Stream 1.2  Oceans and marine ice in the Southern Hemisphere

Stream goal

To understand the extent of large-scale physical, biological and biogeochemical change occurring in the Southern Ocean and marine ice environment (including ice shelves, sea ice and icebergs), and to attribute the cause(s) to anthropogenic emissions or natural variations for inclusion in IPCC models.

Some elements of this plan are being addressed by projects listed below each KRQ. However significant gaps, and hence priorities for research for new proposals in this application round can be identified. Individual areas have been rated for priority (1 or 2) on the basis of urgency, impact or sequencing needs.

1.2.1  Sea ice interactions with the climate system and ecosystems

Key research question

KRQ 1.2.1.1 How is the Antarctic sea ice physical environment changing on regional scales?

Projects under this key research question include:

<table>
<thead>
<tr>
<th>Project</th>
<th>Chief Investigator</th>
<th>Project Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>4061</td>
<td>Dr Andrew Moy</td>
<td>High Resolution East Antarctic Climate History (HiREACH): Ice core records of continental, hemispheric and global change</td>
</tr>
<tr>
<td>4062</td>
<td>Dr Andrew Moy</td>
<td>Law Dome Summit Snow-Climate Observatory</td>
</tr>
<tr>
<td>4072</td>
<td>Dr Petra Heil</td>
<td>A multi-instrument approach to derive East Antarctic sea-ice dynamics</td>
</tr>
<tr>
<td>4073</td>
<td>Dr Klaus Meiners</td>
<td>Sea Ice Physics and Ecosystems Experiment II - an integrated study of physical and ecological sea ice processes off East Antarctica during spring</td>
</tr>
<tr>
<td>4075</td>
<td>Dr Mark Curran</td>
<td>Aurora Basin North ice coring</td>
</tr>
<tr>
<td>4116</td>
<td>Dr Rob Massom</td>
<td>Large-scale Change and Variability in Antarctic Sea Ice, and Links with the Ice Sheet</td>
</tr>
<tr>
<td>4123</td>
<td>Dr Luke Bennetts</td>
<td>Modelling ocean wave / sea ice interactions: experimental validation and assimilation into operational models</td>
</tr>
<tr>
<td>4298</td>
<td>Dr Klaus Meiners</td>
<td>An integrated study of Antarctic land-fast sea ice physical and biological processes</td>
</tr>
<tr>
<td>4301</td>
<td>Dr Petra Heil</td>
<td>Towards an estimate of East Antarctic Sea-Ice volume and its variability</td>
</tr>
<tr>
<td>4329</td>
<td>Prof. Robert Harcourt</td>
<td>Seals as Oceanographic Samplers</td>
</tr>
<tr>
<td>4390</td>
<td>Dr Petra Heil</td>
<td>Multi-scale characterisation of the Antarctic sea-ice response in a changing environment</td>
</tr>
<tr>
<td>4408</td>
<td>Dr Klaus Meiners</td>
<td>Physical drivers of ice-algal biomass and characterisation of under-ice habitats in the Antarctic pack-ice zone</td>
</tr>
<tr>
<td>4434</td>
<td>Dr Luke Bennetts</td>
<td>Drift of the Antarctic ice edge</td>
</tr>
</tbody>
</table>
Research is still required to do the following:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Priorities for new research proposals</th>
<th>Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identification of trends in Antarctic sea ice extent and seasonality, thickness and snow cover thickness, kinematics and breakout behaviour, for both pack ice and fast ice. Improved process understanding and sea-ice model performance, (from timescales suitable for operational forecasting through to climate) and better characterisation of impacts on, and interactions with, ocean, atmosphere and ice sheets. More robust detection and attribution of changes in sea ice.</td>
<td>Determination and monitoring of sea-ice thickness and snow cover thickness, and better understanding of mass balance processes. <strong>Priority 1</strong></td>
<td>Development of satellite remote sensing techniques. Airborne and remote sensing studies exploiting new above-ice, under-ice and surface measurement technologies. Routine underway sea ice observations including autonomous instrumentation of ships (camera systems etc.). Targeted studies for calibration/validation of remote sensing (satellite and aircraft) capabilities using fast ice (station-based logistics).</td>
</tr>
<tr>
<td></td>
<td>Sea ice dynamics: characterisation of physics of drift and deformation. <strong>Priority 2</strong></td>
<td>Development of remote sensing and integrated analysis techniques. Observations using instrumented buoys and improvement of remote sensing techniques (with collaborative, non-AAP logistics). Process studies and modelling.</td>
</tr>
<tr>
<td>Fast-ice processes and change, including interactions with polynyas, platelet ice and coastal ice sheet. ‘Desktop’ studies, airborne and station-based field studies. <strong>Priority 1</strong></td>
<td>Remote sensing studies to construct large-scale maps of present state and change. Process studies to explore sub-ice/supra-ice environment with new technology (collaborative ship or station based logistics). Model/observation intercomparison. High-resolution modelling of the Antarctic coastal environment, including key interactions e.g. between fast ice, icebergs and polynyas. In-situ, airborne, remote sensing studies exploiting new surface, above-ice and under-ice measurement</td>
<td></td>
</tr>
</tbody>
</table>
Oceans and marine ice in the Southern Hemisphere

### Outcome

<table>
<thead>
<tr>
<th>Priorities for new research proposals</th>
<th>Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ice-atmosphere and ice-ocean interaction studies (coupled), and attribution of observed regional change and variability. A focus for this round would be for work in the marginal ice zone. <strong>Priority 1</strong></td>
<td>Modelling and theoretical studies of processes of ice motion, growth and decay (including high-resolution modelling), combined with satellite remote sensing analysis.</td>
</tr>
<tr>
<td>technologies (including ROV, AUV, UAV and ice mass balance buoys) using airborne, collaborative ship or station based logistics.</td>
<td></td>
</tr>
</tbody>
</table>

### Key research question

**KRQ 1.2.1.2 What is the impact of changes on Southern Ocean primary production and ecosystem dynamics? [Refer also to Theme 3.1]**

### Projects under this key research question include:

<table>
<thead>
<tr>
<th>Project</th>
<th>Chief Investigator</th>
<th>Project Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>4051</td>
<td>Dr Delphine Lannuzel</td>
<td>Role of Antarctic sea ice as a natural ocean fertilizer during the spring 2012-13 sea ice research voyage SIPEX-2.</td>
</tr>
<tr>
<td>4072</td>
<td>Dr Petra Heil</td>
<td>A multi-instrument approach to derive East Antarctic sea-ice dynamics</td>
</tr>
<tr>
<td>4073</td>
<td>Dr Klaus Meiners</td>
<td>Sea Ice Physics and Ecosystems Experiment II - an integrated study of physical and ecological sea ice processes off East Antarctica during spring</td>
</tr>
<tr>
<td>4116</td>
<td>Dr Rob Massom</td>
<td>Large-scale Change and Variability in Antarctic Sea Ice, and Links with the Ice Sheet</td>
</tr>
<tr>
<td>4140</td>
<td>Dr Kerrie Swadling</td>
<td>Secondary production associated with sea ice during SIPEX II: biomass, diversity and trophic links between lower trophic level invertebrates.</td>
</tr>
<tr>
<td>4291</td>
<td>Dr Delphine Lannuzel</td>
<td>Impact of changes in sea ice extent on primary productivity in the Southern Ocean: links between the iron and carbon cycles in fast ice and the marginal ice zone</td>
</tr>
<tr>
<td>4298</td>
<td>Dr Klaus Meiners</td>
<td>An integrated study of Antarctic land-fast sea ice physical and biological processes</td>
</tr>
<tr>
<td>4347</td>
<td>Dr Jess Melbourne-Thomas</td>
<td>Projecting ecosystem change in the Southern Ocean using end-to-end models</td>
</tr>
<tr>
<td>4408</td>
<td>Dr Klaus Meiners</td>
<td>Physical drivers of ice-algal biomass and characterisation of under-ice habitats in the Antarctic pack-ice zone</td>
</tr>
<tr>
<td>4434</td>
<td>Dr Luke Bennettts</td>
<td>Drift of the Antarctic ice edge</td>
</tr>
</tbody>
</table>
Research is still required to do the following:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Priorities for new research proposals</th>
<th>Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characterisation of sea-ice ecosystem dynamics.</td>
<td>Multi-disciplinary sea ice ecosystem studies to identify physical drivers of ice algal dynamics, and to inform sea-ice ecosystem model developments. <strong>Priority 1</strong></td>
<td>Development of sea ice ecosystem models.</td>
</tr>
<tr>
<td>Mechanistic understanding of the processes that link sea ice with marine primary and secondary production, to inform ecosystem model developments.</td>
<td>Understanding sea-ice processes that control pelagic primary and secondary production. <strong>Priority 1</strong></td>
<td>Seasonal multi-disciplinary land-fast sea-ice field studies, in particular making use of new technologies and collaborative or station-based logistics.</td>
</tr>
<tr>
<td>Improved understanding of the impacts of changing sea-ice conditions on Antarctic marine ecosystem function.</td>
<td></td>
<td>Desktop studies using existing underway ship data and new data streams from robotic floats and other sources.</td>
</tr>
</tbody>
</table>

**1.2.2 Southern Ocean processes, variability and change**

**Key research question**

**KRQ 1.2.2.1** How and why are the Southern Ocean circulation and water properties changing?

Projects under this key research question include:

<table>
<thead>
<tr>
<th>Project</th>
<th>Chief Investigator</th>
<th>Project Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>4131</td>
<td>Dr Steve Rintoul</td>
<td>Southern Ocean circulation and water mass formation in a warming world</td>
</tr>
<tr>
<td>4287</td>
<td>Dr Ben Galton-Fenzi</td>
<td>Ocean forced evolution of the Antarctic Ice Sheet</td>
</tr>
<tr>
<td>4329</td>
<td>Prof. Robert Harcourt</td>
<td>Seals as Oceanographic Samplers</td>
</tr>
<tr>
<td>4352</td>
<td>Dr Tom Trull</td>
<td>Integrated Marine Observing System Southern Ocean Time Series automated moorings for climate and carbon cycle studies southwest of Tasmania</td>
</tr>
<tr>
<td>4479</td>
<td>Steve Rintoul</td>
<td>Tracking the evolution of Southern Ocean variability and change</td>
</tr>
</tbody>
</table>

Research is still required to do the following:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Priorities for new research proposals</th>
<th>Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved ability to predict future change and interpret past change through better</td>
<td>Improved modelling capability for Southern Ocean processes identified by IPCC as key uncertainties</td>
<td>Modelling studies of the response of the Southern Ocean to modes of variability e.g. El Niño-Southern</td>
</tr>
<tr>
<td>Outcome</td>
<td>Priorities for new research proposals</td>
<td>Approach</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>understanding of physical and biogeochemical processes in the Southern Ocean.</td>
<td>including: mixing, water mass formation and subduction, hydrological cycle (atmosphere-ocean-cryosphere), overturning and potential for abrupt change, and climate feedbacks (circulation, carbon, sea ice). <strong>Priority 1</strong></td>
<td>Oscillation (ENSO) and Southern Annular Mode (SAM), are needed to provide insight into the dynamics of atmosphere–ocean–ice interactions involved in both climate variability and climate change.</td>
</tr>
<tr>
<td>Detection and attribution of climate change in the Southern Ocean region.</td>
<td>Improved ‘fingerprint’ techniques for combining observations and model output for detection/attribution. Determine contributions of anthropogenic drivers (e.g. greenhouse gas, ozone loss) and natural variability to observed and projected Southern Ocean change. <strong>Both Priority 1</strong></td>
<td>Use of hierarchy of models (including Australian Community Climate Earth-System Simulator (ACCESS)) and comprehensive observations to attribute observed change to different drivers.</td>
</tr>
<tr>
<td>Improved climate projections from models that better reproduce Southern Ocean climate processes.</td>
<td>Quantitative assessment of climate model skill to represent observations. <strong>Priority 2</strong> Testing and improvement of parameterisations, including eddies, mixing, subduction, topographic interactions. <strong>Priority 1</strong></td>
<td>Use high resolution models to test climate model parameterisation. Develop new parameterisations incorporating improved process understanding.</td>
</tr>
</tbody>
</table>

**Key research question**

**KRQ 1.2.2.2** *What is the impact of changes [in the Southern Ocean] on other parts of the climate system?*

There are no projects currently addressing this question.

**Research is required to do the following:**

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Priorities for new research proposals</th>
<th>Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Better understanding of links between Australian climate and the Southern Ocean.</td>
<td>Determine the sensitivity of Australian climate, now and in the future, to changes in the Southern Ocean and overlying atmosphere. <strong>Priority 1</strong></td>
<td>Identify regions where Southern Ocean sea surface temperatures (SSTs) are correlated with Australian climate variations in the past.</td>
</tr>
</tbody>
</table>
1.2.3  Ice-ocean interaction and the Southern Ocean freshwater budget

Key research question
KRQ 1.2.3.1 *How will a warming ocean affect floating ice shelves, ice tongues and sea ice around Antarctica?*

Projects under this key research question include:

<table>
<thead>
<tr>
<th>Project</th>
<th>Chief Investigator</th>
<th>Project Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>4096</td>
<td>Dr Ben Galton-Fenzi</td>
<td>Interactions between ice shelf and ocean in the cavity beneath the Amery Ice Shelf.</td>
</tr>
<tr>
<td>4131</td>
<td>Dr Steve Rintoul</td>
<td>Southern Ocean circulation and water mass formation in a warming world</td>
</tr>
<tr>
<td>4287</td>
<td>Dr Ben Galton-Fenzi</td>
<td>Ocean forced evolution of the Antarctic Ice Sheet</td>
</tr>
<tr>
<td>4329</td>
<td>Prof. Robert Harcourt</td>
<td>Seals as Oceanographic Samplers</td>
</tr>
<tr>
<td>4342</td>
<td>Dr Christian Schoof</td>
<td>Outlet Glacier Dynamics in Princess Elizabeth Land</td>
</tr>
<tr>
<td>4346</td>
<td>Dr Jason Roberts</td>
<td>ICECAP II</td>
</tr>
<tr>
<td>4436</td>
<td>Prof. Matthew King</td>
<td>Totten Ice Dynamics and Evolution</td>
</tr>
</tbody>
</table>
Research is still required to do the following:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Priorities for new research proposals</th>
<th>Approach</th>
</tr>
</thead>
</table>
| Improve projections of response of ice shelves, glacier tongues and sea-ice to a warming ocean. | Ice-shelf/ocean/atmosphere modelling:  
  - development/evaluation and applications  
  - quantifying the response of ice shelves to changes in the Southern Ocean in particular characterising variability and trends (including coupling these changes to the ice sheet in conjunction with stream 1.1)  
  - exploring basal mass loss and grounding line processes (In conjunction with stream 1.1). | Ice shelf/ocean/atmosphere coupled modelling studies to test model processes/physics against observations of present ice shelf/ocean and atmospheric interactions and producing improved estimates of future ice shelf and ocean changes. Exploring parameterisations of ice shelf melting for models. Studies of ice shelf rifting/calving for modelling – theoretical, remote-sensed and field-based. Mapping of continental shelf sea bathymetry and sub-ice-shelf cavity geometry and incorporating these into models. |
| All Priority 1                                                          |                                                                                                       |                                                                          |
| Exploring impacts of ocean controls on sea ice volume, the evolution of sea-ice distributions and possible changes in the locations and roles of polynyas (in conjunction with stream 1.3.2 for full atmosphere-ice-ocean treatment). | High resolution coupled computer modelling of sea-ice and ocean interactions in a circum-Antarctic setting. Emphasis on understanding processes such as polynyas in driving sub-ice circulation and developing schemes to incorporate their influences in climate models. |                                                                                                                                 |
| Priority 1                                                              |                                                                                                       |                                                                          |
| Capture the variability and search for trends in changes under floating ice: ice shelves, fast ice and pack ice. | Interannual-interdecadal changes in ice ocean interactions, ocean heat fluxes and water mass properties under ice shelves (connects to stream 1.1). Determination of water mass properties under pack ice and fast ice (connects to stream 1.3.1). | Maintained long-term sub shelf circulation studies through boreholes. Integrate automated instrumentation into long-term research sites. Oceanographic moorings/tracking at shelf fronts (using collaborative logistics). |
| Both Priority 1                                                         |                                                                                                       |                                                                          |

Stream 1.2  Oceans and marine ice in the Southern Hemisphere  
7
Key research question

**KRQ 1.2.3.2 How will changes in ice melt and other processes affect ocean stability and the overturning circulation?**

Projects under this key research question include:

<table>
<thead>
<tr>
<th>Project</th>
<th>Chief Investigator</th>
<th>Project Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>4096</td>
<td>Dr Ben Galton-Fenzi</td>
<td>Interactions between ice shelf and ocean in the cavity beneath the Amery Ice Shelf.</td>
</tr>
<tr>
<td>4131</td>
<td>Dr Steve Rintoul</td>
<td>Southern Ocean circulation and water mass formation in a warming world</td>
</tr>
<tr>
<td>4287</td>
<td>Dr Ben Galton-Fenzi</td>
<td>Ocean forced evolution of the Antarctic Ice Sheet</td>
</tr>
</tbody>
</table>

Research is still required to do the following:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Priorities for new research proposals</th>
<th>Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved climate projections from models that better reproduce ice/ocean interaction processes.</td>
<td>Improved parameterisation of Antarctic coastal shelf sea processes and phenomena, such as polynyas, fast ice, iceberg calving and iceshelf disintegration,</td>
<td>Process orientated field/laboratory and modelling studies to test specific deficient areas in climate models.</td>
</tr>
</tbody>
</table>
### Outcome

<table>
<thead>
<tr>
<th>Priorities for new research proposals</th>
<th>Approach</th>
</tr>
</thead>
</table>
| iceberg trajectory/grounding, ice shelf/ocean interactions. **Priority 1** | Satellite remote sensing.  
Use high resolution models to test climate model parameterisation.  
Develop new parameterisations incorporating improved process understanding. |
| Determine the risk of an abrupt change in climate resulting from a change in the overturning circulation. | Assess the sensitivity of the overturning circulation to changes in forcing (wind and buoyancy, including sea ice formation and melt, and melt of glacial ice and icebergs). **Priority 2**  
Determine the impact of a change in overturning on the climate system and biogeochemical cycles. **Priority 1** | Assess sensitivity of water mass formation and circulation to changes in forcing, using observations of past change and model sensitivity tests (e.g. response to perturbed forcing).  
Use of model simulations to determine magnitude and impact of projected changes in overturning.  
Combine physical and biogeochemical observations to determine the link between overturning changes and biogeochemical cycles (e.g. sensitivity of ocean carbon uptake to changes in Southern Ocean overturning).  
Use existing data or collaborative logistics.  
Develop Southern Ocean modelling system and improved parameterisations of sub-grid scale features in global ocean models, such as ACCESS. |

### 1.2.4 Southern Ocean biogeochemical processes in the climate system

**Key research question**

KRQ 1.2.4.1 *How do Southern Ocean biochemical and ecosystem processes feed back to the climate system?*

**Projects under this key research question include:**

<table>
<thead>
<tr>
<th>Project</th>
<th>Chief Investigator</th>
<th>Project Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>4131</td>
<td>Dr Steve Rintoul</td>
<td>Southern Ocean circulation and water mass formation in a warming world</td>
</tr>
</tbody>
</table>
Research is still required to do the following:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Priorities for new research proposals</th>
<th>Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine impact of changes in Southern Ocean biology on cloudiness and therefore climate (links with stream 1.3 and theme 3).</td>
<td>Determine the contribution of biological processes (e.g. dimethyl sulphide production) to cloudiness over the Southern Ocean, and the potential for this to change with climate change. <strong>Priority 2</strong></td>
<td>Analysis, modelling and synthesis of measurements in the ocean and lower atmosphere, in different seasons and phases of climate modes (e.g. ENSO and SAM) (desktop studies). Laboratory studies of physiological response of dimethyl sulphide producers to changes in the physical or chemical environment.</td>
</tr>
</tbody>
</table>

Key research question

**KRQ 1.2.4.2 How will [Southern Ocean biogeochemical] changes affect the rate of carbon dioxide uptake by the ocean?**

Projects under this key research question include:

<table>
<thead>
<tr>
<th>Project</th>
<th>Chief Investigator</th>
<th>Project Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>4026</td>
<td>Dr Andrew Davidson</td>
<td>Effects of Ocean Acidification on marine microbes in the Southern Ocean</td>
</tr>
<tr>
<td>4051</td>
<td>Dr Delphine Lannuzel</td>
<td>Role of Antarctic sea ice as a natural ocean fertilizer during the spring 2012-13 sea ice research voyage SIPEX-2.</td>
</tr>
<tr>
<td>4131</td>
<td>Dr Steve Rintoul</td>
<td>Southern Ocean circulation and water mass formation in a warming world</td>
</tr>
<tr>
<td>4167</td>
<td>Dr David Etheridge</td>
<td>Greenhouse gases in the southern atmosphere</td>
</tr>
<tr>
<td>4291</td>
<td>Dr Delphine Lannuzel</td>
<td>Impact of changes in sea ice extent on primary productivity in the Southern Ocean: links between the iron and carbon cycles in fast ice and the marginal ice zone</td>
</tr>
<tr>
<td>4352</td>
<td>Dr Tom Trull</td>
<td>Integrated Marine Observing System Southern Ocean Time Series automated moorings for climate and carbon cycle studies southwest of Tasmania</td>
</tr>
</tbody>
</table>

**Research is still required to do the following:**

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Priorities for new research proposals</th>
<th>Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment of the capacity of the Southern Ocean to take up carbon and thereby moderate the rate of climate change.</td>
<td>Determine sensitivity of Southern Ocean carbon uptake to changes in forcing and the physical environment (e.g. wind stress, upwelling, coastal ocean processes). <strong>Priority 1</strong></td>
<td>Observations of carbon chemistry (DIC, alkalinity and pH), covering the open ocean, shelf and sea ice zone, in all seasons (routine underway data or collaborative logistics).</td>
</tr>
<tr>
<td>Outcome</td>
<td>Priorities for new research proposals</td>
<td>Approach</td>
</tr>
<tr>
<td>---------</td>
<td>--------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td></td>
<td>Determine potential for carbon export by biological pump to change with climate change and quantify strength of potential feedback. <strong>Priority 1</strong></td>
<td>Determine extent to which eddies act to compensate wind-driven changes in influence of overturning on air-sea C exchange (and over what time-scale).</td>
</tr>
<tr>
<td></td>
<td>Quantify the rate of change in the chemical state of the Southern Ocean (‘acidification’ and solubility state). <strong>Priority 2</strong></td>
<td>Quantify strength of biological pump and its sensitivity to change in the physical environment or ecosystem (including acidification), using models and in situ studies from sediment traps and changes in water properties e.g. nutrient drawdown (using routine underway data or collaborative logistics).</td>
</tr>
<tr>
<td></td>
<td>Identify the major sources of iron for the Southern Ocean, as the limiting nutrient for phytoplankton growth and carbon uptake. <strong>Priority 2</strong></td>
<td>Studies of delivery of iron by sea ice, glaciers and by icebergs of marine ice using available data or station-based and collaborative ship-based logistics.</td>
</tr>
</tbody>
</table>

Please note:

- The Australian Antarctic program does not have the logistical capability to support all aspects of these implementation plans simultaneously.
- Stream implementation plans represent the current research priorities and approaches.
- Alignment to implementation plans is an important criterion in assessing research proposals. As proposals are being developed, Theme Leaders are available to provide feedback on specific priorities for future years including locations, approaches and opportunities to participate in coordinated field campaigns.
- Projects mentioned above can be viewed on the AAD web site’s database of current and previous projects.