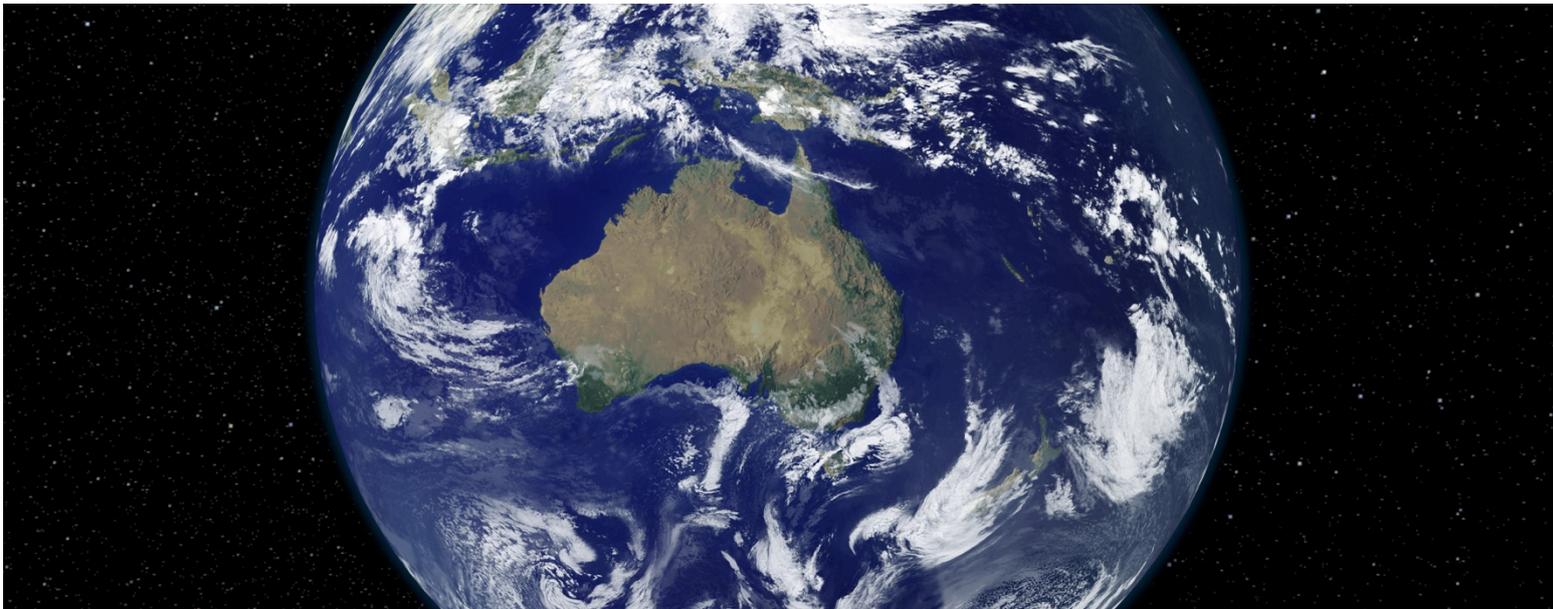




**Earth Systems and
Climate Change
Hub**

National Environmental Science Programme



Earth Systems and Climate Change Hub Research Plan

VERSION 2

April 2016



Australian Government



**National
Environmental
Science
Programme**

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Introduction

The National Environmental Science Programme (background)

The National Environmental Science Programme (NESP) is a long-term commitment to support environmental and climate research. The key objective of the NESP is to improve our understanding of Australia's environment through collaborative research that delivers accessible results and informs decision making. The focus of NESP is on practical and applied research that informs on-ground action and that will yield measurable improvements to the environment.

The Programme will build on its predecessors - the National Environmental Research Program and the Australian Climate Change Science Programme – in securing for decision makers the best available information to support understanding, managing and conserving Australia's environment.

The NESP is delivered through multi-disciplinary research Hubs or consortia, hosted by Australian research institutions. These include the:

- Clean Air and Urban Landscapes Hub - University of Melbourne
- Earth Systems and Climate Change Hub - Commonwealth Scientific and Industrial Research Organisation (CSIRO)
- Marine Biodiversity Hub - University of Tasmania
- Northern Australia Environmental Resources Hub - Charles Darwin University
- Threatened Species Recovery Hub - University of Queensland
- Tropical Water Quality Hub – The Reef and Rainforest Research Centre (Cairns)

The NESP seeks to achieve its objective by supporting research that:

- Is practical and applied and informs on-ground action
- addresses the needs of the Australian Government and other stakeholders by supporting and informing evidence-based policy and improving management of the Australian environment
- is innovative and internationally recognised
- enhances Australia's environmental research capacity
- is collaborative and builds critical mass by drawing on multiple disciplines, research institutions and organisations to address challenging research questions
- produces meaningful results accessible to government, industry and the community
- includes synthesis and analysis of existing knowledge
- builds relationships between scientists and policy-makers to encourage collaborative problem solving on environmental issues.

NESP end-users will be a broad range of stakeholders whose decisions may impact on the environment, and include the Australian Government, state governments, industry, business, community groups and Indigenous land managers (or Indigenous Communities).

The expected outcomes of the NESP are:

- Enhanced understanding of, and capacity to manage and conserve Australia's environment.

- Improved climate and weather information for Australia through a greater understanding of the drivers of Australia’s climate.
- Timely research that is used by policy and decision-makers to answer questions and provide solutions to problems.
- Research outcomes that are communicated clearly to end-users and the general public, and stored in a manner that is discoverable and accessible.

Role of the Earth Systems and Climate Change Hub

In the context of the intended NESP outcomes, the goal of the Earth Systems and Climate Change (ESCC) Hub is to ensure that Australia’s policies and management decisions are effectively informed by Earth Systems and Climate Change Science now and into the future.

It will achieve this by building a national partnership, with world-leading capability in multi-disciplinary Earth system science and modelling that provides Earth system and climate information in support of a productive and resilient Australia.

The Hub will deliver knowledge, information, and data products and services to ensure that environmental decision making is informed by an understanding of Australia’s past, current and future climate. It will build a national climate Earth System and Climate simulation capability in ACCESS (the Australian Climate Community Earth System Simulator); ensure the provision of nationally coordinated climate information for use across NESP and the broader stakeholder community; support the University of Melbourne to establish a National Centre for Coasts and Climate (NCCC); and undertake research that informs low cost abatement options.

Consistent with the Hub’s stated goal and intended outcomes, the objectives of the Hub are, through world class research, to:

- Lead the further development of a world-competitive, national Earth System and Climate modelling capability (this is ACCESS), to deliver for weather and climate predictions and projections for the Australian community.
- Advance understanding of Australia’s climate variability, extremes and associated drivers.
- Develop and strengthen stakeholder relationships, and support informed management and evidence-based decision-making.
- Facilitate outreach and communication of science products and services to end-users and the general public.

History of Australian Earth System and Climate Research

As stated in the NESP guidelines the NESP is an amalgamation of the National Environmental Research Program (NERP) and the Australian Climate Change Science Programme (ACCSP). Much of the Earth System and Climate research done in Australia, through the CSIRO and Bureau of Meteorology, was funded under the ACCSP (and its predecessors) since 1989, with existing research activity in the above programmes continuing until contracts with the Bureau and CSIRO end on 30 June 2016. The funding “profile” in this research plan reflects the wind-down of the ACCSP and ramp-up of research delivery of NESP ESCC research in the second half of 2016. 2015–16 is primarily focussed on building the Hub and the Research Plan, and undertaking stakeholder engagement. This has been mostly at the Hub leadership team level.

Purpose of Research Plan

This Research Plan has been developed by the ESCC Hub, in consultation with the Department of the Environment and other key stakeholders.

The purpose of the Research Plan is to outline:

- the research priorities the Hub is funded to investigate
- the research projects that will address these priorities
- how the output of the research will be communicated and brokered to key stakeholders
- how the impact of the research will be measured
- how Hubs will work collaboratively within and across Hubs



This Research Plan also provides appropriate detail on the overall governance of the Hub, including outlining the broader funding profile, key staff and research organisations, and the key risks needing to be monitored and managed to ensure success.

Hub Governance

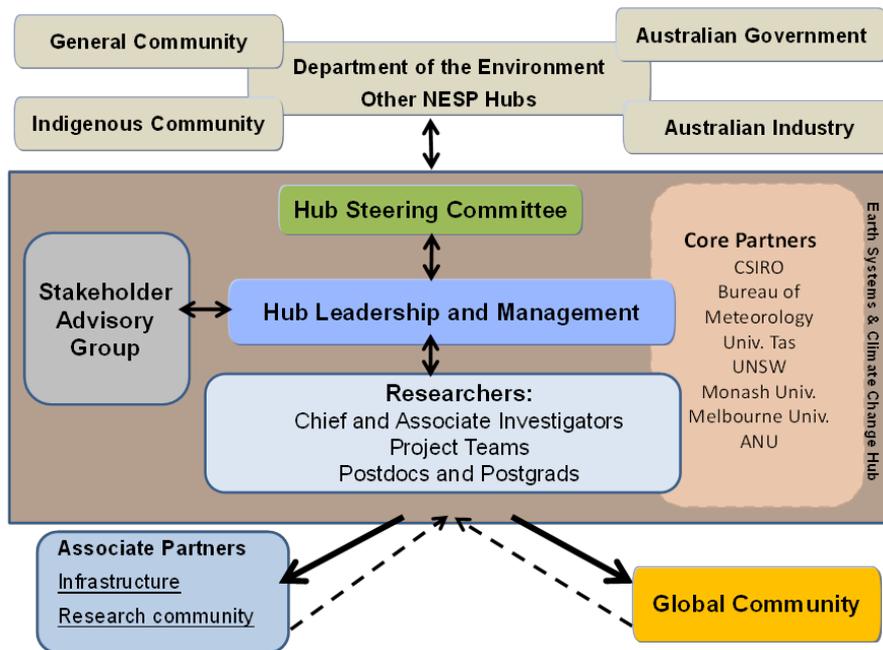
Hub Leadership and governance

The Hub Leadership Team (HLT) and Hub Programme Management Team (HPMT) collectively have responsibility for the Hub's research delivery and operational management and administrative activities. Research activities are structured via an agreed research portfolio and annual work plan endorsed by the HSC and approved by the Department. The Hub Leader, working together with the HLT and the HPMT, has accountability for overall Hub performance, including research delivery and associated milestone compliance, and day-to-day management and administration of all Hub activities across all Partners.

The HLT/HPMT currently meets twice monthly (likely to be monthly in 2016), and includes the Hub Leader (Chair), Deputies, and Programme Managers as follows (see also Figure 1):

- a) The Hub Leader is Dr Helen Cleugh, from CSIRO;
- b) The Deputy Leaders are Dr Aurel Moise (from the Bureau of Meteorology, a Hub Partner), Mr Kevin Hennessy (from CSIRO, the lead Agency and Hub Partner), and Professor Nathan Bindoff (from the University of Tasmania, representing the University Partners); and
- c) The Hub Programme Management Team comprises Dr Geoff Gooley (Programme Manager and primary contact for Monitoring & Evaluation activities); and Ms Mandy Hopkins (Programme Coordinator and primary contact for Indigenous Engagement activities). Mandy and Geoff are also our primary contacts for coordinating Hub-level data and information management, and communications and knowledge brokering activities.

Figure 1: Earth Systems and Climate Change Hub Governance



Steering Committee

The Hub Steering Committee (HSC) provides strategic oversight of the Hub’s performance against its objectives. They meet quarterly, and as needed either out-of-session or by videoconference, at other times. The roles, responsibilities and membership of the Steering Committee and meeting frequency are outlined in its Terms of Reference (Appendix 4), and include:

- ensuring the alignment of research activity to the policy needs and interest of the Department and other key stakeholders;
- connecting the Hub’s research questions, activities and outputs to relevant research activity and policy initiatives outside the Department;
- overseeing the development and implementation of the Research Plan, including the review and amendment of the Research Plan, as required;
- directing, and endorsing, the development, and delivery of any reporting, monitoring and evaluation requirements under this agreement; and
- review, monitor and guide project performance.

Stakeholder Advisory Group

The Hub Stakeholder Advisory Group (HSAG) will comprise a cross-section of Associate Partners and key next and end-users of the Hub’s research. Its role will be to provide the Hub Leadership with an external perspective and guidance. The Chair of the HSAG will be on the Hub Steering Committee, and the Hub Leader (potentially along with the Hub Programme Manager and/or a Deputy Hub Leader) will participate in HSAG meetings as an observer in an ex-officio role. The HSAG is still to be formed and the Terms of Reference are under development. This task will be completed through Research Plan V2.

The Department of the Environment

The Department of the Environment has responsibility for managing the National Environmental Science Programme (NESP), including the approval of this Research Plan, assessment of progress of projects under this Research Plan and payment of any NESP funding associated with the Hub agreement.

Importantly, the Department is the key end user of research under the NESP, and works closely with the Hub and other key stakeholders in determining and negotiating the delivery of research under the Research Plan.

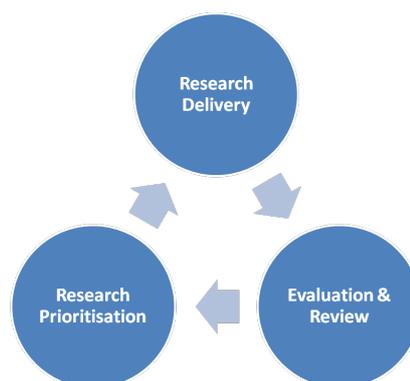
The Minister

The Minister for the Department of the Environment provided approval to fund the Earth Systems and Climate Change Hub and is the sole delegate with authority to approve major changes to the scope and funding allocation to the Hub. The Minister approved Version 1, and will approve Versions 2 of this Research Plan. The Minister will endorse the subsequent annual versions of the Research Plan.

Research Priorities

The Earth Systems and Climate Change Hub is committed to a body of activity that includes short and long-term research projects. Each activity year the Department of the Environment will work with the Minister, the Hubs and other key stakeholders to identify and refine research priorities and develop projects that align with these priorities.

This research prioritisation is a rolling process, and delivery of key milestones in each activity year, along with the Hub's Annual Progress Report and submission of the next Research Plan, will inform the process. The NESP and Hub level Monitoring and Evaluation activities, including the Biennial NESP Programme Evaluation, which will review the impact and success of the programme across all Hubs, also play an important role in informing strategic directions and associated research priorities.



This constant consideration and evaluation of research output and impact will give confidence in the performance and effectiveness of the Hub in addressing its objectives, and thence the programme. It will also provide the basis for the flexibility needed for the Hub to adapt and respond to new and emerging stakeholder needs and research priorities in an adaptive manner, and ensures that the Hub's focus is fixed on the delivery of relevant and practical research which is outcome focused and targeted at addressing the needs of end-users.

The research priorities of the Earth Systems and Climate Change Hub are listed below and summarised in Figure 2.

1. Building the utility of Earth Systems and Climate Change information

- Work with our Partners and NESP to establish a National Centre for Coasts and Climate.
- Research to inform the lowest cost abatement opportunities, by both cost and weighted potential for mitigation.
- Engage with stakeholders to ensure that the information is being provided in a manner which supports decision-making and is meeting the needs of end users.
- Collaborate across National Environmental Science Programme Hubs to ensure that Earth Systems and climate change research informs the broader Programme. This would include provision of nationally consistent and targeted regional climate projections and information relevant to specific issues, such as threats to marine and terrestrial ecosystems and ocean acidification.
- Develop and enhance Australia's national capability in Earth System and Climate simulation through ongoing improvement of the Australian Climate Community Earth System Simulator (ACCESS) in the areas of accessibility and simulation performance.

2. Improving our understanding of how the climate system may change in the future.

- Investigate how human activities will continue to influence the carbon cycle and change the chemistry and physical state of our oceans, atmosphere and terrestrial systems.
- Improve understanding and simulation of Southern Hemisphere climate drivers¹ in our climate models (especially ACCESS) to increase our confidence in projections of likely future climate change at multi-annual to multi-decadal time scales. Improve our understanding of how climate variability (e.g. the El Niño-Southern Oscillation) and the frequency, intensity and extent of extreme events (e.g. tropical cyclones and droughts) may change in the future.
- Further develop our ability to simulate and provide regional information on future climate, from years to decades.
- Consider low likelihood but high impact consequences of climate change for Australia to improve risk management decisions.
- Use improved climate projections and understanding of the drivers of climate to inform understanding of climate and coastal interactions.

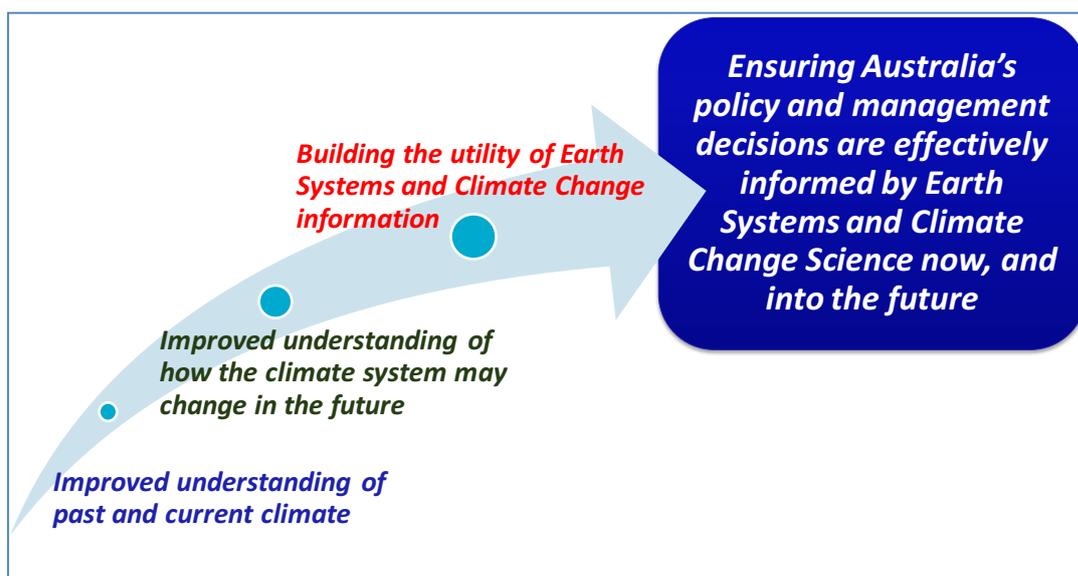
3. Improving our observations² and understanding of past and current climate

- Use observations of greenhouse gases and the Australian regional carbon budget to track changes and improve our understanding of how the different components of the natural and human elements of the carbon cycle interact and influence each other.
- Identify how the different scale drivers¹ of the climate system interact in the Southern Hemisphere to generate our past and current climate.
- Improve observational records² used for Australian climate change research, and examine the current and past patterns and trends in climate variability and extremes in the Southern Hemisphere, with an emphasis on the Australian region.
- Analyse robust observational records of our atmosphere, oceans, cryosphere and terrestrial systems to undertake 'detection and attribution' studies in order to identify and explain significant changes in our current climate.

¹ The term "climate drivers" is used here to mean the main modes of variability and change, such as the El Niño Southern Oscillation (ENSO) and changes in radiative forcing due to factors such as increases in greenhouse gases

² The Hub has confirmed with the Department that this priority does not imply that the Hub undertakes primary observations – especially those that are the responsibility of operational agencies such as the Bureau of Meteorology.

Figure 2: Earth System and Climate Change Research Priorities and Goal



The Table of Research Projects has been moved to Page 13 and Appendix 1

Expected Outcomes

The expected outcomes of the NESP are:

- Enhanced understanding of, and capacity to manage and conserve Australia's environment.
- Improved climate and weather information for Australia through a greater understanding of the drivers of Australia's climate.
- Timely research that is used by policy and decision-makers to answer questions and provide solutions to problems.
- Research outcomes that are communicated clearly to end-users and the general public, and stored in a manner that is discoverable and accessible.

Research under the NESP is expected to inform the policy and programme delivery of the Department of the Environment. More broadly, it will engage and inform all key stakeholders with an interest in the outputs of environmental and climate science research, including state and local governments, business and industry, community groups, Indigenous land managers (or Indigenous Communities) and education institutions.

ESCC Hub Outcomes

In the context of these NESP outcomes, the Hub's goal is:

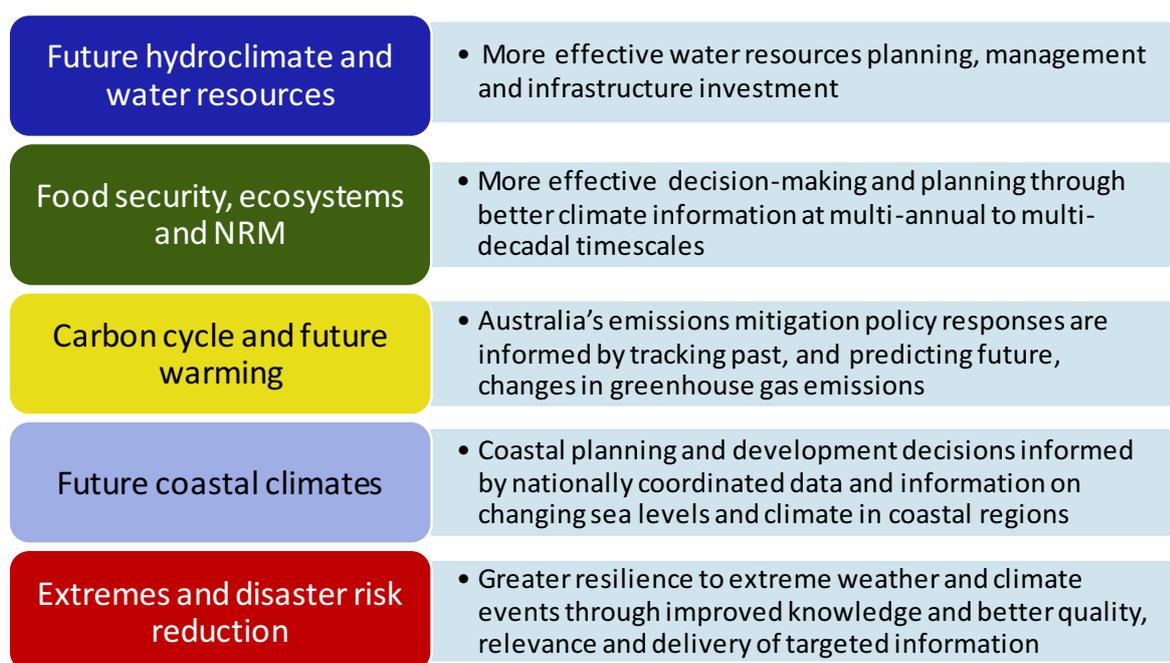
To ensure that Australia's policies and management decisions are effectively informed by Earth Systems and Climate Change Science now and into the future.

Achieving this goal requires a portfolio of integrated research across the land, oceans and atmosphere domains; using modelling, simulations, projections and analyses of observations; and ensuring the provision of information to next- and end-users, and other stakeholders.

Hub-level outcomes, within the scope of the Hub’s research priorities, were determined to better focus the research needed. This analysis, and resulting outcomes, were based on information contained in: a) relevant national strategies and plans, including: the National Marine Science Plan [October 2015]; Australia’s national science and research priorities [May, 2015]; the emerging National Climate and Resilience and Adaptation Strategy; and the former National Climate Change Science Framework; and b) relevant end-user needs assessments conducted over the last 3 years (some of these were done by the Hub Partners).

Through this process, the Hub identified the top five climate challenges facing Australia - these are the current, priority outcomes for the Hub in Figure 3. The Hub’s portfolio of proposed research projects is designed to address these outcomes at a sectoral level and thereby deliver impact and benefit for Australia. Additional and important climate challenges, in the health, heritage, infrastructure, and national security/defence sectors, are also acknowledged and will be indirectly addressed by the Hub’s research to varying degrees.

Figure 3: Earth System and Climate Change Hub Outcomes (left) and Summary (right)



These five ESCC Hub outcomes are being validated through our engagement with key stakeholders, including target end-users at federal, state and local government level, natural resource management (NRM) groups, Indigenous communities and the private sector. To date, the outcome areas for the Hub have resonated strongly with state government jurisdictions welcoming the sectoral focus on key areas – e.g. South Australia who identified Water Resources, Ecosystems, Resource Management and Food Security, Coasts, and Extremes (especially fire weather) as all critical for the State’s climate adaptation strategy; the Managing Climate Variability program identified water and extremes as a high priority for their industry; and Tasmania identified regional climate information and fire weather as priority areas.

In addition to these five sectoral-focussed outcomes are a further four, largely Hub-centric cross-cutting and capability-oriented outcomes (as identified in Research Plan V1):

- a) A national climate and Earth System simulation capability providing Australia with the ability to prepare and plan for, and manage, the societal, economic and environmental risks associated with climate variability and change.
- b) Nationally consistent and targeted climate information (data, knowledge and products) for the Australian region that informs and provides the evidence base for:
 - o Adaptation, planning, and mitigation responses and decision-making.
 - o Decision-making to enhance resilience, productivity and better manage climate risk.
- c) Enhanced end-user capacity in the effective use of Hub research outputs.
- d) A vibrant and critical mass Australian capability in Earth System and climate science; deeply engaged with global climate research activities that deliver benefit to Australia.

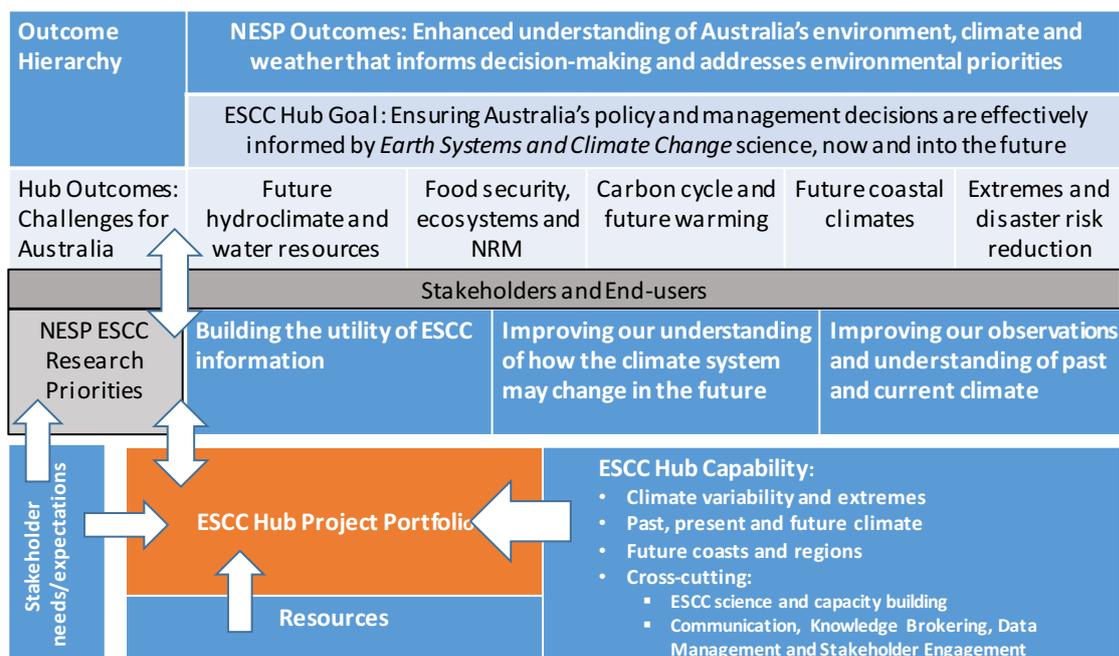
All outcomes align strongly with the draft adaptation principles being developed by the Australian government, especially:

- *Good adaptation avoids passing risks onto future Australians* – this requires future projections of climate that allow the consequences of future greenhouse gas emissions scenarios to be quantified, and to inform society about its adaptation and mitigation choices.
- *The changing climate is considered when making decisions now and into the future.*
- *Decisions are informed by the best available information.*

ESCC Hub Programme Logic – from NESP and Hub Outcomes to Research Projects

The Programme Logic for the Hub (Appendix 2) and the summary schematic in Figure 4 show how the outputs of the Hub’s proposed Research Project Portfolio link to the Hub’s Goal, Research Priorities and Outcomes.

Figure 4: Summary schematic of NESP Earth Systems and Climate Change (ESCC) Hub Programme Logic.



The Programme Logic also describes the core capability within the Hub, which is critical to delivering the outcomes and providing flexibility. The Project research areas are all strategically important priorities for each of the Partner agencies, meaning that the Hub is able to leverage significant research capability from the Partners. This critical mass of core capability is also one of the Hub's approaches to managing the risks associated with key skills and expertise (as described in Attachment B). Each of the Partners is committed to maintaining a critical mass capability in those priority research areas that underpin the twelve research projects proposed in Research Plan V2.

Table 1: Summary of Earth Systems and Climate Change Hub Project Portfolio for Research Plan V1 and V2. [Note that Projects in the Research Plan V2 were scoped to be a maximum of 3 years in duration. Additional research proposals (to 2020) will be called for under later Research Plans].

Project number	Project name	Project leader (CI - Chief Investigator)	Time frame
Approved projects in Research Plan V1			
1.1	Current Capability and Future Directions Assessment	Helen Cleugh	2015 only (as approved in RP V1)
1.2	Stakeholder Engagement	Helen Cleugh	2015 only (as approved in RP V1)
1.3	Low cost abatement options: Scoping Workshop and Report	Helen Cleugh	2016 only (as approved in RP V1)
1.5	Supporting the Establishment of the NCCC: Phase I (Engagement)	Helen Cleugh	Jan 2015 – Dec 2015
1.1	Current Capability and Future Directions Assessment	Helen Cleugh	July 2015 – July 2016
1.3	Low cost abatement options: Scoping Workshop and Report	Helen Cleugh	July 2015 – July 2016
Research Plan V2			
2.1	Preparing ACCESS for CMIP6	Simon Marsland	Mar 2016 – Jun 2019
2.2	Enhancing Australia's capacity to manage climate variability and climate extremes in a changing climate	Scott Power	Jul 2016 – Jun 2019
2.3	Towards an ACCESS decadal prediction system	Terry O'Kane	Jul 2016 – Jun 2019
2.4	Changing oceans and Australia's future climate	Susan Wijffels	Feb 2016 – Jun 2019
2.5	Improving Australia's Climate Model (ACCESS)	Tony Hirst	Jul 2016 – Jun 2019
2.6	Regional Climate Projections Information and services	Kevin Hennessy	Jul 2016 – Jun 2019
2.7	Refining Australia's Water Futures	Dewi Kirono	Jul 2016 – Jun 2019
2.8	Extreme Weather Projections	Andrew Dowdy	Jul 2016 – Jun 2019
2.9	Risk assessment of future carbon sources and sinks	Pep Canadell	Jul 2016 – Jun 2019

Project number	Project name	Project leader (CI - Chief Investigator)	Time frame
2.10	Coastal Hazards in a Variable and Changing Climate	Kathy McInnes	Jul 2016 – Jun 2019
2.11	Establishing the NCCC	Stephen Swearer	May 2016 – May 2019
2.12	Sea level projections for NCCARF	Kathy McInnes	Sep 2015 – Jul 2016

The ESCC Hub Research Project portfolio (Table 1, above and detailed in Appendix 1) has been developed as an integrated body of work to ensure that, collectively, all Projects deliver to the outcomes described in Figure 3. There are several projects whose path-to-impact is through other Projects, and so their delivery is primarily via next-users, rather than directly to end-users. Furthermore, the outputs from some Projects primarily address just one or two outcomes, while the outputs from other Projects addresses multiple outcomes.

The Hub has developed a map (Figure 5) to illustrate this integrated nature of the research activities, while the matrix in Figure 6 explicitly identifies the inter-dependencies and linkages between ten of the twelve proposed research Projects for the V2 Research Plan (noting that Project 2.11 is still under development). Given the highly integrative, inter-dependent and cross-agency collaborative nature of the research portfolio, the Hub is able to leverage on the complementary capability that resides across the Hub's partners. Note that Project 2.11 will be included in these figures in the third version of this Research Plan.

The proposed research projects represent what can be achieved with the funding available. While some projects may seem ambitious in terms of their goals, in fact the research proposed is often modest given the magnitude of the challenge and the potential for on-ground impact. The Chief Investigators, HLT and Partners have carefully reviewed the Project proposals to ensure that the research can be delivered within the time and resource constraints of the Hub, however it is important to note that several Projects (e.g. Projects 2.4 "*Changing oceans and Australia's future climate*", 2.5 "*Improving Australia's climate model (ACCESS)*", and 2.9 "*Risk assessment of future carbon sources and sinks*", while coherent and self-contained, are actually part of a larger effort within the Partner agencies.

Figure 5: Schematic showing how RPV2 research projects align to Hub Outcomes. Cross cutting projects, with a primarily next-user focus, are positioned towards the lower part of the figure, while more targeted projects with an end-user focus are positioned in the upper part of the figure. The Lead Chief Investigator (LCI) for each project is the first name. Subsequent names are for Deputy and Chief Investigators if they are from different Partner agencies. The size of the project boxes conveys no specific meaning.

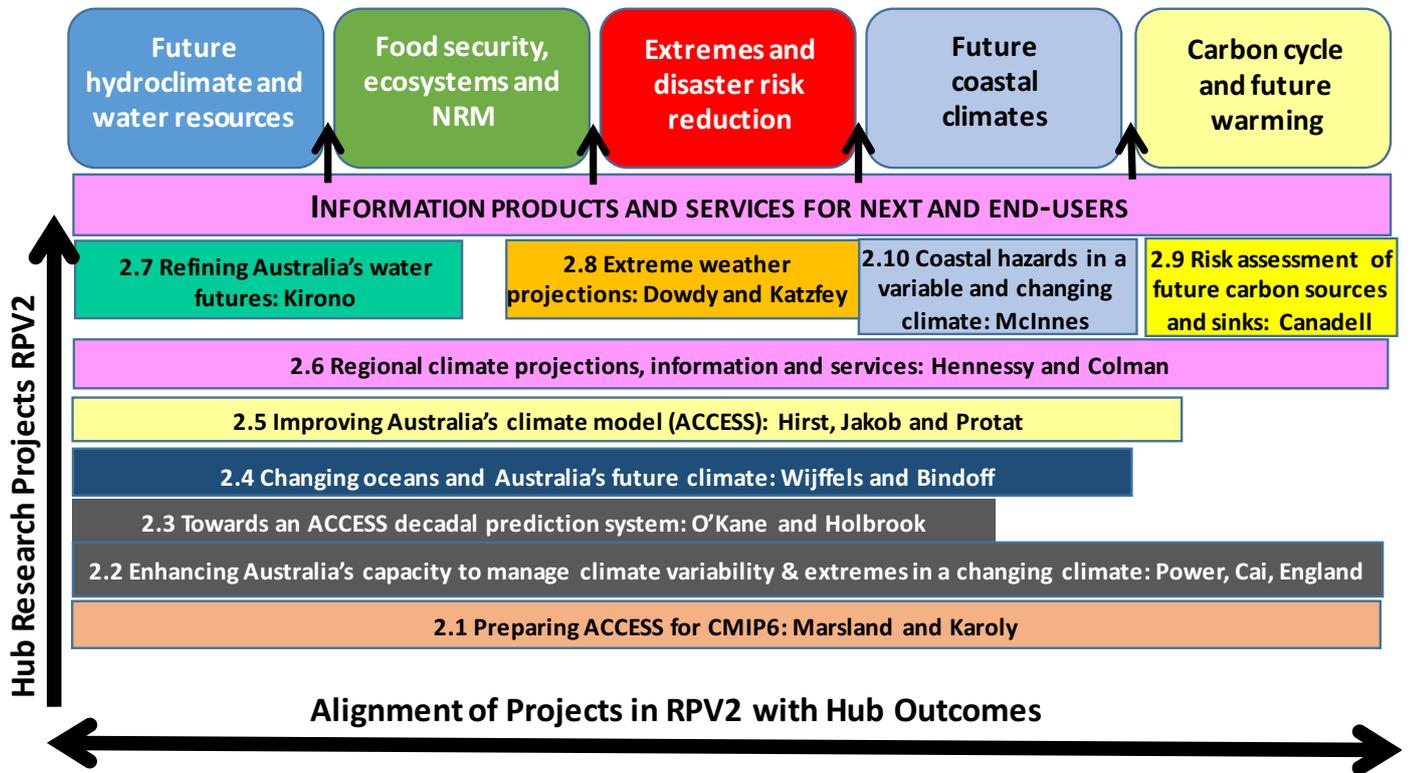


Figure 6: Primary linkages and inter-dependencies between Projects (Project numbers are the same as in Figure 5 above). This captures the information provided in the individual research project proposals.

	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.10
2.1										
2.2										
2.3										
2.4										
2.5										
2.6										
2.7										
2.8										
2.9										
2.10										

Expected Outputs

Outputs from the Hub are targeted at the needs of key stakeholders (next/end-users) and support our goals and outcomes. They broadly fall into two nominal categories:

- **Outputs that provide scientific and technical information and credibility:** Enhanced models; data and information; analyses, simulations and projections; data access and analysis tools; journal publications, technical reports and high-value information products.

- **Outputs that support the Hub’s communications, knowledge brokering, outreach and capacity development:** Websites and content; non-technical summaries, brochures and reports; multi-media content and training; postgraduate and professional development and training; professional and public fora (training workshops, seminars, conferences etc).

Table 2 describes the type of outputs that will be produced by the Hub, either through the Research Projects (described more fully in Attachment A) and/or via the Hub communications and knowledge brokering activities (described in the Hub’s Communication and Knowledge Brokering and Indigenous Engagement Strategies). Output types #1 - 4 primarily address the specific scientific and technical needs of next/end-users, while types #4 - 6 primarily address the more general communications, knowledge brokering and outreach needs of next/end-users. These outputs reflect the key activities, methods and deliverables described in Section 4.1 of the Hub’s Communications and Knowledge Brokering Strategy V2.0 and the Projects listed under Attachment A.

Table 2: Earth System and Climate Change Hub Outputs

Type of output	Purpose	Comments
1. Research publications a) Journal papers b) Conference papers c) Technical and/or summary Reports	<ul style="list-style-type: none"> • Peer review – establish quality and credibility of Hub research • Communication and exchange of knowledge 	Publically available, via links available via ESCC Website
2. Data a) Model data – hindcasts, current assessments and future projections as digital data sets, maps and similar visualisation products b) Observed data – past and current c) Application-ready datasets d) Information products	<ul style="list-style-type: none"> • Peer review – establish quality and credibility of data and information products • Deliver credible, peer-reviewed information for scientific assessments, impact assessment, adaptation planning and mitigation responses • Data available for other users 	Publically available, via links available via ESCC Website Information products may be a combination of modelled and measured data, along with additional analyses, to transform these data into information
3. Model system, components and tools a) Enhanced or new model versions and/or systems b) Enhanced or new sub-models, modules and/or parameterisations c) Diagnostic tools and/or frameworks	<ul style="list-style-type: none"> • Benchmarking to evaluate model performance and establish credibility • Credible future climate simulations for research; assessment of Australia’s future climates under different economic and emissions scenarios; and input into regional climate projections for impact assessment, adaptation planning and mitigation responses • Improve model competitiveness, availability and accessibility for researchers and/or end users 	Australia’s national weather and climate model system (ACCESS) is the only global model developed in the Southern Hemisphere. Where possible, participate in national or international benchmarking activities.
4. Communication and knowledge products a) Targeted information products. b) Brochures. c) Case Studies. d) Newsletters (including The Chirp). e) Tailored products to support Indigenous engagement, capacity building and research, as appropriate and consistent with the Hub’s <i>Indigenous Engagement Strategy</i>	<ul style="list-style-type: none"> • Communications and knowledge-brokering • Building knowledge and understanding • Deliver credible, peer-reviewed information for impact assessment, adaptation planning and mitigation responses 	Products will be made available via the ESCC (and other appropriate) website and stakeholder networks. Some use of social media is envisaged, but only where it is effective. Products will be derived from Research Project materials as appropriate.

Type of output	Purpose	Comments
<p>5. Communication engagement and activities</p> <p>a) Workshops and conferences b) Seminars and forums c) Annual “Science informing Policy” event d) Briefings e) Regular engagement with stakeholder networks. f) Tailored activities to support Indigenous engagement, capacity building and research, as appropriate and consistent with the Hub’s <i>Indigenous Engagement Strategy</i></p>	<ul style="list-style-type: none"> A more active way to share knowledge, information – either to a general or specific audience – that facilitates feedback, problem-solving and value-add. 	<p>The Hub is proposing:</p> <ul style="list-style-type: none"> Annual, targeted Workshops, including cross-NESP (Hub) Workshops (kick-off will be Feb., 2016) Briefings to the government, States, business sector and other key stakeholders. This includes a regular (6-monthly) briefing to the Minister.
<p>6. Training</p>	<p>Building the capacity of our next-users, end-users, general public and Indigenous communities to: a) understand the current state of climate change science; b) effectively utilise the information provided by our Hub and other knowledge providers; and c) effectively use Hub models, data and other products</p>	<ul style="list-style-type: none"> For postgraduates: training activities will “piggy-back” on the world-class training activities that the ARCCSS already provide. For stakeholders: training activities will be provided through our stakeholder networks as appropriate and affordable.

Stakeholders and Stakeholder Engagement

The Hub’s stakeholder engagement strategy and associated actions are described in Section 6 of the *Communication and Knowledge Brokering Strategy*. The Hub’s stakeholders include any group or individual with an interest in, or use for, the best available Earth system and climate change science delivered by the Hub.

The Hub’s stakeholders encompass a range of next/end-users at federal, state and local government level, the private sector, NGOs, Indigenous communities and other Australian communities of interest, and other researchers. The latter include agencies and programs that invest in infrastructure upon which the Hub’s research depends (for example, the National Computational Infrastructure [NCI] led by ANU and the Integrated Marine Observing System [IMOS]); and research providers/programs outside the Hub but with strong allied interests (for example, NCCARF, ACE CRC). As indicated by the description of the Hub’s research and identified risks, research delivery is critically dependent on these stakeholders in terms of identifying gaps and needs and for delivery of tangible, on-ground impact.

The Hub recognises that the broader Australian community are also stakeholders, given the national and global importance of climate change and its high profile in the community. The general public of course will have access to all Hub products (as they are open source). The Hub will invest in developing general communication products for dissemination via traditional and social media (including for example The Conversation, radio and print interviews, targeted magazine articles etc). However, given the Hub’s limited resources and primary research delivery role, such activities and products will typically be done in liaison with the Partner agencies.

The very nature of Earth system and climate research means that there is often no one-to-one relationship between a specific research project and end-user needs. For example, end-users may require credible, tailored estimates of future temperatures for an Australian region; producing this requires: i) development of an internationally-benchmarked model that performs well for Australia and has been tested and parameterised using Earth system observations and data; ii) these simulations then need to be combined with other global climate model simulations to produce an ensemble of simulations; iii) the model outputs are then evaluated and refined to a finer spatial resolution; and iv) the results then need to be packaged and delivered in a way that is useful for end-users (which may require an iterative process of engagement and co-design).

The task of identifying the Hub's specific key stakeholders, and their respective needs, is being undertaken under several activities in Research Plan V1 and as part of ongoing implementation of the Hub's *Communication and Knowledge Brokering Strategy*, *Indigenous Engagement Strategy* and *Monitoring and Evaluation Framework*. At this stage interim external and internal stakeholder groupings in the form of target next/end-user audiences have been tentatively identified pending further engagement and more detailed planning for the Hub. These are provided in the Communications and Knowledge Brokering Strategy and are also identified under Collaborations and Partnerships section below, and Table 3.

ESCC Hub Research – informed by users

Engaging with this broad group of stakeholders – with their varying interests and levels of technical understanding – requires a thoughtful and well targeted approach that recognises the range of relationships sought, the Hub's goals, and alignment with similar activities being undertaken by the Partner agencies. This engagement includes the full cycle from engagement to inform research prioritisation; to the delivery of research outputs; and evaluation and review (as illustrated in the earlier figure). This is the framework that formally captures the commitment to ensuring the Hub's research projects are informed by next- and end-user needs. At a Hub-level, and for all Projects within the Hub, this cycle is managed formally within the Hub's Evaluation Framework³. Its implementation occurs via the Monitoring & Evaluation Plan and progress reporting; and the Hub's Communications and Knowledge Brokering (including stakeholder identification and engagement) and Indigenous Engagement Strategies.

Communication and Knowledge Brokering

Integral to the success of the NESP for delivering outputs which influence decision-making (and thereby realising outcomes and on-ground impact) is the clear and effective communication and brokerage of research outputs to key stakeholders. To this end, the ESCC Hub has developed and implemented a Communication and Knowledge Brokering Strategy that:

- strongly aligns with this Research Plan
- describes how the Hub will facilitate knowledge sharing between researchers and target next/end-users
- specifically identifies and includes activities that bring researchers, policy makers and environmental managers together to facilitate evidence-based decision-making

³ NESP ESCC Hub Evaluation Planning Framework V2.4 (note this is still draft)

- details the research products and services and associated promotional material to be developed by the Hub
- describes how data and information produced by the Hub will be managed (including curation) and made accessible to the general public
- demonstrate how the Hub meets or exceeds the funding agreement requirements for Communications and Knowledge Brokering by identifying the specific Communications and Knowledge Brokering roles and allocated resources associated with these activities.

The Hub has updated its *Communication and Knowledge Brokering Strategy*, including feedback from the Department on Research Plan V1 and reflecting the progress made by the Hub through 2015. The draft Version 2 of the Hub's *Communication and Knowledge Brokering Strategy* has been submitted as part of the Research Plan V2 package of materials.

The key developments are:

- a) The stakeholder section has been populated in more detail, noting this will continue to be updated throughout our stakeholder engagement.
- b) An action plan has been developed for 2016 aligned with implementation of the proposed V2 Research Plan project portfolio; this is in Part 2 of the strategy and identifies activities that involve individual research projects and teams. Note that this necessarily is limited in 2016 given that projects will not begin until July 2016. Research Plan V3 and V4 will include much greater detail about project-level communications and knowledge brokering activities and products.
- c) A section outlining the business development opportunities that are possible as part of the Hub's stakeholder engagement is also included.
- d) Clarity around the relative roles of the Hub Leadership, and projects, in delivering communications and knowledge brokering functions, as follows: *"Delivery of general communication and knowledge brokering activities relevant to stakeholders across the Hub's project portfolio will primarily be undertaken at the Hub level. More project specific research communication and knowledge brokering activities will primarily be undertaken at the project level. For practical reasons to do with enhancing the effectiveness and efficiency of communications and knowledge brokering activities more generally within the Hub, opportunities for Hub level coordination of multiple/simultaneous project level engagements with stakeholders will also be realised where appropriate."*

In Research Plan V2, this is being managed via inclusion of an additional Deliverable, and associated Milestone in Q3/2016, to *"develop a project Work Plan which includes activities relating to Comms & KB, Stakeholder identification and engagement; Indigenous Engagement (where appropriate); and the nature and timing of data outputs"* (see also discussion under M&E. below)

Data accessibility

The NESP guidelines require that all information (including research data) produced under the programme is made publically and freely available on the internet. In this context, the ESCC Hub recognises the need to promote open access to public sector and publically funded information.

The Hub’s approach to data and information management is covered in Section 5.1 of the *Communication and Knowledge Brokering Strategy V2*. The Hub is committed to ensuring that all data and information data are discoverable by and available to, stakeholders. Accordingly, appropriate protocols are under development to ensure that metadata statements for each project are completed, collated and catalogued as per NESP guidelines.

The Hub aims to make the metadata catalogue available on its external website in accordance with Departmental arrangements for NESP. The Hub leadership will also work with Partner Agencies to ensure consistency with relevant agency-specific data and information management arrangements.

Where appropriate, the Hub will utilise existing research infrastructure, developed under NCRIS, ACCSP and ANDS to curate and, where appropriate, distribute ESCC datasets. This specifically includes: the Earth Systems Grid at the NCI for CMIP data; IMOS and TERN data portals for oceans and terrestrial data; the Carbon Observatory for carbon cycle information (see Project 2.9); and CSIRO’s Cape Grim greenhouse gas data website.

The Hub anticipates playing a role in coordinating data curation and distribution across these complementary agencies and initiatives, but this vision has not yet been articulated via any formalised plan. The Hub committed to ensuring that an inventory of ACCSP data sets is created, and these data are also curated and potentially available for further use. This is being achieved via an activity guided by NESP but being done under the auspices of the ACCSP to develop a record of all data collections and models from at least the last 3-years of the ACCSP.

The Hub will also be enhancing model systems – specifically ACCESS, with the goal of ensuring ACCESS can be used by the research community; and model simulations are accessible. It is not envisaged that the ACCESS model will be publically available although those components developed within Australia are already open source (e.g. the Land Surface Model, CABLE - [Community Atmosphere Biosphere Land Exchange]).

Monitoring and Evaluation

Monitoring and Evaluation Plan

The NESP Monitoring and Evaluation Plan (M&E Plan) provides the framework through which the progress and success of the Hub will be measured. It will enable clear performance assessment via a common set of high level indicators used across the programme, along with qualitative, narrative based reporting of project progress and impact.

Key Performance Indicators for each NESP Hub will be aligned to a number of key themes:



Two important elements of the Monitoring and Evaluation Plan are annual project reporting and the biennial programme evaluation.

Project and Financial Reporting

Under the terms of the NESP funding agreement, the following reports are required to be submitted to demonstrate Hub performance and project progress;

- **Annual Progress Report:** to be submitted in April of each year and describes, in quantitative and qualitative terms, the progress of work against the Research Plan.
- **Audited financial information:** submitted alongside the Annual Progress Report and demonstrates the income and expenditure of the Hub.
- **A Final Report:** submitted at the conclusion of all Hub activity.

Biennial Evaluation

Under the Portfolio Budget Statements for the Environment Portfolio, the single key performance indicator for the NESP is biennial qualitative assessments that show Departmental staff, state governments, business, community groups and others are using research output from the NESP to inform policy development. The NESP Biennial Evaluation is a key performance metric and output of the NESP's M&E Plan.

The outcomes and findings of the Biennial Evaluation will inform and direct the future delivery of the programme, including the research priorities. The biennial review will be used to inform the review and evaluation of the NESP after two and four years as requested by the Minister in making his funding decision for the NESP.

Under the terms of the funding agreement, the Earth Systems and Climate Change Hub is required to participate in any programme evaluations or reviews planned during the life of the NESP.

Hub Monitoring and Evaluation (M&E) Plan

The Hub has developed its own Evaluation Framework, and Hub level M&E Plan, that guide our *Communication and Knowledge Brokering Strategy* and *Indigenous Engagement Strategy*, and the development of the Hub's Research Project portfolio. It will also provide the relevant input to facilitate implementation of the NESP M&E Plan, specifically including the delivery of the Biennial Evaluation Report. The updated Programme Logic from the ESCC Hub M&E plan is contained in the Appendix.

Importantly and as already described above, the Hub's Evaluation Framework and M&E Plan guide the implementation of a cycle of: research prioritisation → delivery → evaluation → review; and ensures that the Hub's research is continually informed by stakeholder needs.

As a part of this, the Projects will develop a more detailed (annual) Work Plan describing their objectives, tasks and outputs. Operationally, these Work Plans will feed into the Hub's (internal) quarterly Progress Reports and annual reporting to the Department. They also enable the Hub to monitor resourcing, and track progress in a measureable way.

These Project Work Plans and Progress Reports are the primary means by which the Hub will monitor the ongoing process of stakeholder gaps and needs review and analysis. These feed back into the Hub's Communications, Knowledge Brokering, Indigenous Engagement Strategies, and Evaluation Planning Framework throughout the life of the Hub: at both a Hub and project level

(where it is also the means by which the research responds to changing and emerging stakeholder needs).

Collaboration and Partnerships

The NESP encourages a collaborative, multi-disciplinary approach to environmental and climate science research. The success of the Hub in achieving its impact depends on a capacity to foster partnerships across Hubs, and with a wide range of relevant stakeholders – as explained above on p. 14 under Stakeholders. Table 3 identifies those partners and stakeholders with whom the Hub has already engaged in 2015, or with clear plans to engage in 2016. This list will grow and mature through Research Plan V2, as explained in our *Communication and Knowledge Brokering Strategy*.

Table 3: Hub Collaborations and Partnerships (see Glossary for all acronyms at Appendix 3). The Hub has had face-to-face contact with all partners and stakeholders listed below in 2015. The Hub’s Communication and Knowledge Brokering Strategy V2 identifies all key stakeholders with whom the Hub will engage by the end of 2016.

Partner	Relationship to ESCC Hub	Role (institution, program, individual)	Expertise	Alignment to Hub goals
Programs or agencies who are non-funded partners providing research capability and/or represent key next and end users				
IMOS	Proposed Associate Partner; and member of HSAG	Program: Provides critical research infrastructure to NESP ESCC research	Ocean observing infrastructure	Critical to ocean observations; which underpin several outcomes and research priorities
NCI	Proposed Associate Partner; and member of HSAG	Program: Provides critical research infrastructure to NESP ESCC research	High Performance Computing for ACCESS modelling; CMIP and observed data storage	Critical to ACCESS development and use; CMIP6 participation; and delivery of climate information
ARCCSS	Director is member of HSC. CIs are involved in Hub research projects	ARC-funded Centre providing underpinning climate system science to Hub research	Climate Systems Science	Aligned to some research priorities
ACE CRC	Proposed Associate Partner. CEO is a member of the HSC	Program: CRC potentially both users, and providers, of research	Antarctic and Southern Ocean – cryosphere processes	Aligned to some research priorities; complementary research goals
NCCARF	Proposed Associate Partner and member of HSAG	Program: Climate Adaptation Facility are next and end users of Hub research. They also connect the Hub’s research to broader end-user communities	Adaptation to climate change, with a focus on the coastal zone, especially sea-level rise impacts	Aligned to some research priorities; complementary research goals
Managing Climate	Proposed Associate Partner and likely member of HSAG	Program: Links to agricultural and production	Climate variability and its links to	Stakeholder who represents two of the Hub’s five

Partner	Relationship to ESCC Hub	Role (institution, program, individual)	Expertise	Alignment to Hub goals
Variability Program		sector. Users of ESCC Hub research. MCV's climate champion program may be a way for the Hub to build its engagement with end-users of Hub climate information.	agricultural production.	outcome areas (NRM and Food Security; Water)
Reef Traditional Owners and Reef Catchments NRM	Stakeholders and collaborator on Indigenous Engagement	Program: Stakeholder group with whom we are developing several Indigenous Engagement activities	Traditional owners and Indigenous knowledge; Natural resource management	Aligned to Hub's Indigenous engagement goals and objectives.
Jurisdictions – Key Stakeholders and Collaborators, with whom the Hub has established links already in 2015 (Qld, WA, ACT, NT pending)				
State & Local Government Departments and Agencies	<ul style="list-style-type: none"> a) SA Dept of Environment, Water & Natural Resources b) Tas Dept of Primary Industries, Parks, Water & Environment c) Vic Dept of Environment, Land, water & Planning; and Dept of Economic Development, Jobs, Transport & Resources 	Institutions with interest in Hub research and climate information products. The Hub are likely to work with States to develop case studies demonstrating relevance of Hub research to their on-the-ground climate adaptation and mitigation needs.		
Individual collaborators				
Ro Hill and Pethie Lyons, CSIRO	Hub are providing a cash contribution to a Project funded by CSIRO and the Qld government (see Indigenous Engagement text for details).	Individual researchers linked to other NESP Hubs (Tropical Water Quality, Northern Australia) and related CSIRO activities	Deep experience and expertise in Indigenous Engagement.	Aligned to Hub's Indigenous Engagement goals
NESP Hubs				
<ul style="list-style-type: none"> • CAUL • Marine Biodiversity • Threatened Species • Northern Australia • Tropical Water Quality 	Collaborators on specific areas of research; Indigenous engagement; and users of climate knowledge and information. A review of RPV1, and discussions, reveals the following potential joint areas: i) climate information (all Hubs); ii) marine temperature extremes (Marine Biodiversity Hub); and iii) greenhouse gas emissions in urban regions (CAUL). These, and additional links, will be identified at our first cross-Hub Workshop in Q1, 2016.		Primarily urban greenhouse gas emissions and climate change (CAUL); climate impacts (all); and Indigenous engagement (NA)	Aligned to some research priorities

Indigenous Engagement

The Hub is committed to meaningful, beneficial and respectful Indigenous engagement and collaboration during all phases of the delivery of the NESP. Where relevant, due consideration will be given to actively involving key Indigenous stakeholders in research prioritisation, research delivery and, especially, the communication of research output. The Hub's approach to Indigenous engagement is detailed in its *Indigenous Engagement Strategy*.

The Hub's approach is to have a strong, centrally coordinated approach to Indigenous Engagement at the Hub level, with individual research Projects undertaking specific activities and developing tailored communications and information products within this overarching framework. The following description therefore applies both at the Hub level, and for individual research projects.

The overall goal of the Hub's *Indigenous Engagement and Collaboration Strategy* in 2015 was to begin to build relationships with Aboriginal and Torres Strait Islander people and communities as a first step towards our long-term goal of providing targeted climate information to Indigenous Australian communities. To this end, the Hub has established very good contacts with researchers working with Indigenous communities – for example an initial meeting with the Traditional Owners of the Great Barrier Reef is proposed for November 2015.

The Hub has also arranged for research ethics/cultural awareness training for all Lead Chief Investigators and the Hub's leadership and programme management staff through a CSIRO program called '*Seeing thorough both eyes*'. The first training will take place in November 2015 and will be repeated in 2016, and beyond as needed. This training program will: i) equip the Hub's leadership team with the awareness and understanding needed to enable them to work with Indigenous staff, groups and communities in an effective and meaningful way; ii) increase the capacity of individuals and teams to communicate with Indigenous stakeholder groups and contribute to more effective engagement generally with Indigenous people and communities; and iii) it will also recognise the existing Indigenous knowledge systems within science and established as part of Australia's culture. The Hub leadership also participated in the proposed CAUL Hub Indigenous Research Protocol workshop and NESP Hub Community of Practice event.

In 2016, the Hub's Indigenous Engagement activities are designed to realise the potential richness of knowledge of Traditional Owner communities, and Indigenous intellectual property whilst centrally co-ordinating engagement to minimise the likelihood of engagement fatigue. The Hub will continue its journey of developing engagement activities that will integrate knowledge and resources to address climate impacts on natural resources, ecosystems, and communities themselves; provide customised communication products, tools and services to support decision-making and enhanced adaptation planning within Indigenous Communities; and continue to build strong relationships with Aboriginal and Torres Strait Islander people and communities either through direct engagement or through the collaborative relationships with other Hubs, research agencies and the broader community.

The priority ESCC Hub specific Indigenous engagement activities for 2016 are:

1. Continue building relationships with relevant Aboriginal and Torres Strait Islander groups; and engaging with the other NESP Hubs and initiatives of the Partner agencies.
2. Engage an Indigenous Cadet through CSIRO - a cadetship provides a full time tertiary student with a study allowance during the 40 weeks of the academic year and 12 weeks of relevant work experience each year. We have advertised for candidates.

3. Partnering with Dr Pethie Lyons on an “Advance Queensland Fellowship” proposal for a project entitled ‘*How we know our climate is changing and making new ways of working together*’. Dr Lyons holds an OCE postdoctoral fellowship with CSIRO and she has been engaged in research that investigates the integration of scientific and Indigenous knowledge for biodiversity management. The Hub is keenly interested in this Project, as it aligns to the Hub’s goals of providing targeted climate information to Indigenous Australian communities with an emphasis on integrating knowledge and resources to inform the way climate change affects natural resources, ecosystems, and communities; and providing communication products and tools to support decision-making and enhanced adaptation planning. One of the Hub’s principles is to build from strong relationships that have already been developed with Traditional Owner communities – clearly this research proposal is consistent with this principle.
4. Exploring opportunities to engage with the Murray Lower Darling Rivers Indigenous Nations and the Gippsland lakes communities in Victoria, with a view to implementing lessons from the ‘*How we know our climate is changing and making new ways of working together*’ project.

Funding

The ESCC Hub is supported through funding from the Australian Government’s National Environmental Science Programme. Under the Department of the Environment Portfolio Budget Statements, the NESP provides for around \$142 million over the life of the Programme.

The tables below describe the funding from the NESP available to the ESCC Hub over the life of the agreement, by both financial and calendar years (in \$K).

2014/2015	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021
466.00	500.00	5,100.00	5,100.00	5,100.00	5,100.00	2,550.00

2015	2016	2017	2018	2019	2020	2021
716.00	2800.00	5,100.00	5,100.00	5,100.00	4,550.00	550.00

Expenditure of NESP funding under the Hub is expected to be distributed amongst three main items of expenditure (Research, General Communications and Administration). The funding must be expressed, in the table below, as a percentage of the total for any given calendar year noting that funding for Research must total at least 80% of the funding. The balance (20%) of the funding can be allocated between General Communications and Administration with no more than 10% of the funding being allocated to Administration.

Research	General communication	Administration
80%	10%	10%

Under the terms of the NESP, the minimum total for recipient and other contributions per year is 100% of the funds paid by the Department under this agreement.

At Attachment C are the budget tables for the Hub for calendar year 2015 onward. It describes the budget for each Hub project, and includes recipient and other contributions.

Hub Approach to Project-level Risk Mitigation and Management

Attachment B contains the Hub's Risk Register, which is divided into a) Hub level risks, and b) risks that have been identified and categorised from the individual research project proposals in Attachment A that will be managed and treated at a whole-of-Hub level – primarily via implementation of the Hub's governance arrangements and Hub-level Monitoring and Evaluation Plan. A consistent risk management approach implemented across the Hub delivers significant benefits in terms of effectiveness and efficiency; especially as the risks identified by all projects fell mostly into the following five categories:

1. Dependency on project(s), infrastructure and data sources that are funded external to the Project and/or Hub and are not always under the control of the project leadership, specifically:
 - IT skills and infrastructure (including the NCI facility at ANU, which provides processing capacity for climate model simulations along with significant data storage capacity).
 - Observational infrastructure.
 - Observed and modelled data (including CMIP6).
 - Performance of climate models generally, and especially Australia's climate model – ACCESS.
2. Staffing: Loss of staff with key skills and/or insufficient critical mass of staff.
3. Inadequate Hub Level Communications and Knowledge Brokering; Stakeholder and Indigenous Engagement, that could limit the effectiveness of these activities at a research project level and/or Hub level (see also Risk Category #5).
4. Resource constraints and stakeholder expectation management.
5. Path-to-impact limited because it will be realised via other projects, Hubs and/or stakeholders (i.e. the project primarily delivers to next rather than end-users), and/or because of misinterpretation and/or miscommunication of results.

This also means that all Hub risk mitigation and treatment actions are identified in Attachment B.

Flexibility

The Hub is aware that flexibility is important for the Department. The following is a summary of the Hub's approach to ensuring there is adequate flexibility in the Hub's research portfolio:

1. **Leveraging off past commitments:** The Hub is able to leverage existing IP from previous investments (e.g. ACCSP), whereby a small amount of discretionary Hub investment can deliver more immediate stakeholder benefits ('low hanging fruit'). Such IP is broad-based and has flexibility to meet fit-for-purpose needs while funded NESP projects gain traction and begin delivery.
2. **ESCC Hub capability and IP:** This extends beyond existing (RPV2) project teams and across all core Partners. The Hub is confident it has the capability needed to re-orient its research activities to meet emerging Departmental needs and priorities.

3. **Research Plan V2 - implementation:** The project commitments vary in duration from 12 months to 3 years, with provision for periodic stop/go reviews where appropriate. This provides the option for re-scoping/re-direction throughout the lifetime of the RPV2 projects. There are also uncommitted NESP research funds available from 2018-2021 for reinvestment.
4. **Communications and Knowledge Brokering Strategy:** The Hub has some discretionary resources “held-back” that are available to be committed to activities (including products and services) that emerge from yet-to-be determined next/ end-user needs.
5. **Business Development and Stakeholder engagement:** We are also undertaking a strategic and systematic approach to Business Development as an integral part of our stakeholder engagement strategy. The purpose is to facilitate new coinvestment opportunities to leverage core Hub funding (detailed in our draft Communications and Knowledge Brokering Strategy). Examples to date include recent developments in the ‘water’ project area and Outcome domain; which has seen direct additional coinvestment from CSIRO of \$200k and indirect coinvestment via SA Govt/Goyder for proposed case studies.

Appendix: 1A. Summary of Earth Systems and Climate Change Hub Project Portfolio

All project activities proposed for funding under the Earth Systems and Climate Change (ESCC) Hub in Research Plans V1 and V2 are listed below. For more detail on each specific project, refer to Attachment A – Research Projects. Note that Projects in the Research Plan V2 were scoped to be a maximum of 3 years in duration. Additional research proposals (to 2020) will be called for under later Research Plans.

Project number	Project name	Project leader (Lead CI)	Lead organisation	Timeframe	Status - Completed - Ongoing – no changes from RPV1 - Ongoing – changed from RPV1 - New
1.1	Current Capability and Future Directions Assessment	Helen Cleugh	CSIRO	Jul 2015 – Jul 2016	Ongoing – changed from RPV1 Project Plan in Attachment A
1.2	Communications, Indigenous and Stakeholder Engagement	Helen Cleugh	CSIRO	Jan 2016 – Dec 2016	Ongoing – changed from RPV1: i) Costs include Hub-level communications, data management Indigenous engagement – i.e broader than RPV1 version of this Project. ii) In RPV2, this activity is encompassed in the Hub's Communications and Knowledge Brokering budget allocation; and the associated activities are described in the respective Strategies.
1.3	Low cost abatement options: Scoping Workshop and Report	Helen Cleugh	CSIRO	Jul 2015 – Jul 2016	Ongoing – changed from RPV1 2016 costs have been updated. Project Plan in Attachment A
1.5	Supporting the Establishment of the NCCC: Phase I (Engagement)	Helen Cleugh	CSIRO	1 Jan to 31 Dec 2015	Completed
2.1	Preparing ACCESS for CMIP6	Simon Marsland	CSIRO	Mar 2016 – Jun 2019	New Project Plan in Attachment A
2.2	Enhancing Australia's capacity to manage climate variability and climate extremes in a changing climate	Scott Power	Bureau of Meteorology	Jul 2016 – Jun 2019	New Project Plan in Attachment A
2.3	Towards an ACCESS decadal prediction system	Terry O'Kane	CSIRO	July 2016 – June 2019	New Project Plan in Attachment A Additional \$50K from Marine Biodiversity Hub under negotiation

Project number	Project name	Project leader (Lead CI)	Lead organisation	Timeframe	Status - Completed - Ongoing – no changes from RPV1 - Ongoing – changed from RPV1 - New
2.4	Changing oceans and Australia's future climate	Susan Wijffels	CSIRO	February 2016 – June 2019	New Project Plan in Attachment A
2.5	Improving Australia's Climate Model (ACCESS)	Tony Hirst	CSIRO	July 2016 – June 2019	New Project Plan in Attachment A
2.6	Regional Climate Projections Information and services	Kevin Hennessy	CSIRO	July 2016 – June 2019	New Project Plan in Attachment A
2.7	Refining Australia's Water Futures	Dewi Kirono	CSIRO	July 2016 – June 2019	New Project Plan in Attachment A
2.8	Extreme Weather Projections	Andrew Dowdy	Bureau of Meteorology	July 2016 – June 2019	New Project Plan in Attachment A
2.9	Risk assessment of future carbon sources and sinks	Pep Canadell	CSIRO	July 2016 – June 2019	New Project Plan in Attachment A
2.10	Coastal Hazards in a Variable and Changing Climate	Kathy McInnes	CSIRO	July 2016 – June 2019	New Project Plan in Attachment A
2.11	Establishing the NCCC	Stephen Swearer	University of Melbourne	May 2016 – May 2019	New. Project Plan in Attachment A
2.12	Sea level projections for NCCARF	Kathy McInnes John Church	CSIRO	September 2015 – July 2016 (NESP funding from 1/1/2016 only)	This is the former Project 1.4, which was not formally approved in RPV1. The following changes (for record tracking) from that unapproved version: a) Name changed (was: "Enhanced Coastal Planning Information and Delivery"). b) Budget changed to reflect final Project agreement with NCCARF.

Appendix: 1B. Project Summaries

<p>Project 2.1: Preparing ACCESS for CMIP6</p>	<p>ACCESS is Australia’s global climate model, which provided climate simulations for IPCC’s Fifth Assessment. Given the investment in ACCESS, and its importance to Australia’s climate preparedness and resilience, ACCESS needs to be internationally competitive and the model of choice for the Australian community. A benchmarked, world-class global climate modelling capability supports Australia’s effective engagement with future climate assessments, and Australia’s management of climate risks and opportunities. This project addresses this outcome by preparing the current ACCESS model for participation in the next Climate Model Intercomparison Project (CMIP6) to benchmark the credibility of ACCESS for application across the NESP ESCC Hub.</p>
<p>Project 2.2: Enhancing Australia’s capacity to manage climate variability and climate extremes in a changing climate</p>	<p>Heatwaves, floods and droughts in Australia cause high economic, agricultural and human costs. Managing the risks – and reducing the costs – associated with climate variability and extremes requires a transformation in our current understanding of the influence of climate change now and into the future.</p> <p>This project will analyse past climate variability and extremes to significantly enhance our understanding of the underpinning mechanisms and processes. Its focus is longer timescale extremes such as extended heatwaves, floods and droughts and the historical record of tropical cyclones; with the aim of informing the development of robust projections that will help Australia prepare for and respond to climate variability, extremes and change in the future.</p>
<p>Project 2.3: Towards an ACCESS decadal prediction system</p>	<p>The marine, agriculture, energy and water sectors have consistently requested climate information at multi-year to decadal timescales. Australia currently has severely limited predictive capability at these timescales, because of the need for innovative, multi-year-focussed ocean data assimilation and prediction methods. This project develops forecasting capability specific to filling the critical gap between seasonal climate predictions and multi-decadal climate projections, within ACCESS. The project will deliver targeted stakeholder specific products to inform marine and agriculture policy and adaptive management strategies, for industry and the environment, including assessment of marine temperature extremes, which have large impacts on marine life and fisheries.</p>
<p>Project 2.4: Changing oceans and Australia’s future climate</p>	<p>Global warming is ocean warming: over 93% of the extra heat stored by the Earth over the past 50 years is found in the ocean. To interpret past changes, and better predict changes in the climate we need to understand how the ocean takes up heat, and how ocean heat uptake may change as the planet warms.</p> <p>Projections of future warming, sea level rise and water availability for Australia and our region can be improved by ensuring that ocean heat uptake is well represented in climate models. This project will use observations and models to provide these improvements; underpinning a more resilient Australia.</p>

<p>Project 2.5: Improving Australia's climate model (ACCESS)</p>	<p>ACCESS equips Australia with a global climate modelling capability that is uniquely concerned with the weather and climate of the Australasian and Southern Hemisphere region. The key outcome is a national preparedness that enables Australia to better manage weather and climate impacts, including future risks and opportunities; saving lives, resources and money.</p> <p>This project will enhance ACCESS's competitiveness by improving its simulation of critically important climate processes in the Australasian region, focussing on rainfall and weather extremes. It will facilitate the robust predictions needed for adaptation and emissions policies, and deliver an enhanced system to the Hub and broader community.</p>
<p>Project 2.6: Regional climate projections science, information and services</p>	<p>Our stakeholders have told us that they want credible and salient projections to underpin adaptation. However, there are a few areas where uncertainties remain large, data are inadequate for impact assessment, and uptake has been limited. Furthermore, a new set of climate simulations are due in 2018-19, so we need to begin development of new projections that maintain credibility and salience.</p> <p>This project addresses these issues by: (1) enhancing uptake of information through improved products and services for targeted stakeholders; (2) constraining uncertainty and improving confidence in projections; and (3) laying the groundwork for the next generation of regional projections.</p>
<p>Project 2.7: Refining Australia's water futures</p>	<p>Information about, and analyses of, future water availability are critical for water resources planning and investment decisions; however credible and consistent projections for a range of hydroclimate variables are not currently available.</p> <p>We will improve our national modelling capability to simulate how changes in climate and land use in the future will affect Australia's hydroclimates and water resources into the future. As part of this activity we will engage with stakeholders to ensure that the projections are both relevant and useful to sectors that are significantly affected by climate and water, such as (but not limited to) agriculture.</p>
<p>Project 2.8: Extreme weather projections</p>	<p>Extreme weather events (tropical cyclones, east coast lows, thunderstorms, extreme fire weather) incur economic costs associated with property, environmental and human impacts (injury, displacement and death). Effective disaster risk reduction, emergency response, infrastructure design/operation, planning and policy making all require information about how these extreme events will change in the future.</p> <p>This research will fill knowledge gaps and improve understanding of existing and projected characteristics of these extreme events. We will use this knowledge to improve simulations and projected changes in these extreme events and, through ongoing and effective stakeholder engagement, transform our research into targeted, useful and application-ready information.</p>

<p>Project 2.9:</p> <p>Risk assessment of future carbon sources and sinks</p>	<p>Policy makers need information on carbon and greenhouse gases to develop successful national policies and international engagement to achieve climate mitigation targets. The potential for current carbon abatement, through revegetation and native vegetation conservation in Australia, will be assessed with an emphasis on their potential vulnerability under future climate change, and long-term carbon – climate feedbacks. We will also deliver data products showing national and global carbon (CO₂ and CH₄) budget trajectories, and how these track the pathways needed for global climate stabilisation by the end of the 21st century. These products will be delivered in stakeholder-relevant formats, suitable for use by government agencies, business and enterprises, and the broader community.</p>
<p>Project 2.10:</p> <p>Coastal hazards in a variable and changing climate</p>	<p>Coastal erosion and inundation will be influenced by changes in sea levels and waves. Over \$226B in Australian assets could be at risk from a 1.1 m increase in sea level (a high-end projection for 2100). However, the projected changes and their coastal impacts remain uncertain and controversial. We will improve our understanding of past, and develop projections for future, changes to coastal stressors (sea level, storm surges and waves) and their physical impact. Through engagement with end-users in government and industry, our products will be tailored and delivered in ways that ensure Australians can plan effectively for coastal change.</p>
<p>Project 2.11:</p> <p>Establishment of the National Centre for Coasts and Climate – Phase 1</p>	<p>This project will establish the National Centre for Coasts and Climate (NCCC), a flagship research, teaching, and engagement organization for coastal and climate change issues in Australia. NCCC will engage with stakeholders to identify the best on-ground actions for addressing climate change impacts in Australian coastal ecosystems, by:</p> <ul style="list-style-type: none"> • Building upon current understanding of how coastal vegetated habitats influence carbon accumulation rates; • Improving understanding of how coastlines are likely to respond to climate change; and • Integrating this knowledge into ecological engineering solutions to enhance the adaptive capacity of coastal ecosystems to respond to climate change.
<p>Project 2.12:</p> <p>Sea level projections for NCCARF</p>	<p>We will provide to NCCARF the latest projections of sea-level rise for each local government area in Australia, including all mainland and Tasmanian Councils and the Torres Strait Islands; and communicate the information in guidance material and stakeholder workshops. Our goal is to ensure that our current knowledge is delivered to the community, particularly coastal planners and managers, in a coherent and efficient manner to aid in decision making and planning for future coastal change. It does this by using the latest regional climate projections for Australia, and by working with NCCARF who will deliver this information via their coastal tool.</p>

Appendix: 2. Earth Systems and Climate Change Hub: Programme Logic (V1.12)

Attachment A: NESP Earth Systems & Climate Change Hub - Programme Logic (V1.12)

NESP Goal & ESCC Specific Outcome	To improve our understanding of Australia's environment through collaborative research that delivers accessible results and informs decision-making					
	Improved climate and weather information for Australia through a greater understanding of the drivers of Australia's climate.					
ESCC Hub National Challenges	Water Futures	Global Warming & the Carbon Cycle	Climate Extremes & DRM	Coasts & Communities	Food Security & NRM	
ESCC Hub Goal	Policy development, planning, management and associated decision-making in Australia effectively and efficiently informed by <i>Earth Systems & Climate Change Science</i> now and into the future					
ESCC Hub Objective(s)	<p>Through world class research and development, to:</p> <ul style="list-style-type: none"> • lead further development of the nation's modeling capability and capacity for weather and climate prediction and projections • achieve greater understanding of Australia's climate variability, extremes and associated drivers • develop and strengthen stakeholder relationships and support informed management and evidence-based decisions-making, and • facilitate outreach and communication of science products and services to end-users and the general public 					
Practice change	ES science more targeted at end-users through clearer path-to-impact and outcomes focus		ES science more effectively & efficiently integrated within Australian environmental research	End-users routinely access best available ES science capability and knowledge to inform policy and management decisions	Stakeholders actively engage with the Hub; seek to understand ES science; and provide positive feedback and support to Hub	
Stakeholders and Next/end-users	Australian Government Minister/Department of the Environment	Other NESP Hubs	Federal, State & Local Government Sectors	Australian industry - business, finance and insurance groups	Indigenous communities and general community	Australian and international Earth system science and climate research community
ESCC Hub Governance	Programme Management: Administration; Progress Reporting; Performance, Financial and Risk Management; Monitoring & Evaluation Communication, Knowledge Brokering and Outreach: Steering Committee and Stakeholder Engagement; Data & Information Management; Coordination and Management					
ESCC Hub Research Outputs	<p>Science & Technical: Enhanced models (multi-year and higher spatial resolution); data/information management systems; analyses, forecasts & projections; data access and analysis tools; journal papers, technical reports and other information products</p> <p>Communications, knowledge brokering, outreach and capacity development: knowledge management systems, websites and content, non-technical summaries, multi-media content and training, postgraduate and professional development, professional and public forums (training workshops, seminars, conferences etc)</p>					
ESCC Hub Research Priorities	Building the utility of ESCC information		Improving our understanding of how the climate system may change in the future		Improving our observations and understanding of past and current climate	
ESCC Hub Thematic Research Areas	Communications, knowledge brokering, data/Information management & outreach/end-user engagement					
	Climate variability & extremes		Past, present & future climate		Future coasts & regions	
	Earth Systems & Climate Change Science integration & capacity building					
ESCC Hub Partners, IP, resources & capacity	<p>Hub consortium – CSIRO, Bureau and Universities</p> <p>Cash/in kind – existing capability and IP, infrastructure, collaborative and stakeholder networks</p> <p>Leveraged off existing capacity, momentum and track record in ACCSP, NRM, PACCSAP, TERN, IMOS, NCI, SEACI, IOCI etc</p>					

Appendix: 3. Glossary - for Research Plan V2 and Proposals in Attachment A

Acronym	Definition
ACCESS	Australian Community Climate and Earth-System Simulator
ACCSP	Australian Climate Change Science Programme
ACE CRC	Antarctic Climate and Ecosystems Cooperative Research Centre
ARC	Australian Research Council
ARCCSS	Australian Research Council's Centre of Excellence for Climate System Science - Australian Research Council Centre for Climate System Science: collaboration of key universities and PRFAs on climate modelling and extremes
Argo	A global array of profiling floats operated by over 25 nations under the auspices of the United Nations' World Meteorological Organisation and the International Oceans Commission. Argo Australia is major contributor funded partially by the Integrated Marine Observing System and partner programs such as the Australia Climate Change Science Program, the ACE CRC , Bureau of Meteorology and CSIRO. www.argo.net ; www.imos.org.au
AWRA	Australian Water Resources Assessment (model)
BIOS	Fine-spatial-resolution (0.05 degree) offline modelling environment for Australia, in which predictions of CABLE are constrained by multiple observation types
BoM	Bureau of Meteorology
CABLE	Community Atmosphere Biosphere Land Exchange model
CAPRICORN	Clouds, Aerosols, Precipitation Radiation & Atmospheric Composition over the southern Ocean
CAUL	Clean Air and Urban Landscapes Hub
CCAM	Cubic Conformal Atmospheric Model (a CSIRO global model that can “zoom” to high resolution over regions of interest – used to generate downscaled climate projections)
CCHDO	CLIVAR and Carbon Hydrographic Data Office, funded by the US National Science Foundation and operated by the Scripps Institution of Oceanography. CCHDO is the data curator, repository and distribution point for the global GO-SHIP program and also helps compile high-quality calibration data sets used to quality control Argo profiles for climate applications.
CFT	Climate Futures for Tasmania
CORDEX	COordinated Regional Downscaling EXperiment
CMIP5 and CMIP6	Coupled Model Intercomparison Project 5 and 6
CMOR	Climate Model Output Rewriter
CSIRO DAP	CSIRO's Data Access Portal – access to publically available, catalogued and DOI'd data resources. Collections in the DAP are curated for long-term storage and distribution.
DECK	Diagnosis Evaluation & Characterisation of KLIMA
ECL	East Coast Low
ENSO	El Niño Southern Oscillation
ESCC	Earth Systems and Climate Change
ESGF	Earth System Grid Federation
ET-CCDI	Expert Team on Climate Change Detection & Indices
GCP	Global Carbon Project
GHG	Greenhouse Gases

Acronym	Definition
GO-SHIP	An internationally coordinated global decadal-repeated survey of ship-based sections of top-to-bottom ocean physical and chemical properties. Australia has contributed to key regional lines via the ACCSP and the ACE CRC. GO-SHIP uniquely monitors the ocean carbon inventory and full depth heat and freshwater budgets, extending below Argo's current operating depth. www.go-ship.org .
HLT	Hub Leadership Team
HSAG	Hub Stakeholder Advisory Group
HSC	Hub Steering Committee
IMOS	Integrated Marine Observing System - Integrated Marine Observing System, funded by Australia's National Collaborative Research Infrastructure Strategy. IMOS provides partial support for key climate ocean observing systems such as Argo, moored series, some carbon measurements.
IPCC	Intergovernmental Panel on Climate Change
LSAVs	Large-scale Atmospheric Variables
M&E	Monitoring and Evaluation
MCV	Managing Climate Variability research and development program
MHW	Marine Heat Waves
MOM	Modular Ocean Model (MOM), developed by NOAA GFDL (see below) and is part of the ACCESS system.
NARCLIM	NSW / ACT Regional Climate Modelling
NCCARF	National Climate Change Adaptation Research Facility
NCCC	National Centre for Coasts and Climate
NCI	National Computational Infrastructure
NCRIS	National Collaborative Research Infrastructure Strategy
NERP	National Environmental Research Program
NESP	National Environmental Science Program
NOAA	US National Oceans and Atmosphere Administration. NOAA spans operational forecasting and research services across fisheries, weather, oceans and climate. NOAA's many laboratories and arms operate substantial parts of the global climate and ocean observing system and modelling centres.
NOAA GFDL	NOAA Geophysical Fluid Dynamics Laboratory – a key partner in ACCESS as the developer of the ocean model used, the Modular Ocean Model (MOM).
NRM	Natural Resources Management
OTE	Ocean Temperature Extremes
PACCSAP	Pacific-Australia Climate Change Science & Adaptation Planning Program
PEGS	Process Evaluation Groups
POP	Population Orders Physiology (a stand-alone tree demography and landscape structure module for Earth System models)
PCCSP	Pacific Climate Change Science Program
RCP	Representative Concentration Pathways
SAM	Southern Annular Mode
SEACI	South Eastern Australia Climate Initiative
SOCRATES	Southern Ocean Clouds Radiation Aerosol Transport Experimental Study
TC	Tropical Cyclones

Acronym	Definition
TERN	Terrestrial Ecosystem Research Network
TRMM	Tropical Rainfall Measurement Mission
UM	Unified Model
UoM	University of Melbourne
UNFCCC	United Nations Framework Convention on Climate Change
WCRP	World Climate Research Program

Appendix: 4. ESCC Hub Steering Committee Terms of Reference and Membership

Purpose

The Hub Steering Committee (HSC hereafter) provides strategic direction and oversight of Hub governance, including processes for managing partnerships, setting research priorities, approval and acquittal of finances, allocation of funding and resources, and performance monitoring and assessment of hub impacts.

The HSC is not a decision-making body, rather is a high level review and advisory forum designed to facilitate outcomes as an independent source of reference and oversight on behalf of the Hub and the Department relating to:

- Strategic decisions made by the Hub Leader/Leadership team and Partners (both Supporting and Associate); and
- Strategic advice and directions provided to the Hub by Department of the Environment.

Membership

The HSC will comprise the following members and representation:

Role	Nominee	Status
1. Independent Chair	Dr Wendy Craik	Accepted
Partner Representatives:		
2. CSIRO	Dr Ken Lee, Oceans & Atmosphere Director	Accepted
3. Bureau of Meteorology	Dr Peter May, Assistant Director, R&D Branch	Accepted
4. Universities	Dr Neville Nicholls, Monash University	Accepted
5. Dept of the Environment	Dr Diana Wright, First Assistant Secretary, DotE Beth Brunoro, Assistant Secretary Adaptation & International Climate Change Policy	Accepted Accepted
6. Hub Stakeholder Advisory Group (SAG)	Chair of SAG, to be appointed once SAG established	TBA
7. Director of ARC Centre of Excellence in Climate System Science (<i>ex officio</i>)	Dr Andy Pitman, UNSW	Accepted
8. Up to two independent members with expertise in Earth Systems science and its application to government policy, industry and broader end-user needs	Ms Jo Mummery, University of Canberra (previous Assistant Secretary of climate science and adaptation related work in the former Department of Climate Change) Professor Tony Worby, ACE CRC/U.Tas	Accepted Accepted
9. Hub Leader (<i>ex officio</i>)	Dr Helen Cleugh, CSIRO	Accepted
Other invitees from time to time as appropriate (observer status), including other key personnel representing the ES Hub, other NESP Hubs, Dept of the Environment, other government portfolio agencies, the HSAG and other key end-users and stakeholders		

Specific HSC Roles and Responsibilities

Given their purpose, the specific functions and associated roles and responsibilities of the HSC will be to:

1. Provide a structured forum for engagement between the Hub Leadership with:

- The Minister and Department of the Environment (NESP management);
 - The Hub Stakeholder Advisory Group, and
 - Other NESP Hubs and external stakeholders.
2. Provide strategic guidance to the Hub on research directions, priorities, delivery and outputs, communication and engagement, to ensure alignment of research activities to policy needs of Department of the Environment and other target end-users and key stakeholders.
 3. Oversee, review and endorse or approve as appropriate:
 - Research Plan development, implementation and resource allocation;
 - Amendments to the Hub organisational arrangements, Research Plan and associated allocation of resources that may constitute a variation to formal agreements between the Hub and Department of the Environment, and
 - Development and delivery of annual progress, financial, monitoring and evaluation and final reporting to: i) ensure compliance with agreed performance and associated quality standards, and ii) strategic alignment with agreed NESP priorities and expected outcomes.
 4. Identify and communicate high level issues and opportunities, including new and emerging research gaps and needs of target end-users, to facilitate linkages to broader research and government initiatives across government and other stakeholders.
 5. Provide a forum for members to share information relevant to core business of the Hub and the NESP more generally, including providing specific advice to the Hub in relation to communicating outcomes to external stakeholders within Government, industry and the general community.

Decisions made by the HSC will be by consensus.

Role of the Independent Chair

The independent chair will be appointed in agreement with the Department, and will work closely with Hub Leader to:

1. Preside over HSC meetings and ensure the HSC is well organised, functions effectively, and meets its obligations and responsibilities.
2. Act as a conduit between Hub leadership, the Steering Committee members and the Department as appropriate.
3. Ensure the Hub leadership is reporting well to the HSC and the functionality and responsibilities of the relationships between the two groups is well managed
4. Ensure all HSC members are meeting the roles and responsibilities as detailed in these Terms of Reference.

Terms of appointment

Appointments will be made by formal invitation from the Hub Leader. Members will be appointed for a term of three years. After this time they will be eligible for re-appointment. If a member wishes to resign his or her appointment, they must provide the Hub Leader and Chair with a written resignation. The appointment of a Steering Committee member may be terminated, on the advice from the Hub Leader to the Chair, if they fail to meet the HSC Terms of Reference or failure to attend three consecutive Steering Committee meetings.

Meeting Frequency

The HSC will meet quarterly during the term of the Hub; meetings will be scheduled 12 months in advance (from 2016). HSC meetings will be scheduled to align with the delivery of key milestones that require HSC approval due in April (Annual progress reports) and October (Research Plans) of each year.

Operational Matters

The HSC secretariat support will be provided by the Hub Management Team, who will be responsible for the preparation and circulation of agendas, minutes and actions arising, and of supporting documentation, papers and reports on behalf of the HSC.

A draft agenda and relevant background documentation will be circulated to all members for comment a minimum of ten working days prior to scheduled meetings.

All meetings will be minuted, with draft minutes and associated actions circulated to members for comment a maximum of ten working days after scheduled meetings, and final minutes circulated to members after a maximum of ten further days.

Remuneration

All HSC operating costs including out-of-pocket costs for HSC members will be covered by the Hub Leadership & Management component of the Hub budget.

The Hub reserves the right to provide a modest honorarium to the HSC Chair if needed, funded from the Hub budget.

Conflict of interest

Steering committee members must declare any conflicts of interest at the start of each meeting or before discussion of the relevant agenda item or topic. Details of any conflicts of interest should be appropriately minuted. Where members of the HSC are deemed to have a real or perceived conflict of interest, it may be appropriate that they are excused from Committee discussions and/or deliberations on the issue. The Chair will be responsible for assessing declared conflicts of interest and how these will be managed for the meeting and/or particular agenda items.