annual report

2006-07

Antarctic Climate & Ecosystems
COOPERATIVE RESEARCH CENTRE

Established and supported under the Australian Government's Cooperative Research Centre Programme

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table of contents

CRC AUSTRALIA

executive summary

The Antarctic Climate & Ecosystems Cooperative Research Centre (ACE CRC) was funded to lead Australian research on the roles of Antarctica and the Southern Ocean in the global climate system and climate change. We also have a brief to investigate likely impacts of climate change on Southern Ocean marine ecosystems and analyse diverse policy issues relevant to Australia's interests in the region. We deliver this agenda through communication, education and research delivery programs and five research programs: Antarctic Marine Ecosystems; Climate Variability & Change; Ocean Control of CO_2; Policy; and Sea-level Rise. The implications of our research extend from the management of marine living resources around Antarctica, to the consequences of changing sea level on our coasts and Pacific island nations, to the understanding of global climate change processes and their impacts.

The release of the Fourth Assessment Report (4AR) from the Intergovernmental Panel on Climate Change (IPCC) this year is a reflection of the impact of some of our work over the last four years. The ACE CRC and its partners provided multiple lead authors and contributing authors to the 4AR. The results reported in areas such as sea-level rise, ice sheet mass balance, ocean thermohaline circulation and the ocean role in global carbon sequestration, all reflect significant contributions from research by the ACE CRC. Research published by ACE CRC scientists and colleagues after the AR4 demonstrated that many climate change signals, such as temperature and sea-level rise, have been changing at the most severe rates previously projected, realising the worst case scenario previously considered feasible.

ACE CRC researchers, with funding from the Australian Greenhouse Office, this year provided the first field evidence linking changes in atmospheric CO_2 concentrations, with consequential changes to ocean chemistry (ocean acidification), and the potential ecological impacts in the Southern Ocean. Small marine plants that use CO_2 as raw material to build their shells are an important part of the marine ecosystem and also play a major role in drawing CO_2 from the atmosphere down into the ocean. It has been hypothesised that increasing acidification of the ocean will make if difficult for these plants to form their carbonate shells. ACE CRC researchers have compared shell weights from the geological past with those just prior to the industrial revolution and those from modern day plants, and have demonstrated a 38% reduction in shell weights since 1750, corresponding with increased atmospheric levels of CO_2 and ocean acidification. The geological samples demonstrate a similar relationship over previous periods when atmospheric CO_2 changed, but none as rapid as the recent impacts.

There have also been some exciting developments from our paleoclimate group working on signals of past climate captured in the Antarctic ice sheet. We have strengthened the previous evidence of signals in ice cores of winter sea ice cover around eastern Antarctica, allowing hind-casting of sea ice dynamics that will enable us to properly interpret recent events possibly related to climate change. Our researchers also have unfolded recent and distant history of southern hemisphere temperatures and demonstrated that ice core might provide signals of rainfall patterns over southern Australia. These results are important because they allow us to put recent events, such as the prolonged drying period in Australia, into the context of history and so infer whether such recent changes are simply part of climate variability, or more likely to be more chronic manifestations of climate change.

ACE CRC's Antarctic Marine Ecosystems Program collaborated with WWF Peregrine Adventures during 2006-07 to produce the first bioregionalisation of the entire Southern Ocean. This represents a significant step forward in developing ecosystem-based management of resources across the Southern Ocean, including within the Antarctic Treaty area. The bioregionalisation was the major product of an international workshop we convened, with WWF and Peregrine, in Hobart in September 2007.

The ACE CRC is a Round 8 CRC (2003-2010) and the third CRC with an Antarctic focus. Accordingly, during 2006-07 we so completed the Third Year Review required of all Round 8 CRCs. The review proved to be a useful opportunity to 'reality check' our own perceptions of progress against the assessment of an independent triumvirate drawn from the biomedical / biotechnology and insurance industries and international research community, and the review was an important catalyst in assessing our progress as we approached our mid-term. It was gratifying to receive confirmation from the Panel of the CRC's sound progress and an endorsement of the value of the work we are doing. There were just two recommendations from the review, which have resulted in enhancement of one our research programs (Policy) and strengthening of our focus on industry engagement through the appointment of a Deputy CEO (Business Development). Both changes provide us with greater capacity to deliver greater benefit in our remaining three years.

The ACE CRC is delivering its contracted milestones as expected, but is also delivering many additional outputs that are proving particularly relevant to the increasingly public concerns about climate change and its implications for us all.

executive summary

The Antarctic Climate & Ecosystems Cooperative Research Centre (ACE CRC) is a partnership dedicated to the study of atmospheric, cryospheric and oceanic processes of the Southern Ocean, their role in global and regional climate change, and their impact on sustainable management of Antarctic marine ecosystems.

Based in Hobart, Tasmania, the ACE CRC has five major research programs. This research, combined with an integrated research training and education program, provides a focus for Australia's national effort to understand the variability of Antarctica and Southern Ocean processes and their role in our national and global future.

The ACE CRC works closely with Australian and international stakeholders to ensure that the research focus remains relevant and the results are made accessible in useful forms. Knowledge gained from ACE CRC research is disseminated through dedicated communications and research delivery programs as well as by publication in the research literature.

Key Staff Appointments

The following cash funded appointments were made during the year:

Member	ACE CRC Position	ACE CRC Program
Kate Maloney[1]	Business Manager	Administration
Tessa Jakszewicz[2]	Deputy CEO Business Development	Commercialisation
Jan Lieser	Sea Ice Scientist	CVC
Terry O'Kane	Mathematical Oceanographer	CVC

[1] Commenced June 2007
[2] Appointed in year 2006-2007 commenced July 2007

Major Equipment Purchases

The following major equipment purchases were made during the year:

Equipment	ACE CRC Program
Radiometer ($27,996)	AME
Computer Server ($22,221)	Administration
Floats ($308,000)	CVC
Time series moorings ($100,000)	CO_2
Astrolab ($20,000)	CO_2

national research priorities

National research priority goals

Climate change, its impacts and the need for action has been emphasised this past year with the release of the Intergovernmental Panel on Climate Change Fourth Assessment Report (IPCC AR4) and the start of the International Polar Year (IPY). ACE CRC research has contributed greatly to both of these global initiatives.

In addition to the partner organisations and international scientific community, end-users of the ACE CRC's research in this field include decision-makers in various local, state and national government agencies, as well as educators and the general public.

We anticipate a continuing increase in demand for our research, especially about climate change impacts on sea-level rise and extreme events, to provide accurate predictions to support Australia's adaptation and mitigation strategies.

2006-07 research highlights

- Climate Variability and Change Program scientists played a major role in the recently released IPCC AR4. Nathan Bindoff and Ian Allison served as Coordinating Authors and numerous other staff wrote sections of the report and provided scientific results that are cited within the report.
- Researchers in the Ocean Control of Carbon Dioxide Program examined the influence of ocean acidification on calcification rates in calcareous marine organisms and provided the first field observations for reduced calcification in Southern Ocean carbonate plankton. The results indicate there has been a 38% reduction in calcification, consistent with the impact due to altered ocean chemistry resulting from increased dissolution of atmospheric carbon dioxide (CO_2) in the ocean.
- ACE CRC researchers led an international investigation into the controls on phytoplankton production and carbon cycling in the Subantarctic region south of Tasmania (SAZ-SENSE). Understanding why phytoplankton biomass is larger east than west of Tasmania is a step to evaluating whether the warmer higher biomass waters east of Tasmania may expand in concert with global warming.
- The Antarctic Marine Ecosystems Program, together with the World Wildlife Fund-Australia, hosted an Experts' Workshop on Bioregionalisation of the Southern Ocean. Information gathered from the workshop will be used to improve large-scale ecosystem modelling, ecosystem management and the development of an ecologically sound system of marine protected areas.
- The Sea-level Rise Program showed that sea level has been rising at the upper limit of the projections in the IPCC Third Assessment Report since 1990. They also produced a report for the Tasmanian government that provides statistical assessments of future sea level extremes at Hobart and Burnie, using projections from the Third Assessment Report.
- Members of the Policy and Sea-level Rise Programs conducted a strategic review of the Australian Agency for International Development (AusAID)/BoMET South Pacific Sea Level and Climate Monitoring Project: Phase IV. The project is to assemble an archive of sea level and climate related data to provide partner countries with information about sea level variability and change needed to manage their near-shore and coastal resources sustainably and to develop policies and strategies for responding to long-term trends in sea level.

Table 1: National Research Priorities and CRC Research

NATIONAL RESEARCH PRIORITIES	CRC RESEARCH (%)
AN ENVIRONMENTALLY SUSTAINABLE AUSTRALIA – *Transforming the way we use our land, water, mineral and energy resources through a better understanding of environmental systems and using new technologies*	
Sustainable use of Australia's biodiversity	30%
Responding to climate change and variability	70%

governance & management

The ACE CRC was successful in its bid as a new from existing CRC in the 2002 round of CRC funding, its predecessor being the Antarctic and Southern Ocean CRC. The ACE CRC began its seven-year life on July 1, 2003 and is an unincorporated joint venture. The University of Tasmania has been appointed as the ACE CRC agent, and contributes services for finance, human resources and asset management.

Core Partners	Supporting Partners
Australian Antarctic Division (AAD)	Alfred Wegener Institute (AWI, Germany)
Australian Bureau of Meteorology (BoM)	Australian Greenhouse Office (AGO)
CSIRO Division of Marine and Atmospheric Research (CMAR)	The Australian National University (ANU)
University of Tasmania (UTAS)	National Institute of Water and Atmospheric Research (NIWA, New Zealand)
	Silicon Graphics International (SGI)
	Tasmanian Department of Economic Development (DED)

Governing Board

The ACE CRC Governing Board has an independent Chair and members from the core partners and key research users. The Australian Antarctic Division holds an additional *ex-officio* seat in recognition of the magnitude of its contributions. The Board meets quarterly and considers ACE CRC matters out of session as required.

Key Skills of Board Members

Dr Katherine Woodthorpe is a management adviser and professional director. She specialises in innovation and commercialisation issues. Her varied background is in science, technology, HR, commercialisation and government interaction. Her areas of expertise include developing strategies for rapid growth, commercialisation of technology products and services, venture capital and private equity. She has extensive and varied expertise in the Cooperative Research Centre program.

Dr Tony Press has been Director of the Australian Antarctic Division since November 1998. Key achievements in that position have included implementing the Government's goals for Australia's Antarctic programme, taking a lead role in developing measures to combat illegal fishing in the Southern Ocean and introducing a new era of air transport in Antarctica. Dr Press has been a Board member of the ACE CRC since its inception, a member and former Chair of the Board of its predecessor, the Antarctic and Southern Ocean CRC, and was a founding Board Member of the CRC for the Sustainable Use of Tropical Savannas.

Professor Allan Canty has been a staff member at the University of Tasmania since 1974 including Head of School of Chemistry (1993-2005), Acting Pro Vice-Chancellor (Research) (1998, and 2006-07), and Acting Dean of the Faculty of Science, Engineering and Technology (1999-2000). He is a member of the ARC College of Experts (2005-2007) responsible for peer-review allocation of research grants by the ARC. His research encompasses a broad spectrum of inorganic and organometallic chemistry.

Dr Bill Downey joined the Bureau of Meteorology as a Cadet Meteorologist in 1959. From 1989 to 2000 he was the Assistant Director (Executive and International Affairs). In 2001, he was appointed to the position of Deputy Director (Research & Systems) and was responsible for the overall planning and coordination of research and systems activities throughout the Bureau. In 2003, he transferred to his present position of Deputy Director (Corporate Activities) where he is responsible for coordinating the Bureau's corporate planning and management functions and its International Activities Program.

Dr Greg Ayers is Chief of CSIRO's Division of Marine and Atmospheric Research, having previously served as Chief of Atmospheric Research. He has pursued broad scientific interests ranging across a range of topics in marine and atmospheric biogeochemistry. He currently serves on the editorial boards of four international scientific journals.

Mr Greg Johannes is the Deputy Secretary of the Tasmanian Department of Economic Development. His major responsibilities include innovation, science and technology. His background is in industry policy, environmental management and public affairs, and he has held senior positions in industry, Commonwealth and state government. His areas of expertise include commercialisation of public sector R&D, small business development, biotechnology and innovation.

Mr Bill Trestrail was recently appointed Vice President of Silicon Graphics International (Asia Pacific). As such he is responsible for all operations of SGI in this region. Previously, he joined SGI in 1995 as ACT State Manager and since then has held various positions including, National Defence Business Unit Manager and National Sales Manager - Corporate & Government. Prior to joining SGI, he held a number of sales and management roles with Seer Technologies, Informix Software and Australian Consolidated Technologies in Canberra, Sydney and Brisbane.

Mr Howard Bamsey is a Deputy Secretary in the Department of the Environment and Water Resources and head of the Australian Greenhouse Office. In 2006, he was appointed as co-chair to the United Nations 'Dialogue on Long-term Cooperative Action on Climate Change'. He spent over twenty years in the Australian foreign service and served in the United Nations centres of New York, Geneva and Vienna as well as other capitals. His positions included Ambassador to the United Nations in Geneva and Ambassador for the Environment.

Board Meetings 2006-07: 30 August 2006, 30 November 2006; 5 June 2007

Table 2: Specified Personnel

2.1 CEO and governing board members

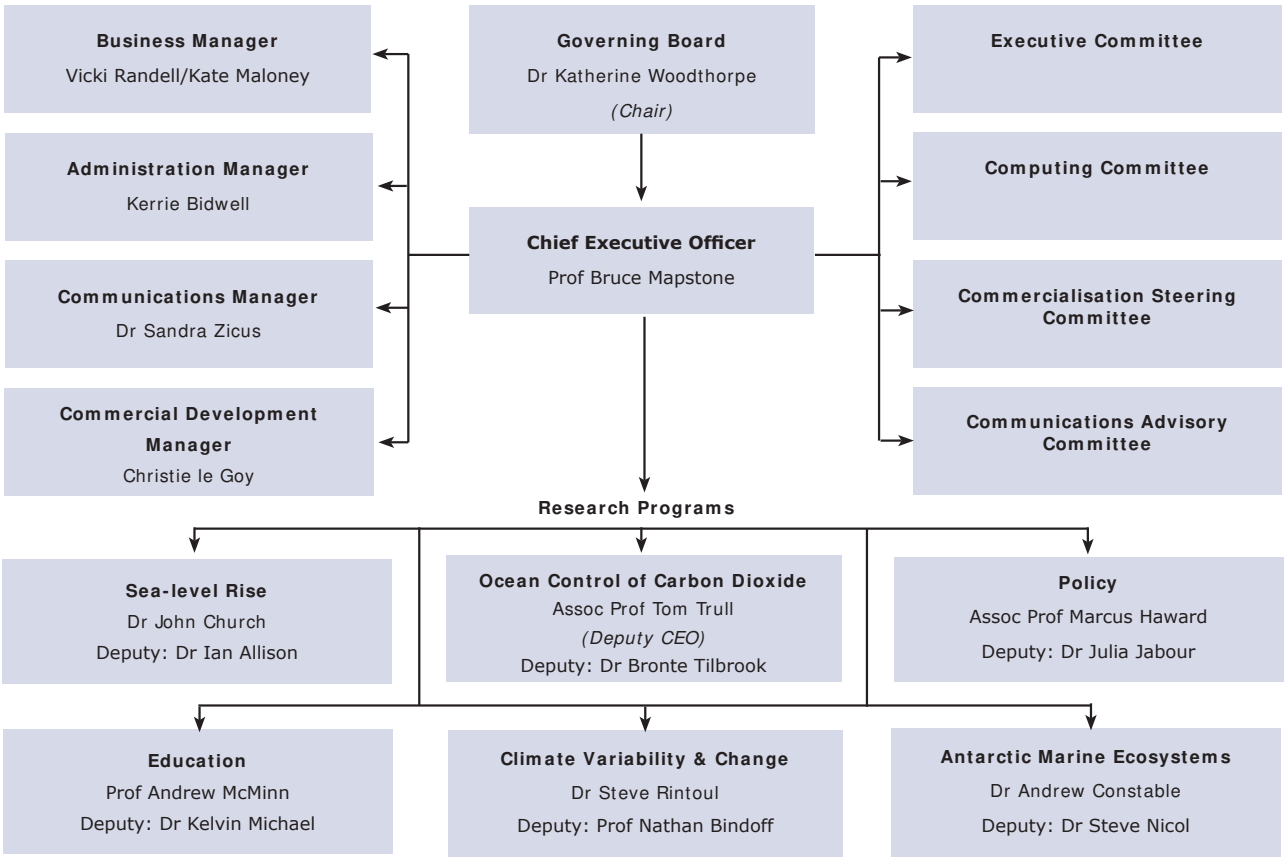
Board Member	Organisation	Position / Role
Dr Katherine Woodthorpe, *Chair*	People & Innovation Corporate Advisers	Director
Dr Tony Press	AAD	Director
Prof Allan Canty	UTAS	Pro Vice-Chancellor (Research)
Dr Bill Downey	BoM	Deputy Director Corporate Activities
Dr Greg Ayers	CSIRO	Director Science & Policy (Chief-on-secondment CMAR)
Mr Greg Johannes	DED	Deputy Secretary
Mr Bill Trestrail	SGI	Vice President, Asia Pacific
Mr Howard Bamsey	AGO	Deputy Secretary, Department of the Environment and Water Resources
Prof Michael Stoddart, *ex-officio*	AAD	Chief Scientist
Prof Bruce Mapstone, *ex-officio*	ACE CRC	Chief Executive Officer

2.2 Program leaders and deputy leaders

Program leader	Organisation	Position
Dr Steve Rintoul	CMAR	Leader: Climate Variability & Change
Prof Nathan Bindoff	CMAR/UTAS	Deputy Leader: Climate Variability & Change
Dr Andrew Constable	AAD	Leader: Antarctic Marine Ecosystems
Dr Steve Nicol	AAD	Deputy Leader: Antarctic Marine Ecosystems
Assoc Prof Tom Trull	CMAR/UTAS	Leader: Ocean Control of Carbon Dioxide
Dr Bronte Tilbrook	CMAR	Deputy Leader: Ocean Control of Carbon Dioxide
Dr John Church	CMAR	Leader: Sea-level Rise
Dr Ian Allison	AAD	Deputy Leader: Sea-level Rise
Assoc Prof Marcus Haward	UTAS	Leader: Policy
Dr Julia Jabour	UTAS	Deputy Leader: Policy
Prof Andrew McMinn	UTAS	Leader: Education – Looking South Together
Dr Kelvin Michael	UTAS	Deputy Leader: Education – Looking South Together

governance & management

Organisational Structure



The Governing Board has approved the following management committees:

Executive Committee

The ACE CRC Executive Committee advises the CEO and Board on a range of matters relating to management of resources and coordination of research across the ACE CRC portfolio. It comprises all Program Leaders, selected deputies and ACE CRC administration, together with representatives from the Tasmanian Partnership of Advanced Computing (TPAC), the BoM and research student body.

Member	ACE CRC Position
Prof Bruce Mapstone, Chair ACE CRC	Chief Executive Officer
Dr Ian Allison AAD	SLR Program Deputy Leader
Dr John Church CMAR	SLR Program Leader
Assoc Prof Marcus Haward UTAS	Policy Program Leader
Ms Christie le Goy ACE CRC	Manager, Research Delivery and Commercial Development
Prof Andrew McMinn UTAS	Education Program Leader
Dr Kelvin Michael UTAS	Education Program Deputy Leader
Dr Sandra Zicus ACE CRC	Communications Manager
Dr Andrew Constable AAD	AME Program Leader
Ms Jane Broweleit UTAS	PhD student
Ms Vicki Randell ACE CRC	Business Manager
Dr Stephen Rintoul CMAR	CVC Program Leader
Dr Jason Roberts TPAC	Chair Computing Committee
Assoc Prof Thomas Trull CMAR/UTAS	CO_2 Program Leader/Deputy CEO
Ms Kerrie Bidwell, Secretary ACE CRC	Administration Manager

Executive Committee Meetings 2006-07: 3 August 2006, 16 November 2006; 22 February 2007, 24 May 2007

Computing Committee

The ACE CRC Computing Committee supports the science, education and policy programs of the ACE CRC through advice on Information Technology infrastructure and management. This support is focused primarily on those components of the ACE CRC based at the University of Tasmania's Hobart Campus. The ACE CRC Computing Committee advises the ACE CRC Executive Committee and CEO.

Member	Position
Dr Jason Roberts TPAC (Chair)	Researcher
Prof Bruce Mapstone ACE CRC	Chief Executive Officer
Assoc Prof Marcus Haward UTAS	Leader Policy Program
Dr Kelvin Michael UTAS	Deputy Leader Education Program
Mr Glenn Hyland AAD	Researcher
Dr Simon Marsland	Researcher (resigned April 2007)
Dr Richard Matear CMAR	Researcher
Dr Benedicte Pasquer ACE CRC	Researcher
Dr Roland Warner AAD	Researcher
Dr Steven Phipps TPAC	Researcher (resigned January 2007)
Dr Jan Leiser ACE CRC	Researcher (appointed April 2007)
Mr Michael Sumner UTAS	PhD student
Mr John Dalton UTAS	Information Technology Resources
Mr Nick Grundy UTAS (*ex-officio*)	Information Technology Resources
Mr Ben Joseph ACE CRC	Computer Support Officer
Ms Vicki Randell ACE CRC	Business Manager
Ms Kerrie Bidwell ACE CRC (Secretary)	Administration Manager

Computing Committee Meeting 2006-07: 30 April 2007

Commercialisation Steering Committee

The ACE CRC Commercialisation Steering Committee provides advice on commercialisation opportunities arising from ACE CRC activities. The ACE CRC Commercialisation Steering Committee advises the CEO, Executive Committee and Board of the ACE CRC.

Member	Position
Prof Bruce Mapstone ACE CRC (Chair)	Chief Executive Officer
Mr Rod Allen AAD	General Manager, Corporate
Dr Steve Pendlebury BoM	Regional Director, Tasmania
Ms Jackie Zanetti CMAR	Business Development Manager
Ms Christie le Goy ACE CRC	Commercial Development Manager
Ms Wendy Spencer DED	Director – Innovation, Science & Technology Unit
Ms Laura Denholm	Manager, Office of Research Services

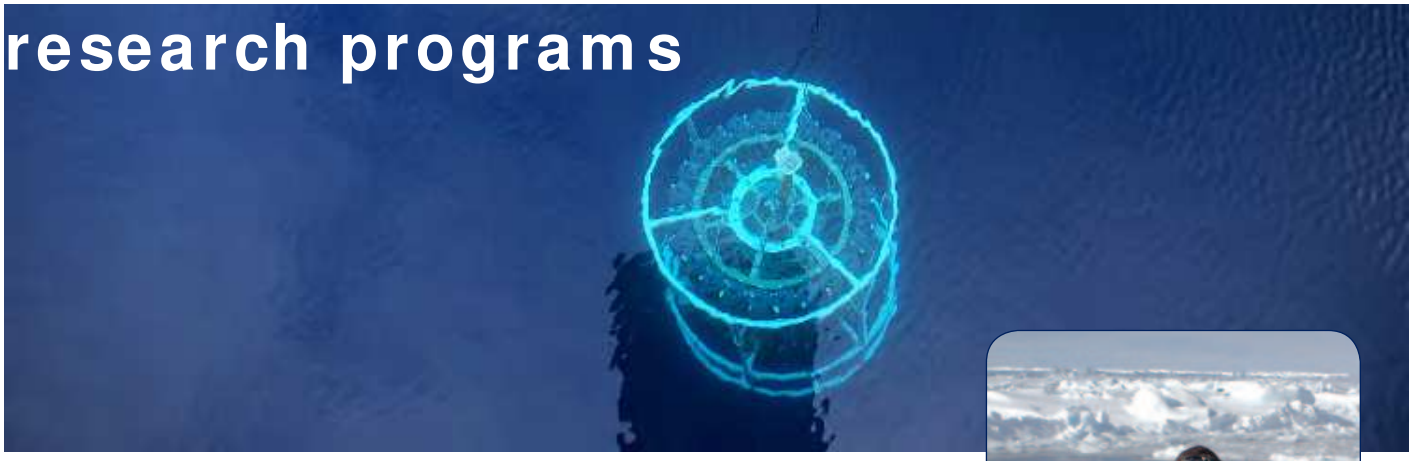
Commercialisation Steeering Committee Meetings 2006-07

Throughout the year the committee members maintained contact via a number of out-of-session communications.

Communications Coordinating Committee

The ACE CRC Communication Coordinating Committee is a network of communicators within the ACE CRC and its partner organisations. It was formed to support the implementation of the ACE CRC through the coordination of public communication and reporting strategies. Informal gatherings of a number of the Partner communications staff were held throughout the year as opportunities arose.

research programs



ACE CRC research is organised around five interconnected programs:

Climate Variability & Change (CVC)

Improving our ability to predict the impact of Southern Ocean processes on climate, sea-level, marine ecosystems and the marine carbon cycle.

Ocean Control of Carbon Dioxide (CO_2)

Determining carbon dioxide uptake and its effects on the ocean, and relating ocean processing of carbon dioxide to predictions of human-induced global change.

Antarctic Marine Ecosystems (AME)

Exploring relationships among the biological patterns and processes of the marine ecosystems around East Antarctica and relating them to physical oceanographic processes to assist in development of sustainable management strategies.

Sea-level Rise (SLR)

Improving our ability to project and respond to future changes in sea-level by increasing our understanding of historical sea-level change and factors that contributed to it.

Policy (POL)

Providing analyses of possible policy implications arising from the science research programs and addressing issues that will help Australia formulate its input to Antarctic and Southern Ocean affairs and manage its interests in the region.

climate variability & change

Program Leader

Dr Steve Rintoul

CSIRO Marine & Atmospheric Research

Variability of the physical environment of the Southern Ocean influences regional and global climate, the distribution and productivity of marine organisms, the ocean uptake and storage of carbon dioxide, and the rate and pattern of sea-level rise. Understanding the variability of the coupled ocean-atmosphere-ice system is therefore a prerequisite for all of the ACE CRC research programs.

More reliable projections of climate variability and change and their impacts will allow Australia to plan for the future and minimise the risks of a variable and evolving climate. Specific applications of CVC Program research will include improved predictions of the status of Southern Ocean ecosystems, improved marine resource management, marine impact studies, public good services such as search and rescue, guidance for safe Antarctic shipping operations, and research into global ocean and climate dynamics.

Program Objectives

- ***To characterise the variability of Southern Ocean currents, sea ice and climate and to understand their causes.*** Our present understanding of Southern Ocean variability is limited, primarily due to the lack of observations. New tools (including autonomous floats, highly accurate satellites and improved numerical models) and measurements collected over the last decade make it now possible to investigate the variability of the Australian sector of the Southern Ocean.
- ***To determine the likelihood and impact of significant changes in the Southern Ocean physical environment.*** Changes such as a slow-down in the Southern Ocean overturning circulation, a decrease in sea ice extent, or an alteration in circulation patterns in the atmosphere and ocean would have substantial impacts on Antarctic ecosystems and Australian and global climate. We need to determine the risk of such changes in order to develop robust management strategies for Southern Ocean resources and to guide planning for the impacts of future changes in climate.
- ***To combine state-of-the-art ocean observations and numerical models to provide simulations and forecasts of ocean currents and sea ice for Southern Ocean applications.*** Knowledge of ocean variability can also provide opportunities for prediction and is required to assess the skill of model simulations and to combine models and data in sensible ways.

Projects

CVC-01: Variability of Southern Ocean currents and air-sea interaction

Project leader

Steve Rintoul, CSIRO

Project Aim: *To characterise and understand the variability of the Southern Ocean and to use this knowledge to test and improve climate models.*

Research outcomes include advances in understanding Southern Ocean dynamics, improved projections of climate variability and change from models that better represent Southern Ocean processes, an enhanced ability to manage and assess the status of marine ecosystems, and ocean circulation estimates for use in operations such as search and rescue and transport.

climate variability & change

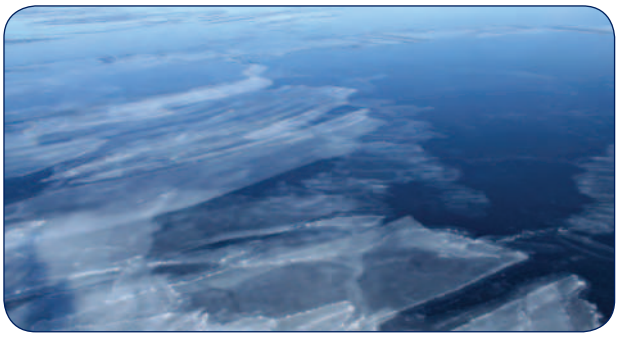
CVC-02: Ocean-atmosphere-cryosphere interactions at the Antarctic margin

Project leader

Anthony Worby, AAD

Project Aim: *To characterise and understand the variability of Southern Ocean sea ice and the interaction between the ocean, atmosphere and cryosphere at the Antarctic margin.*

Sea ice is critically important in both the physical and biological processes of the Southern Ocean, affecting many other processes that are essential to driving and maintaining the global climate system. Our research enables more reliable predictions of variability and change in the sea ice zone and of the effects of such variability on climate and ecosystems.



CVC-03: Climate history project

Project leader

Tas van Ommen, AAD

Project Aim: *To provide records of past climate from ice cores and ocean sediment cores that will help improve understanding of underlying climate mechanisms and factors that drive climate and natural climate variability.*

Our research is providing new data-sets and interpretations that put current climate conditions in the context of long-term patterns in past climate. These provide improved capability for detection and attribution of contemporary climate change, better understanding of uncertainties in climate assessment and greater capacity for verification of climate models.

CVC-04: Simulation of ice-ocean-atmosphere interaction and climate

Project leader

Nathan Bindoff, UTAS/CSIRO

Project Aim: *To develop a better understanding of seasonal and decadal variations and long-term trends in Southern Ocean water masses.*

We are testing numerical simulations of the Southern Ocean and its components and validating them against observational data from the other ACE CRC research programs. This allows us to diagnose the important processes acting in the Southern Ocean that both influence and respond to global and regional climate. The enhanced climate models resulting from this research deliver more reliable projections of climate variability and change and their impacts.

Key achievements 2006-07

- Made a significant contribution to the recently released IPCC Fourth Assessment Report. The IPCC Assessments are the primary way in which scientific results influence government and industry strategies for dealing with climate change. Nathan Bindoff and Ian Allison served as Coordinating Authors and numerous other staff wrote sections of the report and provided scientific results that are cited within the report.
- Discovered that the Antarctic Circumpolar Current (ACC), the largest current in the world ocean, is made up of multiple narrow jets. The study helps to reconcile previous conflicting views of the current from theory and sparse ship-based observation. *(CVC-01)*
- Carried out major oceanographic expeditions south of Tasmania to study controls on ocean uptake of carbon dioxide (a joint project with the CO_2 Program) and along the Macquarie Ridge. (joint project with New Zealand partner NIWA)
- Demonstrated through analysis of ocean data that precipitation has decreased in low latitudes and increased in high latitudes in recent decades, in line with projections of climate change caused by the increase in greenhouse gas concentrations. *(CVC-01)*
- Provided new insights into the physical processes controlling the distribution, structure and variability of sea ice. Analysis of 25 years of observations collected from ships has provided the first circumpolar maps of sea ice thickness, a key parameter determining the climate response of the high latitude atmosphere-ocean-ice system. (*CVC-02)*
- Used climate proxies recorded in ice cores to provide important new information on past climate changes. A two-century long record of Antarctic temperatures showed warming in phase with the Southern Hemisphere mean temperature, but with a strong influence of the Southern Annular Mode. Additional analyses of methanesulphonic acid (MSA) in ice cores has strengthened confidence in the use of MSA as a sea ice extent proxy. In a collaboration with France, methane measurements were used to study the global signature of the rapid climate event that occurred 8200 years ago. Beryllium-10, commonly used as a proxy for solar activity, was shown to be affected by climate variations as well, information crucial for interpretation of this important proxy. *(CVC-03)*
- Used IPCC class models to show global scale patterns of water mass change broadly consistent with the observations. We also made new estimates of changes in subduction rates and the underlying processes driving these changes in models in the Southern Ocean. *(CVC-04)*

Plans for 2007-08

This summer, the first Antarctic field season of the International Polar Year, will be a busy one for CVC scientists. A multi-disciplinary winter sea ice research program will take place in September-October 2007. The program will focus on understanding the relationships between the physical sea ice environment and Southern Ocean ecosystems. The study will include buoy deployments to study stress and deformation, helicopter-based laser altimeter measurements of sea ice thickness which will be used to validate NASA's ICESat instrument, and the first flights of a snow radar system over Antarctic ice.

A second multi-disciplinary voyage, targeting goals of the CVC, CO_2 and AME Programs, will be carried out in December-January as a joint project of the CASO and CAML IPY projects. We will repeat a long transect between Tasmania and Antarctica to measure changes in the transport and water masses of the Antarctic Circumpolar Current, the storage of CO_2 by the ocean and the distribution of plankton. The CAML part of the voyage will sample biodiversity over the Antarctic continental shelf; simultaneous physical measurements will allow the distribution of organisms to be related to physical forcing.

ocean control of carbon dioxide

The ocean currently absorbs about one-third of the carbon dioxide (CO_2) emitted by human activities. Determining to what degree uptake of CO_2 by the ocean can help keep atmospheric levels of CO_2 low is essential for predicting future atmospheric concentrations of greenhouse gases.

Accumulation of CO_2 in the ocean makes the water more acidic, reducing the shell-forming ability of certain marine organisms such as corals, molluscs and many phytoplankton. This may alter the mix of species that do well in Southern Ocean ecosystems and have a major impact on marine ecosystems.

Understanding these complex processes is a key focus of the ACE CRC CO_2 Program. Our research results are useful both in international assessment processes, such as the IPCC, and for Australian agencies addressing emissions management and policy.

Program Leader

Assoc Prof Tom Trull

University of Tasmania and CSIRO Marine & Atmospheric Research

Program Objectives

- ***To determine the current magnitude of uptake of anthropogenic atmospheric CO_2 by the Southern Ocean south of Australia.*** This work contributes to an assessment of global ocean uptake and helps quantify relationships among ocean circulation and CO_2 uptake.
- ***To determine the role of upper ocean dynamics in the control of phytoplankton production and biological carbon export to the deep ocean.*** Understanding how this natural sequestration process works is important for discerning human impacts on the Earth's climate.
- ***To determine the influence of iron availability on Southern Ocean plankton community structure and the associated ecosystem control of carbon transfer to the deep ocean.*** Research is determining the availability of iron and other micronutrients needed for plankton growth through extensive surveys and process studies of ecosystem responses. This helps us assess the benefits and risks of proposals to increase biological sequestration of carbon through controlled iron fertilisation.
- ***To determine the impact of increasing CO_2 concentrations on phytoplankton and on the relative growth rates of different classes of Southern Ocean phytoplankton.*** Laboratory experiments and field studies are determining how phytoplankton communities and associated ecosystems respond to increased concentrations of CO_2. The results will be incorporated into computer models to assess the impacts on marine ecosystems in the Southern Ocean.
- ***To develop simulations of future scenarios of global and regional ocean carbon cycle dynamics.*** These assessments assist Australian and other governments in devising effective short- and long-term mitigation and adaptation strategies to future climate change.

Projects

CO2-01: Carbon uptake in the Southern Ocean

Project leader

Bronte Tilbrook, CSIRO

Project Aim: *To describe the variability and large-scale biological and physical drivers of the air-sea exchange of CO_2 in the Southern Ocean south of Australia.*

This work helps define the role of the Southern Ocean in controlling atmospheric CO_2 concentrations, and allow more robust predictions of how the Southern Ocean uptake may be altered in future. It also contributes to a major new initiative to determine regional- and global-scale carbon budgets to develop useful strategies to manage future CO_2 emissions.

CO2-02: Carbon export processes

Project leader

Tom Trull, UTAS/CSIRO

Project Aim: *To estimate rates of photosynthetic production and subsequent transfer of particulate carbon between the ocean surface and the deep sea, identify the major processes that control these rates, and develop conceptual models of the sensitivity of these processes to climate variability and change.*

The overall outcome is a clearer view of the role of the 'biological pump' (the transfer of carbon to the deep sea in particulate form) in the Southern Ocean in regulating atmospheric CO_2. This is a necessary step towards the development and verification of reliable carbon cycle models for the simulation of future atmospheric CO_2 levels. Understanding of the modern biological pump also helps interpret past changes in the Southern Ocean environment and estimate future changes.

CO2-03: Iron biogeochemistry

Project leader

Andrew Bowie, ACE CRC

Project Aim: *To evaluate the importance of iron and other trace micronutrient elements in driving Southern Ocean biogeochemical cycles.*

We are mapping the distribution of dissolved iron in waters south of Australia, fingerprinting supply and removal mechanisms, and quantifying trace element limitation of phytoplankton growth and community structure in subantarctic ecosystems. This project feeds vital information into biogeochemical and ecosystem models of the region, allowing a prediction of the role of Southern Ocean biology in past and future regulation of atmospheric CO_2 through ecosystem control of carbon transfer to the deep ocean. The research helps assess the risk and efficacy of proposals to increase carbon sequestration through intentional iron fertilisation of the Southern Ocean.

CO2-04: Effect of elevated CO_2 on phytoplankton

Project leader

Simon Wright, AAD

Project Aim: *To describe how Southern Ocean phytoplankton and microbial communities will change as atmospheric CO_2 concentrations increase.*

We are studying the likely changes in phytoplankton species and size distribution, in rates of uptake of CO_2 through photosynthesis, and the extent to which CO_2 is recycled through the microbial loop or sedimented to the deep ocean. The results are important for developing ecosystem models that allow assessment of impacts of climate change on Antarctic marine ecosystems and provide advice for ecosystem based management of Southern Ocean fisheries, particularly those regulated through CCAMLR.

CO2-05: Biogeochemical simulations

Project leader

Richard Matear – CSIRO

Project Aim: *To quantify the Southern Ocean uptake of atmospheric CO_2 and explore potential feedbacks of projected global warming on this uptake through the development and application of ocean carbon models.*

The results of this research enable prediction of the role the Southern Ocean will play in absorbing and storing anthropogenic CO_2 in the future and, therefore, how future atmospheric CO_2 levels will evolve.

ocean control of carbon dioxide

Key achievements 2006-07

- Led an international investigation into the controls on phytoplankton production and carbon cycling in the subantarctic region south of Tasmania (SAZ-SENSE). Understanding why phytoplankton biomass, as seen in satellite ocean colour images, is larger east than west of Tasmania is a step to evaluating whether the warmer higher biomass waters east of Tasmania may expand in concert with global warming. Possible responses of the microbial ecosystem to another coming change – acidification from the uptake of anthropogenic CO_2 – were also examined via sample collection and shipboard experiments. Preliminary results suggest that iron supply to fuel phytoplankton production is stronger east than west of Tasmania. *(all projects)*.
- Provided evidence that intensification of westerly winds affects CO_2 uptake, suggesting ocean uptake of atmospheric CO_2 will decline if intense westerly winds become more common in the future, as predicted by climate models. Additional evidence suggests that atmospheric dust inputs cause high CO_2 drawdown and affect primary production. *(CO2-01, CO2-05)*
- Showed that carbon sequestration is tenfold more efficient in Southern Ocean waters under the influence of natural iron fertilisation on the Kerguelen plateau than in open-ocean blooms resulting from artificial iron addition. This result sheds new light on the effect of long-term palaeoclimatic fertilisation by iron and macronutrients on atmospheric CO_2 concentrations. *(CO2-03, CO2-02)*
- Helped produce new international standard materials for measuring dissolved iron in seawater and, in concert with ACE CRC partner organisation NIWA, developed a novel autonomous trace metal rosette sampling system and deployed it in the Southern Ocean for the first time, enabling a ten-fold improvement in sampling. *(CO2-03)*
- Showed that ocean acidification from the uptake of anthropogenic CO_2 leads to decreased shell weights in an important class of Southern Ocean zooplankton. This work is one of the first studies to demonstrate a marine impact of elevated CO_2 in a natural system, as opposed to culture studies. *(CO2-04, CO2-02)*
- Conducted experiments to evaluate the effects of elevated CO_2 and ocean acidification on microbial communities (phytoplankton, protozoa, bacteria, and viruses) and microbial processes (rates of production, respiration, grazing, viral infection, CO_2 uptake, oxygen evolution, and calcification). Species identified as 'losers' or 'winners' under conditions of high acidity/CO_2 can then be cultured to determine the physiological basis of sensitivity or tolerance. *(CO2-04)*
- Modelled the interaction between climate warming and ocean acidification. Results suggest that warming will moderate the pH decrease driven by anthropogenic CO_2 uptake, but will not reduce the impact of acidification on the saturation state of aragonite. Precipitation of this calcium carbonate mineral will become more difficult in a warmer, more acid, ocean. *(CO2-05)*

Plans for 2007-08

Field work will again represent a major effort for the CO_2 Program, including studies to examine the availability of micro-nutrients that fuel the biological carbon pump in sea ice and open waters (onboard *Aurora Australis* voyages 1 and 3); measurements to determine the distribution of ocean uptake of CO_2 from these and other *Aurora* and *Astrolabe* voyages; and deployment of the PULSE biogeochemical mooring to obtain a full seasonal view of carbon cycling in the Sub-Antarctic Zone as part of the Integrated Marine Observing System Southern Ocean Time Series program.

Analysis, synthesis, and publication of results from the SAZ-SENSE voyage will be a major focus for the program, including plans for a special volume of *Deep-Sea Research* dedicated to marine biogeochemical and ecosystem research south of Australia.

antarctic marine ecosystems

Program Leader

Dr Andrew Constable

Australian Antarctic Division

Program Objectives

- ***To identify how biological productivity is affected by sea ice extent and properties, and by ocean circulation.*** Productivity in the Southern Ocean has been linked to the winter sea ice cover and to large-scale ocean circulation patterns, both of which are sensitive to climate change. We are using a variety of new and historical data to test the hypothesis that reduced sea ice extent due to climate warming or other factors will lead to a smaller sea ice algal community and to explore what impacts such changes would have further up the food chain.
- ***To quantify and describe processes that link sea ice, and primary and secondary productivity.*** Our research is resulting in models of the small-scale processes linking the physical and biological components of the Antarctic marine ecosystem. The models are used as the basis for predicting the impacts of physical or biological changes on the overall function of the ecosystem.
- ***To project the effects of long-term change on Antarctic ecosystems.*** We are using remote sensing of ocean colour and water movements, as well as field-based oceanographic and biological measurements, to improve our abilities to accurately model the effects of ocean circulation and sea ice on biological productivity.
- ***To translate predictions of the effects of climate change on Southern Ocean ecosystems into sustainable management models.*** A combination of field data and models are being used to predict the effects of ecosystem changes on harvested species and the food web. This work is being used in combination with credible models of fishery dynamics to promote more effective management of marine living resources.

Many of the vertebrate species (eg, whales, seals and penguins) of the Antarctic region are of high conservation value and depend primarily on Antarctic krill for food. The current inability to predict the effects of environmental changes on their populations makes it difficult for organisations such as the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) and the International Whaling Commission (IWC) to establish sound long-term management strategies.

The krill fishery is projected to expand into one of the world's largest fisheries, yet the effects of climate change on krill stocks, and on the species dependent on krill (seabirds, penguins, seals and whales), are unknown. We are examining the predicted environmental changes and their implications for sustainable management of Southern Ocean fisheries and the marine life protected through CCAMLR.

Projects

AME-01: Prediction of ecosystem variability and change for sustainable management

Project leader

Andrew Constable, AAD

Project Aim: *To develop a framework for marine ecosystem modelling, including a coupled biophysical model of the Southern Ocean.*

This framework is developed to explore and assess the consequences of historical exploitation of biota in the Southern Ocean, the ecological sustainability of exploitation and conservation strategies in the Southern Ocean, and the impacts of climate change on the ecology of the Southern Ocean. A key outcome is flexible software that can be used by researchers to simulate the Southern Ocean ecosystem at any scale.

AME-02: Processes linking physical and biological elements in the sea ice zone

Project leader

Klaus Meiners, ACE CRC

Project Aim: *To identify and quantify the relative importance of processes that link physical and biological elements of Antarctic marine ecosystems in the sea ice zone.*

We are evaluating the effect of sea ice on the productivity of these ecosystems. We are providing information for the development and validation of an ecosystem modelling framework to enable assessments of the impact of historical and potential future changes on Antarctic marine ecosystems. Our work improves the science-based development of sustainable management and conservation plans by CCAMLR and the IWC.

AME-03: Large-scale biological patterns and oceanographic processes

Project leader

Steve Nicol, AAD

Project Aim: *To describe the large-scale relationships between the biological patterns and oceanographic processes of the marine ecosystem of the Southern Ocean around East Antarctica and to use this knowledge to assess the impact of climate change.*

This research helps guide Australian government and industry decision-makers in the formulation of policy and management strategies in response to future climate change.

Key achievements 2006-07

- Conducted Experts' Workshop on Bioregionalisation of the Southern Ocean.
- Developed a model to simulate algal production in sea ice. *(AME-01)*
- Continued the development of a high-resolution physical dispersion model and a model of primary productivity for the Heard and McDonald Islands region. *(AME-01)*
- Approval of AAS grant #2767 'An integrated study of processes linking sea ice and biological ecosystem elements off East Antarctica during winter.' *(AME-02)*
- Completed successful testing of hyperspectral sensors to determine ice-algae biomass from beneath sea ice during Winter Weddell Outflow Study with RV *Polarstern*. *(AME-02)*
- Integrated a hyperspectral sensor onto a remotely operated vehicle (ROV) *(AME-02)*
- Analysed and wrote up information about the BROKE-West voyage and held a workshop to integrate multidisciplinary outputs from the voyage. *(AME-03)*
- Secured agreement for a special volume of *Deep-Sea Research* to be published in 2008. *(AME-03)*

Plans for 2007-08

A multi-disciplinary sea ice voyage, jointly organised by the ACE CRC and the AAD, will sail from Hobart in September 2007. The focus of this 'Sea Ice Physics and Ecosystems Experiment' (SIPEX) will be to understand the links between sea ice physics, sea ice biology and the pelagic food web. SIPEX is one of eight Australian-led projects contributing to the International Polar Year.

An international team consisting of scientists from eight nations will use a suite of cutting-edge technologies to study processes on the ice surface, as well as within and under the ice. The study will take place in the region east of Australia's Casey station (110-130ºE) during early spring, when longer daylight hours and melting snow and sea ice result in a rapid increase in biological activity.

The AME team will send an instrumented ROV with optical sensors under the sea ice to measure the amount of algae within the sea ice. A specially designed trawl net will be used to sample the environment directly under the ice and to examine the size and abundance of krill in that environment. It will also provide live krill that can be used for physiological and growth experiments in the ship's laboratories.

sea-level rise

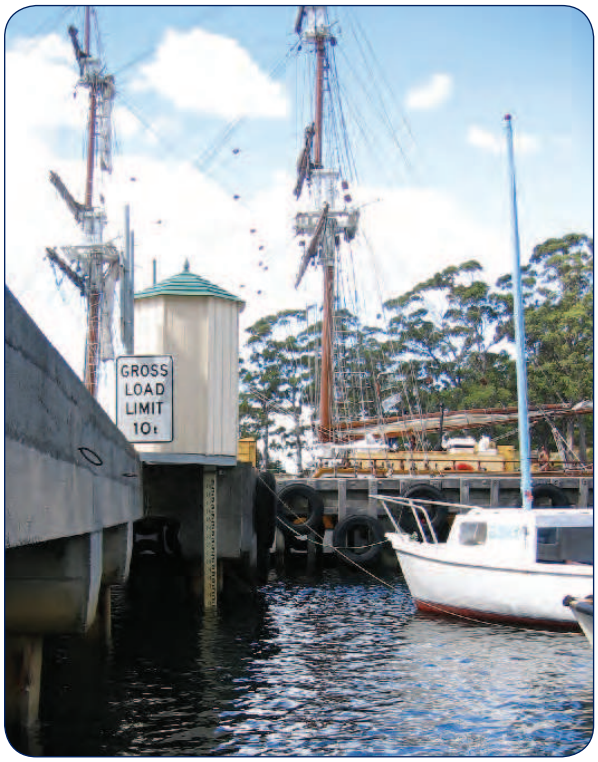
Program Leader

Dr John Church

CSIRO Marine & Atmospheric Research

The Sea-level Rise Program is reducing uncertainties related to estimates of 20th century sea-level rise and projections for the 21st century and beyond.

More reliable projections of sea-level rise and estimates of potential changes in sea-level variability (particularly related to extreme events, such as severe storms and tidal surges) allow better planning of coastal land use and development of infrastructure to minimise the impacts of sea-level rise and any changes in the intensity/frequency of extreme events. The results contribute directly to the IPCC Assessment Reports. Decreased uncertainties are also important in successful intergovernmental negotiations under the United Nations Framework Convention on Climate Change.



Program Objectives

- ***To narrow estimates of the range of 20th century global-averaged and regional sea-level rise***. We are enhancing our knowledge of sea-level rise over the past century through analyses of historical and new data. This improves tests of models that project future sea levels and increases our confidence in the projections.
- ***To improve estimates of the different contributions to 20th century sea-level rise.*** We are using *in situ* and satellite observations and measurements, combined with computer modelling, to improve understanding of how different processes interacted to affect sea-level rise and its regional distribution during the 20th century. This reduces uncertainties in future projections, especially at regional and local scales.
- ***To significantly reduce the range of 21st century projections of sea-level rise.*** Our research results are increasing the precision of projections for global average and regional sea levels in the 21st century, enabling society to develop appropriate responses to projected changes.
- ***To forecast change in extreme events during the 21st century for strategic locations***. We are assessing how climate change will affect the frequency and intensity of natural extreme events around Australia and selected South Pacific locations. This helps coastal planners assess the vulnerability of different parts of the coastline and provide guidance for adaptation and mitigation strategies to protect coastal communities and assets.
- ***To address key uncertainties in the longer-term projections of sea-level rise***. Sea level will continue to rise after 2100, potentially by several metres, because of ongoing warming and resultant expansion of the ocean, as well as changes in the Antarctic and Greenland ice sheets. The rate and amount of rise are uncertain, however, and reducing that uncertainty is central to planning longer term responses to sea-level rise.

sea-level rise

Projects

SLR-01: Observations of sea-level rise

Project leader

John Church, CSIRO

Project Aim: *To produce new estimates of historical sea level change and changes in the observed frequency of extreme events.*

These estimates are an essential element in the IPCC Assessment Reports.

SLR-02: Estimates of ocean thermal expansion

Project leader

John Church, CSIRO

Project Aim: *To increase confidence in our understanding of changes in sea level during the 20th century by developing more accurate estimates of observed 20th century thermal expansion.*

Confirmation that climate models are realistically simulating observations results in reduced uncertainty of future projections of thermal expansion.

SLR-03: Ice sheet and glacier contributions to sea-level rise

Project leader

Ian Allison, AAD

Project Aim: *To deliver more robust estimates of snow and ice changes on the Antarctic and Greenland continents during the 20th and 21st centuries.*

Modelling of the Antarctic and Greenland ice sheets delivers estimates of longer-term contributions to changes in sea level from ice discharge or melt water from the ice sheets. We are also drawing on international efforts to estimate contributions to changes in sea level from glacier melting as well as from ice sheets. These improved projections, in turn, guide Australian decision-makers in the formulation of policy and management strategies to respond to sea level change induced by climate change.

SLR-04: Modelling extreme events

Project leader

Kathleen McInnes, CSIRO

Project Aim: *To develop Australia-wide guidance about the impact of climate change on extreme sea level hazard due to the combined effect of rising sea levels and changed behaviour of severe storm events under future climate conditions.*

We are investigating how climate change may affect the frequency and intensity of extreme sea level events around Australia and selected South Pacific locations due to future changes in severe weather systems and increases in mean sea level.

sea-level rise

Key achievements 2006-07

- Produced plots of regional sea-level rise in the Australian region from 17 IPCC models for 2030, 2070, 2100.
- Showed that since 1990 sea level has been rising at the upper limit of the projections in the IPCC Third Assessment Report. *(SLR-01)*
- Documented the rate of sea-level rise for tropical islands in the Pacific and Indian Oceans for the period 1950 to 2001. *(SLR-01)*
- Documented the rate of sea-level rise for Australia for the period 1920 to 2001. *(SLR-01)*
- Produced a report for the Tasmanian government that provides statistical assessments of future sea level extremes at Hobart and Burnie, using projections from the IPCC Third Assessment Report. *(SLR-01, SLR-04)*
- Made significant progress toward improved estimates of ocean thermal expansion. *(SLR-02)*
- Found that there has not been a significant increase in Antarctic precipitation over the last 50 years, unlike what had been expected from climate change simulations. *(SLR-03)*
- Completed an estimation of current climate extreme sea level events for Westernport and Port Phillip Bay. *(SLR-04)*
- Through research on Corner Inlet and Gippsland Lakes, found that under pessimistic sea-level rise scenarios for 2070, the '1-in-100-year-event' becomes a '1-in-2-to-5-year-event' for a number of locations along the Victorian coast. *(SLR-04)*
- Continued to extend storm surge analysis to include Tasmania, South Australia, Western Australia and New South Wales. *(SLR-04)*

Plans for 2007-08

We plan to complete a reassessment of ocean thermal expansion estimates from historical observations. We will then compare it to the IPCC Fourth Assessment Report model simulations and attempt a reassessment of the sea level budget for the corresponding period.

We will produce new projections of sea-level rise for the 21st century, based both on regression models and on a simplified climate model.

We will continue the analysis of extremes in sea level records from Australia and elsewhere. In particular, we will produce statistical assessments of future extremes, using the sea level projections of the IPCC and of others.

We will carry out a comparison of the regional sea-level rise in IPCC models to narrow the selection of models for future projections. We will seek those that best represent realistic temperature, salinity and density for chosen regions in control simulation and best represent reconstructed heat content changes at the end of 20th Century.

policy

Program Objectives

- ***To translate research outputs into forms useful to research users in the spheres of law, public policy and regulation.*** Improving integration of Australian government goals, objectives and interests into the work of the science programs increases the policy relevance of our research and provides the greatest opportunity for use of relevant research in policy formulation. For example, we have created science-policy working groups to develop position analyses on key issues of ocean acidification and sea-level rise.
- ***To identify emergent issues influencing developments in legal and political regimes in the Southern Ocean and Antarctica.*** Scientific research on Antarctic and Southern Ocean climate and ecosystems has direct impacts on the management of the region and raises a number of policy issues. Linking our science research to potential policy implications is a core business of the Policy Program.
- ***To contribute to improved effectiveness of public policy management arrangements and regimes governing the Southern Ocean and Antarctica.*** There are a large number of international regimes and legal instruments that affect the Southern Ocean. We are exploring issues related to the effectiveness of these regimes and looking at the interconnections between them. One result of this research is advice about options for refining and improving regulatory processes underpinning these instruments to make them more robust and effective.

Program Leader

Assoc Prof Marcus Haward

University of Tasmania

Australia will face a range of challenges over the next decade in managing its Southern Ocean interests. We are contributing to national benefit by providing greater understanding of the nature of international marine resources and environmental regulation, the patterns of interaction amongst stakeholders, and the types of institutional forms that support and/or inhibit the effectiveness of these regimes.

The Policy Program also ensures that scientific outputs from the other ACE CRC research programs are able to contribute to policy development and outcomes for partner agencies and research users within Australian Government Agencies.

Projects

POL-01: Improving the effectiveness of Southern Ocean regimes

Project leader

Marcus Haward, UTAS

Project Aim: *To assess the effectiveness of relevant international and regional instruments and regimes, given domestic effect in Australia through national legislation and policy, and identify gaps, strengths and weaknesses in these regimes.*

A key question is the relationship between the Law of the Sea Convention (LOSC) and the Antarctic Treaty System. While much has been written on this nexus, neither the question of the relationship between these instruments, nor how this relationship affects other regimes that cover the Southern Ocean, is yet fully explored.

POL-02: Management of marine living resources in the Southern Ocean

Project leader

Julia Jabour, UTAS

Project Aim: *To identify and assess the utility of the regimes managing areas and species in the Southern Ocean and their place in international law.*

This project focuses on isolating specific problems of marine living resources management with broad applicability to Australia's national interest, including factors that could affect these interests.

POL-03: The nexus between the Antarctic Treaty System (ATS) and international instruments and regimes in marine areas south of latitude 60°S

Project leader

Marcus Haward, UTAS

Project Aim: *To identify the impact and influence of the nexus between the ATS and international instruments and regimes in the Antarctic Treaty Area.*

This project focuses on the extent to which actions by Australia or other parties under regimes such as the Law of the Sea Convention, the Convention on Biological Diversity and or the World Heritage Convention may directly challenge the primary objective of maintaining the ATS and affect Australia's goal of enhancing its influence within the system.

POL-04: Managing science intensive public policy: Institutional arrangements and climate change policy

Project leader

Rosemary Sandford, ACE CRC

Project Aim: *To reduce the science-policy gap in the integration of climate science research and Australian public policy.*

This project is a comparative study of institutional structures and knowledge management systems for integrating climate science research and Australian public policy. It will provide a comprehensive analysis of the ways in which Australian scientific and public policy institutions and systems manage climate change knowledge, policy making and implementation as it relates to the predicted impacts of climate variability and change on four resource policy issue areas: coastal zones, water use, wild fisheries and aquaculture, and international aid.

The project outcomes include better understanding of links and gaps in climate science and policy, and opportunities for improving science-policy integration. It will enhance understanding of the importance of key clearance points in the development and implementation of climate policy as they affect all three levels of government in Australia.

policy

Key achievements 2006-07

- Developed and presented third ACE CRC Research Users' Forum and followed up with government agencies.
- Participated in the AAD's Antarctic Futures Study and discussed future scenarios affecting the Antarctic Treaty System. *(POL-01, POL-04)*
- Completed joint ACE CRC and Sydney Centre for International and Global Law research on Australia's Antarctic Agenda. Key achievements were publication of paper 'Australia's Antarctic Agenda' in *Australian Journal of International Affairs*. *(POL-01)*
- Co-authored Australian Strategic Policy Institute (ASPI) Insight Paper 'Frozen Assets: Securing Australia's Antarctic Future'. *(POL-01, POL-03)*
- Updated review of criteria used to identify internationally important breeding sites for Albatrosses and Petrels listed in Annex I - Agreement on the Conservation of Albatrosses and Petrels (ACAP), presented at ACAP Advisory Committee Meeting. *(POL-01, POL-02, POL-03)*
- Contributed to *Looking South: Australia's Antarctic Agenda* by Lorne Kriwoken, Julia Jabour and Alan Hemmings, to be published by The Federation Press in late 2007. *(POL-01, POL-02, POL-03, POL-04)*
- Prepared briefing note to Department of Foreign Affairs and Trade: 'An answer to the proposition that 'whales eat fish' therefore they should be culled (surplus yield model).' *(POL-02)*
- Researched and analysed the application of Law of the Sea Convention Art. 76 (delimitation of the legal continental shelf) of subantarctic islands and Antarctica. *(POL-03)*
- Held briefings with government agencies: Department of Agriculture Fisheries and Forestry (July 2006, December 2006); Department of Foreign Affairs and Trade (July 2006, December 2006); AusAid (December 2006, February 2007, May 2007); Australian Greenhouse Office (December 2006); Department of Environment and Water Resources (December 2006). *(POL-01, POL-02, POL-03, POL-04)*
- Served as Team Leader, Strategic Review of the Australian Agency for International Development (AusAID)/BoM South Pacific Sea Level and Climate Monitoring Project: Phase IV. The project is to assemble an archive of sea level and climate related data to provide partner countries with the information about sea level variability and change that they need to manage their near-shore and coastal resources sustainably and to develop policies and strategies for responding to long-term trends in sea level. *(POL-04)*

Plans for 2007-08

We will maintain engagement with research users through targeted fora and ongoing development of position analyses on emergent issues and topics.

Analysis of legal and policy issues surrounding commercialisation of outputs from Southern Ocean biological prospecting will focus on the interaction with concepts of 'benefit sharing' and the context of the Antarctic Treaty's obligations for free exchange of scientific information. The consequences of amendments to international instruments to permits for deep ocean storage or sequestration of CO_2 will be analysed in relation to the Southern Ocean.

Research on how scientific knowledge is incorporated in Australia's climate policy will focus on strategies for managing science-policy gaps, 'hot-spots' or conflicts. This will involve collaboration with researchers and officials from selected Australian and state government agencies and their South Pacific Island counterparts. International collaborators include the Massachusetts Institute of Technology (MIT)-United States Geological Survey (USGS) Science-Impact Collaborative, known as MUSIC.

Table 3: Research outputs and milestones

Outcome 1: Reliable climate forecasts.

Output / Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestones
Output 1.1	Assessment of the variability of Southern Ocean currents and sea ice	2006, 2010	Yes (2006) On track (2010)		
Milestone 1.1.1	Complete circumpolar oceanographic transect at 30°S, with Japan	2004	Yes		
Milestone 1.1.2	Complete oceanographic transects at 115°E (WOCE I9) and across Kerguelen boundary current (joint with CO_2), collaboration with Japan. Complementary observations at 0°E by AWI (Germany)	2005	Yes		
Milestone 1.1.3	Complete oceanographic survey of shelf/slope waters between 30°E and 80°E (joint with AME; collaboration with Germany)	2006	Yes		
Milestone 1.1.4	Quantify transport and variability of bottom waters in Australian sector (with Japan) and compare to Atlantic sector (with Germany)	2007	In progress		
Milestone 1.1.5	Deploy array of Argo profiling floats (collaboration with Germany, USA and other nations)	2007	In progress		
Milestone 1.1.6	Census of water mass changes from recent and historical data	2008	In progress		
Milestone 1.1.7	Assessment of variability and change of the sea ice mass budget in the Indian Ocean sector of the Southern Ocean	2008	In progress		
Milestone 1.1.8	Identification and quantification of physical mechanisms driving variability in the ocean-ice system in the Australian Antarctic sector	2009	In progress		
Output 1.2	Production of scenarios of changes in Southern Ocean circulation and sea ice and their impact on ecosystems, carbon uptake and sea-level rise	2009	In progress		
Milestone 1.2.1	Assess influence of projected changes in Southern Ocean climate on basal melting of ice shelves and assess impact on the Southern Ocean of resulting changes on freshwater inputs and/or changes in iceberg discharge	2007	In progress		

research outputs & milestones

Output / Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestones
Milestone 1.2.2	Estimation of sensitivity of overturning strength to changes in forcing, from forward and inverse models	2008	In progress		
Milestone 1.2.3	Past changes of annual- to centennial-scale climate variability in the Southern Ocean, its sea ice cover and the southern atmosphere inferred from ice core proxy records	2009	In progress		

Outcome 2: Efficient, safe and sustainable operations in Antarctic waters

Output / Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestones
Output 2.1	Forecasts of currents and sea ice	2005, 2010	Yes (2005) On track (2010)		
Milestone 2.1.1	Construct data-assimilating ocean model	2005	Yes		
Milestone 2.1.2	Produce ocean analyses (hindcasts) covering the last decade	2008	In progress		
Milestone 2.1.3	Operational, fully-coupled ocean-sea ice analysis and forecast system	2010	In progress		

Outcome 3: Sustainable management of Antarctic marine living resources

Output / Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestones
Output 3.1	Incorporation of physical and biological information into Antarctic ecosystems model	2005, 2009	Yes (2005) On track (2009)		
Milestone 3.1.1	Development of under-ice remote sensing instrumentation for AUV	2004	No	Joint proposal with UK colleagues to the UK NERC to use *Autosub* failed on technical grounds. AUV development was not completed in time for preparations for winter sea ice voyage.	Research plan modified to proceed with other technology. Optical sensor package has been purchased and was tested in under-ice conditions during fieldwork (*Polarstern* cruise, Aug-Oct 2006). ROV replacement has been secured and optical sensors attached for early season cruise in September 2007. In addition, an under-ice trawl has been built by AAD to assist with under-ice sampling of krill and environmental conditions.
Milestone 3.1.2	Testing of the hypothesis that there has been a major change in sea ice extent in the 1950s and 1960s using data from ice cores, sediment cores, penguin rookeries and operational data	2005	No (In progress)	Biological data for eastern Antarctica was more sparse than anticipated.	Available data have been assembled and a workshop held in September 2005 (the East Antarctic Workshop) to begin the analyses. Data available for statistical and dynamic modelling will now be reviewed by a joint workshop of the Scientific Committees of CCAMLR and IWC to be co-convened by Dr Constable in 2008. Analyses will then be undertaken of potential changes in eastern Antarctica.

Output / Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestones
Milestone 3.1.3	Submission to CCAMLR of an estimate of the biomass of krill in Division 58.4.2	2006	Yes		
Milestone 3.1.4	Autumn/winter/spring process study voyages	2007-09	In progress		
Milestone 3.1.5	Development of an observation-based model that links physical variables (sea ice, oceanography, meteorology) with biological productivity at the primary and secondary levels	2008	In progress		
Milestone 3.1.6	Development of a region-based predictive model that integrates existing climate models with higher trophic level ecosystem models	2010	In progress		

Outcome 4: Recognition of oceanic carbon sinks and their impacts, to examine the justification for and permit the effective management of carbon dioxide emissions

Output / Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestones
Output 4.1	An estimate of the current inventory of anthropogenic CO_2 in the Southern Ocean south of Australia	First estimate in 2005; second estimate in 2009	Yes (2005) On track (2009)		
Milestone 4.1.1	Measurement of anthropogenic CO_2 contents along the WOCE/CLIVAR I9 section from Western Australia to Antarctica	March 2005	Yes		
Milestone 4.1.2	Measurement of anthropogenic CO_2 contents on a transect along the Antarctic shelf	March 2006	Yes*	Achieved, although lack of CFC measurements as a result of unavailability of international collaborators will restrict the quality of anthropogenic CO_2 estimates. Development of CFC analytic capability in Australia is needed but beyond the scope of the ACE CRC.	

Output / Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestones
Milestone 4.1.3	Measurement of anthropogenic CO_2 contents along the WOCE/CLIVAR SR3 section from Tasmania to Antarctica	March 2008	In progress		This work is planned for a voyage in 2008 jointly with the CVC Program, as part of the International Polar Year and in conjunction with the Census of Antarctic Marine Life.
Output 4.2	Determination of the role of stratification in biological carbon export to the deep sea, to inform estimates of future carbon export in an increasingly stratified ocean		In progress	This project has been delayed by failure of the automated PULSE mooring. Achievement of the mooring is likely to be delayed until 2009.	Redesign of the mooring is ongoing. Participation in US NSF-funded VERTIGO program provided an alternate route to achieving this goal and this work has been published in *Science*.
Milestone 4.2.1	Development of a model with explicit ecosystem structure linking stratification and export over seasonal timescales	2006	Yes		
Milestone 4.2.2	Comparison of the model to observations of stratification and surface export in the Southern Ocean south of Australia	2008	In progress		
Milestone 4.2.3	Comparison of the model to observations of export to deep sediment traps in the Southern Ocean south of Australia	2010	In progress		
Output 4.3	Determination of the role of iron limitation for biological carbon export to the deep sea		In progress		
Milestone 4.3.1	Examination of the links between iron supply and export in an area of natural iron inputs	2003-05	Yes		
Milestone 4.3.2	Quantification of the response of Southern Ocean ecosystems to controlled iron fertilisation (2005 and 2009), with assessments of efficacy and risk issued in 2005 and 2010	2005-10	Yes (2005) On track (2010)		
Output 4.4	Determination of the role of elevated CO_2 levels on phytoplankton communities		In progress		
Milestone 4.4.1	Laboratory experiments under elevated CO_2	2007	In progress		

research outputs & milestones

Outcome 5: Estimates of sea level change resulting from anthropogenic climate change used as one of the bases for intergovernmental climate change negotiations

Output / Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestones
Output 5.1	Review of 20th century sea level change.	June 2005, June 2010	Yes (2005)		
Milestone 5.1.1	Revised estimates of historical (20th century and early 21st century) sea level change	June 2004, December 2009	Yes (2004) On track (2009)		
Milestone 5.1.2	Revised estimates of ocean thermal expansion from observations and models (both the CSIRO and AWI models)	June 2005, December 2009	Yes (2005) On track (2009)		
Milestone 5.1.3	Revised estimate of the 20th century Antarctic ice sheet contribution to sea level change derived from a comparison of measured ice discharge (field observations and remote sensing) with results from a balance flux model forced with improved estimates of accumulation distribution and temporal variability (from field observations, meteorological models and ice cores)	December 2005, December 2009	Yes (2005) On track (2009)		
Output 5.2	Revised projections for future sea level change during the 21st century and on longer time-scales	June 2006, June 2010	Yes (2006) On track (2010)		
Milestone 5.2.1	Revised estimates of future ocean thermal expansion	December 2005, December 2009	Yes (2005) On track (2009)		
Milestone 5.2.2	Estimate of the future contribution of the Antarctic and Greenland ice sheets to sea level change using an improved high-resolution ice sheet-system model (including ice stream-ice shelf interaction, full thermodynamics and flow anisotropy) and changes in meteorological forcing	June 2010	In progress		
Milestone 5.2.3	Estimates of the response of ice shelves to global warming from improved models of ice shelf-ocean interaction (validated against field observations and remote sensing data from the Amery Ice Shelf); prediction, from improved models of ice stream-ice shelf boundaries, of the consequence of ice shelf collapse on the discharge of grounded ice	June 2006, December 2009	Yes (2006) On track (2009)		

Outcome 6: Estimates of sea level change as an essential input to coastal zone management and other planning considerations in Australia and in neighbouring nations in the South Pacific

Output / Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestones
Output 6.1	Estimates of the historical impacts of sea level change at key locations	December 2005	Yes		
Milestone 6.1.1	Estimates of the historical frequency of extreme events from observational (and proxy) records	December 2004	Yes		
Output 6.2	Estimates of the expected impacts of sea level change at key locations	June 2010	In progress		
Milestone 6.2.1	Selection of key locations for more detailed studies	June 2004	Yes		
Milestone 6.2.2	Estimates of the changes in frequency of extreme events from numerical modelling studies	December 2009	In progress		

Outcome 7: Delivery of science outputs to research users.

Output / Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestones
Output 7.1	Annual forum for research users	2003-10	Yes (ongoing)		
Milestone 7.1.1	Organisation of research users' forum	Annual (July-August)	Yes (ongoing)		
Milestone 7.1.2	Hosting of research users' forum	Annual (Nov)	Yes (ongoing)		

Outcome 8: Improving responses to emergent issues

Output / Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestones
Output 8.1	Identify and, with science programs, provide policy users with details on emergent issues and likely impacts on Southern Ocean management regimes		Yes (ongoing)		
Milestone 8.1.1	Identify emergent issues – eg bioprospecting, iron fertilisation	Ongoing	Ongoing		
Milestone 8.1.2	Complete an inventory of Southern Ocean management regimes	June 2004	Yes		
Milestone 8.1.3	Critical review and assessment of regimes	June 2006	Yes		
Milestone 8.1.4	Identification of gaps in regimes	June 2008	In progress		

research outputs & milestones

Output / Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestones
Milestone 8.1.5	Completion of project; recommendations to government	June 2010	In progress		

Outcome 9: Improved Australian influence in and effectiveness of Southern Ocean management regimes

Output / Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestones
Output 9.1	Establish criteria for assessment of Australian influence in, and the effectiveness of, Southern Ocean management regimes				
Milestone 9.1.1	Complete an inventory of Southern Ocean management regimes	June 2004	Yes		
Milestone 9.1.2	Establishment of assessment criteria to measure influence and effectiveness	June 2006	Yes		
Milestone 9.1.3	Assessment of Southern Ocean management regimes against criteria	June 2008	In progress		
Milestone 9.1.4	Completion of project; recommendations to government	June 2010	In progress		

research collaboration

The nature of Antarctic and global climate research is such that collaboration is essential. The study of global climate is multidisciplinary by nature, and relies on a wide range of research conducted by multiple organisations in many countries. For Antarctic research, distances are vast, conditions are harsh and costs are enormous.

The ACE CRC's collaborative efforts result in increased logistical and scientific support – such as ship time, satellite data, and access to computer facilities, data bases and models – that is necessary to maintain Australia's leadership position in this field of research.

In addition to ongoing collaborations among the different research programs within the ACE CRC, our researchers were involved in 36 national collaborative projects and 69 international collaborative projects involving 17 different countries. They also served on 21 national and 46 international committees.

National and international collaborative projects, committee memberships, staff exchanges and international visitors are detailed in the appendices.

Research Consultancies & Contracts

Staff Name	Consultancy or contract	Period	Total A$	2006-07 A$
Constable A	Peregrine/WWF – Bioregionalisation of the SO	July-Oct 2006	*$100,000	$100,000
Hunter J	Historical and projected sea level extremes for Hobart and Burnie, Tasmania	Oct 2006-June 2007	$9,500	$9,500
	Peer review of Inception Report for the 'Study on the Effects and Impacts of Global Climate Change on Singapore' (with John Church)	May-June 2007	$10,000	$10,000
Sandford R Hunter J	Strategic Review South Pacific Sea level and Climate Monitoring Project: Phase IV (AusAID/BoM)	March-Oct 2007	$94,500	$80,000

*Funds not administered by the ACE CRC.

Grants

Project & Granting Body	Researcher	Grant period	Cash and/ or In-Kind	
			Total A$	2006-07
Ice sheet–atmosphere interaction and surface climatology of interior Antarctica *Australian Antarctic Research Program*	Allison I	2003-08	Logistical support	Logistical support
The drift of Antarctic sea ice *Australian Antarctic Research Program*	Allison I	2003-08	Logistical support	Logistical support
Ice shelf–ocean interaction in the cavity beneath the Amery Ice Shelf *Australian Antarctic Research Program*	Allison I, Bindoff N, Craven M	2003-07	Logistical support	Logistical support
Ocean acidification impacts – potential effects of increasing anthropogenic CO_2 on plankton in the Southern Ocean *AGO*	Howard, W	April 2006-May 2007	$109,608	
Ocean acidification impacts – potential effects of increasing anthropogenic CO_2 on pteropods in the Southern Ocean *AGO*	Howard, W	May 2006-May 2007	$137,900	$137,900
Abrupt climate change – synchronizing ice core records using rapid changes in methane concentrations in trapped air *AGO*	van Ommen T, Morgan V	to December 2007	$40,500	
IPCC, Chapter 5 Observations – Oceanic Climate Change and Sea Level *AGO*	Bindoff N	July 2004-July 2007	$58,000	$29,000
TPAC National Facility, Grid and EOT program *APAC*	Bindoff N	2004-2006	$1,440,000	$480,000
TPAC National Facility, Grid and EOT program *APAC*	Bindoff N	Jan-June 2007	$390,000	$390,000
The oceanography of the region between 30 and 80 degrees East (CCAMLR Division 58.4.2) *ASAC*	Bindoff N, Trull T, Tilbrook B, Nicol S	July 2005-June 2007	Ship time for $1,792,000	Ship time
Ocean micronutrients (Australian sector) – IPY-GEOTRACES SR3 section and associated aerosol study *AAS grant*	Butler E, Bowie A	2007-08	Ship time	Ship time
Selenium as a key micronutrient in primary productivity in the Southern Ocean *Australian Antarctic Science grant*	Butler E, Wake B, Bowie A	2004-07	$122,000 in-kind	In-kind
Controls on Ross Sea algal community structure *NSF, Office of Polar Programs (USA)*	DiTullio G, Hutchins D, Smith W, Sedwick P, Dunbar R, Tortell P, Bowie A	2005-2007	$495,428	$12,000
Supporting or sabotaging sustainable development? State policy responses to environmental certification schemes *ARC*	Gale F, Haward M	2004 -2006	$145,000	$50,000
Sea ice motion, deformation, thickness, and lead dynamics in the Antarctic *European Space Agency*	Haas C, Heil P, Geiger C, Massom R, Maksym E, Clemente-Colon P, Worby A	2007-2010	In-kind satellite data	In-kind satellite data
Hyphenated capillary electrophoresis – mass spectrometry facility *ARC Linkage – Infrastructure, Equipment and Facilities*	Haddad P, Clark M, Reid J, Bowie A and others	2006	$262,706	$263,000
Implementation of a sea ice model for application in the Antarctic *AAS*	Heil P	2004-2008	Logistical support	Logistical support
Variability of the coastal Antarctic climate derived from fast ice observations *AAS*	Heil P, Allison I	2004-2009	Logistical support	Logistical support

Project & Granting Body	Researcher	Grant period	Cash and/ or In-Kind	
			Total A$	2006-07
Studying high-frequency Arctic and Antarctic sea ice dynamics using drifting buoy data *AAS*	Heil P, Allison I	2004-2008	Logistical support	Logistical support
Complete Mapping of Antarctic Sea Ice Dynamics and Thickness *ESA*	Heil P, Massom R, Geiger C, Haas C, Clemente-Colon P	2007-2010	In-kind satellite data	In-kind satellite data
^{10}Be in Antarctic Ice Cores (Post-graduate award for J Pedro) *AINSE*	Howard W	July 2007 – Nov 2009	$44,500	
Holocene chronology for calibration of South Tasman Rise palaeoceanographic proxies *AINSE*	Howard W, Moy A	2007	$9508	$4500
SAZ-SENSE – Physical and biogeochemical dynamics of the SAZ *ASAC*	Howard W, Trull T, Bowie A, Wright S, Griffiths B, Tilbrook B	July 2006 – June 2007	30 days' ship time; worth approx. $2.5M	30 days' ship time; worth approx. $2.5M
The SO and sea ice response to climate variability and change, modelling work in support of CVC *APAC*	Marsland S, Roberts J, Heil P, Bindoff N	2007	$80,000 of computer time	$40,000 of computer time
APAC MAS grant k68/f27 extension *APAC*	Marsland S, Bindoff N, Roberts J, Heil P, Lieser J, Petrelli P	2006-2007	160000 cpu hours 2007 380000 cpu hours 2006	180000 cpuh
A study of fast ice distribution and polynyas in East Antarctica using ALOS data JAXA *JSA*	Massom R, Worby A, Lytle V	2003-2007	Satellite data	Satellite data
Validation of AMSR-E Antarctic Sea-Ice Products in East Antarctica *NASA*	Massom R, Lytle V, Worby A, Michael K, Young N	2002-2006	Satellite data	Satellite data
Remote sensing validation experiment (ARISE) *ASAC*	Massom R, Allison I, Worby A, Lytle V, Michael K, Young N	2002-2006	Logistical support for V1 2003-04	Ship time
The validation of CryoSat 2 sea ice thickness measurements in Antarctica *ESA*	Massom R, Allison I, Worby A, Michael K, Lytle V, Young N	2007-2010	Satellite data	Satellite data
Study of Mertz Glacier Tongue, East Antarctica *NASA*	Massom R, Giles B	2007-2009	Satellite data	Satellite data
Mapping and monitoring of circum-Antarctic fast ice *ESA*	Massom R, Heil P, Haskell T, Ohshima K, Ushio S, Aoki S, Young N	2007-2010	Satellite data	Satellite data
Understanding changing ice flow and rift propagation in the Mertz Glacier Tongue, East Antarctica *ESA*	Massom R, Heil P, Haskell T, Ohshima K, Ushio S, Aoki S, Young N	2007-2010	Satellite data	Satellite data

research collaboration

Project & Granting Body	Researcher	Grant period	Cash and/ or In-Kind	
			Total A$	2006-07
ARC Discovery Bio-optical model of Antarctic sea ice algae photosynthesis *ARC*	McMinn A, Ralph P, Kuhl M	2007-2010	$350,000	$55,000
Effect of global change on the primary production of Antarctic coastal ecosystems *AAS*	McMinn A	2006-2007	Approx $95,000 and logistical support	$19,600
Sea ice primary production off Eastern Antarctica *AAS*	McMinn A, Meiners K, Ralph P	2006-2007	Approx $33,500 & logistical support	$17,000
UV climate over the SO south of Australia and its biological Impact *AAS*	Michael K, Nunez M	2006-2007	$11,000 & logistics for marine science	$11,000 & logistics for marine science
The influence of energetic solar particles on the polar atmosphere *UTAS*	Michael K, Klekociuk A	2007	$8,000	$8,000
Simulating the climate of the last glacial cycle *APAC*	Phipps S, Roberts J, Budd W, van Ommen T	2001-2007	Computer time $340,000 (approx.)	$46,000 (approx.)
Simulating the climate of the last glacial cycle *iVEC*	Phipps S, Roberts J, Budd W, van Ommen T	2004-2007	Computer time $340,000 (approx.)	$120,000 (approx.)
The ARC Earth System Science Network *ARC*	Pitman A, Beringer J, Bindoff N, England M, Hughes L and 44 others	2005-2009	$1,950,000	$400,000
Earth Systems Science OPeNDAP computer server framework *ARC*	Roberts J, Bindoff N, Hyland G	Jan-Dec 2006	$81,900	$40,950
Impact of atmospheric deposition on the distribution and speciation of trace elements in the upper ocean – focus on iron in the Sargasso Sea *NSF, Chemical Oceanography (USA)*	Sedwick P, Church T, Sholkowitz E, Bowie A	2006-2009	$565,205	$10,000
Application of novel nitrogen isotope techniques to SO marine productivity *AAS*	Trull T	July-Aug 2006	Travel support for visit to North America	$11,000
Climate modulation of the ^{10}Be solar activity proxy. Understanding of solar forcing of climate *AINSE*	Trull T, Pedro J ,Van Ommen T, Morgan V, Curran M, Smith A (ANSTO), Fink D (ANSTO)	July 2006-June 2007	$17,220	$17,220
PULSE: Role of rapid and seasonal mixed-layer dynamics in SO plankton production and carbon transports including air-sea exchange of CO_2 and particulate carbon fluxes to the ocean interior *Marine National Facility*	Trull T, Griffiths B, Tilbrook B, Butler E, Bowie A	July 2006-June 2007	Southern Surveyor Voyage (10 days)	Logistics valued at approx. $400,000
Subantarctic zone mooring study of interannual variability in particulate carbon export *AAS Program Award # 1156*	Trull T, Bray S	July 2006-June 2007	10 days' shiptime	Logistics valued at approx. $850,000
SO Time Series Automated Observations Program (SOTS) *NCRIS IMOS*	Trull T, Schulz E (BoM)	2006-2011	$3.9M	

Project & Granting Body	Researcher	Grant period	Cash and/ or In-Kind	
			Total A$	2006-07
Redox and colloidal iron biogeochemistry in surface Atlantic waters and its role in ocean productivity *NERC (UK)*	Worsfold P, Ussher S, Achterberg E, Bowie A	2004-2006	$515,120	$4,000
Land ice monitoring in East Antarctica and Heard Island using data from the Advanced Spaceborne Thermal Emission and Reflection Radiometer *USGS (USA)*	Young N	2003-2007	Satellite data	Satellite data
Iceberg tracking and environment monitoring using QuikScat scatterometer *JPL-NASA (USA)*	Young N	1999-2007	Satellite data	Satellite data
Antarctic iceberg freeboard height and volume distribution *ESA*	Young, N, Bindoff N, Hyland G, Massom R	2005-2009	Satellite data	Satellite data
Dynamics and characteristics of ice shelves and glaciers in East Antarctica *JAXA (JAPAN)*	Young N, Coleman R	2006-2009	Satellite data	Satellite data
Antarctic ice stream, ice shelf, ice sheet, and ocean interaction *ESA*	Young N, Coleman R, Fricker H, Hyland G, Damm V	2005-2009	Satellite data	Satellite data
Recent changes and dynamics of Heard Island glaciers *JAXA (JAPAN)*	Young N, Coleman R, Hyland G	2006-2009	Satellite data	Satellite data
Antarctic iceberg production, dispersion and dissolution rates *ESA*	Young N, Hyland G, Williams R	2003-2007	Satellite data	Satellite data
Antarctic iceberg drift, dispersion, and dissolution rates in the SO *ESA*	Young N, Massom R	2007-2010	Satellite data	Satellite data

commercialisation & utilisation

Program Leader

Christie le Goy, ACE CRC

Overview

The ACE CRC's Commercialisation & Utilisation Plan (C&UP) received formal approval from the Department of Education, Science and Technology at the end of August 2005. Our approach to the commercialisation objectives of the CRC Programme took into account the specific context of this CRC's research program:

- The development of technology is not a strategic goal of this CRC, nor of our research users. However, innovative technology is developed as part of the operational activity that underpins the CRC's research.
- The Antarctic Treaty has established a spirit of cooperation between treaty partners, who readily collaborate on research and technology. The Australian Antarctic Science program places a high value on open access to the technology of other treaty partners, and offers Australian technology in return. Successful candidates for commercial exploitation of ACE CRC technologies are likely to be those for which a broader market can be identified outside that of polar operations.
- The market for ACE CRC's research is not industry based: it is primarily our core partners, supporting partners and sectors of the Australian Government and the international community. The focus of the ACE CRC will be on promoting effective utilisation of our research in these markets.

Two distinct strategies developed from this context; the commercialisation of technology, and the utilisation of research.

Commercialisation and utilisation strategies and activities

Technology Commercialisation

This strategy established disclosure, assessment and formal decision making processes for the ACE CRC. Because Antarctic, climate and ecosystems research generally offers low exposure to a commercial culture, the ACE CRC has given a high priority to education as a necessary prerequisite.

Education

The ACE CRC Commercialisation Program delivers formal generic commercialisation training and specific ACE CRC briefings to staff and students, to meet CRC Programme objectives and to provide the necessary background and common understanding to support implementation of the C&UP. In 2006-07 the ACE CRC undertook the following activities:

Workshops

With the support of the Tasmanian Department of Economic Development, we commissioned a commercialisation workshop for researchers and PhD students from the Australian Institute for Commercialisation in October 2006. The ACE CRC has now delivered these workshops to:

- 30 PhD students
- 37 staff associated with the ACE CRC
- 5 partner staff not closely associated with the ACE CRC

Staff Briefings

All new assigned staff members now receive an individual briefing on the ACE CRC's Commercialisation practices and policies, and are supplied with a 'User Guide to the ACE CRC', which relates their obligations to their employer to the requirements of the CRC.

Disclosure and Assessment

Disclosure of innovative technology within the ACE CRC was formally introduced during 2005-06 through the use of a Technology Disclosure Report. In late 2006 the ACE CRC adopted an assessment framework called IDEAS ('Innovation Development Early Assessment System') and the support of the Australian Innovation Research Centre in its application. It is a structured method that assists in mapping the strategic alternatives for commercialisation at an early stage of an idea. We have also found it to be a useful tool to educate individual researchers about the commercialisation process.

Spin-offs and patents

To date the ACE CRC has not applied for any patents, nor created any spin-off companies.

Research Utilisation

We continue to evolve strategies for improving our capability for delivering economic, environmental or social value from our research. The Research Delivery program approved early in this current year has two main streams of activity:

Deliver Now

We are building a portfolio of delivery projects that are complementary to the existing activities within the ACE CRC research programs. These projects have a clearly identified end user (or users) and a definite outcome for each end-user within the life of the ACE CRC, to which a credible economic value could conceivably be applied. We aim to develop projects associated with each of our research programs.

Progress this year:

Sea Levels in Tasmania, a collaborative project between the Tasmanian Department of Primary Industries and Water and the ACE CRC Sea-level Rise Program, involves the analysis of key tide gauges and projections of the characteristics of 21st century extreme sea level events, and the presentation of these results to coastal planning authorities in Tasmania.

South Pacific Sea Level and Climate Monitoring Project Review, undertaken jointly by the ACE CRC's Policy and Sea-level Rise Programs for AusAID, assesses the efficacy of this important AusAID project and develops recommendations for more effective delivery.

Sea Ice Analysis and Forecasting System is an initiative of the Climate Variability and Change Program to deliver to the Australian Bureau of Meteorology the systems to enable both now-casting and short-term forecasting of sea ice conditions in the Southern Ocean.

Other smaller engagements are included in the end-user involvement table on page 39.

Improve Prospects for Future Delivery

Because some of the value of the ACE CRC's work will only be realised after the term of the CRC expires, we need to pay attention to the activities that will support the future capacity of our research users to exploit the significance of our findings. The strategies complement those of the Communication Program and the Policy Program, and focus upon improving engagement with our Australian research users – for our PhD projects as well as our core projects.

During the year we spent considerable time consulting with Tasmanian organisations to further develop their appreciation of the climate factors that impact upon their strategic decision-making. A project proposal that aims to deliver regional climate projections of these factors to Tasmanian stakeholders is under development for completion within the life of this CRC. This project is likely to prove a useful model for broader applicability in other Australian states.

Intellectual property management

During the period under review, the ACE CRC has not sold, transferred or licensed its IP for commercialisation.

The ACE CRC implemented all core policies and procedures for IP management before the end of the previous year. The Third Year Review confirmed that our approach is appropriate for our organisation and the activities we undertake. We continue to work closely with our partners to ensure a common understanding and approach in the application of these policies and procedures.

Table 4: Commercialisation Milestone

Output / Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)
Commonwealth Agreement	Commonwealth approval of Commercialisation & Utilisation Plan	26/08/06	Yes

commercialisation & utilisation

Communication strategy

The ACE CRC Communication Strategy was developed in 2004 to provide a framework for both internal and external communication activities. The first year of communications activity established the foundation, including the necessary processes and frameworks, for effective communication. The following years have built on this foundation to achieve the goals and resulted in an increased commitment and support for communications initiatives from program leaders and other research staff and students.

Internal communication is maintained through email lists, the participants' section of the website, an internal email newsletter, weekly lunchtime seminars at UTAS, CSIRO and AAD, quarterly staff fora and an annual symposium.

External communication to the public and to specific end-users is addressed by means of the media, the website, information sheets and booklets about the research and issues, scientific publications, presentations at conferences and symposia, special interest workshops, individual personal contacts and special events.

Key Communication Activities 2006-07

3rd Annual ACE CRC Symposium

More than 100 staff, students and visitors attended part or all of the 3rd Annual ACE CRC Symposium in August 2006. The first day featured 15 presentations and posters from staff and students about recent research. The theme of the second day was *Antarctica & the Southern Ocean: Physical Changes, Ecosystem Responses & Management Issues*. ACE CRC researchers discussed sea ice, ocean acidification, BROKE-West and ecosystem modelling. Management issues were addressed by guest speakers from CCAMLR, the Australian Fisheries Management Authority (AFMA), the Tasmanian Fishing Industry Council and the Australian Greenhouse Office.

3rd Research Users' Forum, Canberra

The 3rd Research Users' Forum was held in at Old Parliament House in Canberra in November 2006. The forum theme was *Southern Ocean Ecosystems and Climate Change: Insights for Managing Impacts.* This year's forum included perspectives from two research-user groups – the DAFF and AFMA. There were 25 attendees representing 17 agencies, as well as 10 ACE CRC staff.

5th World Science Journalists' Conference

More than 600 journalists, science writers and scientists from around the globe attended the 5th World Science Journalists' Conference in Melbourne. A combined session with the Canadian government on polar science and the International Polar Year was attended by about 80 people. Information about IPY projects, the ACE CRC and the upcoming sea ice voyage was distributed to attendees at the session.

SCAR-COMNAP

The ACE CRC had a booth in the exhibit hall at the SCAR-COMNAP Open Science Conference. The exhibit was open to the more than 800 delegates for the entire conference and to the public on Saturday, 15 July. The ACE CRC was a Bronze sponsor of the conference and many ACE CRC staff and students volunteered time to help staff the booth.

Public outreach

We provided background information, images and feedback to the Australian Science Teachers' Association (ASTA) on the teacher resource guide on Antarctic science that they prepared for National Science Week. The published book was sent to every school in Australia.

ACE CRC researchers also gave 33 talks to general or non-scientist audiences. Audiences included the general public, politicians, teachers, and primary and secondary school students. These talks are detailed in Appendix D.

An estimated 2,500 people visited an Antarctic Midwinter Festival exhibition in Hobart where the ACE CRC had a staffed exhibit booth and presented several talks.

Publications and conference presentations

ACE CRC publications included 81 articles in refereed journals, 20 book chapters, 53 published conference abstracts, 8 special reports and 10 other papers. (Appendix A)

ACE CRC researchers gave 72 national and 118 international presentations at conferences, seminars or workshops. (Appendix D)

End-user involvement and CRC impact on end-users

Much of our end-user involvement occurs through collaborative projects and committee work. These are detailed later in this report under Research Collaboration. The following table supplements that information. Our end-users have found it difficult to quantify the benefit received from involvement with ACE CRC activities.

Industry or other research users and basis of interaction	Relationship with CRC	Type and location of activity	Nature and scale of benefits to end-users	Actual or expected benefit to user
Australian Bureau of Agricultural and Resource Economics	(Non-participant)	Participation in Research Users' Forum, Canberra	Increased awareness of projected risks associated with climate change	
Australian Fisheries Management Authority	(Non-participant)	Participation in Research Users' Forum, Canberra	Increased awareness of projected risks associated with climate change	
Bureau of Rural Sciences	(Non-participant)	Participation in Research Users' Forum, Canberra	Increased awareness of projected risks associated with climate change	
Cradle Coast Water		Consultation on impact of climate change to their business	Increased sensitivity to projected risks	
CSIRO/UTAS/BoM	Core partners	Development of core modules for ACCESS – Australian Community Ocean Model and TPAC/AAD sea ice model	A state-of-the-art system science model for predicting or simulating future climate scenarios and for sea ice forecasts underpinning all Australian Weather Forecasts by BoM.	
Department of Agriculture and Fisheries and Forestry	Non-participant	Participation in Research Users' Forum, Canberra	Increased awareness of projected risks associated with climate change	
Department of Education Science and Training	Non-participant	Participation in Research Users' Forum, Canberra	Increased awareness of projected risks associated with climate change	
Department of Environment and Water Resources, Australian Antarctic Division	Core partner	Participation in Research Users' Forum, Canberra	Increased awareness of projected risks associated with climate change	
Department of Environment and Water Resources, Australian Greenhouse Office	Supporting partner	Participation in Research Users' Forum, Canberra	Increased awareness of projected risks associated with climate change	Contribution towards the objectives of the Australian Climate Change Science Program
Department of Environment and Water Resources, Australian Greenhouse Office	Supporting partner	Commissioned further project on ocean acidification ($137,900 ex GST). Hobart.	Increased readiness to adapt to projected risks	Contribution towards the objectives of the Australian Climate Change Science Program

commercialisation & utilisation

Industry or other research users and basis of interaction	Relationship with CRC	Type and location of activity	Nature and scale of benefits to end-users	Actual or expected benefit to user
Department of Foreign Affairs and Trade – AusAid	Non-participant	Commissioned review of South Pacific Sea Level and Climate Monitoring Project ($110,000 ex GST). Hobart, Melbourne, Canberra and Pacific Islands	Increased understanding of effective delivery of Australian aid projects aimed at preparing recipients to respond to climate risk	
Department of Foreign Affairs and Trade – AusAid	Non-participant	Participation in Research Users' Forum, Canberra	Increased awareness of projected risks associated with climate change	
Department of Foreign Affairs and Trade	Non-participant	Participation in Research Users' Forum, Canberra	Increased awareness of projected risks associated with climate change	
Esk Water	Non-participant	Consultation on impact of climate change to their business	Increased sensitivity to projected risks	
Geoscience Australia	Non-participant	Participation in Research Users' Forum, Canberra	Increased awareness of projected risks associated with climate change	
Gunns	Non-participant	Consultation on impact of climate change to their business	Increased sensitivity to projected risks	
Hobart Water	Non-participant	Consultation on impact of climate change to their business	Increased sensitivity to projected risks	
Insurance Australia Group	Non-participant	Participation in the ACE CRC's third year review through chairing the review panel.	Awareness of the contribution of the Antarctic to understanding of the risk of insured weather events	
Local Government Association of Tasmania	Non-participant	Consultation on impact of climate change on Local Government in Tasmania	Increased sensitivity to projected risks	
Melbourne Water	Non-participant	Delivery of 'Sea-level Rise Primer' to key planners associated with risk assessment, Melbourne	Improved understanding of the issues that might impact the sewerage and drainage/waterway management activities	
Mineral Resources Tasmania	Non-participant	Consultation on impact of climate change to their business	Increased sensitivity to projected risks	
NEA (National Environment Agency), Singapore	Non-participant	Commissioned peer review of Inception report for project 'Study on the effects and impacts of global climate change on Singapore'.	Early advice on the efficacy of an important national study.	
Prime Minister and Cabinet	Non-participant	Participation in Research Users' Forum, Canberra	Increased awareness of projected risks associated with climate change	
Royal Australian Navy	Non-participant	Participation in Research Users' Forum, Canberra	Increased awareness of projected risks associated with climate change	

Industry or other research users and basis of interaction	Relationship with CRC	Type and location of activity	Nature and scale of benefits to end-users	Actual or expected benefit to user
Tasmanian Department of Primary Industries and Water	Non-participant	Commissioned tide gauge analysis and projections of 21st century extreme sea level events	Increased awareness of risks and adaptation issues	
Tasmanian Department of Primary Industries and Water	Non-participant	Coordination of Sea-level Rise Reference Group, Hobart	Access to expert and current advice on emerging developments in understanding of sea-level rise	
Tasmanian Farmers and Graziers Association	Non-participant	Consultation on impact of climate change to their business	Increased sensitivity to projected risks	
Tasmanian State Emergency Service	Non-participant	Consultation on impact of climate change to their business	Increased sensitivity to projected risks	
Wine Industry Tasmania	Non-participant	Consultation on impact of climate change to their business	Increased sensitivity to projected risks	
Australian Science Teachers' Association	Non-participant	Provision of scientific information, images and review for teacher resource book on Antarctic science	Improved education resources available to educators about the importance of Antarctica and climate change issues	

education & training

Looking South Together is an integrated research training and knowledge transfer program of the Antarctic Climate & Ecosystems CRC. The program uses ACE CRC expertise to produce well-trained scientists who have world class skills in research, an understanding of its broad application and its role in enterprise, and international experience. It is managed by the University of Tasmania's Institute of Antarctic and Southern Ocean Studies (IASOS), whose staff contribute 50 per cent of their time to the ACE CRC.

Program Leader

Prof Andrew McMinn

University of Tasmania

Program Overview

Postgraduate Training

Development of highly-trained scientists is a priority of the ACE CRC. This training program builds on the significant contribution made by the previous Antarctic CRC to national training in strategic scientific areas. *Looking South Together* works with the Science and Policy Programs and all ACE CRC participants to identify high priority research for students and uses a mix of broadly advertised, fully-funded and 'top-up' scholarships to attract first-rate students to these areas.

Knowledge Transfer

It is also important for the ACE CRC to communicate its research outputs and outcomes to the wider community. We are working with our core partners, museums and education organisations to raise awareness of Antarctic Science. We contribute to displays and exhibitions, provide speakers and generally seek to enhance awareness of the importance of Antarctic and Southern Ocean science. We also participate in national science and education promotions to ensure that our research results are communicated to the widest possible audience. Most staff members also contribute undergraduate and postgraduate lectures. This work is coordinated with, and supported by, the ACE CRC Communications Manager.

Progress towards objectives

- ***To develop higher education programs that meet the needs of ACE CRC stakeholders.***

  Developing higher education programs is a continuing process of refinement. The program is focussed on postgraduate training through the PhD program. The program is large by both national and international standards and produces a steady flow-though of finishing graduate students. These students are substantial contributors to each of the ACE CRC subprograms.

- ***To address the long-term unmet national demand for highly trained personnel with quantitative skills in oceanography and marine ecology.***

  By working with the Quantitative Marine Science (QMS) program we are providing, advanced, high level training courses to help meet the shortage of quantitative scientists. This program, which is now in its third year of operation, has ten of our PhD students enrolled. All other ACE CRC students are enrolled in projects identified as research required by the CRC.

- ***To facilitate the communication of our research outcomes to the community through interaction with the media, museums, schools and other community associations.***

  ACE CRC researchers contributed to the continuing development of a major permanent Antarctic display at the Tasmanian Museum and Art Gallery. They also gave more than 30 presentations to non-specialist audiences such as school groups, teachers, and community organisations. The ACE CRC also participated in several different events during the Hobart Midwinter Festival including public talks and an exhibition.

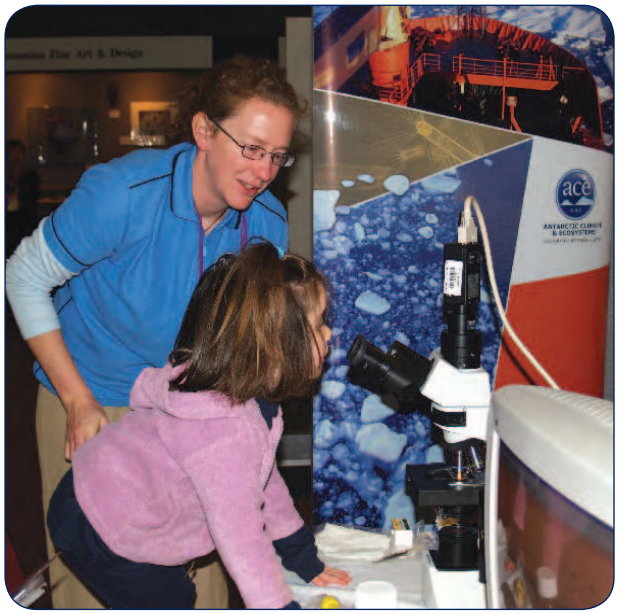
Key Achievements 2006-07

- Recruited 17 new graduate students into the Education Program. We currently have 61 students enrolled.
- Supported 8 students to attend international conferences, 2 to participate in the AWI exchange program and 4 to attend national conferences.
- Held extension courses in commercialisation and scientific poster making.
- Six ACE CRC staff members run or contribute to QMS courses. A further 3 ACE CRC funded staff and 13 other ACE CRC staff lectured in other UTAS undergraduate courses.
- Eleven students were awarded either a MSc or PhD and a further 10 are under examination.
- Twenty Tasmanian teachers toured the ACE CRC and met with researchers as part of the Antarctic Teachers' Day. The program was a joint initiative of the Tasmanian Departments of Education and Economic Development and was organised to celebrate IPY.
- Provided resources to both the Australian and international education communities through work on the international IPY Education, Outreach and Communications Subcommittee.

Plans for 2007-08

In the coming year, we will conduct a final recruitment drive to attract as large a cohort of new students as possible to maximise the use of scholarships prior to the completion of the CRC in 2010. Other programs will continue.

We will also continue to provide support for student conference travel and maintain the AWI exchange program, with two students scheduled to travel to Germany.



Progress against contractual milestones

Table 6: Education and Training Outputs and/ or Milestones

Outcome 10: Increase awareness of the climate system and our role/influence in it.

Output / Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)
Output 10.1	Train the climate specialists of tomorrow	2003-2010	Ongoing
Milestone 10.1.1	Looking South Together will attract an increasing number of top-quality students and deliver on-time completion of research theses	2003-2010	Ongoing

Outcome 11: Raise public awareness of Antarctica and Southern Ocean science.

Output / Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)
Output 11.1	Communication liaison with the general public	2003-2010	Ongoing
Milestone 11.1.1	Establish communications/liaison with community groups via ACE CRC contributions to * 'Antarctic Adventure', museums and educational facilities	2003-2010	Ongoing

* Note: 'Antarctic Adventure' no longer exists.

third year review

The ACE CRC underwent its Third Year Review in September 2006. The review report was extremely positive, with the review panel stating that the overall performance was excellent and the research world class.

Two recommendations for improvement were made by the panel:

1. The ACE CRC should develop a strategy for capitalising on current opportunities to increase its value to the Australian community. In this context, the Commercialisation and Utilisation Program needs to have more resources devoted to end-user interaction, equivalent to at least one additional FTE who should not be expected to conduct scientific research.
2. The Policy Program needs to directly address the 'science-policy gap' by explicitly recognising the need for its effort to be led by needs of policy makers, rather than being research driven.

To address recommendation 1, in June 2007 the ACE CRC appointed a Deputy CEO (Business Development), to bring a business development and marketing focus to the ACE CRC, with an emphasis on commercial sector interaction and engagement. The Deputy CEO will develop and implement a business plan for the ACE CRC.

The Policy Program has directly addressed recommendation 2, and has successfully implemented it through the following initiatives:

- Regular meetings and briefings with key Australian government agencies that focus on specific policy needs. This has led to a prioritisation of research activities and a refinement of project objectives.
- Internal ACE CRC interaction has been directly addressed by forming science-policy working groups that are developing position analyses on ocean acidification and sea-level rise; topics identified through briefing and engagement with Government research uses.
- Linking program research to policy needs is also being addressed by members of the Policy Program being active participants in the AAD's Antarctic Futures Study and in discussion of future scenarios affecting the Antarctic Treaty System. Associate Professor Haward was a member of the Australian delegation to the 30th Antarctic Treaty Consultative meeting in New Delhi; Dr Jabour attended the annual meeting of the International Association of Antarctica Tour Operators; and Dr Sandford was Team Leader in the AusAid Strategic Review of the AusAid-BoMET South Pacific Sea Level and Climate Monitoring Project Phase IV.
- Linking policy-relevant research to the work of the Policy Program has been enhanced by the appointment of Mr Andrew Jackson from the AAD as an ACE CRC contributed staff member (0.2 FTE).

The key recommendations from the Third Year Review have been ratified by the Board and have been fully implemented.

Table 7: Progress on Performance Measures

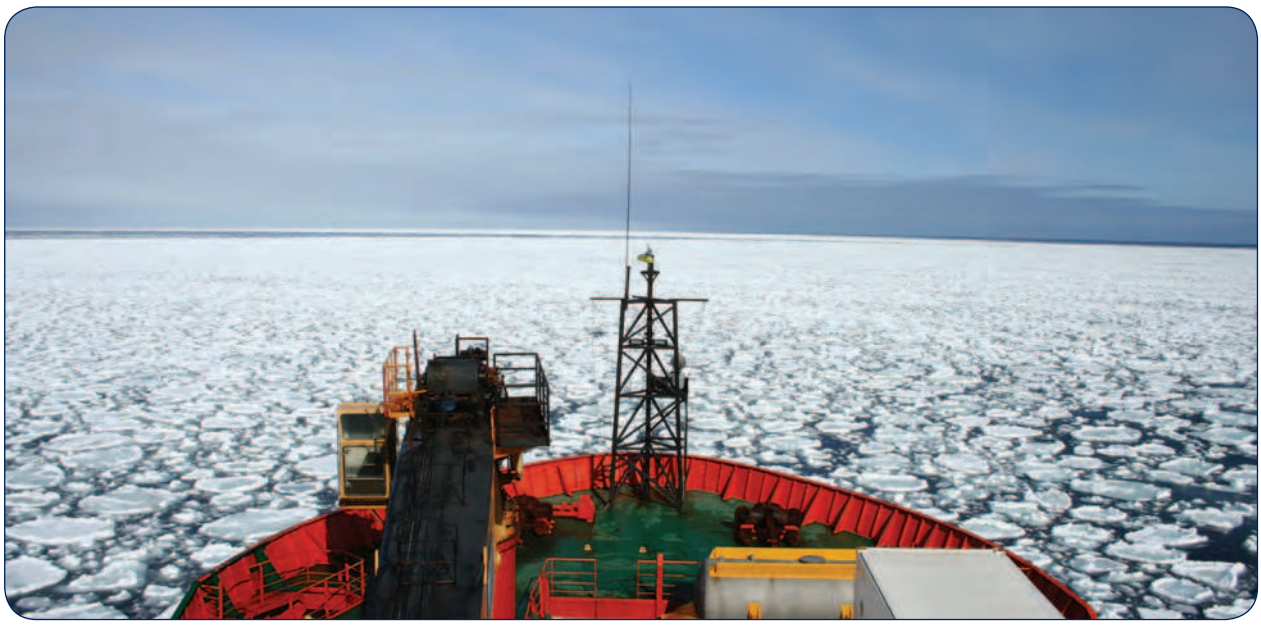
Objective 1: Enhance the contribution of long-term scientific and technological research and innovation to Australia's sustainable economic and social development

1.1 Advance Australia's aspirations for its Antarctic territory and Southern Ocean exclusive economic zones.

Performance Measures	2005-06 Progress/ Achievements	2006-07 Progress/ Achievements
International commitment to Australia's claims is augmented by wise stewardship. ACE CRC will provide scientific leadership necessary to this stewardship. Performance measures include: 1. Use of ACE CRC research by EA, AGO, and other Australian agencies in their international discussions, regulatory activities and management decisions. 2. Broad recognition by the international community that Australian Antarctic climate and ecosystem science is of the highest quality, and is targeting essential issues.	ACE CRC researchers served on 24 national and 56 international committees, editorial boards or advisory boards related to Antarctic and Southern Ocean research/ management and climate change prediction and analysis. ACE CRC researchers authored or co-authored 63 refereed papers, 3 books, 10 book chapters, 4 conference articles, 29 conference abstracts, 2 technical reports and 14 other papers. 8 ACE CRC researchers served as consultants to various industries or government agencies. 2 ACE CRC researchers served as lead author and convening lead author for chapters in the upcoming IPCC Fourth Assessment Report.	ACE CRC staff served on 21 national and 46 international committees, editorial boards or advisory boards related to Antarctic and Southern Ocean research/management and climate change prediction and analysis. 7 staff members served in international leadership roles such as chair, co-chair, or workshop co-convenor. ACE CRC researchers authored or co-authored 81 refereed papers, 20 book chapters, 53 conference abstracts, 8 special reports and 10 other papers. 4 ACE CRC researchers served as consultants to various industries or government agencies.

1.2 Increase international engagement in Southern Ocean and Antarctic research relevant to Australia's interests.

Performance Measure	2005-06 Progress/ Achievements	2006-07 Progress/ Achievements
Commitment by other nations to undertake scientific research in collaboration with the ACE CRC, in the Australian Antarctic territory and in the Southern Ocean south of Australia.	ACE CRC researchers took part in 82 international collaborations involving 17 countries. ACE CRC hosted 19 international visitors from 6 different countries.	ACE CRC researchers took part in 69 international collaborations involving 17 countries. ACE CRC hosted 21 international visitors from 7 different countries.



performance measures

Objective 2: Enhance the transfer of research outputs into commercial or other outcomes of economic, environmental or social benefit to Australia

2.1 To develop new approaches to the forecasting of ocean and ice conditions, which can be implemented for operational use by partner and other agencies.

Performance Measure	2005-06 Progress/ Achievements	2006-07 Progress/ Achievements
Uptake of these approaches by operational agencies.	Meteorologist responsible for developing sea ice data assimilation from satellite images employed; work is ongoing in the development and delivery of a sea ice analysis system for Bureau of Meteorology forecasters in the Antarctic. Planning well advanced for July 2006 International Workshop on Antarctic sea ice thickness, to be held in Hobart. Variability of the sea ice in the Mk3.0 and Mk3.5 models has been analysed and strengths of links with ENSO, SAM and Southern Ocean overturning in each sector calculated.	Conducted initial trials of coupled ocean-sea ice model through the OASIS coupler, and driven by the TPAC boundary layer atmosphere model. This was a concerted effort by the ACE CRC and our partner staff to establish the Australian coupled ocean sea ice model, which is planned to become ocean-sea ice component of the Australian Community Climate Earth System Simulator. Used satellite observations of sea surface height to show for the first time that the Antarctic Circumpolar Current is made up of multiple narrow jets, study providing a bridge between two previously unreconciled views. Led an international investigation into the controls on phytoplankton production and carbon cycling in the Subantarctic region south of Tasmania (SAZ-SENSE). The focus was on understanding why phytoplankton biomass, as seen in satellite ocean colour images, is larger east than west of Tasmania. This is a step to evaluating whether the warmer higher biomass waters east of Tasmania may expand with global warming.

2.2 To provide science for the assessment of sustainable ecosystem management.

Performance Measure	2005-06 Progress/ Achievements	2006-07 Progress/ Achievements
Use of these outputs by management agencies.	BROKE-West expedition surveyed more than 1 million square kilometres of the Southern Ocean, gathering data on krill populations and physical oceanographic properties. Developed krill population model based on empirical measurements for the southwest Atlantic, and a conceptual model for large-scale sea ice algal distribution. A large international program involving ACE CRC scientists examined the impact of anomalous atmospheric circulation on sea ice and associated biota in the West Antarctic Peninsula region. This showed the importance of extreme events on ice conditions and ice dynamics, and the devastating impact such conditions may have on local breeding success.	Hosted an Experts' Workshop on Bioregionalisation of the Southern Ocean. Information gathered from the workshop will be used to improve large-scale ecosystem modelling, ecosystem management and the development of an ecologically sound system of marine protected areas. Led an international investigation into the controls on phytoplankton production and carbon cycling in the subantarctic region south of Tasmania to understand why phytoplankton biomass is larger east than west of Tasmania. This is a step to evaluating whether the warmer higher biomass waters east of Tasmania may expand in concert with global warming. Conducted experiments to evaluate the effects of elevated CO_2 and ocean acidification on microbial communities and measured pH-induced changes in community composition and microbial processes. Developed a model to simulate algal production in sea ice.

2.3 To ensure recognition of oceanic carbon sinks and their impacts; to contribute to the effective management of carbon dioxide emissions.

Performance Measure	2005-06 Progress/ Achievements	2006-07 Progress/ Achievements
Consideration of ocean carbon sinks in carbon management plans and agreements.	Demonstrated that climate models must include both physical and biological aspects of sea ice gas dynamics to correctly simulate atmospheric carbon budgets. Demonstrated that elevated phytoplankton biomass over Kerguelen plateau is fuelled by iron inputs from deep waters; thus this region represents an area of natural persistent iron fertilisation that can inform debate about the role of iron in the control of atmospheric CO_2. Simulation of ocean acidification through the end of this century suggests major impacts on carbonate-shell forming organisms, and that the greatest effects are likely to occur in Antarctic waters; emphasises direct effect of anthropogenic CO_2 on marine ecosystem.	Modelled the interaction between climate warming and ocean acidification, which suggests that warming will moderate the pH decrease driven by anthropogenic CO_2 uptake, but not reduce the impact of acidification on the saturation state of aragonite. The precipitation of this calcium carbonate mineral will become more difficult in a warmer, more acid, ocean. Explored a global carbon cycle model of the seasonal cycles of ocean-atmosphere O_2 exchange as a tool to estimate the fixation of CO_2 into organic carbon and its transfer to the ocean interior. Results suggest that physical ventilation has a larger influence than previously realised, which models can help to address at large scale. In concert with ACE CRC partner organisation NIWA, developed a novel autonomous trace metal rosette sampling system and deployed it in the Southern Ocean for the first time, enabling a 10-fold improvement in sampling resolution compared with traditional hydrocast technology.

2.4 To provide observations essential to the consideration of climate change and variability in economic and environmental planning.

Performance Measures	2005-06 Progress/ Achievements	2006-07 Progress/ Achievements
1. Improved assessments of climate variability and change, and 2. Increased reference to this information by economic and environmental research users.	Showed that volcanic eruptions have a significant impact on ocean heat content and steric sea level and that 20th century eruptions masked sea-level rise that would otherwise have been present. Showed that the rate of sea-level rise has increased during the 20th century and provided the first comprehensive estimate of the rate of sea-level rise during the latter half of the 20th century for Pacific and Indian Ocean islands. Comparison of new measurements with historical data confirm that the bottom water south of Australia is undergoing rapid and widespread change, suggesting both the northern and southern limbs of the global overturning circulation are responding to changes in high latitude climate.	Completed a new reconstruction of Antarctic snow accumulation variability that showed no significant changes since 1957. The study showed large spatial and decadal-scale variability in accumulation, with little overall trend, especially in East Antarctica. Produced plots of regional sea-level rise in Australian region from 17 IPCC models for 2030, 2070, 2100. Showed that since 1990 sea level has been rising at the upper limit of the projections in the Third Assessment Report. Played a major role in the IPCC Fourth Assessment Report, which sets the world standard for climate change assessment.

performance measures

Objective 3: Enhance the value to Australia of graduate researchers

3.1 To become a major training centre for climate, marine, and ecosystem science.

Performance Measure	2005-06 Progress/ Achievements	2006-07 Progress/ Achievements
Increased recognition of Hobart as a top educational centre in these areas.	59 PhD and 8 Masters students associated with ACE CRC. 8 PhD and 2 Masters students under examination; 6 students awarded PhDs; 1 received Masters.	73 PhD and 7 Masters students associated with the ACE CRC. 15 PhD and 2 Masters students began their studies in the past fiscal year. 10 students under examination; 9 students awarded PhDs; 2 received Masters.

3.2 To deliver students with interdisciplinary skills useful to the climate, marine, and ecosystem research and research user communities.

Performance Measure	2005-06 Progress/ Achievements	2006-07 Progress/ Achievements
Successful placement of students within these communities.	4 students who completed their PhDs took up employment with industry/ research user groups.	7 students who completed their PhDs and 2 who completed Masters degrees took up employment with industry/research user groups.

Objective 4: To enhance collaboration among researchers, between researchers and industry or other users, and improve efficiency in the use of intellectual and other research resources

4.1 To undertake interdisciplinary research which is larger in scope than the interests of individual participants.

Performance Measures	2005-06 Progress/ Achievements	2006-07 Progress/ Achievements
Number of projects involving multiple participants. Degree to which participants view the research as larger than the sum of its parts.	ACE CRC researchers were involved in 43 national and 82 international collaborative projects involving 17 countries.	ACE CRC researchers were involved in 36 national and 69 international collaborative projects involving 17 countries.

4.2 To undertake research of direct value to research users.

Performance Measures	2005-06 Progress/ Achievements	2006-07 Progress/ Achievements
Number and success of projects involving research users in their design and completion.	Conducted 2nd Research Users' Forum for government agencies. Involved research users in ACE CRC Annual Symposium. Conducted stakeholders' workshop on extreme sea levels to help in research design.	3rd Research Users' Forum for government agencies included presentations by research users. 3rd ACE CRC Annual Symposium included research user presentations. Produced a report for the Tasmanian government that provides statistical assessments of future sea level extremes at Hobart and Burnie, using projections from the IPCC Third Assessment Report. Conducted a strategic review of the AusAID/BoMS South Pacific Sea Level and Climate Monitoring Project: Phase IV. The project is to assemble an archive of sea level and climate related data to provide partner countries with information about sea level variability and change that they need to manage their near-shore and coastal resources sustainably and to develop policies and strategies for responding to long-term trends in sea level.

glossary of terms

AAD	Australian Antarctic Division
AAS	Australian Academy of Science
ACAP	Agreement for the Conservation of Albatross and Petrel Species
ACE CRC	Antarctic Climate & Ecosystems Cooperative Research Centre
AGCS	Antarctica and the Global Climate System
AGO	Australian Greenhouse Office
AGU	American Geophysical Union
AME	Antarctic Marine Ecosystems Program (ACE CRC)
AINSE	Australian Institute of Nuclear Science and Engineering
AMSA	Australian Marine Sciences Association
ANARE	Australian National Antarctic Research Expeditions
ANCAR	Australian National Committee for Antarctic Research
ANSTO	Australian Nuclear Science and Technology Organisation
Antarctic CRC	CRC for Antarctica and the Southern Ocean
ANU	The Australian National University
APAC	Australian Partnership for Advanced Computing
ASAC	Antarctic Science Advisory Committee
ASLO	American Society of Limnology and Oceanography
ASPeCt	Antarctic Sea Ice Processes and Climate
ATS	Antarctic Treaty System
AusCOM	Australian Climate Ocean Model
AUV	Automated Underwater Vehicle
AWI	Alfred Wegener Institute (Germany)
BAS	British Antarctic Survey
BMRC	Australian Bureau of Meteorology Research Centre
BoM	Australian Bureau of Meteorology
CAML	Census of Antarctic Marine Life
CASO	Climate of Antarctica and the Southern Ocean
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CCLR	Council for the Central Laboratory of the Research Councils (UK)
CERES	Clouds and the Earth's Radiant Energy System
CIGL	Centre for International & Global Law (U. Sydney)
CliC	Climate & Cryosphere Program
CLIM-OSS	Climate - Sezione Analisi Sperimentali ed Osservazioni (Italy)
CLIVAR	Climate Variability & Predictability Program
CMAR	CSIRO Marine & Atmospheric Research
CNES	Centre National d'Etudes Spatiales (France)
CO_2	Ocean Control of Carbon Dioxide Program (ACE CRC)
CRC	Cooperative Research Centre
CVC	Climate Variability and Change Program (ACE CRC)
DED	Tasmanian Department of Economic Development
DMIP	Data Management and Information Panel (of CliC)
DPIWE	Tasmanian Department of Primary Industries, Water and Environment
DSTO	Defence Science and Technology Organisation
EEZ	Exclusive Economic Zones
EGU	European Geosciences Union
ENEA	Ente per le Nuove Technologie, l'Energia e l'Ambiente (Italy)
ERF	Estuarine Research Foundation (USA)
ESA	European Space Agency
FAO	Food and Agriculture Organisation (United Nations)
FRISP	Forum for Research into Ice Shelf Processes
GFDL	Geophysical Fluid Dynamics Laboratory

glossary of terms

GOOS	Global Ocean Observing System
IASOS	Institute for Antarctic and Southern Ocean Studies (UTAS)
ICCED	Integrated Analyses of Circumpolar Climate Interactions and Ecosystem Dynamics in the Southern Ocean
ICRW	International Convention for the Regulation of Whaling
ICSU	International Council of Science
IGS	International Glaciological Society
IOCCP	International Ocean Carbon Program
IPCC	Intergovernmental Panel on Climate Change
IPICS	International Partnerships in Ice Core Science
IPY	International Polar Year 2007-2008
ISPOL	Ice Station Polarstern (Germany)
IUU	Illegal, Unreported and Unregulated (fishing)
iVEC	Interactive Virtual Environments Centre (Perth, WA)
IWC	International Whaling Commission
JAMSTEC	Japan Marine Science and Technology Center
JPL	Jet Propulsion Laboratory (USA)
JSA	Japanese Space Agency
KEOPS	Kerguelen compared study of Ocean and Plateau in surface waters
LEGOS	Laboratoire d'Etudes en Geophysique et Oceanographie Spatiales (France)
LOSC	Law of the Sea Convention
NASA	National Aeronautics and Space Administration (USA)
NILOS	Netherlands Institute for Law of the Sea
NIPR	National Institute of Polar Research (Japan)
NIWA	National Institute for Water and Atmospheric Research (NZ)
NOAA	National Oceanic and Atmospheric Administration (USA)
NSF	National Science Foundation (USA)
OASIS	Ocean Acquisition System for Interdisciplinary Science
POOZ	Permanent Open Ocean Zone
PRNA	Programma Nazionale de Recerche Antartide (Italy)
QMS	Quantitative Marine Science (UTAS)
SAZ	Subantarctic Zone
SC-CCAMLR	Scientific Committee of the Commission for the Conservation of Antarctic Marine Living Resources
SCAR	Scientific Committee on Antarctic Research
SCOR	Scientific Committee on Oceanographic Research
SGI	Silicon Graphics International
SIO	Scripps Institution of Oceanography (USA)
SLR	Sea-level Rise Program (ACE CRC)
SO	Southern Ocean
SOLAS	Surface Ocean Lower Atmosphere Study
SMRU	Sea Mammal Research Unit (UK)
SSG	Scientific Steering Group
TOS	The Oceanographic Society
TPAC	Tasmanian Partnership for Advanced Computing
UNCLOS	United Nations Convention on the Law Of the Sea
UNESCO	United Nations Educational, Scientific and Cultural Organization
USGS	United States Geological Survey
UTAS	University of Tasmania
VERTIGO	Vertical flux in the Global Ocean
WCRP	World Climate Research Programme
WMO	World Meteorological Organization

appendices

table of contents

appendix a: publications

Refereed Journals

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appendix a: publications

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appendix b: research collaboration

National Collaborative Projects

Project	ACE Researcher	Collaborator, Affiliation
Australian Community Ocean Model	Bindoff N, Roberts J, Heil P	Alves O, *BMRC*
Hyphenated capillary electrophoresis - mass spectrometry facility	Bowie A	Haddad P, *School of Chemistry, UTAS*
Selenium as a key micronutrient in primary productivity in the SO	Bowie A	Butler E, *CMAR*; Wake B, *UTAS*
Trace metal content of SO phytoplankton material above Kerguelen plateau: Implications for carbon transfer to the deep sea	Bowie A	Townsend A, *Central Science Laboratory, UTAS*
Biogeochemical cycling of trace elements, and their influence on ocean primary production and Earth's climate: An initiative for Australian leadership in the international GEOTRACES program	Bowie A	Ellwood M, *ANU*; Butler E, *CMAR*
AME01 – Modelling oceanography in support of ecosystem models	Constable A, Sporcic M, Matear R	Fulton B, Gray R, *CSIRO*
Amery sediment core analysis	Craven M	Post A, *Geoscience Australia*; Hemer M, *CSIRO*
Amery seafloor benthos	Craven M	Riddle M, *AAD*
Amery marine ice analysis	Craven M	Senden T, *ANU*
Australia's Antarctic Agenda	Haward M	Rothwell D, *ANU*
Australian interests in Antarctica	Haward M	Bergin A, *Australian Strategic Policy Institute*
Comparative polar oceans governance	Haward M	Kaye S, *University of Melbourne*; Rothwell D, *ANU*; Rayfuse R, *UNSW*
The SO and sea ice response to climate variability and change	Heil P, Bindoff N	Marsland S, *CMAR*; Roberts J, *TPAC*
Integrated Ocean Drilling Program	Howard W	Arculus R, De Deckker P, Exon N, *ANU*
Stable isotopic variability in planktonic and benthic foraminifera and pteropods	Howard W, Moy A	Gagan M, *ANU*
Sea ice analysis and forecast	Lieser J	Worby T, Massom , Heil P, Allison I, *AAD*; Bindoff N, Roberts J, *IASOS*; Adams N, Reid P, *Bureau of Meteorology*; Rintoul S, Oke P, Marsland S, *CSIRO*
Sea Ice freeboard from laser altimetry	Lieser J	Worby T, Massom R, Allison I, Brolsma H, Handsworth R, *AAD*
Impact of patterns of anomalous atmospheric circulation on sea ice and biota	Massom R	Pook M, *CMAR*
Impact of patterns of anomalous atmospheric circulation on the break-up of the Larsen B Ice Shelf	Massom R	Simmonds I, *University of Melbourne*
SO carbon cycle	Matear R	McNeil B, *UNSW*
An integrated study of processes linking sea ice and biological ecosystem elements off East Antarctica during winter	Meiners K	Allison I, Davidson A, Hosie G, Nicol S, Wright S, Constable A, Worby T, McMinn A, Trull T, Williams G, Kawaguchi S, Wadley V, *ACE CRC, AAD, UTAS*
Sea ice primary production off eastern Antarctica	Meiners K	McMinn A, *UTAS*
Cumulative solar irradiance and potential large-scale sea ice algae distribution off East Antarctica	Meiners K	Raymond B, *AAD*
Isotopic and elemental tracers in ice and snow	Morgan V	Rosman K, *Curtin University of Technology*
Stable isotopic variability in planktonic and benthic foraminifera and pteropods	Moy A, Howard W	Gagan M, *ANU*

appendix b: research collaboration

Project	ACE Researcher	Collaborator, Affiliation
10Be in Antarctic ice and radiomethane in Antarctic ice	Pedro J, Morgan V, Curran M, van Ommen T, Smith B	Smith A, Fink D, *ANSTO*
The CSIRO Mk3L climate system model	Phipps S, Roberts J, Bindoff N, Hyland G	England M, *Australian Research Council Research Network for Earth System Science*
Wealth from Oceans National Research Flagship	Rintoul S, Church J, Tilbrook B	*CSIRO*
Australian Climate Change Science Program	Rintoul S, Church J, van Ommen T, Tilbrook B	*AGO, CSIRO*
AusCOM	Roberts J	Hirst T, Phipps S, Bi D, O'Farrell S, Collier M, Marsland S, Matear R, *CSIRO*; Alves O, Brassington G, Tseitkin F, *BMRC*; Heil P, *AAD*; Larson J, Kahn M, *APAC*; Baird M, *UNSW*
East Antarctic and circum-Antarctic climate history from ITASE coring in Eastern Wilkes Land	van Ommen T, Curran M, Morgan V, Smith B	Goodwin I, *University of Newcastle*
Air sampling from Antarctic firn and ice	van Ommen T Morgan V	Etheridge D, *CSIRO-MAR*
Electromagnetic induction techniques for measuring Antarctic sea ice thickness	Worby A	Reid J, *UTAS*; Bishop J, *Mitre Geophysics Pty Ltd.*
Analysis of floe size data from ISPOL	Worby A	Steer A, *IASOS*
Analysis of AMSR-E snow thickness data using in situ data from ARISE	Worby A	Steer A, *AAD*
Effect of ocean acidification on marine microbes. (AAS Project 40) & Effect of elevated CO_2 on phytoplankton	Wright S, Davidson A	Nash G, *AAD*; McMinn A. *IASOS*; Jones G, *Southern Cross University*; Ralph P, *University of Technology Sydney*; Beardall J, *Monash University*; Griffiths B, Tilbrook B, Blackburn S, Thompson P, *CSIRO Marine Research*; Hallegraeff G, *UTAS Plant Science*

International Collaborative Projects

Project	ACE researcher	Collaborators & affiliations
Prediction of the future mass balance of the polar ice sheets under a range of possible climate conditions	Allison I	Gogineni P, *NSF Science and Technology Center for Remote Sensing of Ice Sheets, University of Kansas* (USA)
Surface meteorological measurements in East Antarctic using automated weather stations	Allison I	Xiao C, Bian L-G, Qin D-H, *Chinese Meteorological Administration* (CHINA)
Amery Ice Shelf – ocean interaction and marine ice properties	Allison I, Craven M	Li Y-S, Sun B, *Polar Research Institute of China* (CHINA)
AUKEGGS	Bindoff N, Roberts J, Hyland G	Woolf A, *CCLRC Rutherford Appleton Laboratory* (UK)
Impact of atmospheric deposition on the distribution and speciation of trace elements in the upper ocean – focus on iron in the Sargasso Sea	Bowie A	Sedwick P, *Bermuda Institute of Ocean Sciences* (BERMUDA); Church T, *University of Delaware*; Sholkowitz E, *WHOI* (USA)
Redox and colloidal iron biogeochemistry in surface Atlantic waters and its role in ocean productivity	Bowie A	Worsfold P, *University of Plymouth*; Ussher S, Achterberg E, *National Oceanography Centre, Southampton* (UK)
Dissolved iron in the Australian sector of the SO (SR3 line)	Bowie A	Sohrin Y, *Kyoto University* (JAPAN)

appendix b: research collaboration

Project	ACE researcher	Collaborators & affiliations
Controls on Ross Sea algal community structure	Bowie A	DiTullio G, *Grice Marine Laboratory*; Hutchins D, *University of Delaware*; Smith W, *Virginia Institute of Marine Science* (USA); Sedwick P, *Bermuda Biological Station for Research* (BERMUDA); Dunbar R, *Stanford University* (USA); Tortell P, *University of British Columbia* (CANADA)
AMISOR	Craven M, Allison I	Fricker H, *SIO* (USA)
Amery Ice Shelf ice cores	Craven M, Allison I	Yuansheng L, Minghong C, *Polar Research Institute of China* (CHINA)
Borehole ice camera probe	Craven M, Allison I	Carsey F, Behar A, *California Institute of Technology, JPL* (USA)
Deglacial ice core chemistry	Curran M, Morgan V, van Ommen T, Smith B	Steffensen J-P, Dahl-Jensen D, *University of Copenhagen* (DENMARK)
Holocene chemistry of the Law Dome DSS ice core	Curran M, Morgan V, van Ommen T, Smith B	Mayewski P, *University of Maine* (USA)
Trace ion and metal analysis techniques and applications	Curran M, van Ommen T, Morgan V	McConnell J, Edwards R, *Desert Research Institute* (USA)
Comparative polar oceans governance	Haward M	VanderZwaag D, *Dalhousie University*; Huebert R, *University of Calgary* (CANADA)
Complete mapping of Antarctic sea ice dynamics and thickness	Heil P, Massom R	Haas C, *AWI* (GERMANY); Geiger C, *CRREL*; Clemente-Colon P, *NSIDC* (USA)
Antarctic Fast-Ice Network	Heil P, Massom R	Haskell T, *IRL*; Langhorne P, *Otago University*; Trodahl J, *Victoria University* (NZ); Haas C, *AWI* (GERMANY); Melnikov I, *AARI* (RUSSIA); Ushio S, *NIPR* (JAPAN)
Sea ice motion, deformation, thickness, and lead dynamics in the Antarctic	Heil P, Massom R Worby A	Haas C, *AWI* (GERMANY); Geiger C, *CRREL*; Clemente-Colon P, *NSIDC* (USA); Maksym E, *BAS* (UK)
Trace-metal and boron isotopic composition of SO planktonic foraminifera	Howard W, Moy A	Dunbar G, Carter L, *Victoria University of Wellington* (NZ)
IGBP-SCOR Fast Track Initiative 'Ocean Acidification'	Howard W, Moy A	Co-Chairs: Elderfield H, *Cambridge University* (UK); Riebesell U, *IFM-GEOMAR* (GERMANY); Caldeira K, *Stanford University*; Kleypas J, *National Center for Atmospheric Res.*; Broecker W, *Lamont-Doherty Earth Observatory* (USA); Bassinot F, *Lab. des Sciences du Climat et de l'Environnement* (FRANCE)
SAZ-SENSE	Howard W, Trull T, Bowie A, Wright S, Griffiths B, Tilbrook B	Queguinier B, Armand L, *Centre d'Océanologie de Marseille* (FRANCE); Boyd P, *Nat'l Inst. of Water & Atmosphere* (NZ); Brussaard C, *Royal Institute for Sea Research* (NETHERLANDS); Difiore P, *Princeton University*; Lam P, *WHOI* (USA); Dehairs F, *Vrijie Universiteit Brussel*; Cardinal D, *Musée Royal de l'Afrique Centrale* (BELGIUM)
Sea ice satellite product validation	Lieser J	Andersen S, *Danish Meteorological Institute* (DENMARK)
IPY Project POLYANNA	Marsland S, Massom R	Zambianchi E, *Parthenope University* (ITALY); Ackley S, *University of Texas* (USA); Brandon M, *The Open University*; Flocco D, *Centre for Polar Observation and Modelling*; Willmott A, *Proudman Oceanographic Laboratory* (UK)

appendix b: research collaboration

Project	ACE researcher	Collaborators & affiliations
Impact of patterns of anomalous atmospheric circulation and sea ice on the break-up of the Larsen B Ice Shelf	Massom R	Scambos T, *NSIDC, University of Colorado*; Stammerjohn S, *Lamont-Doherty Earth Observatory, Columbia University*; Fahnestock M, *University of New Hampshire*; MacAyeal D, *University of Chicago*; Sponsler M, *Stormsurf Ltd.;* Aster R, *New Mexico Tech.* (USA); Turner J, *BAS* (UK); Squire V, Williams T, *University of Otago* (NZ)
Review of bi-polar polynya processes	Massom R	Barber D, *University of Manitoba* (CANADA)
Polar remote sensing	Massom R	Lubin D, *SIO; University of California San Diego* (USA)
Behaviour of, and rift development on, the Mertz Glacier tongue	Massom R	Fricker H, *SIO; University of California San Diego* (USA); Legresy B, *CNRS, Toulouse, France* (FRANCE)
ARISE remote sensing validation experiment – data analysis	Massom R	Comiso J, *NASA Goddard Space Flight Center*; Scambos T, Haran T, *NSIDC, University of Colorado*; Key E, *University of Miami* (USA); Enomoto H, Tateyama K, *Kitami Institute of Technology*; Tamura T, *University of Hokkaido* (JAPAN); Pfaffling A, *AWI* (GERMANY)
Impact of patterns of anomalous atmospheric circulation on sea ice in the West Antarctic Peninsula region in 2005	Massom R	Lefebvre W, *Université Catholique de Louvain* (BELGIUM); Harangozo S, *BAS* (UK); Stammerjohn S, *Lamont-Doherty Earth Observatory, Columbia University*; Scambos T, *NSIDC, University of Colorado*; Fowler C, *Colorado Center for Astrodynamics Research* (USA)
An integrated study of processes linking sea ice and biological ecosystem elements off East Antarctica during winter	Meiners K	Granskog M, *University of Lapland* (FINLAND); Werner I, *University of Kiel* (GERMANY); Thomas D, *University of Wales, Bangor* (UK); He J, *Polar Research Institute of China* (CHINA)
KEOPS modelisation	Mongin M	D'Ovidio F, *LMD Paris*; Doglioli A, *COM Marseille* (FRANCE)
Radiocarbon age of late glacial deep water from the SO	Moy A, Howard W	Broecker W, *Lamont-Doherty Earth Observatory* (USA); Barker S, *Cardiff University* (UK)
Boron isotopic tracers of ocean acidification	Moy A, Howard W	Bijma J, *AWI* (GERMANY)
SOPHOCLES	O'Farrell S	*CLIC/CLIVAR/SCAR* (International project across numerous countries and organizations)
Using tracers to describe processes governing heat uptake in the ocean.	O'Farrell S	Gregory J, *University of Reading*; Lowe J, *Hadley Centre* (UK)
Analysis of Antarctic Climate processes in IPCC Models.	O'Farrell S	Turner J, *BAS* (UK); Bromwich D, *Byrd Polar Research Center* (USA)
Improving our understanding of Antarctic sea ice ecosystems using numerical models	Pasquer B	Belém A, *University Center of Monte Serrat/ UNIMONTE* (BRAZIL)
ACECRC/WWF bioregionalisation workshop	Raymond B, Constable A	Grant S, *BAS* (UK) and others
Water mass variability in the SO	Rintoul S	Aoki S, *Hokkaido University* (JAPAN)
Transport of the Kerguelen deep western boundary current	Rintoul S, Church J, Sokolov S	Watkatsuchi M, Fukamachi Y, *Hokkaido University* (JAPAN)
CLIMA project	Rintoul S	Spezie G, *University of Naples* (ITALY)
SURVOSTRAL	Rintoul S	Morrow R, *LEGOS* (FRANCE)
Earth Systems Science OPeNDAP computer server framework	Roberts J, Bindoff N, Hyland G, Phipps S	Woolf A, *CCLRC Rutherford Appleton Laboratory* (UK)

appendix b: research collaboration

Project	ACE researcher	Collaborators & affiliations
Managing science-intensive public policy in Australia and the USA	Sandford R	Karl H, *MIT* (USA)
Microparticle measurements in ice cores	Smith B, van Ommen T, Morgan V, Curran M	Petit J-R, *Laboratoire de Glaciologie et Géophysique de l'Environnement* (FRANCE)
Glacier recession, Heard Island	Thost D	Truffer M, *University of Alaska* (USA)
Southern Ocean CO_2	Tilbrook B	Goyet C, *Université Perpignan*; Poisson A, Metzl N, *Université Pierre et Marie Curie* (FRANCE)
Mixed layer oxygen saturation in the SO	Tilbrook B	Bender M, *Princeton University* (USA)
KEOPS	Trull T, Bowie A, Griffiths B, Remenyi T	Blain S, Queguiner B, Armand L, *University of Marseille* (FRANCE)
VERTIGO	Trull T, Bray S	Buesseler K, *WHOI* (USA)
Water isotopes and solar climate signals	van Ommen T	Usoskin I, *University of Oulu* (FINLAND); *Max-Plank Institut für Sonnensystemforschung* (GERMANY)
Atmospheric methane records from the Law Dome DSS ice core (as part of AGO CCSP project 'Abrupt Climate Change and North-South Climate Connections')	van Ommen T, Morgan V	Chappellaz J, *Laboratoire de Glaciologie et Géophysique de l'Environnement* (FRANCE)
ICECAP: Investigating the cryospheric evolution of the central Antarctic plate: Internationally coordinated long-range aerogeophysics over East Antarctica's Domes A and C and the Aurora subglacial basin	Warner R, Young N	Blankenship D, *Institute for Geophysics, University of Texas* (USA); Siegert M, *University of Edinburgh* (UK) + 18 others from USA, UK, GERMANY, AUSTRALIA
Antarctica's subglacial waters: Is frazil ice a vital factor?	Warner R	Williams M, *NIWA* (NZ)
Understanding changing ice flow and rift propagation in the Mertz Glacier Tongue, East Antarctica	Warner R, Massom R, Young N	Legresy B, *CNRS LEGOS* (FRANCE); Fricker H, *SIO* (USA)
CRAC-ICE: Collaborative research into Antarctic calving and iceberg evolution	Warner R, Young N, Coleman R	Hellmer H, *AWI* (GERMANY); Fricker H, *SIO* (USA) + 13 others from USA, GERMANY, BRASIL, FRANCE, UK
Electromagnetic induction techniques for measuring Antarctic sea ice thickness	Worby A	Pfaffling A, Haas C, *AWI* (GERMANY)
Antarctic sea ice thickness distribution from the ASPeCt data archive	Worby A	Geiger C, *Cold Regions Research and Eng. Lab*; Ackley S, *University of Texas San Antonio*; Van Woert M, *National Science Foundation*; DeLiberty T, *University of Delaware* (USA)
Assessment of Envisat radar altimetry data over East Antarctic sea ice	Worby A	Laxon S, Giles K, *University College London* (UK)
Diatom induced silicon isotopic fraction in Antarctic sea ice	Worby A	Fripiat F, Andre L, *Royal Museum for Central Africa*; Cardinal D, Tison J-L, *University of Brussels* (BELGIUM)
Analysis of sea ice properties from the ISPOL ice station program	Worby A	Haas C, Willmes S, Nicolaus M, *AWI* (GERMANY); Tison J-L, De Jong J, De Lille B, Lannuzel D, *University of Brussels* (BELGIUM)
SIMBA: Sea ice mass balance in Antarctica	Worby A, Heil P	Ackley S, *Clarke University* (USA) and 15 others
Drift and deformation of sea ice in the western Weddell Sea	Worby A, Heil P	Hutchings J, Hibler W, *International Arctic Research Centre* (USA); Johansson M, Launiainen J, *Finnish Institute of Marine Research* (FINLAND)

appendix b: research collaboration

Project	ACE researcher	Collaborators & affiliations
Assessment of NASA's Geoscience Laser Altimeter for measuring sea ice freeboard	Worby A, Lieser J, Massom R	Zwally J, Donghui Y, Markus T, *NASA/ Goddard Space Flight Center* (USA)
Analysis of AMSR-E snow thickness data using in situ data from ARISE	Worby A, Massom R	Markus T, *NASA/Goddard Space Flight Center* (USA); Lytle V, *Norwegian Polar Institute* (NORWAY)
Effect of ocean acidification on marine microbes. (AAS Project 40) & Effect of elevated CO_2 on phytoplankton	Wright S, Davidson A	Lefevre D, *Laboratoire de Microbiologie Geochimie Ecologie Marine* (FRANCE); Dehairs F, *Vrije Universiteit Brussel* (BELGIUM); Brussard C, *Royal Netherlands Institute for Sea Research (NIOZ)* (NETHERLANDS)
Australian – Italian collaborative project on the mass budget of the East Antarctic ice sheet	Young N	Frezzotti M, Tabacco I, Forieri, A, *ENEA-CLIM-OSS & Università degli Studi di Milano* (ITALY)
Radio echo sounding measurements of ice thickness in the Lambert Glacier tributaries and its hinterland	Young N	Damm V, *Bundesanstalt fur Geowissenschaften und Rohstoffe (BGR)* (GERMANY)
Global Land Ice Monitoring from Space (GLIMS)	Young N	Kargel J, *Department of Hydrology and Water Resources, University of Arizona, & USGS* (USA)

Staff Exchanges

Staff Name	Institution visited	Purpose of exchange
Bindoff N	*IFM-GEOMAR* (GERMANY)	Preparation of final draft of Chapter 5 of the IPCC WG1 Report fourth assessment. WG1 report
Bowie A	*University of Plymouth* (UK)	Collaborative research on the intercomparison of dissolved iron in Atlantic seawater
	NIWA (NZ)	Collaborative research on trace metal studies during SAZ-SENSE
Howard W	*Lamont-Doherty Earth Observatory* (USA)	Seminar on ACE research
	Rutgers University (USA)	Post-cruise briefing
McMinn A	*University of Hokkaido* (JAPAN)	IAI, fieldwork
	University of Tromso (NORWAY)	Plenary lecturer, Arctic Frontiers Meeting
Meiners K	*AWI* (GERMANY)	Training, research
	Wageningen University Research (NETHERLANDS)	Training, research
	University of Kiel (GERMANY)	Research
Mongin M	*Laboratoire d'Océanographie et de Biogéochimie Marseille* (FRANCE)	Modelisation KEOPS project
	Laboratoire de Météorologie Dynamique Paris (FRANCE)	Lagrangian Diagnostic KEOPS project
O'Farrell S	*WHOI* (USA)	Presentation on SIOMip (now SOPHOCLES) to Arctic modelling group AOMIP
Phipps S	*CCLRC Rutherford Appleton* (UK)	International collaboration
Tilbrook B	*Université Pierre et Marie Curie* (FRANCE)	Plan collaborative research and joint publications
Trull T	*WHOI* (USA)	VERTIGO and KEOPS stable isotope discussions and research, UTAS-WHOI education program links discussions
	University Paul-Sabatier, CNES (FRANCE)	KEOPS, GEOTRACES, IPY discussions and research
Young N	*GAMMA Remote Sensing* (SWITZERLAND)	Training in SAR interferometry and cooperation in InSAR applications

appendix b: research collaboration

International Visitors

Visitor's Name	Institution & affiliation	Purpose of visit
Blondeau N	*Ecole Polytechnique, Paris* (FRANCE)	Student internship, working on models of sea-level rise
Edwards R	*Desert Research Institute* (USA)	Collaborative work on Law Dome trace element records over the last 200 years
Fricker H	*SIO* (USA)	Cooperation on the Amery Ice Shelf program; AMISOR Workshop
Gehrels R	*School of Geography, University of Plymouth* (UK)	Collaborate in project estimating historic sea-level in Tasmania using cores from saltmarshes
Hegseth E	*University of Tromsø* (NORWAY)	Study leave
Hildreth R	*University of Oregon* (USA)	Fulbright Conference and discussions on oceans and fisheries governance
Ishimaru T	*Tokyo University of Marine Science and Technology* (JAPAN)	Discuss mooring collaboration for SO climate-carbon cycle science
Jouandet M-P	*Laboratoire d'Océanographie et de Biogéochimie Marseille* (FRANCE)	KEOPS carbon budget
Lam P	*WHOI* (USA)	Collaborative research on particulate iron and carbon cycling in the Subantarctic ocean
Lannuzel D	*Université Libre de Brussels* (BELGIUM)	Collaborative research on iron distributions in the sub-Antarctic SO south of Australia
Legrésy B	*LEGOS/CNRS Toulouse* (FRANCE)	Discussion of dynamics of Mertz Glacier Tongue; cooperation on analysis of satellite radar altimeter data in assessment of ice sheet mass budget
Loulergue L	*Laboratoire de Glaciologie et Géophysique de l'Environnement* (FRANCE)	Collaborative work on abrupt climate change and 8200 B.P. climate event
McConnell J	*Desert Research Institute* (USA)	Collaborative work on Law Dome trace element records over the last 200 years
Measures C	*University of Hawai'i* (USA)	Collaborative research on the use of dissolved aluminium as a tracer of atmospheric dust inputs to the ocean
Poisson A	*Université Pierre et Marie Curie* (France)	Joint research on *Astrolabe*
Roberts A	*IARC/ University of Alaska* (USA)	Discussions on modelling initiative
Rodehach C	*University of Lamont* (USA)	Discuss ocean carbon inventory estimates
Samyn D	*Laboratoire de Glaciologie, Département des Sciences de la Terre et de l'Environ nement,Université Libre de Bruxelles* (BELGIUM)	Discussions about ice deformation studies
Sauter E	*AWI* (GERMANY)	Consider polar commercialisation strategies
Schoemann V	*Université Libre de Brussels* (BELGIUM)	Collaborative research on the importance of iron for phytoplankton productivity in the subantarctic SO south of Australia
Warner J	*US Embassy, Canberra* (USA)	Briefing of work of ACE CRC Policy Program

appendix c: committees

National Committees

Staff Name	Name of Committee
Allison I	National Committee for Earth System Science (AAS), July 2006-February 2007
	Antarctic Research Assessment Committee, Physical Sciences
	Local Organizing Committee, SCAR Open Science Conference 2006, Hobart (*Chair*)
Bindoff N	APAC Program Coordination Committee, 2004 to present
	ANARE (ASA and SPMCC), 2003 to present (*Oceanography Coordinator*)
	BlueNET Steering Committee, 2005 to present
	ARCNESS Board (*IT Node Coordinator*), 2005 to present
Constable A	Australian Fisheries Management Authority – Subantarctic Resource Assessment Group
Haward M	CCAMLR Consultative Forum
	Mawson's Huts Gifts to the Nation Steering Committee
Howard W	MARGO – Australian Committee for Marine Geoscience (*Chair*) 2007-2010
Lambeck K	AAS (*President*) 2006 – 2010
McMinn A	ANCAR
Michael K	TERSS Board (Representative for UTAS)
Roberts J	ACCESS Ocean IT Sub-Working Group, 22 Mar 2007 to present
Sandford R	Tasmanian NRM South Committee, 2006 to present
	NRM South Executive Committee, 2006 to present
van Ommen T	National Committee for Earth Systems Science (AAS)
	Antarctic Research Assessment Committee, Physical Sciences
Young N	Board of Management for TERSS
Zicus S	Australian IPY Education, Outreach and Communication Committee

International Committees

Staff Name	Name of Committee
Allison I	ICSU/WMO Joint Committee for IPY 2007-08 (*Co-Chair*)
	IGS Committee (*Vice-President*)
	International Commission for Polar Meteorology (ICPM), International Association of Meteorology and Atmospheric Sciences
	IPCC Fourth Assessment Report, July 2006-February 2007 (*Lead Author, Chapter 4:"Observations: Changes in Snow, Ice and Frozen Ground," Working Group I*)
	Editorial Advisory Board, *Antarctic Science*
	Editorial Advisory Board, *Terra Antarctica*
	SCAR IPY Committee
	Scientific Organizing Committee, SCAR Open Science Conference 2008, St Petersburg, January 2007-July 2007
Bindoff N	IPY Data Management Committee, 2000 to present
	IPCC Fourth Assessment Report, 2004 to present (*Coordinating Lead Author [with J Willebrand] Chapter 5 'Observations: oceanic climate change and sea level'*)
	CLIVAR Expert Team on Climate Change Detection, Monitoring and Indices, 2002-2006
Bowie A	GEOTRACES: marine biogeochemical cycles of trace elements and their isotopes in the Pacific basin 2007 ongoing
Church J	Joint Scientific Committee of the WCRP (*Chair*)

appendix c: committees

Staff Name	Name of Committee
Constable A	CCAMLR Working Group on Ecosystem Monitoring and Management, 17-28 July 2006 (*Representative for Australia*)
	CCAMLR Working Group on Fish Stock Assessment, 10-14 July 2006 (*Representative for Australia*)
	CCAMLR Steering Committee on bioregionalisation for the CCAMLR Convention Area (*Representative for Australia*)
	Steering Group for CCAMLR-IWC Workshop on data requirements for Antarctic marine ecosystem models (*Co-Convenor*)
Haward M	Ocean and coastal management journal (*Editorial board member*)
Massom R	IGOS (International Global Observing Strategy) Cryosphere Theme (*A lead author of the Theme Report*)
	Science Steering Group, US NSF Palmer Long-Term Ecological Research Program
	NASA Aqua AMSR-E Science & Software Team
	International Programme for Antarctic Buoys
	Scientific Editorial Board, Annals of Glaciology 44 (*Scientific Sub-Editor*)
Matear R	European CarboOcean project (*Science Steering Committee member*)
McMinn A	Arctos (International Arctic Foundation) (*International Advisor*)
Nicol S	SCAR Group of Experts on SO Oceanography
O'Farrell S	SIOMIP/SOPHOCLES (*Co-Chair*)
	International Commission for Polar Meteorology and Climatology
Rintoul S	Southern Hemisphere Meteorology and Oceanography Committee of the American Meteorological Society
	SCAR/SCOR Expert Group on Oceanography
	CLIVAR/CliC/SCAR SO Implementation Panel
	SO Observing System Design Team
Tilbrook B	International Ocean Carbon Coordination Project
	CLIVAR Indian Ocean Panel
Trull T	GOOS Steering Committee, 2003-2006
	Integrated Marine Biogeochemistry and Ecosystem Research (IMBER), 2006 to present (*National representative*)
	SCOR Research Experts Working Group on Upper Ocean Export, 2003-2006
van Ommen T	SCAR Standing Scientific Group on Physical Sciences, Executive committee (*Secretary*)
Williams G	International Antarctic Zone Program (*Australian and New Zealand representative*)
Worby A	SCAR ASPeCt SSG (*Co-Chair*)
	WCRP/SCAR CliC SSG(*Co-Vice Chair*)
	WCRP/SCAR CliC Marine Cryosphere program (*Project Leader*)
	SCAR Committee on AGCS
Young N	European Space Agency Category 1 Advisory Group
	European Space Agency ENVISAT Symposium Science Committee, 2006-2007
Zicus S	Education, Outreach & Communication Subcommittee of the ICSU/WMO Joint Committee for IPY 2007-08 (*Co-Chair*)

appendix d: presentations

National scientific presentations

Staff name	Title or topic	Type	Event	Location
Allison I	Overview of the AMISOR project	Workshop	Amery Ice Shelf Workshop	Hobart, TAS
Allison I	The Australian Automatic Weather Station network in Antarctica and its applications	Oral	2007 Argos Users meeting	Hobart, TAS
Allison I	Melting ice on Earth: Hot evidence of climate change, but cold comfort for our future.	Seminar	AAD World Environment Day Seminar	Hobart, TAS
Allison I	Setting the scene: sea ice	Oral	ACE CRC Symposium: Ocean: Physical Changes – Ecosystem Responses – Management Issues	Hobart, TAS
Bindoff N	Impact of climate variability on global ocean water masses: 1950-1990s	Oral	AMOS Conference	Adelaide, SA
Bindoff N	Climate difference signals in the global oceans	Seminar	Monash seminar	Melbourne, VIC
Bindoff N	Science behind the Summary for Policy Makers	Seminar	IASOS seminar	Hobart, TAS
Bindoff N	Observations: Oceanic climate change and sea level	Seminar	IASOS seminar	Hobart, TAS
Bindoff N	Observations: Oceanic climate change and sea level	Seminar	CSIRO MAR seminar	Aspendale, VIC
Bindoff N	Observations: Oceanic climate change and sea level	Seminar	BMRC seminar	Melbourne, VIC
Bowie A	The impact of natural iron fertilisation on the SO: results from the KEOPS team	Oral	ACE CRC Symposium	Hobart, TAS
Bowie A	Effect of natural iron fertilisation on carbon sequestration in the SO	Oral	ACROSS seminar series, School of Chemistry, UTAS	Hobart, TAS
Church J	Global sea levels; past present and future	Oral	Priestley Symposium	Melbourne, VIC
Constable A	Fathoming futures: population and ecosystem assessments of climate change impacts	Oral	ACE CRC Research Users Forum	Canberra, ACT
Constable A	Bioregionalisation	Oral	Experts Workshop on bioregionalisatio of the SO	Hobart, TAS
Constable A	Ecosystem Productivity, Ocean, Climate (EPOC) modelling framework: a general tool for exploring the relative importance of ecosystem processes	Seminar	AAD seminar	Kingston, TAS
Constable A	Options for managing krill fisheries to account for the requirements of krill predators: the utility of exploring different plausible ecosystem scenarios for evaluating management options	Seminar	School of Zoology seminar, UTAS	Hobart, TAS
Court J Warner R	Influence of the 'loose tooth' rifts on flow of the Amery ice shelf	Oral	ACE CRC Symposium	Hobart, TAS
Craven M	AMISOR double-dip	Oral	ACE CRC Symposium	Hobart, TAS
Craven M	AMISOR double-dip	Oral	AAD	Hobart, TAS
Craven M	Amery Ice Shelf data	Oral	AMISOR Workshop	Hobart, TAS
Craven M	Science planning & logistics (x 6 tutorials)	Seminar	IASOS honours class	Hobart, TAS
Curran M	Sea salt in Antarctica: Ocean storms versus sea ice production?	Oral	ACE CRC Symposium	Hobart, TAS

appendix d: presentations

Staff name	Title or topic	Type	Event	Location
Curran M	Sea ice extent proxies from ice core MSA records	Workshop	ACE CRC sea ice extent	Hobart, TAS
Davidson A	Antarctic marine microbes seen in a bad light	Oral	IASOS undergraduate lecture	Hobart, TAS
Downes S, Bindoff N, Rintoul S	Climate impacts on SO water masses during the 21st Century	Oral	AMOS	Adelaide, SA
Haward M	Coordination and capacity in ocean governance	Oral	Fulbright Symposium Maritime Governance and Security: Australian and American Perspectives	Hobart, TAS
Haward M, Vince J	Australian ocean governance – initiatives, challenges and opportunities	Oral	Australasian Political Studies Association Conference	Newcastle, NSW
Heil P	Sea-ice dynamics in the Weddell Sea during summer 2004	Oral	SCAR	Hobart, TAS
Heil P	Tidal forcing on sea-ice drift and deformation in the Western Weddell Sea in early austral summer, 2004	Oral	AMOS, 14th conference	Adelaide, SA
Heil P	In situ observations of Antarctic Sea-ice Drift and Deformation	Oral	Argos User Meeting	Hobart, TAS
Heil P	Antarctic fast-ice monitoring during IPY 2007/2008 and beyond	Oral	ASPecT Workshop on Antarctic Sea Ice Thickness	Hobart, TAS
Hunter J	The effect of climate change on the frequency of extreme sea-level events	Oral	ACE CRC Symposium	Hobart, TAS
Hunter J	Monitoring shoreline movement in Tasmania using aerial photos and satellite imagery	Poster	ACE CRC Symposium	Hobart, TAS
Hunter J	High sea-level events	Oral	Extreme Climate Events Workshop (AGO)	Canberra, ACT
Hunter J	Climate change and sea-level rise	Oral	Workshop on Tides (National Tidal Centre)	Adelaide, SA
Hunter J	Sea level: where have we come from and where are we going?	Oral	Don Wallace Memorial Lecture	Darwin, NT
Jabour J	eLearning: Cool science	Oral	CRC Conference	Perth, WA
Jabour J	The Lake Vostok drilling program	Oral	15th Annual Conference of the Australian and New Zealand Society of International Law	Canberra, ACT
Massom R	Bioregionalisation of the SO – Sea ice	Oral	Bioregionalisation of the SO	Hobart, TAS
Massom R	What controls a sea ice edge?	Oral	ACE CRC Sea Ice Extent Workshop	Hobart, TAS
Massom R	Sea ice remote sensing	Oral	AAD Voyage Management Team Meeting	Kingston, TAS
Moy A, Howard W	Potential effects of increasing anthropogenic CO_2 on marine plankton in the Southern Ocean	Oral	ACE CRC Symposium	Hobart, TAS
Murray C	'Scott of the Antarctic': the conservation of a story	Seminar	AAD seminar	Kingston, TAS

appendix d: presentations

Staff name	Title or topic	Type	Event	Location
Nichols P	Signature lipids and fatty acids in trophic Studies	Oral	Australian Society for Fish Biology Workshop and Conference	Hobart, TAS
Nichols P	Signature lipids in food web and environmental studies.	Oral	Australasian Section of AOCS Biennial Conference	Melbourne, VIC
Nicol S	BROKE-West	Seminar	ANU	Canberra, ACT
O'Farrell S	Sea ice variability in the CSIRO Mk3 and Mk3.5 models in the Antarctic region	Poster	ACE CRC Symposium	Hobart, TAS
O'Farrell S	Variability and projections in sea level calculated in 20th and 21st centuries with the CSIRO Mk3.5 model	Poster	ACE CRC Symposium	Hobart, TAS
O'Farrell S' Massom R	Sea ice variability in CSIRO Mk3 and Mk3.5 models and it links to recent observations of ice thickness variability in the Antarctic peninsula region	Oral	AMOS conference	Adelaide, SA
O'Farrell S	SOPHOCLES	Oral	AMISOR workshop	Hobart, TAS
O'Kane T	Subgrid-scale parameterizations for inhomogeneous geophysical wave-turbulence	Oral; poster	Australian Workshop on Fluid Mechanics	Melbourne, VIC
O'Kane T	Dynamical subgrid-scale parameterizations from closures and DNS	Poster	Australian Workshop on Fluid Mechanics	Melbourne, VIC
O'Kane T	Subgrid-scale parameterizations of the eddy-topographic force	Seminar	IASOS research seminar	Hobart, TAS
O'Kane T	Stochastic, deterministic and statistical dynamical methods for data assimilation and ensemble prediction	Seminar	University of Adelaide, Applied mathematics seminar	Adelaide, SA
Phipps S	Multi-millennial simulations of the climate of the late Holocene	Oral	UNSW Ocean and Climate Research Retreat	Terrigal, NSW
Phipps S, Woolf A, Bindoff N, Hyland G, Roberts J	Earth Systems Science OPeNDAP computer server framework	Oral	Third AUKEGGS workshop	Canberra, ACT
Rintoul S	Climate change and the SO	Oral	Australian Earth Science Convention	Melbourne, VIC
Rintoul S	Rapid freshening of Antarctic Bottom Water formed in the Indian and Pacific oceans	Oral	AMOS	Adelaide, SA
Rintoul S, Bindoff N	Observed decadal stratification change across the Antarctic Circumpolar Current. Is this due to climate change or a phase shift of the SAM?	Poster	AMOS	Adelaide, SA
Rintoul S, Hill K	Dynamics of low frequency variability of the East Australian Current	Oral	AMOS	Adelaide, SA
Roberts J	Ocean modelling	Oral	ARCNESS (Australian Research Council Network for Earth Systems Science) winter school	Melbourne, VIC
Sokolov S, Rintoul S	Multiple jets of the Antarctic Circumpolar Current	Oral	AMOS	Adelaide, SA
Treverrow A, Warner R, Budd W	Anisotropic flow of Antarctic ice – a comparison of laboratory, field and model studies	Poster	ACE CRC Symposium	Hobart, TAS

appendix d: presentations

Staff name	Title or topic	Type	Event	Location
Tria J, Butler E, Haddad P, Bowie A	Application of shipboard determination of aluminium in seawater to dust deposition studies in the Ross Sea, Antarctica	Oral	Interact 2006	Perth, WA
Tria J, Butler E, Haddad P, Bowie A	Determination of aluminium in seawater to trace dust deposition to the Ross Sea, Antarctica	Poster	RACI Research and Developments Topics Meeting	Wollongong, NSW
Wake B, Butler E, Bowie A, Haddad P	Selenium speciation and behaviour in the waters of the Southern hemisphere	Oral	RACI Research & Developments Topics Meeting	Wollongong, NSW
Wheatley K, Nichols P, Bradshaw C, Harcourt R, Hindell M	Fatty acid mobilization in lactating Weddell seals: implications for selective transfer.	Poster	Australasian Section of AOCS Biennial Conference	Melbourne, VIC
Williams G	Southern elephant seals as ocean samplers	Poster	ACE CRC Symposium	Hobart, TAS
Young N	A century of change in the Shackleton and West Ice Shelves	Oral	ACE CRC Symposium	Hobart, TAS
Young N	Surface wind field over the Antarctic ice sheet mapped from satellite thermal infrared images	Poster	ACE CRC Symposium	Hobart, TAS
Young N	A circum-Antarctic survey of the abundance and size characteristics of near-coastal population of icebergs	Poster	ACE CRC Symposium	Hobart, TAS

International scientific presentations

Staff name	Title or topic	Type	Event	Location
Adams N	Operational Antarctic meteorological support offered by BoM	Poster	SCAR Open Science Conference	Hobart, AUSTRALIA
Adams N	Advances in numerical weather prediction and weather forecasting systems in support of the Australian Antarctic program.	Oral; poster	2nd Antarctic Meteorological Observation, Modelling and Forecasting Workshop	Rome, ITALY
Adams N	Status of the Australian Automatic Weather Station (AWS) network in support of flying operations.	Oral; poster	2nd Antarctic Meteorological Observation, Modelling and Forecasting Workshop	Rome, ITALY
Allison I	Estimating long-term East Antarctic snow accumulation from automatic weather station data.	Oral	SCAR Open Science Conference	Hobart, AUSTRALIA
Allison I	The surface climate of the East Antarctic ice sheet between Dome A and the coast.	Oral	SCAR Open Science Conference	Hobart, AUSTRALIA
Allison I	The climate of Dome A and surrounds: Results from the Chinese-Australian automatic weather station program	Oral	International Workshop on Dome A Expedition during IPY	Shanghai, CHINA
Allison I	The impacts of climate change to ice and snow on Earth.	Oral	Shanghai Normal University, graduate students seminar	Shanghai, CHINA
Bell E, Davidson A	Mixotrophy by two Antarctic phytoflagellates	Oral	SCAR Open Science Conference	Hobart, AUSTRALIA

appendix d: presentations

Staff name	Title or topic	Type	Event	Location
Bell E, Pearce I, Davidson A	Annual changes in an Antarctic fast-ice microbial community	Oral	SCAR Open Science Conference	Hobart, AUSTRALIA
Bindoff N	Chapter 5: Key results and progress	Seminar	IPCC WG1 LA4	Bergen, NORWAY
Bindoff N	Southern Ocean eddies	Seminar	IFM-Geomar	Kiel, GERMANY
Bindoff N	Southern Ocean eddies and climate difference signals	Seminar	NOC seminar	Southampton, UK
Bindoff N	Direct observations of changes in current climate	Oral	IPCC WG1 LA5	Paris, FRANCE
Bindoff N	Sea level rise observations	Oral	IPCC WG1 LA5	Paris, FRANCE
Bindoff N	Observations: Oceanic climate change and sea level	Oral	Royal Society	London, UK
Blankenship D, and others incl. Warner R, Young N	Investigating the cryospheric evolution of the central Antarctic plate (ICECAP): Internationally coordinated long-range aerogeophysics over East Antarctica's Domes A and C and the Aurora subglacial basin	Poster	SCAR Open Science Conference	Hobart, AUSTRALIA
Bowie A	The impact of natural iron fertilisation on the Southern Ocean: results from the KEOPS team	Oral	Marine Institute seminar series, University of Plymouth	Plymouth, UK
Butler E	Aspects of analytical science underpinning chemical oceanography and marine environmental chemistry	Seminar	University of Hawaii at Manoa, seminar series in Department of Oceanography	Honolulu HI, USA
Chever F, Bucciarelli E, Blain S. Bowie A, Sarthou G	Distribution of total dissolvable iron during the natural iron fertilisation experiment KEOPS (Kerguelen Island, SO)	Poster	EGU General Assembly	Vienna, AUSTRIA
Church J	The Earth System Science Partnership now and in the future	Oral	Earth System Science Open Science Conference	Beijing, CHINA
Church J	Sea-level trends: Past, present and future	Oral	Earth System Science Open Science Conference	Beijing, CHINA
Constable A	SSMUs, climate change and krill fishing: Data and analytical needs (the utility of using 'models' to articulate requirements)	Oral	Lenfest workshop to consider requirements for models to assist management of the krill fishery in the southwest Atlantic	Santa Cruz, USA
Constable A	Ecological sustainability of mackerel icefish fisheries	Seminar	University of California Santa Cruz, seminar series in Department of Mathematics	Santa Cruz, USA
Court J, Warner R	Model derived dynamics, basal melt and time evolution of the Mertz Glacier Tongue, East Antarctica	Oral	SCAR Open Science Conference	Hobart, AUSTRALIA
Craven M	Amery Ice Shelf borehole imagery	Poster	SCAR Symposium	Hobart, AUSTRALIA
Curran M	Sea salt in Antarctica: A proxy for ocean storms or sea ice production?	Oral	SCAR	Hobart, AUSTRALIA
Curran M	Links between DMS/MSA production and Antarctic sea ice extent	Oral	XXIX Symposium on Polar Biology	Tokyo, JAPAN

appendix d: presentations

Staff name	Title or topic	Type	Event	Location
Davidson A, Cadman N, Michael K, Nunez M	Ozone depletion inhibits natural Antarctic phytoplankton blooms	Oral	SCAR Open Science Conference	Hobart, AUSTRALIA
DeLiberty T, Geiger C, Van Woert M, Worby A, Ackley S	An evaluation of sea ice thickness estimated from ice charts for the Southern Ocean	Oral	International Workshop on Antarctic Sea Ice Thickness	Hobart, AUSTRALIA
DeLiberty T, Geiger C, Van Woert M, Worby A, Ackley S	Antarctic sea ice thickness derived from operational ice charts	Oral	SCAR Open Science Conference	Hobart, AUSTRALIA
Haward M	The LOS Convention and the ATS: Problems and prospects	Oral	Conference: Towards a Framework for the New Order of the Sea, hosted by The Law of the Sea Institute and INHA University	Seoul, SOUTH KOREA
Heil P, Worby A, Johansson M	Sea ice dynamics in the Weddell Sea during summer 2004	Oral	SCAR Open Science Conference	Hobart, AUSTRALIA
Howard W, Moy A	Past and future of the Southern Ocean carbon cycle	Seminar	Weekly Climate Seminar	Lamont-Doherty Earth Observatory, Palisades, NY, USA
Howard W, Moy A, Bijma J, Nehrke G	Potential effects of increasing anthropogenic CO_2 on marine plankton in the Southern Ocean	Poster	IGBP–SCOR Workshop: Ocean Acidification – modern observations and past experiences	Lamont-Doherty Earth Observatory, Palisades, NY, USA
Jabour J	Science and politics in the polar regions	Oral	International Studies Association Conference	Chicago, USA
Jackson A	Antarctic policy: The importance of joining the Antarctic Treaty	Oral	3rd Malaysian International Seminar on Antarctica	Sabah, MALAYSIA
Jackson A	Australian delegation		30th Antatrctic Treaty Consultative Meeting	New Delhi, INDIA
Kawaguchi S, King R, Nicol S	Making krill behave in the aquarium	Oral	4th International Zooplankton Production Symposium	Hiroshima, JAPAN
Lambeck K	Sea-level change during the last glacial cycle: Constraints on ice sheets and their rates of growth and decay	Keynote Address	SEALAIX '06	Giens, FRANCE
Lieser J	Towards a sea ice forecast and analysis system for the Antarctic	Workshop	Sea ice data assimilation workshop	Oslo, NORWAY
Lieser J	We can walk on water – sea ice research down-under	Oral	Institute's Seminar Max Planck Institute for Meteorology	Hamburg, GERMANY
Massom R	Extreme atmospheric & sea ice conditions in the West Antarctic Peninsula region: Ice thickness implications	Oral	International Workshop on Antarctic Sea Ice Thickness	Hobart, AUSTRALIA

appendix d: presentations

Staff name	Title or topic	Type	Event	Location
Massom R	ARISE (Antarctic Remote Sensing Ice Experiment) in the East: Validation of satellite sea-ice data products	Poster	International Workshop on Antarctic Sea Ice Thickness	Hobart, AUSTRALIA
Massom R	The contribution of extreme events in the austral spring-summer 2001-02 to the disintegration of the Larsen-B Ice Shelf	Oral	IGS Symposium on "Cryospheric Indicators of Global Climate Change"	Cambridge, UK
Massom R	ARISE (Antarctic Remote Sensing Ice Experiment) in the East: Validation of satellite sea-ice data products	Poster	SCAR Open Science Conference	Hobart, AUSTRALIA
McMinn A	Can a fast repetition-rate fluorometry estimate primary production in the Southern Ocean?	Oral	SCAR Open Science Conference	Hobart, AUSTRALIA
McMinn A	Global change and marine primary production: More or less?	Plenary lecture	Arctic Frontiers meeting	Tromsø, NORWAY
Meiners K, Pasquer B, Raymond B	On the large-scale distribution of sea-ice algae off East Antarctica and the importance of sea-ice thickness and snow cover	Poster	International Workshop on Antarctic Sea Ice Thickness	Hobart, AUSTRALIA
Mongin M	Seasonality and scale of the Kerguelen plateau phytoplankton bloom: A remote sensing and modeling analysis of the influence of natural iron fertilization in the SO	Seminar	Université de la Méditerranée Laboratoire d'Océanographie et de Biogéochimie	Marseille, FRANCE
Mongin M	Seasonality and scale of the Kerguelen plateau phytoplankton bloom: A remote sensing and modeling analysis of the influence of natural iron fertilization in the SO	Seminar	Toward Integration of Subgrid Turbulence in Ecosystem Dynamics: Workshop, LOCEAN	Paris, FRANCE
Nichols P, Young J, Phleger R, Guest M, Lansdell M	Fatty acids: A robust method for evaluating trophic relationships (and ecosystems?)	Oral	Pelagic Fisheries Research Project	University of Hawaii, Honolulu. USA
Nicol S	The big picture	Chair's	Gordon Research Conference	California, USA
Nicol S, Williams G, Jarvis T	The BROKE-West marine ecosystem survey	Poster	Gordon Research Conference	California, USA
O'Farrell S	Sea ice variability in the CSIRO Mk3 and Mk3.5 models in the Antarctic region	Poster	SCAR Open Science Conference	Hobart, AUSTRALIA
O'Farrell S	Climate variability in the Antarctic region in the CSIRO Mk3 and Mk3.5 models	Oral	SCAR AGCS meeting	Hobart, AUSTRALIA
O'Farrell S	Southern ice ocean model intercomparison project –SIOMIP	Oral	AOMIP meeting, WHOI	Woods Hole, USA
O'Farrell S	Southern ice ocean model intercomparison project (SIOMIP)	Poster	AGU	San Francisco, USA
Paget M, Worby A	The ASPeCt sea ice observations archive: Quality control, processing and management	Poster	International Workshop on Antarctic Sea Ice Thickness	Hobart, AUSTRALIA
Pearce I, Davidson A, Bell E	Seasonal changes in bacterial biomass and activity at an Antarctic coastal site	Poster	SCAR Open Science Conference	Hobart, AUSTRALIA
Pedro J	10Be in Antarctic ice	Oral	SCAR Open Science Conference	Hobart, AUSTRALIA
Pedro J	10Be in Antarctic Ice	Oral; poster	European Research Course on Atmospheres	Grenoble, FRANCE

appendix d: presentations

Staff name	Title or topic	Type	Event	Location
Pfaffling A, Worby A, Massom R	Cross validation of in-situ airborne and remote sensing data from east Antarctica	Oral	International Workshop on Antarctic Sea Ice Thickness	Hobart, AUSTRALIA
Raymond B	An Antarctic sea ice thickness database: Issues, analysis and design	Oral	International Workshop on Antarctic Sea Ice Thickness	Hobart, AUSTRALIA
Raymond B, Meiners K, Curran M, van Ommen T	A conceptual model of the large-scale distribution of sea ice algae off East Antarctica	Oral	SCAR Open Science Conference	Hobart, AUSTRALIA
Rintoul S	Rapid freshening of Antarctic Bottom Water	Oral	SCAR Open Science Conference	Hobart, AUSTRALIA
Rintoul S	CLIVAR/Clic SO Implementation Panel and the CASO IPY program	Poster	SCAR Open Science Conference	Hobart, AUSTRALIA
Rintoul S	The SEAOS (Southern Elephant Seals as Oceanographic Samplers) program	Oral	SCAR Open Science Conference	Hobart, AUSTRALIA
Rintoul S	Fronts and transport variability of the Antarctic Circumpolar Current south of New Zealand	Oral	SCAR Open Science Conference	Hobart, AUSTRALIA
Rintoul S		Co-organiser	POGO/SCAR/COML workshop on an integrated SO Observing System	Hobart, AUSTRALIA
Rintoul S	Freshening of Antarctic Bottom Water and multiple jets of the Antarctic Circumpolar Current	Oral	University of Buenos Aires	Buenos Aires, ARGENTINA
Rintoul S	Monitoring of SO transports	Oral	CLIVAR/CliC/ SCAR SO Region Implementation Panel	Buenos Aires, ARGENTINA
Rintoul S	Climate of Antarctic and the SO (CASO) IPY project	Oral	CLIVAR/CliC/ SCAR SO Region Implementation Panel	Buenos Aires, ARGENTINA
Rintoul S	Cold places in warm times: Polar regions driving and responding to climate change	Oral	World Congress of Science Journalists	Hobart, AUSTRALIA
Rintoul S, Sokolov S	Fronts of the Antarctic Circumpolar Current	Oral	Experts workshop on bioregionalisation of the SO	Hobart, AUSTRALIA
Sokolov S, Rintoul S	Multiple jets of the Antarctic Circumpolar Current	Poster	Ocean Surface Topography Science Team	Hobart, AUSTRALIA
Sokolov S, Rintoul S	Tracking the Antarctic Circumpolar Current Fronts using penguin and seal dive data	Oral	SCAR Open Science Conference	Hobart, AUSTRALIA
Thomson P, Davidson A, Cadman N	Effects of ozone depletion on natural communities of Antarctic marine protists	Oral	SCAR Open Science Conference	Hobart, AUSTRALIA
Tilbrook B	Working group reports	Workshop	Surface Ocean CO_2 Variability and Vulnerability	Paris, FRANCE
Tilbrook B	Upper ocean variability in CO_2, South of Australia	Oral	SCAR Open Science Conference	Hobart, AUSTRALIA
Tilbrook B	Large temporal air-sea CO_2 flux variability in the SO, south of Australia	Poster	SCAR Open Science Conference	Hobart, AUSTRALIA

appendix d: presentations

Staff name	Title or topic	Type	Event	Location
Treverrow A, Warner R, Budd W	Strain rates and crystal orientation fabrics from the laboratory deformation of ice from Dome Summit South, Law Dome, East Antarctica	Poster	SCAR Open Science Conference	Hobart, AUSTRALIA
Trull T	Australian SO Bigeochemistry	Oral; web	NSF Ocean Carbon Biogeochemistry Workshop, WHOI	Mass, USA
Trull T	Iron, CO_2, and the SO: An Australian perspective	Oral	Laboratoire d'Etudes Geophysiques et Spatiales seminar series	Toulouse, FRANCE
Trull T	The influence of natural iron fertilization on carbon sequestration in the SO	Oral	Laboratoire de Geochimie des Isotopes Stables, University of Paris	Paris, FRANCE
Trull T	Nitrogen and carbon isotopic insights into nutrient cycling and export in naturally iron-fertilized waters of the SO: Results from KEOPS	Oral	Marine Geochem Seminar Series, University Paul-Sabatier	Toulouse, FRANCE
Trull T	The influence of iron on phytoplankton nitrogen metabolism in the SO	Oral	University of Bordeaux	Talence, FRANCE
Trull T	Seasonality and size of the Kerguelen plateau phytoplankton bloom: A combined remote sensing and modeling analysis of the influence of natural iron fertilization in the SO	Oral	University of Paris	Paris, FRANCE
Trull T	Particle sinking rates and the control of carbon flux to the ocean interior	Oral; web	US National Acad. of Sciences VERTIGO workshop, WHOI	Mass, USA
Trull T	*In-situ* particle sinking rates and forms at mesopelagic depths from the Subtropical and Subarctic Pacific	Oral	University of Marseille	Luminy, FRANCE
Vance T, Davidson A, Thomson P, Jones G	Effects of UVR on biogenic sulfur production by Antarctic marine microbes	Oral	SCAR Open Science Conference	Hobart, AUSTRALIA
van Ommen T	Messages from the ice: Antarctic ice core records and the global climate system	Oral	SCAR Open Science Conference	Hobart, AUSTRALIA
van Ommen T	The 8200 B.P. climate event in the Southern Hemisphere	Oral	EGU General Assembly	Vienna, AUSTRIA
van Ommen T	Connections between coastal East Antarctic snowfall and southern Australian climate	Oral	EGU General Assembly	Vienna, AUSTRIA
van Ommen T	Zooming out: Taking the longer view	Oral	Gordon Research Conference on Polar Marine Science	Ventura, California, USA
Wake B, Butler E, Bowie A, Haddad P	Selenium distribution in the Australian sector of the Southern Ocean	Poster	SCAR Open Science Conference	Hobart, AUSTRALIA
Wake B, Butler E, Bowie A, Haddad P	Selenium speciation and behaviour in the waters of the Southern hemisphere	Oral	DISCO XX: Dissertations Symposium on Chemical Oceanography	Honolulu, HI, USA
Warner R	Reassessing the input-output mass budget of East Antarctica between 50°E And 140°E	Oral	SCAR Open Science Conference	Hobart, AUSTRALIA
Warner R, Williams M	Modelling observed episodes of frazil ice formation beneath winter fast-ice in McMurdo Sound, Antarctica	Oral	SCAR Open Science Conference	Hobart, AUSTRALIA

appendix d: presentations

Staff name	Title or topic	Type	Event	Location
Williams G	Preliminary oceanographic results from BROKE-West	Oral	SCAR Open Science Conference	Hobart, AUSTRALIA
Williams G	Oceanography of the Adélie Depression	Oral	SCAR 2007 /CAML Workshop	Vienna, AUSTRIA
Williams G	BROKE-West physics and biological distributions across the Antarctic Slope Front	Poster	AGU 2006	San Francisco, USA
Williams G	Physical processes and biological patterns during BROKE-West	Poster	EGU 2007	Vienna, AUSTRIA
Williams G	Under ice oceanography beneath a north-east Greenland polynya with an AUV	Oral	EGU 2007	Vienna, AUSTRIA
Williams G	Australian Antarctic oceanography	Oral	Invited Talk at University of East Anglia	Norwich, UK
Williams G	Physical-biological oceanography	Oral	Invited Talk at L'OCEAN	Paris, FRANCE
Worby A, Geiger C, Paget M, Van Woert M, Ackley S, DeLiberty T	The ASPeCt data set – recent analysis and applications	Poster	Fall AGU	San Francisco USA
Worby A, Geiger C, Paget M, Van Woert M, Ackley S, DeLiberty T	ASPeCt Program	Poster	SCAR Open Science Conference	Hobart, AUSTRALIA
Worby A, Massom R, Lytle V, Markus, T	Validation of AMSR-E derived snow thickness over East Antarctic sea ice.	Oral	International Symposium on Cryospheric Indicators of Global Climate Change (IGS)	Cambridge, UK
Worby A, Steer A	Textural analysis of aerial photographs over sea ice to determine surface roughness and snow cover characteristics	Poster	International Workshop on Antarctic Sea Ice Thickness	Hobart, AUSTRALIA
Worby A, Steer A, Heil P	Changes in floe size distribution in the Weddell Sea during November and December 2004	Oral	SCAR Open Science Conference	Hobart, AUSTRALIA
Young N	A circum-Antarctic survey of the abundance and size characteristics of near-coastal population of icebergs	Oral	SCAR Open Science Conference	Hobart, AUSTRALIA
Young N	Melt-freeze conditions under the Amery Ice Shelf inferred from wave-form analysis of RES data and mass flux calculations	Oral	SCAR Open Science Conference	Hobart, AUSTRALIA
Young N	Negative mass budget of Totten Glacier, East Antarctica	Oral	SCAR Open Science Conference	Hobart, AUSTRALIA
Young N	Surface wind field over the Antarctic ice sheet mapped from satellite thermal infrared images	Poster	SCAR Open Science Conference	Hobart, AUSTRALIA
Young N	East Antarctic ice shelves: status quo or decline	Poster	SCAR Open Science Conference	Hobart, AUSTRALIA
Young N	Icebergs in the SO: Their distribution and drift	Oral	ESA-ENVISAT-2007	Montreux, SWITZ
Young N	Roughness of the Antarctic snow cover detected by scattering of microwave and visible radiation	Poster	ESA-ENVISAT-2007	Montreux, SWITZ
Zicus S	Use of satellite and ocean images to inform the Australian community	Oral	Ocean Surface Topography Science Team	Hobart, AUSTRALIA

appendix d: presentations

Public presentations

Staff name	Title or topic	Type	Event/ audience	Location
Allison I	The legacy of the International Polar Year	Oral	International Launch of IPY 2007-2008	Paris, FRANCE
	Sea ice matters for Southern Ocean ecosystems	Oral	ACE CRC Research Users' Forum	Canberra, ACT
Andrews-Goff V	Becoming an Antarctic scientist	Oral	Sacred Heart College- Year 8	Hobart, TAS
Bindoff N	TPAC achievement and highlights	Oral	APAC All hands Meeting	Melbourne, VIC
	TPAC's activities in climate change science	Seminar	DPWI	Hobart, TAS
Craven M	What's happening on the Amery?	Oral	AAD Corporate Branch	Kingston, TAS
Howard W	Ocean acidification and ACE CRC research	Oral	AGO	Canberra, ACT
Hunter J	Climate change & sea-level rise	Oral	Mid-city School for Seniors	Hobart, TAS
	Commentary on *An Inconvenient Truth*	Panel	General public	Launceston, TAS
	Planning for sea-level rise	Oral	Planners' meeting organised by Australian Planning Institute (PIA) and AGO	Launceston, TAS
	The vulnerability of Tasmania to climate change	Oral	Cities for Climate Change workshop	Hobart, TAS
	Variability and trends of sea-level, storm-surges and offshore wave conditions in the Australian region	Oral	AGO	Canberra, ACT
Jabour J	180° in 80 days	Oral	Mid-city School for Seniors	Hobart, TAS
	Environmental management	Oral	St Mary's School	Hobart, TAS
	The great whale debate	Oral	St Mary's School	Hobart, TAS
	The great whale debate	Oral	The Friends School	Hobart, TAS
	The great whale debate	Oral	Mid-city School for Seniors	Hobart, TAS
	Antarctic tourism: The road to nowhere	Oral	Glenorchy School for Seniors	Hobart, TAS
Jordan L	Living in Antarctica	Oral	Blackmans Bay Primary School	Blackmans Bay, TAS
	Living in Antarctica	Oral	Blackmans Bay Primary and Japanese exchange students	Blackmans Bay, TAS
	Living in Antarctica	Oral	Grade 4/5/6, Kingston Primary School	Kingston, TAS
	Antarctica	Q & A session	Kingston Primary School	Kingston, TAS
	Living in Antarctica	Oral	Preshil High School	Melbourne, VIC
Le Goy C	Climate futures for Tasmania	Oral	Tasmanian Environment Industry Council	Hobart, TAS
McInnes K	Assessing the impact of climate change on storm surges along the Victorian coast	Oral	National Seachange Taskforce	Cowes, VIC

appendix d: presentations

Staff name	Title or topic	Type	Event/ audience	Location
Mapstone B	Climate change and the importance of multi-disciplinary science in Antarctica	Oral	Australian 2007 World Meteorological Day Address, Bureau of Meteorology	Melbourne, VIC
Nicol S	Krill for whales in a changing climate	Oral	Research Users' Forum	Canberra, ACT
Rintoul S	Oceans and climate	Oral	Friends School year 4	Hobart, TAS
Sandford R	Bridging the science-policy gap	Oral	Research Users' Forum	Canberra, ACT
	Integrating climate science and public policy	Oral; meetings	State and Commonwealth Government Officials: Several occasions	Hobart, TAS Brisbane, QLD Canberra, ACT
Smith B	Ice and bubbles: What do they tell us about climate history?	Oral	Antarctic Midwinter Festival	Hobart, TAS
Tilbrook B	Oceans, carbon and acidification	Oral	Research Users' Forum	Canberra, ACT
Worby A	Antarctic science in IPY	Oral	Antarctic Teachers' Day	Hobart, TAS
Zicus S	Antarctica and the Southern Ocean: Global climate connections	Oral	'Science under the Southern Lights' teacher seminar, Tasmanian Museum & Art Gallery	Hobart, TAS

Media

Name	Media Outlet(s)	Subject	Date
Allison I	ABC TV 7:30 report	Australian Antarctic scientific research, IPY	9 Feb 2007 (interview)
	Launceston Examiner	General profile	12 Feb 2007
	Herald Sun (Melbourne), Discovery section	IPY	13 Feb 2007
	SBS World View Radio	IPY	28 Mar 2007
	ABC TV Media Watch	Melting of ice in Arctic & polar bears	29 Mar 2007
Bindoff N	AP News myway (on-line)	IPCC 4th Assessment Report	2 Feb 2007
	The Australian	IPCC 4th Assessment Report	6 Feb 2007
	ABC Radio (Hobart)	IPCC 4th Assessment Report	21 Feb 2007
Bowie A	ABC Radio (Hobart)	Iron in the Southern Ocean	21 Feb 2007
Church J	ABC Radio National (Canberra, Adelaide, Sydney), 2UE (Sydney), SBS World News Australia (Melbourne), *The Age*, *Sydney Morning Herald*, *The Australian*, AAP Newswire, ABC online, Perth Now (on-line), NASA Earth Observatory on-line newsletter	Sea-level rise & IPCC projections	2 Feb 2007
	Ballarat Courier, Sydney Morning Herald (on-line)	Sea-level rise & IPCC projections	3 Feb 2007
	Sunday Tasmanian	Sea-level rise & IPCC projections	4 Feb 2007
	Khaleej Times On-line (Dubai), a2 Media Group (on-line), Science*Daily* (on-line)	Sea-level rise & IPCC projections	5 Feb 2007
	Innovations Report (Germany, on-line)	Sea-level rise & IPCC projections	6 Feb 2007
	Courier Mail	Effects of climate change	28 Feb 2007
	AAP Newswire, *The Age* (online), The West (online)	Sea-level rise and Ocean Surface Topography Science Team meeting	6 Mar 2007
	Chelsea Independent	Sea-level rise and IPCC report	20 Mar 2007
	Mornington Southern Peninsula Mail	Sea-level rise and IPCC report	21 Mar 2007
	Sydney Morning Herald	Sea-level rise and IPCC report	30 Mar 2007
	The Australian	Cryosphere melting faster than predicted	13 June 2007
Church J Hunter J van Ommen T	MSNBC.com; *Sydney Morning Herald*; Knight Science Journalism Tracker (all online from Reuters report)	Melting ice in Antarctica and sea-level rise	23-26 Mar 2007
Church J McInnes K	*Business Review Weekly*	Effect of rising sea levels on Australia's coast	2 Feb 2007
Church J Rintoul S van Ommen T	*West Australian* (online)	'Climate doomsday' (changing ocean currents and sea-level rise)	24 Mar 2007
Griffiths B Bowie A Trull T	ABC TV News (Hobart, Launceston)	Role of iron in the Southern Ocean	21 Feb 2007
Haward M	*The Age*	Importance of Antarctic territory to Australia	4 April 2007
	Herald Sun, *Daily Telegraph*, AAP Newswire, ABC online, ABC Radio (national), 2CC (Canberra)	Importance of Antarctic territory to Australia (Australian Strategic Policy Institute work)	5 April 2007
	New Zealand Herald (online)	Importance of Antarctic territory to Australia (Australian Strategic Policy Institute work)	28 April 2007
Hindell M	Radio National (Canberra)	Effects of climate change on marine species around Australia	2 Feb 2007
Howard W	ABC Online, AAP Newswire, ABC Radio (Hobart)	SAZ-SENSE cruise return	21 Feb 2007

appendix e: media

Name	Media Outlet(s)	Subject	Date
Howard W	TVNZ World News (on-line)	Southern Ocean carbon dioxide and acidity	22 Feb 2007
	Stuff.co.nz; Nine News online; *Sydney Morning Herald* online; Peak Oil News & Message Board (online)	Southern Ocean carbon dioxide and acidity	23 Feb 2007
Hunter J	ABC lateline	Sea-level rise in the Pacific Islands	2 Feb 2007
	ABC TV (Hobart) News	Local issues related to sea-level rise	3 Feb 2007
	Heart FM radio (central Tasmania)	Local issues related to sea-level rise	6 Feb 2007
	ABC Radio (Hobart)	Sea-level rise	2 April 2007
	Fluter magazine (German)	Sea-level rise & Tuvalu	8 June 2007
	Canberra Times	*Global Swindle* (Durkin film) falls on sword of fallacies and misrepresentations	25 Jun 2007
Jabour J	ABC Central Australia Drive Show	Impacts of tourism on Antarctica	1 May 2007
	ABC 936 Hobart	Antarctic Midwinter Festival and oil mining in Antarctica	19 Jun 2007
McMinn A	*Hobart Mercury*	New UNESCO-Cousteau Chair to recruit & train new generation of marine scientists - focusing on Antarctica and the Southern Ocean	23 Jun 2007
	Sth Cross Tas TV Nightly News;ABC Radio (Hobart)	Award of Cousteau Chair	22 Jun 2007
Mapstone B	ABC Country Radio (Victoria)	Climate change & Antarctica	23 Mar 2007
	SBS International Radio	Climate change & Antarctica	28 Mar 2007
Matear R Trull T	ABC Radio National, ABC Online	Plankton, iron and global warming	1 May 2007
Rintoul S	ABC TV 7:30 report	Australian Antarctic scientific research	9 Feb 2007 (interview)
	NZPA Newswire, ABC Online, ABC Radio (national)	Measuring the Antarctic Circumpolar Current (NIWA *Tangaroa* voyage)	7 Mar 2007
	CDNN; *Khaleej Times*; *Scientific American*; Skywatch media; Peak Oil News & Message Board; *The Australian* (science & nature); Climate Crisis Coalition News; Global Surf News; Planet Ark; MSNBC.com (all online from Reuters article)	Changes in Southern Ocean currents	21-23 Mar 2007
Smith B	ABC Radio (Hobart & Northern Tasmania)	Lectures & demonstrations about ice cores & Antarctica as part of Antarctic Midwinter Festival	20 Jun 2007
Trull T	*The Age*	VERTIGO mesopelagic sinking particle carbon export project (published in *Science*)	1 May 2007
Virtue P	ABC Radio (Hobart); Statewide Mornings	UNESCO-Cousteau Chair	22 Jun 2007
Zicus S	*Launceston Examiner*	Launch of IPY	2 Mar 2007
Generic	Scoop Independent News (New Zealand online), *The Press* (Christchurch, New Zealand), *Launceston Examiner*	Measuring the Antarctic Circumpolar Current (NIWA *Tangaroa* voyage)	6 Mar 2007
	Otago Daily Times (New Zealand)	Measuring the Antarctic Circumpolar Current (NIWA *Tangaroa* voyage)	8 Mar 2007

appendix g: staff resources

Staff Name	Total % Time	AME	CO_2	CVC	POL	SLR	Rsch Total	Educ'n	Commerc	Admin
Australian Antarctic Division - In-Kind										
I Allison	65%	5%		25%		30%	60%		5%	
J Anderson	85%					80%	80%		5%	
I Ball	20%	20%					20%			
R Brand	85%			40%		45%	85%			
A Constable	75%	70%					70%		5%	
M Craven	85%			45%		40%	85%			
M Curran	85%			85%			85%			
A Davidson	50%	25%	25%				50%			
A Elcheikh	80%			40%		40%	80%			
L Emmerson	20%	20%					20%			
S Frydman	5%	5%					5%			
J Gedamke	20%	20%					20%			
P Heil	85%	20%		65%			85%			
G Hosie	10%	10%					10%			
G Hyland	60%			30%		30%	60%			
A Jackson	10%				10%		10%			
T Jarvis	60%	60%					60%			
S Kawaguchi	55%	55%					55%			
R Leaper	30%	30%					30%			
R Massom	90%	15%		70%			85%		5%	
V Morgan	85%			70%		15%	85%			
S Nicol	50%	50%					50%			
J Pedro	10%			10%			10%			
B Raymond	50%	50%					50%			
M Richardson	80%			40%		40%	80%			
G Robertson	5%	5%					5%			
T Robertson	5%	5%					5%			
B Smith	45%			45%			45%			
C Southwell	15%	15%					15%			
A Steer	80%	25%		55%			80%			
D Thost	80%			40%		40%	80%			
T Van Ommen	80%			50%		25%	75%		5%	
R Warner	85%			25%		60%	85%			
A Worby	85%	25%		55%			80%		5%	
S Wright	45%	45%					45%			
N Young	85%			10%		70%	80%		5%	
	1960%	**575%**	**25%**	**800%**	**10%**	**515%**	**1925%**	**0%**	**35%**	**0%**
Australian Bureau of Meteorology - In-Kind										
N Adams	50%			45%			45%		5%	
O Alves	5%			5%			5%			
G Brassington	5%			5%			5%			
D Greenslade	5%			5%			5%			
P Reid	100%			95%			95%		5%	

appendix g: staff resources

Staff Name	Total % Time	AME	CO_2	CVC	POL	SLR	Rsch Total	Educ'n	Commerc	Admin
E Schulz	5%			5%			5%			
N Smith	5%			5%			5%			
F Tseitkin	70%			70%			70%			
Total	**245%**	**0%**	**0%**	**235%**	**0%**	**0%**	**235%**	**0%**	**10%**	**0%**
CSIRO Division of Atmospheric Research - In-Kind										
T Hirst	5%			5%			5%			
I Macadam	4%					4%	4%			
K McInnes	8%					8%	8%			
J McGregor	4%					4%	4%			
K Nguyen	4%					4%	4%			
Total	**25%**	**0%**	**0%**	**5%**	**0%**	**20%**	**25%**	**0%**	**0%**	**0%**
CSIRO Division of Marine Research - In-Kind										
N Bindoff	45%			45%			45%			
K Berry	6%		6%				6%			
E Butler	76%		76%				76%			
J Church	80%			15%		60%	75%		5%	
R Coleman	10%					10%	10%			
L Clementson	5%		5%				5%			
B Griffiths	36%		36%				36%			
V Latham	11%		11%				11%			
R Matear	21%		21%				21%			
P Nichols	14%	14%					14%			
J O'Sullivan	48%		48%				48%			
K Paterson	35%		35%				35%			
S Rintoul	35%			30%			30%		5%	
B Tilbrook	34%		34%				34%			
T Trull	50%		50%				50%			
R Watson	45%		45%				45%			
N White	19%					19%	19%			
Total	**570%**	**14%**	**367%**	**90%**	**0%**	**89%**	**560%**	**0%**	**10%**	**0%**
University of Tasmania – In-Kind										
N Bindoff	45%			30%		10%	40%		5%	
R Coleman	10%			5%			5%	5%		
L Forbes	*10%*		*5%*				*5%*	*5%*		
R Hall	10%				10%		10%			
M Haward	50%				25%		25%	15%	10%	
M Hazlewood	30%						0%	5%		25%
M Hindell	*5%*	*0%*					*0%*	*5%*		
J Jabour	50%				25%		25%	20%	5%	
G Jackson	15%	5%					5%	10%		
A Kellow	10%				10%		10%			
L Kriwoken	10%				10%		10%			
G Lugten	15%				15%		15%			
A McMinn	45%	20%					20%	20%	5%	

appendix g: staff resources

Staff Name	Total % Time	AME	CO_2	CVC	POL	SLR	Rsch Total	Educ'n	Commerc	Admin
K Michael	50%			25%			25%	25%		
S Phipps	10%			10%			10%			
J Roberts	50%	15%		30%		5%	50%			
T Trull	40%		20%				20%	5%	5%	10%
Total	***455%***	***40%***	***25%***	***100%***	***95%***	***15%***	***275%***	***115%***	***30%***	***35%***
Australian National University – In-Kind										
K Lambeck	15%					15%	15%			
J Zhao	15%					15%	15%			
P Tregoning	5%					5%	5%			
Total	**35%**	**0%**	**0%**	**0%**	**0%**	**35%**	**35%**	**0%**	**0%**	**0%**
NIWA – In-Kind										
P Boyd	10%	10%					10%			
H Bostok	10%			10%			10%			
S Nodder	10%		10%				10%			
M Williams	25%			10%		15%	25%			
Total	**55%**	**10%**	**10%**	**20%**	**0%**	**15%**	**55%**	**0%**	**0%**	**0%**
Tasmanian Department of Economic Development – In-Kind										
C le Goy	50%								50%	
Total	**50%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**50%**	**0%**
TOTAL IN-KIND	***3395%***	***639%***	***427%***	***1250%***	***105%***	***689%***	***3110%***	***115%***	***135%***	***35%***
Cash Funded Staff University of Tasmania										
K Bidwell	85%						0%			85%
A Bowie	95%		95%				95%			
S Bray	100%		95%				95%		5%	
D Davies	80%		80%				80%			
W Howard	100%	10%	35%	50%			95%		5%	
J Hunter	100%					95%	95%		5%	
C le Goy	50%						0%		25%	25%
J Liesner	73%			73%			73%			
B Mapstone	100%	5%	5%	5%	5%	5%	25%	10%	30%	35%
S Marsland	83%			83%			83%			
K Meiners	100%	85%				15%	100%		0%	
M Mongin	100%		100%				100%		0%	
A Moy	10%		10%				10%			
C Moy	40%		15%	25%			40%			
T O'Kane	33%			33%			33%			
B Pasquer	95%	90%	5%				95%			
V Randell	90%						0%		10%	80%
T Remenyi	100%		98%				98%		2%	
L Robertson	18%		18%				18%			
M Rosenberg	95%		25%	70%			95%			
R Sandford	100%				95%		95%		5%	
E van Wijk	80%				80%		80%			

appendix g: staff resources

Staff Name	Total % Time	AME	CO_2	CVC	POL	SLR	Rsch Total	Educ'n	Commerc	Admin
G Williams	95%	95%					95%			
S Zicus	100%						0%	5%	5%	90%
Total	**1922%**	**285%**	**581%**	**339%**	**180%**	**115%**	**1500%**	**15%**	**92%**	**315%**
Cash Funded Staff CSIRO Division of Atmospheric Research										
I Macadam	2%					2%	2%			
K McInnes	8%					8%	8%			
D Bi	11%			11%			11%			
S O'Farrell	40%			20%		20%	40%			
Total	**61%**	**0%**	**0%**	**31%**	**0%**	**30%**	**61%**	**0%**	**0%**	**0%**
Cash Funded Staff CSIRO Division of Marine Research										
P Nichols	10%	10%					10%			
K Paterson	35%		35%				35%			
C Rathbone	3%		3%				3%			
S Sokolov	65%			65%			65%			
Total	**113%**	**10%**	**38%**	**65%**	**0%**	**0%**	**113%**	**0%**	**0%**	**0%**
Cash Funded Staff Australian National University										
D Fouracre	20%					20%	20%			
G Estermann	50%					50%	50%			
Total	**70%**	**0%**	**0%**	**0%**	**0%**	**70%**	**70%**	**0%**	**0%**	**0%**
TOTAL CASH	***2166%***	***295%***	***619%***	***435%***	***180%***	***215%***	***1744%***	***15%***	***92%***	***315%***
TOTAL INKIND & CASH	***5561%***	***934%***	***1046%***	***1685%***	***285%***	***904%***	***4854%***	***130%***	***227%***	***350%***

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page 22: M Mongin

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National Institute of Water and Atmospheric Research (New Zealand)
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