ANTARCTIC CLIMATE & ECOSYSTEMS
COOPERATIVE RESEARCH CENTRE

2010 Annual Report

Australian Government
Department of Sustainability, Environment, Water, Population and Communities
Australian Antarctic Division

CSIRO

UTAS

Australian Government
Department of Climate Change and Energy Efficiency

AWI
Alfred Wegener Institute for Polar and Marine Research in the Helmholtz Association

NIWA
Taihoro Nukurangi

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Antarctic Climate and Ecosystems Cooperative Research Centre
Private Bag 80
Hobart Tasmania 7001
Tel: +61 3 6226 7888
Fax: +61 3 6226 2440
Email: enquires@acecrc.org.au
www.acecrc.org.au

1 Executive Summary

There was a smooth transition from the 'old' CRC to the 'new' ACE CRC. By the end of the reporting period agreements had been concluded and the new Board had begun meeting formally. Advertising and recruitment to vacant positions had begun, and the science programs were taking their new shape.

1.1 Achievements

There were a number of major utilisation and training achievements during the reporting period. These included an end user roundtable in Canberra involving representatives from key federal government departments. This forum was a two-way dialogue allowing ACE CRC to explain its proposed science program and for policymakers to provide input on their needs.

Two ACE scientists, Dr Ian Allison and Prof Nathan Bindoff were key contributors to the publication, "The Copenhagen Diagnosis: *Updating the World on the Latest Climate Science*" (2009). This report synthesised the most policy-relevant climate science published since the close-off of material for the last the Intergovernmental Panel on Climate Change (IPCC) report. The Copenhagen Diagnosis also served as a handbook of science updates to supplement the IPCC's Fourth Assessment Report for the Copenhagen Climate Conference which was held in December 2009.

ACE also ran a short vocational training course for policy makers on the latest Antarctic and climate change science in March. This built on the successful previous short courses held in the last CRC.

As well as having four SME organisations as Participants in the CRC (Metocean, Myriax, Pitt&Sherry and SGS Economics and Planning), ACE is developing tools which will assist SMEs on a broader scale. These include the ACE sea-level rise decision support tool, which supports SME engineering and consulting firms to make decisions about the design and maintenance of coastal infrastructure. ACE is also developing a range of vocational training courses in climate change-related topics which will be able to be delivered face-to-face or online to SME end users (such as environmental and engineering consultants). ACE has collaborated with Pitt&Sherry to assist them to develop ClimateAsyst® (a decision support tool that assists owners, managers and planners assess the susceptibility of their infrastructure to projected changes in climate).

Over the January to June 2010 reporting period one new employee was appointed to the position of Ice Core Palaeoclimatologist. Dr Tessa Vance commenced employment in this position on the 17th of May 2010.

During the reporting period $272,000 was paid for mooring equipment for the Oceans Program.

No internal or external reviews were conducted during this reporting period.

Various ACE staff members and students have been presented with Honours and Awards during the reporting period. In January 2010, Dr Andrew Bowie was invited to join the Scientific Steering Committee for the international program GEOTRACES: 'An International Study of Marine Biogeochemical Cycles of Trace Elements and their Isotopes'.

Dr Bowie also received the Royal Society-Australian Academy of Science "Exceptional Young Researcher" Award in May 2010.

In June, Mr Joel Pedro was a participant in the 60th Lindau Meeting of Nobel Laureates. He earnt this honour as a "high achieving early career researcher" from the Australian Academy of Science.

In June, Dr Miguel de Salas was shortlisted for 2010 Eureka Prize (with Gustaaf Hallegraeff et al), while Dr Ian Allison and Prof Nathan Bindoff were nominated as finalists in the 2010 Eureka Prize for Advancement of Climate Change Knowledge for "The Copenhagen Diagnosis".

1.2 Obstacles

The major obstacle to fulfilling the goals of the CRC was related to the shortfall in funds from the Commonwealth. Balancing the budget across all programs to meet this shortfall has been difficult. The budget and the achievable outputs will be under regular review.

Historically, it has been difficult to fill some post-doctoral positions in the ACE CRC. In this round, ACE advertised all vacancies in one recruitment drive with the strategy to fill as many positions as possible early in the life of the CRC. This strategy proved highly successful with all positions eventually being offered.

1.3 End-user Environment

The major change in the end user environment relates to the political and policy arena. The ACE CRC built its impact template on the assumption that a price on carbon would be established around the time of the Copenhagen climate change negotiations. This has not happened as anticipated and there has been somewhat of a shift in emphasis from governments from climate change mitigation actions to climate change adaptation. In spite of this significant shift in the global and national political environment, it has not impacted on the importance, need or value of ACE CRC research. Our research provides critical input to government and industry end users, enabling them to more accurately project future changes in climate and to plan accordingly, whether by way of mitigation or adaptation.

ACE climate science will provide important input into the IPCC 5th Assessment Report. Two ACE scientists have been selected as coordinating lead authors and a further two as lead authors for Working Group 1 of the 5th Assessment Report 'Climate Change 2013: The Physical Science Basis'.

The Climate Futures for Tasmania project has highlighted the value of producing climate change projections at local scales, developing the outputs in close collaboration with end user groups, and delivering the outputs in formats that are meaningful to various sectors of the community. The Climate Futures for Tasmania model has received recognition from end users in Tasmania and opportunities are arising to deploy this model in other regions of Australia.

The climate change science community is discussing the need to increase the quality of its communications and also to integrate the social sciences into multidisciplinary research programs. The ACE CRC is exploring multidisciplinary research projects with its commercial partners and the University of Tasmania (UTAS).

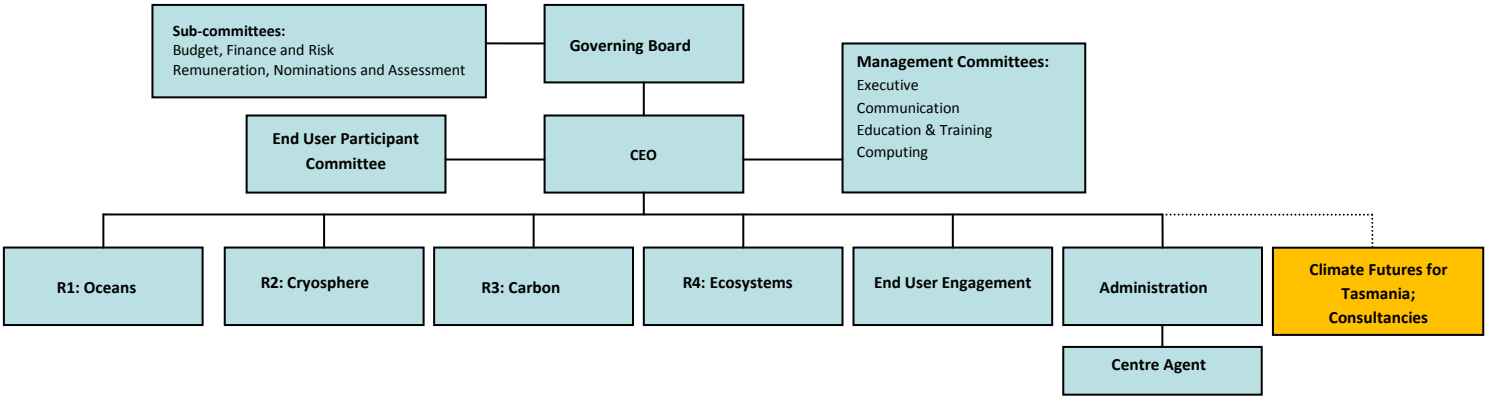
The ACE CRC continues to focus on building stronger and wider links at many levels in relevant government departments and with industry. This assists in ensuring ACE is abreast of any likely changes in the end user environment and that our research remains relevant to end user needs.

1.4 Impacts

The ACE CRC does not anticipate any major changes to the key outputs outlined in the ACE CRC Impact Template. Our focus during the reporting period has been to establish our research teams and to scope the research projects in more detail. Output delivery is concentrated on publishing research outputs in time to provide input into the IPCC 5th Assessment Report in 2012. Achieving the expected impacts will depend on delivering targeted scientific advice that will assist policy makers to shape the most cost effective policy frameworks to achieve balance between climate change mitigation and economic performance. It is too early in the life cycle of our research programs to assess performance. We maintain regular contact with policymakers to ensure our research is relevant to their needs.

2 Governance and Management

The ACE CRC is an unincorporated joint venture comprising 6 essential and 17 other participants. The University of Tasmania continues to provide Centre Agent services, such as human resources and financial management, as in-kind contributions and has signed the Commonwealth Agreement on behalf of all participants. The Essential Participants are bound by a Participants' Agreement with 17 Other Participant's Agreements setting out the duties and commitments of all parties. The governance and management structure of ACE CRC has been established as follows:



2.1 Governance – Board, Committees and Key Staff

THE GOVERNING BOARD

The governing board is constituted with a balance of skills, experience and independence and operated in accordance with the provisions of the Participants' Agreement. It comprises an independent chairperson, representatives of our six-Essential Participants, two representatives from Other Participants (including one commercial), two independent members (one position vacant) and two ex-officio members (without voting rights). An ACE CRC Code of Conduct for Board Members has been developed and approved by the board.

Board Meetings are held every quarter. During this reporting period these occurred on the 2nd of March 2010 and the 18th of June 2010.

End user organisations, Pitt & Sherry Pty Ltd and the Department of Climate Change and Energy Efficiency (DCCEE), were represented on the Governing Board by Mr John Pitt and Dr Ian Carruthers respectfully. A vacancy exists on the Governing Board. The ACE CRC aims to fill this position during the 2010/2011 reporting period.

At the end of 2009 two members of the board resigned and were replaced in this reporting period by two new appointees. Mr Howard Bamsey (DCCEE) resigned and was replaced by Mr Ian Carruthers, of the same organisation. University of Tasmania representative, Prof Johanna Laybourn-Parry, resigned and was replaced by Prof Alan Canty, also of the University of Tasmania.

The Governing Board also received 3 new appointees in the reporting period: Mr John Pitt (Pitt & Sherry Pty Ltd), Dr Rob Murdoch (National Institute of Water and Atmospheric Research - NIWA) and Prof Ulrich Bathman (Alfred Wegener Institute - AWI).

Name	Role	Key Skills	Independen/ Organisation	Number of meetings	% as board member
Dr Katherine Woodthorpe	Chair	- High level management skills - CEO of the Australian Private Equity and Venture Capital Association Ltd. - High level Board skills – over a number of years Dr Woodthorpe has been on the boards of several listed companies, a University, several CRCs (including chairing 2) and a couple of private companies (including chairing Insearch). - Dr Woodthorpe sat on several audit committees of listed companies – Ventracor, Agenix and chaired the Audit Committee of Australian Cancer Technologies Ltd and Insearch	Independent	2	100%
Professor Ulrich Bathmann	Board Member	- Leadership in international scientific programs - High level administrative experience - Strong international standing as a scientist	Alfred Wegener Institute (Essential Participant)	0	0% Granted leave of absence by Board
Professor Allan Canty	Board Member	- Extensive experience in research and teaching - Experience in allocation of research grants - Senior administrative experience	University of Tasmania (Essential Participant)	2	100%
Mr Ian Carruthers	Board Member	- High level executive experience in government - Leadership on strategies to deliver science capability for national needs - Broad and extensive experience on climate change, environment and natural resources management	Department of Climate Change & Energy Efficiency (Essential Participant)	1	100%
Mr Tony Coleman	Board Member	- High level executive management experience in private enterprise - Financial audit, actuarial and risk management expertise - Commercial objectivity and independence from CRC participants	Independent	1	50%
Mr Greg Johannes	Board Member	- High level executive management experience in both policy and operational	Tasmanian Government	2	100%

Name	Role	Key Skills	Independen/ Organisation	Number of meetings	% as board member
		roles in the public and private sector - Substantial and wide ranging board experience in both the research and community sector - Lead State Government representative in national negotiations under COAG on climate change policy, legislation and regulation	(Other Participant)		
Ms Lyn Maddock	Board Member	- High level executive management experience in government - Extensive policy experience - Board experience in a number of NGO's	Australian Antarctic Division (Essential Participant)	2	100%
Dr Bruce Mapstone	Board Member	- Extensive experience in research leadership and management at senior & institutional levels - Established experience with CRC establishment, leadership, and governance, including the previous ACE CRC - Broad relevant domain expertise in climate and marine science	CSIRO (Essential Participant)	1	50%
Dr Rob Murdoch	Board Member	- over 12 years experience as a senior executive in a government owned research organisation, including the operation of research vessels, and attended the INSEAD Advanced Management Programme - currently Deputy Chair of the WWF NZ Board, and a member of a range of science advisory and management boards - science expertise in biological oceanography and marine ecology	NIWA (Essential Participant)	0	0% Granted leave of absence by Board
Mr John Pitt	Board Member	- Experienced company director including broad network across private and public sectors - High level private sector executive management (including technology commercialization) experience - Strategic planning expertise in relation to the adaptation of infrastructure assets to climate change	Pitt&Sherry (Other Participant)	1	100%
Dr Tony Press	Ex-Officio	- High level leadership and administrative experience - Extensive experience in government and	ACE CRC	2	100%

Name	Role	Key Skills	Independen/ Organisation	Number of meetings	% as board member
		public policy - High level international experience in science and policy			
Mr John Gunn	Ex-Officio	-High level executive management experience in research agencies and government -Strategic planning of national and international research programs -Marine and climate science leadership	Australian Antarctic Division (Essential Participant)	2	100%

The Governing Board developed 2 Board Sub-committees. The first of these is focussed on dealing with budget, finance and risk. The members of this sub-committee are Mr John Gunn, Dr Bruce Mapstone and the University of Tasmania's Pro Vice-Chancellor (Research). The second sub-committee deals with remuneration, nominations and assessment. This committee consists of Dr Katherine Woodthorpe, Ms Lyn Maddock and Mr Greg Johannes.

THE EXECUTIVE COMMITTEE

The ACE CRC Executive Committee advises the CEO and Board on a range of matters relating to management of resources, research coordination and research utilisation across the ACE CRC portfolio. The ACE CRC Executive Committee normally convenes quarterly but met only once in this reporting period on 15th February 2010.

Name	Role	Key Skills	Organisation
Ms Wenneke ten Hout	Administration Manager	Administration	ACE CRC
Prof Nathan Bindoff	Leader, Climate Futures; Director TPAC	Computing/ research	ACE CRC/TPAC
Dr Andrew Constable	Leader, Ecosystems Impacts Program	Research	ACE CRC/AAD
Assoc Prof Marcus Haward	School of Government, UTAS	Research/policy/end user engagement	ACE CRC/UTAS
Ms Tessa Jakszewicz	Deputy CEO, Business Development	Business Development/end user engagement	ACE CRC
Prof Andrew McMinn	IMAS Representative	Education	IMAS
Ms Kate Maloney	Business Management	Finance, administration, governance	ACE CRC
Dr Julia Jabour	IMAS Representative	Education	IMAS
Dr Tony Press	CEO	Management,	ACE CRC

Name	Role	Key Skills	Organisation
		governance	
Dr Kelvin Michael UTAS	IMAS Representative	Education	IMAS
Dr Tas van Ommen	Program Leader, Cryosphere	Research	ACE CRC/AAD
Dr Jason Roberts AAD	Researcher	Research/computing	ACE CRC/AAD
Prof Thomas Trull CMAR/UTAS	Program Leader, Carbon	Researcher	ACE CRC/UTAS/CSIRO
Dr Steve Rintoul	Program Leader, Oceans	Researcher	ACE CRC/CSIRO
Tomas Remenyi UTAS	Student	Education	ACE CRC

COMMUNICATIONS COORDINATING COMMITTEE

In the absence of an ACE Communications and Media Manager the committee did not meet during the reporting period. The committee structure and purpose will be reviewed and revised, if applicable, with the recruitment of a new ACE Communications and Media Manager. Committee meetings will be held as required.

Name	Role	Organisation
Ms Sally Chambers	General Manager, Corporate Communications	AAD
Ms Moya Fyfe	Communications and Media Manager	UTAS
Mr Craig Macaulay	Communications Officer	CSIRO
Ms Tessa Jakszewicz	Acting Communications and Media Manager	ACE CRC

EDUCATION AND TRAINING COMMITTEE

An education and training committee is under development between the new Institute of Antarctic and Marine Studies (based at UTAS) and ACE.

Name	Role	Organisation
Professor Michael Stoddart	Interim Director IMAS	UTAS
Dr Tony Press	CEO	ACE CRC

COMPUTER 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. The ACE CRC Computing Committee advises the ACE CRC Executive Committee and CEO. The ACE CRC Computing Committee did not meet during met during 1 January- 30 June 2010 as no computing issues arose.

Member	Role	Organisation
Ms Wenneke ten Hout	Administration Manager	ACE CRC
Mr Glenn Hyland	Researcher	AAD
Mr Ben Joseph	Information Technology Resources	UTAS
Dr Jan Lieser	Researcher	ACE CRC
Ms Kate Maloney	Business Management	ACE CRC
Dr Tony Press	Chief Executive Officer	ACE CRC
Dr Kelvin Michael	Deputy Leader, Education Program	UTAS
Dr Jason Roberts (Chair)	Researcher	AAD
Dr Roland Warner	Researcher	AAD
Mr Colin Broadbent	Information Technology Resources	UTAS

END USER COMMITTEE

An end user committee is under development. It is proposed to comprise end user participants in the ACE CRC and selected representatives from applicable government departments. It is anticipated that this committee will be established in the latter half of the 2010/11 financial year.

KEY STAFF

Staff Member	Role	% Time
Dr Tony Press	CEO	100%
Dr Tas van Ommen	Program Leader - Cryosphere	80%
Prof Tom Trull	Program Leader - Carbon	75%
Dr Andrew Constable	Program Leader - Ecosystems	60%
Dr Steve Rintoul	Program Leader - Oceans	30%

2.2 Participants

No changes to participants have occurred for the reporting period.

Type of Participant	Participant
Essential	Alfred Wegener Institute of Polar and Marine Research (AWI), Germany
Essential	Australian Antarctic Division (AAD)
Essential	CSIRO Division of Marine and Atmospheric Research (CMAR)
Essential	Department of Climate Change and Energy Efficiency (DCCEE)
Essential	National Institute of Water and Atmospheric Research Ltd (NIWA), New Zealand
Essential	University of Tasmania (UTAS)
Other	Centre for Polar Oceanography and Modelling (CPOM), University College London, UK

Type of Participant	Participant
Other	Chinese Academy of Meteorological Science (CAMS)
Other	Department of the Environment, Water, Heritage and the Arts (DEWHA)
Other	First Institute of Oceanography (FIO), China
Other	GHD Pty Ltd
Other	Institute of Low Temperature Science (ILTS), Hokkaido University, Japan
Other	Laboratoire d'Etudes en Geophysique et Oceanographie Spatiales (LEGOS), France
Other	Memorial University of Newfoundland (MUN), Canada
Other	Myriax Software Pty Ltd
Other	National Institute of Polar Research (NIPR), Japan
Other	Pitt & Sherry (PS)
Other	RPS MetOcean Pty Ltd
Other	SGS Economics and Planning Pty Ltd
Other	Tasmanian Government
Other	University of Texas at Austin (UT), USA
Other	University of Texas at San Antonio (UTSA), USA
Other	Vrije Universiteit Brussel (VUB), Belgium

2.3 Financial Management

The ACE CRC commenced the new operations with the task of balancing the budget after the shortfall in funding. Factors that assisted in this rebalancing included:

- Two participants provided additional cash contributions to cover the cost of staff positions, sea level rise tool costs and ocean acidification research costs. The additional cash contributions were $103,000 from AAD and $150,000 from DCCEE.
- The carried forward cash of $2,797,362 from the "Old" ACE CRC shown as "Other Firm Cash" in the CRC financial tables.
- In addition interest of $55,848 was earned on the CRC account for this reporting period, also shown as "Other Firm Cash" in the CRC financial tables.

In addition to the above modest increased cash inflows, there was also a substantial favourable variance in the agreed in kind contribution. This arose due to the Mill Island Core field work being completed a year in advance of the milestone. It is expected that this will be a timing difference only.

The expenditure table of the CRC over the first six months shows major variances to the agreement.

Fig 2.3.1 Excerpt from Financial Table 3

	Actual	**Agr'mt**	**Diff**	**%Diff**
Employee Expenses	1,394	303	1,091	360
Supplier Expenses	386	93	293	315
Capital	273	187	86	46
Other Expenses	0	0	0	0
TOTAL EXPENSES	2,053	583	1,470	252

This is due to the CRC reporting system not amending the "Agr'mt" column (shown in figure 2.3.1 above) for the carried forward cash. The expected use of these additional funds and the years in which the expenditure was budgeted was advised to the CRC program in June 2010. The resulting variances when this is taken into accounts are more reasonable (shown in fig 2.3.2 below). In addition, the budget prepared in the first six months of the year was on a cash basis, but the new CRC financial tables require expenditure to be reported on an accruals basis. Hence the majority of the remaining variance is due to accruals and represent a timing difference not an overspend.

Fig 2.3.2 Table 3 adjusted for carried forward cash

	Actual	Agr'mt	Diff	%Diff
Employee Expenses	1,394	1,124	270	24
Supplier Expenses	386	200	186	93
Capital	273	187	86	46
Other Expenses	0	0	0	0
TOTAL EXPENSES	2,053	1,511	542	36

The closure of the "old" CRC and the requirements to commence the "new" CRC doubled the reporting requirements for ACE in 2009/10. The introduction of a new finance system by the University of Tasmania produced additional burdens on the ACE CRC staff with issues with payments and receipting systems, a lack of reporting and incorrect balances carried over. Manual reporting was developed as a workaround and used for the first ten months of the "new" CRC. Reports are currently being specified for the finance system and are expected to be operational prior to the end of the next reporting period.

2.4 Communications

ACE CRC conducted a number of internal and external communications activities during the reporting period. ACE endeavours to measure and ensure their effectiveness of its communications by actively seeking input from end users via face-to-face meetings, end user representation on the board and key committees (such as the end-user (to be established), communications and executive committees) and end user round tables.

Internal communications activities

During the reporting period the following internal communications activities were performed:

Activity	Description	Date
ACE CRC Executive meeting	Meeting of key representatives of research participants and staff to discuss matters of research coordination and utilisation.	15th February 2010
ACE CRC Staff Forum	Information exchange between ACE CRC management, researchers and staff.	18th March 2010
ACE CRC e-newsletter	Newsletter includes CEO message and several topical research articles.	May 2010

Activity	Description	Date
	Distributed to ACE staff, board, honours and higher degree students.	
ACE CRC website www.acecrc.org.au	Regular updates including ACE news and events and news clipping on relevant research topics.	Several times per month
Participant briefings	One-on-one briefing sessions held with following participants: AAD, CSIRO, DCCEE, GHD, IMAS/UTAS, Myriax, Pitt&Sherry, SGS, Tasmanian State Government.	Throughout reporting period.

External communications activities - success and end user knowledge transfer

ACE CRC has undertaken a number of communications activities both to communicate our successes and to transfer knowledge to end users. A highlight during the reporting period was an end user round table held in Canberra in June, with attendance from across a range of key government departments including DAFF, DCCEE, DEWHA, DFAT, DIISR, NRM, Office of Chief Scientist and ONA. This forum was a two-way dialogue allowing ACE CRC to explain its proposed science program and for policymakers to provide input on their needs. It is proposed to conduct further end user roundtables throughout the life of the CRC.

A short course for policymakers and public servants was also held in Canberra in March. The objective was to provide an overview of the latest Antarctic and climate change science which would be of relevance to the audience. This built on the success of the short course held in FY2009.

ACE researchers Dr Ian Allison and Prof Nathan Bindoff were also were significant contributors to "The Copenhagen Diagnosis: *Updating the World on the Latest Climate Science*" (2009). This report synthesises the most policy-relevant climate science published since the close-off of material for the last IPCC report. It serves as an interim evaluation of the evolving science mid-way through an IPCC cycle - IPCC AR5 is not due for completion until 2013. The report also served as a handbook of science updates that supplemented the IPCC AR4 for the Copenhagen Climate conference in December 2009, and any national or international climate change policy negotiations that may follow.

Building on our well-received synopses of the latest science summarised in Position Analyses documents, three more continued development in January to June 2010: 'Southern Ocean Circulation and Climate Change', 'Southern Ocean Marine Ecosystems and Climate Change' and 'Southern Ocean Sentinel and monitoring for climate change'.

Other external communications activities included:

Activity	Description	Date
'The Copenhagen Diagnosis: *Updating the World on the Latest Climate Science*' (2009)	Synthesis of the most policy-relevant climate science published since the close-off of material for the last IPCC report.	January 2010

Activity	Description	Date
Media releases	Two ACE media releases were issued: 'Large iceberg breaks off the Mertz Glacier in the Australian Antarctic Territory'; 'Deep-sea volcanos play an important role in Southern Ocean carbon storage'	February 2010; March 2010
***'Estimating Sea-level Rise in an Uncertain Future'* Workshops**	Melbourne industry and government; Tasmanian State Government	February 2010; April 2010
Short course on Antarctic and climate change science	Held in Canberra for policymakers and public servants.	March 2010
ACE CRC video	A short overview of ACE CRC research ACE Video Clip	April 2010
ACE CRC e-newsletter	Newsletter includes CEO message and several topical research articles. Distributed to over 200 research participants and government and industry end users.	May 2010
End user Round table Canberra	Forum for ACE CRC to explain proposed science program and for policymakers to provide input on their needs. Attendance from DAFF, DCCEE, DEWHA, DFAT, DIISR, NRM, Office of Chief Scientist and ONA.	June 2010.
ACE Technical Report: "The CSIRO Mk3L climate system model v1.2" was released.	A user guide to the CSIRO Mk3L climate system model version 1.2	June 2010
The International Polar Year (IPY) Science Conference, Oslo, Norway.	ACE scientists participated in the largest ever gathering of Polar scientists. ACE led projects "Antarctic sea ice in IPY" and "Climate of Antarctica and the Southern Ocean were prominent in the sessions, with a large number of papers presented that resulted from these projects.	June 2010
Face to face briefings	ABARE, DAFF, DCEE, DIISR, Premier of Tasmania and a number of key corporations	Throughout reporting period
ACE CRC website www.acecrc.org.au	Regular updates including ACE news and events and news clipping on relevant research topics.	Several times per month

Overall strategy to ensure communications effectiveness

A number of strategies are underway to maximise communications effectiveness. An ACE Communications and Media Plan is under development to reflect the recent changes in the CRC Participants and the new research and utilisation objectives. This plan will have 'effectiveness'

measures incorporated within it. A communications and media specialist is being recruited. Regular review processes are being established with key stakeholders to check effectiveness and an End User Committee is to be established.

2.5 Intellectual Property Management

Identification of current project IP is being undertaken as part of the ACE CRC Project Plans (Schedule 3 ACE CRC Participants Agreement).

Upon its creation ACE CRC IP is owned by the Participants in proportion to their respective Participant Share. ACE CRC IP is managed by the Board but it is administered by UTAS as Centre Agent on behalf of the Participants. External project IP is owned in accordance with the relevant external project agreement. The ACE Board decides whether patent or other types of IP protection are required.

The ACE CRC IP is managed in accordance with the ACE CRC Participants Agreement. The IP clauses within the Agreement were established in accordance with the National Principles of IP Management.

ACE CRC guiding principles are outlined in its vision and mission as follows: Our vision is to provide science, knowledge and understanding to help Australia meet the challenges of climate change. Our mission is to understand the crucial role played by Antarctica and the Southern Ocean in global climate, and the impacts of climate change on Australia and the world. From this understanding, our objective is to inform governments and the community about climate change to guide everyone's future.

These form the basis of our approach to the management of IP, which is primarily to deliver the IP in a form which maximises its availablility and transfer to Australian government, industry and the community.

The ACE CRC does not hold any patents.

3 Performance against Activities

3.1 Progress against the Key Challenge

1. Oceans: The Southern Ocean and Sea Level Rise (SLR)

How is the Southern Ocean changing, and the implications that this will have for Australian and global climate now and in the future.

ACE is exploiting the recent revolution in ocean observations to investigate the role of the Antarctic Circumpolar Current and overturning circulation in global and regional climate. One such example is that ACE is using profiling floats that drift with the ocean currents and periodically rise to the surface to transmit temperature and salinity measurements. Miniaturised oceanographic sensors attached to seals are providing information on seal biology and measurements of the ocean beneath the winter sea ice. Ships and satellites are also being used to measure the Southern Ocean.

ACE uses an integrated mix of sustained multi-disciplinary observations and process-focused experiments using ships, satellites, floats, and moorings to determine the nature and causes of changes in the Southern Ocean. New technologies have been developed to fill "blind spots" in existing data. For example, oceanographic sensors used to understand elephant seal ecology that are mounted on the animals, have also allowed monitoring of the ocean under the sea ice, and the use of moorings has allowed for the monitoring of Antarctic Bottom Water (AABW). We are also repeating tests previously carried out to calibrate changes in ocean characteristics and using satellite altimetry to determine how the Antarctic Circumpolar Current (ACC) distributes surface chlorophyll and sea ice, and to monitor regional variations in sea surface height. This allows Intergovernmental Panel on Climate Change (IPCC)-class models to be tested against our observations, identifying aspects that need to be improved to deliver more reliable climate predictions.

By collaborating with US, French, German, Chinese and Japanese partners at other locations around the region, ACE is improving the knowledge of current and future changes in the Southern Ocean. The more accurate data ACE is collecting allows us to improve global climate models and climate projections. This reduction in uncertainty is vital for the world to plan for the future.

One of the most significant impacts of climate change will be a rise in sea level. Recent research by ACE and others has shown that sea levels are rising at rates near the higher end of previous projections and that the rate of sea-level rise is accelerating. The Sea Level Rise (SLR) Impacts project will focus on providing decision-makers with targeted assessments of the risk of sea-level rise. This work will include the effects of storm surges and recession of the coast line.

ACE is addressing current knowledge gaps by conducting research to better understand how complex climate processes work and how the combined effects of climate change and sea-level rise may interact. By providing technical consulting about sea-level rise and climate change vulnerability, specialised vocational training for governments and industry and a sea-level rise decision support tool (www.sealevelrise.info), ACE is helping Australians plan and prepare for sea-level changes in the future. The tool provides key stakeholders an understanding of how to assess risk to existing assets, plan adaptations, and set appropriate design codes and planning strategies for future developments.

2. Cryosphere: Impacts of Changing Snow and Ice Cover

How will sea ice and the Antarctic ice sheet respond to changes in climate and what impact will changes in the cryosphere have on climate and sea level?

The ACE CRC's Cryosphere program is split into three research projects: The dynamic role of polar ice sheets in future sea level; the role of Antarctic sea ice in the climate system; and Past and present climate: records and dynamics.

The great ice sheets of Antarctica and Greenland hold the largest potential for substantial and prolonged contributions to sea level rise in a warming climate, but present ability to predict these changes is limited. Recent observations suggest that the contribution to sea-level rise from both great ice sheets is increasing, and that this is due to increasing discharge of ice by glaciers, rather than simply by increased melting. Current computer models which simulate ice sheet dynamics and their links within the climate system are inadequate for quantifying the nature, rapidity and extent of the response of the ice sheets to climate change, and this gives rise to the major uncertainty in sea-level predictions over century and longer time scales.

ACE's "dynamic role of polar ice sheets in future sea level" project aims to improve computer models of ice flow dynamics, basal processes and interactions with atmosphere and ocean. We will collaborate with international efforts in model development, particularly building on our expertise in ice flow properties and ice-shelf ocean interactions. Models will include stresses, presently neglected in ice sheet models, treatment of basal conditions, including sliding ice and sediments, basal hydrology and subglacial lakes. The transition from grounded ice flow to floating ice shelves will be refined, so that changes at the ocean margins are correctly propagated to the flow in the ice sheet interior.

ACE will join international partners in a major aerogeophysical survey of unexplored sectors of East Antarctica. The suite of instruments will gather vital knowledge of bedrock topography, basal rock, sediment and water conditions to ensure that ice sheet models have real-world boundary data as inputs. The survey targets deep subglacial basins and major outlet glaciers which hold the greatest potential for dynamic ice sheet changes.

The ACE CRC's second Cryosphere project, "The role of Antarctic sea ice in the climate system", revolves around the fact that sea ice is a key component of Earth's climate system. Through a variety of feedback mechanisms, it acts as an agent and indicator of climate change. Sea ice also plays a structuring role in marine ecosystem function. Over the last decades the extent of sea ice and its thickness have decreased in the Arctic, and a reduction in extent is also reported from the Antarctic Peninsula region. However, we do not know how the thickness of Antarctic sea ice is changing.

ACE aims to conduct field-going research including the deployment of an AUV, instrumented with upward-looking sonar to measure sea ice draft. In situ observations to validate/calibrate satellite remote sensing including airborne laser altimetry will also be conducted, as well as remote sensing and deployment of sea ice mass balance stations, equipped with biological sensors, and sea ice drifting buoy arrays.

The last project in the Cryosphere program is “Past and present climate: records and dynamics”. Climate records from the Antarctic region, Southern Hemisphere and even Australian region are relatively sparse and of short duration. The IPCC reports have underscored the need for more records from the Southern Hemisphere. These records are needed to support climate reconstructions, process studies and to test models. This project will provide additional high resolution climate records for the Antarctic, develop existing records and use these to investigate regional and hemispheric climate processes, with emphasis on connections to Australian climate.

In order to investigate this, ACE aims to expand the spatial extent, and extend the temporal length of the network of high-resolution ice core records from East Antarctica. We also plan to calibrate high resolution ice core records against modern meteorological data, and use these to probe climate dynamics over timescales beyond the instrumental period. Finally, ACE aims to investigate longer-term fundamental climate processes related to forcing changes due to insulation and greenhouse gas variations over the last glacial cycle, and explore hemispheric climate coupling and abrupt climate change events.

3. Carbon: Southern Ocean Uptake

Will the Southern Ocean continue to remove CO_2 from the atmosphere and how rapidly will this increase the acidity of the ocean?

Currently one third of humankind’s annual emissions of the fossil-fuel derived greenhouse gas, Carbon Dioxide (CO_2), are absorbed by the oceans The Southern Ocean presently absorbs about half of that total.. The oceans act as a reservoir, called a Carbon Sink, which accumulates and stores carbon via its physicochemical and biological processes.

The absorption of CO_2, however, comes with a cost – an increase in ocean acidity. This will have potentially serious impacts, within the 21st century, for the sustainability and management of many marine and coastal ecosystems and fisheries. Acidification is occurring first in polar seas, and for this reason examining ecosystem responses in the Southern Ocean offers a bellwether for probable impacts around Australia.

ACE CRC collaborates with many organisations and countries around the world in the pursuit of understanding the ability of the Southern Ocean to draw down atmospheric carbon, and whether or not the ocean carbon sink has a saturation point. Understanding the Southern Ocean’s ability to sequester carbon is vital for understanding our environmental future and, as emphasised by the IPCC, is of crucial importance for the setting of efficient emissions reductions to limit climate warming.

The ACE Carbon program has the overall goal of quantifying the role of the Southern Ocean in the global carbon cycle. It focuses on 3 key projects.

The first of these projects involves measuring the magnitude of uptake of atmospheric CO_2, the processes that control this uptake, and their propensity for change. The Southern Ocean’s ability to uptake CO_2 will not continue at current rates if global climate change reduces the rate of overturning oceanic circulation and hence hampers the effectiveness of the physical pump. Also changes in sea ice cover, ocean warming and stratification, and lack of supply of the limiting trace nutrient iron all potentially have negative effects on the effectiveness of the biological pump to lock CO_2 in the

Southern Ocean carbon sink. An important question ACE is studying is whether or not the ocean has a carbon saturation point. Will the ocean, at some point in the future, be no longer capable of sequestering CO_2 from the atmosphere?

Determining the extent of ocean acidification caused by the uptake of CO_2, and its biogeochemical ramifications, is the second project in the Carbon program. The overall goal ACE is to determine how the progress of acidification depends on both the uptake of anthropogenic CO_2 and its interaction with naturally varying processes that control the distributions of alkalinity, dissolved inorganic carbon, and nutrients. By obtaining samples during Antarctic voyages, we hope to both map the progress of acidification and measure the amount of particulate inorganic carbonate (PIC) suspended in surface waters. This will allow us to estimate of the abundance of carbonate forming organisms that may be impacted by ocean acidification.

The final Carbon project will involve examining the potential and ecological risks of increasing Southern Ocean uptake of CO_2 via ocean iron fertilisation. ACE aims to study natural iron fertilisation to investigate the associated extent of carbon uptake and ecosystem health and compare these results to deliberate fertilisations. ACE then will assess the efficacy and risks of ocean fertilisation using field observations, synthesis, and numerical simulations. ACE collaborates with DCCEE, SEWPAC, ACCESS, the Australian Climate Change Science program, CSIRO, AAD and other international agencies (IOCCP, CO2/CLIVAR, GEOTRACES, and IPCC). Impacts of ACE's research include cost savings by governments and industry derived from more accurate carbon cycle models and more informed carbon management strategy.

4. Ecosystems: Impacts of Climate Change on Antarctic Marine Life

What will be the impact of Southern Ocean and sea ice changes on Antarctic ecosystems and fisheries?

The Ecosystem Impacts program addresses the challenge of what will be the impact of Southern Ocean and sea ice changes on Antarctic ecosystems and fisheries. The current expectation is that the "keystone" nature of krill will remain the same but that the productivity of the ecosystem will generally decline with the loss of sea ice. However, emerging science is showing that the productivity of the system is uncertain and that the development of a pelagic system without sea ice may result in the structure of the food web shifting from a krill-based food web to a fish-based food web, such as that seen on the Kerguelen Plateau. This could seriously impact fisheries in the region, and the conservation of whales and other higher predators. A combination of field studies along with qualitative and quantitative modelling will evaluate different scenarios for the Antarctic marine ecosystem based on prognoses of change from the IPCC AR5 analyses.

The Ecosystem program plans to research the impact of Southern Ocean and sea ice changes on Antarctic ecosystems and fisheries by focussing on 4 key projects. The first of these will be to assess the risks to key species of Southern Ocean marine ecosystems from climate change impacts, such as temperature and ocean acidification.

Literature and expert opinion will be used in a risk assessment framework to assess species' responses to climate change scenarios, including the development of conceptual models of the

impacts of change in the physical environment and food webs. Spatial modelling will ascertain key environment drivers for species. IPCC AR5 results will be used to ascertain change in those drivers and the likely consequences to species distributions and dynamics.

The second project in the Ecosystems program aims to contribute to determining the ecosystem impacts of predicted changes in Antarctic sea ice by evaluating the linkages between ocean productivity and the spatial and temporal dynamics of the sea ice zone, including sea ice physical and biological parameters.

A realistic model of sea ice algal productivity will be developed which requires a model of algae attached to the underside of the sea ice as well as algae entrapped in the brine channels throughout the entire ice thickness. Furthermore, the Ecosystems program aims to collate historical datasets. Thus, a dataset will be developed where, at present, there are no geological compilations of data on sea ice biological and biogeochemical parameters from ice cores. The number of ice cores to be included in this database is likely to increase as more scientists become involved and release their unpublished data.

The third aspect of this project will be to conduct in-situ studies, including field programs. In situ measurements of ice algal biomass and production and an understanding of how they relate to the physical attributes of sea ice and the water column are essential for developing the spatial models and the dynamic simulation models.

Identification of key food web processes that could be impacted by changes in the physical and biogeochemical environments in eastern Antarctica is the third project involved in the Ecosystems program. This project has been split into two parts.

Part 1 will include regular sampling on the SR3 oceanographic transect combined with spatial statistical analyses of available data will be used to evaluate the types of changes in phytoplankton and zooplankton assemblages that could arise as a result of a changing climate and the mechanisms that could cause those changes.

Part 2 will include the development of a ship- and land-based integrated ecosystem study to evaluate the primary food web linkages from phytoplankton to top predators in eastern Antarctica. This project will be a multidisciplinary food web study including integration of land-based and sea-based activities in collaboration with other relevant projects in the Australian Marine Mammal Centre at the AAD.

The last project in this program focuses on drawing on the results of the other ACE CRC Ecosystem Impacts projects to create a second generation marine ecosystem model which will be used to assess historical and future climate change impacts on Antarctic marine ecosystems, as well as to evaluate the types of objectives that could be appropriate for the conservation of Southern Ocean taxa.

Models currently under development include the Ecosystem Productivity Ocean Climate (EPOC) modelling framework, a ROMS model of eastern Antarctica and the Kerguelen Plateau and the Australian Earth-system model through ACCESS. This project aims to synthesise and integrate knowledge on food webs and ecosystems to build a second generation model that couples EPOC

with the ROMS model. This will require reviews of different components of the ecosystem and to develop an appropriate representation of those components in the modelling environment. Testing will be needed to develop the most efficient representations possible of each module while still preserving their sensitivity to climate change impacts.

The enhanced ecosystem models will be coupled to an ocean-ice-atmosphere model through the Regional Ocean Modelling System (ROMS), in partnership with the modelling group at Old Dominion University, USA. Once developed, experiments can be undertaken based on plausible scenarios for climate change impacts, as developed in the other three projects in the ACE CRC Ecosystem Impacts program.

An important component of this early phase is to develop user-friendly interfaces for model development that will enable greater participation of ecologists and modellers alike from partner laboratories in Australia and overseas.

3.2 Research

1. Oceans

The ACE CRC's Oceans program is on target to achieve its research outputs but research was hampered by the delay in commencement of staff taking up new positions. Although all positions were filled, none commenced in the reporting period.

On 23rd June 2010 the IPCC released the author list for its fifth assessment report (AR5) in which Dr Stephen Rintoul was announced as a coordinating lead author of the "Observations: Oceans" chapter and Prof Nathaniel Bindoff was announced as a coordinating lead author of the "Detection and Attribution of Climate Change: from global to regional" chapter. These appointments of ACE researchers ensure input into the IPCC process fundamental to the CRC's goals of contributing to global understanding and science.

The first IPCC workshop in Kuala Lumpur was attended by Prof Nathan Bindoff during the reporting period.

Australia deployed 35 floats in the Southern Ocean between January 1 and June 30 2010. The majority of these were funded by IMOS2 – EIF.

Moorings in the Mertz polynya (and additional floats) will be deployed on a voyage on Aurora Australis leaving Hobart around the end of 2010. Between January 1 and June 30 2010 the new moorings were designed, built and tested in preparation for their deployment.

Future sea-level rise work involves developing the web-based decision-support tool (www.sealevelrise.info) further. Currently it provides probabilistic assessments of the likelihood of extreme flooding events between 2010 and 2100 (information available in 10-year time intervals) for 29 key locations around the Australian coastline. Our intention is to develop the web tool so that it integrates effects such as sea-level rise, tides, surges, waves, estuarine flooding and coastal

recession, and will generally be applicable to the whole Australian coastline. We will also develop a technique to convert probability and frequency assessments into actual risk (i.e. estimated impacts in terms of cost).

A National Stormtide Modelling Workshop was held on 27 July 2010 in Melbourne and attended by Dr John Hunter and Tessa Jakszewicz, to discuss the need for a national stormtide model, the current research completed and the future directions of the Cyclone Strategy project.

2. Cryosphere

The ACE CRC's Cryosphere program is on target to achieve its research outputs and has completed several milestones which are not due until the 2010/2011 reporting period.

Highlights of this period include; a successful ice core field project that recovered a new core from Mill Island; a second successful ICECAP airborne radar season, which is already producing interpreted products; a major publication in *Nature Geoscience* on the link between Antarctic precipitation and southwest Western Australian drought; and, high profile coverage in the journal *Science* of our East Antarctic work with ICECAP.

Milestone 2.2.3"Laser aerial measurements undertaken and capability expanded to fixed-wing aircraft" was affected by logistical problems in 2010. Aerial sea ice work during the transit of the sea-ice zone during V1 2009/10 was cancelled due to operational constraints. Some opportunistic work was undertaken from Davis Station, however, and hardware has been upgraded and improved. Five days of sea ice science are scheduled in 2010, which will allow for more aerial work to be done.

Dr Tessa Vance was appointed and commenced her employment during the reporting period, but Dr Adam Treverrow, Mr Alex Fraser, Dr Ben Galton-Fenzi and Miss Laura Herraiz-Borreguero have all been appointed since the reporting period.

Progress has deviated slightly from the work plan in some respects: while the research team has been assembled, human resource limits and the priorities given to ACE's participation in ICECAP have slowed model development. However with additional staff in place ACE will be on track by the next reporting period. Sea-ice radar fieldwork was impacted by logistical constraints in last season, slowing some of the development work, but this will be rectified in spring 2010 by an allocation of voyage time for this work.

3. Carbon

The ACE CRC's Carbon program is on target to achieve its research outputs.

Research in this period was hampered by the delay in appointed staff taking up new positions. Compilation of information on the controls on Southern Ocean CO2 uptake and resulting acidification will be advanced on the arrival of the postdoctoral fellow in early 2011.

The complex nature of iron as a limiting nutrient in to Southern Ocean primary production (and thus biological CO2 uptake) was further demonstrated in multiple publications on iron availability in sea-ice and seawater, iron supply from shelf sediments and deep ocean hydrothermal sources, and iron-recycling by whale feeding.

Results from ACE research has shown that there is no enhancement of carbon transfer to the interior of the ocean in naturally iron-fertilised waters in the Sub-Antarctic zone to the east of Tasmania, despite elevated biomass. This is in contrast to results from the polar frontal zone over the Kerguelen plateau.

ACE contributed to provide leadership by contributing to the Southern Ocean component of the global surface ocean carbon atlas (SOCAT).

The program of underway observations on RV Astrolabe between Hobart and Antarctica will continue and be augmented with additional bio-optical and biogeochemical measurements to examine links between biomass and primary production. The Southern Ocean Times Series automated moorings will be deployed for a second year to determine seasonal controls on air-sea CO2 exchange and carbon transport to the ocean interior.

4. Ecosystems

The ACE CRC's Ecosystems program is on target to achieve its research outputs.

Publications from major research voyages including BROKE West and SIPEX are now completed. Preparatory work is also completed with the filling of vacant positions, due to begin in January 2011.

The late appointment of staff meant delays in achieving milestone 4.1.2: Strategies for 2nd generation model, inclusion of ecosystem considerations in IPCC 5. An Ecosystems Modeller, Dr Stuart Corney, is due to commence employment in January, who will immediately begin work on this milestone.

Substantial progress and publications on risk assessments of climate change impacts on different components of Antarctic marine ecosystems will form the foundation for further dynamic ecosystem modelling. A prototype ocean-ice model for eastern Antarctica and the southern Indian Ocean will be developed to form the foundation of food web modelling in the region. Prototype components for a fish-based food web model will be completed.

3.3 Utilisation, Commercialisation and End User Engagement

Achievement of utilisation/commercialisation outputs:

Utilisation No.	Program	Utilisation Milestone	Due Date	Progress	Strategies in Place to Address any Issues
1.1.1; 2.1.1; 3.1.1; 4.1.1	Oceans; Cryosphere; Carbon; Ecosystems	Conduct workshop with 30 key research users, including government departments relevant commercial	30 June 2010	End users workshop held in Canberra June 2010 including government departments: DAFF, DCCEE, DEWHA,	Workshop for research and commercial participants scheduled for August 2010

Utilisation No.	Program	Utilisation Milestone	Due Date	Progress	Strategies in Place to Address any Issues
		participants and research partners		DFAT, DIISR, NRM, Office of Chief Scientist and ONA	
1.1.2; 2.1.2; 3.1.2; 4.1.2	Oceans; Cryosphere; Carbon; Ecosystems	Establish liaison and review mechanism with key government departments, research partners and commercial participants	30 June 2010	Face-to-face meetings conducted with key government contacts	An ACE CRC End User Committee is under development. Timetable for further face-to-face meetings to be established
1.2.1	Oceans	Conduct training workshops and seminars in major capital cities in use of probability assessment tool (~ 150 participants)	30 June 2010	Workshop held in Melbourne (Feb 2010) and seminar in Hobart (April 2010). 110 participants	Developing an online training tool to reach a broader audience more easily and increase usage

Strategies for ensuring uptake by end-users of the research outputs and the current levels of uptake;

The strategy for ensuring uptake of ACE research is to build on our previous successful research utilisation plan which focussed on the publication of timely, plain-English assessments of recent developments in climate science and related policy issues; proactive and regular liaison with industry and government; regular workshops and seminars for industry and government across all research programs; and a strategic communications plan. In addition ACE is in the process of establishing an End User Committee to help guide our utilisation program and the development of tools to assist end user uptake. Current level of uptake of new research is low as we have just commenced our new research program.

Commercialisation arrangements with industry, including SMEs;

ACE CRC has a commercial agreement with SME consulting firm Pitt&Sherry in relation to the development and commercialisation of ClimateAsyst® (a decision support tool that assists owners, managers and planners assess the susceptibility of their infrastructure to projected changes in climate). ClimateAsyst® is currently being promoted within Tasmania with a view to marketing it nationally and internationally.

Details of any new or improved products, services or processes

ClimateAsyst® is scheduled for full commercial launch. The sealevelrise.info decision-support tool is undergoing a number of enhancements scheduled for release later in financial year 2010-2011.

Specific benefits to end-users (including SMEs), their nature and scale;

End user benefits will arise from being able to make policy and business decisions using tools to more accurately assess the likely impacts of climate change. For example, coastal infrastructures owners will be able to use our sea-level rise decision support tool (sealevelrise.info) to assist in deciding what height above sea level to build their asset (a recent assessment for a new airport runway identified a $1 million build cost for each extra centimetre above sea-level). The datasets from the Climate Futures for Tasmania project have been used by end users to calculate the cost of climate change to their business (data commercial-in-confidence). ClimateAsyst® will be used by infrastructure owners, engineers and managers to analyse the affect that changing climate variables will have on infrastructure.

Spin off companies

The ACE CRC has not established any spin off companies.

3.4 Education and Training

At the beginning of the reporting period UTAS established the Institute for Marine and Antarctic Studies (IMAS) to bring together the Tasmanian Aquaculture and Fisheries Institute (TAFI), the Institute of Antarctic and Southern Ocean Studies (IASOS), and several university researcher schools with marine interests. IASOS had previously provided the education program within the “Old” ACE CRC via inkind contributions from the university. This contribution in the “new” ACE will be provided principally through IMAS.

IMAS staff teach into undergraduate science degrees, and graduate diploma, honours, coursework masters, research masters and PhD programs. Students study a range of topics relevant to Antarctica and the Southern Ocean.

In the reporting period 5 PhD students commenced. UTAS has commenced a new Elite PhD Scholarship program. ACE CRC has listed 13 student projects for this new program. ACE CRC also worked closely with CSIRO-UTAS QMS program in an effort to improve recruitment of candidates.

A total of 17 current students are being supervised by staff from the AAD; 17 by staff of CSIRO and 19 by staff funded directly by ACE CRC.

Three students who submitted their thesis for examination in the period were successful in securing postdoctoral positions one interstate and two overseas.

In addition ACE CRC provided travel support for conferences to four PhD candidates during the period.

Ten students were enrolled in the Masters of Antarctic Science by coursework at the end of reporting period. The course is designed to produce expertly trained scientists with international experience and research skills in the area of Antarctic marine science. At the end of the reporting period 5 honours students were enrolled in ACE CRC related projects.

3.5 SME Engagement

There are four SME Participants within the CRC. These are Metocean, Myriax, Pitt&Sherry and SGS Economics and Planning. These organisations are participating in a number of our research programs, working closely with our research scientists, sharing and building research capability. Specifically, ACE CRC has collaborated with Pitt&Sherry to assist them to develop ClimateAsyst® (a decision support tool that assists owners, managers and planners assess the susceptibility of their infrastructure to projected changes in climate). ClimateAsyst® is currently being promoted within Tasmania with a view to marketing it nationally and internationally.

In conjunction with Pitt&Sherry and SGS Economics and Planning ACE has submitted a number of tenders for climate-change related consulting projects. ACE is awaiting outcomes on a number of opportunities with government.

As well as working closely with selected SMEs as Participants in the CRC, ACE is developing tools which will assist SMEs on a broader scale. These include the development of the ACE CRC sea-level rise decision support tool (which supports SME engineering and consulting firms to make decisions about the design and maintenance of coastal infrastructure). Secondly we are developing a range of vocational training courses in climate change-related topics which will be able to be delivered face-to-face or online to SME end users (such as environmental and engineering consultants). ACE will focus on working with peak bodies such as Engineers Australia to assist us in marketing our products and services.

During the reporting period the following SME engagement activities occurred:

Activity	Description	Date
Meeting with Pitt&Sherry	Development of ClimateAsyst; consulting projects for sea-level rise assessments	March 2010
Meetings with SGS Economics and Planning	Development of sea-level rise decision support tool and consulting projects for sea-level rise assessments	Jan, Feb March 2010
Estimating Sea-level Rise in an Uncertain Future	Vocational training workshop in Melbourne attended by a number of SME consulting firms.	February 2010

3.6 Collaboration

Currently, the ACE CRC collaborates with 66 organisations. Of these, 13 are Australian/ New Zealanders, 11 Asian, 17 North American and the remaining 24 are scattered throughout Europe.

For further discussions on end-user collaborations, see section 4.4 of this report.

The ACE CRC relies on collaboration for the enhancement of scope of research by the provision of additional funds and staff. One example in the current period is the ICECAP project. ICECAP, International Climate and Environmental Change Assessment Project, is an essential part of Cryosphere milestone 2.1: "A high resolution 3-dimensional dynamical ice sheet and ice shelf model for improved assessment of future response of the Antarctic and Greenland ice sheets to climate change." ICECAP is an international collaboration including participants from the research communities in the UK and the USA with access to resources much larger than the ACE CRC cryosphere project.

ACE's contribution to this project means that ICECAP extends the range of the scanned grid which the ICECAP team were originally investigating, making resulting data more thorough and thus more reliable.

The ICECAP project aims to reduce uncertainty in future sea-level rise arising from better model predictions. These are based on improved physics and better knowledge of the boundaries (bed rock) of the ice sheet.

4 Other activities

ACE CRC continued to undertake a number of externally funded research and consultancy activities, primarily in the areas of fine-scale climate modelling and analysis (Climate Futures for Tasmania) and sea-level rise impact assessments.

Climate Futures for Tasmania is an externally funded, collaborative research project that is generating improved climate change information for Tasmania over the 21st century. During the reporting period there was an intense focus on the analysis of data sets and the preparation of technical reports: Climate Modelling, General Climate Impacts, Water and Catchments, Agricultural Impacts and Extreme Events. These reports will be distilled into a series of end user orientated documents. The project continued its emphasis on end user engagement activities. There were over 20 complementary research projects in progress using the Climate Futures data sets. The science emerging from the project was tested and reviewed at several national and international conferences, where the pioneering efforts in dynamical downscaling global climate models over Tasmania attracted much interest and complements.

ClimateAsyst: The ACE CRC has a commercial agreement with SME consulting firm Pitt&Sherry in relation to the development and commercialisation of ClimateAsyst®. The project received funding from the Tasmanian and Local Governments. ClimateAsyst® is a software tool that assists infrastructure asset owners to understand the potential impacts of future climate change on their infrastructure at a local scale. ClimateAsyst® outputs help end users to determine the risk to existing infrastructure from a changing climate or whether current design codes for planned infrastructure will still be adequate. ClimateAsyst® is currently being promoted within Tasmania with a view to marketing it nationally and internationally.

Estimating Sea-Level Extremes in an Uncertain Future: This project is co-funded by the DCCEE and has delivered a web-based decision support tool (www.sealevelrise.info). Users can determine the appropriate allowance for sea-level rise depending on the location, greenhouse gas emission scenario and the level of acceptable flooding risks. Approximately 1000 individuals from federal, state and local government and from industry have been trained in the use of the web tool through a national series of seminars and workshops. Further enhancements to the web tool are planned as part of our 2010-2014 CRC program.

Sutherland Shire Council NSW: In conjunction with commercial participant GHD, ACE CRC delivered an assessment of likely future sea-level rise impacts to council coastal infrastructure.

Tasmanian Planning Commission SLR Project: This project is a collaborative project with UTAS. It combines GIS mapping, storm-tide modelling and sea-level rise probability of flooding data. It will be able to determine and map the probability of flooding from the sea for all parts of the Tasmanian coastline where there is LIDAR data.

WA Government Department of Transport: A second technical review of the draft WA Government report 'Sea Level Change in Western Australia; Application to Coastal Planning' was requested and delivered.

5 Glossary of Terms

Abbreviation	Organisation Name
A	
AABW	Antarctic Bottom Water
AAD	Australian Antarctic Division
AARI	Arctic & Antarctic Research Institute (RUS)
AARP	Australian Antarctic Research Programme
AAS	Australian Academy of Science
AASGS	Australian Antarctic Science Grants Scheme
ACC	Antarctic Circumpolar Current
ACCESS	Australian Computational Earth Systems Simulator
ACCSP	Australian Climate Change Science Program
ACE CRC	Antarctic Climate & Ecosystems Cooperative Research Centre
ACROSS	Australian Centre for Research on Separation Science
AGO	Australian Greenhouse Office (now DCCEE)
AIMS	Australian Institute of Marine Science
AINSE	Australian Institute of Nuclear Science and Engineering
ANMS	Argentine Navy Meteorological Service (ARG)
ANU	Australian National University
AME	Antarctic Marine Ecosystems Program, ACE CRC
AMISOR	Amery Ice Shelf Ocean Research
ANDRILL	Antarctic Drilling Project
ANSTO	Australian Nuclear Science and Technology Organisation
AORI	Atmosphere and Ocean Research Institute, University of Tokyo (Japan)
APAC	Australian Partnership for Advanced Computing
ARA	Airborne Research Australia (FlindersU)
ARC	Australian Research Council
ARCNESS	Australian Research Council Network for Earth System Science
ASAC	Australian Science Advisory Committee
ASPI	Australian Strategic Policy Institute
AUV	Autonomous Underwater Vehicle
AVCAL	Australian Private Equity & Venture Capital Association Ltd
AWI	Alfred Wegener Institute for Polar Research (DEU)
B	
BAS	British Antarctic Survey (GBR)
BCCR	Bjerknes Centre for Climate Research
BoM	Bureau of Meteorology
BROKE-West	Baseline Research on Oceanography, Krill and the Environment (western sector)
C	
CAML	Census of Antarctic Marine Life
CASO	Climate of Antarctica and the Southern Ocean
CCA	Colorado Center for Astrodynamics (USA)
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CCPO	Centre for Coastal Physical Oceanography (USA)
CEAMARC	Collaborative East Antarctic Marine Census
CERF	Commonwealth Environmental Research Facilities Program
CFT	Climate Futures for Tasmania
CliC	Climate and Cryosphere Program (WCRP)
CLIVAR	Climate Variability and Predictability Program (WCRP)
CMA	Chinese Meteorological Association (CHN)
CMAR	CSIRO Marine & Atmospheric Research
CNRS	Centre National de la Recherche Scientifique (FRA)
CO2	Ocean Control of Carbon Dioxide Program, ACE CRC
CPOM	Centre for Polar Oceanography and Modelling (GBR)

Abbreviation	Organisation Name
CRC	Cooperative Research Centre
CRREL	Cold Regions Research and Engineering Laboratories (USA)
CRESIS	Centre for Remote Sensing of Ice Sheets (USA)
CSL	Central Science Laboratory, UTAS
CVC	Climate Variability and Change Program, ACE CRC
D	
DCCEE	Department of Climate Change and Energy Efficiency (formerly AGO)
DED	Tasmanian Department of Economic Development
DEEWR	Department of Education, Employment & Workplace Relations
DEWHA	Department of the Environment, Water, Heritage & the Arts
DFAT	Department of Foreign Affairs and Trade
DIER	Tasmanian Department of Infrastructure, Energy & Resources
DIISR	Department of Innovation, Industry, Science & Research
DPAC	Tasmanian Department of Premier & Cabinet
DPIW	Tasmanian Department of Primary Industries & Water
DRI	Desert Research Institute (USA)
E	
EA	Environment Australia (now DEWHA)
EPICA	European Project for Ice Coring in Antarctica
ENEA	Ente per le Nouve Technologie, l'Energia e l'Ambiente (ITA)
ESF	European Science Foundation
ESA	European Space Agency
EUROCEANS	European Network of Excellence for Ocean Ecosystems Analysis
G	
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 & Nuclear Science (NZL)
I	
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
ICSU	International Council for Science
IFREMER	Institut Français de Recherche pour L'Exploitation de la Mer (FRA)
IGOS	Integrated Global Observing Strategy
ILTS	Institute of Low Temperature Science, Hokkaido University (Japan)
IMAS	Institute of Marine and Antarctic Studies, University of Tasmania
IMOS	Integrated Marine Observing System
INGV	Instituto Nazionale di Geofisica e Vulcanologia, sezione di Roma (ITA)
IPCC	Intergovernmental Panel on Climate Change
IPY	International Polar Year 2007–2008
ISSI	International Space Science Institute
ITASE	International Trans Antarctic Scientific Expedition
IWC	International Whaling Commission
J	
JAMSTEC	Japan Marine Science and Technology Center (JPN)
JAXA	Japanese Aerospace Exploration Agency (JPN)
K	
KEOPS	Kerguelen compared study of Ocean and Plateau in Surface waters
KIT	Kitami Institute of Technology (JPN)
L	
LDEO	Lamont Doherty Earth Observatory (USA)
LEGOS	Laboratoire d'Etudes en Geophysique et Oceanographie (FRA)
LGGE	Laboratoire de Glaciologie et Géophysique de l'Environnement (FRA)

Abbreviation	Organisation Name
LiDAR	Light Detecting and Ranging equipment
LOBB	Laboratoire d'Océanographie Biologique de Banyuls (FRA)
LOCEAN	Laboratoire d'Océanographie et du Climat: Expérimentations et Approches Numériques (FRA)
LOHAFEX	Ocean iron fertilisation experiment (IND)
LOV	Laboratoire d'Océanographie Villefranche (FRA)
LSCE	Laboratoire des Sciences du Climat et de l'Environnement (FRA)
M	
MEXT	Ministry of Education, Culture, Sports, Science & Technology (JPN)
MIT	Massachusetts Institute of Technology (USA)
N	
NASA	National Aeronautics and Space Administration (USA)
NCI	National Computational Infrastructure (Canberra)
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)
NMIT	New Mexico Institute Technology (USA)
NSF	National Science Foundation (USA)
NSIDC	National Snow and Ice Data Centre (USA)
O	
OOV	Oceanographic Observatory of Villefranche-sur-mer (FRA)
ODU	Old Dominion University (USA)
P	
POL	Policy Program, ACE CRC
POL	Proudman Oceanographic Laboratory (GBR)
PRIC	Polar Research Institute of China (CHN)
R	
RSES	Research School of Earth Sciences (Australian National University)
ROV	Remotely Operated Vehicle
RUTGERS	Rutgers University (USA)
S	
SAZ	Sub-Antarctic Zone
SAZ-SENSE	Sensitivity of Sub-Antarctic Zone waters project
SCAR	Scientific Committee on Antarctic Research
SEWPAC	Department of Sustainability, Environment, Water, Population and Communities
SES	State Emergency Service
SGI	Silicon Graphics International
SIMBA	Sea-ice Mass Balance in Antarctica
SIO	Scripps Institute of Oceanography (USA)
SIPEX	Sea-ice Physics & Ecosystem Experiment
SLR	Sea-level Rise Program, ACE CRC
SSI	Space Science Institute (USA)
SURVOSTRAL	Surveillance de l'Océan Austral project (FRA)
T	
TERSS	Tasmanian Earth Resources Satellite Station
TIAR	Tasmanian Institute of Agricultural Research
TPAC	Tasmanian Partnership for Advanced Computing
U	
U3A	University of the Third Age
UN	United Nations
USGS	United States Geological Survey (USA)
UTAS	University of Tasmania
W	
WCRP	World Climate Research Programme

Abbreviation	Organisation Name
WHOI	Woods Hole Oceanographic Institute (USA)
WMO	World Meteorological Organisation
WOCE	World Ocean Climate Experiment (WCRP)

6 Appendix

1. Refereed journals

Authors	Year	Title	Journal	Vol and Edition	Pages	doi	Accepted but not yet published
Nicol S and Meiners K (eds)	2010	"BROKE-West" a biological/oceanographical survey off the coast of east Antarctica (30-80°E) carried out in January-March 2006	Deep-Sea Research II – Topical Studies in Oceanography	Volume 57 Issues 9-10	693-991	Special Volume	
Gaebler-Schwarz S, Davidson AT, Assmy P, Chem J, Henjes J, Noethig E, Lunau M, Medlin L A	2010	A new cell stage in the haploid-diploid life cycle of the colony-forming haptophyte *Phaeocystis antarctica* and its ecological implications.	Journal of Phycology				Accepted
Jarvis T, Kelly N, Kawaguchi S, van Wijik E and Nicol S	2010	Acoustic characterization of the broad-scale distribution and abundance of Antarctic krill (Euphausia superba) off East Antarctica (30-80°E) in January-March2006	Deep-Sea Research Part II	Volume 57 Issues 9-10	916–933	10.1016/j.dsr2.2008.06.013	
Gedamke J and Robinson SM	2010	Acoustic survey for marine mammal occurrence and distribution off East Antarctica (30-80°E) in January-February2006	Deep-Sea Research Part II	Volume 57 Issues 9-10	968–981	10.1016/j.dsr2.2008.10.042	
Chever F, Sarthou G, Bucciarelli E, Blain S, Bowie AR	2010	An iron budget during the natural iron fertilization experiment KEOPS (Kerguelen Island, Southern Ocean)	Biogeosciences	7	455-468	www.biogeosciences.net/7/455/2010/	
Lei, R., Li, Z., Cheng, B. Zhang, Z., and Heil, P.	2010	Annual cycle of landfast sea ice in Prydz Bay, East Antarctica	Journal of Geophysical Research, Oceans	115		10.1029/2008JC005223	
Williams, G. D., S. Aoki, S.S. Jacobs, S.R. Rintoul, T. Tamura and N.L. Bindoff	2010	Antarctic Bottom Water from the Adelie and George V Land Coast, East Antarctica	Journal of Geophysical Research – Oceans	115	C04027	10.1029/2009JC005812	
Kramer M, Swadling KM, Meiners KM, Kiko R, Scheltz A, Nicolaus M, Werner I	2010	Antarctic sympagic meiofauna in winter: comparing diversity, abundance and biomass between the western Weddell Sea and the southern Indian Ocean	Deep-Sea Research II – Topical Studies in Oceanography				Accepted
Cheah, W., McMinn A, Griffiths B, Westwood KJ, Webb J, Molina E, Wright SW, van den Enden R	2010	Assessing Sub-Antarctic Zone primary productivity from fast repetition rate fluorometry	Deep Sea Research II				Accepted

Authors	Year	Title	Journal	Vol and Edition	Pages	doi	Accepted but not yet published
Vancoppenolle, M., Timmermann, R., Ackley, S.F., Fichefet, T., Goosse, H., Heil, P., Lieser, J., Leonard, K.C., Nicolaus, M., Papakyriakou, T., and Tison, J.-L.	2010	Assessment of radiation forcing data sets for large-scale sea ice models in the Southern Ocean	Deep-Sea Research II				Accepted
Haward M,	2010	Australia and the Antarctic Treaty' - 50 Years On: Invited Reflections on the Antarctic Treaty	*Polar Record*	46 (236)	11-14.	10.1017/S0032474099090246	
Gabric A, Cropp R, McTainsh G, Johnston, B, Butler, H, Tilbrook, B, Keywood, M.	2010	Australian dust storms in 2002-2003 and their impact on Southern Ocean biogeochemistry	Global Biogeochemical Cycles	24		Gb2005 10.1029/2009gb003541	
Wen J, Wang Y, Wang W, Jezek K, Liu H, Allison I	2010	Basal melting and freezing under the Amery Ice Shelf, East Antarctica	Journal of Glaciology	56, 195	81-90	10.3189/002214310791190820	
Schwarz JN, Raymond B, Williams GD, Pasquer B, Marsland SJ and Gorton RJ	2010	Biophysical coupling in remotely-sensed wind stress, sea surface temperature, sea ice and chlorophyll concentrations in the South Indian Ocean	Deep-Sea Research Part II	Volume 57 Issues 9-10	701–722	10.1016/j.dsr2.2009.06.014	
Nicol S, Meiners K and Raymond B	2010	BROKE-West, a large ecosystem survey of the South West Indian Ocean sector of the Southern Ocean, 30°E–80°E (CCAMLR Division 58.4.2)	Deep-Sea Research Part II	Volume 57 Issues 9-10	693-700	10.1016/j.dsr2.2009.11.002	
Haward M, Press T,	2010	Commentary: Australia, the Antarctic Treaty and the Law of the Sea	*Australian Journal of Maritime and Oceans Affairs*	2, 1	32-33		
Doblin, MA, Ralph, PJ, Petrou, KL, Shelly, K, Westwood, K, van den Enden, R, Wright, S, Griffiths, B	2010	Diel variation of chl-a fluorescence, phytoplankton pigments and productivity in the Sub-Antarctic Zone	*Deep-Sea Research II*				Accepted
Jones G, Fortescue D, King S, Williams G and Wright S	2010	Dimethylsulphide and dimethylsulphoniopropionate in the South-West Indian Ocean sector of East Antarctica from 30o to 80oE during BROKE-West	Deep-Sea Research Part II	Volume 57 Issues 9-10	863–876	10.1016/j.dsr2.2009.01.003	
Lindsay MCM and Williams GD	2010	Distribution and abundance of Larvaceans in the Southern Ocean between 30 and 80°E	Deep-Sea Research Part II	Volume 57 Issues 9-10	905–915	10.1016/j.dsr2.2009.04.021	

Authors	Year	Title	Journal	Vol and Edition	Pages	doi	Accepted but not yet published
Thomson PG, Davidson AT, van den Enden R, Pearce I, Seuront L, Paterson JS and Williams GD	2010	Distribution and abundance of marine microbes in the Southern Ocean between 30 and 80^{o}E	Deep-Sea Research Part II	Volume 57 Issues 9-10	815–827	10.1016/j.dsr2.2008.10.040	
Lannuzel D, Schoemann V, de Jong J, Pasquer B, van der Merwe P, Masson F, Tison J-L, Bowie AR	2010	Distribution of dissolved iron in Antarctic sea ice: Spatial, seasonal, and inter-annual variability	Journal of Geophysical Research - Biogeosciences	115	G03022	10.1029/2009JG001031	
Pasquer B, Mongin M, Johnston N and Wright S	2010	Distribution of particulate organic matter (POM) in the Southern Ocean during BROKE-West (30^{o}E-80^{o}E)	Deep-Sea Research Part II	Volume 57 Issues 9-10	779–793	10.1016/j.dsr2.2008.12.040	
Van de Putte AP, Jackson GD, Pakhomov E, Flores H and Volckaert FAM	2010	Distribution of squid and fish in the pelagic zone of the Cosmonaut Sea and Prydz Bay region during the BROKE-West campaign	Deep-Sea Research Part II	Volume 57 Issues 9-10	956–967	10.1016/j.dsr2.2008.02.015	
Howard W, Roberts D, Moy A, Lindsay M, Hopcroft R, Trull T, Bray S	2010	Distribution, abundance and seasonal flux of pteropods in the Sub-Antarctic Zone	Deep Sea Research II	SAZ-Sense Voyage Special Edition			Accepted
Lannuzel D, Remenyi T, Lam P, Townsend A, Ibisanmi E, Butler E, Wagener T, Schoemann V, Bowie AR	2010	Distributions of dissolved and particulate iron in the sub-Antarctic and polar frontal Southern Ocean (Australian sector)	Deep-Sea Research II	In press			Accepted
Jordan L, McMinn A, Thompson P	2010	Diurnal changes of photoadaptive pigments in microphytobenthos	Journal of the Marine Biological Society of the UK	90	1025-1032		
Meiners, K.M., Norman, L., Granskog, M.A., Krell, A., Heil, P., and Thomas, D.N.	2010	Eco-biogeochemistry of East Antarctic pack ice during the winter-spring transition	Deep-Sea Research II				Accepted
Cook, SS, Hovenden, MJ, Ralph PJ, Wright, SW & Hallegraeff GM	2010	Ecophysiological differences between two Southern Ocean morphotypes of Emiliania huxleyi (Haptophyta): 2. Non-photochemical fluorescence quenching and xanthophyll cycle responses.	Journal of Phycology				Accepted
Cook, SS, Hovenden, MJ, Wright, SW & Hallegraeff GM .	2010	Ecophysiological differences between two Southern Ocean morphotypes of Emiliania huxleyi (Haptophyta): 1. Photosynthetic Pigment Profiles and Morphotaxonomy.	Journal of Phycology				Accepted

Authors	Year	Title	Journal	Vol and Edition	Pages	doi	Accepted but not yet published
Koubbi, P. , C. Ozouf-Costaz, A. Goarant, M. Moteki, P.-A. Hulley, R. Causse, A. Dettai, G. Duhamel, P. Pruvost, E. Tevernier, A. Post, R. J. Beaman, S. R. Rintoul, T. Hirawake, D. Hirano, T. Ishimaru, M. Riddle and G. Hosie	2010	Estimating the biodiversity of the East Antarctic shelf and oceanic zone for ecoregionalisation: example of the icthyofauna of the CEAMARC (Collaborative East Antarctic Marine Census) CMAL surveys	Polar Science				Accepted
Willatt R, Laxon S, Giles K and Worby A	2010	Field investigations of Ku-band radar penetration into snow cover on Antarctic sea ice	Geophysical Research Letters	48(1)	365-372		
Markus T, Massom R, Worby A, Lytle V, Kutz N and Maksym T	2010	Freeboard, snow depth and sea ice roughness in East Antarctica from in situ and multiple satellite data	Annals of Glaciology				Accepted
Tagliabue A, Bopp L, Dutay J-C, Bowie AR, Chever F, Jean-Baptiste P, Bucciarelli E, Lannuzel D, Remenyi T, Sarthou G, Aumont O, Gehlen M, Jeandel C	2010	Hydrothermal contribution to oceanic dissolved iron inventory	Nature Geoscience	3	252 – 256	10.1038 /NGEO818	
Kookana R; Holz G; Barnes C; Bub K; Fremlin R; Boardman R	2010	Impact of climatic and soil conditions on environmental fate of atrazine used under plantation forestry in Australia	Journal of Environmental Management			10.1016 /j.jenvman.2010 .07.037	Accepted
McMinn′ A., Pankowski A., Ashworth C, Bhagooli R., Ralph P., Ryan K	2010	In situ net primary productivity and photosynthesis of Antarctic sea ice algal, phytoplankton and benthic algal communities	Marine Biology	175	1345-1356	10.1007 /s00227 -010-1414-8	
van der Merwe, P, Lannuzel D, Mancuso Nichols CA, Meiners M, Bowie AR	2010	Iron fractionation in pack and fast ice in East Antarctica: potential for temporal decoupling between the release of dissolved and particulate iron during spring melt	Deep Sea Research II – Topical Studies in Oceanography				Accepted
Kawaguchi S, Nicol S, Virtue P, Davenport SR, Casper R, Swadling KM and Hosie GW	2010	Krill demography and large-scale distribution in the Western Indian Ocean sector of the Southern Ocean (CCAMLR Division 58.4.2) in Austral summer of 2006	Deep-Sea Research Part II	Volume 57 Issues 9-10	934–947	10.1016 /j.dsr2. 2008.06 .014	
Virtue P, Kawaguchi S, McIvor J, Nicol S, Wotherspoon S, Brown M, Casper R, Davenport S, Finley L, Foster J, Yoshida T and Yoshiki T	2010	Krill growth and condition in Western Indian Ocean sector of the Southern Ocean30-80^{o}E in austral summer 2006	Deep-Sea Research Part II	Volume 57 Issues 9-10	948–955	10.1016 /j.dsr2. 2008.11 .035	

Authors	Year	Title	Journal	Vol and Edition	Pages	doi	Accepted but not yet published
Pearce I, Davidson AT, Thomson PG, Wright S, van den Enden R	2010	Marine microbial ecology in the Sub-Antarctic Zone: rates of bacterial and phytoplankton growth and grazing by heterotrophic protists.	*Deep-Sea Research II*				Accepted
Pearce I, Davidson AT, Thomson PG, Wright S and van den Enden R	2010	Marine microbial ecology off East Antarctica (30-80°E): Ratesofbacterial and phytoplankton growth and grazing by heterotrophic protists	Deep-Sea Research Part II	Volume 57 Issues 9-10	849–862	10.1016/j.dsr2.2008.04.039	
Bowie AR, Townsend A, Lannuzel D, Remenyi T & van der Merwe, P	2010	Modern sampling and analytical methods for the determination of trace elements in marine particulate material using magnetic sector ICP-MS	Analytica Chimica Acta				Accepted
Nicol S, Bowie A, Jarman S, Lannuzel D, Meiners K, van der Merwe P	2010	Natural ocean iron fertilization by krill and baleen whales	Fish and Fisheries	11(2)	203-209	10.1111/j.1467-2979.2010.0356.x	
Ma YF, Bian LG, Xiao CD, Allison I and Zhou XJ	2010	Near surface climate of the traverse route from Zhongshan Station to Dome A, East Antarctica.	Antarctic Science	22 (4)	443-459	10.1017/S0954102010000209	
Eleaume, M., R. J. Beaman, H. J. Griffths, B. Best, M. J. Riddle, V. Wadley, S. R. Rintoul, L. G. Hemery, and N. Ameziane,	2010	Near-bottom current direction inferred from comatulid crinoid feeding postures on the Terre Adelie and George V shelf, East Antarctica.	Deep Sea Research Part II	Available online 1 June 2010		10.1016/j.dsr2.2010.05.023	
Tagliabue A, Bopp L, Dutay JC, Bowie AR, Chever F, Jean-Baptiste P, Bucciarelli E, Lannuzel D , Remenyi T, Sarthou G, Aumont O, Gehlen M and Jeandel C	2010	On the importance of hydrothermalism to the oceanic dissolved iron inventory	Nature Geosciences			10.1038/NGE0818	
Bengtson Nash S, Rintoul SR, Kawaguchi S, Staniland I, van den Hoff J, Tierney M and Boissi R	2010	Perfluorinated compounds in the Antarctic region: Ocean circulation provides prolonged protection from distant sources	Environmental Pollution	158 (9)	2985-2991	10.1016/j.envpol.2010.05.024	Accepted
Petrou K, Hill R, Doblin MA, McMinn A, Johnson R, Wright SW, P. Ralph PJ	2010	Photoprotection of sea ice microalgal communities from the east Antarctic pack ice.	Journal of Phycology				Accepted
Davidson AT, Scott FJ, Nash GV, Wright SW and Raymond B	2010	Physical and biological control of protistan community composition, distribution and abundance in the seasonal ice zone of the Southern Ocean between 30 and 80°E	Deep-Sea Research Part II	Volume 57 Issues 9-10	828–848	10.1016/j.dsr2.2009.02.011	

Authors	Year	Title	Journal	Vol and Edition	Pages	doi	Accepted but not yet published
Meiners KM, Norman L, Granskog MA, Krell A, Heil P, Thomas DN	2010	Physico-ecobiogeochemistry of East Antarctic pack ice during the winter–spring transition	Deep-Sea Research II – Topical Studies in Oceanography				Accepted
McMinn, A., Martin, A. Ryan K.	2010	Phytoplankton and sea ice biomass and physiology during the transition between winter and spring (McMurdo Sound, Antarctica).	Polar Biology			10.1007/s00300-010-0844-6.	
Wright SW, van den Enden RL, Pearce I, Davidson AT, Scott FJ and Westwood KJ	2010	Phytoplankton community structure and stocks in the Southern Ocean (30–80°E) determined by CHEMTAX analysis of HPLC pigment signatures	Deep-Sea Research Part II	Volume 57 Issues 9-10	758–778	10.1016/j.dsr2.2009.06.015	
Westwood KJ, Griffiths FB, Webb JP, Wright SW	2010	Primary production in the Sub-Antarctic and Polar Frontal zones south of Tasmania, Australia; SAZ-Sense survey, 2007.	*Deep-Sea Research II*				Accepted
Westwood KJ, Griffiths FB, Meiners KM, Williams GD	2010	Primary productivity off the Antarctic coast from 30˚-80˚ E, BROKE-West survey, 2006	Deep-Sea Research II – Topical Studies in Oceanography	57(9-10)	794-814	10.1016/j.dsr2.2008.08.020	
de Salas MF, Eriksen R, Davidson AT, Wright SW	2010	Protistan communities in the Australian sector of the Sub-Antarctic Zone during SAZ-SENSE.	*Deep-Sea Research II*				Accepted
Urbini S, Cafarella L, Zirizzotti A, Tabacco IE, Bottari C, Baskaradas JA, Young N	2010	Radio echo sounding data analysis of the Shackleton Ice Shelf	Annals of Geophysics	53,2, April 2010	79-87	10.4401/ag-4563	
Herraiz-Borreguero , L., and S. R. Rintoul	2010	Regional circulation and its impact on upper ocean variability south of Tasmania (Australia)	Deep-Sea Research II				Accepted
van Wijk, E. M., S. R. Rintoul, B. M. Ronai and G. D. Williams	2010	Regional circulation around Heard and McDonald Islands and through the Fawn Trough, central Kerguelen Plateau	Deep-Sea Research I	57	653-669		
Worby A, Steer A, Lieser J, Heil P, Yi D, Markus T, Allison I, Massom R, Galin N, Zwally H	2010	Regional-scale sea ice and snow thickness distributions from in situ and satellite measurements over East Antarctic pack ice during SIPEX 2007	Deep-Sea Research Part II				Accepted
Seuront L, Leterme SC, Seymour JR, Mitchell JG, Ashcroft DA, Noble W, Thomson PG, Davidson AT, van den Enden R, Scott FJ, Wright SW, Schapira M, Chapperon C and Cribb N	2010	Role of microbial and phytoplanktonic communities in the control of seawater viscosity off East Antarctica (30-80° E)	Deep-Sea Research Part II	Volume 57 Issues 9-10	877–886	10.1016/j.dsr2.2008.09.018	

Authors	Year	Title	Journal	Vol and Edition	Pages	doi	Accepted but not yet published
Woehler EJ, Raymond B, Boyle A and Stafford A	2010	Seabird assemblages observed during the BROKE-West survey of the Antarctic coastline(30°E–80°E), January–March2006	Deep-Sea Research Part II	Volume 57 Issues 9-10	982–991	10.1016/j.dsr2.2008.12.041	
Piquet A M-T, Bolhuis H, Davidson A T, Buma A G.J.	2010	Seasonal succession and UV sensitivity of marine bacterioplankton at an Antarctic coastal site.	FEMS Microbiology Ecology			10.1111/j.1574-6941.2010.0882.x	
Hutchings, J.K., Heil, P., Steer, A., and Hibler III, W.D.	2010	Small-scale spatial variability of sea ice deformation in the western Weddell Sea during early summer	Journal of Physical Oceanography				Accepted
van Ommen, T, Morgan, V	2010	Snowfall increase in coastal East Antarctica linked with southwest Western Australian drought	Nature Geoscience	3	267-272	10.1030/NGEO761	
Nicol S, Bowie A, Jarman S, Lannuzel D, Meiners KM, van der Merwe P	2010	Southern Ocean iron fertilisation by krill and baleen whales	Fish and Fisheries	11(2)	203-209	10.1111/j.1467-2979.2010.0356.x	
Sallée, J.-B., K.Speer, S. R. Rintoul, and S. Wijffels	2010	Southern Ocean thermocline ventilation	Journal of Physical Oceanography	40	509-529	10.1175/2009JPO4291.1	
Fukamachi, Y., S. R. Rintoul, J. A. Church, S. Aoki, S. Sokolov, M. Rosenberg and M. Wakatsuchi	2010	Strong export of Antarctic Bottom Water east of the Kerguelen Plateau.	Nature Geoscience	3	327-331		
Herraiz-Borreguero , L., S. R. Rintoul and R. Coleman	2010	Subantarctic Mode Water variability influenced by mesoscale eddies south of Tasmania	Journal of Geophysical Research – Oceans	115	C04004		
Sampson C, Golden K, Gully A and Worby A	2010	Surface impedence tomography for Antarctic sea ice	Deep-Sea Research Part II				Accepted
Williams GD, Nicol S, Aoki S, Meijers AJS, Bindoff NL, Iijima Y, Marsland SJ and Klocker A	2010	Surface oceanography of BROKE-West, along the Antarctic margin of the south-west Indian Ocean (30-80°E)	Deep-Sea Research Part II	Volume 57 Issues 9-10	738–757	10.1016/j.dsr2.2009.04.020	
Brown M, Kawaguchi S, Candy S and Virtue P	2010	Temperature effects on the growth and maturation of Antarctic krill (Euphausia superba)	Deep-Sea Research Part II	Volume 57 Issues 7-8	672-682	10.1016/j.dsr2.2009.10.016	
DeLiberty T, Geiger C, Ackley S, Worby A and van Woert M	2010	The annual cycle of sea ice thickness and volume in the Ross Sea	Deep-Sea Research Part II				Accepted

Authors	Year	Title	Journal	Vol and Edition	Pages	doi	Accepted but not yet published
Norman L, Thomas DN, Stedmon CA, Granskog MA, Papadimitriou S, Meiners KM, Lannuzel D, van der Merwe P, Dieckmann GS	2010	The characteristics of dissolved organic matter (DOM) and chromophoric dissolved organic matter (CDOM) in Antarctic sea ice	Deep-Sea Research II – Topical Studies in Oceanography				Accepted
Meijers AJS, Klocker A, Bindoff NL, Williams GD and Marsland SJ	2010	The circulation and water masses of the Antarctic shelf and continental slope between 30 and 80°E	Deep-Sea Research Part II	Volume 57 Issues 9-10	723–737	10.1016/j.dsr2.2009.04.019	
Cassar N, DiFiore P, Barnett BA, Bender ML, Bowie AR, Tilbrook B, Petrou K, Westwood KJ, Wright SW, Lefevre D	2010	The influence of iron and light on carbon export production in the subantarctic and polar frontal zones.	*Biogeoscience*				Accepted
Stammerjohn, S., Maksym, T., Heil, P., Massom, R.A., Vancoppenolle, M., and Leonard, K.C.	2010	The Influence of Winds, Sea Surface Temperature and Precipitation Anomalies on Antarctic Regional Sea Ice Conditions during IPY 2007	Deep-Sea Research II				Accepted
Stevens, R.P., and Heil, P.	2010	The interplay of dynamic and thermodynamic processes in driving the ice-edge location in the Southern Ocean	Annals of Glaciolog				Accepted
Ibisanmi EB, Hunter KA, Sander S, Boyd PW, Bowie AR	2010	Vertical distributions of iron-(III) complexing ligands in the Southern Ocean	Deep-Sea Research II	In press			Accepted
Lannuzel D, Schoemann V, Pasquer B, van der Merwe P, Masson F, Tison JL, de Jong J & Bowie AR	2010	What controls the distribution of dissolved iron in the seasonal ice zone? Spatial, seasonal or inter-annual variability	Journal of Geophysical Research, Biogeosciences				Accepted
Sallée, J.-B., K.Speer, S. R. Rintoul	2010	Zonally asymmetric response of the Southern Ocean mixed-layer depth to the Southern Annular Mode	Nature Geoscience	3	273-279	10.1038/ngeo812	

2. Research Related Books and Book Chapters

Authors	Year	Chapter Title	Book	Publisher	Country
Boehme, L. & Co-Authors (including S. Rintoul)	2010	Biologging in the Global Ocean Observing System	Proceedings of OceanObs'09: Sustained Ocean Observations and Information for Society (Vol. 2),	ESA	France
Rintoul, S. R. & Co-Authors	2010	Deep circulation and meridional overturning	Proceedings of OceanObs'09: Sustained Ocean Observations and Information for Society (Vol. 1	ESA	France

Authors	Year	Chapter Title	Book	Publisher	Country
McMinn A, Bolch CJ, DeSalas M, Halegraeff GM	2010	Dinoflagellate Cysts.	Algae of Australia; Phytoplankton of temperate coastal waters,	CSIRO Press	Australia
Trenberth, K. & Co-Authors (including S. Rintoul)	2010	Intergovernmental Panel for Climate Change (IPCC) and attribution and prediction of climate: Progress since the Fourth Assessment	Proceedings of OceanObs'09: Sustained Ocean Observations and Information for Society (Vol. 1)	ESA	France
Charrassin, J. & Co-Authors (including S. Rintoul)	2010	New Insights Into Southern Ocean Physical and Biological Processes Revealed by Instrumented Elephant Seals	Proceedings of OceanObs'09: Sustained Ocean Observations and Information for Society (Vol. 2)	ESA	France
Turner, J. and 57 others, including S. Rintoul	2010	Observations, Data Accuracy and Tools	Antarctic Climate Change and the Environment	SCAR chapter 2	UK
Garzoli, S. & Co-Authors (including S. Rintoul)	2010	Progressing Towards Global Sustained Deep Ocean Observations	Proceedings of OceanObs'09: Sustained Ocean Observations and Information for Society (Vol. 2)	ESA	France
Worby A and Eicken H	2010	Ship-based ice observation programs	Handbook of sea-ice field research techniques	University of Alaska Press	USA
Sturm M and Massom R	2010	Snow and Sea Ice	Sea Ice, 2nd Edition, edited by Thomas D and Dieckmann G	Wiley-Blackwell	UK
Rintoul, S. R. & Co-Authors	2010	Southern Ocean Observing System (SOOS): Rationale and Strategy for Sustained Observations of the Southern Ocean	Proceedings of OceanObs'09: Sustained Ocean Observations and Information for Society (Vol. 2)	ESA	France
Turner, J. and 64 others, including S. Rintoul	2010	The Instrumental Period	Antarctic Climate Change and the Environment	SCAR chapter 4	UK
Cunningham, S. & Co-Authors (including S. Rintoul)	2010	The Present and Future System for Measuring the Atlantic Meridional Overturning Circulation and Heat Transport	Proceedings of OceanObs'09: Sustained Ocean Observations and Information for Society (Vol. 2)	ESA	France
Rintoul S	2010	The Southern Ocean in the Earth system	Science Diplomacy: Antarctica, Science and the Governance of International Spaces. Berkman, P.A., Lang, M.A., Walton, D.W.H., and Young O.R. (Eds.). S	Smithsonian Institution	USA

3. Full Written conference papers published in referred proceedings

Authors	Year	Title	Event	Place and date
A.J.S. Meijers, Galton-Fenzi, B. K., S.R. Rintoul and S. Sokolov.	2010	Adelie Depression seasonal circulation and dense shelf water export.	European Geophysical Union	Vienna, Austria
M Grose, SP Corney, CJ White, G Holz, J Bennett and NL Bindoff.	2010	Assessing rainfall trends and remote drivers in regional climate change projections: the demanding test case of Tasmania	IOP Conference Series: Earth and Environmental Science	*AMOS Conference Canberra, January*
Cassar N, Bender ML, DiFiore PJ, Tilbrook BD, Wright S, Bowie AR, Petrou K	2010	Controls on productivity and carbon export in the Australian Subantarctic Zone of the Southern Ocean	AGU Ocean Sciences Meeting	Portland, Oregon (USA), 22-26 February
Bowie AR, Lannuzel D, Remenyi T, van der Merwe P, Wagener T, Lam P & Tagliabue A	2010	Different biogeochemical processes drive iron supply in the subantarctic and polar Southern Ocean south of Australia	AGU ocean sciences meeting	22-26 February 2010, Portland, Oregon, United States.
Bowie AR, Lannuzel D, Remenyi T, van der Merwe P, Wagener T, Lam P, Tagliabue A	2010	Different processes drive seasonal biogeochemical iron supply in the subantarctic and polar Southern Ocean south of Australia	AGU Ocean Sciences Meeting	Portland, Oregon (USA), 22-26 February
Remenyi T, Tria J, Nesterenko P, Bowie A, Butler E, Haddad P	2010	Direct chromatographic determination of aluminium at trace level in seawater	Pittcon 2010	Orlando, Florida (USA). 28 February - 5 March
Lannuzel D, Schoemann V, van der Merwe P, Townsend A, Bowie AR	2010	Dissolved and particulate metals distribution in Antarctic sea ice and their role in tracing iron sources	AGU Ocean Sciences Meeting	Portland, Oregon (USA), 22-26 February
Sedwick PN, Bowie AR, Trull TW	2010	Dissolved iron in the Pacific sector of the Southern Ocean: distribution, seasonality, and prospects for the future	AGU Ocean Sciences Meeting	Portland, Oregon (USA), 22-26 February
A.J. Constable, B. Raymond, S. Doust, D. Welsford, and K. Martin-Smith	2010	Elaborating a representative system of marine protected areas in eastern Antarctica, south of 60S	CCAMLR WG-EMM	
SP Corney, J Katzfey, J McGregor, M Grose, CJ White, G Holz, J Bennett, and NL Bindoff.	2010	Improved regional climate modelling through dynamical downscaling	IOP Conference Series: Earth and Environmental Science	*AMOS Conference Canberra, January*
van der Merwe P, Lannuzel D, Mancuso-Nichols CA, Meiners K, Bowie AR	2010	Iron partitioning in pack and fast ice in East Antarctica: potential for temporal decoupling between the release of dissolved and particulate iron during spring melt	AGU Ocean Sciences Meeting	Portland, Oregon (USA), 22-26 February
CJ White, SP Corney, M Grose, J Bennett, G Holz, K McInnes, LA Sanabria, RP Cechet and NL Bindoff.	2010	Modelling Extreme Events in a Changing Climate using Regional Dynamically-Downscaled Climate Projections	International Environmental Modelling and Software Society (iEMSs) 2010 International Congress on Environmental Modelling and Software, Fifth Biennial Meeting	*5-8th July 2010, Ottawa, Canada*

Authors	Year	Title	Event	Place and date
Tagliabue A, Bopp L, Dutay J-C, Bowie AR, Chever F, Jean-Baptiste P, Bucciarelli E, Lannuzel D, Remenyi T, Sarthou G, Aumont O, Gehlen M, Jeandel C.,	2010	On the importance of hydrothermalism to the oceanic dissolved iron inventory	AGU Ocean Sciences Meeting	Portland, Oregon (USA), 22-26 February
Timmermann R., A. Le Brocq, T. Deen, E. Domack, B.K. Galton-Fenzi, D. Graffe, H. Hellmer, A. Humbert, D. Jansen, A. Jenkins, A. Lambrecht, K. Makinson, F. Niederjasper, F. Nitsche, L.H. Smedsrud, and W. Smith.	2010	RTOPO-1: A consistent dataset for Antarctic ice shelf topography and global ocean bathymetry.	European Geophysical Union	Vienna, Austria
Molina E, Mongin M, Trull T, Bowie AR	2010	Seasonality of the ecosystem response to iron stimulation of the Southern Ocean	AGU Ocean Sciences Meeting	Portland, Oregon (USA), 22-26 February
S Rand, P Gee, CJ. White, SP Corney and NL Bindoff.	2010	The Analysis of Infrastructure Asset Susceptibility using High Resolution Climate Projection Modelling	Engineers Australia: Practical Responses to Climate Change National Conference	Melbourne, September-October
Galton-Fenzi, B. K., S. Marsland, A. Meijers and A. Fraser.	2010	The Influence of Coastal Polynyas on the Basal Melting of Ice Shelves.	European Geophysical Union	Vienna, Austria
Butler E, O'Sullivan J, Watson R, Bowie A, Remenyi T, Lannuzel D,	2010	Trace Metals Cd, Co, Cu, Ni, Pb and Zn in Waters of the Sub-Antarctic and Polar Frontal Zones south of Tasmania during the 'SAZ-Sense' Study	Australian Marine Sciences Association conference	4-8 July 2010.