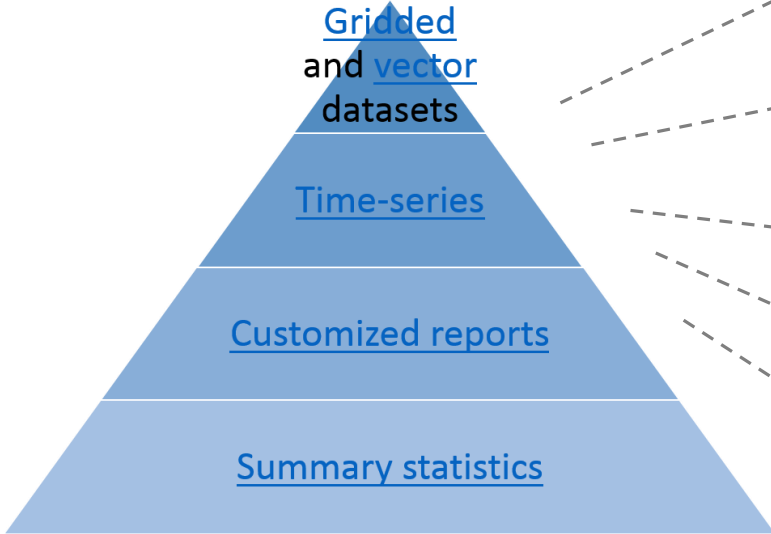
- Coming soon – stay tuned!

<https://longpaddock.qld.gov.au/qld-future-climate/>

Future climate is the starting point: a modelling chain is needed to address multi-sectorial risk

Risk

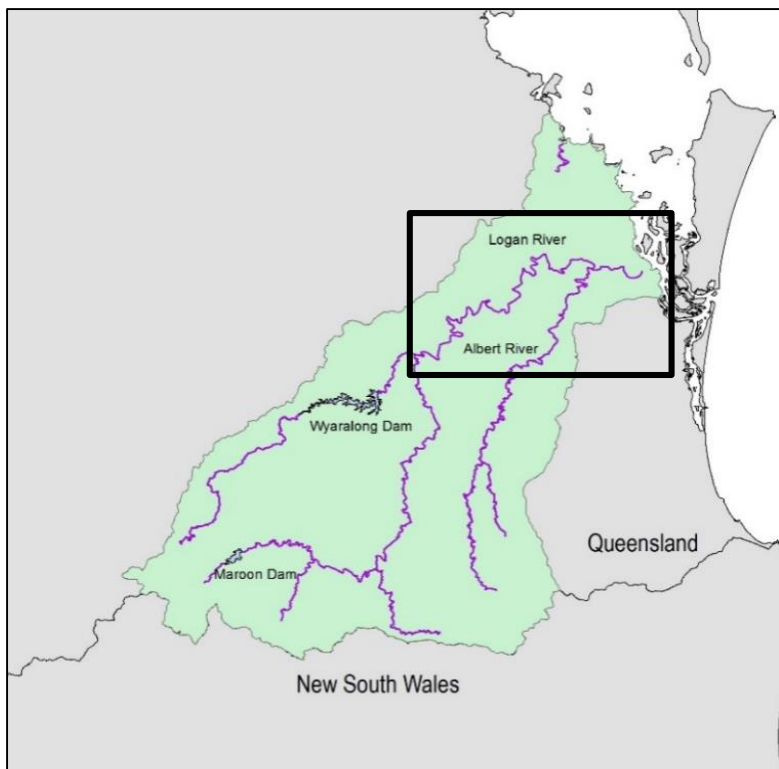
Future climate data



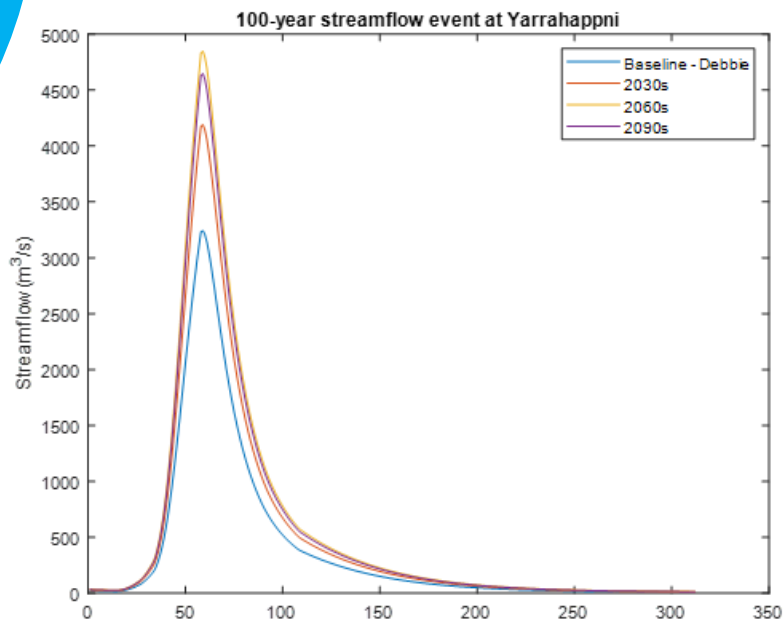
Collaborations are essential to make progress in this space.

Effects of climate change on riverine flooding and water quality

- An ensemble of downscaled bias-corrected climate models were used to drive a hydrological model for the catchment, which provided the boundary conditions for an inundation model of the study domain.



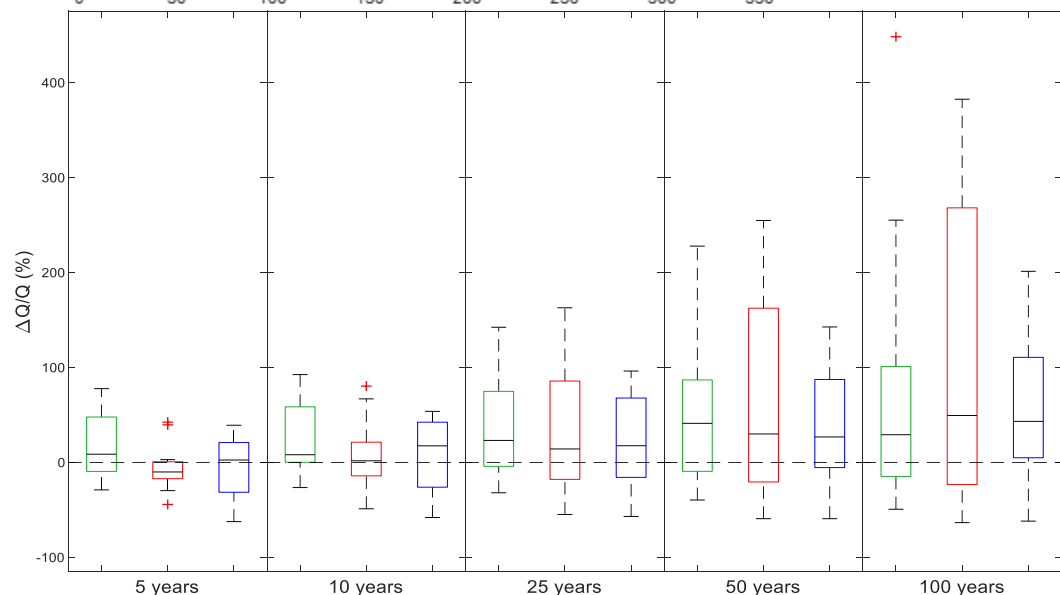
Location of the study domain within the Logan-Albert catchment.



Rohan Eccles, Prof Hong Zhang, Prof David Hamilton
Email: rohan.eccles@griffithuni.edu.

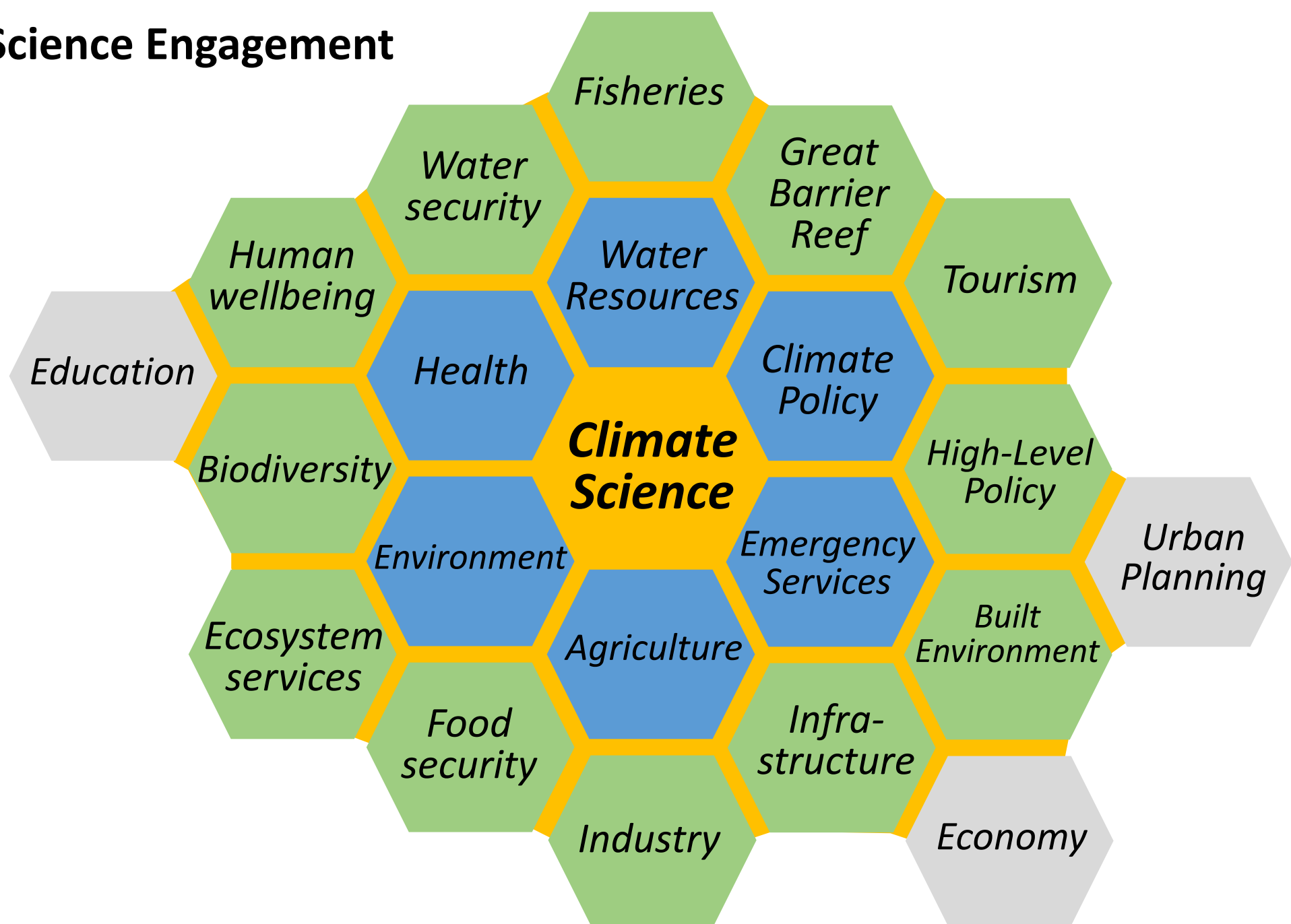


Predicted change to hydrograph of an approximate 100-year flood event for the Logan River using the ensemble median change from the climate models.

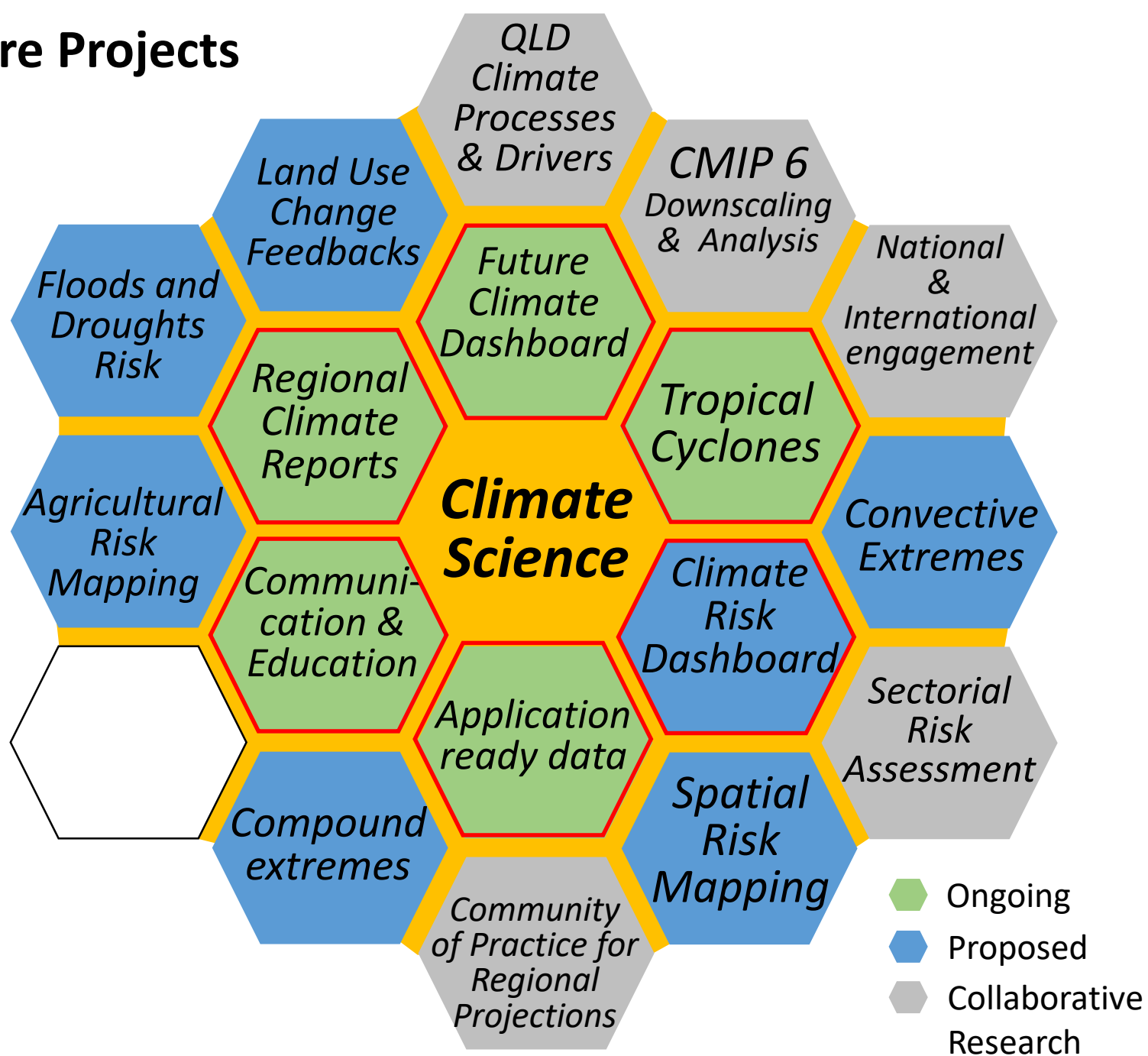


Predicted multi-model ensemble percentage change to future 5, 10, 25, 50, and 100-year flood events, relative to the model baseline (1980-2010) for the Logan River. Green, red, and blue boxplots show projected changes for the 2020s, 2050s, and 2080s, respectively.

Climate Science Engagement



Ongoing and Future Projects



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