



# ICED

Integrating Climate and Ecosystem Dynamics

## Integrating **C**limate and **E**cosystem **D**ynamics:

### *Analyses of Circumpolar Southern Ocean Ecosystems*

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& E.J. Murphy



**British  
Antarctic Survey**

NATURAL ENVIRONMENT RESEARCH COUNCIL

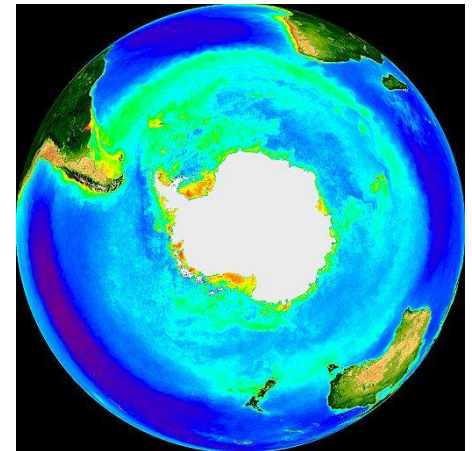


# Southern Ocean Ecosystem



- Important in global climate processes, maintaining food security and unique biodiversity
- Major changes occurring as a result of harvesting impacts and climate change effects

*To address these issues requires:*

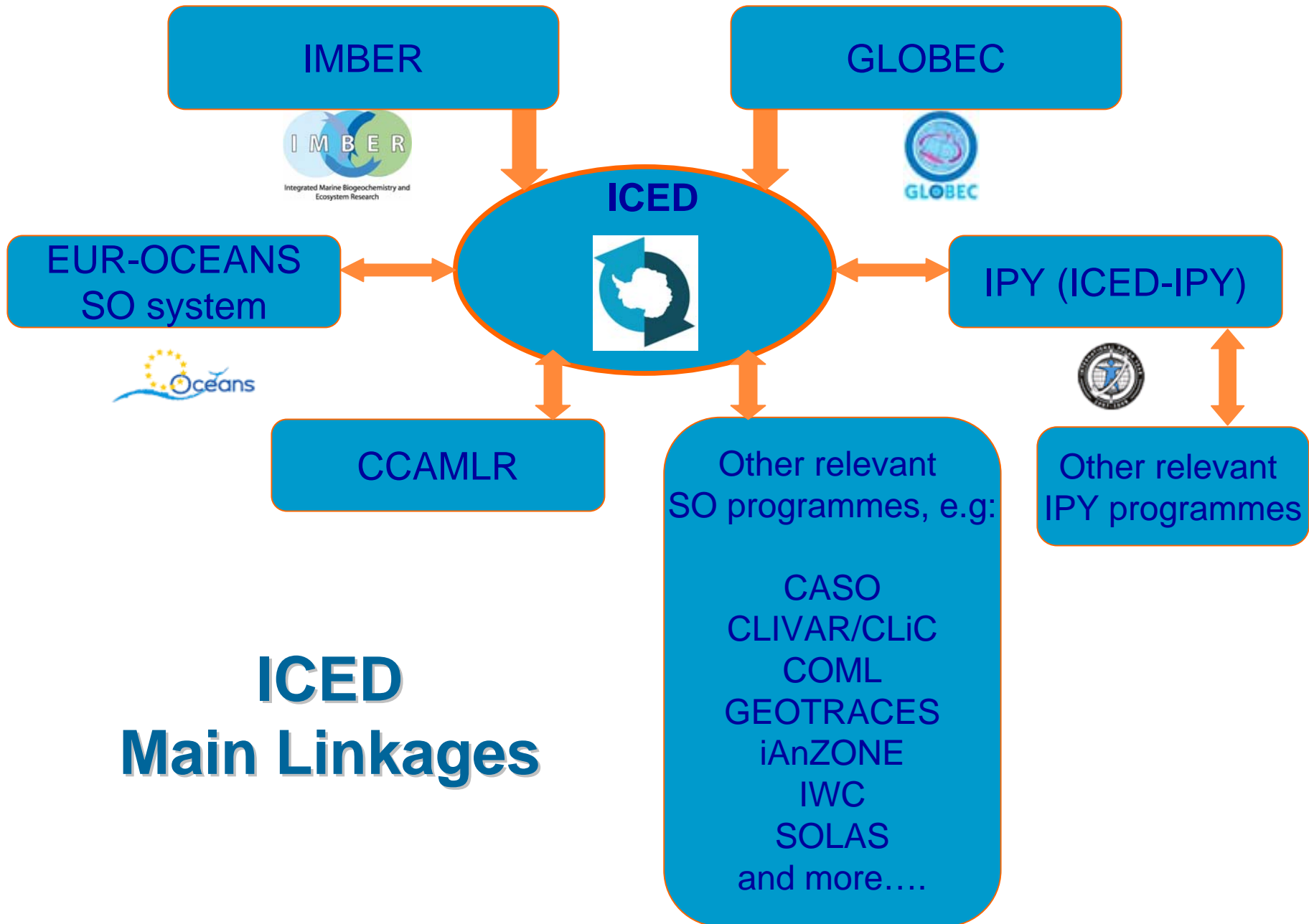


- **Integrated circumpolar analyses of ecosystem operation**
- **Integration & coordination of international research effort**



## Integrating Climate and Ecosystem Dynamics in the Southern Ocean - ICED

- International multidisciplinary 10-year programme
- Long-term goal:  
*“Develop a coordinated circumpolar approach to understand climate interactions in the Southern Ocean, implications for ecosystem dynamics, impacts on biogeochemical cycles, and development of management procedures for sustainable exploitation of living resources”*
- In conjunction with SCOR, SCAR & IGBP, directed jointly by IMBER & GLOBEC
- In partnership with EUR-OCEANS Southern Ocean System and the IPY consortia “ICED-IPY”
- Will integrate with other Southern Ocean programmes, e.g. CLIVAR/CliC, CCAMLR, IWC, SOLAS and GEOTRACES

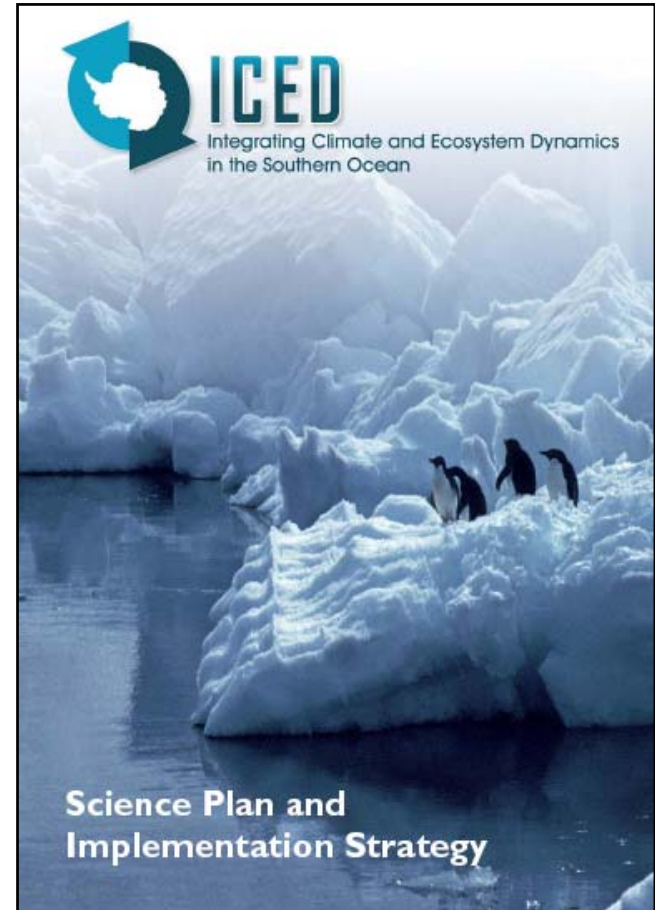




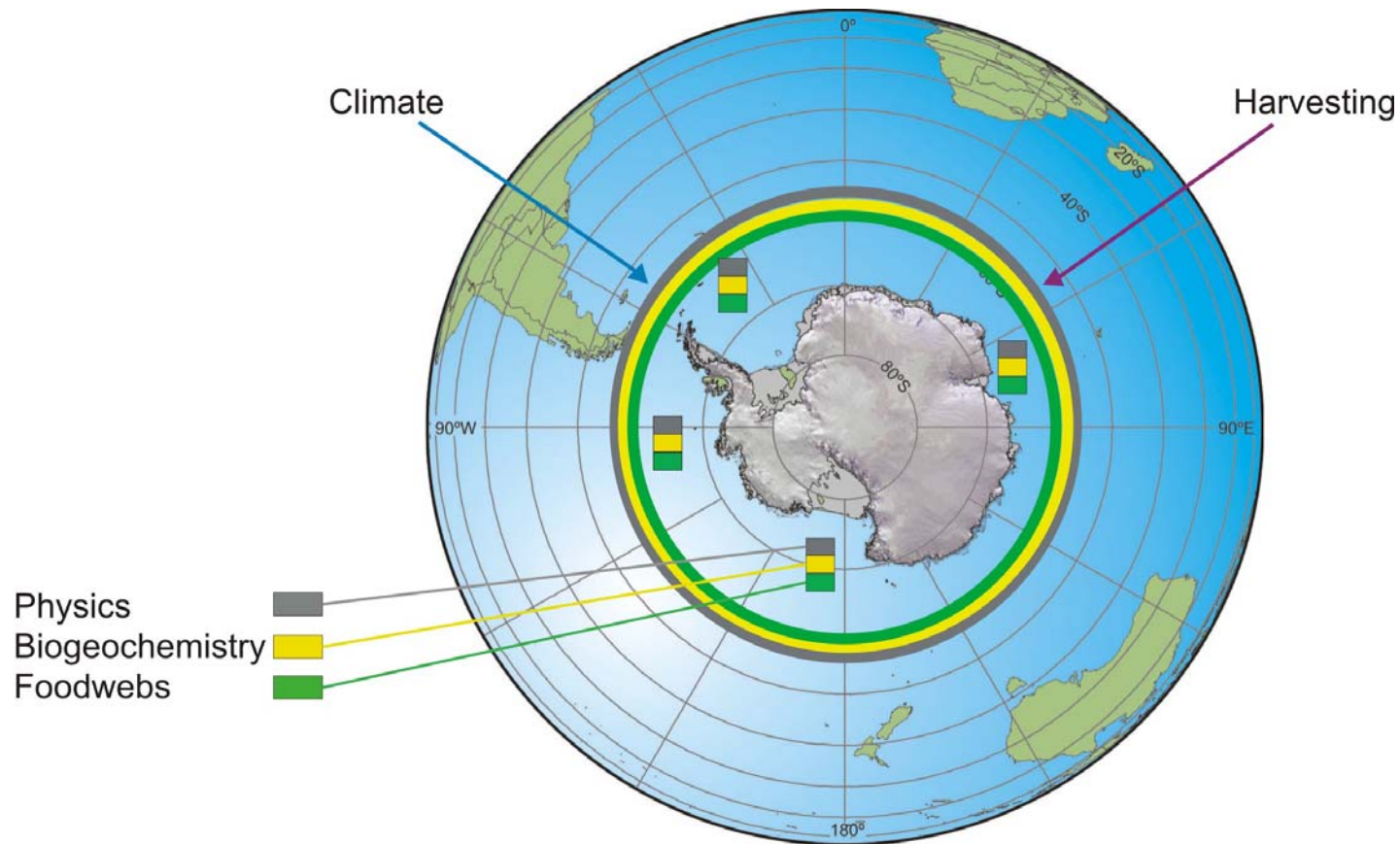
# Science Plan



- One of the main activities this year - development of Science Plan & Implementation Strategy
- Has clarified structure and focus of ICED
- Rest of presentation will highlight some of the key aspects



# Key ICED concepts



Understanding the interactions between physical, biogeochemical and food web processes (at local, regional and circumpolar scales), and the influence of climate and harvesting on the Southern Ocean ecosystem

# ICED Objectives



- To understand how **climate processes** affect the structure and dynamics of ecosystems in the Southern Ocean
- To understand how ecosystem structure and dynamics affect **biogeochemical cycles** in the Southern Ocean
- To determine how ecosystem structure and dynamics should be incorporated into management approaches to **sustainable exploitation** of living resources in the Southern Ocean



# Core Activities



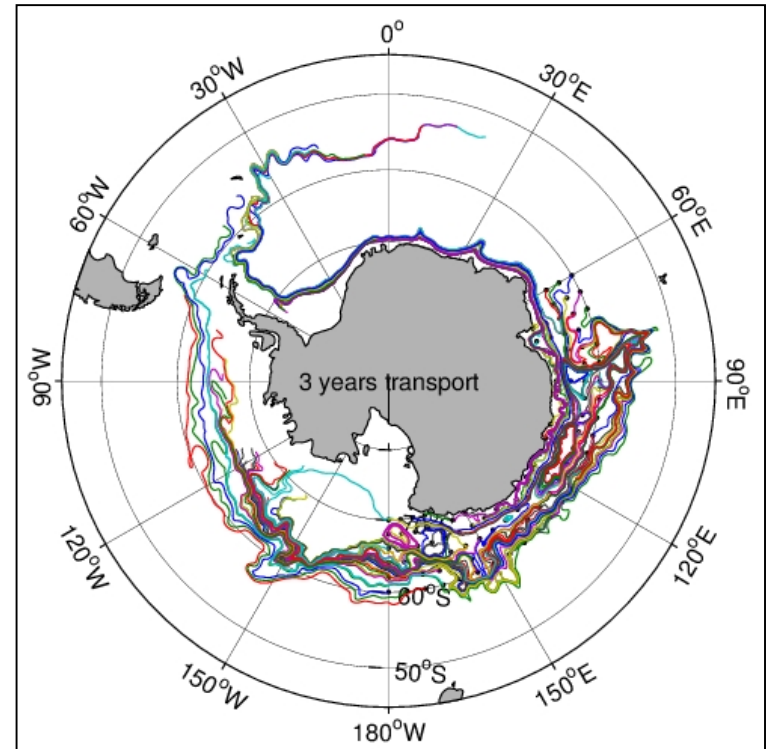
- Development of integrated ecosystem models
- Data synthesis and collation of historical data
- Coordination of field studies



# Model development



- Improve **reliability of predictions** of ecosystem dynamics
- Suite of models of **oceanographic** circulation, **biogeochemical** cycles and end-to-end operation of **food webs**
- Hierarchical framework of models of different **spatial, temporal** and **trophic** resolution
- Integrated modelling group – broad range of expertise
- First workshop (food web modelling) end 2007

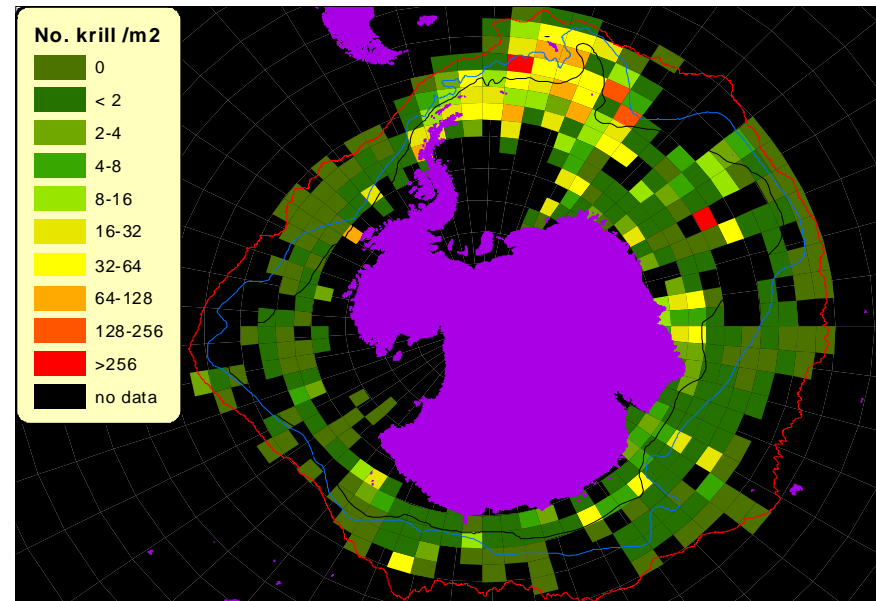


Lagrangian particle tracking analysis examining circumpolar connections of krill populations. Using OCCAM circulation model data. S. Thorpe, BAS.

# Data Mining & Synthesis



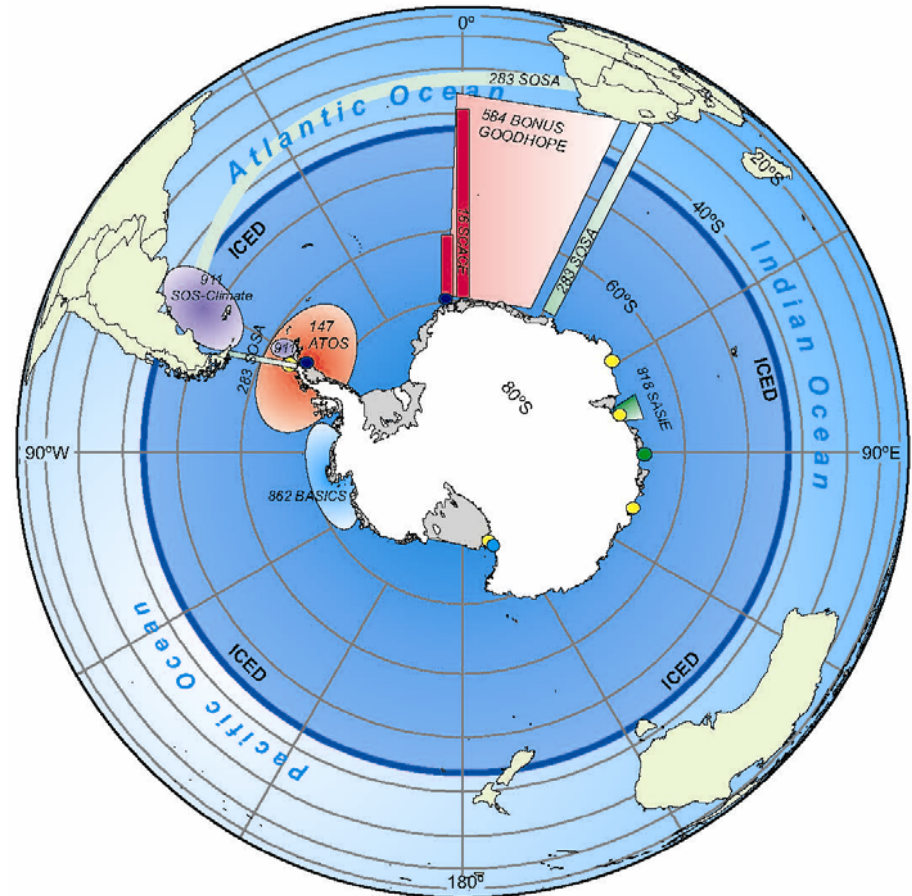
- Historical datasets in variety of locations and storage media
- High priority - integrating datasets to investigate long-term, large-scale Southern Ocean ecosystems
- Circumpolar maps of biogeochemical/biological distributions
- Collaborations – e.g. linking predator/food web data with other programmes e.g. OBIS-SEAMAP, CAML, CCAMLR, IWC, etc



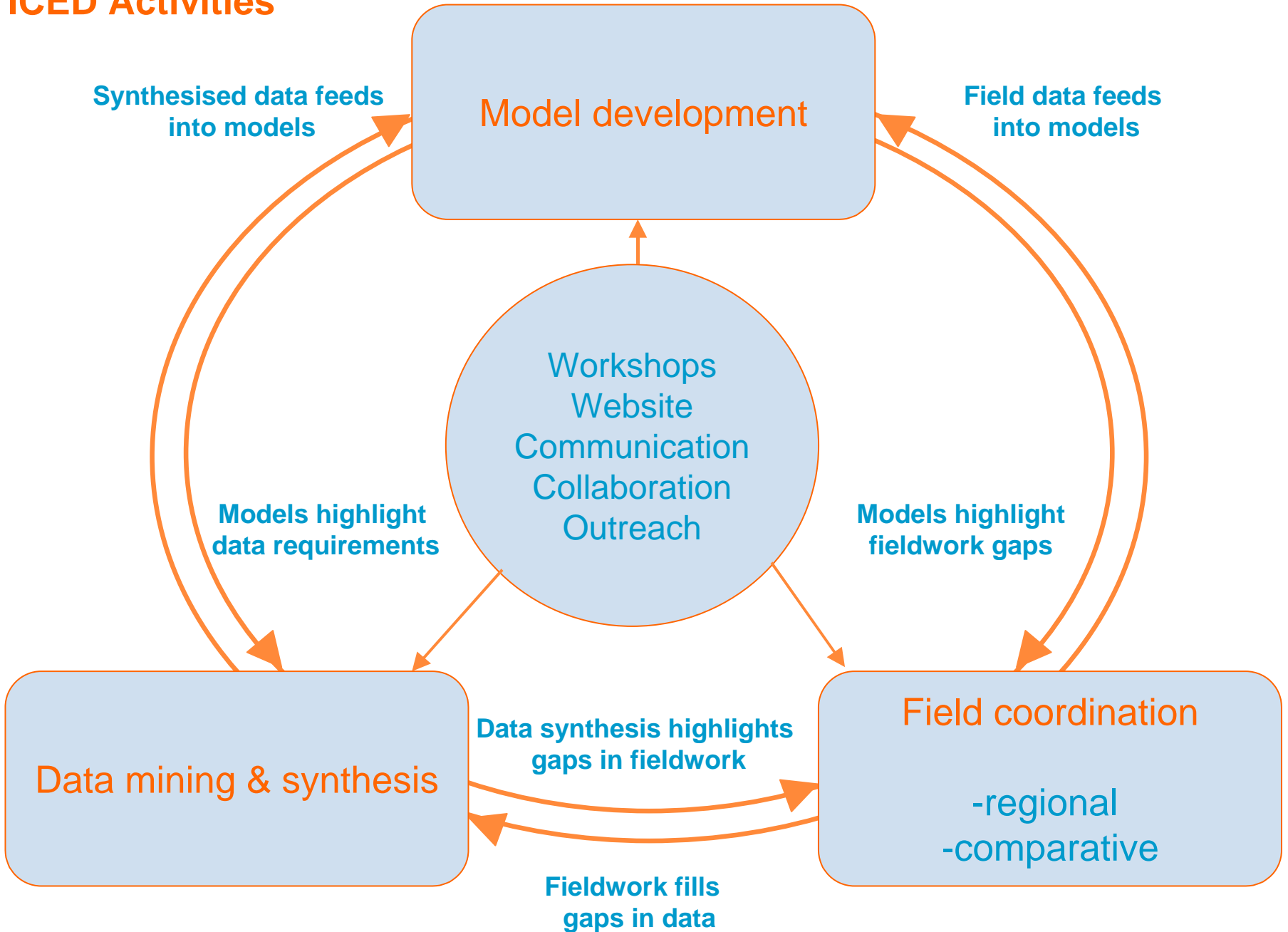
Mean density of Antarctic krill across the Southern Ocean. Data based on 6675 net samples taken **between 1926 and 2003**. Source Atkinson *et al.* (2004).

# Field Coordination

- Firstly, improve integration of existing/ planned studies – primarily through ICED-IPY
- Secondly, dedicated ICED fieldwork – 4 priority regions
- ICED seeks to address gaps in knowledge identified through model/ data activities and plan fieldwork accordingly
- Fieldwork maps – building up to represent all SO activities during IPY
- Field planning workshops



# ICED Activities





# Modelling Workshop



Two major objectives for the Southern Ocean (also globally relevant):

- To determine how trophic interactions affect the **dynamics of individual species/groups** in oceanic food webs and their responses to climate change
- To understand how trophic interactions affect the **overall structure of the ecosystem** and its characteristic responses to change

The major aim of this first workshop in the ICED Workshop Series is to generate an outline structure for an ecosystem model (or models) to examine the circumpolar operation of ocean ecosystems, focusing on the issue of trophic interactions and the end-to-end operation of food webs


## ICED & the International Polar Year: ICED-IPY

- IPY launched March 2007 - from ice sheets and space science to the ecology of the polar oceans, >200 projects, >50,000 people, >60 nations
- ICED-IPY leading “Ecosystems and Biogeochemistry of the Southern Ocean”
  - 10 projects (including ICED), also integrating with other SO international programmes/IPY groups
- Coordinate data, field and modelling activities to further understanding of Southern Ocean ecosystem operation
- Interactive fieldwork map, database, website pages and email to facilitate coordination and communication

# Update




- In 2007 (to date) ICED represented at:
  - *European and UK launches of IPY*
  - *EUR-OCEANS PI Meeting, Athens*
- ICED Science Plan and Implementation Strategy – under review by committee
- ICED Planning Workshop Report – available on ICED website
- ICED-IPY/IPY-Oceans database
- Interactive fieldwork maps



**Members' Login**

# ICED

Integrating Climate and Ecosystem Dynamics



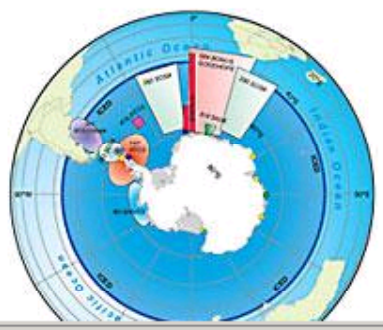
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### Integrating Climate and Ecosystem Dynamics in the Southern Ocean

ICED is a new international multidisciplinary initiative launched in response to the increasing need to develop integrated circumpolar analyses of Southern Ocean climate and ecosystem dynamics.

ICED has been developed in conjunction with the Scientific Committee on Oceanic Research (SCOR) and the International Geosphere-Biosphere Programme (IGBP), through joint support from the Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) and Global Ocean Ecosystem Dynamics (GLOBEC) programmes.

The ICED vision is to develop a coordinated circumpolar approach to better understand climate interactions in the Southern Ocean, the implications for ecosystem dynamics, the impacts on biogeochemical cycles, and the development of sustainable management procedures.



### International Polar Year Cruises

During the International Polar Year (IPY) there will be a number of ICED-IPY cruises with the aim of providing new insights into some of the mechanisms controlling biogeochemical cycles and ecosystem structure in the Southern Ocean.

A key feature of the ICED website is to provide maps of the cruise tracks to assist other researchers in planning their own activities and to improve coordination.

### What's New?

#### International Polar Year launched

Thousands of scientists, from over 60 countries and a wide range of research disciplines, will carry out 220 science and outreach projects. [IPY 2007-08](#) will initiate a new era in polar science with a stronger emphasis on interdisciplinary research and strong partnerships with indigenous communities and educators. See [ICED-IPY page for more details](#).

#### Southern Ocean Science

The latest issue of the GLOBEC International Newsletter, with a special 37-page section on Southern Ocean science, is now available from the GLOBEC website. [Download PDF](#)

### Featured project





# Immediate Priorities



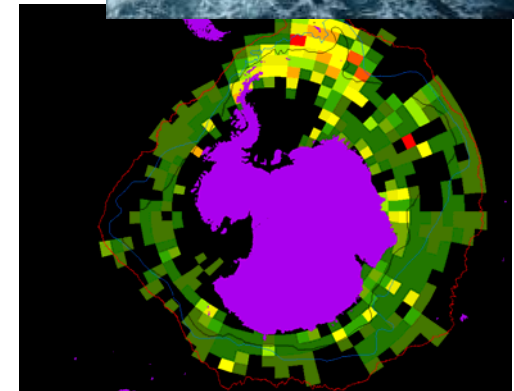
- ICED Science Plan/Implementation Strategy (review by GLOBEC/IMBER June/July 2007, followed by formal adoption and publication)
- Formally establish a Steering Committee and Working Groups
- Distribute/promote Science Plan throughout international community
- Organise workshops (modelling workshop end 2007; step up field coordination via website/email, through ICED-IPY)
- Convene meeting of the appointed Steering Committee

# Summary



**Southern Ocean ecosystems are important in global climate processes and in maintaining food security and unique biodiversity**

- IPY - major *catalyst for integration* activities during next few years
- ICED - developing a *coordinated international approach* to Southern Ocean studies of climate, biogeochemistry, ecosystems and fishery impacts
- *Integrated circumpolar analyses* will address globally important science questions



➤ **Lasting legacy**

**ICED programme over the next decade**

<http://www.antarctica.ac.uk/Resources/BSD/ICED/index.htm>

# Acknowledgements



## ICED-IPY

Project Leaders &  
Steering Committee



**Volker Strass**, Alfred-Wegener-Institut, Germany  
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