



Australian Government  
Bureau of Meteorology

# Land Surface Modelling

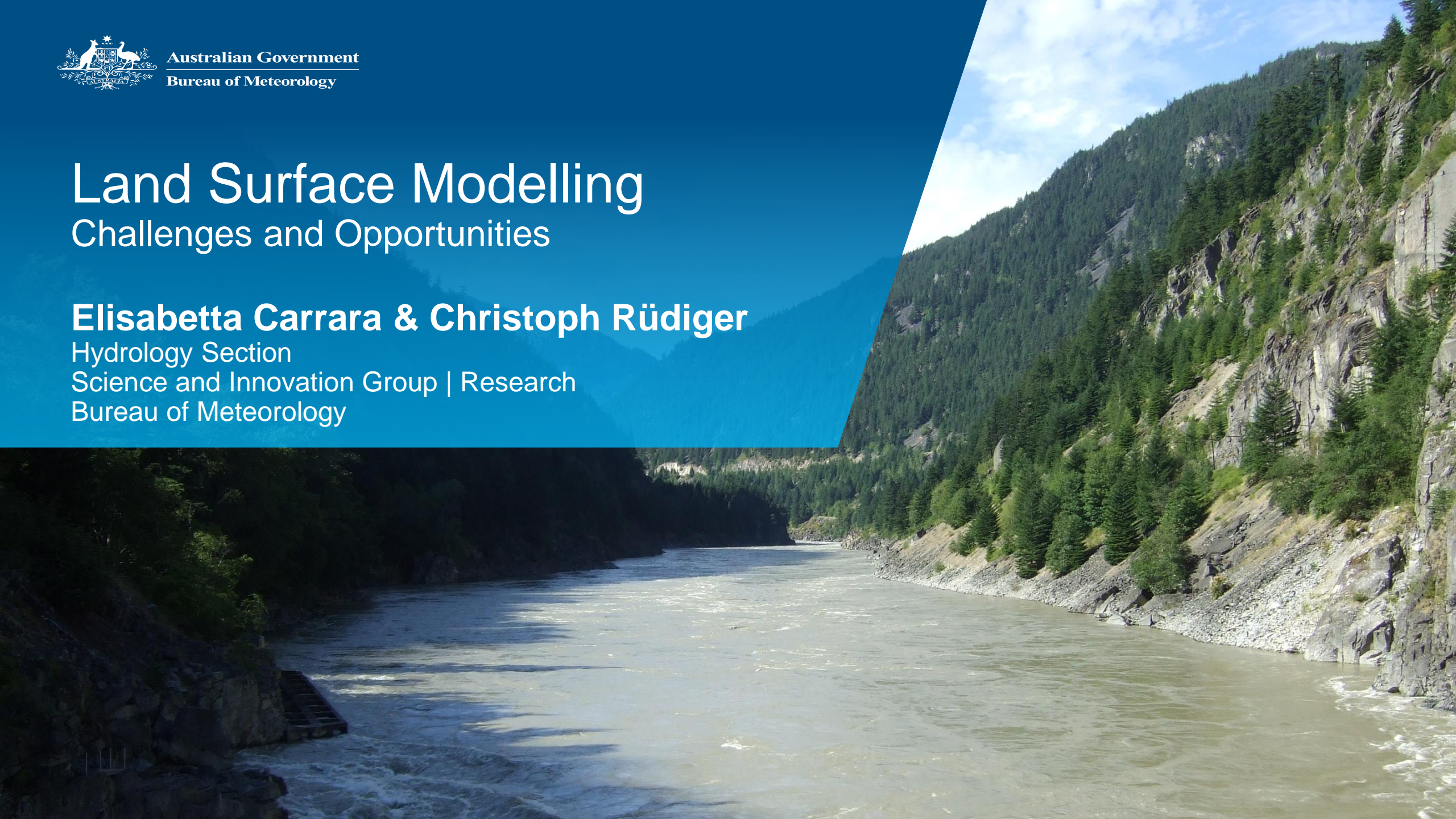
## Challenges and Opportunities

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Hydrology Section

Science and Innovation Group | Research

Bureau of Meteorology



# The Bureau's Research Plan and Groups

National Operations Centre  
Bureau of Meteorology  
MSLP Analysis (hPa)  
Valid: 0000 UTC 22 Mar. 2021

# Not Only Weather

The Bureau carries a range of responsibilities relating to weather prediction and to [water](#):

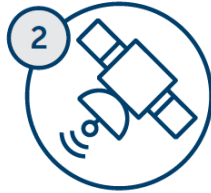
- a. The Bureau is the [lead national agency for flood warning](#), as mandated through the Meteorology Act (1955), following the Hunter floods of 1955.
- b. The [Water Act \(2007\)](#) mandates the Bureau to issue national water information standards, collate and publish water data, monitor and report on water availability (including water accounting), and water availability forecasts among other responsibilities.
- c. The Bureau supports a range of services requiring hydrological modelling and input (e.g., bushfire and drought risk).

# Research Plan 2020-2030



## **OBJECTIVE 1: CUSTOMISED IMPACT-BASED FORECASTS AND WARNINGS WHEN AND WHERE IT COUNTS**

*More localised, timely and better information for cities and regional areas*



## **OBJECTIVE 2: RELIABLE AND TRUSTED FORECASTS**

*Enhanced assimilation of observations for more accurate predictions*



## **OBJECTIVE 3: AN EARTH SYSTEM NUMERICAL PREDICTION CAPABILITY**

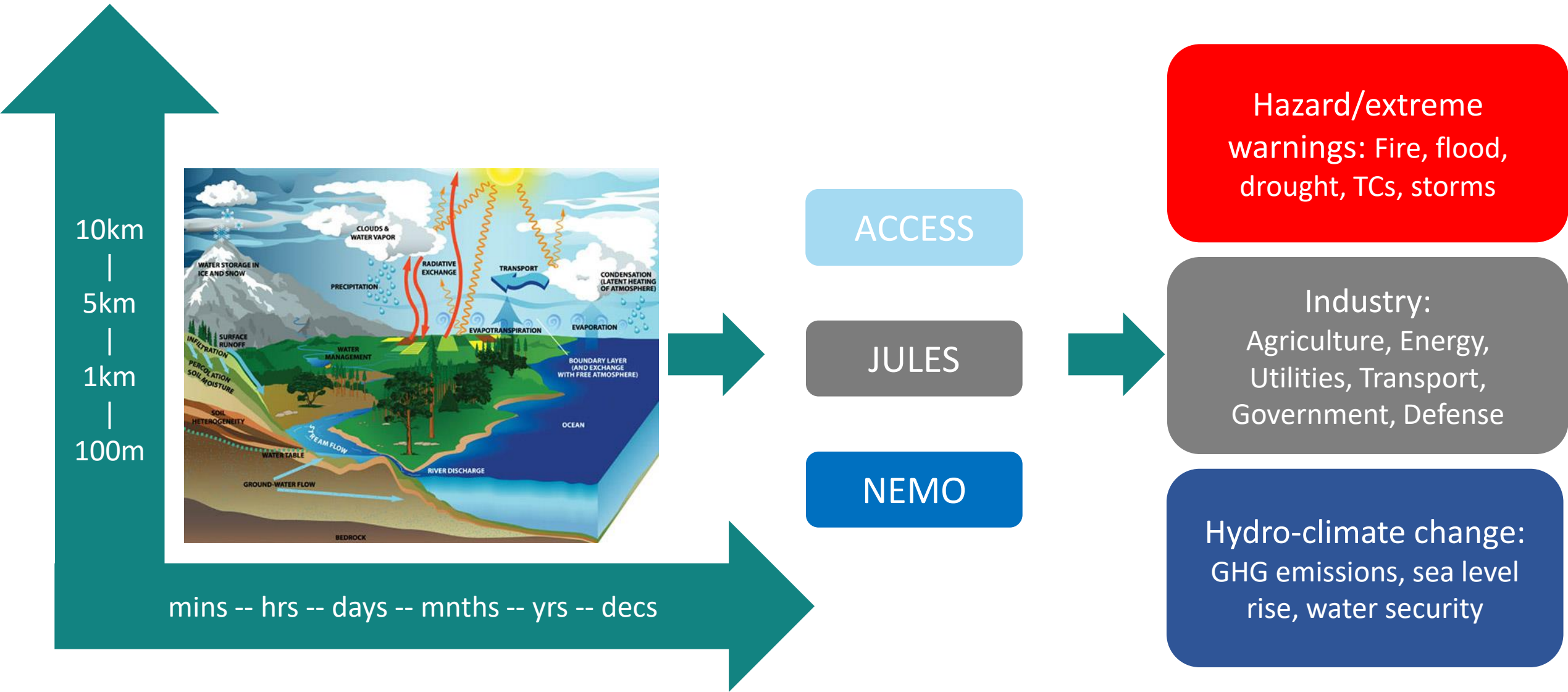
*Fully integrated atmosphere, ocean, sea-ice and hydrology models*

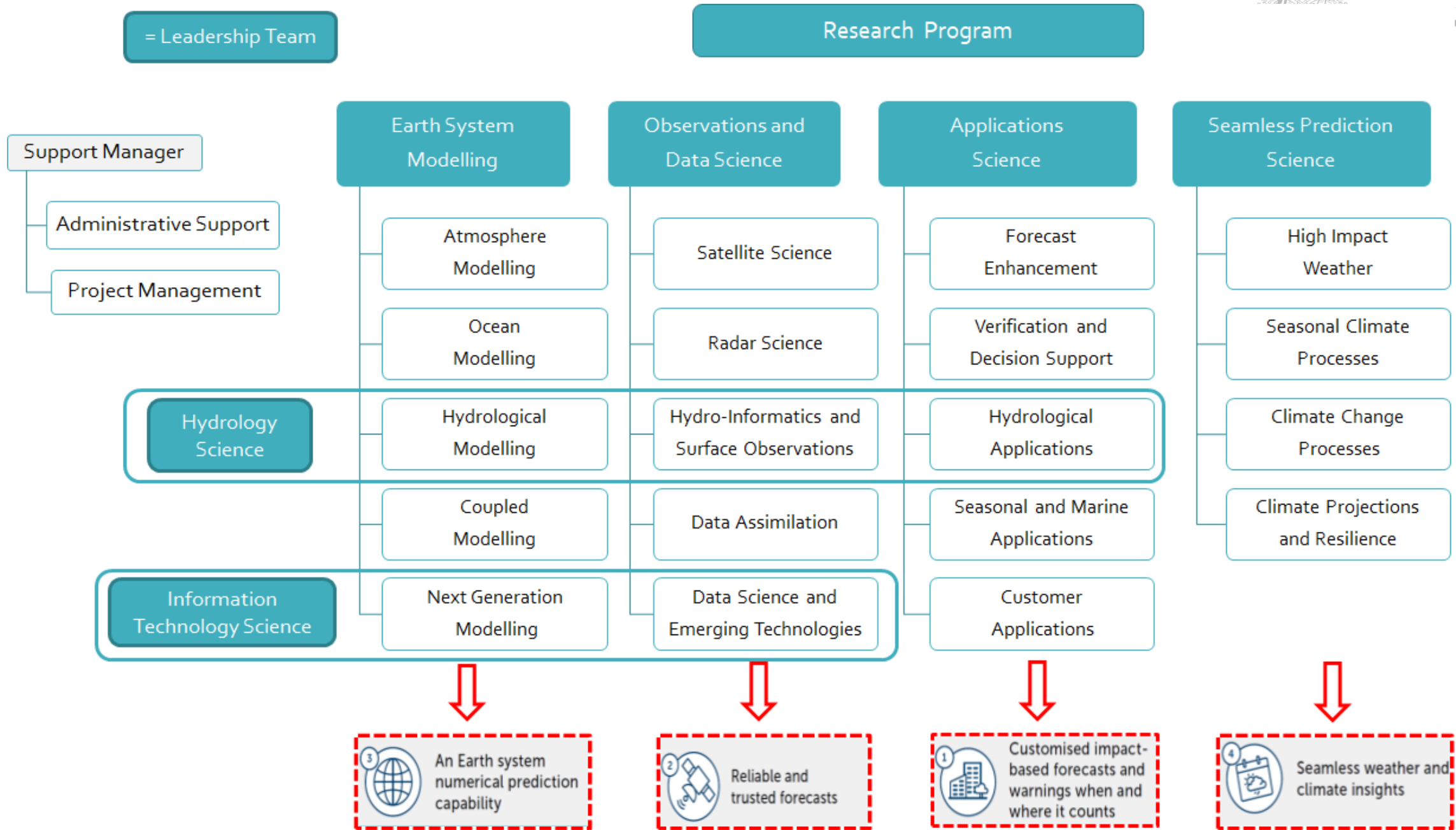


## **OBJECTIVE 4: SEAMLESS WEATHER AND CLIMATE INSIGHTS**

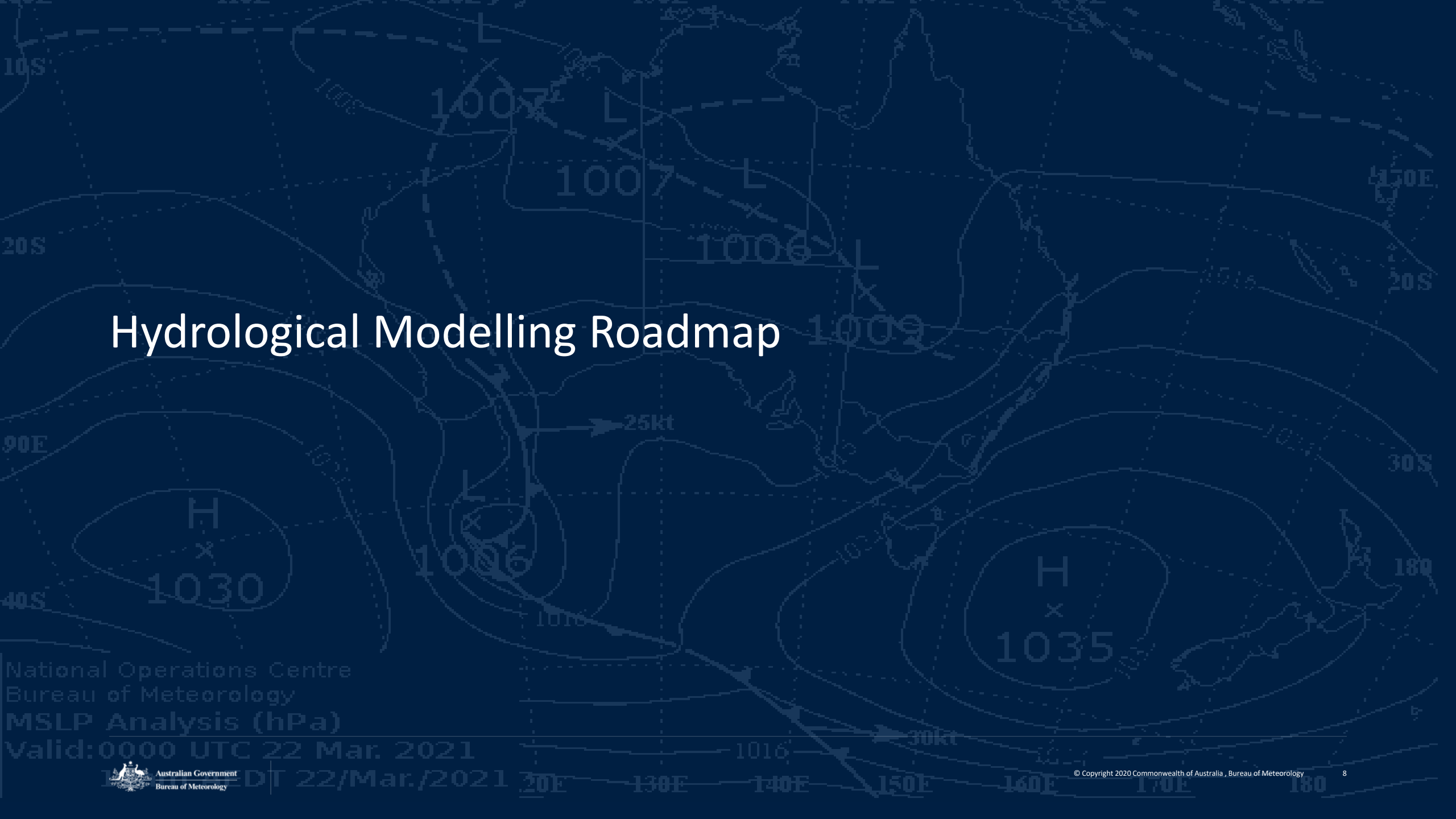
*Historical observations and predictions, from minutes to decades*

# Hydrology research plans at BoM





# Hydrological Modelling Roadmap

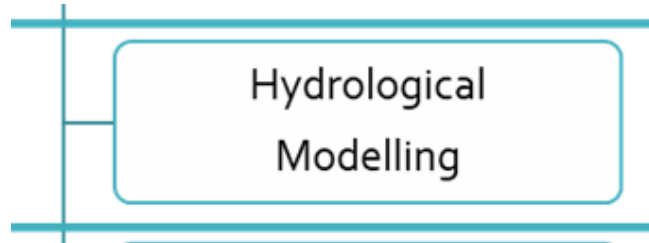


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# Hydrological Modelling Team



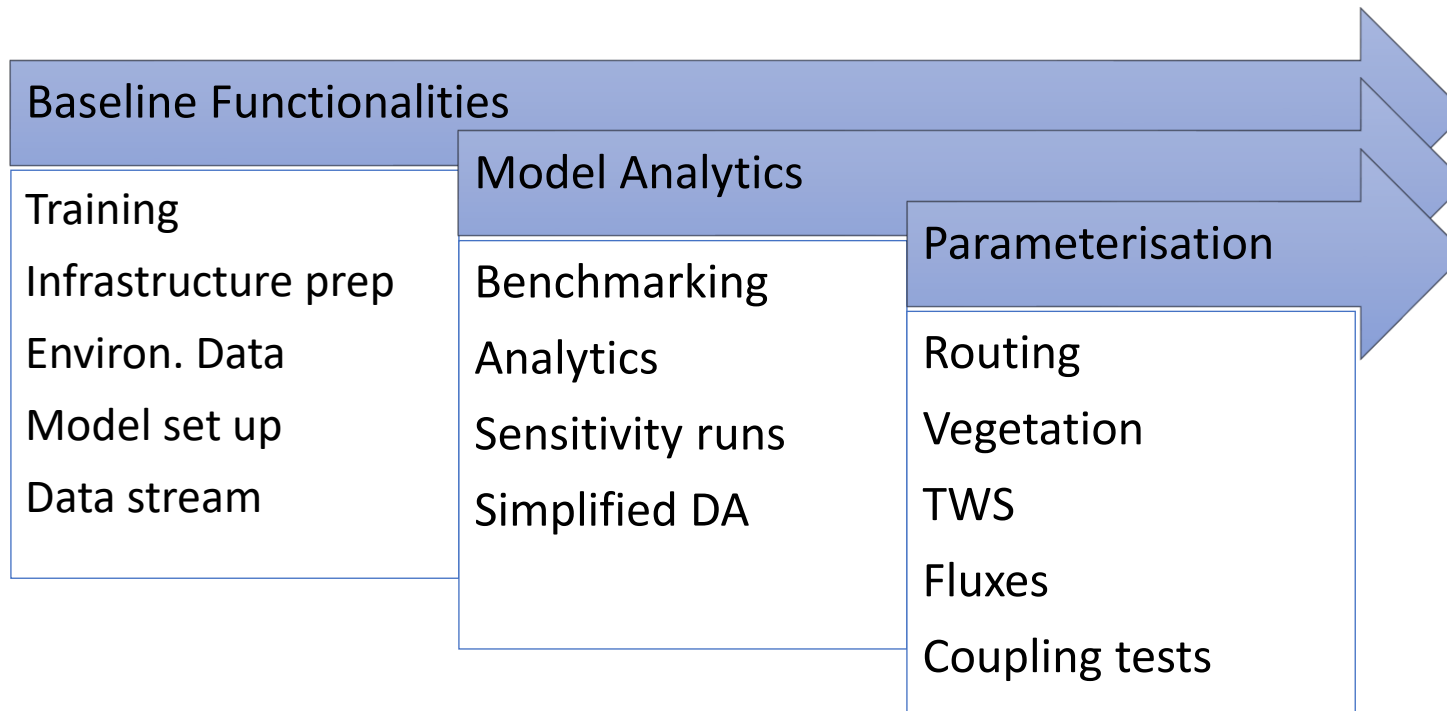
- Model development (JULES, Hydro-JULES)
- Adaptation to Australian landscapes
- Uncoupled and coupled simulations
- Coupling with NEWP (ACCESS)
- Rainfall prediction and hydrological cycle closure

## Supporting other Teams and Sections:

- Hydrological product development
  - Flood inundation
  - Fires
  - Landslide
  - Storm surge
- Coupled prediction systems
  - Improved land surface representation
  - EO integration and DA
- Other
  - Agriculture
  - Climate projections
  - Urban



# Roadmap



# Roadmap

## Coupling

- Reanalysis
- Verification
- Atmosp. Impact
- Vegetation response

## NWP integration

- Nowcasting
- Short-term forecasts
- Hydrol. Impact
- DA assessment

## Seasonal and long-term

- Test against reanalysis
- Long-term test run
- Data pipelines

# Specific Challenges



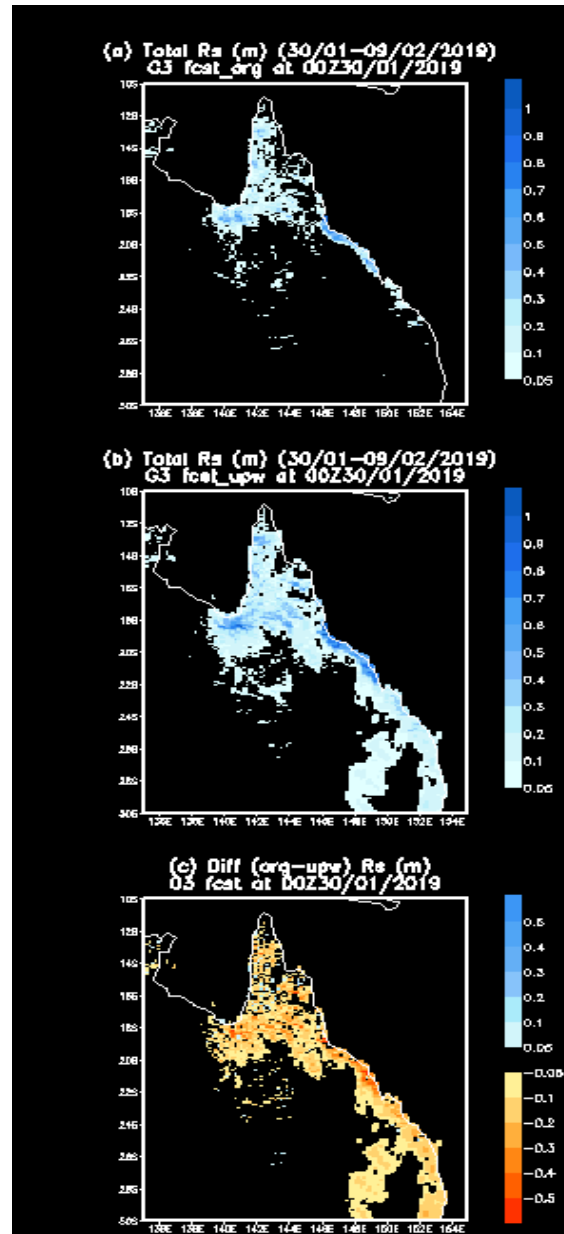
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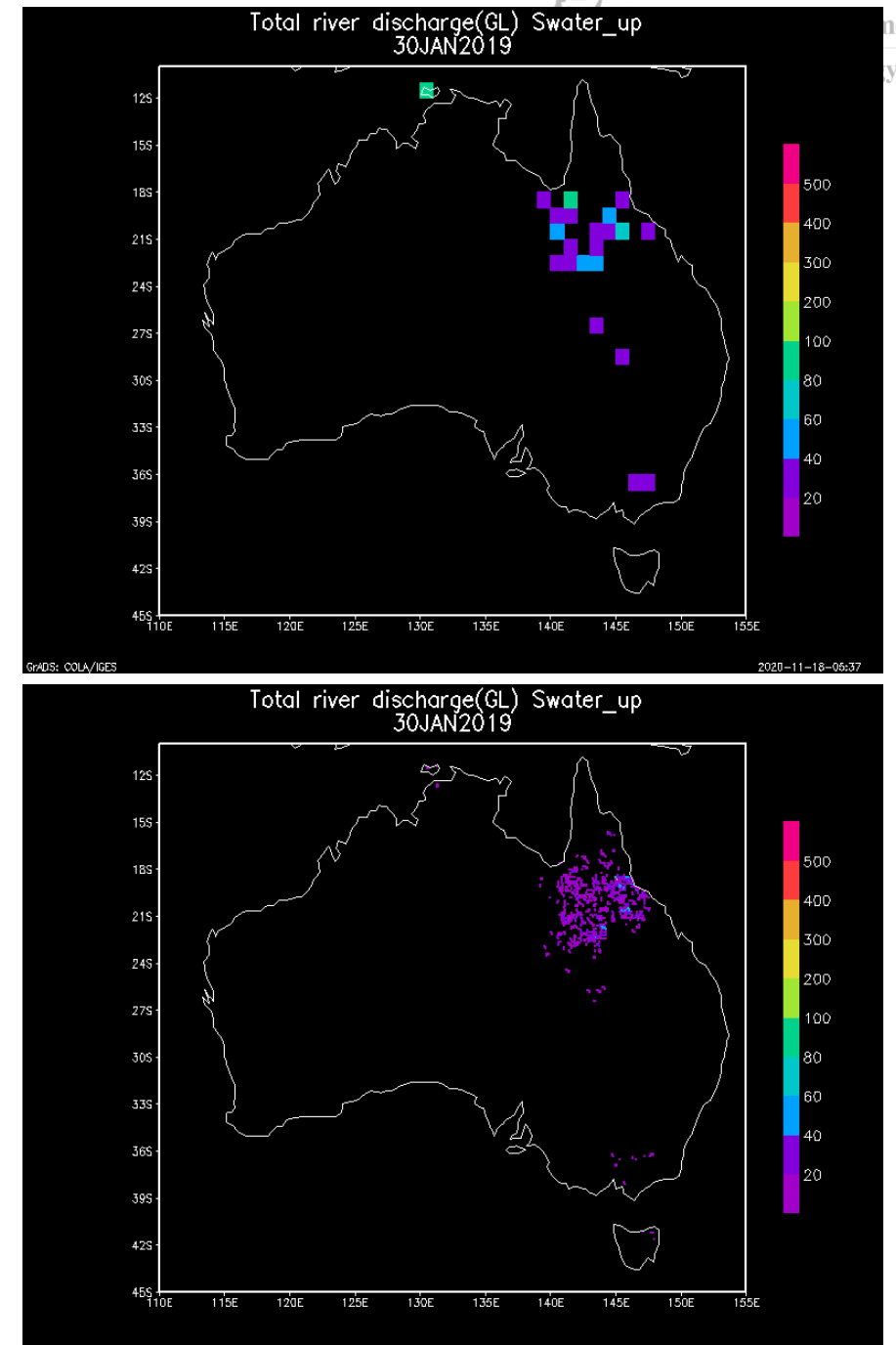
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# Routing

Parameterisation  
of vertical flow



Scale



# Routing

Relief



Ephemeral  
Streams

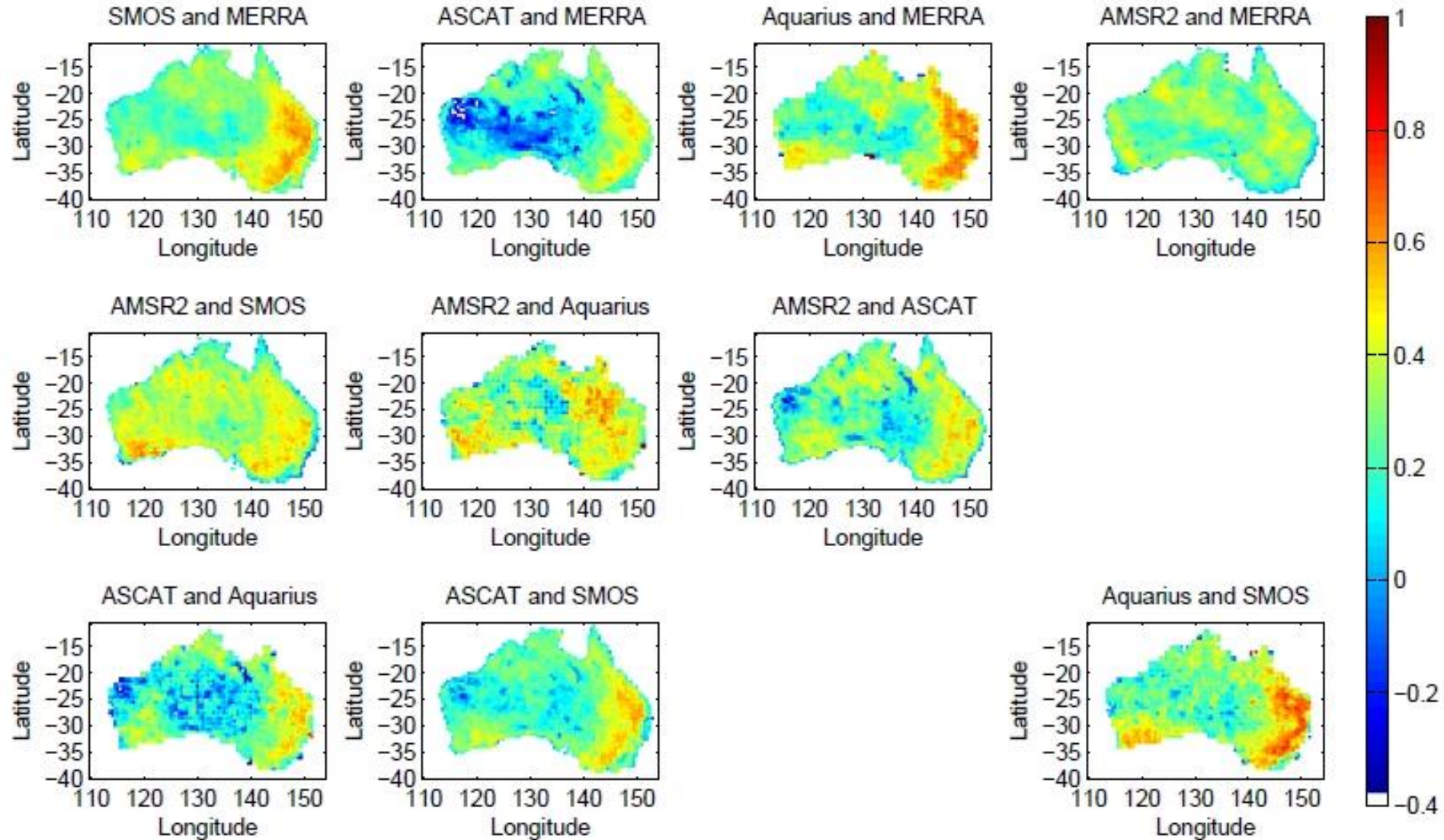


# Vegetation

- Investigation of different hydroclimatic regions
  - Vegetation activity
    - Growth (e.g. GPP)
    - Water content
    - Seasonality
  - Parameterisation of interactive vegetation module
    - Evapotranspiration
    - GPP and greenness
    - Rooting depth
- Land cover variation across the years
  - Plant migration and replacement

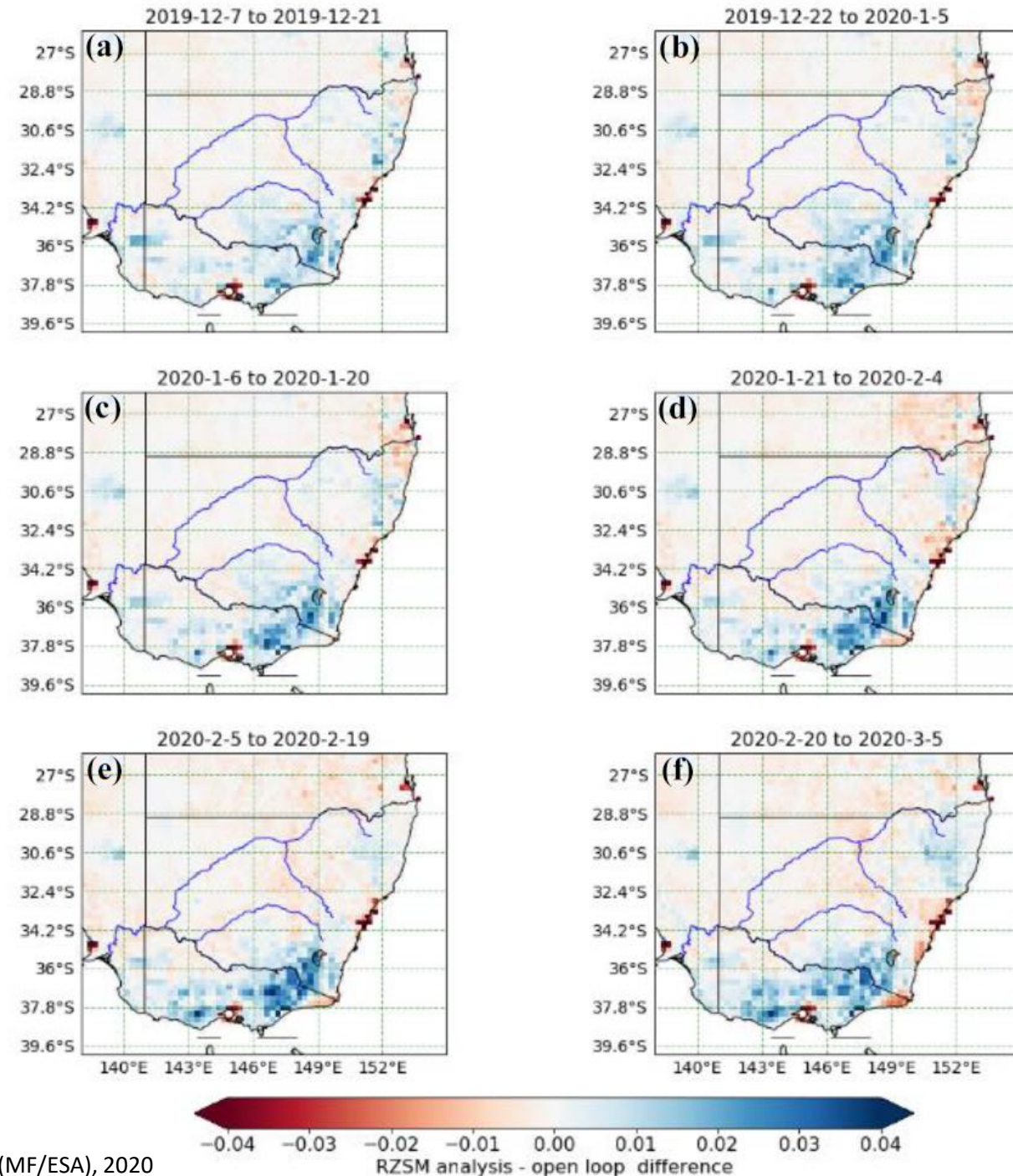


# Surface Soil Moisture



# Data Assimilation

- Vegetation
- Surface soil moisture and groundwater
- (LST)
  
- Determination of error covariances
- Triple collocation across the continent
- Seasonality of model and observational uncertainties





# Extreme Conditions

**Damian Carrington's  
blog**  
Environment

## Australia adds new colour to temperature maps as heat soars

Forecast temperatures are so extreme that the Bureau of Meteorology has had to add a new colour to its scale. It is a sign of things to come

- Australian project simulates effects of runaway climate change
- Deadly heatwaves will be more frequent in coming decades

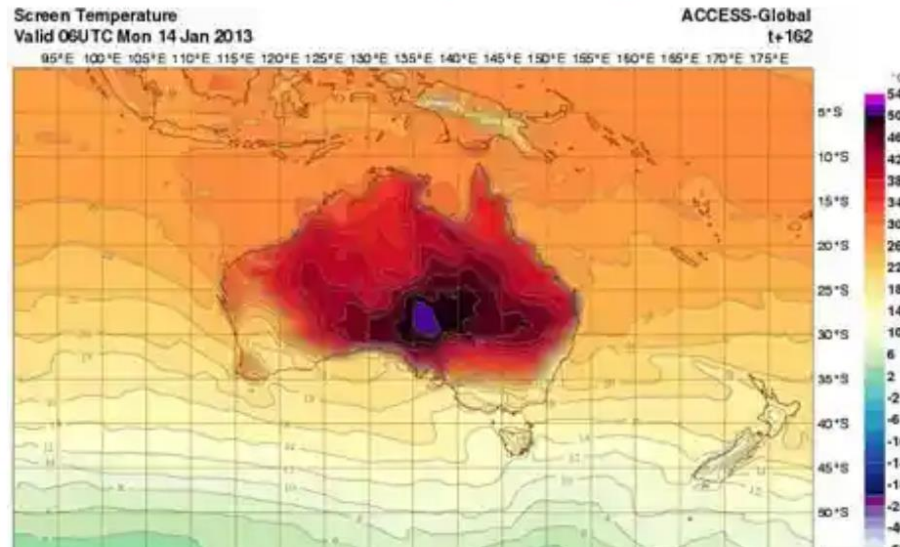
**Damian Carrington**

Twitter: @dpcarrington

Tue 8 Jan 2013 22:34 AEDT

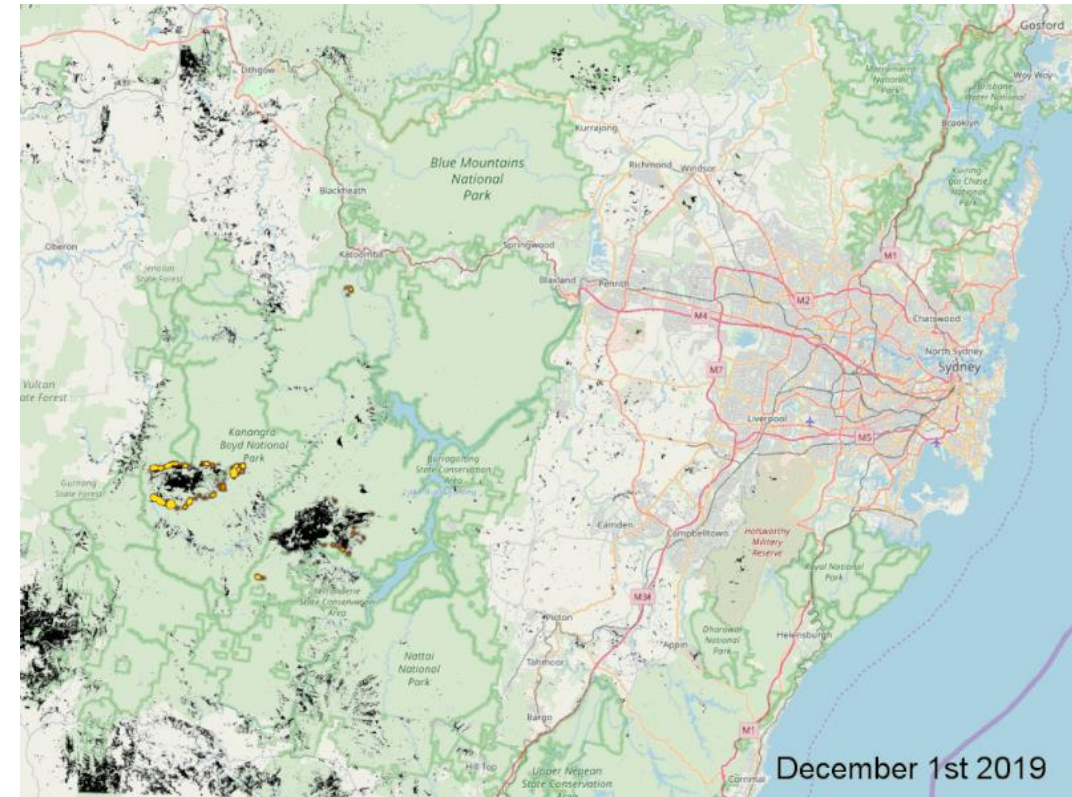


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Australian Bureau of Meteorology temperature map - with a new colour for 52-54C. Photograph: BOM. [Click the image to see a larger version](#)

Global warming is turning the volume of extreme weather up, [Spinal-Tap-style](#), to 11. The [temperature forecast](#) for next Monday by Australia's Bureau of Meteorology is so unprecedented - over 52C - that it has had to add a new colour to the top of its scale, a suitably [incandescent purple](#).



# Conclusions



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# Looking Ahead

- Consolidation of hydrology research in one section will enable much more focused and stronger collaboration opportunities
- The new team will be contributing to the research community in full from 2022
- Broad research interests across the entire landscape
  - Contribution to diverse research projects
- Particular focus on parameterization and model verification over the next years
- Increasing strategic intake and use of EO data



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# Thank you

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