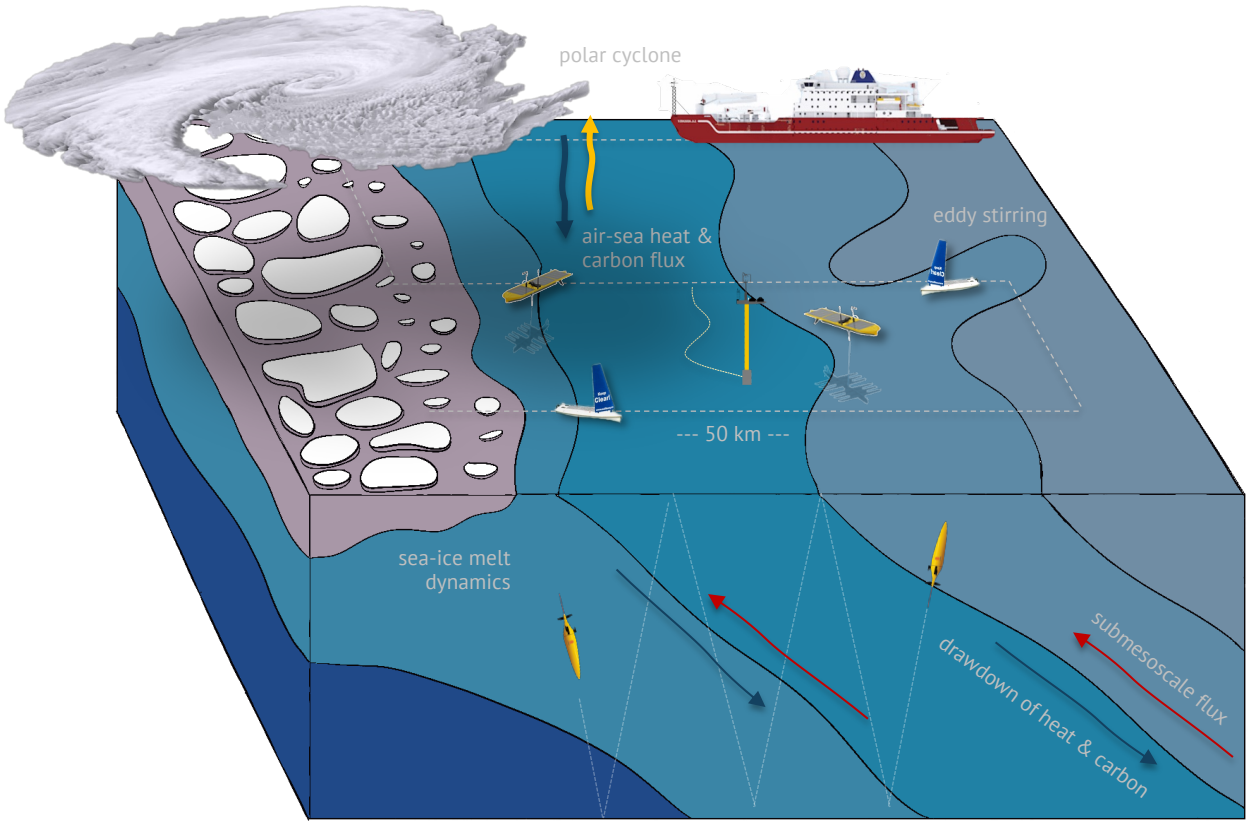
Pulse of the Weddell Sea

Sampling Air-sea impacts on the Vertical Ocean using Uncrewed Robotics

Direct connections to T1, T2 & T4



POLARFORSKNINGS SEKRETARIATET
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Sampling Air-sea impacts on the Vertical Ocean using Uncrewed Robotics

Direct connections to T1, T2 & T4

Principal Investigator: Marcel du Plessis, UGOT, air-sea interactions

Co-PIs:

- Sebastiaan Swart, UGOT, upper ocean physics, air-sea interactions
- Isabelle Giddy, UGOT, upper ocean turbulence

Project Participants:

- Sarah Nicholson, SOCCO-CSIR: ocean turbulence, air-sea interactions
- Brian Ward, National University of Ireland: ocean turbulence, air-sea interactions
- John Prytherch, SU: air-sea flux observations
- Bastien Queste, UGOT: ocean gliders and biogeochemistry
- Johan Edholm, UGOT: USV, fine scale fronts, and ADCP derives velocities
- Carol-Anne Clayson, WHOI: air-sea interactions
- Jim Edson, WHOI: air-sea interactions
- Sabrina Speich, ENS Paris: marine atmosphere boundary layer dynamics
- Sam Fredriksson, SMHI: ocean turbulence, air-sea interactions

Scientific hypotheses / Research questions

1. What sets the magnitude and variability of the **air-sea heat and carbon exchange** in the Antarctic Marginal Ice Zone?

2. What are the short and long-term **impacts of polar cyclones on the ocean heat content and transport**?

3. How does **synoptic-scale variability modulate submesoscale dynamics** associated with sea-ice processes?

Parameters measured within the project

CTD
- Temperature
- Salinity
- Chlorophyll
- Oxygen
- DIC

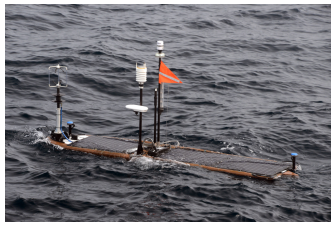
Underway
- Temperature
- Salinity
- Velocity
- Oxygen

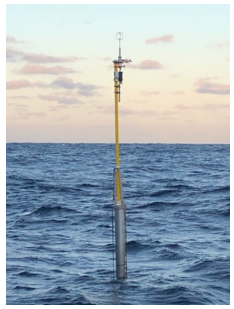
Meteorology
- Air Temperature
- Relative humidity
- Wind speed
- Downwelling longwave and shortwave radiation
- Cloud properties

Direct Covariance
- 3D winds
- Water vapour
- CO_2

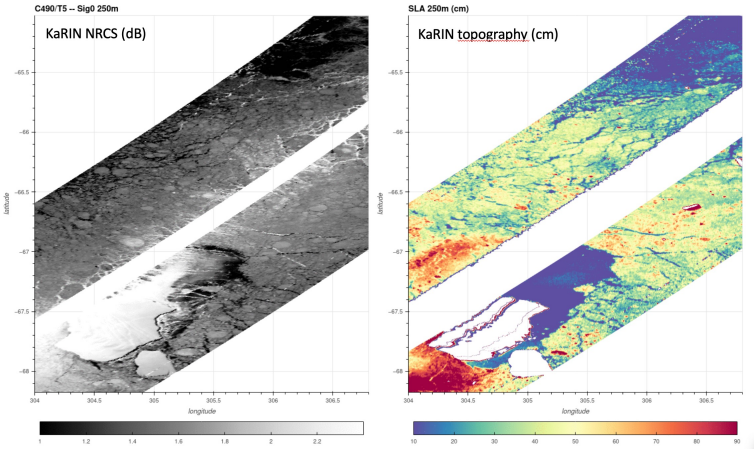
USVs
- 3D winds
- Air-sea temp
- Relative humdity
- Pressure
- Rainfall + PWV
- Waves
- ADCP

X-Spar
- 3D winds
- Air-sea temp
- Relative humidity
- Pressure
- Rainfall
- Waves





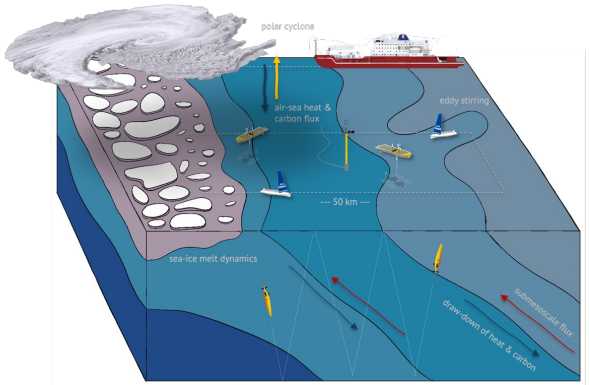
Type of data collection



Sea-ice edge survey northward and within sea-ice edge

~2 days for deployment, 8 days (roughly 2 synoptic periods)

- Deploy USVs (Wave Gliders & Sailbuoys)
  - *A-frame winch aft deployment using quick release*
  - *Approximately 3 hours for deployment*
  - *Intercalibration ongoing during other deployments*
- Deploy X-Spar buoy
  - *Approximately 3 hours for deployment*
- Deploy other autonomous instrumentation (e.g. Seb Swart & Bastien Queste projects)
  - *Seagliders, SeaExplorers, ASIP profiler etc.*
  - *4 -6 hours required*
- Deep CTD cast for calibration of instrumentation
  - *Characterisation of upper ocean oceanography (e.g. Adam Ulfsbo project and others)*
- Ship grid-style survey overlapping with autonomous vehicles, excursions into and out of the sea ice edge
  - *Eddy covariance and mean meteorology running (connection to John Prytherch)*
  - *Underway T, S, Alkalinity*



Logistic support requirements

- Mean meteorology sensor installed on ship mast
  - Wind speed and direction, relative humidity, air temperature, rainfall, pressure, downwelling shortwave and longwave radiation
  - Possible collaborative installation of ceilometer, lidar, radiosondes…
- Direct Covariance Flux System
  - Mast on forefront of the bow, preferable extention forward to reduce wind distortion effect
  - Container near the mast on the ship bow with power supply + regular access
- Aft winch / side crane
  - Deployment & recovery of Uncrewed Surface Vehicles (~2 m) and X-Spar buoy (14 m height)
- Zodiac
  - Deployment and recovery of autonomous instrumentation
- Integrated ship sampling operations
  - CTD
  - Towed underway system highly advantageous (e.g. MVP)
  - Underway TSG system
  - Salinometer for salinity calibration
- Space:
  - Bench space for chlorophyll filtration and oxygen titration (collab?)
  - Sufficient storage for autonomous instrumentation and open air testing
  - 5 berths (overlap with other projects, *e.g.* S. Swart, J. Prytherch, B. Queste)