

Pulse of the Weddell Sea

Marginal Ice Characterisation of Remote-sensing Observations & Submesoscale Controls of Productivity and Export in the Weddell Sea (Topics 1-4)

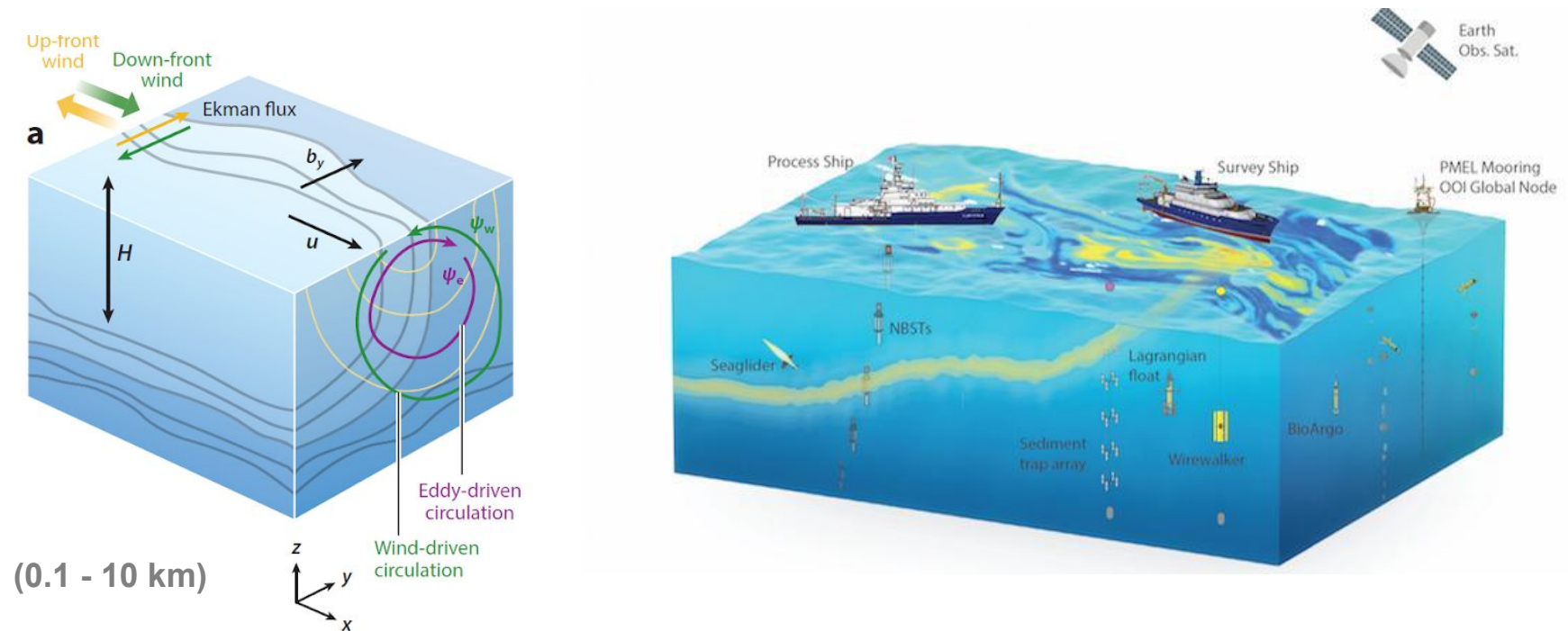


Figure adapted from: Mahadevan et al. (2016)



[MICRO_SCOPE] Topics 1-4

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- Gliders, physics, biophysical interactions, export

Co-PI: Hilde Oliver (WHOI, USA)

- Remote sensing validation, absorbance/irradiance

Participant(s): Meredith Meyer (Uni. East Anglia, UK)

- Primary productivity modelling

Polar Gliders team (Uni. Gothenburg)

- Submesoscales and MIZ expertise.



Scientific hypotheses / Research questions

- » **How do submesoscale processes enhance prod/export and how can we assess their impact?**
- » **WP 1:** Map out net primary production and carbon export (in space and time). Identify importance of different carbon pumps.
- » **WP 2:** Do the above change in regions of strong surface horizontal buoyancy gradients. How?
- » **WP 3:** Generic remote sensing algorithms for Chl-a, PP and export don't work here, so develop regional parameterisation to estimate over longer time/space scales.



Parameters measured within the project

Physics - SEA057:

T, S, O₂

Chl-a, Phycoerythrin, bbp @ 700nm

Microstructure turbulence

ADCP

Biology – SEA070:

T, S, O₂

Chl-a, CDOM, bbp @ 700nm

PAR + 3 irradiance wavelengths

NO_x, H₂S



$$\frac{d[\Omega]}{dt} = -u \frac{\partial[\Omega]}{\partial x} - v \frac{\partial[\Omega]}{\partial y} - w \frac{\partial[\Omega]}{\partial z} + K_h \left(\frac{\partial^2[\Omega]}{\partial x^2} + \frac{\partial^2[\Omega]}{\partial y^2} \right) + K_v \frac{\partial^2[\Omega]}{\partial z^2} + \text{Bio}([\Omega])$$

Ω representing any of POC, O₂, NO_x



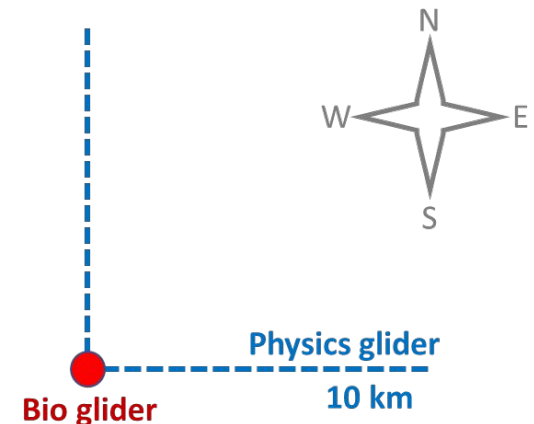
Type of data collection

Characterisation of water column optical properties

- >> Multispectral absorbance profiles from the ship-based CTD for calibration of remote sensing observations. Specific instrument to be confirmed later, on loan from WHOI. Mounted onto the ship's CTD and will collect data on every CTD cast.
- >> CTD casts at regular intervals for broader view of hydrography. Especially if can capture subducting filament.
- >> CTD casts at launch, recovery and ideally weekly intervals to calibrate Chl-a, NO_3 , O_2 , POC, PAR, irradiance.

Dual glider survey

- >> L-shaped transect to map horz. gradients and curl with ADCP.
- >> VM to capture vertical processes, export and time dependence.
- >> Daily glider crossings, 500m hourly profiles with 700m horz. spacing. 1-month endurance before recharge.



Logistic support requirements

- >> Small boat for deployment and recovery & internet for piloting of gliders.
- >> Ideally 2 berths for SeaExplorer glider preparation team and analysis of calibration samples. At a push, this can be reduced if we can synergise between projects.
- >> Dedicated 6 hour slot at start and at end for deployment/recovery of gliders.
- >> Sporadic CTD profiles at glider location (weekly ideal) for calibration.
- >> Sporadic CTD profiles across region (no time constraints, no specific location constraints but interest in subducting filaments). SeaExplorer specialists will have little to do while instrument is at sea and can contribute to science needs from other projects if helpful.
- >> Chlorophyll-a, POC, and nutrient sampling are key for calibrations. Winklers would also be beneficial. *Who else is planning analysis of Chl-a, POC and nutrients? Should we analyse all samples in same place? If a project has a plan, I'm keen to pay for samples to be analysed with.*
- >> *Photosynthesis-Irradiance curves from incubations would be hugely valuable but lacking instrumentation/expertise.*

