



SOUTHERN OCEAN AND CLIMATE
FIELD STUDIES WITH INNOVATIVE TOOLS

Options for SOCLIM moored observations over the Kerguelen Plateau:

as informed by experiences at the
Australian Southern Ocean Time Series

Tom Trull



An Australian Government Initiative



ANTARCTIC CLIMATE & ECOSYSTEMS
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SOTS deploys 3 moorings:

1. SAZ sediment trap mooring – this technology is already available to SOCLIM
2. SOFS meteorological tower mooring – some overlap with Kerguelen island
3. Pulse mooring for upper ocean biogeochemical sensors and sample collection

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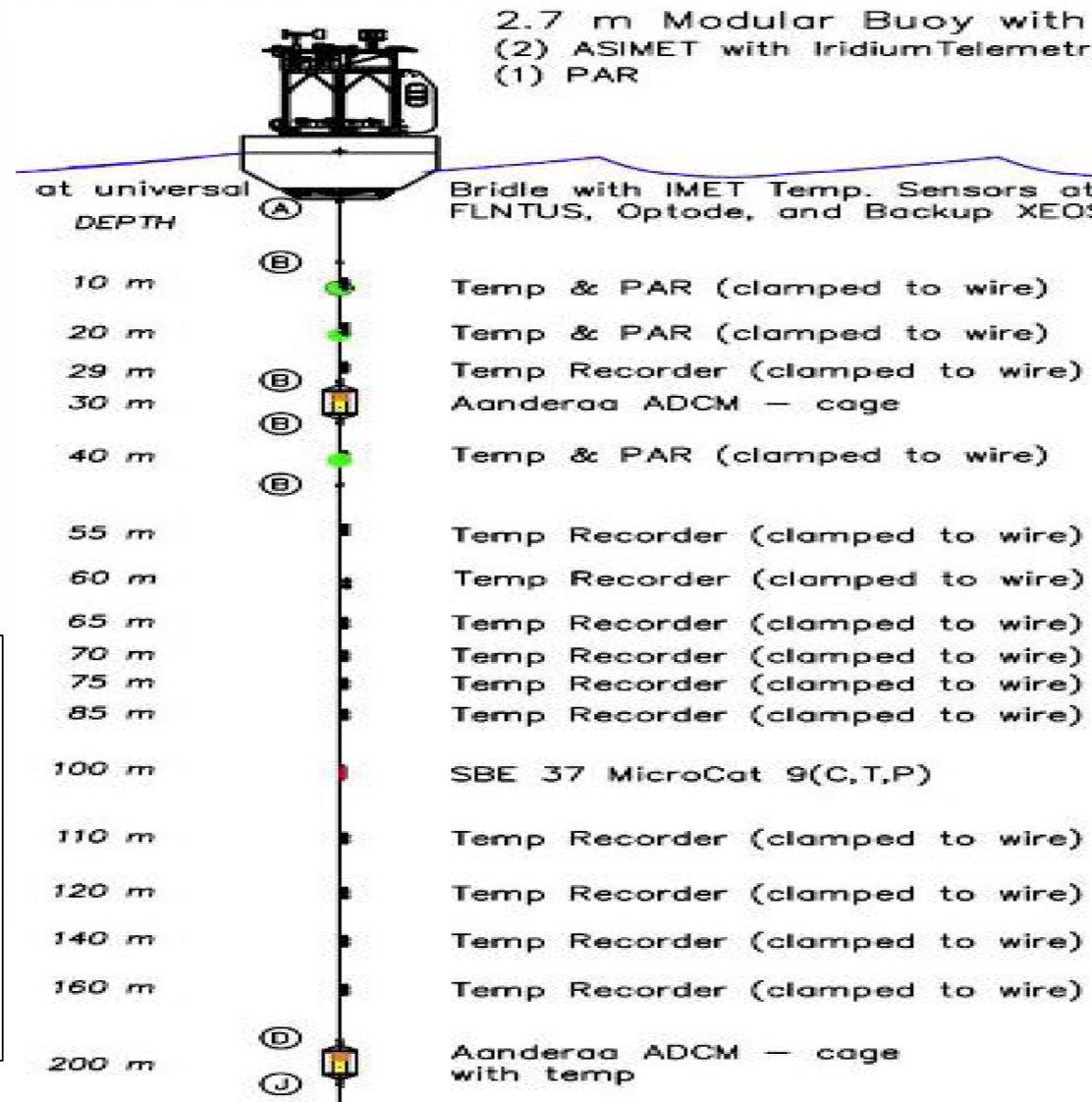


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SOFS Air-Sea Flux Mooring

- ASIMET Meteorology
- ADCP currents
- Accelerometer waves
- NOAA pCO₂
- Sea Surface T,S,O₂, FI-BB
- AWCP zooplankton (4 frequency acoustics)



Pulse BGC Mooring

- 1 m diameter, 0.5m freeboard float
- Elastic decoupler, inertial mass, S-tether, integrated instrument package
- Aanderaa Optode O2
- Seabird T, S, Electrode O2
- Pro-Oceanus Gas Tension
- Mclane RAS 24x2x500ml water samples: nutrients, DIC, Alk, Phyto ID
- Wetlabs PAR, Fluo-Backscatter
- ISUS UV nitrate sensor

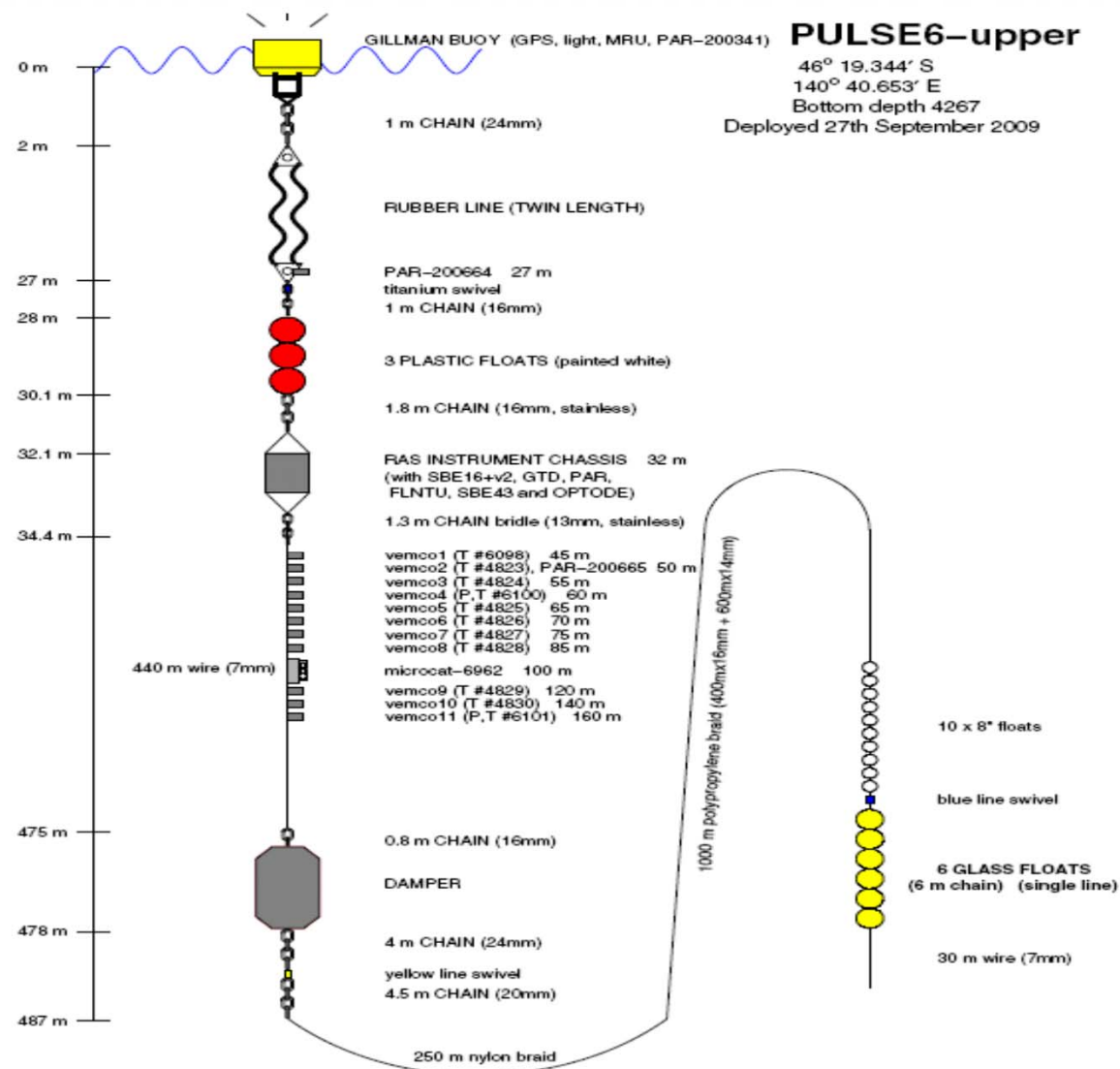


Intake outside shroud through 1mm screen
 No filtration
 Backflushing with mercuric chloride instead of acid

Samples collected in pairs:

HgCl₂ for nutrients, DIC, Alk, 13C-DIC

Buffered/Si-enriched glutaraldehyde for microscopy



What's been achieved with SOFS and Pulse?

Net community production from O₂/N₂ ratios:

Weeding and Trull 2014. Hourly oxygen and total gas tension measurements at the Southern Ocean Time Series site reveal winter ventilation and spring net community production. *JGR - Oceans*, 119: 1–11.

Partitioning of CO₂ fluxes across physical and biological drivers:

Shadwick, Trull, et al. 2014. Seasonality of biological and physical controls on surface ocean CO₂ from hourly observations at the Southern Ocean Time Series site south of Australia. *Global Biogeochemical Cycles*, in review.

RAS automated water sample collection (48 samples):

Nutrients, DIC, alkalinity, isotopic seasonal cycles – Trull et al., in prep

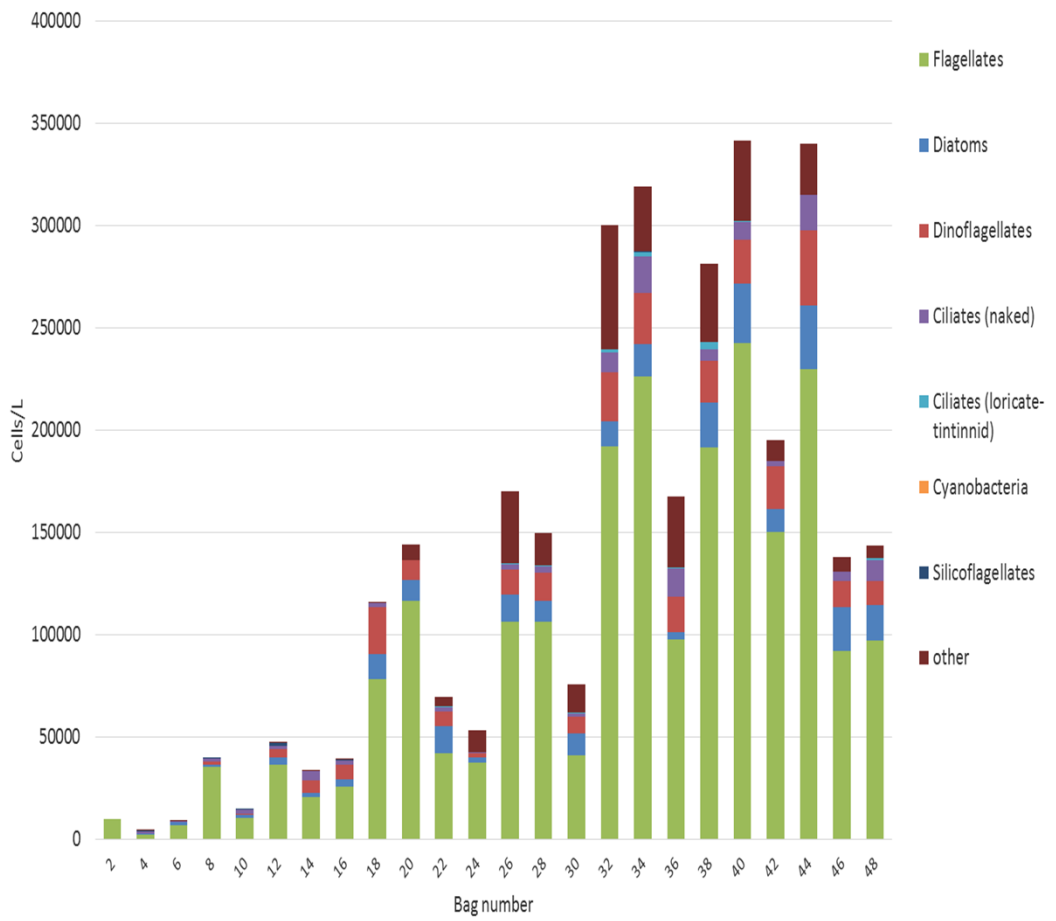
Plankton community structure – Eriksen et al., in prep

AWCP 4-frequency acoustic backscatter :

Zooplankton and mesopelagic fish abundances with depth resolution – Trull et al., in prep

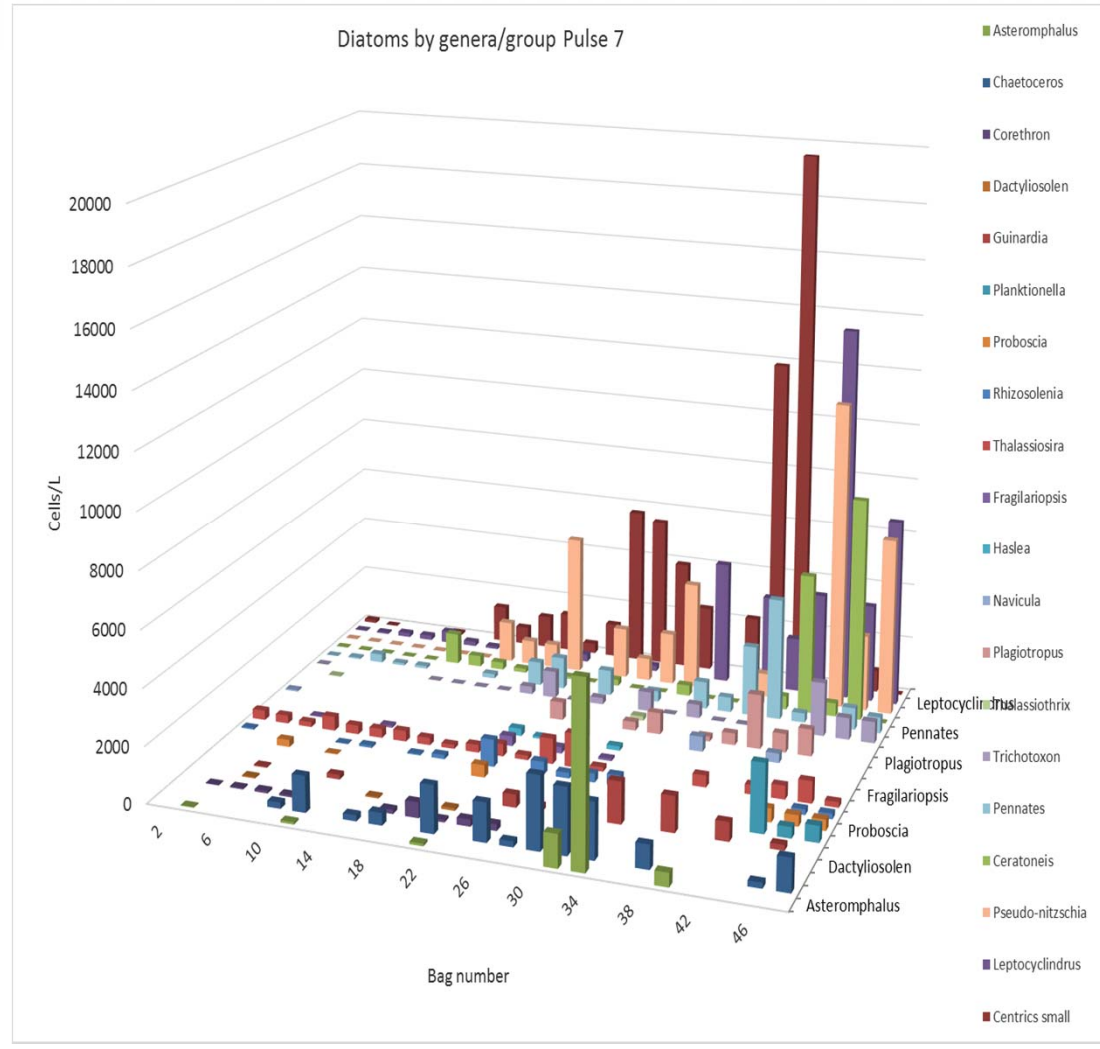
Taxonomic details from RAS water samples

Major group summary Pulse 7



Deployment dates September 12, 2010 – April 7, 2011

Diatoms by genera/group Pulse 7

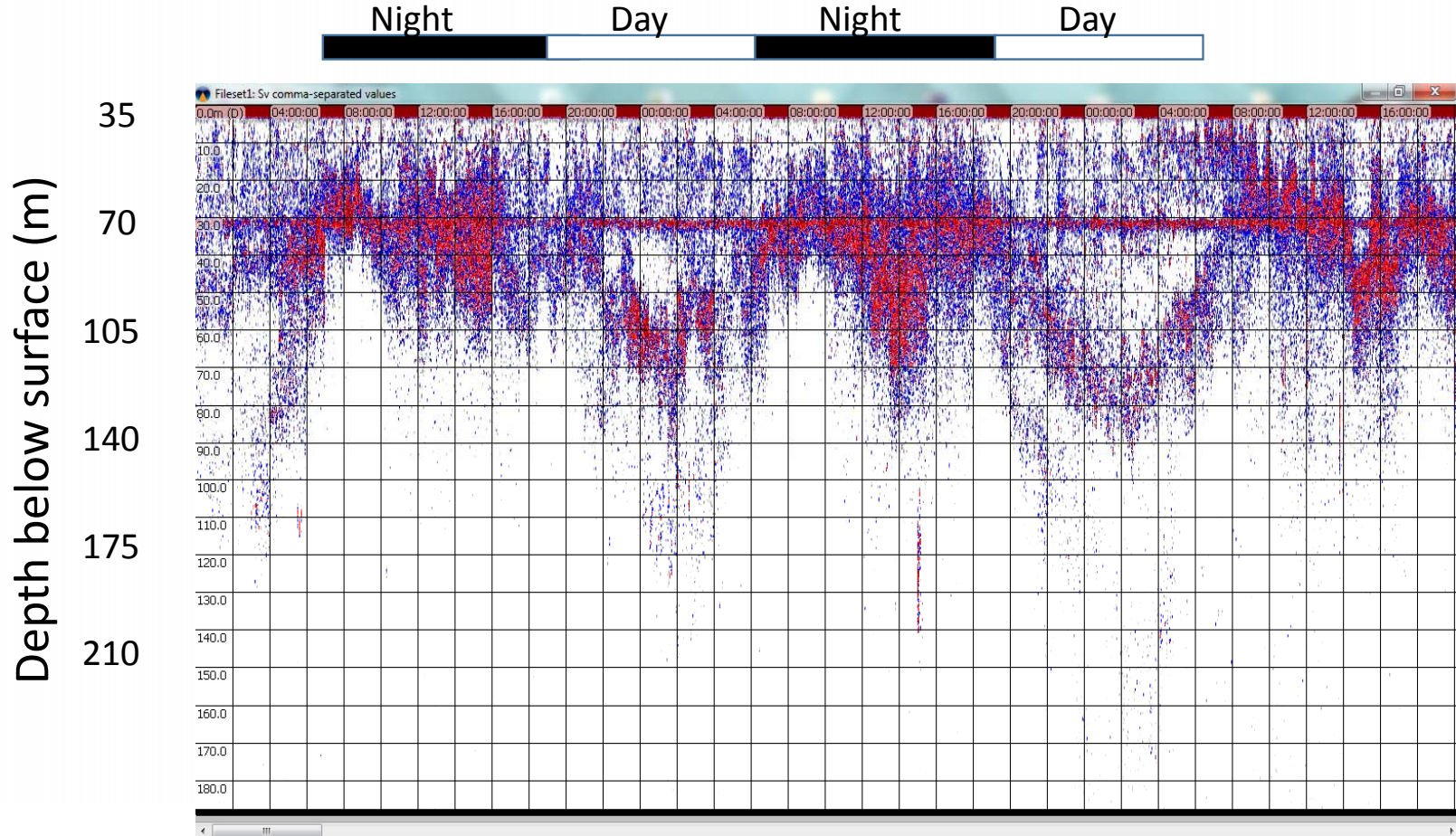


Eriksen, Davies, Davidson, Trull, in prep

AWCP bio-acoustics – more biomass, shallower diel cycle in December

38 kHz

$\lambda \sim 4\text{cm}$



What's missing at SOTS, and needed for SOCLIM?

Vertical gradients:

Oxygen, CO₂, and nutrient budgets are strongly influenced by entrainment.

Gradients are required to calculate fluxes

Options – floats released by a carousel, tethered profiler, distributed loggers

Dissolved trace metals:

RAS sampler has proven difficult to make trace element clean (but some success by others).

Option: Smaller, individual 50ml sample collecting elements under development at ACE CRC.

This approach provides for gradient as well as single depth time series.

Particles:

Options:

Profiling bio-optics

Moored in-situ pumps?