

Independent Review of the Australian Climate Service

Discussion paper

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Acknowledgement of Country

We acknowledge the Traditional Owners of Country throughout Australia and recognise their continuing connection to land, waters and culture. We pay our respects to their Elders past and present.

Foreword

Australia's climate is already changing. We are experiencing more climate extremes – heavier and more intense rainfall, extreme heat events, longer fire seasons and rising sea levels (BoM and CSIRO 2022). Natural hazards resulting from severe weather are expected to become more frequent, complex, and unpredictable.

Hazards become disasters when they affect society. Disasters arising from climate extremes are having an increasing burden on Australia's communities and the economy. The cost of disasters to the Australian economy is \$38 billion per year, and this cost is estimated to reach at least \$73 billion per year by 2060 (Deloitte Access Economics 2021).

Australian citizens, businesses and governments are making many important climate-related decisions and will make many more as we adapt to the changing climate and the challenges it presents. It is critical that those decisions are as well-informed as is practical.

The Australian Climate Service (ACS) was established to improve access to climate-related information and data, initially within the Australian Government, but increasingly for other governments and the public generally. The ACS Review provides an opportunity to consider Australia's climate and natural hazard information needs, and how the ACS should be positioned to support these in the future.

There are calls from all sectors, governments, and the public for improved information. But in this emerging and rapidly growing field, where should the Australian Government prioritise its efforts? Even once the ACS is fully implemented, the Australian Government will not be able to provide a full suite of tailored climate services that suits every user.

We want stakeholders to be part of this Review and, accordingly, request they provide their views on the issues raised in this discussion paper. We recognise that not all respondents will have close engagement with the ACS. Some will have specific feedback regarding the ACS, some on emergency management, and others a broader interest in climate change and adaptation. We ask that you respond to the questions you can.

In considering the merits of any proposals, the Panel will be guided by the Review Terms of Reference (see [Appendix A](#)), and the roles and responsibilities of the Commonwealth and States in emergency management, disaster preparedness, and climate adaptation.

Contents

Introduction.....	5
Why is the ACS being reviewed?	5
Consultation and engagement.....	6
Commonwealth roles and responsibilities	6
Concurrent reviews and consultation processes.....	7
Panel interpretation of Terms of Reference	7
Part 1 – Climate services to improve decision-making.....	8
Short-term decision making.....	8
Medium to long-term decision-making	9
Australian Government investments in climate and natural hazard science	10
From science to services	10
Who else is providing these services?	12
Climate and natural hazard services case studies	13
International examples	15
The Australian model for a national capability	17
Part 2 – The Australian Climate Service	18
ACS governance	18
ACS scope.....	20
Current services	21
Customers and products.....	22
Part 3 – User needs across Australia.....	24
Defined user needs	24
User needs case studies.....	25
Appendices	28
Appendix A – Terms of Reference	28
Appendix B – Royal Commission into National Natural Disasters	29
Appendix C – Reviews relevant to disaster arrangements	30
Appendix D – Australian Government investments in climate and natural hazard science ..	31
Appendix E – Glossary.....	33
Appendix F - References	34

Introduction

The Australian Government has appointed an independent panel to review the Australian Climate Service (ACS). The panel comprises Professor Mary O’Kane (Chair), Mr Daryl Quinlivan and Dr Russell Reichelt.

The Panel has been asked to explore two themes (see Terms of Reference in [Appendix A](#)):

- the performance of the ACS since its establishment
- Australia’s future climate information needs and the suitability of the ACS to deliver on them.

The ACS was established in 2021 in response to the *Royal Commission into National Natural Disaster Arrangements* (the Royal Commission, see [Appendix B](#)) to better connect and leverage Australia’s data, information and capabilities that facilitate climate and disaster risk management. Its intent was to provide an authoritative source of information on climate and disaster risk to benefit all Australians.

There was an expectation that the ACS would expand over time to service multiple sectors. The Royal Commission recommended the implementation of the National Disaster Risk Information Services Capability (NDRISC). The NDRISC pilot envisaged a broad user base, with the expectation that a national capability would bring together and share knowledge across providers and user communities, government, industry and research communities, and sectors (refer Recommendation 3, Home Affairs 2020).

Since the establishment of the ACS there has been an unprecedented scale and number of natural disasters. This has created unforeseen strain on ACS resources early in its establishment due to a high volume of urgent requirements from the now National Emergency Management Agency (NEMA). It has resulted in the ACS employing less efficient manual systems and processes to meet more immediate needs and investing a comparatively small amount in knowledge services to support long-term risk assessment, planning and decision-making. There have been improvements in this area, but short-term emergency response requirements continue to be a major focus for ACS’s capacity, limiting the ACS’s ability to meet its original scope.

In its July 2023 Statement of Expectations for the ACS, the Australian Government repositioned the ACS to support both disaster management and climate adaptation. That is, provide additional information on longer-term climate risks and impacts that Australia needs to adapt to. Both are critical issues for Australian governments and communities. The Statement of Expectations requires ACS to maintain current services in the emergency management sector until the Government has considered the outcomes of this review, whilst simultaneously growing its climate adaptation services offering.

This paper provides an overview of Australia’s current state of climate services – including ACS capabilities and factors that have affected how ACS operates in the emergency support and climate adaptation sectors – and invites input on what Australia will need from its climate services in the future.

Why is the ACS being reviewed?

Access to relevant climate knowledge and data (climate services) is critical for effective adaptation to our changing climate. While Australia cannot avoid all climate impacts, successful adaptation and risk reduction underpinned by high-quality information can help reduce the vulnerability of communities and industries, and the costs associated with those impacts.

The Australian Government has indicated after two years in operation, it is timely for the government to review the ACS.

Consultation and engagement

Consultation is essential for this Review. In providing this input, stakeholders are asked to consider the Australian Government's [roles in climate adaptation](#) and [disaster management](#), the Australian Government's [Statement of Expectations](#) for ACS, and the Terms of Reference (Appendix A) for this review.

The Panel welcomes specific examples it can draw on when providing their advice to government.

The paper reflects the ACS Independent Review ('the ACS Review') Terms of Reference and is set out in three parts:

- Part 1 – provides the high-level context of how climate services can improve decision-making.
- Part 2 – describes the history of the ACS, current governance and services, and future plans.
- Part 3 – identifies gaps in the Australian climate services market.

The webpage for public consultation, including guidance on how to provide responses and publication of responses can be found at: [Consultation hub | Climate \(dcceew.gov.au\)](#).

This consultation period will close on 2 January 2024. The Panel will also engage with stakeholders in 2024 but this closure date is necessary to meet our reporting obligations.

Commonwealth roles and responsibilities

A priority for the Panel is to understand of the Australian Government roles and functions across the disaster continuum as well as in supporting climate adaptation.

Building resilience and responding to natural disasters is primarily a state and territory responsibility, with local governments also having an important role. However, as recent disasters have shown, the Australian Government is expected to play a strong role in supporting and complementing state and territory arrangements. All levels of government have assigned roles in emergency management and disaster preparedness, as outlined in the [Australian Emergency Management Arrangements Handbook](#) (NEMA and AIDR 2023). The Australian Government's responsibilities include:

- Working with states and territories:
 - when requested.
 - when a disaster spans multiple jurisdictions or has the potential to span multiple jurisdictions.
 - to build national resilience against natural hazards.
- Managing emergencies occurring outside of Australia that impact Australia's national interest.
- Providing financial support to those affected by a disaster.
- Being party to international agreements that assist governments to be better prepared for international operations.
- Identifying national priorities.
- Providing information services and public warnings.

All levels of government have [agreed roles and responsibilities for climate adaptation](#), to support Australians to adjust to current or expected climate change and its impacts (DCCEEW 2012). The Australian Government has four key roles and responsibilities:

- Providing leadership on national adaptation reform.
- Providing nationally authoritative science and information.
- Managing Commonwealth assets and services.
- Maintaining a strong flexible economy and a well-targeted social safety net.

Concurrent reviews and consultation processes

The ACS Review is one of four reviews of the Commonwealth's role and capacities in emergency management and disaster risk reduction (further detail in [Appendix C](#)). These reviews are considering: the balance between emergency management and disaster risk reduction; the NEMA's part in delivering the Commonwealth's role; and ACS's role in meeting the NEMA's needs (the ACS Review).

There are numerous intersections between this Review and those above. Our focus is on assessing the Commonwealth's role in decision support for short-term emergencies, and decision-making for longer-term climate adaptation.

Panel interpretation of Terms of Reference

The Panel has been asked to provide an assessment of Australia's future climate information needs and the suitability of the ACS to deliver on them. Given the scale of climate needs and the limited timeframe of the ACS Review, this will only be achieved at a high-level.

The ACS Review is aiming to take account of the broad range of interests in Australia's climate services and decision-making needs, including:

- federal, state and local governments
- the private sector
- academic and research institutions
- individuals.

The ACS Review will provide opportunities for engagement via the public *Have Your Say* portal. However, direct outreach will be done for a targeted group of stakeholders.

Part 1 – Climate services to improve decision-making

Across all government portfolios and sectors of the economy there is an urgent, growing demand for authoritative climate and disaster risk information to inform operational and longer-term policy, program and investment decisions. Demand is growing to address the financial impacts of climate change and disaster: people, livelihoods and assets are more exposed and vulnerable; essential services are increasingly affected; disaster impacts are long term and complex; the stability of natural, social and economic systems can no longer be taken for granted.

Governments are taking steps to embed climate risk in decision-making across all sectors, but capability is still developing. Governments, businesses and individuals now have access to more climate information than ever before but are struggling to assess its relevance and to use it effectively.

Across Australia, there are many different decision-makers who need information relevant to their location and at varied time horizons, to be relevant to their circumstances.

Q1 What climate and natural hazard information does Australia need to improve its decision-making?

Short-term decision making

During the response phase of an extreme event or natural disaster, governments need near real-time information about what is happening on the ground to support effective decisions. This requires hazard monitoring and situational awareness when responding to a disaster event, to ensure those affected are supported as quickly as possible.

The *Royal Commission into National Natural Disaster Arrangements* found that for Australia to be more resilient to disasters, there needs to be a common and much clearer picture of national and local natural hazard and climate risks, vulnerabilities and impacts. This is necessary to improve governments and all decision-makers capacity to predict, plan for, avoid or minimise the impacts – including loss of property and human life – wrought by extreme events and a changing climate.

For example, during a flood event, information about several cascading consequences of rising river heights is required to proactively respond in an emergency context. The ACS has access to a suite of flood inundation tools to assist this decision-making. These tools combine multiple forecasting models, including near real-time river heights, inundation and warnings. This allows emergency services to identify where lives and assets are most at-risk and deploy resources accordingly.

Q2 What is your vision for the future of Australia's national climate and natural hazard data and services?

- a. Does this include public access to trusted data or information products?
- b. What are the key steps towards achieving this?

Medium to long-term decision-making

Many decision-makers are considering climate and disaster risks across longer time horizons, to inform their decisions under uncertain future conditions.

There are two categories of climate-related risks that need to be considered by Australian organisations – physical and transitional risks. The Panel is only dealing with the issue of data and information services to support these decisions.

- **Physical risks** are driven by extreme weather resulting from climatic events as well as long-term shifts in climate patterns, such as changing rainfall patterns and increased heatwaves.
 - Acute physical risks are those that are event driven. For example, extreme increased severity of extreme events, such as floods.
 - Chronic physical risks arise due to long term changes to climate, for example, high temperatures that cause sea level rise and ocean acidification.
- **Transition risks** result from the policy changes to shift to a low emissions economy and society. They can include technological changes, policy shifts, or changes in consumer preferences. For some firms these will provide commercial opportunities.

Decision-makers can also identify **opportunities** when understanding their climate risks. For example, these could be activities that improve resilience against hotter conditions.

Throughout the economy and community generally, decision-makers are trying to account for these climate related risks in their decision-making processes and will require access to appropriate data, information and advice for efficient adaptation and responses to events.

Domain	Who	Types of decisions
Built domain	Governments Energy market operators Operators of major infrastructure Construction businesses Asset owners Investors Asset operators Consultants First Nations peak organisations	Planning an infrastructure investment Understanding the vulnerability of their assets and networks Embedding resilience into land use planning and development decisions Construction design, practices and technology Understanding climate impacts to First Nations communities e.g. heat stress in remote housing
Economic domain	Financial regulators Banks Insurers and underwriters Superannuation funds Energy market operators Private businesses Auditors and accountants Other large investors Consultants	Understanding climate risks (market, reputational) Preparing a climate risk disclosure statement to meet the Taskforce for Climate-related Financial Disclosures (TCFD) requirements Identifying climate opportunities
Natural domain	Governments, regulators and natural resource management organisations	Understanding climate risks to environmental, water, agricultural and fisheries assets

Domain	Who	Types of decisions
	Land managers Primary producers and agri-businesses Communities Consultants First Nations peak organisations	Understanding climate risks to cultural practices as a result of ecosystem disruption Understanding opportunities to incorporate traditional knowledges and cultural practices into land management
Social domain	Governments Medical professionals Health and wellbeing specialists First Nations peak organisations Individuals	Understanding climate risks to health systems including (heat, disease and air quality) Understanding risks of community displacement due to disasters or inhospitable climates Understanding domestic security impacts of climate change and likelihood of extreme climate events

Australian Government investments in climate and natural hazard science

Good quality climate and natural hazard science is a critical component in preparing climate risk information and services for decision-making. Australia's climate and natural hazard science and research is distributed across multiple Commonwealth entities, research cooperatives, research infrastructure (refer [Appendix D](#)).

Q3 How should the Australian Government better integrate investments in climate and natural hazard science? From a user perspective, what would this integration look like?

From science to services

To enable decision-makers to make sense of the foundational science, it needs to be translated into usable information which is targeted to the audience.

Climate services are customised information products that utilise climate data to support climate change adaptation, mitigation and disaster risk management. Although climate services are not new, they are increasingly important due to increased risk, frequency, and severity of natural hazards, growing population, and more potential impacts on the built environment including critical infrastructure.

They can take various forms, such as websites, visualisation tools, charts, descriptive storylines, or direct advice.

Climate services are developed through a knowledge supply chain (Figure 1). To ensure effective climate and natural hazard information services are delivered, all five parts of the supply chain need to work well. The five key stages are:

Earth observation and monitoring

Remote sensing and in-situ Earth observations of environmental variables across the land, oceans, atmosphere and cryosphere.

Key players: CSIRO, the Bureau, GA, the Australian Antarctic Division, state and territory governments (for coastal and terrestrial monitoring), private sector e.g. FrontierSI.

Modelling and data processing

Processing raw data using climate models and data storage systems to generate projections, forecasts and other forms of accessible climate data.

Key players: ACS, CSIRO, the Bureau, state governments (NSW, QLD, WA and SA), National Partnership for Climate Projections (state governments, CSIRO, the Bureau, universities, NESP Climate Systems Hub and ACS), universities and Australian Research Council Centres of Excellence, and private firms.

Assessing climate and disaster risks

An assessment of how climate hazards are changing, exposure to natural hazards and vulnerability. This assessment is used to help understand likely impacts and consequences.

Key players: ACS, CSIRO, the Bureau, state governments, universities and Australian Research Council Centres of Excellence, the private sector, the Climate Change Authority and government departments (including DCCEEW, Department of Agriculture, Fisheries and Forestry (DAFF), Department of Health, Department of Industry, Science and Resources, Department of Infrastructure (DITRDCA)).

Service production

Converting processed climate data into tailored products that meet the specific spatial and temporal needs of end-users.

Key players: Can be performed by a range of actors. Key players are ACS, CSIRO, the Bureau, universities and ARC Centres of Excellence, GA, DAFF, state governments, NESP Climate Systems Hub and the private sector.

End user engagement

The process of end-users requesting, accessing, utilising, and providing feedback on services. It informs modelling and data processing, risk analysis and service production.

Key players: Can be performed by a range of actors across the knowledge supply chain. It is best practice to co-design services alongside the users, incorporating their requirements at each stage.

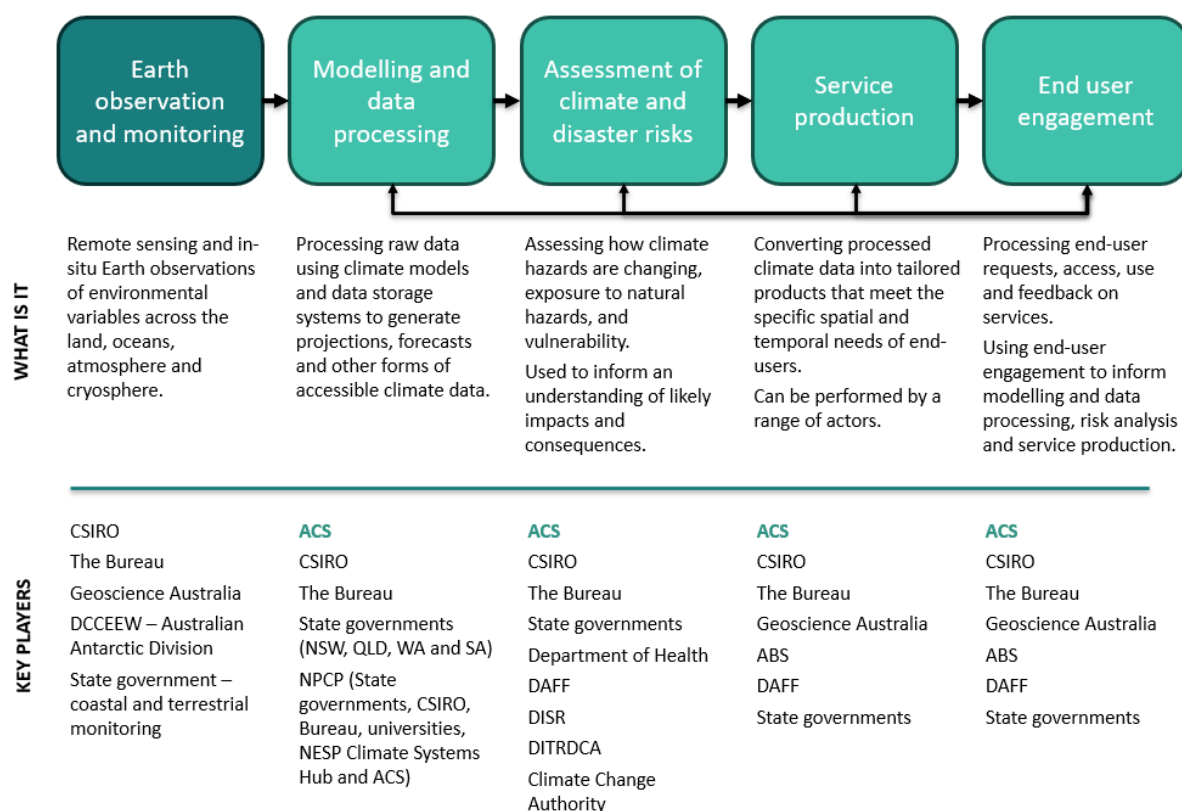


Figure 11: The climate services supply chain.

- Q4 How would you assess Australia's performance across each stage of the climate services supply chain against climate information needs and challenges?
- Q5 Looking from now to 2030 and 2050, what are the major climate services priorities that Australia should focus on?

Who else is providing these services?

State and territory governments

States and territories have a responsibility to deploy emergency services within their jurisdiction, and to implement planning policies and enforce planning standards. For this purpose, they maintain state crisis and emergency management centres, which also link with the National Situation Room.

Many Australian states have developed their own more localised climate models to meet the need for higher resolution climate intelligence. State and territory governments deliver trusted climate projection information for their jurisdictions, provided through various portals and websites. They differ in geographic scope, spatial resolution, choice of emissions futures, and underlying modelling approaches (NPCP 2023).

New South Wales and Queensland are working with the ACS to co-produce the next generation of climate projections for Australia, using models from the Coupled Model Intercomparison Project phase 6, CMIP6 (NPCP 2023).

Private sector

The private sector has a range of experts and consultants who undertake a range of climate and natural hazard services for capital investment, resilient infrastructure planning, insurance and community readiness. For example, their work includes climate risk assessments and disclosures, adaptation planning, climate modelling, scenario analysis, cost benefit analysis, decision-support tools, and development of standards and guidelines (Keele 2018).

These firms are offering these services to a wide range of users. Users include:

- the Australian financial sector, which relies on private advisors to support their climate risk disclosures and investment decision-making
- agronomic producers and advisers – and other heavy water users – who use climate risk assessments as essential elements of their decision-making processes
- government entities who are preparing climate adaptation plans and risk assessments
- insurers and underwriters assess the hazard risk profile for assets and products to determine the availability of insurance cover and pricing.

First Nations

The National First Peoples Platform on Climate Change is an indigenous-led governance forum, which is supported by the National Environmental Science Program's Climate Systems Hub. It promotes sharing of First Nations knowledge, climate science and practices and indigenous-led responses to climate change.

Q6 Is there clarity about the roles and responsibilities of federal, state, and local governments, private firms and industry representative organisations for providing and using climate and disaster risk information?

Q7 State governments are playing a significant role in climate projections.

- a. Are the different roles of the Commonwealth and states clear and coherent?
- b. How should resourcing and responsibilities be split for national climate projections?

Q8 What level of confidence do you have in the quality of climate and natural hazard information services from the range of providers?

Q9 What should the Australian Government's role be in enabling private sector innovation and investment in climate services?

Q10 For entities undertaking climate risk disclosures:

- a. Do you feel that the currently available information is sufficient to allow you to meet your proposed compliance obligations and shareholder interests?
- b. If not, what information would you need?

Climate and natural hazard services case studies

The following case studies illustrate Australia's involvement in climate services and natural hazard services. They range from immediate, short-term services with a decision support focus, to post-

event analysis services, through to intelligence to support long-term climate adaptation strategies. The full suite of ACS services will be explained in Part 2.

National Joint Common Operating Picture

Provider: The NEMA

Audience: The NEMA and state governments

The National Joint Common Operating Picture (NJ-COP) is a near-real time situational awareness platform that displays active, nationally significant disasters. It is accessible to Australian Government emergency management stakeholders and state and territory management agencies. It takes observations and modelled data, combined with datasets that inform vulnerability, and presents it to those who need to make decisions in an emergency.

ACS Impact Briefs

Provider: ACS

Audience: The NEMA

During a disaster, national and state emergency services must coordinate and make efficient decisions to limit impacts to lives and assets. This requires intelligence on what the weather is likely to be, as well as how the weather will impact people, buildings, logistics, transport, utilities, and more.

ACS provides a daily impact brief to the NEMA, before and during a disaster. These are uploaded to NJ-COP and include weather outlook, recorded and likely impacts, active watches and warnings, potential for compounding disasters, road closures, and comparable historical events. It is currently a static PDF document, however the ACS is developing a more dynamic approach to more efficiently provide up-to-date information.

Climate Change in Australia

Provider: CSIRO and the Bureau

Audience: Public

[Climate Change in Australia](#) hosts climate projections (and underpinning data) developed for Australia, which were released in 2015. The data is derived from approximately 40 global climate models to demonstrate the affects and impacts to eight regions of Australia in 20-year increments. Climate Change in Australia is presented as a suite of interactive tools with varying levels of complexity, suitable for a wide range of audiences – from those with the most basic climate data knowledge to those with advanced data analytics capabilities.

My Climate View

Provider: Department of Agriculture, Fisheries and Forestry, developed by CSIRO and the Bureau

Audience: Agriculture sector

The digital tool [My Climate View](#) provides farmers with past observations and future climate outlooks at a 5km resolution, based on their commodity. It allows users to visualise the future climate for their area, and how this will affect what they farm – better preparing farmers to adapt to the changing climate. For example, a lupin farmer in Geraldton will see rainfall observed since 1963, and projected rainfall up to 2085 for April to October, which is the growing season for lupin.

CoastAdapt

Provider: National Climate Change and Adaptation Research Facility, Griffith University

Audience: Public

[CoastAdapt](#) is a decision support framework. It helps the Australian public understand the impact that climate change will have on Australia's coast and supports climate risk management. In addition to making climate impacts easier to understand, CoastAdapt also contains information relevant to different jurisdictions, where planning and regulatory systems differ. CoastAdapt is a website, a series of information manuals, case studies, impact sheets, templates, checklists and data.

The project received funding through the Disaster Risk Reduction Package to refresh the website.

International examples

In contrast to climate and disaster risk services provided in other countries, the ACS is unusual in its direct involvement with both climate *and* disaster information services. The scope of the ACS spans across the disaster continuum, in recognition of the commonalities in information need from disaster response to climate adaptation.

In most other countries, the two functions are served by separate organisations. “Despite the obvious links, [climate change adaptation] and [disaster risk reduction] have been developed largely as separate policy domains. This has resulted from a range of reasons, including the different temporal and spatial scales considered by the two domains, the diversity of actors involved in them and the policies and institutional frameworks of relevance, as well as the differences in the terminology and methodological approaches used in research activities related to the two domains” (Street et. al 2019).

Europe

Copernicus Climate Change Service, the “the European Union's Earth Observation Programme”, provides access to consistent and authoritative climate data through their Climate Data Store (Copernicus 2023). They offer training to users of the Climate Data Store, as well as tools and expert guidance to transform the data into other products like maps and charts. Data and tools are open access. Key users include scientists, consultants, planners and policymakers, media and the public across Europe.

Copernicus also offers emergency management services, in the form of on-demand tools and services. These tools are designed to be used across the disaster continuum, with rapid mapping services for immediately after a disaster, through to risk reduction and recovery by overlaying population grids and data about the built environment.

United Kingdom

The Met Office's [Climate Service UK](#) provides support and advice to both government and the private sector. It includes historical climate information, climatological tools, specialised services, and capacity building to support other countries.

As of 2023, the UK government has published three five-year assessments of climate change risks. The Climate Change Risk Assessment identifies risks and the urgency for further action and has been used to quantify economic damages for each risk at different warming scenarios (United Kingdom Government 2022).

[UKCIP](#) (the United Kingdom Climate Impacts Program) has a strong focus on building partnerships between information providers and information users. It does this by acting as an intermediary between scientific research, policy, and adaptation actions.

Canada

The [Canadian Centre for Climate Services \(CCCS\)](#) is a dedicated multi-disciplinary team with expertise across a broad range of climate-related disciplines (Government of Canada, 2023). The goal of the CCCS is to help Canadians increase their resilience to climate change. This is achieved through:

- delivering climate services driven by user needs
- providing access to climate information
- building local capacity
- offering training and support.

The Canadian model has a strong focus on providing public-good services in the form of data, information and tools. They offer training and support for individuals trying to make sense of climate information. This includes support in finding data, interpreting it, and understanding how to apply it in decision-making.

California, United States

The State of California uses its own unique state-based institution for managing risks associated with water – referred to as Delta Adapts. California's climate adaptation approach is highly localised with a strong focus on engagement at state, local and regional levels (Delta Stewardship Council 2023).

The Delta Adapts initiative consists of two phases, comparable to Australia's National Climate Risk Assessment, firstly identifying climate vulnerability, followed by a broad climate adaptation plan.

New Zealand

The New Zealand Government has committed to completing a National Climate Change Risk Assessment every six years. The first assessment in 2020 involved stakeholder engagement as well as scientific, technical and expert analysis. It identified risks across the human, natural environment, economy, built environment, and governance domains. Like the Australian

National Climate Risk Assessment, the assessment informs a National Adaptation Plan (Ministry for the Environment 2020).

Q11 The Australian approach to organisational design and governance appears unusual among the comparable international models. What can we learn from these international examples?

Q12 Are there international exemplars which are highly effective that could be considered for application within the Australian system of government?

The Australian model for a national capability

The ACS model was set up to provide both climate and disaster services. This decision was informed by the Royal Commission and the NDRISC pilot, which the Royal Commission recommended be implemented in full (refer Recommendation 4.3, in [Appendix B](#)).

The objectives of the NDRISC pilot were to test and prove the concept of a national capability for Australia. It used narrative scenarios to frame climate and disaster risk discussions for freight supply chains, and modelled climate and disaster risks for three specific case studies (Home Affairs 2020).

The Royal Commission (2020) stated that 'It is no longer suitable to assess disaster risk at an individual hazard level, without taking account other possible natural hazards and broader societal pressures that impact resilience. As hazards become more frequent and intense, measures to prevent or mitigate hazards will become more difficult'.

The establishment of an NDRISC was seen as a bridge between disaster management information communities and longer-term climate risk information communities which would improve collaboration. Similar initiatives to are underway in the European Union, as described above in *International examples* (Home Affairs 2020).

The NDRISC pilot identified several issues, some of which have not been resolved following the establishment of the ACS. Issues were 'constraints on accessing available data, incapability between datasets due to lack of standards, absence of required data for modelling and in some cases insufficient understanding of and/or limited ability to model complex real-world systems' (Home Affairs, 2020).

Q13 What are the advantages and/or disadvantages to having both short-term emergency management and medium to long-term climate information services provided by a single entity?

Q14 History suggests communities and governments will give priority to emergency management and disaster response over longer term risks and priorities.

- a. Is there evidence to suggest that a focus on the urgent and immediate has crowded out the development of long-term products (climate information) or delayed capability building?

Part 2 – The Australian Climate Service

The ACS was established in 2021 to connect the Commonwealth’s climate, natural hazard and socio-economic information into a single national view to aid climate-related decision-making.

ACS services are the result of drawing capabilities together across several organisations:

- The **Bureau of Meteorology (the Bureau)** is the accountable authority for the ACS. It provides weather and climate knowledge and advice. Meteorologists, climatologists and hydrologists provide real time knowledge and advice during severe weather events.
- **CSIRO** provides its science and innovation with a focus on climate observations and modelling, resilience, adaptation, and transformation science and practice.
- The **Australian Bureau of Statistics (ABS)** provides social and economic information, enabling an improved picture of vulnerability of geographical locations to help prevent or prepare for natural hazards.
- **Geoscience Australia (GA)** advises on national geology and geography, provides national natural hazard and exposure information, and national geospatial and location services.

The ACS has an unusual governance model, and its scope, service offering, and customer expectations have continued to evolve. While this is not unexpected in the early years of a new organisation and capability, there are concerns that it has not been able to meet the original vision set by the then government in 2020.

Q15 How effectively does the ACS integrate the skills of its partners in its outputs and its effectiveness generally?

Q16 Are these the right partners? Should other/fewer organisations be involved?

ACS governance

The structure of the ACS is unusual in the Commonwealth. It is a Type F agency, operating within the Bureau as the accountable authority. The ACS operates as a virtual partnership across its four partner agencies.

Type F	A secondary government body (the ACS is part of the Bureau of Meteorology) with separate branding, for the purposes of engaging with stakeholders.
Virtual	The ACS has a central office, and all other staff remain employed by the partner agencies, but contribute to ACS projects.
Partnership	The Bureau, CSIRO, GA, and the ABS are equal partners of the ACS.

Figure 2 The ACS is a Type F agency, operating as a virtual partnership.

As a virtual partnership, funding and responsibilities are distributed amongst the four partners via different operating agreements for each project. The Bureau, as accountable authority, is allocated resources which are then allocated based on capital and operational needs for each project. Each partner is then responsible for delivery of their respective components of the project that are allocated to them via the operating agreement.

The ACS has a distributed model. Staff working on ACS projects remain employed by the partner agencies. They often collaborate with other partners across several projects at a time. Each of the partner agencies must balance the work contracted through the operating agreements with their agencies' own priorities and pressures.

DCCEEW provides policy support and direction for the ACS. It does this by:

- supporting the responsible Minister for the ACS
- providing policy support to the ACS
- supporting its governance.

The ACS is governed by:

The ACS **Program Control Group**, a monthly senior governance committee, provides operational oversight of the ACS in line with its strategic direction. The meetings are chaired by the ACS Senior Responsible Officer (CEO, Bureau) and members are heads of the other delivery partner agencies (CSIRO, ABS and GA) and Deputy Secretary (DCCEEW).

The **Customer Committee** provides advice to the Minister on strategic priorities for the ACS, identifies customer priority service, and approves ACS annual work programs. Members are the ACS Senior Responsible Officer (CEO, Bureau), Coordinator General (NEMA), Deputy Secretary (DCCEEW). Heads of the other delivery partner agencies (CSIRO, ABS and GA) are amongst the observers. ACS Senior Responsible Officer (CEO, the Bureau).

The **Operational Steering Group** coordinates capabilities and services and oversees implementation. The members of the Operational Steering Group are SES Band 1 or Band 2 employees from each partner agency. The Chair is the ACS Group Executive.

Q17 How effective is the ACS structure (i.e. a virtual partnership model) from the perspective of the partners, the 'customers' (NEMA and DCCEEW), the states, and the ACS?

Q18 How well does the ACS governance and structure facilitate effective collaboration and project oversight, responsibility, and accountability?

Q19 Are the ACS governance committees fit-for-purpose?

a. What areas should remain unchanged?

b. What areas should be improved?

Q20 If the customer base grows, is the current Customer Committee model scalable?

Q21 If the volume of publicly available ACS products grows, and public expectations about access and utility grows, how should public interests be represented within the ACS governance arrangements?

ACS scope

Original scope

In its establishment phase, the focus of the ACS was on supporting:

- the natural hazard preparedness functions in the National Resilience and Recovery Agency
- the response functions in Emergency Management Australia.

The then government allocated \$210 million over four years with \$37.3 million in ongoing funding. This funding was for the delivery of projects and capabilities to:

- understand built, social, economic and natural assets
- assess disaster and climate risks – now and in the future
- analyse impacts and risk reduction actions
- integrate and harmonise data
- deliver tailored products and services for Commonwealth emergency management and resilience agencies
- support operations and governance of the service.

Redefined 2023-24 scope

In Budget 2023–24, the Australian Government re-focused the ACS to support both short-term and longer-term responses. The reforms included:

- formalising the Assistant Minister for Climate Change and Energy as the single responsible minister for the ACS:
- DCCEE becoming a customer of the ACS to deliver the evidence base for the National Climate Risk Assessment (as outlined below)
- positioning ACS to support both medium- and long-term climate and natural hazard analysis and advice, in addition to its operational support for the NEMA in response to natural disasters.
- positioning the ACS to make data available for reuse within and outside the Commonwealth.

The ACS received \$16.4 million for 2023–24, and \$6.5 million for 2024–25 to deliver the evidence base for the National Climate Risk Assessment. The additional \$22.9 million takes the total ACS investment over 2021–22 to 2024–25 to \$232.6 million.

This shift in strategic direction for the partnership was formalised in through a [Statement of Expectations](#) for the ACS, which was issued on 3 July 2023. It highlighted that the Australian Government intends the ACS to support both short-term and longer-term responses, by continuing to support the NEMA, and maturing its services over time. It flagged that the ACS Review would identify the appropriate level of support to the NEMA, whilst current levels are maintained for the 2023-24 higher risk weather season.

Q22 How should the ACS balance its short-term emergency management and medium to long-term climate information responsibilities, given the demands during a disaster?

Q23 The ACS is built on the capabilities of its partners (the Bureau, CSIRO, ABS, and Geoscience Australia).

- a. Is the value in combining these capabilities and producing integrated outputs via the ACS greater than each partner could provide individually and the costs associated with the interposed ACS?
- b. Is this arrangement sufficient to meet the government's Statement of Expectations for the ACS?
- c. Is this arrangement sufficient to meet your own needs for national climate services?
- d. How could the ACS better leverage the expertise of its partners?
- e. When needed expertise is not available in the partnership, how should ACS source it?
- f. Are there impediments to the ACS accessing that expertise in its production processes?

Q24 Should there be formal arrangements within the government (except for those with national security functions) requiring departments and agencies to make all climate-related data available to the ACS and to consult with the ACS on data-related projects and investments?

Q25 How can we determine the scale for this work? How should the scope of ACS's work be prioritised given competition for resources?

Current services

The ACS provides a range of products and services to the NEMA and DCCEEW. Due to the flooding in 2020/21 and 2021/22 higher risk weather seasons and the urgent situational intelligence required, most ACS resources were applied to emergency response, and the recovery and preparedness functions (including analysing impacts and risk reduction actions) and adaptation-related work have not been able to grow to the originally envisaged scope.

Seasonal preparedness planning

Annually, the ACS is actively involved in seasonal preparedness planning. National and state-based storylines (narratives that describe impacts of the seasonal forecast) draw attention to compounding disasters and consequences of severe weather to the population, infrastructure, and the environment.

Impact briefs

During a disaster, the ACS supplies daily impact briefs to the NEMA. These briefs follow the HEVIC chain (hazard, exposure, vulnerability, impacts and consequences) to clearly communicate the weather events and how it is likely to affect lives and assets.

National Situation Room

The ACS provides natural hazard intelligence and personnel to the NEMA through the National Situation Room, which is the government's 24/7 crisis management information and coordination facility. During a disaster, emergency services personnel in the National Situation Room have real-time decision support from meteorologists, climatologists and hydrologists.

Flood intelligence tools

The ACS has been piloting flood inundation forecasting tools, to directly support decision-making needs in the NEMA. These tools include the ability to quantify impacts to the built environment. This capability was tested regionally but has potential to be applied nationally.

Evidence base for National Climate Risk Assessment

The ACS is developing the evidence base for DCCEEW's National Climate Risk Assessment. The Risk Assessment will deliver a high-level understanding of national priorities for climate adaptation action through analysis of climate hazard, exposure, and vulnerability data (DCCEEW 2023b). The resulting risk assessment will inform the National Adaptation Plan to be developed by DCCEEW – as a critical pivot from identifying risks to taking mitigation actions.

Next-generation climate models

The ACS was tasked with producing a national set of downscaled climate projections (deriving local to regional scale information from larger-scale climate models or data) following the Royal Commission. This will provide a national view of Australia's climate to support decision-making and planning, as well as identify realistic scenarios involving climate extremes. As part of the National Partnership for Climate Projections (NPCP), the ACS is working with state governments, universities, and government-funded initiatives (including the Climate Systems Hub) to downscale climate models to a 5–10km resolution.

Program and policy support across government

ACS provides data and intelligence on request to federal government, including contributions to [Measuring What Matters](#) and the [Intergenerational Report](#). To a lesser extent, the ACS has provided program and policy data and support for disaster risk reduction and mitigation activities within the NEMA.

Q26 How effectively has the ACS delivered on its original scope, strategic objectives, and agreed functions?

Q27 Do you have any other comments on the performance of the ACS since its establishment?

Customers and products

While there has been wide interest in the ACS, to date, access to its products and services has been restricted.

The ACS's current customers are the NEMA and DCCEEW. Customers are those receiving dedicated services, as opposed to those accessing published products.

- The NEMA is ACS's main customer.
 - When the service was established in 2021, the ACS had two customers, the then Emergency Management Agency and the National Recovery Resilience Agency. They have now merged to become the NEMA.
- In July 2023, the ACS expanded its customer base to include DCCEEW, primarily for the National Climate Risk Assessment.

Adding new customers will be a decision for the Australian Government in the future. However, the government has recognised there is a clear need and demand for these information services more generally.

In the Statement of Expectations, the government asked that the ACS make its information available to all governments and the general public, where practicable (Australian Government 2023). This is a step change, but it is not yet clear how this will be managed.

In its [Statement of Intent](#) (the ACS's response to the government's expectations) the ACS said it:

- will make the data, reports and insights generated through its activities accessible to the public via its website
- will develop authoritative climate and weather hazard risk resources, such as baseline national hazard and vulnerability assessments, national scenarios and projections that can be used by multiple decision-makers across the Australian Government to deliver consistent national assessments
- will seek to capture insights and share data from other Australian Government, where possible, to improve access and build the national knowledge base over time (ACS 2023).

The overall intention from the Australian Government is for greater accessibility of ACS products and services. However, it is not clear how an entity seeking tailored climate services could become a customer of the ACS. There is also no visibility of who will become customers of the ACS. This has created uncertainty and potentially duplication, as entities seek services via other climate services providers in Australia.

Part 3 – User needs across Australia

This paper has described the value in access to high quality, usable climate and natural hazard information and the ACS's current role in the landscape. It is evident that there are unmet needs across all industries and sectors for this information.

The needs of users across Australia are varied and complex. There is a large range of decision-makers who need access to information, who work in several timescales, with different purposes and in varied locations. This section aims to outline Australia's user needs and provides some case studies to demonstrate where additional climate and natural hazard information may be needed.

Defined user needs

In 2020 the NDRISC pilot made recommendations and findings for user needs which could be addressed by a national capability. These included recommendations around specific information types:

- hazard information
- scenarios
- exposure information
- vulnerability information
- risk assessment processes and information
- disaster consequence information.

The pilot recommendations acknowledge that information isn't enough, and that there is complexity, uncertainty, and systemic risks. It recommended that the national capability needs to be more than an information platform – it needs to be a socio-technical system that can prioritise, coordinate, and lead products and standards development for climate information.

In its [recent report](#), the National Environmental Science Program's Climate Systems Hub found that 'research into existing climate data portals demonstrates much of the required information already exists, but stakeholder climate literacy and specific information needs are often barriers to this information being applied in decision-making' (NESP 2023). In effect, decision-makers need more easy-to-use climate and natural hazard information and services to help them understand and manage their risks.

The Climate Systems Hub identified 12 high-level themes to capture the needs of decision-makers:

- guidance on accessing, interpreting, and using climate information
- information applicable at a user's location
- information applicable to a specific sector or decision-making process
- information of appropriate complexity – often simplicity is preferred
- a trusted guide to finding the right information
- inter-operability between climate data and other information
- up-to-date information
- data and information presented as visuals, maps or summaries
- guidance on using climate information for risk assessments
- information on climate hazards that may impact a location or sector
- case studies on finding and applying climate information
- guidance on the integration of First Nations traditional knowledge.

For emergency management and disaster preparedness, the requirements can have a greater focus on real-time information to inform situational awareness. The [Australian Disaster Preparedness Framework](#)'s (Home Affairs 2018) national capability requirements, highlight the need to:

- combine situational awareness inputs from all sources with predictive analysis
- translate raw information into intelligence products which are accessible and appropriate for the audience
- access timely information for broadcast and transfer (to the public and relevant decision makers)
- access systems for data interpretation such as geospatial systems
- analyse key events for research and future learnings.

Q28 Where has Australia made progress since the NDRISC report?

Q29 Do you agree that the Climate Systems Hub broadly captures the needs of decision makers? Are there any changes that you would make?

Q30 To what extent does the Australian Disaster Preparedness Framework's capability requirements capture user needs?

User needs case studies

The following case studies demonstrate the information that users in different sectors will need to fulfil reporting requirements that will help them, and Australia, manage climate risk.

Insurance sector

The Insurance Council of Australia (2023) reported that the February and March 2022 flood was the single most expensive event in Australian history. The insurance sector is finding that an increasing number of buildings can either no longer be insured or attract premiums that make insurance cover unrealistic for many people.

The industry is calling for more consistent and accessible climate projections, and datasets that define risk levels for natural hazards at longer timescales.

Climate-related financial disclosure

Due to the physical risks of natural hazards and the transition risks associated with climate adaptation, climate change poses a material risk to financial systems and participants globally. Australia is adopting a tool commonly used in other countries to manage climate-related financial risks – climate-related financial risk disclosures. The disclosure framework the Australian Government is proposing to implement is based on the Taskforce on Climate-related Financial Disclosures recommendations and the International Sustainability Standard Board standard.

The Treasury is leading the climate-related financial disclosure policy development for Australian companies. **Large companies and financial institutions will be required to disclose climate-related financial risks** as part of their existing reporting obligations.

In November 2023, the government released a consultation paper for its [Sustainable Finance Strategy](#), which outlines the government's proposed approach to climate-related financial disclosures. It says 'the Government is implementing mandatory climate-related financial disclosure requirements for large companies and financial institutions. These reforms are proposed to commence for reporting periods starting 1 July 2024 for the largest listed and unlisted companies, with others phased in over time. The Government is closely monitoring the development of other international sustainability-related financial disclosure frameworks and standards, with a view to establishing other globally aligned sustainability-related financial disclosure requirements (including nature) over time.'

The Government is seeking public feedback on sustainability data challenges and priorities for financial system participants, with a focus on what is necessary to support corporate risk disclosure, financial decision-making and transition planning.

As in the private sector, **climate disclosures will be required of all Commonwealth entities**. This is to achieve the government's policy for the public service to reduce greenhouse gas emissions to zero by 2030 and ensure alignment with the corporate sector. This initiative includes reporting obligations for all Commonwealth entities. It will be implemented in a phased approach, commencing with larger and non-corporate entities (Finance 2023).

The **Climate Risk and Opportunity Management Program** will help to develop the capabilities and systems needed for the Australian Public Service to identify, manage and disclose their climate risks. The program will include supporting resources for those undertaking climate risk management activities, including education resources and tools.

Q31 Are you already using climate or natural hazard information in your organisation's planning and decision-making to meet operational, investment, or regulatory requirements?

- a. Where do you source these products at present?
- b. Do you receive any of these products from the ACS?

Q32 Are there any gaps in meeting your needs, and if so, what are they?

- a. If there are gaps, who would be best placed to meet these needs for you?

Q33 What national climate information do you expect your organisation/agency will need in the future?

- a. When will you need it?
- b. Who do you expect will provide it?

Q34 Are there other sectors that would benefit from access to the ACS's current products and services?

Appendices

Appendix A – Terms of Reference

The review is to provide advice on the performance of the Australian Climate Service (ACS) to date and an assessment of the suitability of the ACS to deliver on Australia's future climate information needs.

The review will:

1. examine the performance of the ACS since its establishment, including:
 - a. the effectiveness of ACS in delivering its strategic objectives and agreed functions; including supporting its customers' decision-making needs
 - b. the appropriateness of the ACS governance and operating model, including agreements with existing customers
 - c. the adequacy of ACS resources to deliver its strategic objectives and agreed functions
 - d. the ability of ACS to access the capabilities it requires.
2. provide an assessment of Australia's future climate information needs and the suitability of the ACS to deliver on them. In addition to examining (c) and (d) from a forward-looking perspective, the review will consider:
 - a. the appropriateness of the ACS governance and operating model to meet the government's statement of expectations
 - b. the ACS's role in making its products and services available and accessible to Australian governments, industry and the community
 - c. the ability of the ACS to provide a national climate risk and natural hazard capability
 - d. the ability of the ACS to support the government's climate change, environment and water decision-making needs
 - e. the role of the ACS in enabling and supporting Australia's growing climate services sector, and practical advice on opportunities for meeting the Government's future climate information needs.

The review will have regard to the statement of expectations for the ACS issued on 3 July, relevant recommendations from the Royal Commission into National Natural Disaster Arrangements, Australian Government roles and responsibilities for climate adaptation (as per the 2012 COAG principles), and other relevant reviews about or being undertaken by the NEMA, ACS partners or other relevant bodies. These include the second Department of Finance Gateway Review in 2023 and any early findings from the *Independent Review into Disaster Funding* (NEMA), due for completion by April 2024.

Process

- The review will be conducted by a panel chaired by Professor Mary O'Kane, who will report to the Minister for Climate Change and Energy, the Hon Chris Bowen MP, and the Assistant Minister for Climate Change and Energy, Senator the Hon Jenny McAllister.
- The review will include targeted consultation with DCCEEW, central agencies, the NEMA and the ACS (including partners). All engagement should be cognisant of the demands on the NEMA and the ACS from the 2023-24 High Risk Weather Season and its lead-in.

Deliverables

- A final report will be delivered to government by end of March 2024.

Appendix B – Royal Commission into National Natural Disasters

Supporting better decisions, recommendations 4.1 to 4.7

Recommendation 4.1 – National disaster risk information

Australian, state and territory governments should prioritise the implementation of harmonised data governance and national data standards.

Responsibility: Australian and state and territory governments.

Recommendation 4.2 – Common information platforms and shared technologies

Australian, state and territory governments should create common information platforms and share technologies to enable collaboration in the production, analysis, access, and exchange of information, data and knowledge about climate and disaster risks.

Responsibility: Australian and state and territory governments.

Recommendation 4.3 – Implementation of the National Disaster Risk Information Services Capability

Australian, state and territory governments should support the implementation of the National Disaster Risk Information Services Capability and aligned climate adaptation initiatives.

Responsibility: Australian and state and territory governments.

Recommendation 4.4 – Features of the National Disaster Risk Information Services Capability

The National Disaster Risk Information Services Capability should include tools and systems to support operational and strategic decision-making, including integrated climate and disaster risk scenarios tailored to various needs of relevant industry sectors and end users.

Responsibility: Australian Government.

Recommendation 4.5 – National climate projections

Australian, state and territory governments should produce downscaled climate projections: 1) to inform the assessment of future natural disaster risk by relevant decision makers, including state and territory government agencies with planning and emergency management responsibilities 2) underpinned by an agreed common core set of climate trajectories and timelines, and 3) subject to regular review.

Responsibility: Australian and state and territory governments.

Recommendation 4.6 – Consistent impact data standards

Australian, state and territory governments should work together to develop consistent data standards to measure disaster impact.

Responsibility: Australian and state and territory governments.

Recommendation 4.7 – Collection and sharing of impact data

Australian, state and territory governments should continue to develop a greater capacity to collect and share standardised and comprehensive natural disaster impact data.

Responsibility: Australian and state and territory governments.

Appendix C – Reviews relevant to disaster arrangements

Independent review of National Natural Disaster Governance Arrangements (Governance Review)

Led by Dr Robert Glasser (of the Australian Strategic Policy Institute), the Governance Review will consider how all levels of government work together effectively. This includes how the government serves the current and future states of preparedness, adaptation, response, recovery, and resilience and long-term policy requirements. This review was a recommendation from the Royal Commission. The review was completed in November 2023.

Disaster Recovery Funding Arrangements (DRFA) Review

The NEMA-led DRFA Review will ensure more equitable access to support so that Australians impacted by disasters are treated consistently and fairly, and governments can respond quickly and appropriately. It will also encourage jurisdictions to build back better and generate greater investment in resilience during the recovery effort. The review addresses recommendations from the Royal Commission. The review is due for completion by April 2024.

Independent Review of Commonwealth Disaster Funding

Led by Andrew Colvin (Deloitte), this independent review will examine all Commonwealth disaster funding to ensure it supports an effective system, given the increasing frequency and severity of disasters. It will consider how government investment in disaster risk reduction, preparedness, response, and recovery can better support a national system that makes communities safer and more resilient to disasters. The review is due for completion by April 2024.

Appendix D – Australian Government investments in climate and natural hazard science

The Australian Government's investments include:

- The **National Environmental Science Program** undertakes long-term environment and climate research.
 - The NESP Climate Systems Hub is hosted by CSIRO and partners with the Bureau, University of New South Wales, University of Melbourne, Monash University, University of Tasmania and the Australian National University. The Hub aims to provide research to advance the understanding of Australia's climate, its extremes and associated drivers (rainfall, drought and bushfires), and inform climate adaptation solutions for Australia.
 - The program includes a cross-cutting adaptation mission across all hubs, focused on building the evidence base for climate resilience.
- CSIRO's **Climate Science Centre** provides climate and Earth system modelling to better and observations of the atmosphere and ocean to better understand climate variability.
- The Bureau's **Environmental Prediction Services** provides weather, water, and climate risk-based services, with insights from minutes to decades to improve decision-making and risk reduction.
- The Bureau's **Science and Innovation Group** develops new long-range climate and hydrology models, including under the **Forewarned is Forearmed Project** to support decision-making.
- The Bureau's **Australian Climate and Weather Extremes Monitoring System** provides up to date information on climate and weather extremes of temperature and rainfall. It also provides long-range forecasts which provide seasonal outlook on weather.
- The **Australian Research Council Centre of Excellence for Climate Extremes** focuses on research into weather and climate interactions, attribution and risk, drought and ocean extremes, as well as climate modelling.
- The **Australian Research Council Centre of Weather of the 21st Century**, commencing in 2024, is a consortium of 24 partners which is led by Monash University. The centre will focus on how the weather is being re-shaped by climate change.
- **Natural Hazards Research Australia** works with governments, industry bodies, private and NGO sectors, and the research sector to protect communities through improved decision-making around natural hazards. Research includes community resilience, workforces of the future, built environment resilience, and evidence-informed policy.
- The **Australian Antarctic Science Program** provides fundamental understanding and long-term monitoring to improve modelling, forecasting and climate projections. Led by the Australian Antarctic Division in the Department of Climate Change, Energy, the Environment and Water (DCCEEW), the Program uses Antarctic research infrastructure with national and international researchers.
- The **National Partnership for Climate Projections** is working collaboratively to develop downscaled climate projections. It is a partnership between the Bureau, CSIRO, state governments, universities, and government-funded initiatives (including the Climate Systems Hub).
- Several climate and natural hazard projects have been funded through the National Collaborative Research Infrastructure Strategy.
 - The **National Computing Infrastructure** connects the Australian government with the research sector through high-performance computing and storage of scientific data. It provides a platform for collaboration and data sharing for many sectors, including climate and natural hazard science.

- The **Australian Climate Earth System Simulator** is national research infrastructure to support development and research using the **Australian Community Climate and Earth System Simulator** modelling system.
- **AuScope** provides research infrastructure to Australia's Earth and Geospatial Science community, enabling access, creation, analysis and sharing of data about Earth as it has evolved over time.
- **Integrated Marine Observing System** operates a range of observing equipment throughout Australia's coasts and ocean. The open access data is available to the marine and climate science community.
- **Terrestrial Ecosystem Research Network** undertakes ecosystem observation and data collection to produce data and analytics which understand the current and future impacts of climate change.

Appendix E – Glossary

ABS	Australian Bureau of Statistics.
ACS	Australian Climate Service.
The Bureau	Bureau of Meteorology.
Climate adaptation	The process of adjusting to actual or expected changes in climate to reduce or avoid climate impacts or exploit beneficial opportunities.
Climate projection	<p>The response of the climate system over the coming decades to an emissions scenario as simulated by a climate model. Projections provide us with a sense of the range of future climate conditions that may emerge.</p> <p>By contrast, a ‘prediction’ aims to describe what will actually happen, like a weather forecast for tomorrow. A true climate prediction is not currently possible beyond a few months.</p>
Climate risk	<p>Climate risk typically refers to the potential negative impacts that climate change, and efforts to limit it, can have on the natural environment, ecosystems, infrastructure, economies, and society. Climate risk is made up of two primary types physical and transition.</p> <p>Liability risks can also arise when a person or entity may be held responsible for not acting sufficiently on physical or transition risks, causing damage to others.</p>
Climate services	Climate services involve the provision of climate information in such a way as to assist decision-making. The service includes appropriate engagement from users and providers, is based on scientifically credible information and expertise, has an effective access mechanism, and responds to user needs. (IPCC 2023)
CSIRO	Commonwealth Science and Industrial Research Organisation.
Disaster	A serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts. (UNDRR 2023)
GA	Geoscience Australia.
High risk weather season	While severe weather can occur at any time of the year, October to April is the peak time for severe weather in Australia including heatwaves, bushfires, tropical cyclones, severe thunderstorms and floods (Bureau of Meteorology 2023).
Natural hazard	Natural Hazards are predominantly associated with natural processes and phenomena. Geologic, meteorological, or biological hazard. (UNDRR 2023)
Resilience	The capacity of communities, environments and economies to cope with a hazardous event or disturbance, while maintaining their essential functions and structure.

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