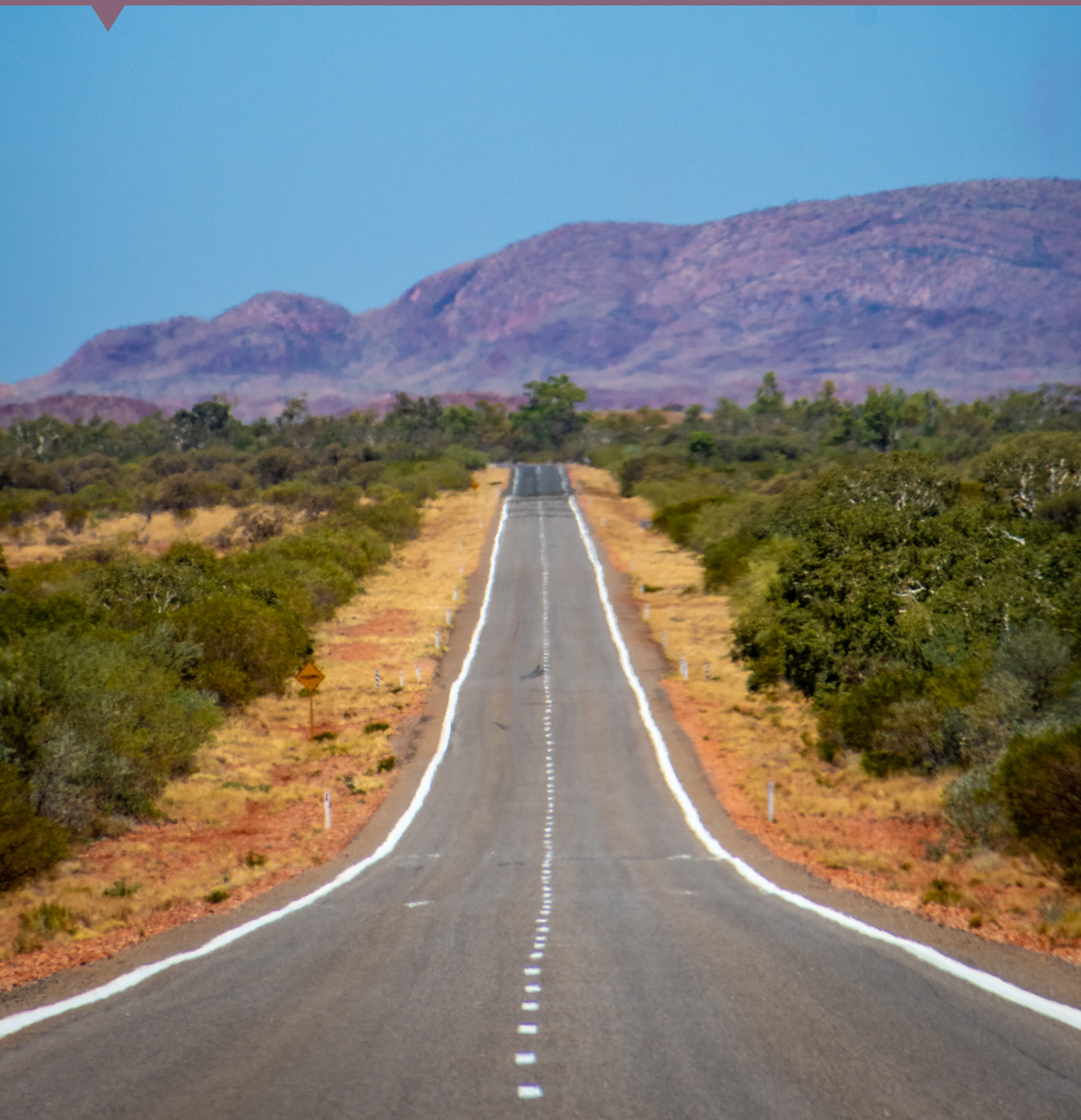
Earth Systems and Climate Change Hub

National Environmental Science Programme

Towards the next generation of climate change projections for Australia



Australian climate change projections need to be updated as our climate continues to change, our understanding of the climate system advances, climate models improve, user needs change and innovations occur in the delivery of products and services. A proposed three-stage approach to developing the next generation of climate change projections for Australia maps out a way forward over the coming decade.

The climate we experienced in the past is no longer a reliable indicator of the climate we will experience in the future. Instead, we need to draw on climate change projections for a guide to what we can expect. Projections, using our understanding of the climate system and how it is changing and powerful climate models based on the laws of physics, are the best tools we have to guide policy and decision-making in a changing climate.

As our understanding of the climate system improves and our modelling capability grows, we can produce climate change projections with increasing levels of detail and more informed confidence. However, developing climate change projections for Australia is no small task.The current suite of national projections (released in 2015) was developed over four years at a cost of around $8.3 million. Limited ongoing user support, maintenance and outreach for these projections are presently supported through the National Environmental Science Program's Earth Systems and Climate Change (ESCC) Hub, which ends in December 2020.

National climate change projections have been released shortly after each Intergovernmental Panel on Climate Change (IPCC) assessment report, and there is broad agreement that this arrangement works well for Australia and should continue into the future. This timing also coincides with releases of the international Coupled Model Intercomparison Project (CMIP) experiments, in which the latest generation global climate models are used to produce climate change projections and scenarios for the next century. The IPCC Sixth Assessment (AR6) and CMIP phase 6 (CMIP6) will be delivered around 2021.

To ensure that current and future decisions are based on the most up-to-date information and evidence provided by AR6 and CMIP6, planning for the development of a new suite of climate change projections must begin now.

In this context, the ESCC Hub has facilitated the development of a NextGen Projections Working Group, composed of representatives from the major research organisations involved in climate projections in Australia. The working group has been active over the last few years in thinking about and planning for the development of future climate change projections for Australia. In 2017, a science-focused workshop was held by the working group to determine the key needs and scientific approaches required to build the next generation of climate change projections. The working group met regularly in 2018 to further develop a strategy around this, suggesting a staged approach to the development of new projections and identifying user information needs, new data and science oppurtunities and delivery mechanisms. Outcomes from the 2017 workshop and discussions held during 2018 by the projections working group has been used to inform this report.

Why we need new climate change projections

Australia's 2015 climate change projections are world class, but changing user needs and advances in our understanding and modelling capability mean that new projections are necessary to ensure that Australian stakeholders have access to products based on the very latest science.

Growing demand for useable and accessible climate information

The demand for regionalised, tailored and accessible science-based future climate information is high and expected to increase as Australian sectors and associated industries come to understand, acknowledge and act on their climate risks.

The financial services sector in particular is placing increasing emphasis on considering physical climate risk in their assessments of financial risk, and stress testing their operations in the context of climate change. There is also a growing emphasis in Australia on planning and investment for natural disaster risk reduction, especially in the context of current and future climate change and its likely impact on critical infrastructure and systems.

Decisions in sectors such as infrastructure, emergency management, health, energy, water, food security, finance, insurance, national security and environmental management need information on current and future changes to our climate. Each sector will have specific needs, so it is not a case of 'one size fits all'.

Enhanced support through knowledge brokering services, close stakeholder engagement, capacity development and better communication will be critical for ensuring the accessibility of the new projections. This engagement with information users will not only guide the development of the next generation of projections but will also help deliver products to meet the huge and growing need for guidance, support, standards and operational protocols for appropriately using climate change projections in the risk assessment and decision-making contexts.

In particular, we need a clear and intuitive framing of climate change in Australia in terms of future emissions trajectories, the amount of global warming since pre-industrial times (e.g. 2°C has high policy-relevance since the 2015 Paris Agreement), or a combination of both.

Meeting user needs

As the body of climate change information users grows, so too do their data and information needs; much of which can not be met by the current climate change projections products, including:

- large, multi-model ensembles with national coverage to provide detailed datasets for specialised analyses that account for a range of plausible future climates
- comprehensive comparison and evaluation of model projections for Australia
- 'seamless' model and observational data delivery to users, covering all weather and climate timescales from the historic past through to the present, and from weather predictions through seasonal predictions, decadal predictions to future projections
- quantitative information on changes in extreme events.

New knowledge, data and modelling

Since the development of the current suite of climate change projections, research has led to new understanding of the climate processes driving change, and tools such as new satellites and improved climate models are now available.

The current suite of national projections are based on CMIP5 global climate models and downscaling of their outputs to finer resolution, which in many cases are now 5–10 years old. New knowledge about climate and socio-economic processes, climate observations (e.g. satellite data of ocean and atmospheric changes), and climate modelling are further clarifying our understanding of the climate system and how it is changing.

Over the next few years, new products and services in the form of 'climate (change) services' from around the world will incorporate the new international scientific assessments such as the IPCC AR6, CMIP6 and the Coordinated Regional Downscaling Experiment project phase 2 (CORDEX2) initiative. New global projections will more closely integrate scenarios of physical climate changes with a set of socio-economic pathways (SSPs) the world could follow. Australia will need to do the same to remain up-to-date. These resources also offer a key opportunity to leverage off the massive international modelling effort and advances in supercomputing power from around the world.

Delivering the next-generation projections: a staged approach

The next generation of climate change projections need to be part of an ongoing, operational climate information service that includes knowledge brokering, regular updates and seamless links to data and other services.

The working group's proposed approach to the development and delivery of these projections leverages off work being done nationally and internationally and is underpinned by a proposed new level of cross-institutional collaboration and coordination to improve effectiveness and efficiency:

- Stage 1: Enhancing the functionality of existing projections, tailoring content for already identified needs, and increased knowledge brokering to deliver projections. This stage also involves the research and modelling required to build towards Stage 2.
- Stage 2: Producing a significantly updated set of national climate change projections based on new science, IPCC AR6, and CMIP6 and CORDEX2 climate model outputs (including Australian contributions). Stage 1 product and service enhancements will be maintained, including the upgraded knowledge brokering capability. All new projections will be put into context of previous projections, so that users can easily understand what is new and what has changed.
- Stage 3: Ongoing delivery and enhancement of national projections from Stage 2, planning and delivery of further enhancements and mainstreaming of climate change products and services in Australia.

The enhanced role of stakeholders in the co-production of the projections is a feature of this approach. New and existing web tools on www.climatechangeinaustralia.gov.au and linked websites will be developed and maintained, and better integrated with other platforms and geospatial datasets, to ensure tools remain relevant, useable and updated. Ongoing monitoring and evaluation will ensure that strengths and weaknesses are identified and managed, and outcomes are achieved.

Next steps

The Australian scientific community is well placed to deliver the next generation of climate change projections through a consortium of climate researchers and knowledge brokers from key universities, the Bureau of Meteorology and CSIRO in partnership with key sectoral and regional stakeholders. Through this collaboration, the expertise that is spread across these institutions can create the critical mass required to achieve this vision.

We suggest a continuation of the public good model of producing climate change projections, but recognise the need to be adaptable in terms of delivery to various stakeholders. The partners on the projections would investigate the possibility for partnerships to more efficiently deliver to various sectors, including through specialist consultants, knowledge brokers and digital platforms.

The ESCC Hub is delivering updates and improvements to the current suite of climate change projections (as identified under Stage 1), as well as continuing to support and build the underpinning projections science capability required for the future delivery of a next generation of projections for Australia. This work is being undertaken in ESCC Hub Project 2.6 and will continue in Project 5.3, commencing in July 2019 through to the completion of the Hub in December 2020.

Proposed timeline

STAGE 1

Now – Jul 2019

- Delivery and communication of existing projections (under ESCC Hub Project 2.6), including market research to measure stakeholder needs and the extent to which current products and services are fit for purpose. Literature review and communication with international partners.
- Ongoing input into the development of a new National Climate Science Strategy, led by the National Climate Science Advisory Committee.

Jul 2019–Jul 2021

- Co-production and testing of a selection of enhancements to the scientific credibility and salience of existing climate projections to better serve the needs of a range of stakeholders, and activities building towards Stage 2.

2021

- Release of Stage 1 update

STAGE 2

2020–2023

- Implementation of strategy for Stage 2 release of new climate change projections

Late 2023

- Release of Stage 2 next generation projections

2024

- Independent evaluation of outcomes and impacts.
- Revision of products and services based on evaluation.
- Ongoing knowledge brokering and support.

STAGE 3

2025–2029

- Ongoing knowledge brokering, communication and stakeholder engagement activities.
- Ongoing maintenance of websites, tools and user support.
- Implement strategies towards future releases and enhanced products and services.

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