

**MARINE**  
**NATIONAL FACILITY**

**voyageplan**  
**SS05-2008**

# 2008 *RV Southern Surveyor* program

**PULSE: Mooring-based measurement of Sub-Antarctic seasonal biogeochemical cycles affecting ocean uptake of carbon dioxide**

## **Itinerary**

Mobilise Hobart 0800hrs, Saturday 5 April, 2008

Depart (IF WEATHER FAVOURABLE) Hobart 1600hrs, Saturday 5 April, 2008

Arrive Hobart 0800hrs, Thursday 10 April, 2008 and demobilise (SUBJECT TO WEATHER)

## **Principal Investigator**

Associate Professor Tom Trull – Antarctic Climate and Ecosystems Cooperative Research Centre, University of Tasmania and CSIRO Marine and Atmospheric Research

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## Scientific Objectives

The Subantarctic Zone (SAZ) of the Southern Ocean is a major sink for atmospheric carbon dioxide. Transfer of the CO<sub>2</sub> to the ocean interior involves both physical and biological processes. Transfer of the CO<sub>2</sub> through the ocean surface mixed layer (~ top 100m) is a highly dynamic process that varies dramatically on seasonal and shorter timescales. The transfer occurs via two 'pumps' – the physical pump consisting of dissolution and subsequent water mass subduction and the biological pump consisting of phytoplankton production and subsequent sinking of organic matter.

The controls on these processes are difficult to assess from short-term ship-based observations because of their temporal variations. For this reason, the primary objective of this voyage is the deployment of a mooring with automated sensors and samplers to obtain a full annual time-series of physical and biological parameters important to these carbon pumps. In concert with this deployment, additional measurements will be made to inform the interpretation of the mooring based measurements. Key measurements include dissolved nutrient, dissolved carbon dioxide (DIC) and oxygen concentrations; bio-optical measures of phytoplankton and suspended particulate organic matter; and assessment of trace-element availability important to phytoplankton health.

## Voyage Objectives

### **1. Recovery of the PULSE mooring (PI. Tom Trull)**

After loss of the fully instrumented PULSE mooring in Jan. 2007, we were forced to return to a period of engineering development, and therefore deployed a modified mooring without scientific instruments in December 2007 from Aurora Australis (known as PULSE\_Test\_5). This voyage will recover that mooring.

### **2. Measurement of underway carbon dioxide partial pressure (PI. Bronte Tilbrook)**

Using the installed and automated pCO<sub>2</sub> system this voyage will collect data useful to the overall goal of characterizing the Subantarctic Zone carbon cycle. Because late 2007 changes in shipping schedules mean that this voyage and the WOCE/CLIVAR SR3 repeat section onboard Aurora Australis will now run at the same time, the CTD based carbon cycle work will be carried out on Aurora Australis.

### **3. Measurement of trace-element concentrations (PI. Edward Butler).**

No work on this project will be carried out on Southern Surveyor. Because late 2007 changes in shipping schedules mean that this voyage and the WOCE/CLIVAR SR3 repeat section onboard Aurora Australis will now run at the same time, this work will be carried out on Aurora Australis.

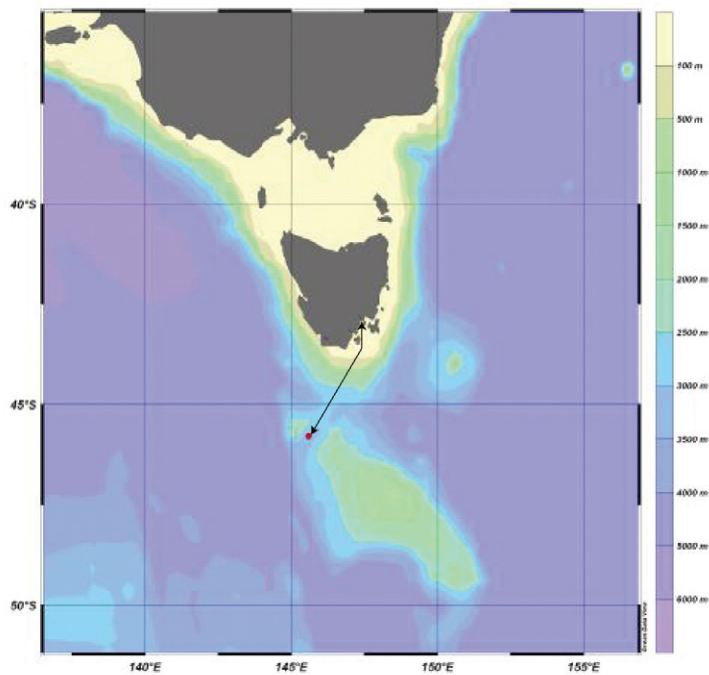
#### **4. Refinement of filtration techniques for particulate organic carbon (POC) measurements (PI. Tom Trull)**

Previous PULSE voyages on Aurora Australis and Southern Surveyor have used vacuum filtration through glass fibre filters to determine suspended POC concentrations, and have compared these measurements to transmissometer measurements as part of the PULSE program of development of sensor-based carbon cycle observations. A small set of POC filtrations will be undertaken using the ship's scientific clean seawater supply to refine the interpretation of the role of absorption of dissolved organic carbon (DOC) in the estimation of POC.

### **Voyage Track**

Hobart to PULSE TEST 5 mooring site at 45.795°S, 145.585°E and return to Hobart.

**Figure 1. Voyage Track**



## Time Estimates

1. ~ 22 hours steam (at 11 knots) from Hobart to mooring site at approximately 45.795 S, 145.585 E. Note that this position is approximate, since the Pulse mooring surface float exhibits large displacements, and since the anchor position is not precisely known (see Figure 2. Surface Float Movements). Thus we must APPROACH WITH CAUTION.
2. ~ 8 hours carefully triangulate acoustic release position for use in engineering analysis.
3. ~ 12 hours of daylight recover mooring and stow onboard (see Figure 3. Mooring Schematic).
4. ~ 22 hours return to Hobart, unload (~4 hours).

We will NOT undertake any additional work (no CTDs, no floating traps, no hydrochem). Thus it seems very likely that the voyage will be relatively short (times above total ~3 days, but with requirement for daylight during recovery). The key issue for a successful deployment is having good weather for the recovery -without it we could damage the mooring, the ship, or ourselves.

WE WILL WANT TO WAIT FOR GOOD WEATHER BEFORE LEAVING HOBART.

## Southern Surveyor Equipment

- Aft-deck A-frame, winches, blocks in working order for mooring recovery.
- Cage pallets for storage of mooring floats and components.
- Spooler and spools for storage of wire.
- Deck unit (2) and hydrophone (2) for communication with acoustic releases

## User Equipment

POC filtration system: vacuum pump and trap, laminar flow bench, in-line filtration system, carboys, requiring ~2m bench space. Access to underway clean scientific seawater supply to fill carboys.

## Personnel List

Tom Trull	UTAS-CSIRO-ACECRC	Chief Scientist
Lindsay Pender	MNF-CSIRO	Mooring recovery leader, Computing support
Steve Bray	ACECRC	Mooring recovery support
Joe Adelstein	ACECRC-IMOS	Mooring recovery support
Drew Mills	MNF	Voyage Manager/ Electronics support

This voyage plan is in accordance with the directions of the National Facility Steering Committee for the Research Vessel Southern Surveyor.

### **Thomas W. Trull**

***Feb. 12, 2008***

Associate Professor of Marine Biogeochemistry

CSIRO Marine and Atmospheric Research – University of Tasmania

Antarctic Climate and Ecosystems Cooperative Research  
Centre – “Ocean Control of CO<sub>2</sub>” Program Leader

**Figure 2: PULSE Surface Float Movements**

Positions are those transmitted from the surface float GPS-Iridium system. Also shown is the probable position of the sub-surface acoustic releases from the anchor drop point and two estimates of "fall-back" as the mooring sank (MR and LP).

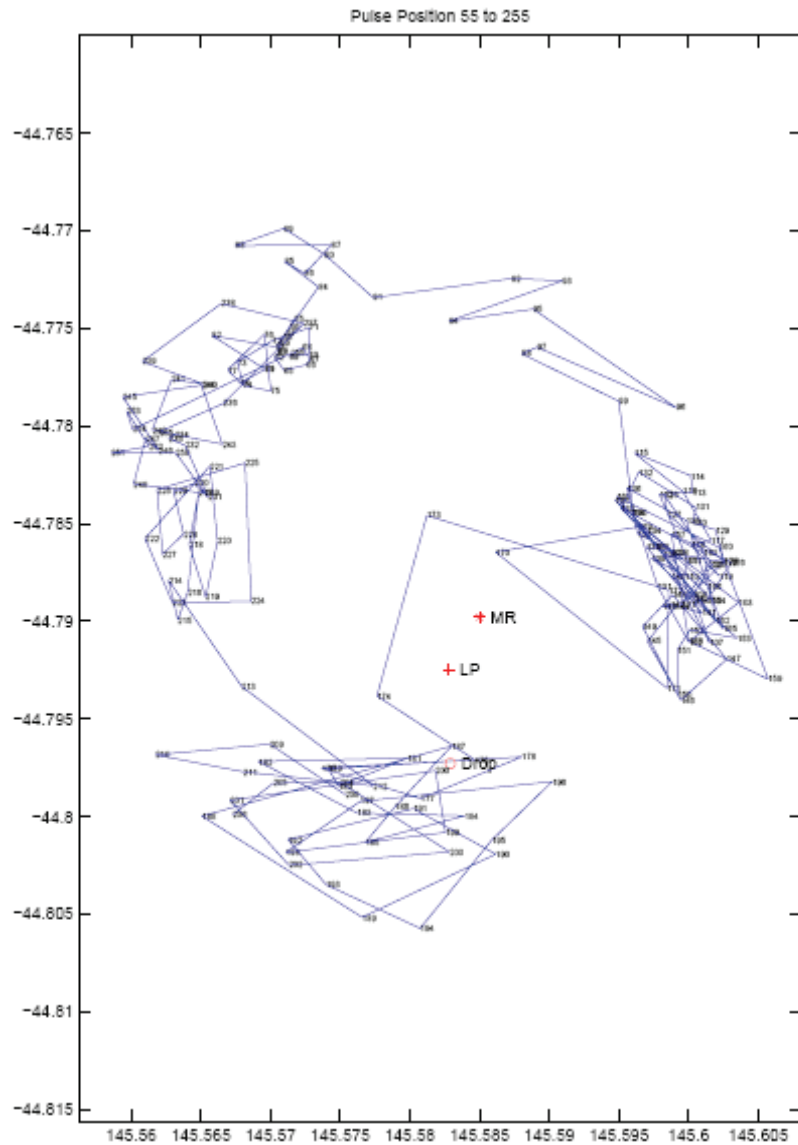


Figure 3: PULSE TEST 5. Mooring Schematic

