

Critical Review of Climate Change and Water Modelling in Queensland

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AS QUEENSLAND'S CLIMATE CHANGES, WE CAN EXPECT:



Rising sea level Sea level is projected to rise by about 0.8m above present day levels by 2100



A substantial decrease in the frequency of frost risk days is projected by 2070



More intense rainfall events

High variability in rainfall will continue. The intensity of heavy rainfall events is likely to increase



By late this century, under a high emissions scenario, it is likely that the south of the state will experience more time in drought

Higher temperatures

Maximum, minimum and average temperatures are projected to continue to rise



Hotter and more frequent hot days

There is likely to be a substantial increase in the temperature reached on the hottest days, and an increase in the frequency of hot days and the duration of warm spells

Warmer and more acidic ocean

Sea surface temperatures are expected to increase and the ocean will become more acidic



More frequent sea level extremes

Higher sea levels will increase the risks of coastal hazards such as storm tide inundation









Harsher fire weather

Climate change is likely to result in harsher fire weather in the future, reflecting fuel dryness and hot, dry, windy conditions

Project drivers

here are no simple answers, and no individual nor single organisation has the capacity to address every aspect of the problem 🎗

communications and education to raise public awareness about climate facts, real impacts, and real opportunities

> regional partnerships and delivery at a regional level is going to maximise outcomes

high quality scientific data on the likely local (and regional) challenges of climate adaptation is essential

> any climate change adaptation strategy needs to recognise climate change adaptation not simply as a technical issue but also as a fundamentally cultural one

meeting the challenges posed by climate change requires community resilience, social justice, and our stewardship of the environment to become the core yardstick of social, political, and economic decision makina

Queensland Government may need to facilitate cross-sectoral, intra-sectoral and cross-departmental discussions to identify perceived vulnerabilities within the region a 'whole-of-community' approach for the most <u>eff</u>ective outcome **9**9

the human element is integral to any discussion on climate change adaptation

government should mobilise action for climate adaptation and lead from the front

> climate policy and action require a range of methods to suit the diversity of problems

Pathways to a climate resilient Queensland

Queensland Climate Adaptation Strategy 2017–2030





Queensland Water Modelling Network

QWMN activities are based around five key themes:

- Model integration
- Model improvement
- Model management
- Building capacity and uptake
- Communications and engagement

Research, Development and Innovation Strategy (2018-2020) priorities:

- Climate change and variability
- Landscape restoration and redesign
 - Water planning, integration and management
- Model management

Outline



- 1. Project overview
- 2. Overview of climate science Anthony Kiem
- 3. Strengths, gaps and opportunities
- 4. Recommendations and strategic investment portfolio

Project overview

Multiple lines of evidence gathered to understand needs, strengths and opportunities

| Review of climate science | Other jurisdictions National products Queensland specific products | |
|---------------------------|--|-------------------------|
| Interviews | Policy, planning, hydrology, OGBR, DNRME, DES, DAF, Griffith | Strategic |
| Workshop | Sharing the latest climate science What are we doing now? What could we be doing better? | investment portfolio |
| Case studies | Great Barrier Reef AussieGrass Water security in SEQ Water planning in the MDB | |

Who?



| Sector roles | Key organisations | Other interested players |
|---|--|---|
| Modellers Planners Operators Policy-makers Media and communication Scientists Politicians Data providers Software developers Investors | Queensland Government: DES, DNRME, DAF, Emergency services Local government Consultants Federal government: CEWH, BoM, GBRMPA, DEE, MDBA Research: CSIRO, AIMS, Universities NGOs: NRM groups, GBRF, HLW Utilities: Seqwater, Sunwater Unitywater, QUU | Insurance Developers Landholders Primary producers Tourism Industrial use Mining and resources Other jurisdictional bodies Community groups |
| Students Regulators | Regulator: QCC | |

Modelling philosophy



Projections to outcomes 'pipeline'





Review of Climate Science



Anthony Kiem – University of Newcastle Francis Chiew and Jai Vaze – CSIRO

Key input from: Jozef Syktus – Department of Environment and Science Chantal Donnelly – Bureau of Meteorology

Case Studies

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- 4 Case studies developed:
 - Paddock to Reef catchment modelling
 - AussieGRASS pasture model
 - Queensland MDB Water Resource modelling
 - SEQ water supply yield







Case Studies

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Key outcomes

- Understanding hydrologic non-stationarity
- Evaluating ecosystem responses under altered climate
 - Land cover/pasture
 - Soil ecosystems
 - Water quality responses within receiving waters
 - Ecological responses within waterways
- Extreme event changes
 - Frequency, intensity
- Accounting for altered water use patterns
 - Storage demands
 - Irrigation usage
 - Cropping patterns

Strengths, gaps and opportunities

- 1. Data, science and modelling platforms
- 2. Capability and capacity
- 3. Drivers for approaches
- 4. Communication and decision making

1. Data, science and modelling platforms

- Need for the availability and accessibility of appropriate, substantiated and relevant data, software, hardware, resourcing and capability
- The DES Climate Change and Sustainable Futures group is leading the development of high-resolution downscaled climate projection data and supporting information
- Bureau of Meteorology is releasing an ensemble of nationally downscaled and bias-adjusted climate data for use in water modelling

2. Capability and capacity

- Strong general awareness of the increasing need to consider climate change risk in planning and decision making
- Ability of individuals and groups to obtain and apply existing climate science effectively, and understand and communicate results, uncertainty and trends remains somewhat limited
- Targeted training, to more effectively use existing climate science, projections data products and modelling solutions
- Opportunity for alignment and sharing of course content across federal, state and local government training packages

3. Drivers for approaches

- Limited legislative imperative for climate change to be explicitly considered in water management, with the exception of the requirement for Water Resource Plans to 'consider climate change'
- The reality of changing frequency, duration and intensity of extreme climate events such as flood, drought, bushfire, cyclones and heat waves is perhaps the primary driver for improving the ability to understand water-related systems under future climate conditions

4. Communication and decision making

- Benefits of water modelling only become realised when the information produced is used effectively to support decision making
- This relies on the effective communication of results from those undertaking the modelling, the ability of decision makers to understand this information, and the communication skills and methods to share the outcomes, and related uncertainty, with broader stakeholders

Ski trail ratings overview



More difficult ("intermediate")

Most difficult ("expert")



Most difficult, use extra caution ("expert only")

Strengths, gaps and opportunities

- 1. Data, science and modelling platforms
- 2. Capability and capacity
- 3. Drivers for approaches
- 4. Communication and decision making



Back to Piet...

Draft recommendations and strategic priorities

OBJECTIVE

Enhance Queensland's ability to understand the impact of climate variability and change on water-related systems, to increase economic, social and ecological resilience

Outcome 1

Increase consistency and defensibility of approaches

Outcome 2

Interpret and summarise the applicability of existing climate science for Queensland

Outcome 3 Address climate science gaps through targeted research initiatives

Outcome 4 Empower individuals and collectives, and facilitate collaboration

Draft recommendations and strategic priorities

| Timeline | Actions |
|-----------------|--|
| Short- term | Develop an online climate risk assessment framework with corresponding approaches and guidance for quantifying response to climate variability and change Undertake on independent review of downseeled climate prejection data segment for Openaleud |
| | Review existing modelling systems used to confirm that they are suitable for use with future climate projections |
| | Conduct training (in collaboration with Climate Change and Sustainable Futures group) Establish a water and climate risk Centre of Excellence (experts) and Community of Practice (practitioners) |
| Medium- term | Establish a centralised data access and sharing portal Provide input to the LGAQ Cert IV-level course on climate risk management for local government Create guidelines for effectively communicating climate, water, and ecological modelling results for decision makers and broader community engagement Improve understanding of changing soil and vegetation impacts on hydrology and water quality Improve understanding of how extreme event frequency, duration and intensity may change in a future climate Evaluate impacts of climate variability and change on water storages in terms of yield, water quality and water demand Review existing hydrological models to confirm that they are suitable for extrapolation to predict the future under climate change, and adapt the models if required |
| Long-term | Collaborate with proposed climate science working group to influence future investment in climate science, climate risk assessment and training packages Understand the biophysical processes in landscapes, rivers and receiving waters under changing climate conditions |

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We are passionate about the protection and restoration of waterways, catchments and water resources. We strive to make a positive difference to the world we live

in.