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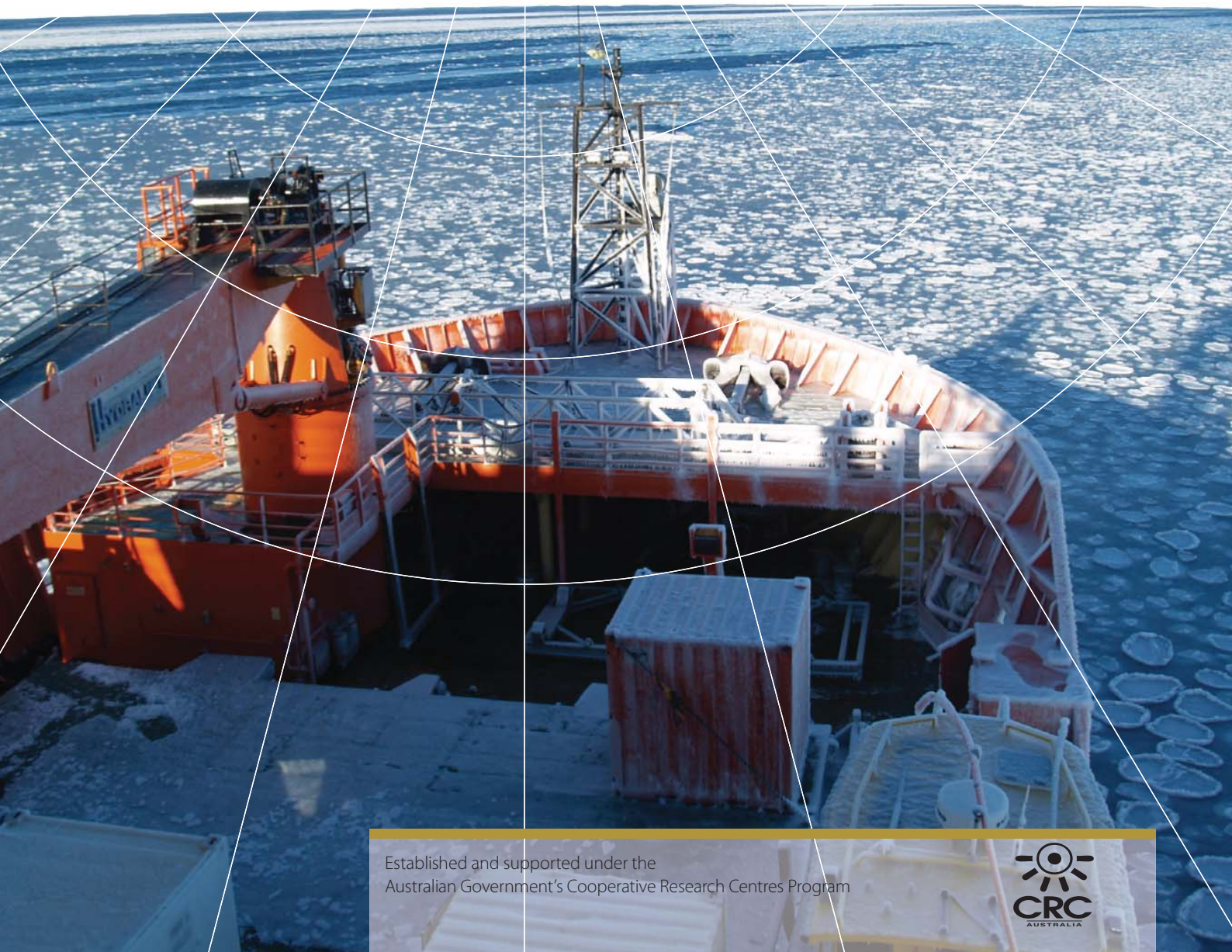
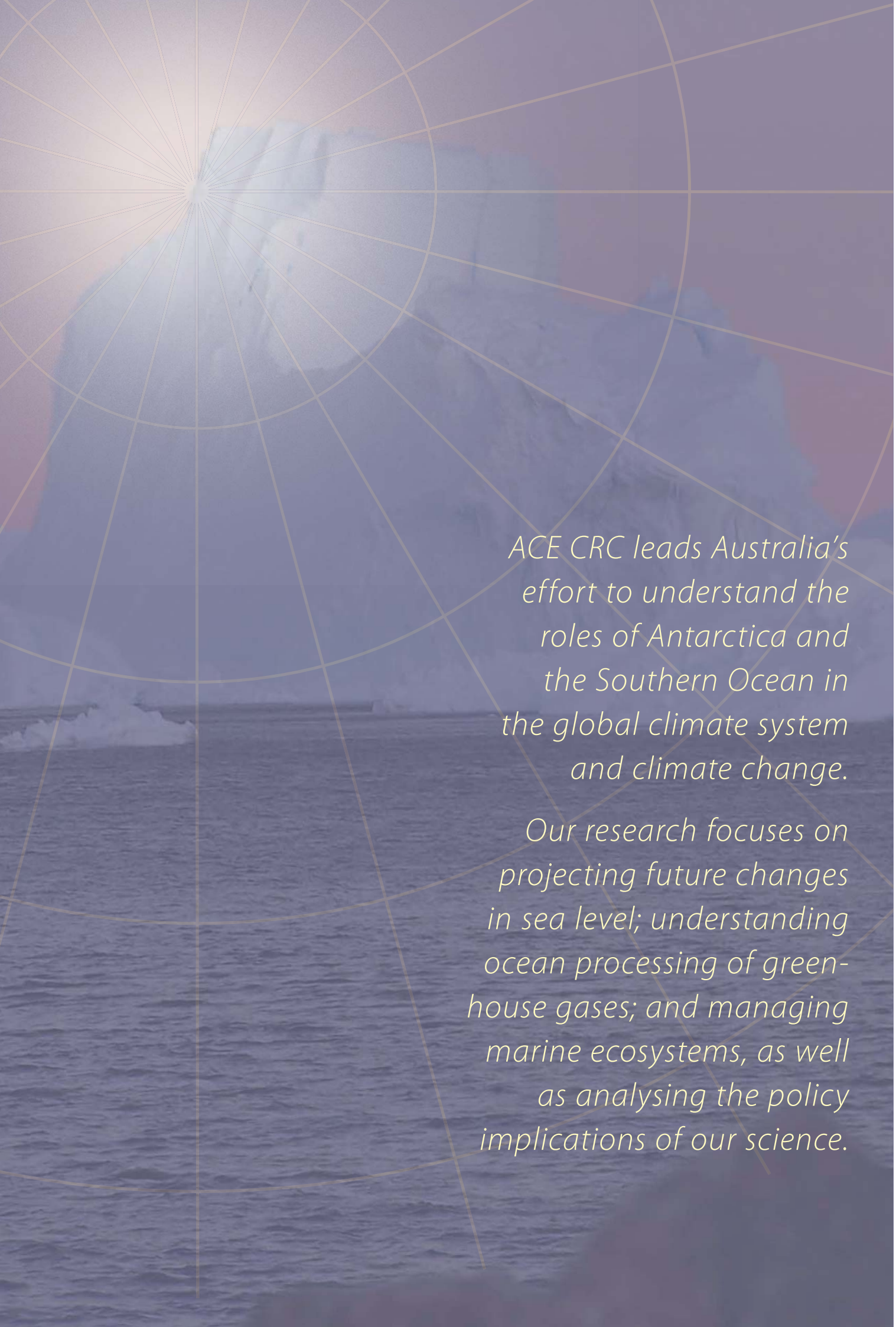
ANTARCTIC CLIMATE & ECOSYSTEMS
COOPERATIVE RESEARCH CENTRE

2008–09
Annual Report



Established and supported under the
Australian Government's Cooperative Research Centres Program



ACE CRC leads Australia's effort to understand the roles of Antarctica and the Southern Ocean in the global climate system and climate change.

Our research focuses on projecting future changes in sea level; understanding ocean processing of greenhouse gases; and managing marine ecosystems, as well as analysing the policy implications of our science.

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Annual Report 2008–2009

Antarctic Climate & Ecosystems
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Department of the Environment, Water, Heritage and the Arts
Australian Antarctic Division

UTAS

CSIRO

Australian Government
Bureau of Meteorology

Executive summary

The ACE CRC's research during 2008–2009 continued to focus on the major climate drivers in the Antarctic and Southern Ocean, changes in the cryosphere, in the physical and biogeochemical ocean environment, and the description of, and changes in, species and ecosystems.

Under the leadership of Dr John Church, the Sea-level Rise (SLR) Program was able to produce updated estimates of sea-level rise by combining in-situ and satellite observations. Sea level continues to rise, and this can be explained substantially by thermal expansion of the ocean, the contribution of melting glaciers, dissipation of the Greenland ice sheet and melt in Antarctica. There are still some uncertainties in estimating the absolute contributions of the Greenland and Antarctic ice sheets to sea-level rise, but recent research suggests that their contributions are most likely underestimated in current models.

The SLR Program, in a significant project which delivered ACE CRC research into the broader community, presented a series of 9 seminars and 4 workshops around Australia on sea-level rise and how to combine sea-level rise, storm surge, and the uncertainties in projected estimates when planning infrastructure and development. Co-funded by ACE CRC and the Australian Government's Department of Climate Change, these seminars and workshops were attended by 476 people as at the end of June 2009, and are scheduled to continue until April 2010.

ACE CRC scientists also participated in the first season of the ICECAP research program, a major international aerogeophysical program which is exploring the thickness of the Antarctic ice sheet and the underlying bedrock. Supported by the Australian Antarctic Division out of the ski-way near Australia's Casey station during the 2008–2009 austral summer, ICECAP explored the deep Aurora Basin inland from Casey. Data from this and future ICECAP research will be used to find sites which are suitable to drill for ice cores which may reveal climate records beyond one million years ago.

The Climate Variability and Change (CVC) Program, under the leadership of Drs Steve Rintoul (to April 2009) and Tas van Ommen, produced enhanced high-resolution models of the interactions between winds and the ocean, showing that stronger winds produced greater eddy formation in the Antarctic Circumpolar Current, rather than increasing its flow; and showed that major oceanographic fronts are moving further south.

The CVC Program also identified new sources of deep ocean water formation in the region between 30°E and 80°E. Formation of this Antarctic bottom water is a key driver of global ocean circulation, and being able to measure its production and characteristics is important in detecting and understanding climate change and its impacts.

The first maps of fast ice (sea-ice which is adhered to the coast) were assembled for the

East Antarctic Coast (10°E to 170°E). Providing the first continuous series for the region, these maps show the variability and extent of fast ice and will be important for understanding not only physical and oceanographic processes but the response of wildlife populations, such as emperor penguins, to changes in sea-ice extent and characteristics.

Under the leadership of Associate Professor Tom Trull, the Ocean Control of Carbon Dioxide (CO2) Program continued to increase our understanding of the role of the oceans in absorbing CO_2 and the physical, biogeochemical and biological controls on these processes. The availability of iron is a major limitation on phytoplankton production, and there are proposals domestically and internationally to promote 'iron fertilisation' as a means of sequestering carbon. Scientists from the ACE CRC, who are world experts in this field, were able to provide robust scientific advice to the Australian Government in international negotiations under the London Convention/Protocol.

Results from the SAZ–Sense research voyage (2007) south of Tasmania, the Clivar–GEOTRACES transect across the Southern Ocean to Antarctica (2008), and the SIPEX (2008) study of sea-ice processes confirmed the central role of iron in ocean primary productivity and the biological carbon pump, and revealed multiple pathways for iron delivery – from aerosol deposition, boundary currents, the thermohaline overturning circulation, and sea-ice melting – that are expected to be impacted differently by climate change.

Scientists in the CO2 Program identified and published the first evidence that 'ocean acidification', caused by the absorption by oceans of anthropogenic CO_2, is having an impact on southern ocean zooplankton (foraminifera and pteropods). The publication of this research created great interest in both scientific and popular media.

The Antarctic Marine Ecosystems (AME) Program, under the leadership of Dr Andrew Constable, played a key role in a series of workshops which brought together Antarctic researchers from around the world. ACE CRC scientists convened and participated in a joint IWC/CCAMLR workshop (Hobart, August 2008) which collated and reviewed data on the abundance, distribution and biology of Antarctic biota and the physical parameters of the Southern Ocean in order to better define and model ecosystem processes.

ACE CRC scientists also played a key role in an international workshop held in Hobart in April 2009 to establish the Southern Ocean Sentinel. This workshop, hosted by ACE CRC, the Australian Antarctic Division and WWF–Australia, brought together Antarctic researchers from many disciplines to establish protocols for designing and implementing long-term research and monitoring programs to detect and estimate climate change in Southern Ocean ecosystems.

Work also continued in the AME Program on finalising the analyses from the BROKE–West voyage (2006) and the production of a special volume of Deep-Sea Research containing 20 papers from this major interdisciplinary Antarctic research voyage. Other significant interdisciplinary research efforts included publication of a model of sea-ice algal production off East Antarctica and the joint international WCRP–SCAR–ACE CRC workshop on Antarctic sea-ice, which will produce another special volume of Deep Sea Research featuring research papers from the SIPEX voyage.

The ACE CRC Policy (POL) Program lead by Associate Professor Marcus Haward continued active engagement with policy makers and stakeholders through 2008–2009. Four ACE CRC Position Analyses were published on Sea-level Rise, Ocean Fertilisation, Sea-ice and Ice Sheets. These Position Analyses provided up to date assessments of the state of knowledge on critical aspects of climate change, and were both popular and well received.

The ACE CRC also designed and presented a short course on 'Antarctica and the Southern Ocean: implications for Australian and global climate change' which attracted 70 Australian Government officials in May 2009.

ACE CRC staff contributed to the Climate Futures for Tasmania (CFT) Project, funded through the Commonwealth Environmental Research Facility and the Tasmanian Government under a contract to the ACE CRC, with additional support from Hydro Tasmania. This is a significant body of work which brings together ACE CRC, CMAR, DPIPWE, Hydro Tasmania, UTAS, TPAC, TIAR, GA and the BoM. CFT 'downscales' the global climate model to produce fine-scale climate projections (14km^2) for Tasmania to inform Governments, key industry, service and utility providers on the range of expected values for key climate indicators into the future. It has produced a new digital elevation dataset for coastal Tasmania and the first set of climate projections to 2100 for Tasmania. A first for Australia, this fine-scale approach is a model for similar projections for the rest of Australia and the globe.

The higher degree profile in the ACE CRC remains strong with 57 active students at June 2009, including 6 PhD students who began their studies in the reporting year.

Professor Bruce Mapstone resigned as CEO of the ACE CRC in November 2008. Prior to the appointment of a new CEO, Dr Ian Allison took up the role of acting CEO from November 2008 to January 2009. I took up the position of CEO in January 2009. I have seen the ACE CRC frame a successful application for Round 11 funding, and have experienced at first hand working with the talented and enthusiastic staff and researchers of the ACE CRC and its partners. It will be a pleasure to work with them during the next life of ACE.

AJ Press
CEO

Key staff appointments

Member	ACE CRC Position	ACE CRC Program
Ms Carrie Bloomfield	Marine Analytical Chemist	CO2
Dr Frank Colberg	Ocean Circulation Modeller	CVC
Dr Stuart Corney	Climate Systems Modeller	CFT
Ms Anja Hilkemeijer	Extension/Research Officer	POL
Ms Wenneke ten Hout	Administration Manager	Administration

Major equipment purchases

Equipment (AUD$)	ACE CRC Program
Coulometer ($34,272)	CO2
Eonfusion software licenses ($82,500)	Across all programs

Major developments and benefits

In its Round 8 application in 2002, the ACE CRC foreshadowed its potential benefits to Australia in economic, environmental and social terms.

- **The ACE CRC will contribute economic value: more reliable climate projections will allow Australia to benefit from the opportunities and better adapt to an evolving climate.** Fundamental climate science research by the ACE CRC has contributed significantly to the world's understanding of the extent and pace of climate change. The ACE CRC has developed specific models and tools to allow Australian planners, engineers and policy makers to take account of sea-level rise in a risk assessment framework in planning and constructing coastal infrastructure. The Climate Futures for Tasmania project is developing climate projections for all of Tasmania and relating these to all primary and industrial sectors of the Tasmanian economy.

- **ACE CRC research will provide data that can underpin improved sustainability of the Southern Ocean krill fishery. The krill fishery in the Southern Ocean continued to grow steadily.** The results of the BROKE–West voyage (Jan–Mar 2006), a major marine science collaboration of the ACE CRC, have provided fundamental information on the status of krill stocks in the East Antarctic. Other ACE CRC research on ocean acidification highlights the crucial relationship between the ocean's role in sequestering atmospheric CO_2 and its impacts on the marine food chain.

- **The ACE CRC will enable Australia to fulfil major environmental goals.** The ACE CRC has contributed significantly to the Australian Government's National Research Priority of a Sustainable Australia and the goal for Australia's Antarctic program of *Understanding the role of Antarctica in the global climate system.*

- **ACE CRC research will enable efficient adaptation to sea-level rise.** ACE CRC research has helped resolve the issue of the fundamental contribution of ocean expansion to sea-level rise, and highlighted the potential contribution of the Antarctic ice sheets to further sea-level rise. Researchers at the ACE CRC have developed an on-line tool to assist decision-makers to assess the extent of sea-level rise in coastal Australia. In collaboration with the Australian Government's Department of Climate Change, the ACE CRC has run sea-level rise seminars and workshops around Australia demonstrating the use of this on-line tool.

- **ACE CRC research will provide for the development of timely ocean and sea-ice extent and thickness forecasts**. Resourcing constraints and technical issues mean that a full operational model is unlikely to be achieved by the end of the current CRC. It is expected that a fully operational forecasting model will be developed outside of the CRC.

- **ACE CRC research will attract and focus international efforts on the sector south of Australia... with significant economic benefits to Tasmania... and contribute to the national identity.** Hobart continues to grow as a significant global centre for Antarctic and marine science. The ACE CRC, as a focus for much of this research, especially on climate change, has attracted researchers and collaborations from around the world. The Anatcrtic and marine science sector is a major component of the Tasmanian economy and Australia is recognised as a significant contributor to Antarctic and Southern Ocean research, climate change science and to Antarctic and Southern Ocean affairs.

- **The ACE CRC is tracking well to achieve its overall goals.** It has continued to deliver fundamental climate change science into the science community nationally and internationally, and to the broader community and policy environment. It successfully introduced a marine ecosystems program and, in responding to its 3rd year review, the ACE CRC has built a strong program of work in translating its science into the policy environment through its Position Analyses, research user workshops and short courses. In addition, a Deputy CEO (Business Development) was appointed to build the business profile of the ACE CRC and develop new pathways to deliver ACE CRC science outputs. Despite difficulties in recruiting modelling expertise and some setbacks in achieving minor milestones, the ACE CRC has established strong foundations in understanding and modelling sea-ice and marine ecosystems. The organisation is poised for transition into its next phase.

Honours and awards

Staff name	Honour or award	Reason for receiving	Date received
Bindoff N	Atmospheric Science Librarians: 2007 ASLI Choice, Scientific and Technical Category for high impact comprehensive publication	Climate Change 2007: The Physical Science Basis	Sep 2008
Bindoff N	NOAA: 2008 OAR Outstanding Atmospheric Scientific Paper Award	Technical Summary, Climate Change 2007: The physical science basis. Contribution of Working Group 1 to the Fourth Assessment report of the IPCC	Sep 2008
Jabour J	UTAS Teaching Merit Certificate	Teaching merit	Jun 2009
Lambeck K	Elected as Foreign Associate of US National Academy of Sciences	Significant contributions to science	Apr 2009
	Awarded Officer of the Order of Australia Award (AO) in 2009 Queens Birthday Honours	For service to science through the development of policy, the promotion of educational programs and as a researcher and educator in the field of geoscience.	Jun 2009
Nichols P	Australian Marine Science Association	Lifetime achievements for marine science	Jul 2009

National research priorities

The ACE CRC continued to develop scientific understanding of climate change and ecosystem related changes to the Antarctic, Southern Ocean and Australian regions and to inform Australia's adaptation and mitigation responses and to support the national research priority of an 'environmentally sustainable Australia'.

ACE CRC made major, strategically-aligned research contributions to the International Polar Year 2007–08 (IPY), which formally concluded in March 2009. IPY was the largest internationally coordinated planetary research effort in the past 50 years and it took place during a period of significant planetary change, particularly evident in polar regions. The scientific legacy of IPY is continuing to evolve and ACE CRC will use data collected, and new observational techniques and systems developed during IPY towards meeting future objectives.

The ACE CRC Position Analyses (contemporary analyses of science topics relevant to government and decision makers) have proven to be a highly successful communications vehicle and have been widely referenced both within Australia and overseas.

National research priority highlights

The CO2 Program contributed strongly to international debate on the efficacy and risks of proposals to stimulate carbon sequestration via ocean fertilisation. ACE CRC participated in Australia's delegations to the London Protocol on the Prevention of Pollution by the Dumping of Wastes in the Ocean meetings in London and Rome, to promote political agreements to permit ocean fertilisation research and place a moratorium on activities other than research. ACE CRC research improved the understanding of the present and projected future ability of the Southern Ocean to uptake CO_2, which will assist in informing emissions control targets.

The CVC Program delivered new understanding of the role of ocean eddies and frontal systems and their response to the observed increasing winds over the period from the 1960's to the present. High resolution ocean modelling shows that stronger winds lead to greater eddy formation in the Antarctic Circumpolar Current rather than to increased overall flow. This work is supported by observational studies which also show southward movement of major ocean fronts.

Using a combination of in-situ and satellite observations, the Sea-Level Rise Program demonstrated that sea level is continuing to rise. Updated estimates of ocean thermal expansion, when combined with published estimates of glacier and Greenland contributions, approximately explain the observed rise. Revised estimates of the Greenland contribution to sea-level rise show an increased loss of ice from Greenland over recent years. Revised estimates of the Antarctic contribution suggest a positive contribution to sea-level rise with indications of an increased contribution from the West Antarctic ice. A model of ice-shelf/ocean interaction has been substantially improved. Simulations using the model of the circulation and melting and freezing for the Amery Ice Shelf and Mertz Ice Tongue regions agree well with observations. Global warming simulations show enhanced melt response to ocean warming.

The AME Program hosted an international workshop on how to design and implement a long-term monitoring program to estimate climate change impacts on Southern Ocean marine ecosystems (a Southern Ocean Sentinel program). A major inter-disciplinary program describing the marine ecosystem in eastern Antarctica (30–80°E) (BROKE–West) was finalised as a special issue of Deep-Sea Research II.

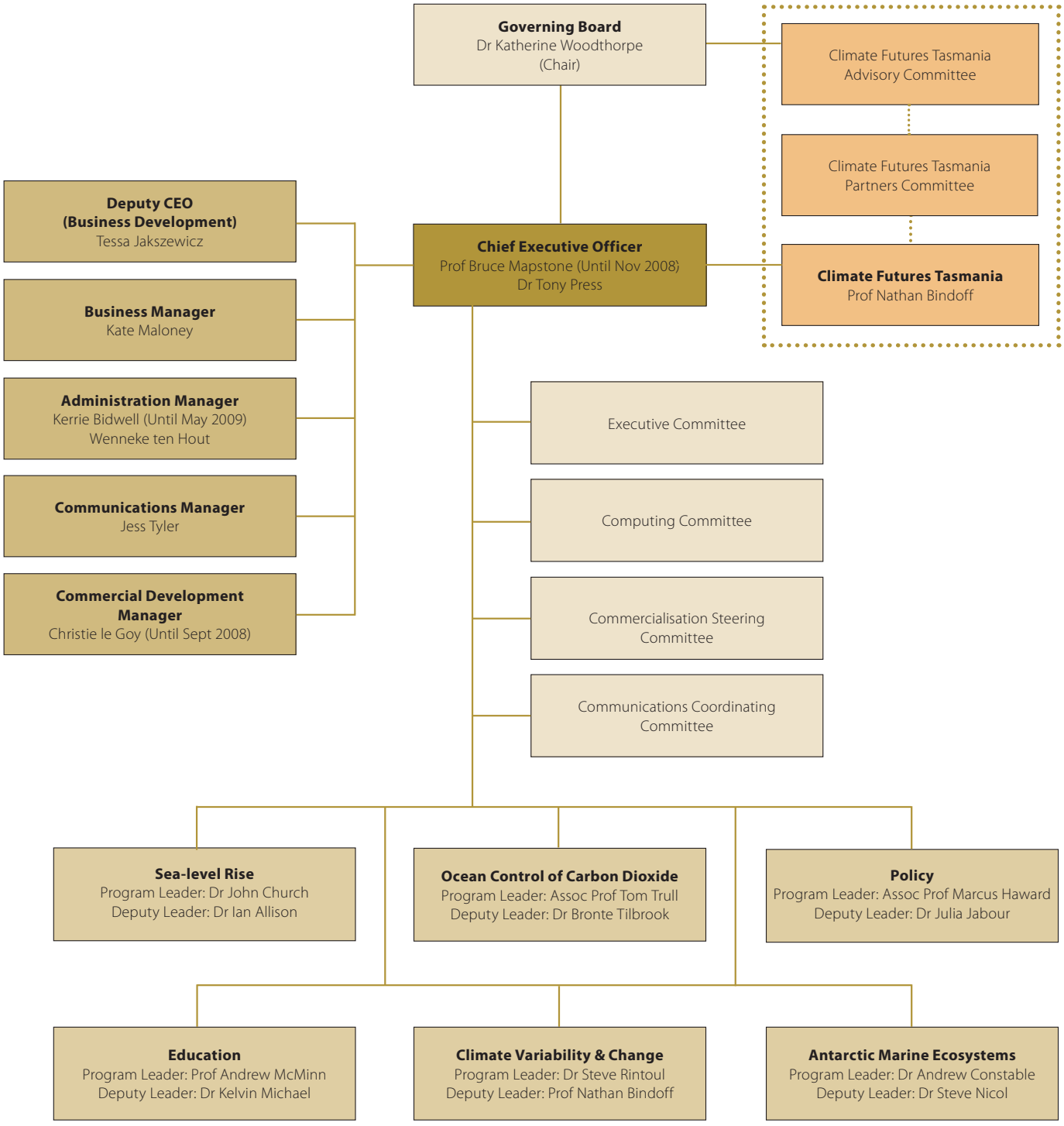
Following the success of the ACE CRC Position Analysis papers in 2007–2008, additional papers were published on Sea-level Rise, Ocean Fertilisation, Sea-ice and Ice Sheets.

The CFT project completed 95% of the modelling simulations, amounting to more than 70 terabytes of modelling outputs available to the research community. Our validation phase has confirmed the ability of the models and downscaling process to reproduce the spatial pattern of observed datasets over Tasmania. This gives us confidence in the ability of the simulations to estimate the effects of climate change on Tasmania through the 21st century.

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 and management

Core partners	Supporting partners
Australian Antarctic Division (AAD)	Alfred Wegener Institute for Polar and Marine Research (AWI, Germany)
Australian Bureau of Meteorology (BoM)	The Department of Climate Change (DCC)
CSIRO Division of Marine and Atmospheric Research (CMAR)	The Australian National University (ANU)
University of Tasmania (UTAS)	National Institute of Water & 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 contribution.
Changes to board membership during the year were as follows:

- Dr Geoff Love resigned on 2 December 2008;
- Dr Greg Ayers resigned on 5 May 2009;
- Dr Tony Press resigned on 22 January 2009 to take up the position of CEO, changing to an ex-officio member of the board;
- Ms Lyn Maddock was appointed on 12 February 2009;
- Dr Steve Rintoul was appointed on 5 May 2009; and
- Mr John Gunn was appointed as the Australian Antarctic Division ex-officio member on 12 February 2009.

Regular quarterly board meetings were held on 1 July 2008, 26 August 2008, 2 December 2008, 12 February 2009 and 15 May 2009. A special board meeting was held on 13 March 2009 to approve and confirm the application to the 11th Selection round of the CRC program.
No change in CRC participants occurred during the year.

Dr Katherine Woodthorpe (Chair) is a management adviser and professional director, specialising in innovation and commercialisation issues and during 2007 she was appointed Chief Executive of AVCAL. Her varied background is in science, technology, human resources, 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.

Mr Howard Bamsey is Deputy Secretary of the Department of Climate Change and Australia's Special Envoy on Climate Change. In 2006 he was appointed 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 include Ambassador to the United Nations in Geneva and Ambassador for the Environment.

Mr Tony Coleman is a director of Lonergan Edwards & Associates Ltd with extensive experience in senior roles in the insurance, investment and finance sectors. He is a former Chief Risk Officer of Insurance Australia Group and was previously a senior corporate finance partner of PricewaterhouseCoopers. Tony is also a past president of the Institute of Actuaries of Australia (IAAust) and a winner of the IAAust's Actuary of the Year award. Consistent with his active interest in the subject of climate change, he is a member of the Advisory Board of the Australian National University's Climate Institute and a Director of Green Cross Australia, a not-for-profit body working on climate change adaption issues.

Professor Johanna Laybourn-Parry commenced her appointment as Pro Vice-Chancellor (Research) at the University of Tasmania in 2007. Her research background is as a polar scientist working on carbon cycling in lakes and glaciers. Her Antarctic research has been conducted with the Australian Antarctic Program at Davis Station and with the United States Long Term Ecological Research Program in the McMurdo Dry Valleys. She has worked at universities including Stirling University, Lancaster University and Nottingham University and Melbourne's La Trobe University.

Dr Greg Ayers has been Director of the Bureau of Meteorology since May 2009, having previously served as Chief of CSIRO's Division of Marine & Atmospheric Research since 2005. He has pursued broad scientific interests across a range of topics in marine and atmospheric biogeochemistry. He is a member of numerous national and international committees and boards, including the International Commission for Atmospheric Chemistry and Global Pollution of the International Association of Meteorology and Atmospheric Sciences. In 1995, Dr Ayers was awarded the Australian Meteorological and Oceanographic Society's Priestley Medal for achievements in the science of acid deposition.

Mr John Gunn is Chief Scientist with the Australian Antarctic Division, having previously served as Deputy Chief, CSIRO Marine and Atmospheric Research. His scientific background is in marine ecology with particular emphasis on the application of science to management of Australian and international marine resources. He has positions on the Commonwealth Fisheries Research Advisory Board and several Australian Fisheries Management Authority advisory committees. He also has broad interests in and involvement with global ocean/marine system observing initiatives and is an invited member of the Global Ocean Observing System Scientific Steering Committee, the Scientific Committee on Ocean Research Panel on New Observing Technologies for Observing Marine Life, the Scientific Board of the Ocean Tracking Network, Chair of the Census of Marine Life TOPP Program Steering Committee and is a Board member of the Australian Integrated Marine Observing System (IMOS).

Mr Greg Johannes is Deputy Secretary (Policy), Tasmanian Department of Premier and Cabinet. His background is in industry, policy, environmental management and public affairs. He has held senior positions in industry and commonwealth and state government. His areas of expertise include commercialisation of public-sector R&D, small business development, biotechnology and innovation. Prior to his current position he was Executive Director of the Tasmanian Office of Climate Change.

Dr Geoff Love joined the Bureau of Meteorology in 1975, and in 1997 was promoted to Deputy Director (Services). He was appointed Secretary of the Intergovernmental Panel on Climate Change in April 2002 and returned to the position of Director of Meteorology in August 2003. Dr Love holds a BSc (Hons) and MSc from La Trobe University, a PhD from Colorado State University and an MBA from Deakin University. His international experience includes a position as Vice President and President of the World Meteorological Organisation Commission for Basic Systems.

Ms Lyn Maddock has been Director of the Australian Antarctic Division since February 2009. Lyn has a background in management, policy research and experience in international matters and sees her role as the Director of the Antarctic Division as an ideal opportunity to utilise all of these skills. She came to this position from the position of Deputy Chair of the Australian Communications and Media Authority (ACMA) to which she was appointed on its establishment in 2005. She had previously been Acting Chair of the Australian Broadcasting Authority. From April 2008 to November 2008, she was on leave from ACMA to be the interim CEO of Screen Australia, the Australian Government screen support agency. Lyn has a Bachelor of Economics (Qld) and was awarded a Public Service Medal in January 2007.

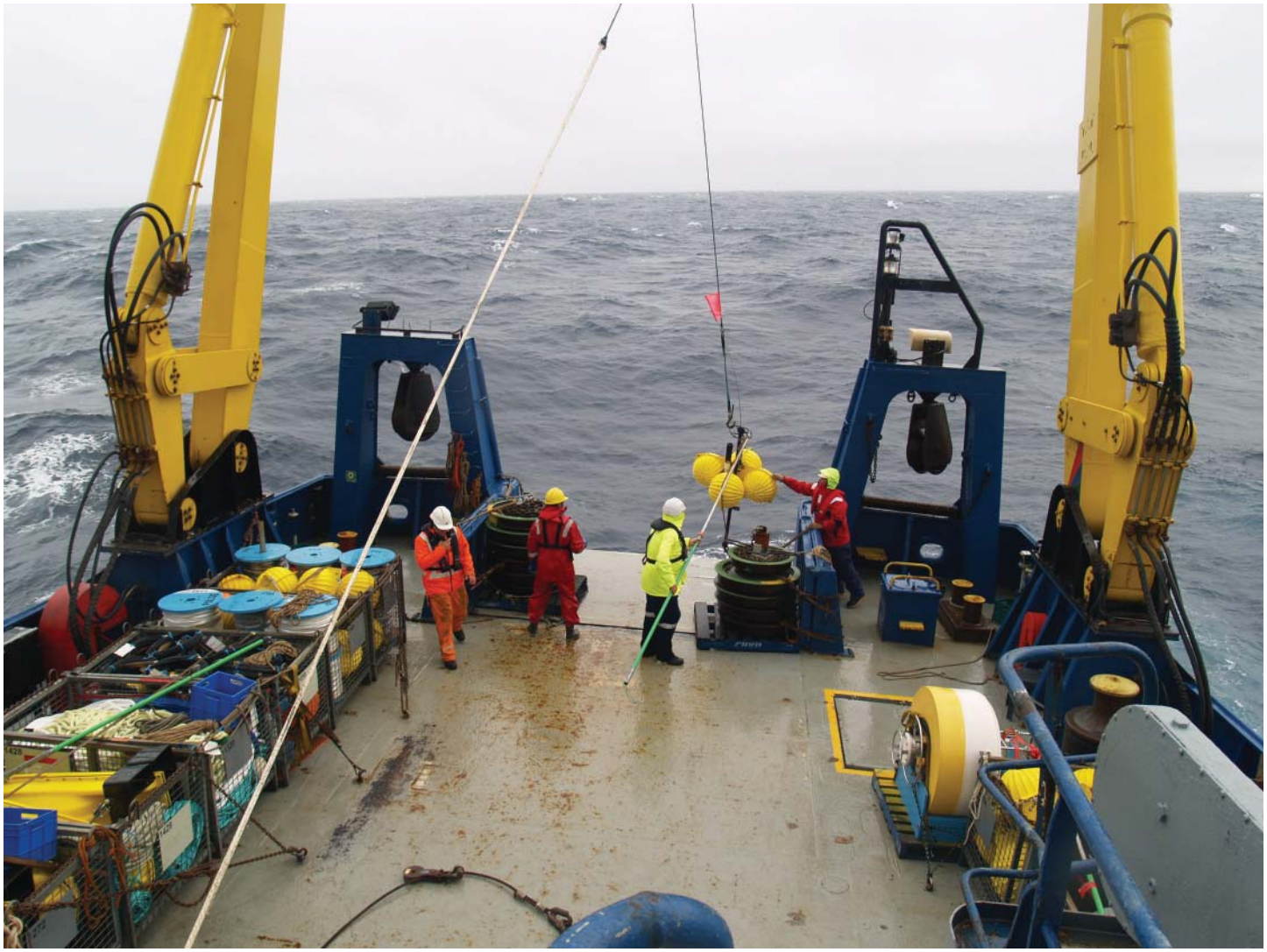
Dr Tony Press has been Chief Executive Officer of the ACE CRC since January 2009. Prior to his appointment as CEO of the ACE CRC, Tony was Director of the Australian Antarctic Division from 1998 to 2009. Key achievements in that position included implementing the Government's goals for Australia's Antarctic program, 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 Development of Tropical Savannas.

Dr Steve Rintoul is Acting Chief of CSIRO's Division of Marine & Atmospheric Research. He has made pioneering contributions to understanding the dynamics, structure and variability of the Antarctic Circumpolar Current and his work has led to a new view of the major pathways of the global overturning circulation and its role in the climate system. In recognition of these achievements, he has received a number of national and international honours. For the last fifteen years he has led the design, implementation and analysis of each of the major international field campaigns carried out to investigate the circulation of the Southern Ocean and its role in the climate system. He is presently leading the development of international plans for a multi-disciplinary Southern Ocean Observing System.

Mr Bill Trestrail is a senior executive with broad experience in advanced technologies. Until recently he was Vice-President of SGI Asia Pacific, where he held a number of senior management positions within the Asia-Pacific region. He is currently a board member of several start-up technology companies and provides consultancy in commercialisation.

The ACE CRC Board

Name	Organisation	CRC position/role
Dr Katherine Woodthorpe	AVCAL	Chair
Mr Howard Bamsey	DCC	Board Member
Mr Tony Coleman	Lonergan Edwards & Associates Ltd	Board Member
Professor Johanna Laybourn-Parry	UTAS	Board Member
Mr Greg Johannes	DED/DPAC	Board Member
Ms Lyn Maddock	AAD	Board Member
Dr Steve Rintoul	CMAR	Board Member
Mr Bill Trestrail	SGI (retired)	Board Member
Dr Tony Press (CEO)	ACE CRC	Ex-officio
Mr John Gunn	AAD	Ex-officio
Dr Greg Ayers	CMAR	Board Member (retired)
Dr Geoff Love	BoM	Board Member (retired)



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 for Advanced Computing (TPAC), the Bureau of Meteorology (BoM) and the research student body. The ACE CRC Executive Committee met during 2008–2009 as follows: 22 Aug 2008; 12 Nov 2008; and 25 Feb 2009.

Member	ACE CRC position
Dr Neil Adams (BoM)	Researcher
Dr Ian Allison AAD	Deputy Leader, SLR Program
Ms Kerrie Bidwell/Ms Wenneke ten Hout ACE CRC (Secretary)	Administration Manager
Prof Nathan Bindoff TPAC	Director TPAC
Dr John Church CMAR	Leader, SLR Program
Dr Andrew Constable AAD	Leader, AME Program
Assoc Prof Marcus Haward UTAS	Leader, Policy Program
Ms Tessa Jakszewicz	Deputy CEO (Business Development); Manager, Research Delivery and Commercial Development
Ms Christie le Goy ACE CRC (Until Sept 2008)	Manager, Research Delivery and Commercial Development
Prof Andrew McMinn UTAS	Leader, Education Program
Ms Kate Maloney ACE CRC	Business Manager
Prof Bruce Mapstone/ Dr Tony Press ACE CRC (Chair)	Chief Executive Officer
Dr Kelvin Michael UTAS	Deputy Leader, Education Program
Dr Stephen Rintoul CMAR	Leader, CVC Program
Dr Jason Roberts AAD	Chair Computing Committee
Assoc Prof Thomas Trull CMAR/UTAS	Leader, CO2 Program
Ms Jess Tyler ACE CRC	Communications Manager
Pier van der Merwe/Tomas Remenyi UTAS	PhD student

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. The ACE CRC Computing Committee met during 2008–2009 as follows: 26 Nov 2008.

Member	Position
Ms Kerrie Bidwell ACE CRC (Secretary)	Administration Manager
Mr John Dalton UTAS	Information Technology Resources
Mr Leigh Gordon UTAS	Information Technology Resources
Mr Nick Grundy UTAS (ex-officio)	Information Technology Resources
Assoc Prof Marcus Haward UTAS	Leader, Policy Program
Mr Glenn Hyland AAD	Researcher
Mr Ben Joseph ACE CRC	Computer Support Officer
Dr Jan Lieser ACE CRC	Researcher
Ms Kate Maloney ACE CRC	Business Manager
Prof Bruce Mapstone ACE CRC	Chief Executive Officer
Dr Richard Matear CMAR	Researcher
Dr Kelvin Michael UTAS	Deputy Leader, Education Program
Dr Benedicte Pasquer ACE CRC	Researcher
Dr Jason Roberts AAD (Chair)	Researcher
Dr Roland Warner AAD	Researcher
Mr James Perkin	Information Technology Resources
Mr Alex Fraser	PhD student

Commercialisation Steering Committee

The ACE CRC Commercialisation Steering Committee provides advice to the CEO, Executive Committee and Board of the ACE CRC on commercialisation opportunities arising from ACE CRC activities. The Commercialisation Steering Committee did not formally meet during 2008 to 2009 as no IP was identified for commercialisation. The role and structure of such a committee will be reviewed for the extension CRC to accommodate the changing structure of the CRC and the inclusion of new commercial partners.

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 communications plan by coordinating with the partner agencies' public communication and reporting strategies. Informal gatherings and regular email/on-line discussion between a number of the Committee members were held throughout the year. The ACE CRC Communications Coordinating Committee met face-to-face during 2008–2009 as follows: 4 Aug 2008; and 30 April 2009.

Member	Position
Ms Moya Fyfe UTAS	Media Manager
Mrs Sally Chambers AAD	General Manager, Corporate Communications
Mr Craig McAulay CMAR	Communications Officer
Mr David Grant BoM	Public Affairs Manager
Ms Jess Tyler ACE CRC (Chair)	Communications Manager

Climate Futures for Tasmania Advisory Committee

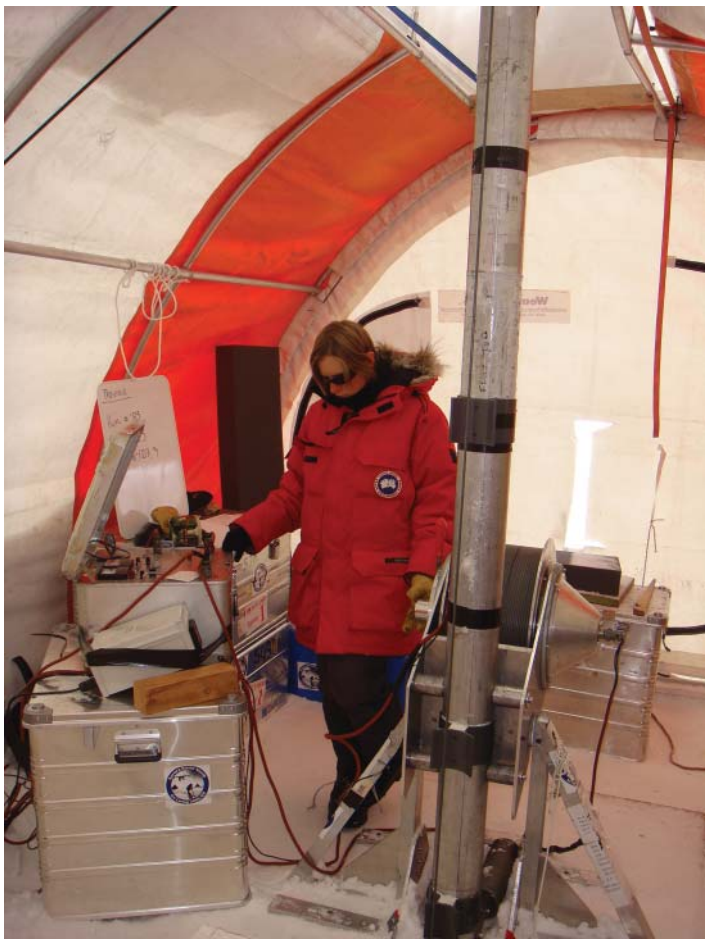
The Climate Futures for Tasmania Advisory Committee is a forum for the major project funding stakeholders to provide strategic advice on the conduct of the project to the ACE CRC Board, the ACE CRC CEO (as Project Supervisor) and Project Leader. The Climate Futures for Tasmania Advisory Committee met during 2008–2009 as follows: 14 Nov 2008; and 22 May 2009.

Member	Position
Nathan Bindoff (ACE CRC; TPAC)	Project Leader
Andrew Catchpole (Hydro Tasmania)	General Manager Communications and External Relations
Greg Johannes (Dep of Premier and Cabinet)	Deputy Secretary (Policy)
Kate Maloney (ACE CRC)	Business Manager
Prof Bruce Mapstone/ Dr Tony Press (ACE CRC)	Chief Executive Officer
Michele Moseley (DPIW)	Deputy Secretary
Scott Tilyard (Department of Police and Emergency Management)	Acting Deputy Commissioner

Climate Futures for Tasmania Partners' Committee

The Climate Futures for Tasmania Partners' Committee provides a forum for discussion among all contributing partners (funding and research) supporting project operations and implementation. The Climate Futures for Tasmania Partners' Committee met during 2008–2009 as follows: 29 Oct 2008; and 8 May 2009.

Member	Position
Chris Beattie (SES)	Assistant Director, Policy and Programs
Nathan Bindoff (ACE CRC; TPAC)	Director, Oceanography
Andrew Catchpole (Hydro Tasmania)	General Manager Communications and External Relations
Bob Cechet (GA)	Senior Research Scientist; Climate Change Project; Risk and Impact Analysis Group
Tony Hirst (CSIRO)	Deputy Research Program Leader, Earth Systems Modelling, CAWCR
David McNeil (TIAR)	Director of TIAR and Chair of Agricultural Science
Kate Maloney (ACE CRC)	Business Manager
Bruce Mapstone/ Tony Press (ACE CRC)	Chief Executive Officer
Steve Pendlebury (BoM)	Regional Director
Jeff Ridley (SES)	Projects Coordinator
Kate Kent (DPIW)	General Manager, Strategic Policy
Steve Wilson (TIAR)	Lecturer, School of Agricultural Science (until December 2008)



CRC-funded research programs

The Antarctic Climate & Ecosystems Cooperative Research Centre 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.

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 – which is necessary to maintain Australia's leadership position in this field of research.

As well as ongoing collaborations among the different research programs within the ACE CRC, our researchers were involved in 39 national collaborative projects and 64 international collaborative projects involving 18 countries. They also served on 17 national and 42 international committees, editorial boards or advisory boards related to Antarctic and Southern Ocean research/management and climate change prediction and analysis. On these committees, 11 ACE CRC researchers served in international leadership roles such as chair, co-chair, or workshop co-convenor. Furthermore, 8 ACE CRC researchers participated in exchanges with international research groups, and ACE CRC hosted 17 international visitors. During 2008-2009, 4 ACE CRC researchers served as consultants to various industries or government agencies.

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

Climate Variability and Change (CVC) – improving our ability to predict the impact of Southern Ocean processes on climate, sea-level, marine ecosystems and the marine carbon cycle.

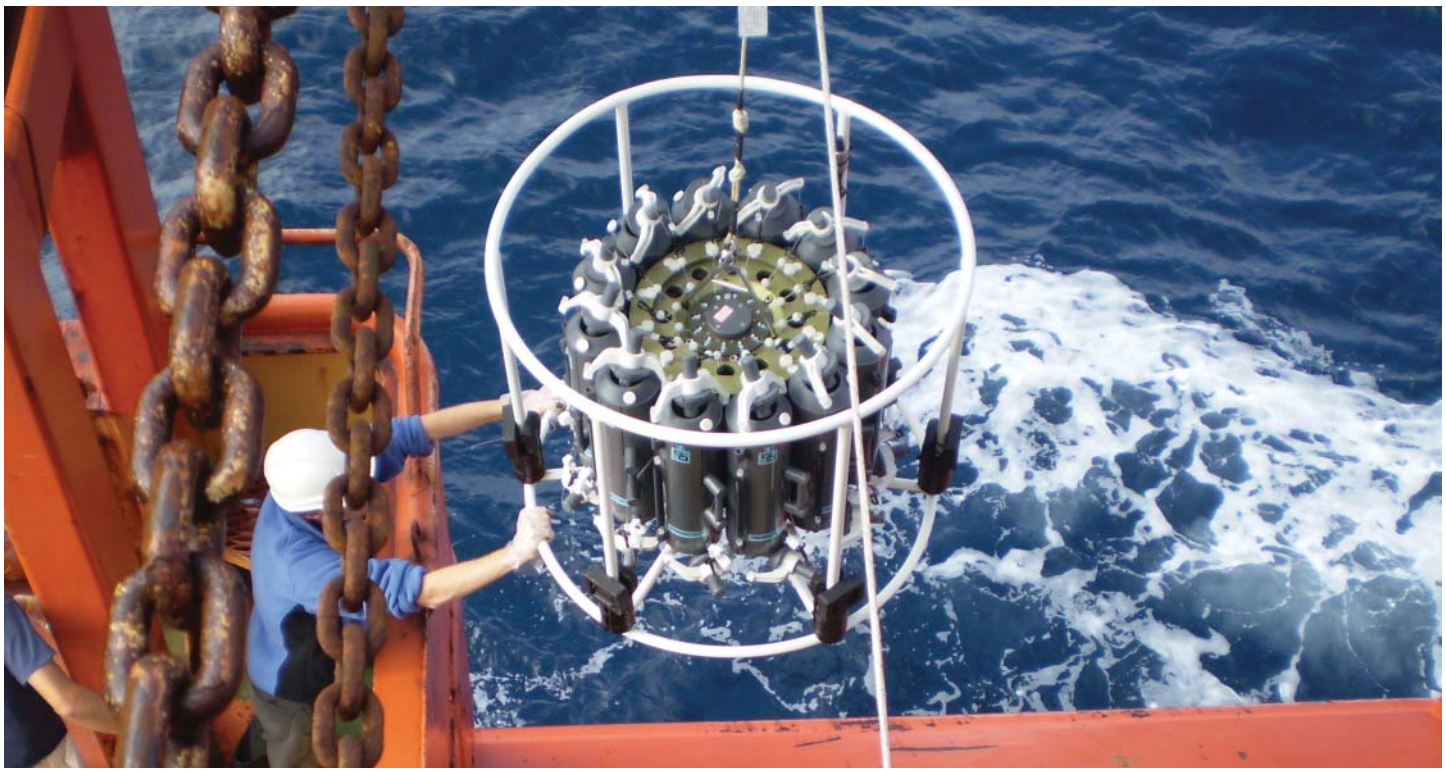
Antarctic Marine Ecosystems (AME) – exploring relationships among the biological patterns and processes of the marine ecosystems around East Antarctica and relating them to physical oceanographic processes to assist in development of sustainable management strategies.

Ocean Control of Carbon Dioxide (CO2) – determining carbon dioxide uptake and its effects on the ocean, and relating ocean processing of carbon dioxide to predictions of human-induced global change.

Sea-level Rise (SLR) – improving our ability to project and respond to future changes in sea level by increasing our understanding of historical and future sea-level changes and factors that control these.

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.

Education (EDU) – working with our core partners, museums and education organisations to identify high priority research for students and raise awareness of Antarctic science.



Climate Variability and Change

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 leader: **Dr Steve Rintoul**, CMAR and **Dr Tas van Ommen**, AAD

Objectives

- **To characterise the variability of Southern Ocean currents, sea-ice and climate and to understand the causes of their variability.** Our present understanding of Southern Ocean variability is limited, primarily due to the lack of data. 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 occurring 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 provide opportunities for prediction and is required to assess the accuracy of model simulations and to combine models and data in sensible ways.

Key achievements 2008–2009

- New understanding of the role of ocean eddies and frontal systems and their response to the observed increasing winds over the period from the 1960s to present. High resolution ocean modelling shows that stronger winds lead to greater eddy formation in the Antarctic Circumpolar Current (ACC) rather than increased overall flow. This work is supported by observational studies which in addition show southward movement of major ocean fronts. [CVC–01].
- Identified new deep water formation zones through characterization of ocean circulation in the BROKE–West study region (30°E to 80°E). This bottom water plays a key role in global circulation and this work is central to establishing a baseline for detection of climate change signals in this region. [CVC–01].
- Assembled maps of fast ice from satellite imagery for the East Antarctic Coast (from 10°E to 170°E). These provide the first detailed continuous series for this region and are providing estimates of variability and extent. Other work is linking fast ice changes to winds and large-scale atmospheric circulation, with a focus on implications for emperor penguin breeding success. [CVC–02].
- Used a newly-developed technique of tracking fine features in satellite images to study changes in the floating Mertz Glacier Tongue, where a significant calving event is imminent. This work seeks to understand calving processes generally, and the Mertz region specifically. Projected changes are expected to have a large impact on the nearby Mertz Glacier Polynya, which is a major region of sea-ice production and bottom water formation. [CVC–02].
- Recovered a new ice core record spanning 200–300 years from Law Dome. This core is being used to validate and extend existing climate records, and to undertake analyses that will provide new indicators for atmospheric circulation change and mid-latitude temperatures. [CVC–03].
- Provided insights into larger-scale atmospheric circulation patterns through synthesis and comparisons of meteorological data and ice core records. New data show connections between coastal East Antarctic circulation and ENSO, while other analysis shows that drought in southwest Western Australia is connected with increased East Antarctic precipitation by large scale north-south transport south of Australia. [CVC–03].
- Completed an assessment of the performance of the ocean component of the IPCC coupled ocean atmosphere models for the Southern Hemisphere against observations of change. The results show that the climate change signal in the models is broadly consistent with large-scale latitudinal patterns of observed change from 1960 to 2000. [CVC–04].
- A finding that the location of key water mass formation zones is likely to remain unchanged in response to anthropogenic forcing and that future formation rates will be similar to present. These zones are responsible for the highest rates of sea-level rise and the highest storage of anthropogenic carbon content. [CVC–04].

Plans for 2009–2010

- Sea-ice studies will focus on the large-scale spatial and temporal behaviour of Antarctic sea ice in response to changes in large-scale atmospheric circulation patterns. Work will also continue on fast ice using the new data sets obtained through ACE-CRC studies, as well as on ice-shelf/sea-ice/fast-ice connections.
- Regional sea-ice thickness mapping will continue with work on SIPEX data set and with collection of new data in 2009.
- Ice-core analysis will continue on the cores retrieved in 2009, while a collaborative drilling expedition to Mill Island in 2010 will extend the array of high resolution cores to a new, highly marine-exposed site. Analysis will focus on improved understanding of the variability in climate and atmospheric circulation from coastal East Antarctica to southern Australia.
- Ocean field studies will continue with sustained measurements of ACC thermal structure from the L'Astrolabe. Research using moorings off Casey will continue in collaboration with Woods Hole Oceanographic Institution. This work is part of a National Science funded mooring program to measure the Antarctic Slope Front. Recovery and analysis of the moorings off the Kerguelen Plateau will also be completed.
- Analyses of the changing structure of the Southern Ocean will be furthered, through detailed synthesis of the sea-surface height measurements and over-lying atmospheric forcing. Work will also complete water mass census and initiate detection and attribution studies of these changes in the Southern Ocean.

Projects

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

Project leader: **Nathan Bindoff**, UTAS/CMAR

Project aim: To characterise and understand the variability of the Southern Ocean and to use this knowledge to improve 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 maritime operations.

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 supports more reliable predictions of variability and change in the sea-ice zone and of the effects on climate and ecosystems.

CVC–03: Climate history

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 and interpretations that put current climate conditions in the context of long-term patterns in past climate. These provide an improved capability for detecting and attributing contemporary climate change, a better understanding of uncertainties in climate assessments and the capacity to better verify models.

CVC–04: Simulation of Ice-ocean-atmosphere Interaction and Climate

Project leader: **Nathan Bindoff**, UTAS/CMAR

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, validating them against observations from other ACE CRC research. This allows us to diagnose the processes acting in the Southern Ocean that influence and respond to global and regional climate. The resulting climate models will deliver more reliable projections of climate variability and change and their impacts.

Antarctic Marine Ecosystems

The Southern Ocean, in particular the coastal region around Antarctica, hosts a vast and complex marine ecosystem that supports the fisheries of Australia and several other nations. In comparison with the Atlantic, Pacific and Indian Oceans, this region remains relatively under-sampled and poorly understood, but is internationally acknowledged as a region of great ecological importance.

The ACE CRC Antarctic Marine Ecosystems Program is exploring relationships among the biological patterns and processes of the marine ecosystem around East Antarctica and relating them to physical oceanographic processes. This knowledge will help guide Australian government and industry decision-makers in formulating policy and management strategies for harvesting resources in response to future climate change.

Program leader: **Dr Andrew Constable**, AAD

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 ability 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 will be used to predict the effects of ecosystem changes on harvested species and the food web. This work will also be used in combination with models of fishery dynamics for more effective management of marine living resources.

Key achievements 2008–2009

- Collated data on important ecosystem parameters for modelling, ranging from physical conditions in the Southern Ocean to the distribution, abundance and biology of the major biota, which was reviewed at a joint workshop of CCAMLR and the IWC in August 2008 at CCAMLR Headquarters in Hobart. The workshop was convened by, and had major contributions from, ACE CRC staff.
- Held an international workshop, hosted by ACE CRC, AAD and WWF–Australia, on how to design and implement a long-term monitoring program to estimate climate change impacts on Southern Ocean marine ecosystems (a Southern Ocean Sentinel program) at CCAMLR Headquarters, Hobart, in April 2009.
- Established international collaborations as a leading partner in sea-ice ecology through international workshops and publications, including convening and participating in the IPY international workshop on Antarctic sea-ice research held in Italy, March 2009.
- Completed the major inter-disciplinary program describing the marine ecosystem in eastern Antarctica (30–80°E) (BROKE–West) and finalised this as a special issue of Deep-Sea Research II.

Plans for 2009–2010

- The key research remaining to be undertaken will be the completion of the sea-ice community simulation model and the larger-scale model of the krill-based ecosystem, which will be used to characterise the possible dynamics of krill populations in eastern Antarctica under possible climate change scenarios.
- Dynamic modelling of climate change impacts on krill populations will be a key output. This work will be strengthened in the extension of the ACE CRC during 2010—2014 to consider more broadly climate change impacts on Antarctic marine ecosystems as a whole.

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 being developed to explore and assess the consequences in the Southern Ocean of historical exploitation of biota, the ecological sustainability of exploitation and conservation strategies and the impacts of climate change on the ecology. A key outcome will be 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 Antarctic marine ecosystem to help develop and validate an ecosystem modelling framework that will be used in making assessments of the impact of historical and potential future changes on the ecosystems. Our work is improving the science-based, sustainable management and conservation plans of the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) and the International Whaling Commission (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 is helping guide Australian government and industry decision-makers in formulating policy and management strategies in response to future climate change.

Ocean Control of Carbon Dioxide

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

Accumulating 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 potentially have a major impact on marine ecosystems.

Understanding these complex processes is a key focus of the ACE CRC CO2 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**, ACE CRC/CMAR

Objectives

- **To determine the current magnitude of uptake of anthropogenic atmospheric CO_2 by the Southern Ocean south of Australia.** This work is contributing to an assessment of global ocean uptake and will help quantify relationships between 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.

Key achievements 2008–2009

- Contributed strongly to international debate on the efficacy and risks of proposals to stimulate carbon sequestration via ocean fertilisation, through publications on the results of the SOIREE artificial and KEOPS natural iron fertilisation studies. This included participation in the Ocean meetings in London and Rome on the London Convention/Protocol, to promote political agreements to permit ocean fertilisation research and place a moratorium on activities other than research.
- Further confirmed new results from the SAZ-Sense project on the central role of iron in setting the overall productivity and carbon export of marine ecosystems.
- Received wide-spread attention in both scientific and public media, establishing the ACE CRC CO2 program as important players in defining research agendas for assessing in ocean impacts of anthropogenic CO_2 emissions resulting from research done on the impact of ocean acidification on foram and pteropod zooplankton. This was strengthened by research done to define the present, and project the future, uptake of CO_2 in the Southern Ocean, and thus to inform emissions control targets.

Plans for 2009–2010

- Two field studies will examine the influence of iron on biological productivity – in the Tasman Sea onboard the Southern Surveyor and in the sea-ice environment with support from Australia's Casey Station to examine iron in sea-ice.
- Continue to measure nutrients, dissolved carbon, alkalinity, dissolved oxygen, phytoplankton pigments, and bio-optical characteristics from the Astrolabe repeat transects between Tasmania and Antarctica as part of Australia's Integrated Marine Observing System (IMOS). A fully instrumented Pulse mooring will be deployed in the Subantarctic Zone to make hourly measurements of temperature, salinity, dissolved oxygen, total dissolved gases, photosynthetically active radiation (PAR), phytoplankton fluorescence, and particle backscatter, and to collect 48 water samples for nutrient analyses and phytoplankton identification. These data will be collected from the surface mixed layer at ~40m depth and will only be recovered when the mooring is retrieved in March 2010. In addition, the surface float reports PAR and wave data live to the internet via IMOS.
- Continue to synthesise perspectives on Southern Ocean CO_2 uptake, and its impact on Southern Ocean ecosystems, and plan for expanded research on these issues.

Projects

CO2–01: Carbon uptake in the Southern Ocean

Project leader: **Bronte Tilbrook**, CMAR

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 is helping to define the role of the Southern Ocean in controlling atmospheric CO_2 concentrations in order to allow more robust predictions of how the Southern Ocean uptake may be altered in the future. It is also contributing 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**, ACE CRC/CMAR

Project aim: To estimate rates of phytoplankton growth and subsequent transfer of organic matter 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 will be a clearer view of the processes that transfer carbon to the deep sea in the Southern Ocean and their role in regulating atmospheric CO_2. This is a necessary step towards developing and verifying reliable carbon cycle models to simulate future atmospheric CO_2 levels. Understanding this process will also help in interpreting past changes in the Southern Ocean environment and estimating 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 Southern Ocean biogeochemical cycles. We are mapping the distribution of dissolved iron in waters south of Australia, fingerprinting supply and removal mechanisms and quantifying the influence of trace elements on phytoplankton growth and community structure in sub-Antarctic ecosystems. This project is feeding vital information into biogeochemical and ecosystem models. These will help understand the role of Southern Ocean biology in past, and predict it in future, regulation of atmospheric CO_2 via ecosystem control of carbon transfer to the deep ocean. The research is also supporting assessments of the risk and efficacy of proposals to increase carbon sequestration through iron fertilisation in the Southern Ocean.

CO2–04: Effect of elevated CO_2 on phytoplankton

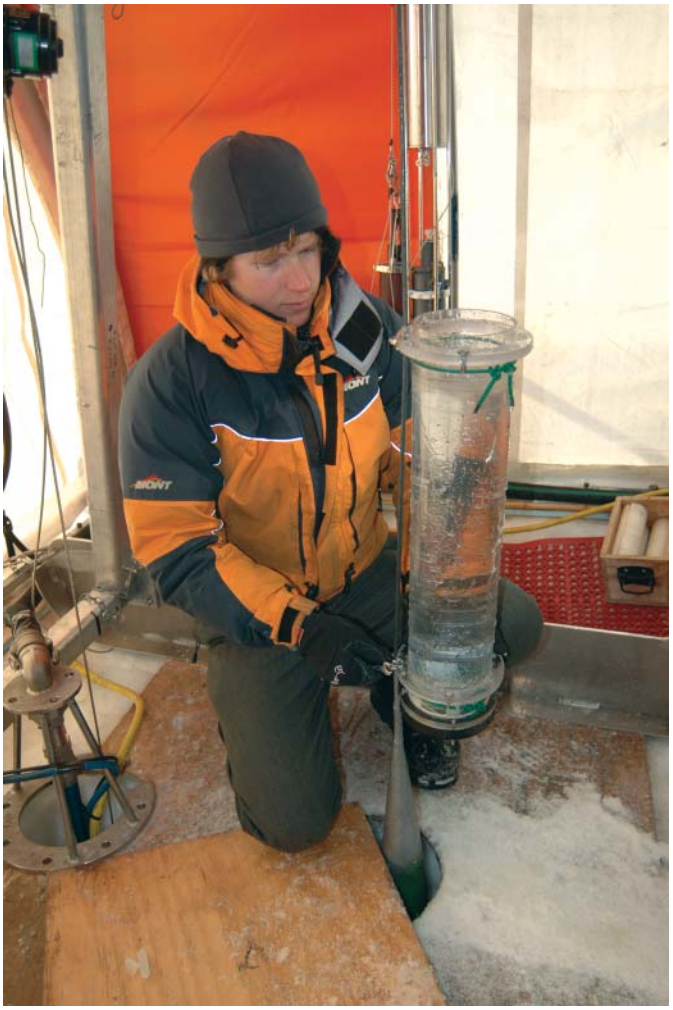
Project leader: **Simon Wright**, AAD

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, as well as the rate of CO_2 uptake through photosynthesis and the extent to which CO_2 is recycled through the food web or sedimented to the deep ocean. The results will be important in developing ecosystem models that will assess the impacts of climate change on Antarctic marine ecosystems, and in providing advice for ecosystem-based management for Southern Ocean fisheries, particularly those regulated through CCAMLR.

CO2–05: Biogeochemical simulations

Project leader: **Richard Matear**, CMAR

Project aim: To quantify the Southern Ocean uptake of atmospheric CO_2 and explore potential feedbacks of projected global warming on this uptake by developing and applying ocean carbon models. The results of this research will support predictions of the Southern Ocean's role in absorbing and storing anthropogenic CO_2 in the future and how atmospheric CO_2 levels will change.



Sea-level Rise

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 leader: **Dr John Church**, CMAR

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.

Key achievements 2008–2009

- Updated estimates of sea-level rise from a combination of in-situ and satellite observations show sea level is continuing to rise. Updated estimates of ocean thermal expansion when combined with published estimates of glacier and Greenland contributions approximately explain the observed rise. Since 1993, the regional distribution of ocean thermal expansion agrees well with the observed sea-level rise.
- Held a series of nine seminars and four workshops in nine centres around Australia on how to combine the risk of storm surge inundation with uncertainties in sea-level projections. These workshops have been well attended (total participation of 476) and very well received.
- Formed an international team for the analysis of extreme sea-level events and a global data set is being assembled.
- Revised estimates of the Greenland contribution to sea-level rise show an increased loss of ice from Greenland over recent years. Revised estimates of the Antarctic contribution suggest a positive contribution to sea-level rise with indications of an increased contribution from the West Antarctic ice sheet.
- Substantially improved a model of ice-shelf/ocean interaction. The model is one of the first to include three-dimensional frazil ice dynamics. Simulations of the circulation and melting and freezing for the Amery Ice Shelf and Mertz Ice Tongue regions agree well with observations. Global warming simulations show enhanced melt response to ocean warming.
- Developed and tested a method for integrating sea-level rise and storm surges into coastal risk assessment. This combines hydrodynamically modelled historical storm surges with tides to estimate return periods. Under the upper estimate of sea-level rise from the IPCC AR4, an extreme sea-level event along the Victorian coast that is exceeded on average once every 100 years under late 20th century conditions is likely to be exceeded once every 20 to 30 years in 2030, once every 2 to 7 years in 2070 and to become a sub-annual event by 2100.
- During the year the sea-level rise program was called upon to deliver sea-level rise technical expertise to a port authority, airport and water authority, as well as to a number of coastal councils.
- Participated in the first season of ICECAP – a major collaborative aerogeophysics program from Casey station, Antarctica – exploring the ice sheet thickness and internal structure and the bedrock properties of the deep Aurora subglacial basin.

Plans for 2009–2010

- Update estimates of sea-level rise (both globally and around Australia) and ocean thermal expansion (and ocean heat content).
- Extend and improve the sea-level budget closure.
- Compare the observed and projected sea-level rise.
- Describe changes in extremes during the 20th century at a network of global sites.
- Publish a book on sea-level rise.
- Complete the delivery of sea-level rise seminars and workshops around Australia and produce a comprehensive report summarising outcomes and outlining future recommendations.
- Couple an evolving ice shelf dynamic model to sub-shelf ocean circulation model, and examine the sensitivity of the Amery ice shelf system to ocean warming.
- Undertake a second season of the ICECAP aerogeophysical survey to explore in detail the outflow path for ice from the Aurora Subglacial Basin though the Totten Glacier system.
- Complete storm tide surfaces for Tasmania.

Projects

SLR–01: Observations of sea-level rise

Project leader: **John Church**, CMAR
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 of the Intergovernmental Panel on Climate Change (IPCC) Assessment Reports.

SLR–02: Estimates of ocean thermal expansion

Project leader: **John Church**, CMAR
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 in Antarctica and Greenland during the 20th and 21st centuries. Modelling the Antarctic and Greenland ice sheets delivers estimates of longer-term contributions to changes in sea level from ice discharge or melt from the ice sheets. We are also drawing on international efforts to estimate contributions to changes in sea level due to melt from glaciers as well as from ice sheets. These improved projections will help guide Australian decision-makers in formulating 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 provide 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 as a result of future changes in severe weather systems and increases in average sea level.

Policy

Australia will face a range of challenges over the next decade in managing its Southern Ocean interests. We are contributing to the 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 output from the other ACE CRC research programs is able to contribute to policy development and outcomes for partner agencies and research users within Australian government agencies.

Program leader: **Assoc Prof Marcus Haward**, ACE CRC/UTAS

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 the ACE CRC's 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, ocean fertilisation and sea-level rise.
- **To identify emergent issues influencing the 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 the 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.

Key achievements 2008–2009

- Continued engagement with key Government Research Users. Successful presentation of three Research User Roundtables, and

follow up engagement. Broad attendance by key government agencies including PM&C, DFAT, DCC, DAFF, DEWHA.

- Produced four Position Analyses: Sea-level Rise, Ocean Fertilisation, Sea-ice, and Ice Sheets.
- Developed and presented a Short Course entitled "Antarctica and the Southern Ocean: implications for Australian and global climate change" to Australian Government officials (70 attendees plus waiting list) in May 2009.
- Maintained and extended engagement of ACE CRC with key government officials in Canberra through briefings on ACE CRC research to DCC, DFAT, DAFF, AFMA officials.
- Ongoing work on the policy and legal implications of oceans acidification and ocean fertilisation, biological prospecting, seabird interactions and ACAP institutional development, climate change impacts on Southern Ocean shipping.
- Published on the IPY, science and the Antarctic Treaty System.
- Coordinated ACE CRC submission to the Royal Society study on Geo-engineering Climate.
- Researched ship safety, search and rescue and Antarctic tourism.
- Researched Australian leadership and engagement in the Antarctic Treaty System.
- Media briefings through Australian Science Media Centre with the launch of each position analysis.

Plans for 2009–2010

- Continue engagement with key Government Research Users – develop briefing material for relevant agencies as required.
- Organise and conduct a second short course for Government officials in February 2010.
- Conduct a Research Users Roundtable on Ocean Circulation and Climate Change in November 2009.
- Publish a Position Analysis on Ocean Circulation and Climate Change in late 2009.
- Organise and conduct a Research Users Roundtable on the Southern Oceans Sentinel program with Australian Government agencies.
- Convene a roundtable on Climate Change and Governance of Antarctica and the Southern Ocean in March 2010.
- Create a compilation of Position Analyses by way of a review of the outcomes of ACE CRC Southern Ocean and Antarctic climate-related science.

Projects

POL–01: Improving the effectiveness of Southern Ocean regimes

Project leader: **Marcus Haward**, ACE CRC/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 to identify gaps, strengths and weaknesses in these regimes. A key question is the relationship between the Law of the Sea Convention 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**, ACE CRC/UTAS
Project aim: To identify the impact and influence of the nexus between the Antarctic Treaty System and other 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 Australian objective of maintaining the Antarctic Treaty System and affect Australia's goal of enhancing its influence within the system.

POL–04: Managing science and intensive public policy: institutional arrangements and climate change policy

Project leader: **Rosemary Sandford**, ACE CRC
Project aim: To reduce the science–policy gap in integrating 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 how Australian scientific and public policy institutions and systems manage climate change knowledge, policy-making and implementation as they relate to the predicted impacts of climate variability and change. It considers four resource policy issues: coastal zones, water use, wild fisheries and aquaculture, and international aid. Outcomes include a 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 developing and implementing climate policy as they affect all levels of government in Australia.

Education

Developing 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. Our Education Program, Looking South Together, works with the Science and Policy Programs and all ACE CRC participants to identify high priority research for students. It uses a mix of broadly advertised, fully-funded and 'top-up' scholarships to attract first-rate students to these areas.

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 to undergraduate and postgraduate lectures.

Program leader: **Prof Andrew McMinn**, UTAS

Objectives

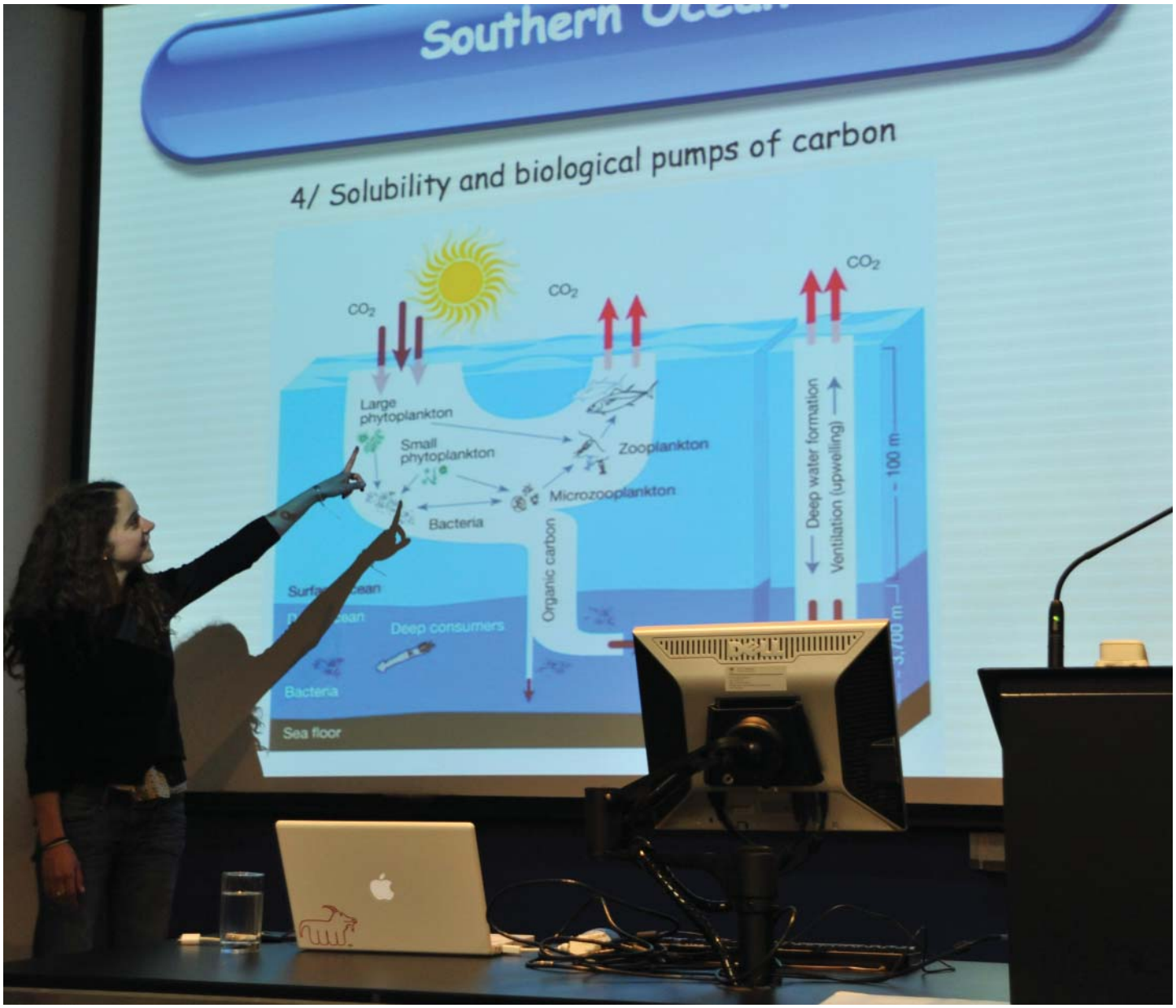
- **To develop higher education programs that meets the needs of ACE CRC stakeholders.** The program is focused on postgraduate training through the PhD program. The program is large by both national and international standards and produces a steady flow-through of finishing graduate students. These 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.**
- **To facilitate the communication of our research outcomes to the community through interaction with the media, museums, schools and other community associations.**

Key achievements 2008–2009

- Recruited 6 new graduate students into the Education Program. Currently, 57 students are enrolled.
- 10 PhD and 1 MSc students were awarded their degrees and a further 7 PhD theses are under examination.
- A total of 31 current students are supervised by staff from the Australian Antarctic Division; 29 by staff of CSIRO Marine and Atmospheric Research; 15 by staff funded by the ACE CRC.
- Students who completed their theses during the reporting year are in employment, either within ACE CRC (1), with ACE CRC partners (3), Tasmanian state government (2), private industry – Australia (2), overseas – postdoctoral (3). Furthermore, the students who have submitted their theses have also been successful in securing employment: with ACE CRC or partners (3), with IMOS (1) and a postdoctoral position at Princeton (1).
- Presented a supervisor training workshop for ACE CRC staff in July 2008, covering topics such as current candidates, past candidates, monitoring student performance and progression. A small cohort of current ACE CRC students addressed the ~30 participants to give their perspective on studying within the ACE CRC.
- Supported 11 students to attend international and national conferences to present their research, and 2 students participated in the AWI exchange program, spending a number of months progressing their research in Germany.

Plans for 2009–2010

Priorities for 2009–2010 will be to continue the excellent rates of completion that have characterised recent years, but also to increase recruitment, particularly in light of the refunding of the ACE CRC for a further term. A primary goal will be to increase the number of ACE CRC scholarships in order to attract larger numbers of candidates to study the Antarctic/Southern Ocean climate system. The Education Program will also undertake a transition to the reshaped goals that are part of the extension of the ACE CRC.


4/ Solubility and biological pumps of carbon
CO_2
CO_2
CO_2
Large phytoplankton
Small phytoplankton
Zooplankton
Microzooplankton
Bacteria
Organic carbon
Deep water formation
Ventilation (upwelling)
100 m
Deep consumers
Bacteria
Sea floor


The Causes of Sea-Level Rise
IPCC Fourth Assessment Report
OZCOASTS.ORG.AU

Research outputs and milestones

Output/ milestone	Description	Date	Progress	Reasons
Outcome 1: Reliable climate forecasts				
Output 1.1	Assessment of the variability of Southern Ocean currents and sea–ice	2006 2010	Completed In progress	Completed sea-ice variability assessment (2009) Analysis of 2003 data completed and published. 2007 data currently being analysed with publication on track for 2010 deadline
Milestone 1.1.1	Complete circumpolar oceanographic transect at 30°S, with Japan	2004	Completed	
Milestone 1.1.2	Complete oceanographic transects at 115°E (WOCE I9) and across Kerguelen boundary current (joint with CO2), collaboration with Japan. Complementary observations at 0°E by AWI (Germany)	2005	Completed	
Milestone 1.1.3	Complete oceanographic survey of shelf/slope waters between 30°E and 80°E (joint with AME; collaboration with Germany)	2006	Completed	
Milestone 1.1.4	Quantify transport and variability of bottom waters in Australian sector (with Japan) and compare to Atlantic sector (with Germany)	2007	Completed	
Milestone 1.1.5	Deploy array of Argo profiling floats (collaboration with Germany, USA and other nations)	2007	Completed	
Milestone 1.1.6	Census of water mass changes derived from recent and historical observations	2008	Completed	
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	Unsuitable weather during SIPEX 2007 voyage prevented direct satellite calibration against in-situ ice thickness measurements. This means that we cannot account for changes in the actual/in-situ snow cover; however, total thickness on tens of km-scales is expected to be comparable and provides progress towards this milestone.
Milestone 1.1.8	Identification and quantification of physical mechanisms driving variability in the ocean-ice system in the Australian Antarctic sector	2009	Completed	
Output 1.2	Climate change scenarios for the Southern Ocean circulation and sea-ice	2009	Completed	
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	Completed	
Milestone 1.2.2	Estimate sensitivity of Southern Ocean overturning strength to changes in forcing, from forward models and inverse models	2008	Completed	
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	Completed	
Milestone 1.2.4	Ocean climate change scenarios for ocean currents and sea-ice derived from coupled climate models	2009	Completed	
Outcome 2: Efficient, safe and sustainable operations in Antarctic waters				
Output 2.1	Forecasts of ocean currents and sea-ice	2005 2010	Completed Part	Resourcing constraints and technical issues mean full operationality is unlikely in this timeframe. Progress on necessary components has been made and full operationality is still expected post-ACE CRC
Milestone 2.1.1	Construct data-assimilating ocean model	2005	Completed	
Milestone 2.1.2	Produce ocean analyses (hindcasts) covering the last decade	2008	Completed	
Milestone 2.1.3	Operational, coupled, ocean – sea-ice analysis and forecast system	2010	Part	Resourcing constraints and technical issues mean full operationality is unlikely in this timeframe. Progress on necessary components has been made and full operationality is still expected post-ACE CRC

Output/ milestone	Description	Date	Progress	Reasons
Outcome 3: Sustainable management of Antarctic marine living resources				
Output 3.1	Incorporation of physical and biological information into Antarctic ecosystems model	2005 2009	Completed Completed	
Milestone 3.1.1	Development of under-ice remote sensing instrumentation for AUV	2004	Part	Project submitted through the AAD's assessment process and was highly rated and received approval. Joint proposal with UK colleagues to the UK NERC to use Autosub failed on technical grounds. Research plan being modified to proceed with other technology. Optical sensor package has been purchased and will be tested in under-ice conditions during upcoming fieldwork. Modified research program successfully implemented in SIPEX voyage utilizing ROV replacement and optical sensors. This capability is now being promoted for use in the AUV being developed under the auspices of IMOS. 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	Part	Available data has been assembled and a workshop held in September 2005 (the East Antarctic Workshop) to begin the analyses. Biological data for eastern Antarctica was more sparse than anticipated. Data available for statistical and dynamic modelling were reviewed by a joint workshop of the Scientific Committees of CCAMLR and IWC in 2008. These data will be available for analyses of potential changes in eastern Antarctica. This will occur during the extension of the ACE CRC
Milestone 3.1.3	Submission to CCAMLR of an estimate of the biomass of krill in Division 58.4.2	2006	Completed	
Milestone 3.1.4	Autumn/winter/spring process study voyages	2007–2009	Completed	
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	Completed	
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	Spatially structured models have been successfully developed (Constable). All work is feeding into this process (Nicol). A sea-ice community model has been developed and awaits coupling to a physical sea-ice model in the coming 12 months. The CCAMLR-IWC workshop on data inputs and also the Sentinel workshop have contributed to the conceptual development of these models
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 4.1	An estimate of the current inventory of anthropogenic CO_2 in the Southern Ocean south of Australia	2005 2009	Completed In progress	
Milestone 4.1.1	Measurement of anthropogenic CO_2 contents along the WOCE/ CLIVAR I9 section from Western Australia to Antarctica	Mar 2005	Completed	
Milestone 4.1.2	Measurement of anthropogenic CO_2 contents along a transect along the Antarctic shelf	Mar 2006	Completed	
Milestone 4.1.3	Measurement of anthropogenic CO_2 contents along the WOCE/ CLIVAR SR3 section from Tasmania to Antarctica	Mar 2008	Completed	
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		Completed	
Milestone 4.2.1	Development of a model with explicit ecosystem structure linking stratification and export over seasonal timescales	2006	Completed	
Milestone 4.2.2	Comparison of the model to observations of stratification and surface export in the Southern Ocean south of Australia	2008	Completed	
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	Research on track for completion on time
Output 4.3	Determination of the role of iron limitation in biological carbon export to the deep sea		Completed	
Milestone 4.3.1	Examination of the links between iron supply and export in an area of natural iron inputs	2003–2005	Completed	
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	2005–2010	Completed	
Output 4.4	Determination of the role of elevated CO_2 levels on phytoplankton communities		Completed	
Milestone 4.4.1	Laboratory experiments under elevated CO_2	2007	Completed	

Output/ milestone	Description	Date	Progress	Reasons
Outcome 5: Estimates of sea-level change resulting from anthropogenic climate change used as one of the bases for intergovernmental climate change negotiations				
Output 5.1	Review of 20th century sea-level change	Jun 2005 Jun 2010	Completed In progress	
Milestone 5.1.1	Revised estimates of historical (20th century and early 21st century) sea-level change	Jun 2004 Dec 2009	Completed Completed	
Milestone 5.1.2	Revised estimates of ocean thermal expansion from observations and models (both the CSIRO and AWI models)	Jun 2005 Dec 2009	Completed In progress	Revised observational estimates have been published in Nature and at various international conferences. Revised model estimates will not be completed before the end of the ACE CRC but will be part of future contribution to the IPCC AR5 (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)	Dec 2005 Dec 2009	Completed Completed	
Output 5.2	Revised projections for future sea-level change during the 21st century and on longer time-scales	Jun 2006 Jun 2010	Completed In progress	
Milestone 5.2.1	Revised estimates of future ocean thermal expansion	Dec 2005 Dec 2009	Completed In progress	Revised model estimates will not be completed before the end of the ACE CRC but will be part of future contribution to the IPCC AR5
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	Jun 2010	In progress	Model development will not be completed by initial ACE CRC term. Within the 2010–2014 ACE CRC extension we will collaborate with other groups internationally who are also still working on development of the next generation of ice sheet models
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	Jun 2006 Dec 2009	Completed (2006) In progress	Definitive predictions of the response of the grounded ice sheet to changes in ice shelves will not be completed by December 2009. Simulations of response of the Amery ice shelf ocean cavity to global warming have been completed, using a three dimensional ocean model. It is anticipated that offline coupling with an ice shelf model will be undertaken within the ACE CRC extension. There is international consensus that major development is required in order to improve ice sheet system models and enable reliable predictions of ice sheet dynamic change. During the 2010–14 extension, ACE CRC will increase participation in international collaborations focused on model improvement
Outcome 6: Estimates of sea-level change as an essential input to coastal zone management and other planning considerations in Australia and in neighboring nations in the South Pacific				
Output 6.1	Estimates of the historical impacts of sea-level change at key locations	Dec 2005	Completed	
Milestone 6.1.1	Estimates of the historical frequency of extreme events from observational (and proxy) records	Dec 2004	Completed	
Output 6.2	Estimates of the expected impacts of sea-level change at key locations	Jun 2010	In progress	
Milestone 6.2.1	Selection of key locations for more detailed studies	Jun 2004	Completed	
Milestone 6.2.2	Estimates of the changes in frequency of extreme events from numerical modelling studies	Dec 2009	In progress	A method for integrating sea-level rise and storm surges into coastal risk assessment was documented in a journal article for Natural Hazards that will appear as a special edition on storm surge modelling. This combines hydrodynamically modelled historical storm surges with tides to estimate return periods. This was applied to the Victorian coast and results for eastern Victoria were considered by VCAT in relation to a planning application. Future exceedance probabilities of flooding under increased sea level have been estimated for 29 key Australian coastal sites
Outcome 7: Delivery of science outputs to research users				
Output 7.1	Annual forum for research users	Annual 2003–2010	Ongoing	
Milestone 7.1.1	Organisation of research users' forum	Annual (Jul–Aug)	Ongoing	Sea-ice and ice sheet plus additional graduate training in Canberra
Milestone 7.1.2	Hosting of research users' forum	Annual (Nov)	Completed	
Outcome 8: Improving responses to emergent issues				
Output 8.1	Identify and, with science programs, provide policy users with details on emergent issues and likely impacts on Southern Ocean management regimes	Annual	Completed	
Milestone 8.1.1	Identify emergent issues eg. Bio-prospecting, iron fertilisation	Ongoing	Ongoing	
Milestone 8.1.2	Complete an inventory of Southern Ocean management regimes	Jun 2004	Completed	
Milestone 8.1.3	Critical review and assessment of regimes	Jun 2006	Completed	
Milestone 8.1.4	Identify gaps in regimes	Jun 2008	Completed	
Milestone 8.1.5	Completion of project; recommendations to government	Jun 2010	In progress	

Output/ milestone	Description	Date	Progress	Reasons
Outcome 9: Improved Australian influence in and effectiveness of Southern Ocean management regimes				
Output 9.1	Establish criteria for assessment of Australian influence in, and the effectiveness of, Southern Ocean management regimes	Annual	Completed	
Milestone 9.1.1	Complete an inventory of Southern Ocean management regimes	Jun 2004	Completed	
Milestone 9.1.2	Establish assessment criteria to measure influence and effectiveness	Jun 2006	Completed	
Milestone 9.1.3	Assessment of Southern Ocean management regimes against criteria	Jun 2008	Completed	
Milestone 9.1.4	Completion of project; recommendations to government	Jun 2010	In progress	
Outcome 10: Increase awareness of the climate system and our role/influence within it				
Output 10.1	Train the climate specialists of tomorrow	2003–2010	Ongoing	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	Ongoing
Outcome 11: Raise public awareness of Antarctic and Southern Ocean science				
Output 11.1	Communication liaison with the general public	2003–2010	Ongoing	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	Ongoing

Other significant projects (non-CRC funded)

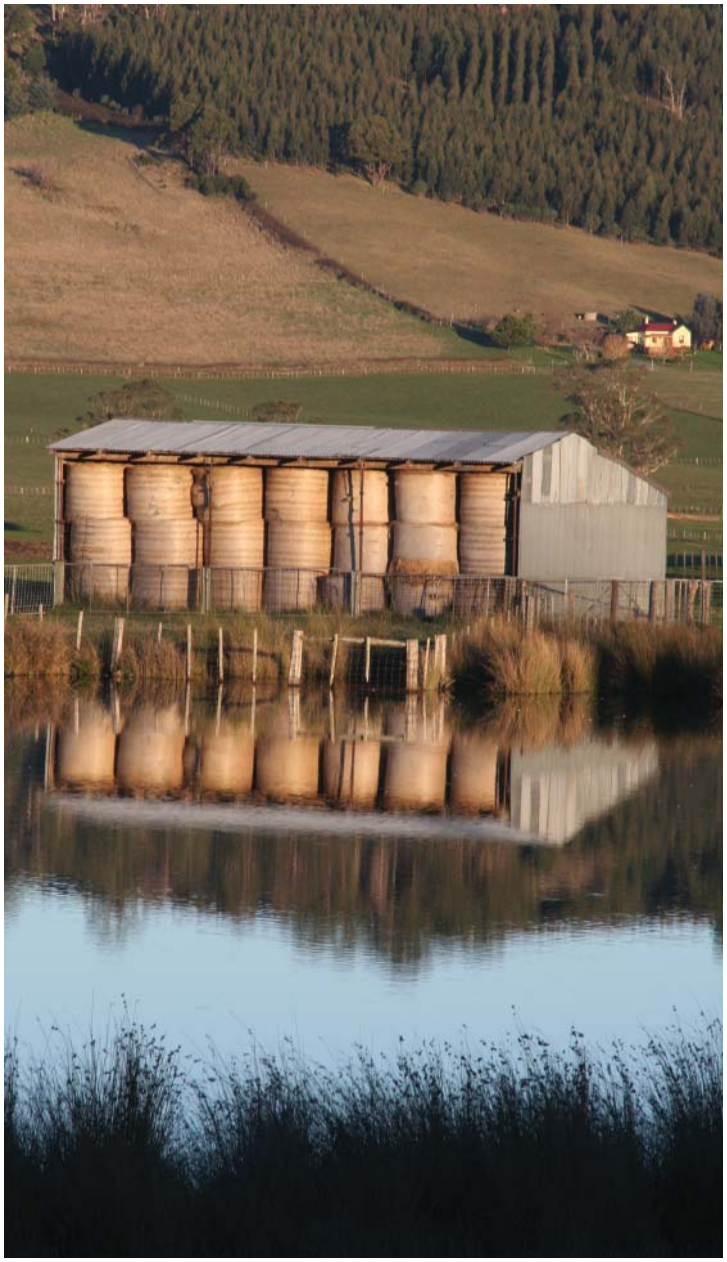
Climate Futures for Tasmania

Climate Futures for Tasmania is an externally funded, collaborative research project that is generating improved climate change information for Tasmania. Making sensible choices on how people can adapt to climate change hinges on understanding what changes are likely, where they are likely, and when they will start to have a significant impact. In a first for Australia, and possibly the southern hemisphere, Climate Futures for Tasmania is generating local climate information over the 21st century for local communities.

The project is strongly end-user driven, with the information needs of community, industry and government central in the research analyses. The new climate projections for Tasmania are at a finer scale than ever before, capturing Tasmania's complex and maritime influences on our weather and climate, to produce a snapshot of our possible future climates.

The research analysis is concentrated in five areas or components: modelling, general climate, water and catchments, agriculture and extreme events. To engage the many and varied end-users interested in the new climate projections, each component has an assigned leader from a contributing research organisation and/or sponsoring stakeholder. The engagement of end-users and communication of the results is supported by an extension and liaison officer. Involving end-users throughout the project will ensure that the research results and communication products are relevant and useable by the target audiences.

Climate Futures for Tasmania is funded primarily by the Australian Government and the State Government of Tasmania. The project also received additional funding support from Hydro Tasmania. Contributing research organisations include: Antarctic Climate & Ecosystems Cooperative Research Centre (ACE CRC); CSIRO Division of Marine and Atmospheric Research; Hydro Tasmania; Department of Primary Industries and Water (Tasmania); University of Tasmania, through the Tasmanian Partnership for Advanced Computing (TPAC) and the Tasmanian Institute of Agricultural Research (TIAR); Geoscience Australia; and Bureau of Meteorology.



Project objectives

- **To produce fine-scale (14km) projections of climate over Tasmania based on a range of credible scenarios for global greenhouse gas emissions.** Climate projections are made at a finer scale than has ever been done before and better represent Tasmania's geography and its effect on the local climate. The fine-scale modelling is generated using sophisticated climate modelling techniques and our current knowledge to describe the most likely future climate scenarios for Tasmania.
- **To derive from the projections key climate variables (indicators) of most importance to diverse industries, utility and service providers, planners and the community.** A key challenge is to interpret climate projections at a local scale, so that communities, industries and individuals can use the information for local planning and adaptation responses. We expect it will promote a more cooperative approach to adapting to climate change than would be possible with individuals working separately.
- **To inform industry, utility and service providers, the community and government on the range of expected values for key climate indicators under alternative scenarios of greenhouse gas emissions to facilitate effective adaptation to the most likely climate futures for Tasmania.** The data will be freely available to the public and accessible for subsequent climate change research through archived fine-scale climate modelling outputs. We will work closely with end users to effectively develop and communicate climate change information.

Key achievements 2008–2009

New digital elevation information for Tasmania

We have produced new digital elevation data for Tasmania's low lying vulnerable coastal areas using LiDAR technology. At the launch of the LiDAR dataset in November 2008, we recorded good interest and application of the new data. More than 50% of Tasmanian councils are using the data as well as three state government agencies, two government business enterprises, one joint authority, two private consultants and a natural resource management (NRM) group. More than 184 organisations/individuals accessed the dataset on-line through 'TheLIST', resulting in more than 35,000 tiles (1 km x 1 km) being downloaded.

New climate projections for Tasmania to 2100

We completed 95% of the modelling simulations, amounting to more than 70 terabytes of modelling outputs available to the research community through the Tasmanian Partnership for Advanced Computing data portal. Our validation phase has confirmed the ability of the models and downscaling process to reproduce the spatial pattern of observed datasets over Tasmania. This gives us confidence in the simulations to estimate the effects of climate change on Tasmania through the 21st century.

New climate change story emerges for Tasmania

The first results show that the average temperature changes over Tasmania will be about 3.2°C, slightly less than the global average. Rainfall over the entire state will remain unchanged, but the spatial pattern of rainfall is evolving away from the current climate. Annual average rainfall around the state tends to increase in the coastal regions, but is drier in the centre of the state. There will be significant changes in the seasonality of rainfall over the state. It appears that the changed rainfall patterns are a result of the East Australian Current extending southwards and modifying the rainfall patterns in response to changes in the ocean circulation.

Engagement and end-user participation activities

With stakeholder engagement a major driver for the analyses, we were involved in more than 300 individual stakeholder interactions, including working with 15 registered complementary research projects interested in using the modelling outputs and engaging with more than 50 interested stakeholders. We published 47 editions of the weekly email newsletter, a general project brochure, the LiDAR Dataset Fact Sheet and two conference posters. As invited guest speakers, we presented at 15 conferences to audiences of international, national and local significance, and provided more than 30 project briefings.

Key plans for 2009–2010

- Further analysis of the modelling simulations for the impacts of climate change across all areas of this project, including extremes, water catchments, agriculture and general climate.
- The publication of the technical reports and public-ready assessments of Tasmania climate in the 21st century for the modelling, general climate, agriculture, water catchments and extreme events.
- The complementary and extended use of modelling simulations by researchers and the use of results by organisations to inform government, business and community decision-making in preparing for climate change.

Component research

1. Modelling

Component leaders:
Nathan Bindoff, ACE CRC, Centre for Australian Weather and Climate Research and University of Tasmania;
Tony Hirst, Centre for Australian Weather and Climate Research
Component aim: To create unique climate projections over Tasmania at scales of 10–15km spatially from existing global climate projections for the period 1960 to 2100.

2. General climate impacts

Component leader:
Ian Barnes-Keoghan, Bureau of Meteorology
Component aim: To understand and describe recent Tasmanian climate, to identify climate indicators that are important to the Tasmanian community and to assess how climate conditions may change in the future under various climate change scenarios.

2. Water and catchments

Component leaders:
Fiona Ling, Hydro Tasmania;
Bryce Graham, Department of Primary Industries and Water
Component aim: To project how water will flow through various Tasmanian water catchments and into storage reservoirs under different climate scenarios.

3. Agriculture

Component leaders:
David McNeil, Tasmanian Institute of Agricultural Research – TIAR;
Steve Wilson, Tasmanian Institute of Agricultural Research – TIAR (to December 2008).
Component aim: To assess the impacts under different climate scenarios on agriculture (yields, pests, soil moisture deficits).

4. Extreme events

Component leaders:
Bob Cechet, Geoscience Australia;
Kathy McInnes, ACE CRC/CSIRO
Component aim: To work with state emergency services to identify the variables of greatest concern to emergency managers and to produce projections of those variables that will help in planning our response to extreme events.

Commercialisation and utilisation

During 2008–2009 ACE CRC focused on commercialisation and utilisation of its research through the delivery of end-user workshops and forums, consultancy, and active participation by industry (including small-to-medium enterprises [SME]) and government bodies in research projects.

Projects of particular note are Climate Futures for Tasmania, the Department of Climate Change co-funded *Estimating Sea-level Extremes in an Uncertain Future* and the collaboration with SME engineering and sustainability consulting firm Pitt&Sherry, Climate Futures for Tasmania – Infrastructure Project.

Program leader: **Tessa Jakszewicz**, ACE CRC.

Intellectual property management

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

Technology commercialisation

Technology disclosure, assessment and formal decision-making processes for the ACE CRC have been established.

Education

During 2008–2009 the ACE CRC continued to provide formal induction on ACE CRC's commercialisation practices and policies to all new staff members with the aim of increasing commercial awareness amongst our scientists.

Disclosure and assessment

SealceViewTool, a flexible, intelligent aid to viewing satellite imagery of sea-ice, was identified through the ACE CRC technology disclosure and assessment process. This tool enables more efficient navigation, voyage management and science planning with potential application in both the Antarctic and Arctic regions. A collaboration agreement with a European consortium to field-test this product in the Arctic region was extended for another year in November 2008.

Spin-offs and patents

To date the ACE CRC has not applied for any patents or created any spin-off companies.

Research utilisation

As a result of recommendations of the Third Year Review ACE CRC continued to focus on extending its reach and actively engaging with a broad range of end users.

Sea-level rise expertise has been in strong demand, in particular to deliver expert technical consultancy services. Major sea-level rise projects for 2008 – 2009 were:

- *Estimating Sea-Level Extremes in an Uncertain Future:* This project is co-funded by the Australian Government Department of Climate Change until June 2010. It utilises the ACE CRC's unique method of statistically combining recorded variations in present sea level (from tides, storms and other meteorological events) with internationally accepted projections of future sea level to provide a basis for coastal infrastructure planning and maintenance decisions in the 21st century. A web-based decision-support tool has been developed to provide projections of the risk of inundation of coastal infrastructure. It will allow managers and planners to determine future maintenance regimes and to design new infrastructure at appropriate levels. A national series of seminars and workshops is being delivered to support the use of the web tool, with 9 seminars and workshops delivered during the reporting period. Industry and government stakeholders are trained in our method of assessing future risk of sea-level rise to coastal infrastructure with the objective of building capability to plan appropriate, targeted and efficient strategies for adaptation to sea-level rise and its impacts (project in progress).
- *Brisbane Airport Corporation:* Sea-level rise and extreme events: implications for Brisbane Airport. An assessment of the appropriate design height for a proposed new airport runway to take into account rising sea levels.
- *Port of Brisbane:* Sea-level rise and extreme events: implications for Port of Brisbane. A technical assessment of the risk of sea-level rise and extreme sea-level events to port infrastructure.
- *City of Melbourne*: Scientific review of draft document: "Towards a City of Melbourne Climate Change Adaptation Strategy: A Risk Assessment and Action Plan Discussion Paper".
- *Melbourne Water:* Plausible upper limits of sea-level rise: a report for Melbourne Water. An assessment of the plausible upper limits of sea level at 2100 and beyond.
- *AusAid:* A technical appraisal of the proposal entitled SPSLCMP Refurbishment Proposal. An assessment of data collection technology (oceanographic, meteorological and geodetic) to be deployed in the Pacific region.
- *WA Department of Transport:* A peer review of the draft report: Sea Level Change in Western Australia – "Application to Coastal Planning Prepared by the Department of Transport (formerly the Department for Planning and Infrastructure) Version B, 26/5/2009" (project in progress).
- *GHD Subconsultancy Agreement:* A generic subconsultancy agreement was signed between the ACE CRC and engineering consulting firm, GHD. This agreement enables ACE CRC expertise to be readily engaged for a range of GHD consulting projects. To date we have provided sea-level rise expertise via GHD to Randwick City Council. A number of other collaborative projects are under development.

In addition, outside the sea-level rise program, the following delivery projects received additional sources of funding:

- *Climate Futures – Infrastructure:* This project examines potential increased risks to infrastructure associated with climate change. The project is adopting the Climate Futures for Tasmania model outputs for practical use by infrastructure owners. The partnership project between Pitt&Sherry and the ACE CRC received support from the Tasmanian Government's Research Partnerships Program in February 2009. The project completed its preliminary development phase in February 2009, the outcomes of which were presented to all stakeholders at a Pitt&Sherry hosted industry workshop. System specification requirements and key infrastructure elements of most value to the stakeholders were identified. Risk identification, based on assessment of engineering principles, current design standards and codes of practice has been completed. Input from technical working groups refined the specific climate change variables required, in conjunction with time periods and data formats, for analysis and presentation. A number of presentation methods for combining the infrastructure features and climate change projections have been assessed. A four-dimensional software visualisation tool has been developed and integration of the various elements within this platform will commence in the near future.
- *Ocean Acidification – Effects of increasing anthropogenic CO_2 on marine calcifiers in the Southern Ocean:* This project is a continuation

of collaboration between the ACE CRC, the Department of Climate Change's Australian Climate Change Science Program and the Australian National University's Research School of Earth Sciences. It continues analysis of pteropod abundances, species compositions and geochemistry in Southern Ocean plankton samples.

- ***Ocean Acidification – Australian Impacts in the Global Context:*** Funded by the Department of Climate Change and ACE CRC, a workshop was convened in 2007–2008 to synthesise current knowledge on the effects of ocean acidification, with particular emphasis on its implications for the Australian marine environment, including the Southern Ocean. An output of this workshop was the delivery of a report to the Department of Climate Change in 2008–2009. A communiqué was released as a result of the workshop, key points of which were used as inputs into the *Monaco Declaration* – a call for action from 150 international scientists for action on ocean acidification.

Communications

Program leader: **Jess Tyler**, ACE CRC

During 2008 to 2009 significant progress was made in implementing the ACE CRC Communications Plan:

Corporate communications tool-kit

The ACE CRC website was refurbished to include a new-look news/media section as an interim solution until the new site goes live. This allows the latest news to be more prominent and allows the site to change regularly. The new corporate identity has been progressively rolled out across Position Analyses, the Annual Report and other promotional materials. Technical report templates were developed to support Sea-Level Rise consultancy projects.

Partners

The Australian Climate Change Science Program hosted a climate communicators' workshop immediately following the ACE CRC Symposium 2008, and representatives from all ACE CRC core partners attended. The meeting investigated issues in climate communications and progressed plans for regular meeting for 2009 as well as an information exchange through an informal national network. The ACE CRC Communication Coordination Committee met twice during the year. The group worked together to coordinate responses to a number of media issues on sea-level rise, ice sheets, sea-ice and ocean acidification.

Consultancies/contracts

Staff name	Consultancy or contract	Period	Total value (AUS$) ex GST	2008–2009 (AUS$) ex GST	Funds administered by ACE CRC
Hunter J Pribac F	Assessment of flooding of Randwick for GHD	Mar 2009	4,000	4,000	Y
Hunter J Church J	Assessment of upper estimates of sea-level rise for Melbourne Water	Apr–May 2009	7,000	7,000	Y
Hunter J Iliff M Church J	Review of Adaptation Strategy for Melbourne City Council	Aug–Sep 2008	10,500	10,500	Y
Hunter J Pribac F Iliff M	Assessment of vulnerability of Port of Brisbane to sea-level rise	Jul 2008 –Feb 2009	43,138	43,138	Y
Hunter J Pribac F Iliff M	Assessment of vulnerability of Brisbane Airport to sea-level rise	Aug 2008 –Feb 2009	47,283	47,283	Y
McInnes K	Launceston City Council	Aug 2007 – May 2009	60,000	20,000	Y
		TOTAL	**171,921**	**131,921**	

Research users

Following their successful introduction in the 2007 to 2008 reporting period, four new Position Analyses were published in 2008-2009 providing a synopsis of the latest science on sea-level rise, ocean fertilisation, sea-ice and ice sheets. The Position Analyses were widely distributed to federal and state ministers, climate research agencies, relevant committees/bodies, international agencies, local government and at the major climate change event, Greenhouse 2009.

ACE CRC was commissioned by the Department of Climate Change to prepare a Post IPCC AR4 ministerial briefing on sea-level rise for The Hon. Penny Wong, Federal Minister for Climate Change. This briefing paper was released publicly in July 2008.

A joint CSIRO/ACE CRC sea-level rise website was launched (www.cmar.csiro.au/sealevel/).

A new website was also developed (www.sealevelrise.info) to promote a national roadshow of seminars and workshops on *Estimating Sea-Level Extremes in an Uncertain Future*. These events are aimed at coastal infrastructure owners and developers and introduce a web-based decision-support tool which can be accessed via www.sealevelrise.info.

ACE Notes e-newsletter was produced in August 2008 and distributed to government and industry end users and research partners.

Media

Highlights of the media program during 2008–2009 included:

- Release of the special edition IPY stamp by Australia Post. This put ACE, CMAR, AAD and other agencies into every post office around the country and on the website with a series of stamps, postcards and special issue notes.
- Launch of ocean fertilisation, ice sheets and sea-ice Position Analyses via online briefings with the Australian Science Media Centre. This system has resulted in a far-ranging media response over the weeks following each online briefing.
- There was worldwide media uptake of our ocean acidification research outcomes in conjunction with the research team's presentations at international conferences and the release of a paper in Nature Geoscience. Major coverage was achieved in The New York Times, Scientific American, The Wall Street Journal – a highlight was uptake by prime time television, NBC News America, which featured an extended news item.
- A new media monitoring service was introduced and was used to produce the following table, highlighting our expanding media profile:

National and International hits attributed to ACE CRC, all media		
Media hits to date 2009	578	peak 202 hits for ocean acidification
Media hits 2008	542	peak 125 for ocean fertilisation
Media hits 2007	171	peak 17 for southern ocean monitoring

Staff

- ACE Notes continues to be the mainstay of regular communications with staff. ACE Notes editions 75, 76, 77, 78, 79, 80, 81 and 82 were produced.
- More than 100 staff, students and visitors attended part or all of the Fifth Annual ACE

CRC Symposium on 3–4 December 2008 at the Hobart Function and Conference Centre.

Special projects

- The co-funded Department of Climate Change project *Extreme Sea-level Events in an Uncertain Future* has continued its extensive media and promotions campaign involving new advertisements and articles in a comprehensive range of relevant media outlets. Greenhouse 2009 was a major publicity staging point. This project has been the dominant element of the communications program for the first half of 2009.
- ACE CRC and AAD provided a collaborative program of media support for the Southern Ocean Sentinel workshop held from 20–24 April 2009 at the CCAMLR Headquarters in Hobart. This international workshop was convened to consider how to measure, assess and provide early-warning detection of climate change impacts on the Southern Ocean and how these could be used to signal future impacts on marine and other ecosystems elsewhere in the world. A focus of the workshop was to promote national and international collaboration among science and technology researchers and policy-makers at various levels.
- Climate Futures for Tasmania: Support for the Climate Futures of Tasmania has been provided as needed.
- Greenhouse 2009: Climate Change and Resources: More than 500 delegates attended the Greenhouse 2009: Climate Change and Resources Conference in Perth, 23–26 March 2009. The ACE CRC booth showcased the ocean fertilisation, sea-level rise and ocean acidification Position Analyses and promoted the Department of Climate Change project *Extreme Sea-level Events in an Uncertain Future*.

End-user engagement: major workshops and forums

Name	Relationship	Nature of benefit	Actual benefit
19 February 2009 *Sea-ice and ice sheets round tables*; Canberra ACT			
Australian Fisheries Management Authority	Research user	Communicate current science and policy issues to key decision-makers	Improved understanding of key research-users' needs
Australian Strategic Policy Institute	Research user		
Bureau of Meteorology	Core partner		
Department of Agriculture, Fisheries and Forestry	Research user		
Department of Climate Change	Research user		
Department of Foreign Affairs and Trade	Research user		
Office of National Assessments	Research user		
Royal Australian Navy	Research user		
Department of Prime Minister and Cabinet	Research user		
February 2009 *Estimating sea-level extremes in an uncertain future* seminar; Hobart Tas			
Local Councils	Research users	Method to assess future risk from sea-level extremes	Delivery of SLR Program Outputs to end-users
Tasmanian State Government			
Engineering and Environmental Consulting Firms			
Hobart Water			
March 2009 *Estimating sea-level extremes in an uncertain future* seminar; Sydney NSW			
Local Councils	Research users	Method to assess future risk from sea-level extremes	Delivery of SLR Program Outputs to end-users
NSW State Government			
Engineering and Environmental Consulting Firms			
March 2009 *Estimating sea-level extremes in an uncertain future* seminar; Newcastle NSW			
Local Councils	Research users	Method to assess future risk from sea-level extremes	Delivery of SLR Program Outputs to end-users
NSW State Government			
Engineering and Environmental Consulting Firms			
March 2009 *Estimating sea-level extremes in an uncertain future* seminar; Brisbane QLD			
Local Councils	Research users	Method to assess future risk from sea-level extremes	Delivery of SLR Program Outputs to end-users
QLD State Government			
Engineering and Environmental Consulting Firms			
March 2009 *Estimating sea-level extremes in an uncertain future* workshop; Hobart TAS			
Local Councils	Research users	Method to assess future risk from sea-level extremes	Delivery of SLR Program Outputs to end-users
Tas State Government			
Engineering and Environmental Consulting Firms			
March 2009 *Greenhouse 2009* ACE CRC Booth; Perth WA			
State, Local, Federal Government Representatives; Researchers; Consulting Firms	Research users	Dissemination of ACE CRC Position Analyses	Increased awareness of ACE CRC research outcomes
April 2009 *Estimating sea-level extremes in an uncertain future* seminar; Gold Coast QLD			
Local Councils	Research users	Method to assess future risk from sea-level extremes	Delivery of SLR Program Outputs to end-users
Researchers and students			
Engineering and Environmental Consulting Firms			
April 2009 *Estimating sea-level extremes in an uncertain future* seminar; Launceston Tas			
Local Councils	Research users	Method to assess future risk from sea-level extremes	Delivery of SLR Program Outputs to end-users
Tasmanian State Government			
Engineering and Environmental Consulting Firms			
20–24 April 2009 *Monitoring climate change impacts on marine biodiversity: establishing a Southern Ocean Sentinel program* workshop; Hobart Tas			
Australian Antarctic Division	Core partner	Measure, assess and provide early-warning detection of climate change impacts on the Southern Ocean and how these could be used to signal future impacts on marine and other ecosystems	Provide early warning of climate change impacts on global marine and other ecosystems based on Southern Ocean ecosystem indicators and assessments of climate change impacts
Tasmanian Partnership for Advanced Computing	Research user		
CSIRO Marine & Atmospheric Research	Core partner		
British Antarctic Survey (GBR)	Research user		
Centre d'Etudes Biologique de Chizé (FRA)	Research user		
Australian Marine Mammal Centre	Research user		
University of California Santa Cruz (USA)	Research user		
Old Dominion University (USA)	Research user		
Stanford University (USA)	Research user		

Name	Relationship	Nature of benefit	Actual benefit
5 May 2009 *Short course: Antarctica and the Southern Ocean – Implications for Australian and global climate change;* Canberra ACT			
Bureau of Rural Sciences	Research users	Communicate current Antarctic and Southern Ocean climate science	Improved understanding of the role of Antarctica and Southern Ocean in regional and global climate change
Embassy of Belgium			
Department of Climate Change			
Deptartment of Agriculture, Fisheries and Forestry			
Department of Foreign Affairs and Trade			
Biosecurity Australia			
Australian Bureau of Agricultural & Resource Economics			
Department of Prime Minister and Cabinet			
Office of National Assessments			
Royal Australian Navy			
Natural Resources Management			
Sydney University			
European Commission			
Australian Quarantine and Inspection Service			
Australian National University			
May 2009 *Estimating sea-level extremes in an uncertain future* seminar; Canberra ACT			
Australian Government Department of Climate Change	Research users	Method to assess future risk from sea-level extremes	Delivery of SLR Program Outputs to end-users
Department of Innovation, Industry, Science and Research			
Geosciences Australia			
May 2009 *Estimating sea-level extremes in an uncertain future* workshop; Sydney NSW			
Local Councils	Research users	Method to assess future risk from sea-level extremes	Delivery of SLR Program Outputs to end-users
NSW State Government			
Engineering and Environmental Consulting Firms			
May 2009 *Estimating sea-level extremes in an uncertain future* workshop; Brisbane QLD			
Local Councils	Research users	Method to assess future risk from sea-level extremes	Delivery of SLR Program Outputs to end-users
QLD State Government			
Engineering and Environmental Consulting Firms			
Researchers and students			
June 2009 *Estimating sea-level extremes in an uncertain future* workshop; Sydney NSW			
Sydney Coastal Councils	Research users	Method to assess future risk from sea-level extremes	Delivery of SLR Program Outputs to end-users
June 2009 *Estimating sea-level extremes in an uncertain future* seminar; Cairns QLD			
QLD State Government	Research users	Method to assess future risk from sea-level extremes	Delivery of SLR Program Outputs to end-users
Local Councils			
Engineering and Environmental Consulting Firms			
Researchers and students			
June 2009 *Estimating sea-level extremes in an uncertain future* seminar; Townsville QLD			
QLD State Government	Research users	Method to assess future risk from sea-level extremes	Delivery of SLR Program Outputs to end-users
Local Councils			
Engineering and Environmental Consulting Firms			
Researchers and students			

End-user engagement: individual consultations

Name	Relationship	Type; Location	Nature of benefit	Actual benefit
Austral Fisheries	Research user	Meeting; Hobart Tas	Future needs of fishing industry	Development of future research strategies
Australian Fisheries Management Authority	Research user	Briefing; Canberra ACT	Communication of ACE CRC science to key end-users	Greater understanding of research user interests and needs
Australian Strategic Policy Institute	Research user	Briefing; Canberra ACT	Communication of ACE CRC science to key end-users	Greater understanding of research user interests and needs
Brisbane Airport Corporation	Research user	Meeting; Brisbane Qld	Future projections of sea-level rise	Set design level for new airport runway
Brisbane Ports Corporation	Research user	Meeting; Brisbane Qld	Future projections of sea-level rise	Assess risk to existing and planned port infrastructure
Commission for the Conservation of Antarctic Marine Living Resources	Research user	Consultative forum; Hobart Tas	Providing input into Australia's position relating to CCAMLR	Communicating input into Australia's position relating to CCAMLR
Department of Agriculture, Fisheries and Forestry	Research user	Briefing; Canberra ACT	Communication of ACE CRC science to key end-users	Greater understanding of research user interests and needs
Department of Climate Change	Research user	Meeting; Canberra ACT	Estimating future sea-level extremes	Future collaboration
Department of Climate Change	Research user	Briefing; Canberra ACT	Communication of ACE CRC science to key end-users	Greater understanding of research user interests and needs
Department of Climate Change	Research user	Meeting for proposed workshop; Canberra ACT	Incorporating ACE CRC science into climate change program	Achieving the incorporation of ACE CRC science into the climate change program
Department of Defence	Research user	Meeting; Canberra ACT	Future projections of sea-level rise	Assess risk to existing and planned defence coastal infrastructure
Geosciences Australia	Research user	Meeting; Teleconference	Estimating future sea-level extremes	Future collaboration
GHD	Research user/ Partner	Meeting; Sydney NSW	Estimating future sea-level extremes	Strategic Partnering Alliance
Maunsell	Research user	Meeting; Sydney NSW	Estimating future sea-level extremes	Assessing risk to existing and planned coastal infrastructure
Melbourne City Council	Research user	Meeting; Melbourne Vic	Estimating future sea-level extremes	Commitment to support seminars and workshops
Melbourne Water	Research user	Meeting; Melbourne Vic	Long term projections of sea-level rise	Development of Melbourne Water strategic plan
Myriax	Research user/ Partner	Meeting; Hobart Tas	Opportunities to use research outputs	Partnering arrangement
Office of National Assessments	Research user	Briefing; Canberra ACT	Communication of ACE CRC science to key end-users	Greater understanding of research user interests and needs
Pitt & Sherry	Research user	CFTI meeting; strategic alliance; Hobart Tas	Progress of CFTI	Contribution towards objectives of CFTI
Queensland Government Office for Climate Change	Research user	Meeting; Brisbane Qld	Estimating future sea-level extremes	Commitment to support 'Estimating Sea-level Extremes' events
Randwick City Council	Research user	Meeting; Sydney NSW	Estimating future sea-level extremes	Assessing risk to future and existing coastal infrastructure
SA State Government	Research user	Meeting; Teleconference	Estimating future sea-level extremes	Commitment to support seminars and workshops
SGS Economics & Planning	Research user/ Partner	Meeting; Hobart Tas	Estimating future sea-level extremes	Partnering arrangement
Sinclair Knight Merz	Research user	Meeting; Hobart Tas	Estimating future sea-level extremes	Assessing risk to future and existing coastal infrastructure
Sydney Coastal Councils	Research user	Meeting; Sydney NSW	Estimating future sea-level extremes	Workshop for Sydney Coastal Councils
Tasmanian Federal Politicians Briefing	Research user	Meeting; Hobart Tas	Update on climate change science	Update on climate change science
Tasmanian State Government	Research user	Future Partnership; Hobart Tas	Contribution towards a future CRC	Commitment to future CRC

Grants

Project title	ACE researcher(s)	Granting body	Grant period	Total (AUD$)	2008–2009 (AUD$)
Ice sheet-atmosphere interaction and surface climatology of interior Antarctica	Allison I	Australian Antarctic Research Program	2004–2013	Logistical support	Logistical support
IPCC Scoping Meeting travel and support grant	Bindoff N	Department of Climate Change	2008	15,000	15,000
Marine and Climate Data Discovery Access Project (MACDDAP)	Bindoff N	NCRIS 5.16	2008–2011	1,000,000	400,000
The Southern Ocean Meridional Overturning Circulation: New observations of vertical mixing	Bindoff N	ARC Discovery Project	2008–2010	318,000	114,500
NCRIS 5.16 TPAC/ARCS	Bindoff N	NCRIS 5.16	2007–2011	1,000,000	250,000
Climate Futures for Tasmania	Bindoff N	Commonwealth Environmental Research Facilities	2008–2010	1,114,961	341,098
		Department of Primary Industries and Water, TAS	2008–2010	900,000	300,000
		HydroTasmania	2008–2010	150,000	50,000
		State Emergency Service, TAS	2008	330,000	20,000
Pathways and impact of Southern Ocean currents on Antarctic Ice Sheet melting in response to global warming	Bindoff N Colberg F	APAC Merit Allocation Scheme, 2009	2009	28,000 Service Units	28,000 Service Units
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	National Science Foundation, Chemical Oceanography (USA)	2006–2009	568,205	10,000
Continental aerosols as vectors of micronutrients to the oceans	Bowie A Butler E	Cape Grim Baseline Air Pollution Station Science Program	2008–2009	4,000	4,000
The role of iron as a micro-nutrient to the Antarctic sea-ice zone algal community	Bowie A Trull T Lannuzel D van der Merwe P	Australian Antarctic Science grant	2008–2010	47,000	24,000
Ocean Micronutrients (Australian sector) – IPY – GEOTRACES section and associated aerosol study	Butler E Bowie A	Australian Antarctic Science grant	2007–2009	1,088,800	
Ice shelf – ocean interaction in the cavity beneath the Amery Ice Shelf	Craven M Allison I Hunter J	Australian Antarctic Research Program	2004–2009	Logistical support	Logistical support
Australia and the Antarctic Treaty System	Haward M	Department of the Environment, Water, Heritage and the Arts	Feb 2009–Dec 2009	80,000	
The Future of Oceans Governance in Polar Areas	Haward M Jabour J	Australian Research Council	2007–2009	17,000	
ISSI team grant	Heil P	International Space Science Institute	2008–2009	16,000	12,000
Monitoring Antarctic sea-ice during IPY	Heil P	International Space Science Institute	Jul 2007–Jun 2010	50,000	5,000
Variability of the coastal Antarctic climate derived from fast-ice observations	Heil P	Australian Antarctic Division	2009–2019	Logistical support	Logistical support
An observatory of coastal sea-ice and environment	Heil P	Australian Antarctic Division	2008–2013	Logistical support	Logistical support
Studying high-frequency Arctic and Antarctic sea-ice dynamics using drifting buoy data	Heil P	Australian Antarctic Division	2008–2013	Logistical support	Logistical support
Sea-ice motion, deformation, thickness and lead dynamics in the Antarctic	Heil P Massom R	European Space Agency	2007–2010	Satellite data	Satellite data
Complete Mapping of Antarctic Sea-ice Dynamics and Thickness	Heil P Massom R	European Space Agency	2007–2010	Satellite data	Satellite data
Integrated Ocean Drilling Program	Howard W	Australian Research Council	2007–2012	6,000,000	1,250,000
Effects of increasing anthropogenic CO_2 on marine calcifiers in the Southern Ocean	Howard W	Department of Climate Change	2008–2009	106,500	106,500
AAS project no. 3046: Southern Ocean calcareous zooplankton response to ocean acidification	Howard W	Australian Antarctic Division	2009–2011	Logistical support	Logistical support

Project title	ACE researcher(s)	Granting body	Grant period	Total (AUD$)	2008–2009 (AUD$)
10Be in Antarctic Ice Cores (PGRA for J. Pedro)	Howard W	Australian Institute of Nuclear Science and Engineering	2007–2009	43,000	17,481
Investigating sea-level extremes in an uncertain future	Hunter J	Department of Climate Change	2008–2010	345,554	309,099
Sea-level change in the Australasian region during the past 6000 years	Lambeck K	ARC Discovery Project	2007–2009	361,000	96,000
The Southern Ocean and Sea-ice Response to Climate Variability and Change	Marsland S Heil P	Australian National Univesity	Jan 2009– Dec 2009	160,000	120,000
Study of Mertz Glacier Tongue, East Antarctica	Massom R	National Aeronautic and Space Administration (USA)	2007–2009	Satellite data	Satellite data
Mapping and Monitoring of Circum-Antarctic Fast Ice	Massom R Heil P Young N	European Space Agency	2007–2010	Satellite data	Satellite data
Understanding Changing Ice Flow and Rift Propagation in the Mertz Glacier Tongue, East Antarctica	Massom R Warner R Young N	European Space Agency	2007–2010	Satellite data	Satellite data
The validation of CryoSat 2 sea-ice thickness measurements in Antarctica	Massom R Allison I Worby A Michael K Young N	European Space Agency	2007–2010	Satellite data	Satellite data
Remote sensing of near-coastal Antarctic sea-ice and its impacts on ice shelves and ecosystems	Massom R Adams N Heil P Lieser J Worby A	AAS Project 3024	2007–2010	Satellite data	Satellite data
Sea-ice primary production off eastern Antarctica	McMinn A Meiners K Griffiths B	AAS grant by Department of Environment, Water, Heritage and the Arts	2006–2010	40,000	8,000
Material properties of southern ocean pteropods influenced by increasing ocean acidification	Roberts D Howard W	Australian Microscopy and Microanalysis Research Facility (AMMRF) Grant #9003	2009	2,450	2,450
Sub-Antarctic Zone Mooring Study of Particulate Carbon Export: provides shiptime for studies of carbon uptake by Southern Ocean	Trull T	Australian Antarctic Sciences Award #1156	2003–2008	~2,000,000 (shiptime on Aurora Australis)	~400,000 (shiptime on Aurora Australis)
Southern Ocean Time Series: provides shiptime for studies of carbon uptake by Southern Ocean	Trull T	Marine National Facility Award	2008–2009	~35,000 (shiptime on Del Richey II)	~35,000 (shiptime on Del Richey II)
Integrated Marine Observing System – Southern Ocean Time Series Facility: provides mooring equipment for studies of carbon uptake by Southern Ocean	Trull T Schulz E	National Collaborative Research Infrastructure Strategy	2008–11	3,900,000	900,000
Purchase of a State of the Art High Resolution Inductively Coupled Plasma Mass Spectrometer: provides capability for marine sample elemental analysis	Trull T Bowie A Butler E	ARC Linkage Infrastructure	2009	250,000	250,000
Sea-ice thickness from space: validating estimates from laser and radar altimeters with ship-based measurements	Worby A	National Aeronautic and Space Administration (USA)	2008–2012	US$500,000	
Investigation of sea-ice physical processes in East Antarctica during early Spring	Worby A Massom R Heil P Lieser J Meiners K	Australian Antarctic Research Program (AARP)	2007–2010	Logistical support	Logistical support

Project title	ACE researcher(s)	Granting body	Grant period	Total (AUD$)	2008–2009 (AUD$)
Land ice monitoring in East Antarctica and Heard Island using data from the Advanced Space-borne Thermal Emission and Reflection Radiometer	Young N	United States Geological Survey (USA)	2003–2011	Satellite data	Satellite data
Iceberg tracking and environment monitoring using QuikScat scatterometer	Young N	National Aeronautic and Space Administration – Jet Propulsion Laboratory (USA)	1999–2012	Satellite data	Satellite data
Antarctic ice stream, ice shelf, ice sheet and ocean interaction	Young N Coleman R	European Space Agency	2005–2010	Satellite data	Satellite data
Dynamics and characteristics of ice shelves and glaciers in East Antarctica	Young N Coleman R	Japanese Aerospace eXploration Agency (JAXA)	2006–2011	Satellite data	Satellite data
Recent changes and dynamics of Heard Island glaciers	Young N Coleman R	Japanese Aerospace eXploration Agency (JAXA)	2006–2011	Satellite data	Satellite data
Antarctic iceberg drift, dispersion and dissolution rates in the Southern Ocean	Young N Massom R	European Space Agency	2007–2010	Satellite data	Satellite data
Antarctic iceberg freeboard height and volume distribution	Young N Bindoff N Massom R	European Space Agency	2005–2012	Satellite data	Satellite data

Performance measures

Performance measure	2007–2008 progress	2008–2009 progress
CRC Program Objective 1: To enhance the contribution of long-term scientific and technological research and innovation to Australia's sustainable economic and social development		
Centre Objective 1.1: Advance Australia's aspirations for its Antarctic territory and Southern Ocean exclusive economic zones		
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 staff served on 20 national and 47 international committees, editorial boards or advisory boards related to Antarctic and Southern Ocean research/management and climate change prediction and analysis. 8 staff members served in international leadership roles such as chair, co-chair or workshop co-convenor. ACE CRC researchers authored or co-authored 95 refereed papers, 1 book, 15 book chapters, 39 conference papers/abstracts, 12 reports and 23 other articles. 3 ACE CRC researchers served as consultants to various industries or government agencies.	ACE CRC staff served on 18 national and 42 international committees, editorial boards or advisory boards related to Antarctic and Southern Ocean research/management and climate change prediction and analysis. 11 staff members served in international leadership roles such as chair, co-chair or workshop co-convenor. ACE CRC researchers authored or co-authored 83 refereed papers, 1 book, 5 book chapters, 46 conference papers/abstracts, 17 reports and 12 other articles. 4 ACE CRC researchers served as consultants to various industries or government agencies.
Centre Objective 1.2: Increase international engagement in Southern Ocean and Antarctic research relevant to Australia's interests		
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 60 international collaborations involving 15 countries. ACE CRC hosted 23 international visitors from 7 different countries.	ACE CRC researchers took part in 64 international collaborations involving 18 countries. ACE CRC hosted 16 international visitors from 7 different countries.
CRC Program Objective 2: To enhance the transfer of research outputs into commercial or other outcomes of economic, environmental or social benefit to Australia		
Centre Objective 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		
Uptake of these approaches by operational agencies.	Provided atmospheric forcing fields for June 2008 to test a limited area version of a numerical model of sea-ice covering the Southern Hemisphere sea-ice zone. Developed insights into interactions between ocean circulation and sea-ice anomalies. Obtained the first detailed maps of fast ice extent around East Antarctic coast from 75°E–170°E, satellite synthetic aperture radar data.	Development and expansion of the East Antarctic Fast Ice Observatory progressed with deployment of automated camera and weather station systems for year-round monitoring, along with mass-balance stations and buoys at Davis Station
Centre Objective 2.2: To provide science for the assessment of sustainable ecosystem management		
Use of these outputs by management agencies.	Undertook a dedicated sea-ice research voyage that focused on understanding the links between sea-ice physics, sea-ice biology and the pelagic food web. Used a remote underwater vehicle with optical sensors to measure the amount of algae within the sea-ice from below. Sampled krill directly under the sea-ice with a specially-designed trawl net to study their size and abundance in that environment. Compiled the results from a large-scale survey of krill, along with oceanography and all levels of biota, in the region from 30°E to 80°E. Clarified the links between ocean circulation and biological productivity by showing how interaction between the fronts of the Antarctic Circumpolar Current and the sea floor drives upwelling and enhances marine plant life, even over deep topography.	Collated data on important ecosystem parameters for modelling, ranging from physical conditions in the Southern Ocean to the distribution, abundance and biology of the major biota, and reviewed at a joint workshop of CCAMLR and the IWC in August 2008. Convened an international workshop "Southern Ocean Sentinel" and identified the key requirements for designing and implementing a monitoring program for estimating climate change impacts on Antarctic marine ecosystems and for undertaking assessments of those impacts. Convened workshops, and a special issue of Deep Sea Research was published which consolidated the state of knowledge of marine ecosystems in eastern Antarctica.

Performance measure	2007–2008 progress	2008–2009 progress
Centre Objective 2.3: To ensure recognition of oceanic carbon sinks and their impacts		
Consideration of ocean carbon sinks in carbon management plans and agreements.	Documented increased phytoplankton, zooplankton and bacterial populations, and greater export of carbon to deep waters, in response to natural iron inputs from the Heard and Kerguelen islands and surrounding plateau sediments. Measured the first full, open-depth section of iron and other trace element distributions between Australia and Antarctica, using a trace-metal rosette developed by our partner NIWA. Completed a repeat inventory of total and anthropogenic dissolved CO_2 and a first survey along a section from Australia to Antarctica of the abundance of marine-calcifying organisms. Designed effective monitoring strategies for ocean uptake of CO_2 based on the relationship between ocean circulation and the uptake. Hosted international workshops on 'Ocean Acidification' and on 'Biogeochemistry of the Sub-Antarctic Zone'. The latter focused on the causes of variations in phytoplankton levels east and west of Tasmania, to evaluate sensitivities to climate change.	Participated in Australia's Interdepartmental Committee on Ocean Fertilisation, and its international delegations to the London Convention/Protocol in the Ocean meetings in London and Rome, to promote political agreements to permit ocean fertilisation research and place a moratorium on activities other than research. Using observations and seasonal resolution of biogeochemical cycles showed that the aragonite form of calcium carbonate will become under-saturated in polar Southern Ocean waters before the year 2040 unless atmospheric CO_2 levels are held below 450ppm (and published this work in the Proceedings of the National Academy of Sciences). This under-saturation is expected to deleteriously impact important organisms such as pteropods and other zooplankton, and the shells of foraminifera already reveal thinning in response to acidifications (as published in Nature Geosciences). Co-chaired the Southern Ocean regional group developing the Surface Ocean Carbon Dioxide Atlas (SOCAT). The atlas now includes 9.5 million measurements until 2008 and is the most comprehensive data available for surface CO_2. The regional groups are now completing quality control of the data and developing synthesis efforts. Public release is planned for 2010.
Centre Objective 2.4: To provide observations essential to the consideration of climate change and variability in economic and environmental planning		
1. Improved estimates of climate variability and change. 2. Increased reference to this information by economic and environmental research users.	Showed enhanced freshening of the surface waters in the Southern Ocean that suggests significant ice shelf melt. This is also supported by observed changes in Antarctic bottom water. Measured the complex circulation over the Antarctic continental shelf and showed that it facilitates export of dense water from the shelf, even in summer. Recovered a large array of moorings that had monitored ocean circulation over the Macquarie Ridge as part of a joint experiment with NIWA. Deployed novel moorings that will provide the first accurate measurements of dense water export from the shelf. Recovered a short ice core from Law Dome to extend the record of past changes in atmospheric conditions up to January 2007. Showed that since 1961 the trend in ocean thermal expansion is 50% larger than previous estimates.	New understanding of the role of ocean eddies and key frontal systems and their response to the observed increasing winds cover the period from the 1960s to present. Described the regional circulation of the BROKE–West region, 30°E to 80°E both in surface and deep waters, revealing new formation zones for deep waters and new estimates of the Antarctic slope front in this region. Understanding the formation regions around Antarctica is central for establishing the baseline for detecting climate change signals in this region. Comparisons of meteorological data and ice core record showing connections between coastal East Antarctic circulation and ENSO. Other analysis is showing that links between drought in southwest Western Australia and East Antarctic precipitation are being driven by large-scale north-south transport south of Australia. Updated estimates of ocean thermal expansion when combined with published estimates of glacier and Greenland contributions approximately explain observations that sea level is continuing to rise. Revised estimates of the Greenland contribution to sea-level rise show an increased loss of ice from Greenland over recent years. Revised estimates of the Antarctic contribution suggest a positive contribution to sea-level rise with indications of an increased contribution from the West Antarctic ice sheet. Improved the ice shelf/ocean interaction model. The model is one of the first to include three-dimensional frazil ice dynamics. Simulations of the circulation and melting and freezing for the Amery Ice Shelf and Mertz Ice Tongue regions agree well with observations. Global warming simulations show enhanced melt response to ocean warming. Developed and tested a method for integrating sea-level rise and storm surges into coastal risk assessment. Participated in the first season of ICECAP – a major collaborative aerogeophysics program from Casey station, Antarctica – exploring the ice sheet thickness and internal structure and the bedrock properties of the deep Aurora subglacial basin.
CRC Program Objective 3: To enhance the value to Australia of graduate researchers		
Centre Objective 3.1: To become a major training centre for climate, marine, and ecosystem science		
Increased recognition of Hobart as a top educational centre in these areas.	67 PhD and 3 MSc students associated with the ACE CRC. 4 PhD students began their studies in the past fiscal year. 3 students awarded PhDs, 6 under examination.	65 PhD and 4 MSc students associated with the ACE CRC. 5 PhD students began their studies in the past fiscal year. 10 students awarded PhDs; 7 under examination.
Centre Objective 3.2: To deliver students with interdisciplinary skills useful to the climate, marine, and ecosystem research and research user communities		
Successful placement of students within these communities.	3 students who completed their PhDs and 1 who completed Masters degrees took up employment with user groups.	8 students who completed their PhDs and 1 who completed Masters degrees took up employment with user groups.

Performance measure	2007–2008 progress	2008–2009 progress
CRC Program Objective 4: To enhance collaboration among researchers, between researchers and industry or other users, and to improve efficiency in the use of intellectual and other research resources		
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 31 national and 60 international collaborative projects involving 15 countries.	ACE CRC researchers were involved in 39 national and 64 international collaborative projects involving 18 countries.
Centre Objective 4.2: To undertake research of direct value to research users		
Number and success of projects involving research users in their design and completion.	4th Research Users' Forum for government agencies, under a new roundtable format on specific issues; 4th ACE CRC Annual Symposium. Developed new publication format, ACE CRC Position Analysis papers, and produced the first issue on ocean acidification collaboratively with Commonwealth regulatory agencies. Provided material to DFAT on ocean fertilisation for UN discussions on the Law of the Sea, and to DEWHA and Attorney-General's Department for the Convention on the Prevention of Marine Pollution by Dumping of Waste and Other Materials, and its related Protocol. Provided input on biological prospecting to AAD prior to the Antarctic Treaty Consultative Meeting. Initiated the Climate Futures for Tasmania Program, in consultation with stakeholders, to deliver climate projections for the state at a fine scale and across a wide range of impact areas. Developed a sea-level rise consultancy unit to support industry and government entities in providing coastal infrastructure risk assessments taking into account the potential impacts of a rising sea level.	Continuing engagement with key Government Research Users. Successful presentation of three Research User Roundtables, and follow up engagement. Broad attendance by key government agencies including PM&C, DFAT, DCC, DAFF, DEWHA. Production of four Position Analyses: Ocean Fertilisation, Sea-ice, Sea-level and Ice Sheets. Development and presentation of Short Course entitled "Antarctica and the Southern Ocean: implications for Australian and global climate change" to Australian Government. Maintaining and extending engagement of ACE CRC with key government officials in Canberra through briefings on ACE research to DCC, DFAT, DAFF, AFMA officials on the policy and legal implications of oceans acidification and ocean fertilisation, climate change impacts on Southern Ocean shipping. Held a series of 9 seminars and 4 workshops in 9 centres around Australia on how to combine the risk of storm surge inundation with uncertainties in sea-level projections. Delivered sea-level rise scientific/technical expertise to a port authority, airport and water authority, as well as a number of coastal councils.

Third Year Review Recommendations

Recommendation	Implemented Y/N	Reason why not	Strategy to implement
1. The ACE CRC should develop a strategy 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	Yes	NA	1. Appointment of Business Development Manager 2. Development and implementation of business development plan 3. Promotion of the relevance of the research being performed within the life of this CRC 4. Secure commercial participants to support a future CRC 5. Industry and government-tailored communications, workshops and forums 6. Securing corporate partnerships and additional funding to support incremental research
2. The Policy Program needs to directly address the "science-policy gap" by explicitly recognising the need for its efforts to be led by policy needs rather than being research-driven	Yes	NA	1. Work with research users on emergent issues and needs 2. In-kind contributions of staff from core partners to policy program 3. Internal science-policy working groups to address issues 4. Refocus Research User Forums as user roundtables 5. Development of Position Analyses to address emergent issues and policy needs

Glossary

All entries are Australian unless otherwise identified by country in brackets

AAD	Australian Antarctic Division
AARP	Australian Antarctic Research Program
AAS	Australian Academy of Science
ACAP	Agreement on the Conservation of Albatrosses and Petrels
ACC	Antarctic Circumpolar Current
ACCESS	Australian Computational Earth Systems Simulator
ACE CRC	Antarctic Climate & Ecosystems Cooperative Research Centre
ACROSS	Australian Centre for Research on Separation Science
AFMA	Australian Fisheries Management Authority
AGCS	Antarctica and the Global Climate System
AGO	Australian Greenhouse Office (now DCC)
AGU	American Geophysical Union
AIMS	Australian Institute of Marine Science
AINSE	Australian Institute of Nuclear Science and Engineering
AME	Antarctic Marine Ecosystems Program, ACE CRC
AMISOR	Amery Ice Shelf Ocean Research
ANARE	Australian National Antarctic Research Expeditions
ANSTO	Australian Nuclear Science and Technology Organisation
ANU	Australian National University
AR4	Fourth Assessment Report (IPCC)
AR5	Fifth Assessment Report (IPCC)
ARAC	Aquaculture Research Advisory Committee
ARC	Australian Research Council
ARCNESS	Australian Research Council Network for Earth System Science
ARCS	Australian Research Collaboration Service
ASAID	Antarctic Surface Accumulation and Ice Discharge
ASASS	Australian Symposium on Advances in Separation Science
ASLO	American Society of Limnology and Oceanography
AUV	Autonomous Underwater Vehicle
AVCAL	Australian Private Equity & Venture Capital Association Ltd
AWI	Alfred Wegener Institute for Polar and Marine Research (DEU)
BAS	British Antarctic Survey (GBR)
BGR	Federal Institute for Geosciences and Natural Resources (DEU)
BoM	Bureau of Meteorology
BROKE-West	Baseline Research on Oceanography, Krill and the Environment (western sector)
CAWCR	Centre for Australian Weather and Climate Research
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CERF	Commonwealth Environmental Research Facilities Program
CFT	Climate Futures for Tasmania
CliC	Climate and Cryosphere Program (WCRP)
CLIVAR	Climate Variability and Predictability Program (WCRP)
CMAR	CSIRO Marine & Atmospheric Research
CNRS	Centre National de la Recherche Scientifique (FRA)
CO2	Ocean Control of Carbon Dioxide Program, ACE CRC
CRC	Cooperative Research Centre
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CVC	Climate Variability and Change Program, ACE CRC
DAFF	Department of Agriculture, Fisheries and Forestry
DBCP	Data Buoy Cooperation Panel
DCC	Department of Climate Change (formerly AGO)
DED	Tasmanian Department of Economic Development
DEWHA	Department of the Environment, Water, Heritage & the Arts
DFAT	Department of Foreign Affairs and Trade
DIISR	Department of Innovation, Industry, Science & Research
DPAC	Tasmanian Department of Premier and Cabinet
DPIW	Tasmanian Department of Primary Industries & Water
DSE	Victorian Department of Sustainability and Environment
EDU	Education Program, ACE CRC
ENEA	National Agency for New Technologies, Energy and Sustainable Economic Development (ITA)
ENSO	El Niño-Southern Oscillation
ESA	European Space Agency
ESF	European Science Foundation
GA	Geoscience Australia
GEOTRACES	An international study of the biogeochemical cycles of Trace Elements and Isotopes in the Arctic and Southern Oceans
GNS	Institute of Geological and Nuclear Science (NZL)
IAMAS	International Association of Meteorology and Atmospheric Sciences
IAPSO	International Association for the Physical Sciences of the Oceans
IARC	International Arctic Research Center (USA)
IASC	International Arctic Science Committee
IASOS	Institute of Antarctic & Southern Ocean Studies (UTAS)
ICECAP	International Climate and Environmental Change Assessment Project
ICED	Integrated Analyses of Circumpolar Climate Interactions and Ecosystem Dynamics in the Southern Ocean
ICES	International Council for the Exploration of the Sea
ICPM	International Commission for Polar Meteorology and Climatology

ICSU	International Council for Science
IFREMER	Institut Français de Recherche pour L'Exploitation de la Mer (FRA)
IFSA	International Forum on the Sub-Antarctic
IMOS	Integrated Marine Observing System
INGV	Istituto Nazionale di Geofisica e Vulcanologia (ITA)
IOCCP	International Ocean Carbon Coordination Project
IP	Intellectual Property
IPCC	Intergovernmental Panel on Climate Change
IPY	International Polar Year 2007–2008
ISSI	International Space Science Institute
IUCN	International Union for Conservation of Nature
IUGG	International Union of Geodesy and Geophysics
IWC	International Whaling Commission
JAXA	Japanese Aerospace eXploration Agency (JPN)
JPL	Jet Propulsion Laboratory (USA)
KEOPS	Kerguelen compared study of Ocean and Plateau in Surface waters
LEGOS	Laboratoire d'Etudes en Geophysique et Océanographie (FRA)
LiDAR	Light Detecting and Ranging equipment
LOCEAN	Laboratoire d'Océanographie et du Climat: Expérimentations et Approches Numériques (FRA)
LSCE	Laboratoire des Sciences du Climat et de l'Environnement (FRA)
MACDDAP	Marine and Climate Data Discovery Access Project
MEXT	Ministry of Education, Culture, Sports, Science and Technology (JPN)
MGT	Mertz Glacier Tongue
MQ	Macquarie University
NASA	National Aeronautics and Space Administration (USA)
NCRIS	National Collaborative Research Infrastructure Strategy
NERC	Natural Environment Research Council (GBR)
NIPR	National Institute of Polar Research (JPN)
NIWA	National Institute for Water and Atmospheric Research (NZL)
NRM	National Resource Management
NSF	National Science Foundation (USA)
NSIDC	National Snow and Ice Data Center (USA)
PAR	Photosynthetically Active Radiation
PM&C	Department of the Prime Minister and Cabinet
POL	Policy Program, ACE CRC
PWEA	Institute of Public Works Engineering
RMIT	Royal Melbourne Institute of Technology
ROMS	Regional Ocean Modeling System
ROV	Remotely Operated Vehicle
SAZ-Sense	Sensitivity of Sub-Antarctic Zone waters project
SCAR	Scientific Committee on Antarctic Research
SES	State Emergency Service
SGI	Silicon Graphics International
SIO	Scripps Institution of Oceanography (USA)
SIPEX	Sea-ice Physics & Ecosystem Experiment
SLR	Sea-level Rise Program, ACE CRC
SME	Small and Medium Enterprises
SOCAT	Surface Ocean Carbon Dioxide Atlas
SOIREE	Southern Ocean Iron Release Experiment
SOOP	Ship of Opportunity
SOPHOCLES	Southern Ocean Physical Oceanography and Cryospheric Linkages
SPSLCMP	South Pacific Sea Level and Climate Monitoring Project
SURVOSTRAL	Surveillance de l'Océan Austral project (FRA)
TAMS	Tasmanian Association of Municipal Supervisors
TERSS	Tasmanian Earth Resources Satellite Station
TIAR	Tasmanian Institute of Agricultural Research
TOMS	Terrain-following Ocean Modeling System
TPAC	Tasmanian Partnership for Advanced Computing
UMelb	University of Melbourne
UNSW	University of New South Wales
UQ	University of Queensland
USGS	United States Geological Survey (USA)
UTAS	University of Tasmania
UTS	University of Technology, Sydney
VCAT	Victorian Civil and Administrative Tribunal
WCRP	World Climate Research Programme
WHOI	Woods Hole Oceanographic Institution (USA)
WMO	World Meteorological Organisation
WOCE	World Ocean Climate Experiment (WCRP)
WWF-Australia	World Wildlife Fund Australia

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Allison I Alley R Fricker H Thomas R Warner R (2008) 'Ice sheet contributions to sea-level rise: a post IPCC AR4 assessment' ***Antarctic Climate and Ecosystems CRC Symposium 2008*** Hobart Australia 3-4 December 2008

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Howard W Roberts D Moy A Roberts J Trull T Bray S and Hopcroft R (2009) 'Ocean acidification impacts on Southern Ocean calcareous zooplankton' ***The 11th Pacific Science Inter-congress*** Tahiti French Polynesia 2-6 March 2009

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Hunter J (2008) 'Flooding of a Pacific atoll island: diagnosing the problem' ***9th International Conference on Southern Hemisphere Meteorology and Oceanography*** Melbourne Australia 9-13 February 2009

Hunter J (2008) 'Sea-level rise and the vulnerability of coastlines' ***2nd Regional Forum on Climate Change and Coastal Communities*** Lismore Australia 3-4 July 2008

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Maksym T Pasquer B Shoosmith D (2008) 'Extreme melt-freeze processes on Antarctic sea-ice: implications for evolution of perennial ice mass balance and biological communities' ***AGU Fall Meeting*** San Francisco USA 15-19 December 2008

Moy A D Howard W R Trull T W Bray S (2008) 'Reduced calcification in modern Southern Ocean planktonic foraminifera' ***2nd International Symposium on the Ocean in a high-CO_2 World*** Monaco 6-8 October 2008

O'Farrell S P (2008) 'Regional sea-level rise around the Australian coastline' ***CAWCR Modelling Workshop*** Melbourne Australia 1 November 2008

O'Farrell S P (2008) 'Response in the CSIRO Mk3.0 and Mk3.5 climate models in the Southern Ocean to 20th and 21st Century climate scenarios' ***SCAR/IASC IPY Open Science Conference*** St Petersburg Russia 8-11 July 2008

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Phleger C F Young J Guest M Lansdell M Nichols P D (2008) 'Signature lipids – A Tool to Monitor Climate and Environmental Change in Top Level Predators' ***New Zealand Oils Society/ Australasian Section American Oils Chemists Society*** Auckland New Zealand 11-13 November 2008

Rintoul S R (2008) 'Continued rapid freshening of the Antarctic Bottom Water of the Indian and Pacific Oceans' ***SCAR/IASC IPY Open Science Conference*** St Petersburg Russia 8-11 July 2008

Rintoul S R (2008) 'Southern ocean variability and change: an overview of results from the CASO program of the International Polar Year' ***9th International Conference on Southern Hemisphere Meteorology and Oceanography*** Melbourne Australia 9-13 February 2009

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Schoemann V Hassler C Dumont I Masson F Bowie A Lannuzel D de Jong J Becquevort S (2008) 'Control of organic ligands on Fe bioavailability, carbon production and export' ***European network of excellence for ocean ecosystems analysis workshop: Controls on organic carbon export and twilight zone mineralisation*** Brussels Belgium 28-30 May 2008

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Sedwick P Marsay C Bowie A Church T Cullen J Johnson R Lohan M McGillicuddy D Ussher S (2008) 'Dynamics and speciation of dissolved iron in the Sargasso Sea (BATS region)' ***AGU Fall Meeting*** San Francisco USA 15-19 December 2008

Sokolov S (2008) 'The circumpolar structure and distribution of the Antarctic Circumpolar Current fronts: mean circumpolar paths and variability' ***9th International Conference on Southern Hemisphere Meteorology and Oceanography*** Melbourne Australia 9-13 February 2009

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Trull T Bowie A Boyd P Cassar N Davidson A Griffiths F Rintoul S Thomson P Tilbrook B Wright S SAZ-Sense team (2009) 'The Australian SAZ-Sense Study of the sensitivity of the Sub-Antarctic zone to Climate Change' ***2nd International Forum on the Sub-Antarctic (IFSA) Environmental Change in the Sub-Antarctic*** Hobart Australia 26-27 April 2009

Williams G D Aoki S Marsland S J Bindoff N L Fukamachi Y Rintoul S R Galton-Fenzi B K (2008) 'Down slope mixing of Antarctic bottom water from East Antarctic polynyas' ***SCAR/IASC IPY Open Science Conference*** St Petersburg Russia 8-11 July 2008

Reports

Allison I Warner R Haward M Hilkemeijer A Sandford R (2009) 'Position Analysis: Polar ice sheets and climate change: global impacts' ***Antarctic Climate & Ecosystems Cooperative Research Centre*** 16pp

Allison I Béland M et al (2009) 'The State of Polar Research: a statement from the International Council for Science/World Meteorological Organization Joint Committee for the International Polar Year 2007–2008' ***World Meteorological Organization*** Geneva

Bindoff N L Stammer D Le Traon P-Y Trenberth K Mauritzen C Church J A Smith N Malone T Suga T Tintoré J Wilson S (2009) '2009: Capabilities of Global Ocean Programs' ***Climate Services WCC-3***

Church J Hunter J (2009) 'Plausible upper estimates of sea-level rise' ***Technical Report for Melbourne Water***

Church J Hunter J Iliff M Preston B (2008) 'Review: towards a City of Melbourne climate change adaptation strategy' ***Report for City of Melbourne***

Church J White N Hunter J Lambeck K (2008) 'Briefing: A post-IPCC AR4 update on sea-level rise' ***Antarctic Climate & Ecosystems Cooperative Research Centre*** 12pp

Hunter J Pribac F Illif M (2009) 'The vulnerability of Brisbane Airport to sea-level rise' ***Brisbane Airport Corporation***

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Massom R Heil P Allison I Worby A Lieser J (2008) 'Theme 3: Sea-ice' ***Workshop Report, National Research Agenda for Climate Change Science in the Antarctic and Southern Ocean Regions – Input for National Framework for Climate Change Research***

Massom R O'Farrell S Adams N Armand L Meiners K Curran M Heil P Arrigo K Pasquer B (2008) 'Observing and Modelling Antarctic Sea-ice Habitats' ***Report to the Joint CCAMLR-IWC Workshop to Review Input data for Antarctic Marine Ecosystem Models***

Sandford R Hunter J Allison I (2008) 'Position Analysis: Climate change, sea-level rise and extreme events: impacts and adaptation issues.' ***Antarctic Climate & Ecosystems Cooperative Research Centre*** 20pp

Thresher R E Klaer N L Lyn V D Bax N J Rintoul S R (2008) 'South-east Demersal Fisheries: Implications of Climate Change for Australian Fisheries and Aquaculture: a preliminary assessment' Hobday A J Poloczanska E Matear R J (eds) ***Department of Climate Change***

Trull T Bowie A Jabour J Haward M Mayo-Ramsay J (2008) 'Position Analysis: Ocean Fertilisation: Scientific and Policy Issues' ***Antarctic Climate & Ecosystems Cooperative Research Centre*** 20pp

Vellinga P et al (2008) 'Exploring high-end climate change scenarios for flood protection of the Netherlands – International Scientific Assessment' ***Delta Committee*** The Netherlands

Worby A Massom R Meiners K Nichol M Curran M and Jabour J (2009) 'Position Analysis: Changes to Antarctic sea-ice: impacts' ***Antarctic Climate & Ecosystems Cooperative Research Centre*** 20pp

Other publications

Asrar G R Church J A Busalacchi A (2009) 'A sign of the climes: the World Climate Research Programme – climate information for decision makers' ***Public Service Review: Science and Technology*** (3) 115-119

Butler E B A (2008) 'Tracing Elements in the Ocean (SR3-IPY-GEOTRACES article)' ***Australian Antarctic Magazine*** 14 20

Galton-Fenzi B and Hunter J (2008) 'Predicting the fate of ice shelves' ***Ice and Climate News*** (11)

Haward M (2008) 'Australia, Antarctic and the Southern Ocean' ***Defence Today*** 7(2) 58-60

Howard W Sandford, R (2008) 'Developing Ocean Acidification Policy' ***Australian Antarctic Magazine*** 15 2-3

Howard W Sandford R (2009) 'The Dangers of Ocean Acidification' ***Tasmania 40° South Magazine*** (52) 28-32

Jabour J (2009) '7th Phillip Law Lecture 2008: Can whales be both a metaphor for civilised society, and dinner?' ***The Phillip Law Lectures (State of Tasmania)*** 2 34-46

Massom R Young N and Pyper W (2009) 'Wilkins Ice Shelf on verge of collapse' ***Australian Antarctic Magazine*** 16 25

Massom R Allison I Scambos T (2008) 'Rapid disintegration of another ice shelf on the Antarctic Peninsula' ***Australian Antarctic Magazine*** 14 22-23

Pearman G Church J Raupach M (2009) 'The global carbon budget' ***Focus*** 154 (February) 34-35

Warner R Roberts J (2008) 'Evolution of the Antarctic cryosphere' ***Australian Antarctic Magazine*** 15 15.

Staff exchanges

Staff name	Institution visited	Country	Purpose of exchange
Bowie A	Kyoto University	JAP	Joint Australia-Japan GEOTRACES Marine Science discussions including seminar: 'Different processes drive biogeochemical iron budgets in the Subantarctic and Polar Southern Ocean during summer'
Grose M	Alfred Wegner Institute	DEU	AWI exchange program – research
Howard W	Australian National University	AUS	Stable isotopic analyses
	Brown University	USA	Distribution of modern Indian Ocean pteropods
Lawrence P	United Nations Convention on Climate Change Secretariat	DEU	Meetings with Secretariat staff to discuss technology transfer issues.
Lawrence P	London School of Economics and Political Science Grantham Institute	GBR	Meetings to discuss intergenerational equity and climate change issues
Massom R	National Snow and Ice Data Center, University of Colorado, Boulder, Colorado	USA	Collaborative research with Dr Ted Scambos on the funded project 'Is Absence of Sea-ice a causal Factor in Recent Antarctic Ice Shelf Breakups?'
Meiners K	University of Kiel	DEU	Data analysis (SIPEX cruise)
	Alfred Wegner Institute	DEU	Planning of joint future field-work
	University of Essex	GBR	Workshop
Roberts J	University of Texas at Austin	USA	Analysis of data gathered at Casey during ICECAP season 1
Trull T	Princeton University	USA	Thesis discussions for PhD student co-supervision

International visitors

Visitor's name	Institution/affiliation	Country	Purpose of visit
Arrigo K	Stanford University	USA	Southern Ocean Sentinel Workshop, April 2009
Boyd P	National Institute for Water and Atmospheric Research	NZL	Coordination of Subantarctic carbon cycle research
Costa D	University of California Santa Cruz	USA	Southern Ocean Sentinel Workshop, April 2009
Fricker H	Scripps Institution of Oceanography, University of California San Diego	USA	Collaborative research on Amery Ice Shelf and Antarctic mass budget projects; and on using satellite data to determine coupling between fast ice and the Mertz Glacier Tongue (MGT), and recent changes in the dynamic behaviour of the MGT
Hoffman E	Old Dominion University	USA	Southern Ocean Sentinel Workshop, April 2009
Legiret F-E	Engineering College of Chemistry in Rennes	FRA	MSc internship (Hassler/Butler)
Legresy B	Laboratoire d'Etudes en Géophysique et Océanographie	FRA	Collaborative research on using satellite data to determine coupling between fast ice and the Mertz Glacier Tongue (MGT), and recent changes in the dynamic behaviour of the MGT
Murphy E	British Antarctic Survey	GBR	Southern Ocean Sentinel Workshop, April 2009
Poisson A	Université Pierre et Marie Curie	FRA	Southern Ocean carbon cycle research
Pugh D	Proudman Oceanographic Laboratory	GBR	General discussions concerning sea level and historic observations of sea level
Schoemann V	Vrije Universiteit Brussel	BEL	Laboratory work, preparation of publications; Seminar: 'The effect of organic ligands on iron bioavailability to natural plankton communities of the Southern Ocean'; Ernest Frohlich Fellowship at CMAR
Trathan P	British Antarctic Survey	GBR	Southern Ocean Sentinel Workshop, April 2009
Wassman P	University of Tromsø	NOR	Research Discussions
Weimerskirch H	Centre d'Etudes Biologique de Chizé	FRA	Southern Ocean Sentinel Workshop, April 2009
Williams M	National Institute for Water and Atmospheric Research	NZL	Collaboration on modelling frazil ice processes.
Xiao C-D	Chinese Academy of Meteorological Science	CHN	Collaboration analysis and interpretation of Antarctic automatic weather station data

National projects

Project title	ACE researcher(s)	Collaborator(s)	Organisation
Marine and Climate Data Discovery Access Project (MACDDAP)	Bindoff N	Mak P Turner P Lohrey J Pugh T Proctor R Roberts K Finney K Jackett C Williams R	TPAC CMAR Arcitecta Pty Ltd BoM IMOS IMOS AAD AAD UTAS
Climate Futures for Tasmania project	Bindoff N Corney S Grose M Holz G White C	Barnes-Keoghan I Cechet B Graham B Hirst T Ling F McInnes K McNeil D Mohammed C Wilson S	BoM GA DPIPWE CMAR Hydro Tasmania CSIRO TIAR TIAR TIAR
Trace elements content of Southern Ocean phytoplankton material: implications for carbon transfer to the deep sea	Bowie A	Townsend A	UTAS
Ocean Micronutrients (Australian sector) – IPY – GEOTRACES section and associated aerosol study	Bowie A	Butler E	CMAR
Quantifying the impact of dust deposition to the Southern Ocean using dissolved aluminium concentrations	Bowie A Butler E	Haddad P Nesterenko P	UTAS CMAR
Biogeochemical cycling of trace elements, and their influence on ocean primary production and Earth's climate: An Australian GEOTRACES initiative	Bowie A Butler E	Ellwood M Hassler C	ANU ANU
Continental aerosols as vectors of micronutrients to the oceans, Cape Grim Baseline Air Pollution Station – Science program	Bowie A Butler E	Keywood M	CMAR
Purchase of a state-of-the-art high resolution inductively coupled plasma mass spectrometer	Bowie A Trull T Butler E	Canty A Peterson G Nesterenko P Carter C Crawford C Townsend A Seen A Snape I	UTAS UTAS UTAS UTAS UTAS UTAS UTAS AAD
The role of iron as a micronutrient to sea-ice zone algae: Fe-EPS interactions and bioavailability	Bowie A Meiners K van der Merwe P Lannuzel D	Mancuso-Nichols C	CMAR
Natural ocean iron fertilisation by krill and baleen whales	Bowie A Nicol S Meiners K Lannuzel D van der Merwe P	Jarman S	UTAS
Australian Climate Change Science Program	Church J	Multiple	CAWCR
Pacific Climate Change Science Program	Church J	Multiple	CAWCR
Amery sediment core analysis	Craven M	Post A Hemer M	GA CSIRO
Amery seafloor benthos	Craven M	Riddle M	AAD
Using new datasets of climate variables	Grose M	Paget M Raupach M	CSIRO CSIRO
Australia and the Antarctic Treaty System	Haward M	Griffiths T	ANU
Australian Computational Earth Systems Simulator (ACCESS)	Heil P	Phipps S Marsland S O'Farrell S Hirst T Bi D	MQ CSIRO CSIRO CSIRO CSIRO
Data Buoy Cooperation Panel (DBCP)	Heil P	Ball G	BoM
ARC Network for Earth System Science (ARCNESS)	Howard W	Pitman A England M others	UNSW UNSW UNSW

Project title	ACE researcher(s)	Collaborator(s)	Organisation
Australian Integrated Ocean Drilling Program	Howard W	Arculus R Exon N others	ANU, 13 other Australian Universities, CSIRO, AIMS, ANSTO
Deglacial Changes in Circulation and Sea-Ice in the SW Pacific	Howard W Armand L	Quilty P Fink D	UTAS ANSTO
Isotope analyses of pteropod shells	Howard W Roberts D	Gagan M	ANU
Stable Isotopic Variability in Planktonic and Benthic Foraminifera and Pteropods	Howard W Roberts D Moy A	Gagan M	ANU
South-West Tasmania survey	Lieser J	Rudman T	DPIPWE
Long baseline GPS data processing in the Antarctic sea-ice zone	Lieser J Worby A Steer A	Watson C	UTAS
Impact of patterns of anomalous atmospheric circulation on the break-up of the Larsen B and Wilkins Ice Shelves.	Massom R	Pook M Simmonds I	CMAR UMelb
Impact of East Antarctic fast ice variability on emperor penguins	Massom R	Emmerson L Pook M	AAD CMAR
Rapid development and persistence of a massive Antarctic sea-ice tongue	Massom R	Sokolov S	CMAR
Sea-ice primary production off eastern Antarctica	Meiners K	McMinn A Ralph P	UTAS UTS
Bio-optics of sea-ice	Meiners K	Clementson L	CMAR
Deployment of Autonomous Underwater Vehicles (AUVs) in the Antarctic sea-ice zone	Meiners K	Bose N	UTAS
Surface water carbonate chemistry in the Tasman Sea since 25 ka: Implications for glacial-interglacial atmospheric CO_2	Moy A Howard W	Gagan M	ANU
Humpback whales – ecotoxicology and signature lipids	Nichols P	Bengston-Nash S Waugh C	UQ UQ
Wealth from Oceans National Research Flagship	Rintoul S Church J Tilbrook B	Multiple	CSIRO
Australian Climate Change Science Program	Rintoul S Church J van Ommen T Tilbrook B	Department of Climate Change	CSIRO
Nanoindentation of pteropod shells	Roberts D Howard W	Bradby J	ANU
Regulation of Ocean Fertilisation	Trull T	Powell C	DEWHA Ports and Marine
Air sampling from Antarctic firn and ice	van Ommen T	Etheridge D	CSIRO
East Antarctic and circum-Antarctic climate history from ITASE coring in Eastern Wilkes Land	van Ommen T Curran M Moy A Frankel B	Goodwin I	MQ

International projects

Project title	ACE researcher(s)	Collaborator(s)	Organisation	Country
Surface meteorological measurements in East Antarctic using automatic weather stations	Allison I	Xiao C-D Bian L-G Qin D-H	Chinese Meteorological Administration	CHN
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	BMU
		Church T	University of Delaware	USA
		Sholkowitz E	Woods Hole Oceanographic Institution	USA
Dissolved trace elements in the Australian sector of the Southern Ocean (SR3 line)	Bowie A	Sohrin Y	Kyoto University	JAP
An iron budget during the natural iron fertilization experiment KEOPS (Kerguelen Island, Southern Ocean)	Bowie A	Chever F Bucciarelli E Blain S Sarthou G	University of Brest Laboratoire d'Océanographie Biologique de Banyuls	FRA
Iron-(III) complexing ligands in the Southern Ocean	Bowie A	Ibisanmi E	University of Otago	NZL
		Hunter K Sander S Boyd P	National Institute for Water and Atmospheric Research	NZL
Trace metal mobility in the Southern Ocean (diffusive gradients in thin films)	Bowie A	Baeyens W	Vrije Universiteit Brussel	BEL
Towards appraising the potential importance of hydrothermal iron to ocean biogeochemistry	Bowie A	Tagliabue A	Laboratoire des Sciences du Climat et de l'Environnement, Paris	FRA
GEOTRACES in the International Polar Year	Bowie A Butler E	Boye M	LEMAR, Technopôle de Brest-Iroise	FRA
		Croot P	Leibniz Institut für Meereswissenschaften	DEU
		de Baar H	University of Groningen	NLD
		Dehairs F	Vrije Universiteit Brussel	BEL
		Masque P	Institut de Ciència i Tecnologia Ambientals, Universitat Autònoma de Barcelona	ESP
		Nishioka J	Institute of Low Temperature Science, Hokkaido University	JAP
		Rutgers van der Loeff M	Department of Geochemistry, Alfred Wegener Institute for Polar and Marine Research	DEU
		Tovar-Sanchez A	Instituto Mediterraneo de Estudios Avanzados, CSIC-University	ESP
Shipboard collection of aerosols in the Southern Ocean	Butler E	Boyd P	National Institute for Water and Atmospheric Research	NZL
Mercury speciation in the Southern Ocean (as part of IPY-GEOTRACES Bipolar project)	Butler E	Cossa D	Institut Français de Recherche pour L'Exploitation de la Mer	FRA
Integrated Climate and Ecosystem Dynamics	Constable A	Hoffman E	Old Dominion University	USA
		Murphy E	British Antarctic Survey	GBR
AMISOR	Craven M Allison I	Fricker H	Scripps Institution of Oceanography, University of California	USA
Amery Ice Shelf ice cores	Craven M Allison I	Yuansheng L Minghong C	Polar Research Institute of China	CHN
Ice shelf – ocean interaction in the cavity beneath the Amery Ice Shelf	Craven M Allison I Hunter J	Fricker H	Scripps Institution of Oceanography, University of California	USA
High Resolution Ice Core Records of Cosmogenic 10Be from Antarctica and Greenland for Examination of Past Solar Variability and Climate	Curran M van Ommen T Morgan V	McConnell J	Desert Research Institute	USA
Deglacial ice core chemistry	Curran M Moy A van Ommen T Frankel B	Steffensen J-P Dahl-Jensen D	University of Copenhagen	DMK
Holocene chemistry of the Law Dome DSS ice core	Curran M Moy A van Ommen T Frankel B	Mayewski P	University of Maine	USA
Trace ion and metal analysis techniques and applications	Curran M van Ommen T	McConnell J Edwards R	Desert Research Institute	USA

Project title	ACE researcher(s)	Collaborator(s)	Organisation	Country
Microparticle measurements in ice cores	Frankel B van Ommen T Curran M	Petit J-R	Laboratoire de Glaciologie et Géophysique de l'Environnement	FRA
Alfred Wegner Institute exchange research	Grose M	Wiencke C Molis M Laturnus F	Alfred Wegener Institute for Polar and Marine Research	DEU
The annual cycle of landfast sea-ice in Prydz Bay	Heil P	Li Z Lei R	Dalian University of Technology	CHN
		Cheng B	Finnish Institute of Marine Research	FIN
		Zhang Z	Polar Research Institute of China	CHN
Investigation of scale-dependency of sea-ice deformation	Heil P	Hutchings J Hibler W	International Arctic Research Center, University of Alaska	USA
Antarctic sea-ice motion	Heil P	Kwok R Fowler C	JPL/CalTech University of Colorado	USA USA
Monitoring Antarctic sea-ice during IPY	Heil P Massom R	Kwok R	JPL/CalTech	USA
		Haas C	University of Alberta	CAN
		Toyota T	University of Hokkaido	JAP
		Saldo R	National Space Institute	DMK
		Maksym T Fleming A	British Antarctic Survey	GBR
		Geiger C	University of Delaware	USA
Space-borne monitoring of polar sea-ice	Heil P Massom R	Kwok R	JPL/CalTech	USA
		Haas C	University of Alberta	CAN
		Toyota T	University of Hokkaido	JAP
		Saldo R	National Space Institute	DMK
		Fleming A Maksym T	British Antarctic Survey	GBR
		Geiger C	University of Delaware	USA
		Kaleschke L Kern S	University of Hamburg	DEU
		Pedersen L	Danish Meteorological Institute	DMK
Antarctic Fast-Ice Network	Heil P Massom R	Haas C	University of Alberta	CAN
		Langhorne P	University of Otago	NZL
		William M	National Institute for Water and Atmospheric Research	NZL
		Li Z	Dalian University of Technology	CHN
		Gerland S	Norsk Polar Institutt	NOR
		Ushio S	National Institute of Polar Research	JAP
Integrated Ocean Drilling Program	Howard W	Multiple	National Science Foundation	USA
			Institute of Geological and Nuclear Science	NZL
			Ministry of Education, Culture, Sports, Science and Technology	JAP
			European Science Foundation	EUR
Trace-metal and boron isotopic composition of Southern Ocean planktonic foraminifera	Howard W Moy A	Dunbar G Carter L	Victoria University of Wellington	NZL
Boron Isotopic Tracers of Ocean Acidification	Howard W Moy A	Bijma J	Alfred Wegener Institute for Polar and Marine Research	DEU
Global Extreme Sea-level Analysis Project	Hunter J	Woodworth P	Proudman Oceanographic Laboratory	GBR
Australia Canada Ocean Research Network	Jabour J Haward M	Van der Zwaag D McConnell M	Dalhousie University	CAN
Special issue on the Asia Pacific Partnership for the Journal: International Environment Agreements Economics Law and Politics	Lawrence P	Van Asselt H	University of Amsterdam	NLD

Project title	ACE researcher(s)	Collaborator(s)	Organisation	Country
Impact of patterns of anomalous atmospheric circulation and sea-ice on the break-up of the Larsen B & Wilkins Ice Shelves	Massom R	Scambos T	National Snow and Ice Data Center, University of Colorado	USA
		Stammerjohn S	University of California	USA
		Turner J	British Antarctic Survey	GBR
		Squire V	University of Otago	NZL
		Williams T	University of Bristol	GBR
		Fahnestock M	University of New Hampshire	USA
		MacAyeal D	University of Chicago	USA
		Sponsler M	Stormsurf Ltd	USA
		Aster R	New Mexico Tech	USA
Coupling between fast ice and the Mertz Glacier Tongue (MGT), and recent changes in the dynamic behaviour of the MGT.	Massom R	Fricker H	Scripps Institution of Oceanography, University of California	USA
		Legresy B	Centre National de la Recherche Scientifique, Laboratoire d'Etudes en Géophysique et Océanographie	FRA
Cape Darnley Polynya Project	Massom R	Tamura T	University of Hokkaido	JAP
		Ohshima K	University of Hokkaido	JAP
Analysis of snow-cover data from SIPEX cruise 2007	Massom R	Toyota T	University of Hokkaido	JAP
		Tamura T	University of Hokkaido	JAP
		Tateyama K	Kitami Institute of Technology	JAP
State of the Climate 2008: Antarctic sea-ice	Massom R	Stammerjohn S	University of California	USA
		Barreira S	Argentine Navy Meteorological Service	ARG
Impact of East Antarctic fast ice variability on emperor penguins	Massom R	Barbraud C	Centre d'Études Biologiques de Chizé, Centre National de la Recherche Scientifique	FRA
		Ancel A	Institut Pluridisciplinaire Hubert Curien, Département Ecologie, Physiologie et Ethologie	FRA
Spatio-temporal changes in the timing of sea-ice advance and retreat: An Antarctic-Arctic comparison	Massom R	Stammerjohn S	University of California	USA
		Rind D	NASA Goddard Institute for Space Studies	USA
An integrated study of processes linking sea-ice and biological ecosystem elements off East Antarctica during winter	Meiners K	Granskog M	Norwegian Polar Institute	NOR
		Krell A	Alfred Wegener Institute for Polar and Marine Research	DEU
		Werner I	University of Kiel	DEU
		Thomas D	University of Wales	GBR
		He J	Polar Research Institute of China	CHN
Surface water carbonate chemistry in the Tasman Sea since 25 ka: Implications for glacial-interglacial atmospheric CO_2	Moy A Howard W	Palmer M	University of Southampton	GBR
		Bijma J	Alfred Wegener Institute for Polar and Marine Research	DEU
		Calvo E	Institut de Ciències del Mar	ESP
		Pelejero C	Institució Catalana de Recerca i Estudia Avançats and Institut de Ciències del Mar	ESP
Record of 17O-excess in ice from Law Dome Antarctica over the LGM – Holocene period	Moy A van Ommen T	Landais A	Laboratoire des Sciences du Climat et de l'Environnement, CEA-CNRS-IPSL	FRA
Application of signature lipids to deep water rattails	Nichols P	Drazen J	University of Hawaii	USA
Sea-ice ecosystem model development	Pasquer B	Maksym T	British Antarctic Survey	GBR
Adélie Land Bottom Water formation	Rintoul S	Houssais MN Sultan E	Laboratoire d'Océanographie et du Climat: Expérimentations et Approches Numériques	FRA
SURVOSTRAL	Rintoul S	Morrow R	Laboratoire d'Etudes en Géophysique et Océanographie	FRA
Transport of the Kerguelen deep western boundary current	Rintoul S Church J Sokolov S	Watkatsuchi M Fukamachi Y	Hokkaido University	JAP
Southern Ocean carbon fluxes	Tilbrook B	Poisson A Goyet C Metzl N	Université Pierre et Marie Curie	FRA
Ocean net production	Tilbrook B	Bender M Cassar N	Princeton University	USA
Southern Ocean CO_2 exchange	Tilbrook B	Hashida G	National Institute of Polar Research	JAP
Nitrogen Isotopic Fractionation by phytoplankton	Trull T	Sigman D	Princeton University	USA
Controls on biological carbon fluxes through the mesopelagic ocean	Trull T	Buesseler K	Woods Hole Oceanographic Institution	USA

Project title	ACE researcher(s)	Collaborator(s)	Organisation	Country
Carbon cycling and ecosystem responses to iron fertilisation: particle export processes	Trull T	Blain S	Centre National de Recherche Scientifique	FRA
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	Chappellaz J	Laboratoire de Glaciologie et Géophysique de l'Environnement	FRA
Understanding Changing Ice Flow and Rift Propagation in the Mertz Glacier Tongue, East Antarctica	Warner R Massom R Young N	Legresy B	Centre National de la Recherche Scientifique, Laboratoire d'Etudes en Géophysique et Océanographie	FRA
		Fricker H	Scripps Institution of Oceanography, University of California	USA
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 Roberts J van Ommen T	Blankenship D Lawver L Dalziel I Morse D Young D Holt J	University of Texas	USA
		Siegert M Wright A Shepherd A	University of Edinburgh	GBR
		Payne T Bamber J	University of Bristol	GBR
		Dowdeswell J	University of Cambridge	GBR
		Brozena J Childers V	Naval Research Laboratory	USA
		Alley R Pollard D	Pennsylvania State University	USA
		DeConto R	University of Massachusetts	USA
		Conway H	University of Washington	USA
		Catania G	University of California	USA
		Demaske D Damm V	Federal Institute for Geosciences and Natural Resources (BGR)	DEU
Wideband radar for measuring snow thickness on Antarctic sea-ice	Worby A	Gogineni P Leuschen C	Center for Remote Sensing of Ice Sheets	USA
Satellite and in situ radar altimetry for determining snow cover thickness on Antarctic sea-ice	Worby A	Willat R Laxon S Giles K Stone-Drake L	Centre for Polar Oceanography and Modelling	GBR
Sea-ice thickness from space: Validating estimates from laser and radar altimeters with ship-based and in situ measurements	Worby A	Ackley S Xie H	University of Texas	USA
Developing a parametric curve fit to seasonal and regional thickness distribution of Antarctic sea-ice	Worby A	Geiger C	University of Delaware	USA
		Ackley S	University of Texas	USA
		Van Woert M DeLiberty T	National Science Foundation	USA
Satellite laser altimetry for determining the freeboard and thickness of Antarctic sea-ice	Worby A Lieser J	Markus T Yi D	NASA/Goddard Space Flight Centre	USA
Global Land Ice Monitoring from Space (GLIMS)	Young N	Kargel J	Department of Hydrology and Water Resources, University of Arizona, United States Geological Survey	USA
Antarctic Surface Accumulation and Ice Discharge (ASAID)	Young N	Bindschadler R	Hydrospheric and Biospheric Sciences Laboratory, NASA-GSFC	USA
Australian – Italian collaborative project on the mass budget of the East Antarctic ice sheet	Young N	Frezzotti M	National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA)	ITA
		Tabacco I Forieri A Urbini S	Università degli Studi di Milano, Istituto Nazionale di Geofisica e Vulcanologia (INGV)	ITA

National presentations

Staff name	Title or topic	Type of presentation	Event	Location
Adams N	Climate trends at Macquarie Island and expectations of future climate change in the Sub-Antarctic.	Oral presentation	2nd International Forum on the Sub-Antarctic	Hobart, Tas
Allison I Warner R	Ice sheet contributions to sea-level rise: a post IPCC AR4 assessment.	Poster	Antarctic Climate and Ecosystems CRC Symposium 2008	Hobart, Tas
Bindoff N	The Climate Futures for Tasmania project	Oral presentation	2008 CERF/DEWHA Conference	Canberra, ACT
Butler E	Trace elements as tracers	Workshop	CMAR Biochemical Tracers Workshop	Hobart, Tas
Church J	Sea-level variability and rise: Understanding the past, implications for the future	Oral presentation	New South Wales Coastal Forum	Wollongong, NSW
Church J	Sea-level variability and rise: Understanding the past, implications for the future	Oral presentation	Victorian DSE	Melbourne, Vic
Church J	Sea-level variability and rise: Understanding the past, implications for the future	Oral Presentation	Climate Change Monitoring Symposium	Sydney, NSW
Church J	Understanding sea-level rise and its implications	Oral presentation	Science Meets Parliament	Canberra, ACT
Corney S	Climate Futures for Tasmania: the modelling story	Oral presentation	Antarctic Climate and Ecosystems CRC Symposium 2008	Hobart, Tas
Davies D Trull T	Distribution of pelagic carbonates south of Australia: is there already an impact of acidification?	Poster	Antarctic Climate and Ecosystems CRC Symposium 2008	Hobart, Tas
Donoghue S	Glaciers of the sub-Antarctic and their recent changes.	Poster	Antarctic Climate and Ecosystems CRC Symposium 2008	Hobart, Tas
Haward M	Policy Program Snapshot	Oral presentation	Antarctic Climate and Ecosystems CRC Symposium 2008	Hobart, Tas
Haward M	Ocean Fertilisation – Legal and Policy issues	Oral presentation	Users' Forum Roundtable	Canberra, ACT
Haward M	Ice Sheets – Research and Policy Issues	Oral presentation	Users' Forum Roundtable	Canberra, ACT
Haward M	Overview and Conclusion	Oral presentation	ACE CRC Short Course: Antarctica and the Southern Ocean: implications for Australian and global climate change	Canberra, ACT
Heil P	The sea-ice model in the ACE CRC Analysis and Forecasting System	Oral presentation	AUSCOM 2008 workshop	Melbourne, Vic
Hosie G Schulz E Tilbrook B Trull T	An observation network for the oceans around Australia – The IMOS bluewater and climate node.	Oral presentation	9th International Conference on Southern Hemisphere Meteorology and Oceanography	Melbourne, Vic
Howard W	Long-Term Change in the Sub-Antarctic on Historical to Glacial Time Scales	Oral presentation	2nd International Forum on the Sub-Antarctic	Hobart, Tas
Howard W	Ocean Acidification Impacts on Southern Ocean Calcareous Zooplankton	Oral presentation	Seminar	Sydney, NSW
Howard W	An integrated modelling-data approach to the Australasian Holocene	Workshop	Workshop: An integrated modelling-data approach to the Australasian Holocene	Sydney, NSW
Howard W	Ocean carbon cycle and ocean acidification	Oral presentation	ACE CRC Short Course: Antarctica and the Southern Ocean: implications for Australian and global climate change	Canberra, ACT
Hunter J	Sea-level rise and the vulnerability of coastlines	Oral presentation	2nd Regional Forum on Climate Change and Coastal Communities	Lismore, NSW
Hunter J	Estimating changes in sea-level extremes under conditions of rising sea level	Oral presentation	Institute of Public Works Engineering Australia National Conference on Climate Change Response	Coffs Harbour, NSW
Hunter J	Climate change and sea-level rise	Oral presentation	Tides Workshop, National Tidal Centre	Adelaide, SA
Hunter J	Sea-level rise and ports	Oral presentation	Ports Australia Conference	Brisbane, Qld
Hunter J	Flooding of a Pacific atoll island: diagnosing the problem	Oral presentation	9th International Conference on Southern Hemisphere Meteorology and Oceanography	Melbourne, Vic
Hunter J	Planning for sea-level rise	Oral presentation	Workshop: Randwick City Council	Randwick, NSW
Hunter J	Sea-level rise and the risk from flooding	Oral presentation	Local Government Planning for Community in a Changing Climate	Hobart, Tas
Hunter J	Estimating sea-level extremes in an uncertain future	Oral presentation	Planning for Climate Change, RMIT	Melbourne, Vic
Hunter J	Sea-level rise and its effect on the frequency of extreme flooding events	Oral presentation	Northern NSW Coast Climate Workshop	Coffs Harbour, NSW

Staff name	Title or topic	Type of presentation	Event	Location
Hunter J Marsland S Warner R	Modelling marine ice accretion beneath ice shelves	Oral presentation	ROMS/TOMS Asia-Pacific Workshop	Sydney, NSW
Jabour J	Law and Policy Issues	Oral presentation	Sea-ice Research Users' Forum February 2009	Canberra, ACT
Massom R	Antarctic Sea-ice Research	Oral presentation	DCC Workshop on Southern Ocean and Antarctic Climate Change Research Needs	Hobart, Tas
Massom R	Sea-ice Studies Using Remote Sensing or The Most Fun You Can Have Without Touching	Oral presentation	Lecture to QMS Class, University of Tasmania	Hobart, Tas
Meiners K	Sea-ice and ecosystems	Oral presentation	Research Users' Forum Roundtable, Kurrajong Hotel	Canberra, ACT
Meiners K	Climate change impacts: sea-ice and biogeochemical systems	Oral presentation	Antarctic Climate and Ecosystems CRC Symposium 2008	Hobart, Tas
Meiners K Pasquer B	Estimation of ice algae biomass using under-ice irradiance measurements	Oral presentation	Hobart Phytoplankton Group Meeting, TAFI Marine Laboratories	Taroona, Tas
O'Farrell S P	Regional sea-level rise around the Australian coastline	Oral presentation	CAWCR Modelling Workshop	Melbourne, Vic
O'Farrell S P	SOPHOCLES	Oral presentation	CLIVAR/CLIC/SCAR Southern ocean panel meeting	Sydney, NSW
Trull T	ACE 'Ocean Control of CO2' Achievements	Oral presentation	Antarctic Climate and Ecosystems CRC Symposium 2008	Hobart, Tas
Trull T	Size fractionated phytoplankton 13C and 15N compositions	Oral presentation	CSIRO Symposium on the use of stable isotopes and dietary lipids in fisheries research	Hobart, Tas
van Wijk E	Argo Delayed Mode Processing at CSIRO Marine and Atmospheric Research	Oral presentation	Argo/Ship of Opportunity (SOOP) Workshop	Sydney, NSW
Warner R Roberts J van Ommen T Young N	ICECAP – Looking comfortably through 4 kilometres of ice.	Oral presentation	AAD – Science in the Spotlight seminar	Kingston, Tas
White C	Climate Futures for Tasmania Project	Oral presentation	PWEA (Institute of Public Works Engineering) and TAMS (Tasmania Association of Municipal Supervisors) Conference	Hobart, Tas
Worby A	Sea-ice observations within a Southern Ocean Observing System	Oral presentation	CLIVAR/CliC Southern Ocean Working Group	Sydney, NSW
Young N	Totten Glacier thinning – contributing to Sea-level Rise	Oral presentation	AAD – Science in the Spotlight seminar	Hobart, Tas

International presentations

Staff name	Title or topic	Type of presentation	Event	Location
Allison I	Ice sheet mass balance and sea level	Oral presentation	SCAR/IASC IPY Open Science Conference	St Petersburg, RUS
Allison I Warner R	Ice sheet contributions to sea-level rise: a post IPCC AR4 assessment	Poster	IPCC-WCRP-IGBP Workshop on New Science Directions and Activities Relevant to the IPCC Fifth Assessment Report.	Honolulu, USA
Bindoff N	Change in the Modern Era of Science and Environmental Consciousness: Oceanography and climate	Oral presentation	2009 International Forum on the Sub-Antarctic – environmental change in the Sub-Antarctic	Hobart, AUS
Bindoff N Rintoul S	ACC cross frontal eddy heat transport inferred from satellite altimetry	Oral presentation	9th International Conference on Southern Hemisphere Meteorology and Oceanography	Melbourne, AUS
Bowie A	Dynamics and speciation of dissolved iron in the Sargasso Sea (BATS region)	Oral presentation	AGU Fall Meeting	San Francisco, USA
Bowie A	Control of organic ligands on Fe bioavailability, carbon production and export	Oral presentation	European network of excellence for ocean ecosystems analysis workshop: 'Controls on organic carbon export and twilight zone mineralisation'	Brussels, BEL
Bowie A	The effect of organic ligands on Fe bioavailability to natural plankton communities of the Southern Ocean	Oral presentation	European network of excellence for ocean ecosystems analysis Workshop 'Iron biogeochemistry across marine systems at changing times'	Gothenburg, SWE
Bowie A	An overview of the biogeochemical features of the Southern Ocean during the International Polar Year	Poster	ASLO 2009 Aquatic Sciences Meeting	Nice, FRA
Bowie A	An overview of the biogeochemical features of the Southern Ocean during the International Polar Year	Poster	Gordon Research Conference: Polar Marine Science – Beyond IPY: Crossing Boundaries	Barga di Lucca, ITA
Bowie A Butler E	GEOTRACES in the International Polar Year: an overview	Oral presentation	ASLO 2009 Aquatic Sciences Meeting	Nice, FRA
Bowie A Boyd P Trull T Griffiths B	Different processes structure biogeochemical iron budgets in the subantarctic and polar Southern Ocean	Poster	2nd International Forum on the Sub-Antarctic (IFSA) Environmental Change in the Sub-Antarctic	Hobart, AUS
Bowie A Boyd P Trull T Griffiths B	Different processes drive biogeochemical iron budgets in the subantarctic and polar Southern Ocean	Poster	Gordon Research Conference: Polar Marine Science – Beyond IPY: Crossing Boundaries	Barga di Lucca, ITA
Butler E	Are sugars the key to ubiquitous control of oceanic iron limitation?	Oral presentation	Gordon Research Conference on Polar Marine Science	Barga di Lucca, ITA
Butler E	In-line solid-phase extraction for matrix elimination and preconcentration of trace element micronutrients in oceanic waters for determination by ICP-QMS	Oral presentation	ASASS – ACROSS Symposium on Advances in Separation Science	Hobart, AUS
Butler E Bowie A	Methylmercury distribution in the upper part of the Southern Ocean (SR3, GEOTRACES)	Poster	AGU Fall Meeting	San Francisco, USA
Church J	Improved Ocean Warming Estimates: Implications for Climate Models	Oral presentation	ClimateChange – Global Risks, Challenges & Decisions	Copenhagen, DMK
Church J	Sea-level variability and rise: Understanding the past, implications for the future	Oral presentation	ClimateChange – Global Risks, Challenges & Decisions	Copenhagen, DMK
Church J	Sea-level variability and rise: Understanding the past, implications for the future	Oral presentation	American Association For the Advancement of Science, Annual Meeting	Chicago, USA
Church J	Improved estimates of upper ocean warming: Implication for climate models and sea-level rise	Oral presentation, Poster	Joint IPCC-WCRP-IGBP Workshop: New Science Directions and Activities Relevant to the IPCC AR5	Hawaii, USA
Constable A	Southern Ocean Sentinel: overview	Oral presentation	Southern Ocean Sentinel	Hobart, AUS
Constable A	Southern Ocean food web research and Southern Ocean Sentinel	Oral presentation	USA Ocean Carbon and Biogeochemistry Working Group meeting on Southern Ocean climate change research	Princeton, USA
Constable A	Coordinated Southern Ocean ecosystem research	Oral presentation	Southern Ocean Research Partnerships	Sydney, AUS
Davies D Trull T	Distribution of pelagic carbonates south of Australia: is there already an impact of acidification?	Poster	Second Forum on the Sub-Antarctic	Hobart, AUS
Donoghue S	Glaciers of the sub-Antarctic and their recent changes	Poster	SCAR/IASC IPY Open Science Conference.	St Petersburg, RUS

Staff name	Title or topic	Type of presentation	Event	Location
Grose M	Climate of Tasmania, past & future	Oral presentation	9th International Conference on Southern Hemisphere Meteorology and Oceanography	Melbourne, AUS
Heil P	East Antarctic sea-ice dynamics: An update	Poster	Gordon Research Conference	Barga di Lucca, ITA
Heil P	Antarctic sea-ice dynamics during IPY	Oral presentation	Sea-Ice Workshop	Barga di Lucca, ITA
Heil P	SAR-derived Antarctic sea-ice dynamics during IPY	Oral presentation	ESA Forum	Bern, CHE
Howard W	Reduced calcification in modern Southern Ocean planktonic foraminifera	Oral presentation	2nd International Symposium on the Ocean in a High-CO_2 World	Monaco, MNC
Howard W	Ocean Acidification Impacts on Southern Ocean Calcifiers	Oral presentation	Climate Change: Global Risks, Challenges and Decisions	Copenhagen, DMK
Howard W	Southern Ocean influence on the carbon cycle and ice sheets: is the Pleistocene the key to the Cenozoic?	Oral presentation	Geosciences08	Wellington, NZL
Howard W	Ocean Acidification Impacts on Southern Ocean Calcareous Zooplankton	Oral presentation	Geological Sciences Seminar	Providence, USA
Jabour J	Antarctic tourism, biosecurity and the changing climate: An updated risk assessment	Oral presentation	11th International Wildlife Law Conference	Gulfport, USA
Lambeck K	Sea-level change and ice volumes about the time of the Last Interglacial (MIS-6 to MIS-5)	Oral presentation	Sea-level Workshop 'Empirical constraints on sea-level rise over the next century' 25-29 August 2008	Bern, CHE
Lambeck K	Sea levels and ice sheets during the last glacial cycle: new results from glacial rebound modelling	Oral presentation	The Geological Society William Smith 2008 Meeting: 'Observations and Causes of Sea-Level Changes on Millennial to Decadal Timescales', 1–2 September 2008	London, GBR
Lambeck K	Introduction to geodynamics, Interaction between ice sheets and the solid earth, and What can we learn from glacial rebound?	Oral presentation	Karthaus 2008: Glaciers and Ice Sheets in the Climate System, 10-17 September 2008	Karthaus, ITA
Lambeck K	Sea level and ice volumes during the glacial cycle from MIS-6 to present	Keynote address	Sea-level Symposium, Tokyo University, 3 October 2008	Tokyo, JAP
Lambeck K	Role of the Australian Academy of Science in development of a national innovation policy	Oral presentation	Academy, Research Institution And National Innovation System Symposium, Chinese Academy of Sciences, 12-14 November 2008	Beijing, CHN
Lambeck K	National Science Academies As One Driver In Knowledge-Based Development	Oral presentation	Academy Presidents' Forum, 6-7 December 2008	Taipei, TAW
Lambeck K	Sea-level change as an indicator of cryosphere instabilities	Oral presentation	Climate Change Congress 10-12 March 2009	Copenhagen, DMK
Lambeck K	Sea-level change along the Tyrrhenian coast from early Holocene to the present	Oral presentation	'Il bacino del Tevere' at Accademia Nazionale dei Lincei, 23 March 2009	Rome, ITA
Lawrence P	Kick starting the climate change technology revolution: the potential – and limitations – of Asia-Pacific partnerships for technology development and transfer	Oral presentation	Climate Law in Developing Countries Post-2012: North – South Interactions -IUCN Academy of Environmental Law Conference Ottawa	Ottawa, CAN
Lawrence P	Generations X-Z: reconfiguring international law to meet the climate change challenge	Oral presentation	London School of Economics and Political Science, philosophy and public policy seminar series.	London, GBR
Lawrence P	Climate change and intergenerational equity	Oral presentation	University of Lucerne	Lucerne, CHE
Lieser J	East Antarctic sea-ice thickness from airborne LiDAR measurements	Poster	Gordon Research Conference on Polar Marine Science	Barga di Lucca, ITA
Massom R	Possible key role of sea-ice and ocean waves in recent ice shelf disintegration events	Oral presentation	National Snow and Ice Data Center Seminar Series, University of Colorado	Boulder, USA
Massom R	Observing and Modelling Antarctic Sea Ice Habitats	Oral presentation	Joint CCAMLR-IWC Workshop to Review Input data for Antarctic Marine Ecosystem Models	Hobart, AUS
Massom R	Recent Antarctic Sea-ice Change and Variability: Physical and Ecological Implications	Oral presentation	ACE CRC Symposium on Monitoring Climate Change Impacts on Marine Biodiversity: Establishing a Southern Ocean Sentinel Program.	Hobart, AUS
Massom R	Crossing Boundaries: Icebergs, Fast Ice, Pack Ice, Winds, Polynyas and Emperor Penguins	Poster	Gordon Conference on Polar Marine Science: 'Beyond IPY: Crossing Boundaries'	Barga di Lucca, ITA
Meiners K	EPS in Arctic and Antarctic sea-ice	Oral presentation	International Workshop on EPS in Sea-ice, University of Essex	Colchester, GBR
Meiners K	Sea-ice Physics and Ecosystems eXperiment (SIPEX) – an overview and first results	Oral presentation	Alfred Wegener Institute for Polar and Marine Research	Bremerhaven, DEU
Meiners K Pasquer B	Bio-optical investigations on Antarctic pack ice: influence of ice algal biomass on under-ice irradiance spectra	Poster	Gordon Research Conference – Polar Marine Science	Barga di Lucca, ITA
Mongin M	Natural Iron Fertilizations in HNLC waters: a modeller approach	Oral presentation	IUEM seminar	Brest, FRA

Staff name	Title or topic	Type of presentation	Event	Location
Mongin M Trull T	Winter advection of iron can explain the summer phytoplankton bloom that extends 1000 km downstream of the Kerguelen Plateau in the Southern Ocean	Poster	GRC polar sciences	El Cuicco, ITA
Mongin M Trull T Bowie A Armand L	Australian contribution to KEOPS 2	Oral presentation	KEOP2 Workshop	Marseille, FRA
O'Farrell S P	Response in the CSIRO Mk3.0 and Mk3.5 climate models in the Southern Ocean to 20th and 21st Century climate scenarios	Oral presentation	SCAR Open Science Conference	St Petersburg, RUS
O'Farrell S P	SOPHOCLES workshop	Oral presentation	Side meeting at SCAR Open Science Conference	St Petersburg, RUS
O'Farrell S P	Comparison of the Southern Ocean response in the CSIRO models at the end of the 21st Century with a selection of AR4 models	Poster	9th International Conference on Southern Hemisphere Meteorology and Oceanography	Melbourne, AUS
Pasquer B	Extreme melt-freeze processes on Antarctic sea-ice: implications for evolution of perennial ice mass balance and biological communities	Oral presentation	AGU Fall Meeting	San Francisco, USA
Reid P	Summer 07–08: Circulation-driven Southern Hemisphere sea-ice extent maximum anomaly	Poster	9th International Conference on Southern Hemisphere Meteorology and Oceanography.	Melbourne, AUS
Reid P	Australian Rainfall and the SOI	Poster	9th International Conference on Southern Hemisphere Meteorology and Oceanography.	Melbourne, AUS
Reid P Massom R Marsland S	Circulation-Driven Southern Hemisphere Sea-ice Area Maximum	Abstract	SCAR/IASC IPY Open Science Conference	St Petersburg, RUS
Rintoul S	Continued rapid freshening of the Antarctic Bottom Water of the Indian and Pacific Oceans	Oral presentation	SCAR Open Science Conference	St Petersburg, RUS
Rintoul S	Southern ocean variability and change: an overview of results from the CASO program of the International Polar Year	Oral presentation	9th International Conference on Southern Hemisphere Meteorology and Oceanography	Melbourne, AUS
Rintoul S	The upper cell of the Southern Ocean	Oral presentation	9th International Conference on Southern Hemisphere Meteorology and Oceanography	Melbourne, AUS
Rintoul S	Subantarctic mode water in the Southern Ocean: properties and circulation	Oral presentation	9th International Conference on Southern Hemisphere Meteorology and Oceanography	Melbourne, AUS
Rintoul S	Mesoscale processes in the Southern Ocean	Oral presentation	CLIVAR Workshop on Ocean Mesoscale Eddies:	Exeter, GBR
			Representations, Parameterizations, and Observations	Kuala Lumpur, MAL
Rintoul S	The nature, causes and consequences of Southern Ocean change	Oral presentation	Malaysian International Symposium on Antarctica 4	Kuala Lumpur, MAL
Rintoul S	Impacts of physical and biogeochemical change on Southern Ocean ecosystems	Oral presentation	Malaysian International Symposium on Antarctica 4	Kuala Lumpur, MAL
Rintoul S	Evolution of the Southern Ocean under climate change: dynamics and feedbacks	Oral presentation	International Scientific Congress on Climate Change	Copenhagen, DMK
Roberts D	Interannual variability of pteropod shell weights in the High-CO_2 Southern Ocean	Oral presentation	The Ocean in a High-CO_2 World II Symposium	Monaco, MNC
Roberts D	Ocean acidification impacts on Southern Ocean calcareous zooplankton	Oral presentation	11th Pacific Science Inter-congress	Tahiti, FRA
Sokolov S	The circumpolar structure and distribution of the Antarctic Circumpolar Current fronts: Mean circumpolar paths and their variability	Oral presentation	9th International Conference on Southern Hemisphere Meteorology and Oceanography	Melbourne, AUS
Sokolov S Rintoul S	The circumpolar structure and distribution of the Antarctic Circumpolar Current fronts: mean circumpolar paths and variability	Oral presentation	9th International Conference on Southern Hemisphere Meteorology and Oceanography	Melbourne, AUS
Tilbrook B	Australian underway CO_2 observing program	Oral presentation	Pacific Ocean group meeting for the Surface Ocean Carbon Atlas	Tsukuba, JAP
Trull T	Southern Ocean Time Series	Oral presentation	Scientific Committee on Oceanographic Research 'Changing Times' Workshop on Biogeochemical Time Series	San Diego, USA
Trull T Bowie A Boyd P Davidson A Rintoul S Tilbrook B Wright S	The Australian SAZ-Sense Study of the sensitivity of the Sub-Antarctic zone to Climate Change	Poster	2nd International Forum on the Sub-Antarctic (IFSA) Environmental Change in the Sub-Antarctic	Hobart, AUS

Staff name	Title or topic	Type of presentation	Event	Location
Trull T Bowie A Davidson A Griffiths B Rintoul S Tilbrook B Wright S	The Australian SAZ-Sense study of the sensitivity of the Sub-Antarctic Zone to climate change: an introduction	Poster	International Council for the Exploration of the Sea Symposium: Effects of climate change on the world's oceans	Gijon, ESP
van Ommen T Curran M	A new ENSO proxy from the Law Dome ice core	Poster	SCAR/IASC IPY Open Science Conference	St Petersburg, RUS
van Ommen T Roberts J Warner R Young N	ICECAP: Long Range Airborne Geophysics over the Wilkes and Aurora Subglacial Basins	Poster	SCAR/IASC IPY Open Science Conference	St Petersburg, RUS
van Wijk E	Global Ocean Salinity Trends 1950-2008	Oral presentation	Third Argo Science Workshop	Hangzhou, CHN
van Wijk E	Delayed Mode Processing at CSIRO: An Introduction	Oral presentation	Third Argo Delayed Mode QC Workshop	Seattle, USA
van Wijk E	Regional Oceanography: Indonesian Throughflow	Oral presentation	Third Argo Delayed Mode QC Workshop	Seattle, USA
van Wijk E Rintoul S	Regional Oceanography: Southern Ocean Argo	Oral presentation	Third Argo Delayed Mode QC Workshop	Seattle, USA
Virtue P Kawaguchi S Meiners K	Relationship between sea-ice and krill from the Sea-ice Physics and Ecosystems eXperiment (SIPEX) voyage	Poster	SCAR Open Science Conference	St Petersburg, RUS
Warner R	Improving Ice Sheet Models	Workshop	ISMASS workshop – 'Improving Ice Sheet Models'	St Petersburg, RUS
Worby A	Airborne radar and laser altimetry techniques for measuring Antarctic sea-ice and snow cover thickness	Oral presentation	SCAR Open Science Conference	St Petersburg, RUS
Worby A	Marine Cryosphere Research within the World Climate Research Program	Oral presentation	WCRP/CliC Scientific Steering Group meeting	Geneva, CHE
Worby A	Ship-based sea-ice observations in the Antarctic and possible applications for Arctic sea-ice observing	Oral presentation	International Workshop on Arctic sea-ice	Tromsø, NOR
Worby A	Polar Marine Science – Crossing international boundaries	Oral presentation	Gordon Conference on Polar Marine Science	Barga di Lucca, ITA

Non-science presentations

Staff name	Title or topic	Type of presentation	Event	Location	Date
Allison I	The state of polar research after the International Polar Year 2007-2008	Oral presentation	Royal Society of Victoria symposium – Georg von Neumayer: his Australian, German and Polar scientific achievements and legacies.	Melbourne, Vic	May-09
Bindoff N	Evidence of Climate Change and the Climate Futures for Tasmania Project	Invited speaker	Hobart City Council Local Government Climate Change Adaptation Toolkit Forum	Hobart, Tas	May-09
Bindoff N	The Climate Futures for Tasmania Project	Stakeholder briefing presentation	Tasmanian Farmers and Graziers Association	Launceston, Tas	Aug-08
Bindoff N	Climate Change and the outcomes of the IPCC – International Panel on Climate Change	Oral presentation	IASOS Seminar	Hobart, Tas	Aug-08
Bindoff N	Evidence of Climate Change and the Climate Futures for Tasmania Project	Oral presentation	DPIW Derwent Valley Discussion Group	New Norfolk, Tas	Aug-08
Bindoff N	The Climate Futures for Tasmania Project	Stakeholder briefing presentation	Hydro Tasmania	Hobart, Tas	Sep-08
Bindoff N	The Climate Futures for Tasmania Project	Stakeholder briefing presentation	CSIRO Seminar	Hobart, Tas	Sep-08
Bindoff N	Evidence of Climate Change and the Climate Futures for Tasmania Project	Oral presentation	Geoscience Australia Seminar	Canberra, ACT	Feb-09
Bindoff N	The Climate Futures for Tasmania Project	Stakeholder briefing presentation	ACE CRC	Hobart, Tas	Feb-09
Bindoff N	Evidence of Climate Change and the Climate Futures for Tasmania Project	Invited speaker	Local Government Association of Tasmania Local Planners' Forum	Hobart, Tas	Mar-09
Bindoff N	The Climate Futures for Tasmania Project	Invited speaker	Tasmanian Climate Action Council	Hobart, Tas	Mar-09
Bindoff N	The Climate Futures for Tasmania Project	Invited speaker	2009 International Forum on the Sub-Antarctic – environmental change in the Sub-Antarctic	Hobart, Tas	Apr-09
Butler E	Micronutrients: macro-importance in chemical oceanography	Oral presentation	Royal Australian Chemical Institute, Tasmanian Branch	Launceston, Tas	Sep-08
Cechet C	The Climate Futures for Tasmania Project	Invited speaker	Australasian Wind Engineering Society (AWES)	Hobart, Tas	Dec-08
Chilcott C	Application of the Climate Futures LiDAR Dataset for Local Government Planning	Workshop	Local Government Association of Tasmania Local Planners' Forum	Hobart, Tas	Mar-09
Corney S	The Climate Futures for Tasmania Project	Stakeholder briefing presentation	Kingborough Council	Hobart, Tas	Oct-08
Corney S	The Climate Futures for Tasmania Project	Stakeholder briefing presentation	University of Tasmania Forestry Researchers	Hobart, Tas	Nov-08
Gaynor S	The Climate Futures for Tasmania Project	Stakeholder briefing presentation	Tasmanian Climate Change Office, Department of Premier and Cabinet	Hobart, Tas	Feb-09
Gaynor S	The Climate Futures for Tasmania Project	Stakeholder briefing presentation	NRM South	Hobart, Tas	Mar-09
Gaynor S	The Climate Futures for Tasmania Project	Stakeholder briefing presentation	Department of Primary Industries and Water	Hobart, Tas	May-09
Grose M	The Climate Futures for Tasmania Project	Workshop	Tasmanian Farmers & Graziers Association	Launceston, Tas	Aug-08
Grose M	The Climate Futures for Tasmania Project	Workshop	NRM North	Launceston, Tas	Sep-08
Grose M	The Climate Futures for Tasmania Project	Stakeholder briefing presentation	Kingborough Council	Kingston, Tas	Oct-08
Grose M	The Climate Futures for Tasmania Project	Stakeholder briefing presentation	Tasmanian Climate Change Office, Department of Premier and Cabinet	Hobart, Tas	Oct-08
Grose M	The Climate Futures for Tasmania Project	Oral presentation	Tonkin Corporation; 'Tasmania Energy 2008 Conference'	Hobart, Tas	Nov-08
Grose M	The Climate Futures for Tasmania Project	Stakeholder briefing presentation	Tasmanian Climate Change Office, Department of Premier and Cabinet	Hobart, Tas	Feb-09
Grose M	The Climate Futures for Tasmania Project	Stakeholder briefing presentation	Federal Government	Hobart, Tas	Mar-09
Grose M	The Climate Futures for Tasmania Project	Stakeholder briefing presentation	NRM South	Hobart, Tas	Mar-09
Holz G	Evidence of Climate Change and the Climate Futures for Tasmania Project	Oral presentation	DPIW Derwent Valley Discussion Group	New Norfolk, Tas	Aug-08
Holz G	The Climate Futures for Tasmania Project	Stakeholder briefing presentation	Department of Primary Industries and Water	Hobart, Tas	Oct-08

Staff name	Title or topic	Type of presentation	Event	Location	Date
Holz G	The Climate Futures for Tasmania Project	Stakeholder briefing presentation	UTAS	Hobart, Tas	Oct-08
Holz G	The Climate Futures for Tasmania Project	Stakeholder briefing presentation	Agricultural Resource Management	Hobart, Tas	Feb-09
Holz G	The Climate Futures for Tasmania Project	Stakeholder briefing presentation	Federal Government	Launceston, Tas	Apr-09
Holz G	The Climate Futures for Tasmania Project	Poster	Agfest 2009	Launceston, Tas	May-09
Howard W	Ocean Acidification	Videoconference	National Science Week	Hobart, Tas & Sydney, NSW	Aug-08
Jabour J	Antarctic krill harvesting	Judge	Oral Finals: Stetson International Environmental Moot Court Competition	Gulfport, USA	Mar-09
Jabour J	Antarctic krill harvesting	Judge	South-east Asia Regional Memorial (written) Finals: Stetson International Environmental Moot Court Competition		Dec-08
Lawrence P	Climate change: Law and governance – issues for Tasmania	Oral presentation	UTAS climate change rural Tasmania Forum	Hobart, Tas	Jun-09
Lieser J	Antarctic marine cryosphere	Oral presentation	Antarctic Midwinter Festival	Hobart, Tas	Jun-09
Massom R	Antarctic air-sea-ice interactions: Physical and ecological implications	Oral presentation	University of the Third Age (U3A)	Kingston, Tas	Jul-08
Massom R	Antarctic Sea-ice – Adventures in the Great White Hell	Oral presentation	Sandy Bay Gentlemans' Club	Sandy Bay, Tas	Jun-09
McNeil D	Evidence of Climate Change in the Agriculture sector	Invited speaker	UTAS Rural Health Forum	Hobart, Tas	Jun-09
Roberts D	Ocean acidification impacts on pteropods	Oral presentation	Tasmanian Members of Legislative Council	Sandy Bay, Tas	Aug-08
Roberts D	Ocean acidification impacts on pteropods	Oral presentation	CRC Association visitors	Sandy Bay, Tas	Mar-09
Roberts D	Ocean Acidification: 'the other CO2 problem'	Oral presentation	Scientific Address, World Ocean Day 2009/ A Sea Change Documentary Premiere	Hobart, Tas	Jun-09
Roberts D	Marine Biotechnology in a Changing Climate	Oral presentation	Biotechnology Networking Event for the Department of Economic Development and Tourism, Tasmania	Hobart, Tas	Jun-09
Thornton K	The Climate Futures for Tasmania Project	Invited speaker	Tonkin Corporation; 'Tasmania Energy 2008 Conference'	Hobart, Tas	Nov-08
White C	The Climate Futures for Tasmania Project	Stakeholder briefing presentation	Hydro Tasmania Researchers	Hobart, Tas	Nov-08
White C	The Climate Futures for Tasmania Project	Invited speaker	PWEA (Inst. of Public Works Engineering) and TAMS (Tas Assoc. of Municipal Supervisors)	Hobart, Tas	Nov-08
White C	The Climate Futures for Tasmania Project	Stakeholder briefing presentation	Aurora Energy	Hobart, Tas	May-09

National committees

Staff name	Committee	Role
Allison I	Antarctic Research Assessment Committee, Physical Sciences	Member
	Local Organising Committee for International Union of Geodesy and Geophysics (IUGG) General Assembly, Melbourne, 2010	Member
	Reference Group, Australian Academy of Science, National decadal strategic plan for Earth System Science	Member
Bindoff N	ARCS ERA Evaluation Panel	Member
	ARCS Executive Committee	Chair
	BlueNET Steering Committee	Member
	ANARE/ARAC Oceanography Coordinator	Coordinator
Haward M	CCAMLR Consultative Forum	Member
Howard W	Australian Marine Geoscience Committee	Chair
	Australian INTegration of Ice-core, MArine and TErrestrial records ('INTIMATE')	Steering Committee Member
Hunter J	Permanent Committee on Tides and Mean Sea Level	Member
Lambeck K	Australian Academy of Science	President
	Prime Minister's Science, Engineering and Innovation Council	Ex-officio member
Trull T	Commonwealth Interdepartmental Committee on Ocean Fertilisation	Member
van Ommen T	National Committee for Earth Systems Science (AAS)	Member
	Antarctic Research Assessment Committee, Physical Sciences	Member
Young N	Board of Management for TERSS	Member

International committees

Staff name	Name of committee	Role
Adams N	International Commission on Polar Meteorology	Member
	SCAR expert working group on operational meteorology in the Antarctic	Member
	Antarctic Observations, Modelling and forecasting workshops organising committee	Member
Allison I	ICSU/WMO Joint Committee for International Polar Year	Co-chair
	International Association of Cryospheric Science (IACS)	President-elect
	Editorial Advisory Board, Antarctic Science	Member
	Editorial Advisory Board, Terra Antarctica	Member
	Editorial Advisory Board, Polar Science	Member
	Inaugural Selection Committee for Martha T Muse Prize for Science and Policy in Antarctica (SCAR/Tinker Foundation)	Member
	International Union of Geodesy and Geophysics (IUGG), delegate to SCAR	Member
	International Science Committee, IAMAS/IAPSO/IACS Joint Assembly, Montreal, July 2009	Member
	International Science Committee, International Polar Year Conference: Polar Science – Global Impacts, Oslo, July 2010	Member
	Academic Committee, International Conference on Cryospheric Changes and Influences: Cryospheric Issues in Regional Sustainable Development LiJiang, China, August 2010	Co-Chair
Bindoff N	UK e_Science Review Team	Member
	IPY Data Management Committee	Member
	OceanObs09 Steering Committee	Member
Bowie A	GEOTRACES: marine biogeochemical cycles of trace elements and their isotopes in the Pacific basin	Member
Butler E	GEOTRACES: marine biogeochemical cycles of trace elements and their isotopes in the Pacific basin	Member
Haward M	Editorial Board Ocean and Coastal Management	Member
Heil P	International Programme for Antarctic Buoys	Deputy Chair
Howard W	Integrated Ocean Drilling Program Australia-New Zealand Science Steering Committee	Chair
	Integrated Ocean Drilling Program Science Planning Committee	Member
	International Quaternary Association Paleoclimate Commission	Corresponding Member
	American Geophysical Union Journal 'Paleoceanography' Editorial Board	Associate Editor
	Australia-New Zealand Integrated Ocean Drilling Program Governing Council	Member
Lambeck K	Federation of Asian Scientific Academies and Societies	President Elect
	InterAcademy Panel	Executive Committee Member
	InterAcademy Council	Board Member
Lawrence P	IUCN (World Conservation Union) climate change and energy interest group	Member
	International Programme for Antarctic Buoys	Member
	NASA Aqua AMSR-E Science & Software Team	Member
Massom R	Editorial Board, Polar Research	Associate Editor
Nichols P	Omega-3 Center	Science advisor
	AusBiotech Tasmanian branch	Member
	Australasian Section American Oil Chemists Society	Past president
O'Farrell S	International Commission for Polar Meteorology and Climatology (ICPM)	Member
	SCAR Antarctica in the Global Climate System (AGCS)	Member
	SOPHOCLES (Southern Ocean Physical Oceanography and Cryospheric Linkages)	Chair
Rintoul S	SCAR/SCOR Expert Group on Oceanography	Co-Chair
	CLIVAR/CliC/SCAR Southern Ocean Implementation Panel	Member
	American Meteorological Society Committee on Southern Hemisphere Meteorology and Oceanography	Member
Tilbrook B	Surface Ocean Carbon Atlas (SOCAT), Southern Ocean regional group	Co-Chair
	Indian Ocean SOCAT	Member
	International Ocean Carbon Coordination Project (IOCCP) scientific steering committee	Member
Trull T	Organising Committee, Second Monaco Conference on the Oceans in a High CO_2 World	Member
	Australian Delegation to the London Convention/Protocol on the Prevention of Pollution by the Dumping of Wastes in the Ocean	Member
van Ommen T	SCAR Standing Scientific Group on Physical Sciences, Executive Committee International Partnerships in Ice Core Sciences (Working groups on 2000-year array and oldest ice)	Secretary Member
van Wijk E (on behalf of Wijffels S)	Argo Steering Team (AST-10)	Member
Worby A	WCRP Cryosphere and Climate (CliC) Scientific Steering Group	Vice-Chair
	CliC Marine Cryosphere program	Leader
	SCAR Antarctic Sea-ice Processes and Climate (ASPeCt) committee	Co-Chair
	SCAR/SCOR Expert Group on Oceanography	Member
Young N	European Space Agency Category 1 Advisory Panel	Member

Media

Staff name	Agency	Story	Date
ACE CRC	Weekend Australian	No credit as oceans turn sour	Jul 2008
ACE CRC	Aust Maritime Digest	ACE CRC Acidification Paper	Aug 2008
ACE CRC	Launceston Examiner	TFGA climate strategy meeting today	Aug 2008
ACE CRC	ABC 936 (Hobart) ABC North Tasmania Radio National Hobart	Dr Tony Press to become new CEO of ACE CRC	Sep 2008
ACE CRC	Hobart Mercury	Antarctic boss takes climate body top job	Sep 2008
ACE CRC	LGA Tasmania	Estimating sea-level extremes in an uncertain future	Dec 2008
ACE CRC	LGA Tasmania	Estimating sea-level extremes in an uncertain future	Jan 2009
ACE CRC	Yorke Peninsula Country Times	Sea-level rise to become part of the plan	Jan 2009
ACE CRC	The Age	Ocean fertilization plan near Antarctica hits trouble	Jan 2009
ACE CRC	smh.com.au	Climate scientists seek a urea moment	Jan 2009
ACE CRC	ABC2-TV Sydney News Breakfast	Key climate change scientists warn of rising sea levels in the coming century	Jan 2009
ACE CRC	Ecosmagazine.com	Our options for global CO_2 drawdown	Feb 2009
ACE CRC	Decision Point	A bioregionalisation for the Southern Ocean	Feb 2009
ACE CRC	3CR (Melbourne)	Evidence of link between ocean acidification and decrease in shell-making ability of some marine organisms	Mar 2009
ACE CRC	Sydney Morning Herald	Ocean seeding fails on carbon but claims a plus for plankton	Mar 2009
ACE CRC	Aust Maritime Digest	Sea shells thinning because of acidification	Apr 2009
ACE CRC Howard W Sandford R	Tasmania 40 degrees South	The dangers of ocean acidification	Issue 52, Autumn 2009
ACE CRC Green Sir Guy	ABC North Tasmania Tas Country Hour	International forum on the Sub-Antarctic aims to promote the scientific interest and unique properties of the area	Apr 2009
ACE CRC	Ecos magazine 149	Cheers to an historic polar research collaboration	Jun-Jul 2009
Allison I	Forbes.com Business news	How great is the threat from melting ice sheets?	Apr 2009
Allison I	The Weekend Australian	Ice sheets and future sea-level rise	Apr 2009
Allison I	ABC Radio National (Fran Kelly)	Ice sheets and future sea-level rise	Apr 2009
Allison I	ABC Darwin (Michael Crowther	Ice sheets and future sea-level rise	Apr 2009
Allison I	ABC Newcastle (Carol Duncan)	Ice sheets and future sea-level rise	Apr 2009
Allison I	ABC Canberra (Louise Maher)	Ice sheets and future sea-level rise	Apr 2009
Allison I	ABC Rockhampton (Craig Zonca)	Ice sheets and future sea-level rise	Apr 2009
Bindoff N	The Mercury	Drought crunch time: Climate outlook seems grim for farms	Aug 2008
Bindoff N	The Mercury	State's climate future 'clearer by next year'	Aug 2008
Bindoff N	The Examiner	Heat is on Tassie	Feb 2009
Bowie A	Sydney Morning Herald	Climate scientists seek a urea moment	Jan 2009
Corney S	Edge Radio (UTAS)	Likely effects of Climate change in Tasmania	May 2009
Haward M	Al Jazeera (Malaysia)	Antarctic Treaty Consultative Meeting	Apr 2009
Haward M	The Age	Australia's Oceans Policy	May 2009
Haward M	The Age	Ocean Care Program 'now dead'	May 2009
Howard W	Australian Science Media Centre	Ocean Acidification/Monaco Declaration	Jan 2009
Howard W	Scientific American	Ocean Acidification Nature Geoscience paper	Mar 2009
Howard W	Inter Press Service	Ocean Acidification Nature Geoscience paper	Mar 2009
Howard W	Agence-France Presse	Ocean Acidification Nature Geoscience paper	Mar 2009
Howard W	ABC Radio National Website	Ocean Acidification Nature Geoscience paper	Mar 2009

Staff name	Agency	Story	Date
Howard W	ABC-TV	Ocean Acidification Nature Geoscience paper	Mar 2009
Howard W	ABC Radio National	Ocean Acidification Nature Geoscience paper	Mar 2009
Howard W	Christian Science Monitor	Ocean Acidification Nature Geoscience paper	Mar 2009
Howard W	ClimateWire	Ocean Acidification Nature Geoscience paper	Mar 2009
Howard W	Environmentalresearchweb.org	Ocean Acidification Nature Geoscience paper	Mar 2009
Howard W	Volkskrant (Dutch Newspaper)	Ocean Acidification Nature Geoscience paper	Mar 2009
Howard W	LiveScience.com	Ocean Acidification Nature Geoscience paper	Mar 2009
Howard W	New York Times	Ocean Acidification Nature Geoscience paper	Mar 2009
Howard W	Swedish Public Radio	Ocean Acidification Nature Geoscience paper	Mar 2009
Howard W	Illustrerad Vetenskap (Swedish Magazine)	Ocean Acidification Nature Geoscience paper	Mar 2009
Howard W	Hindu Times	Ocean Acidification Nature Geoscience paper	Mar 2009
Howard W	Deutschlandfunk (Germany Public Radio)	Ocean Acidification Nature Geoscience paper	Mar 2009
Howard W	Channel 4 News, UK	Ocean Acidification Nature Geoscience paper	Mar 2009
Howard W	NBC Nightly News, USA	Ocean Acidification Nature Geoscience paper	Apr 2009
Howard W	Wall Street Journal	Ocean Acidification Nature Geoscience paper	Apr 2009
Howard W	ABC Local Radio	Integrated Ocean Drilling Program	Apr 2009
Howard W	ABC Radio National	Sub-Antarctic Forum	Apr 2009
Howard W	Australian Science Media Centre	Inter-Academy statement on Ocean Acidification	Jun 2009
Howard W	Australian Financial Review	Ocean Acidification	Jun 2009
Hunter J	Gold Coast Business News	Sea-level rise and coastlines	Jul 2008
Hunter J	Northern Rivers Echo	Sea-level rise and coastlines	Jul 2008
Hunter J	2LM Radio, Lismore	Sea-level rise and coastlines	Jul 2008
Hunter J	Triple Z Radio, Lismore	Sea-level rise and coastlines	Jul 2008
Hunter J	ABC North Coast NSW radio, Lismore	Sea-level rise and coastlines	Jul 2008
Hunter J	Prime North Coast television, Lismore	Sea-level rise and coastlines	Jul 2008
Hunter J	Northern Star, Lismore	Sea-level rise and coastlines	Jul 2008
Hunter J	Australian Financial Review	Vulnerability of coastlines and related infrastructure	Jul 2008
Hunter J	Sunday Telegraph	Sea-level rise and waterfront properties	Jul 2008
Hunter J	ABC Radio, Victoria	Sea-level rise and vulnerability of coastal properties	Aug 2008
Hunter J	Construction Week	Sea-level rise and vulnerability of resorts in the Persian Gulf	Sep 2008
Hunter J	Southern Cross TV News	Sea-level rise and greenhouse gas emissions	Sep 2008
Hunter J	Sunday Mail, Adelaide	Sea-level rise at Tuvalu	Oct 2008
Hunter J	The Mercury, Hobart	Sea-level rise and Takuu Atoll, PNG	Nov 2008
Hunter J	Southern Cross TV News	Sea-level rise and Takuu Atoll, PNG	Nov 2008
Hunter J	ABC Radio, Hobart	Sea-level rise and Takuu Atoll, PNG	Nov 2008
Hunter J	Sydney Morning Herald	Flooding at Takuu Atoll, PNG and sea-level rise extremes	Dec 2008
Hunter J	ABC Radio	Flooding at Takuu Atoll, PNG and sea-level rise extremes	Dec 2008
Hunter J	SBS TV News	Flooding at Takuu Atoll, PNG and sea-level rise extremes	Dec 2008
Hunter J	The Age	Victorian planning allowance for sea-level rise	Dec 2008
Hunter J	ABC Radio PM	Flooding at Takuu Atoll, PNG	Dec 2008
Hunter J	The Mercury, Hobart	Flooding at Takuu Atoll, PNG	Dec 2008
Hunter J	ABC Radio, Queensland	ACE CRC seminars and workshops on sea-level extremes	Jan 2009
Hunter J	Courier Mail, Brisbane	Sea-level rise and coastal vulnerability	Jan 2009
Hunter J	ABC Radio, Darwin	Sea-level rise and coastal vulnerability	Jan 2009
Hunter J	ABC Radio, Mid North Coast	Sea-level rise and coastal vulnerability	Feb 2009
Hunter J	ABC Radio, Ballarat/SW	Sea-level rise and coastal vulnerability	Feb 2009
Hunter J	ABC Radio, Adelaide	Buying a house near the beach	Mar 2009
Hunter J	ABC Radio, Hobart	Coastal monitoring around Tasmania	Mar 2009

Staff name	Agency	Story	Date
Hunter J	Courier Mail, Brisbane	ACE CRC seminars and workshops on sea-level extremes	Mar 2009
Hunter J	ABC Radio, Coast FM	Sea-level rise and coastal vulnerability	Apr 2009
Hunter J	ABC Radio, Cairns	Sea-level rise, coastal vulnerability and ACE CRC seminars and workshops on sea-level extremes	Apr 2009
Hunter J	ECOS	Flooding of Pacific islands	Apr 2009
Hunter J	TV New Zealand	Flooding at Takuu Atoll, PNG	May 2009
Hunter J	Sydney Morning Herald	Sea-level rise and coastal vulnerability	Jun 2009
Hunter J	ABC Far North	ACE CRC seminars and workshops on sea-level extremes	Jun 2009
Hunter J	Townsville Bulletin	ACE CRC seminars and workshops on sea-level extremes	Jun 2009
Jabour J	Dane Gibson, CKLB Radio, Yellowknife, Canada	IPY Research (20 minute live radio interview broadcast by Native Communications Society of the North West Territories, and streamed internationally)	Sep 2008
Lambeck K	Radio National's Ockham's Razor	Innovate today, not tomorrow	Nov 2008
Lambeck K	Radio National's Ockham's Razor	Comments on Heaven and Earth: Global Warming: The Missing Science	Jun 2009
Massom R	ABC TV and Radio News (national), Fiona Blackwood interview	Emperor penguin chick dispersal and sea-ice.	Jan 2009
Massom R	ABC Local Radio (Tim Cox)	A recent US-French paper about the possible extinction of emperor penguins due to projected changes in Antarctic sea-ice conditions over the coming decades.	Jan 2009
Moy A	ABC Newcastle	Reduced calcification in modern Southern Ocean planktonic foraminifera	Mar 2009
Moy A and Howard W	Scientific American	Reduced calcification in modern Southern Ocean planktonic foraminifera	Mar 2009
Rintoul S	ABC Radio	Elephant seals observing the oceans	Aug 2008
Rintoul S	New Scientist	Sea-ice tongue	Sep 2008
Rintoul S	ABC TV, Reuters, Catalyst	Southern Ocean circulation and CO_2 uptake insensitive to changes in winds	Dec 2008
Rintoul S	ABC Radio National Science Show	Oceanographic expedition to Antarctica	Aug 2008
Rintoul S	Catalyst – ABC TV	Elephant Seals observing the oceans	Mar 2009
Roberts D	ABC Radio – Anna Yard	Ocean acidification impacts on pteropods	Jul 2008
Roberts D	AFMA Newsletter – Cate Coddlington	Ocean acidification impacts on pteropods	Aug 2008
Roberts D	CRC Association Newsletter	CRC scientist career story	Apr 2009
Tilbrook B	ABC 730 report	Ocean acidification	Aug 2008
Tilbrook B	US NBC News	Ocean acidification	Apr 2009
Tilbrook B	Cosmos Magazine	Ocean acidification	Dec 2008
van Ommen T	ABC1 TV News	Wilkins ice shelf	Jun 2009
van Ommen T	ABC1 TV Lateline	Wilkins ice shelf	Jun 2009
van Ommen T	The Australian	Wilkins ice shelf	Jun 2009
van Ommen T	ABC2 TV Breakfast program	Wilkins ice shelf	Jun 2009
van Ommen T	ABC Radio 774	Wilkins ice shelf	Jun 2009
van Ommen T	Agence France Press	Wilkins ice shelf	Jun 2009
van Ommen T	Australia Network TV – Newshour	Wilkins ice shelf	Jun 2009
van Ommen T	WIN-TV 'Warm-TV'	ACE CRC Research	Mar 2009
Worby A	ABC Science online	Explanation of reported increase in extent of Antarctic sea-ice	Apr 2009
Worby A	3AW recorded interview	Explanation of reported increase in extent of Antarctic sea-ice	Apr 2009
Worby A	ABC Radio Sydney	Explanation of reported increase in extent of Antarctic sea-ice	Apr 2009
Worby A	AAP phone interview	Explanation of reported increase in extent of Antarctic sea-ice	Apr 2009
Worby A	SBS TV news	Explanation of reported increase in extent of Antarctic sea-ice	Apr 2009
Worby A	ABC Radio Hobart	Explanation of reported increase in extent of Antarctic sea-ice	Apr 2009
Young N	ABC The Hollowmen	Background material for program preparation	Sep 2009
Young N	ABC The World Today	Wilkins Ice Shelf – breakup of ice bridge	Apr 2009
Young N	Sydney Morning Herald	Wilkins Ice Shelf – breakup of ice bridge	Apr 2009
Young N	The Weather Channel	Wilkins Ice Shelf – breakup of ice bridge	Apr 2009

Staff resources

Staff name	Total % time	AME	CO2	CVC	POL	SLR	Rsch total	EDU	COM	ADM
Australian Antarctic Division – In-Kind										
Allison I	85%	5%	2%	25%	2%	30%	64%	2%	5%	14%
Anderson J	80%					80%	80%			
Constable A	75%	75%					75%			
Craven M	85%			45%		40%	85%			
Curran M	85%			85%			85%			
Davidson A	50%	25%	25%				50%			
Double M	5%	5%					5%			
Doust S	40%	40%					40%			
Elcheikh A	80%			40%		40%	80%			
Emmerson L	20%	20%					20%			
Frankel B	33%			33%			33%			
Gedamke J	20%	20%					20%			
Heil P	80%	20%		60%			80%			
Hosie G	10%	10%					10%			
Hyland G	60%			30%		30%	60%			
Jackson A	12%				12%		12%			
Jarvis T	60%	60%					60%			
Kawaguchi S	55%	55%					55%			
Maggs T	8%				8%		8%			
Massom R	90%	15%		75%			90%			
Moy A	85%			85%			85%			
Nicol S	50%	50%					50%			
Raymond B	50%	50%					50%			
Richardson M	80%			40%		40%	80%			
Roberts J	85%			15%		70%	85%			
Robertson T	20%	20%					20%			
Southwell C	15%	15%					15%			
Steer A	80%	25%		55%			80%			
Vance T	80%			80%			80%			
van Ommen T	80%			55%		25%	80%			
Warner R	85%			25%		60%	85%			
Worby A	85%	25%		60%			85%			
Wright S	45%	45%					45%			
Young N	85%			10%		70%	80%		5%	
Total	**1958%**	**580%**	**27%**	**818%**	**22%**	**485%**	**1932%**	**2%**	**10%**	**14%**
Australian Bureau of Meteorology – In-Kind										
Adams N	50%			50%			50%			
Brassington G	20%			20%			20%			
Greenslade D	5%			5%			5%			
Reid P	100%			100%			100%			
Schulz E	20%			20%			20%			
Tseitkin F	70%			70%			70%			
Wang G	30%			30%			30%			
Zhou X	70%			70%			70%			
Total	**365%**	**0%**	**0%**	**365%**	**0%**	**0%**	**365%**	**0%**	**0%**	**0%**

Staff name	Total % time	AME	CO2	CVC	POL	SLR	Rsch total	EDU	COM	ADM
CSIRO Division of Atmospheric Research – In-Kind										
Collier M	2%			2%			2%			
Hirst T	6%			6%			6%			
Macadam I	1%					1%	1%			
McInnes K	10%					10%	10%			
O'Farrell S	30%			15%		15%	30%			
Total	**49%**	**0%**	**0%**	**23%**	**0%**	**26%**	**49%**	**0%**	**0%**	**0%**
CSIRO Division of Marine Research – In-Kind										
Bindoff N	50%			50%			50%			
Bestley S	27%			27%			27%			
Butler E	89%		89%				89%			
Church J	64%					64%	64%			
Coleman R	20%					20%	20%			
Griffiths B	83%		83%				83%			
Latham V	1%		1%				1%			
Rintoul S	46%			46%			46%			
Tilbrook B	45%		45%				45%			
Trull T	50%		50%				50%			
White N	51%					51%	51%			
Total	**526%**	**0%**	**268%**	**123%**	**0%**	**135%**	**526%**	**0%**	**0%**	**0%**
University of Tasmania – In-Kind										
Bindoff N	20%			20%			20%			
Coleman R	10%			5%			5%	5%		
Haddad P	5%						0%	5%		
Hall R	10%				10%		10%			
Haward M	50%				35%		35%	15%		
Hazelwood M	15%						0%	5%		10%
Hindell M	5%						0%	5%		
Jabour J	50%				25%		25%	25%		
Kellow A	10%				10%		10%			
Kriwoken L	10%				10%		10%			
Lawrence P	5%				5%		5%			
Lugten G	15%				15%		15%			
McMinn A	45%	20%					20%	25%		
Michael K	50%			25%			25%	25%		
Miller K	5%						0%	5%		
Trull T	30%		20%				20%	10%		
Virtue P	15%						0%	15%		
Total	**350%**	**20%**	**20%**	**50%**	**110%**	**0%**	**200%**	**140%**	**0%**	**10%**
Australian National University – In-Kind										
Lambeck K	15%					15%	15%			
McQueen H	10%					10%	10%			
Tregoning P	5%					5%	5%			
Total	**30%**	**0%**	**0%**	**0%**	**0%**	**30%**	**30%**	**0%**	**0%**	**0%**

Staff name	Total % time	AME	CO2	CVC	POL	SLR	Rsch total	EDU	COM	ADM
NIWA – In-Kind										
Bostok H	10%			10%			10%			
Boyd P	10%	10%					10%			
Nodder S	10%		10%				10%			
Williams M	25%			20%		5%	25%			
Total	**55%**	**10%**	**10%**	**30%**	**0%**	**5%**	**55%**	**0%**	**0%**	**0%**
Department of Climate Change – In-Kind										
Fuller A	16%				16%		16%			
Total	**16%**	**0%**	**0%**	**0%**	**16%**	**0%**	**16%**	**0%**	**0%**	**0%**
TOTAL IN-KIND	3349%	610%	325%	1409%	148%	681%	3173%	142%	10%	24%
Cash Funded Staff University of Tasmania										
Armand L	50%		50%				50%			
Bidwell K	70%						0%			70%
Bloomfield C	90%		90%				90%			
Bowie A	100%		100%				100%			
Bray S	100%		100%				100%			
Davies D	80%		80%				80%			
Haward M	30%				30%		30%			
Hilkemeijer A	64%				64%		64%			
Howard W	100%	10%	35%	50%			95%		5%	
Hunter J	100%					95%	95%		5%	
Jakszewicz T	100%						0%		100%	
le Goy C	20%						0%		20%	
Lieser J	100%			100%			100%			
Maloney K	100%						0%		10%	90%
Mapstone B	40%	5%	5%	5%	5%	5%	25%	5%	5%	5%
Meiners K	100%	85%				15%	100%			
Mongin M	80%		80%				80%			
Pasquer B	100%	90%	10%				100%			
Press A	40%	5%	5%	5%	5%	5%	25%	5%	5%	5%
Rosenberg M	95%		25%	70%			95%			
ten Hout W	3%						0%			3%
Tyler J	100%						0%			100%
van Wijk E	80%			80%			80%			
Total	**1742%**	**195%**	**580%**	**310%**	**104%**	**120%**	**1309%**	**10%**	**150%**	**273%**
Cash Funded Staff University of Tasmania – Climate Futures of Tasmania										
Corney S	83%			83%			83%			
Gaynor S	100%						0%			100%
Grose M	100%			100%			100%			
Holz G	100%			100%			100%			
White C	100%			100%			100%			
Total	**483%**	**0%**	**0%**	**383%**	**0%**	**0%**	**383%**	**0%**	**0%**	**100%**

Staff name	Total % time	AME	CO2	CVC	POL	SLR	Rsch total	EDU	COM	ADM
Cash Funded Staff CSIRO Division of Atmospheric Research										
Macadam I	1%					1%	1%			
McInnes K	11%					11%	11%			
O'Farrell S	30%			15%		15%	30%			
Total	**42%**	**0%**	**0%**	**15%**	**0%**	**27%**	**42%**	**0%**	**0%**	**0%**
Cash Funded Staff CSIRO Division of Marine Research										
Paterson K	24%		24%				24%			
Rathbone C	9%		9%				9%			
Sokolov S	75%			75%			75%			
Total	**108%**	**0%**	**33%**	**75%**	**0%**	**0%**	**108%**	**0%**	**0%**	**0%**
Cash Funded Staff Australian National University										
Estermann G	50%					50%	50%			
Fouracre D	20%					20%	20%			
Total	**70%**	**0%**	**0%**	**0%**	**0%**	**70%**	**70%**	**0%**	**0%**	**0%**
TOTAL CASH	2445%	195%	613%	783%	104%	217%	1912%	10%	150%	373%
TOTAL IN-KIND & CASH	5794%	805%	938%	2192%	252%	898%	5085%	152%	160%	397%