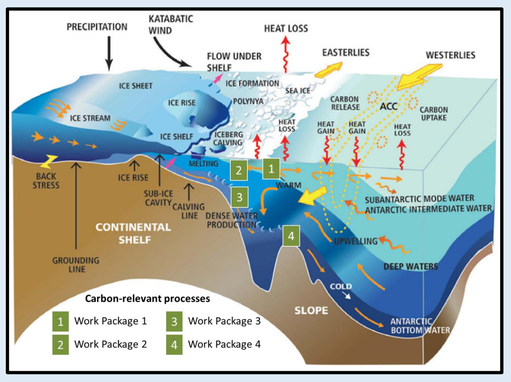
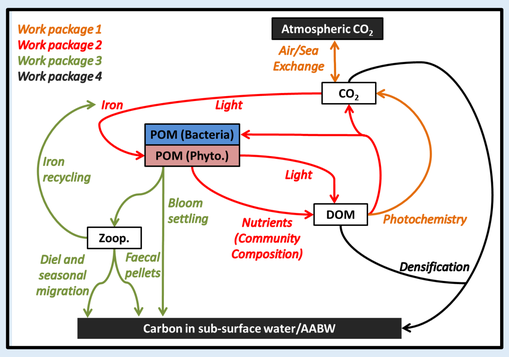
PICCOLO Workpackage 5

Synthesis of processes influencing carbon uptake and deep water sequestration in the lower limb

PICCOLO is a RoSES project designed to define, quantify and provide mechanistic understanding of the key processes controlling the rate of carbon uptake in the lower limb of the Southern Ocean overturning circulation.





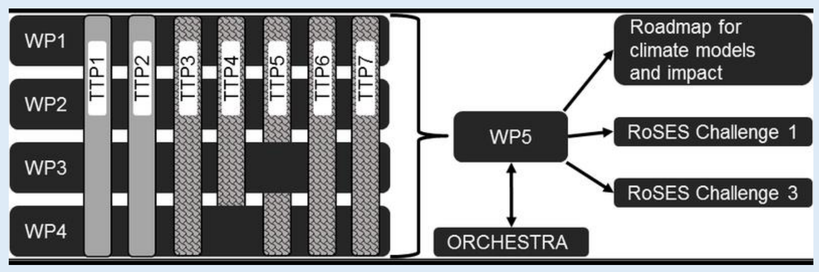
Workpackage 5 will bring together the results from WP1-4 and synthesize into a new understanding of the processes driving carbon cycling in the Weddell Sea. ***See WP1-4 posters for details***

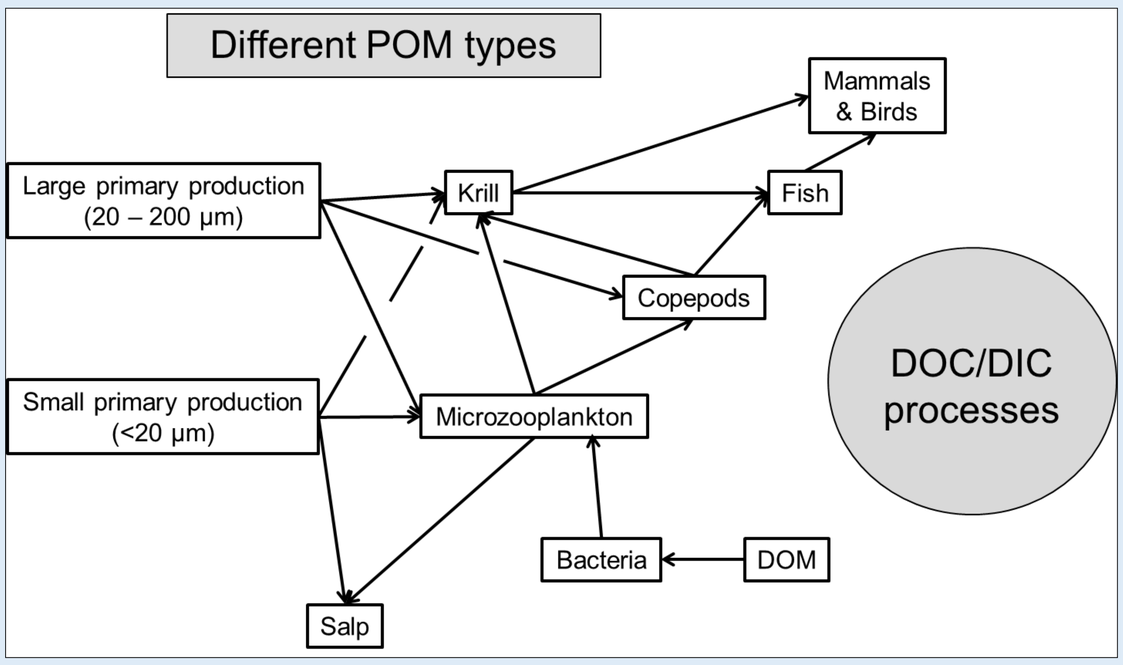
WP hypothesis

1) Annual carbon removal from the surface Weddell Sea is ranked: 1.POC, 2.DOC, 3.DIC

2) Bacterial respiration is the most important biogeochemical process defining surface CO2.

3) Physical, biogeochemical and biological polynya processes are the most important missing aspects of current Earth System models.





Tools and Technology

WP5 will use a combination of synthesis of WP1-4 outputs for impact of abiotic and biotic processes. Runs of Earth system models will not be undertaken, rather output from models of our project partners will be critically evaluates against output of WP1-5 in order to determine model shortcoming and a priority list for improvements to model formulation and parameterisation.

The main tool for WP5 is an inverse model of the food web that will use data collected from the cruise, to parameterise and validate the included biotic and abiotic processes (the figure only show the skeleton structure of the planned model). This will allow us to quantify unmeasured processes (value and uncertainties) as well as comparison of each processes contribution to the carbon cycling. This is also the first toward synthesising PICCOLO's outputs for use by Earth System models.

Deliverables

1) We will generate a *roadmap* that will include, for each priority process identified (whether physical, biogeochemical or ecological):

- A succinct and accessible mechanistic description of the process and its effects;
- A list of input variables required for parameterisation, and a list of generated output variables;
- Clarification of where and when the process would be required (e.g. in a polynya; on the continental slope; during sea ice melt; during winter);
- A small test data set that can be used to assess the efficacy of the parameterisation.

2) We will *quantify* each carbon pathway and its associated uncertainty, together with process level metrics and diagnostics, identification of suitable observation-based evaluation data, and an assessment of the level of uncertainty in these data sets (delivering PICCOLO's impact).

The Piccoliños:

Karen Heywood (k.heywood@uea.ac.uk**), Carol Robinson**, **Elena Garcia-Martín, Dorothee Bakker, Rob Hall** University of East Anglia
Tom Bell, Ming Yang, Jo Dixon, **Vassilis Kitidis, Ruth Airs**, **Giorgio Dall'Olmo**, **Malcolm Woodward, Glen Tarran, Claire Widdicombe, Elaine Fileman, Angus Atkinson, Robert Brewin, Peter Land, Sévrine Sailley (**sesa@pml.ac.uk**)** Plymouth Marine Laboratory
Sophie Fielding, Clara Manno, Ryan Saunders, Keith Nicholls British Antarctic Survey
Simon Ussher, **Angela Milne, Katrin Schmidt** University of Plymouth
Will Homoky Oxford University
Lars Boehme, Mike Fedak University of St. Andrews
Plus project partners from Alfred Wegener Institute, University of Miami, UK Met Office, Caltech, Scripps Institution of Oceanography, VIMS, MBARI, NOC, University of Genoa, UPMC, University of Tromsø, University of Bologna, Old Dominion University, and the Australian ACE CRC

University of East Anglia · PML Plymouth Marine Laboratory · British Antarctic Survey, Natural Environment Research Council · University of Plymouth · University of St Andrews · University of Oxford