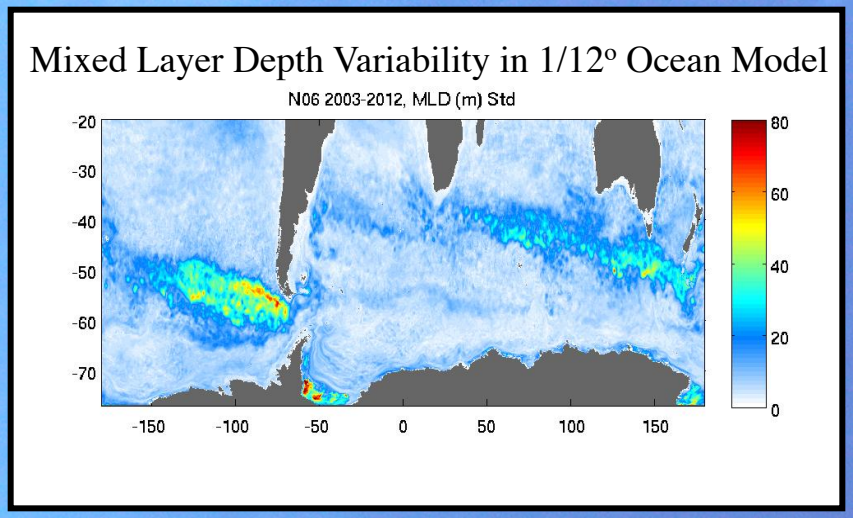
New insights into concurrent air-sea heat flux forcing of Subantarctic Mode Water formation from mooring observations in the Southeast Indian and Southeast Pacific sectors of the Southern Ocean

Outline

- Background – Southern Ocean Sampling
- Recent / Ongoing Results – Model & Obs.
- Conclusions and Outlook



Simon Josey (National Oceanography Centre, UK), Veronica Tamsitt (CSIRO), Ivana Cerovecki, Sarah Gille, Eric Schulz (BoM), EGU, May 7th, 2020

The Southern Ocean Sampling Problem

• Attempts to estimate air-sea exchanges in Southern Ocean are plagued by lack of observations. All available flux fields have significant sampling problems including reanalyses.

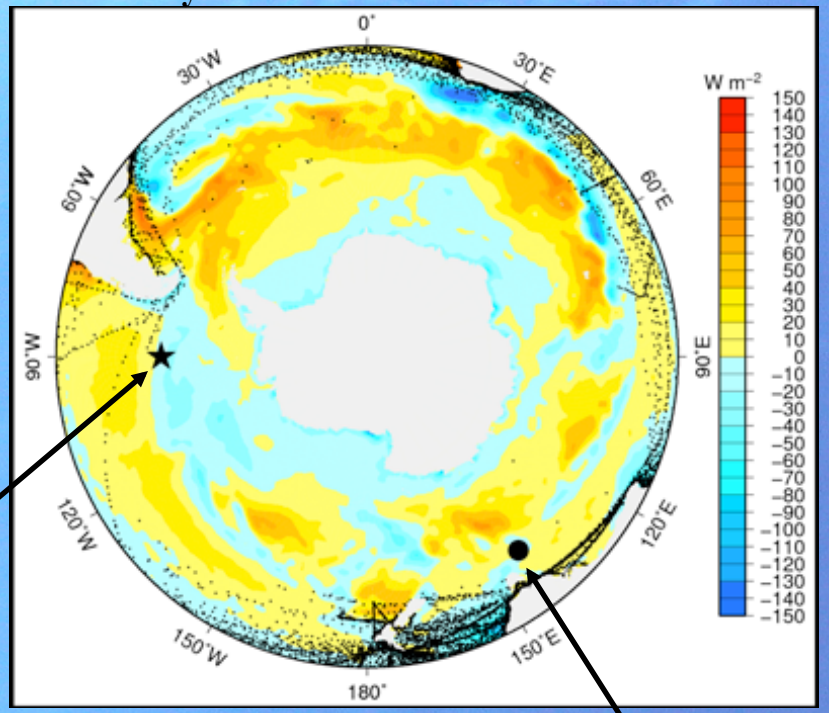
Latent heat flux estimates require wind speed, SST, air temperature and humidity.

• Some coverage in austral summer, virtually nothing in winter.

• Surface flux moorings offer potential for accurate year-round evaluation of reanalysis fields at specific locations.

Southern Ocean Observing System (SOOS) air-sea flux working group (Gille et al., 2016).

All July Latent Heat Flux Obs. 2000-2004.



Ocean Observatories Initiative (OOI) mooring (55 S, 90 W), deployed Mar 2015

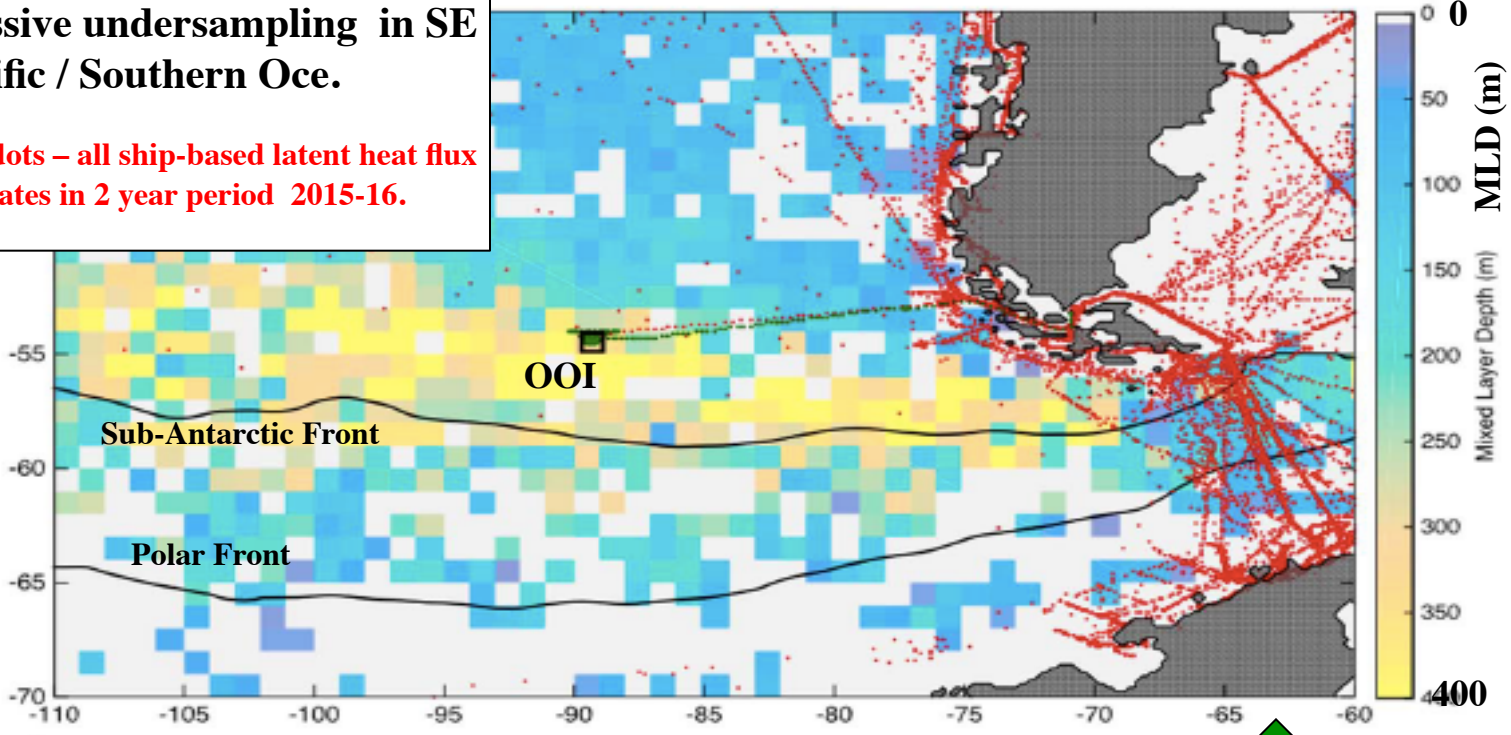
Southern Ocean Flux Station (SOFS) mooring (46.75 S, 142 E), deployed 2010

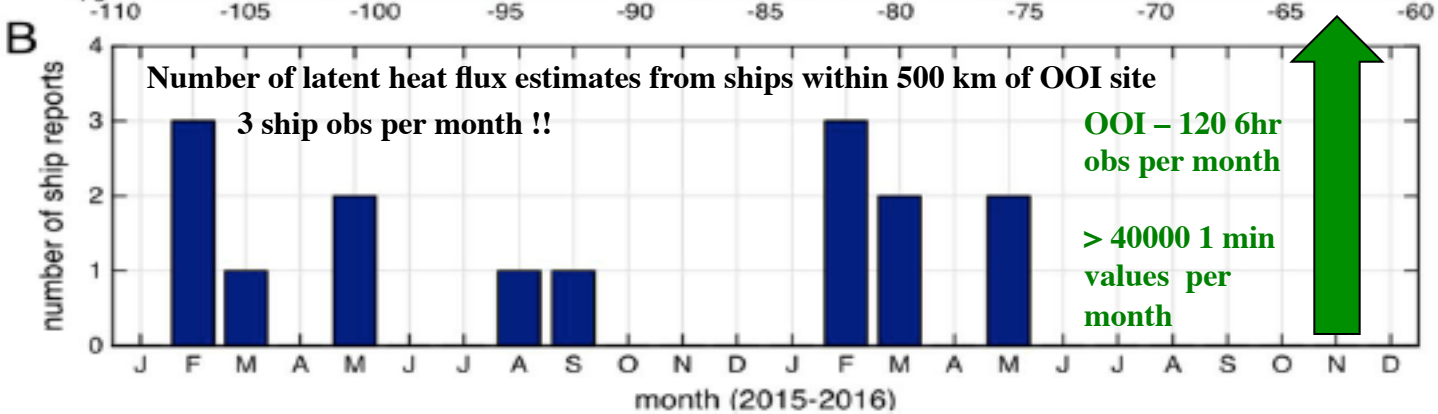
Gille, S., S. A. Josey, and S. Swart, 2016: New approaches for air-sea fluxes in the Southern Ocean, Eos, 97, doi:10.1029/2016EO052243.

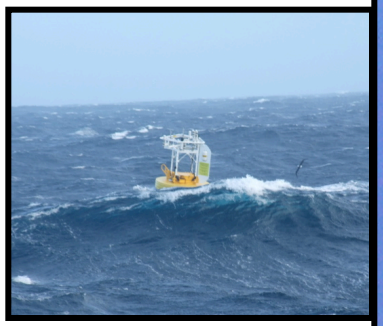
OOI and SOFS Moorings Have Enabled First Multi-month Characterisation of Southern Ocean Air-Sea Interaction

Massive undersampling in SE Pacific / Southern Oce.

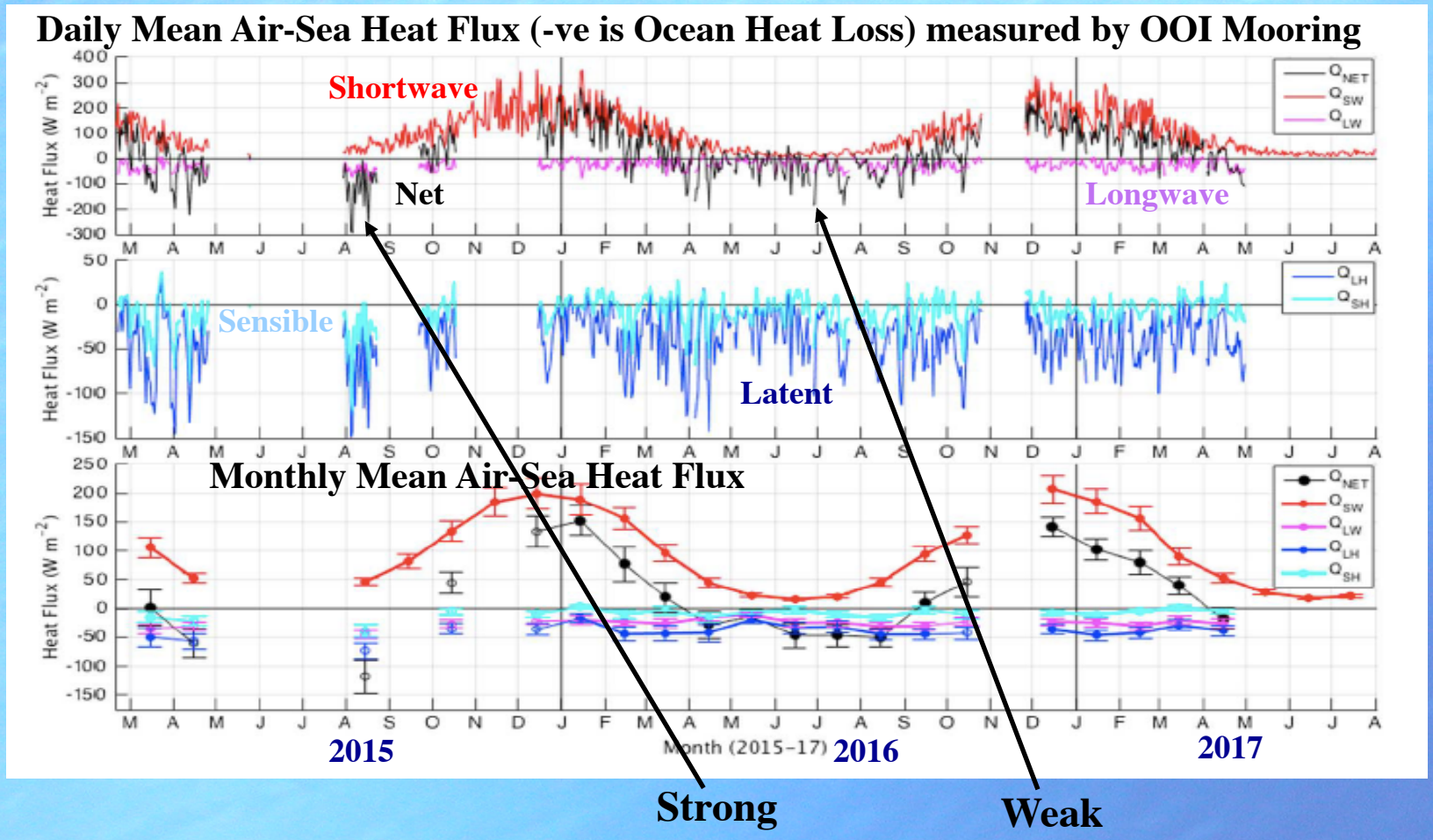
Red dots – all ship-based latent heat flux estimates in 2 year period 2015-16.





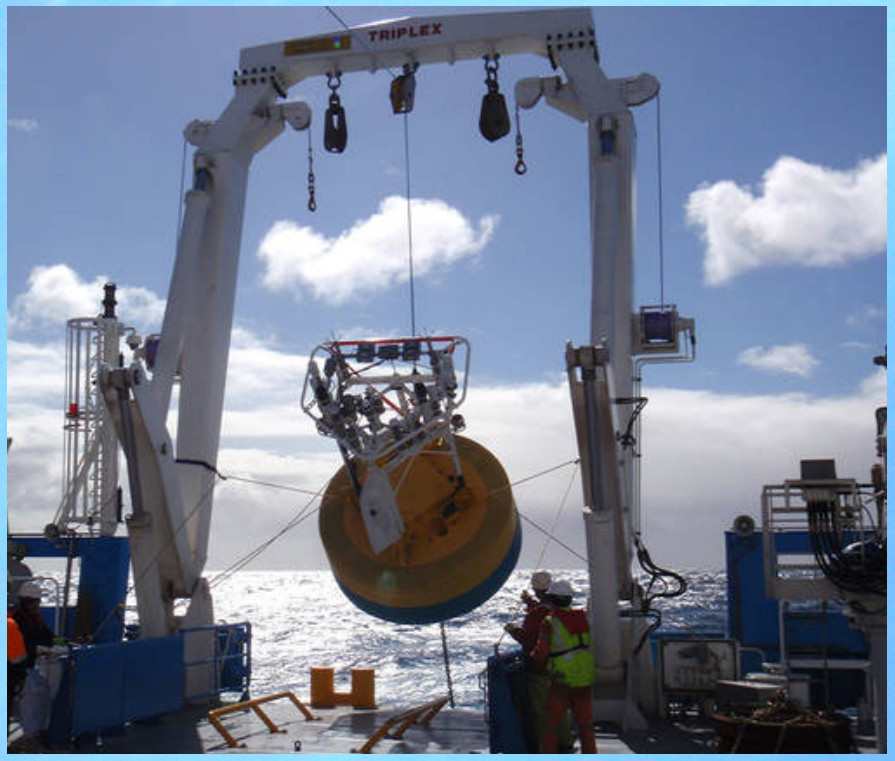


Ogle, S. E., Tamsitt, V., Josey, S. A.,Gille, S. T., Cerove˘cki, I., Talley, L. D., & Weller, R. A. (GRL, 2018). Episodic Southern Ocean heat loss and mixed layer impacts revealed by the farthest south multiyear surface flux mooring.



- First in situ quantification of air-sea heat exchange from prime Subantarctic Mode Water formation region.
- Episodic surface heat loss events occur when SW winds bring cold, dry air to mooring location.
- Wintertime heat loss promotes SubAntarctic Mode Water formation.
- Significant interannual variability: strong heat loss in winter 2015 led to deep mixed layers (>300 m), which were nonexistent in winter 2016 (weak heat loss).

The Moorings

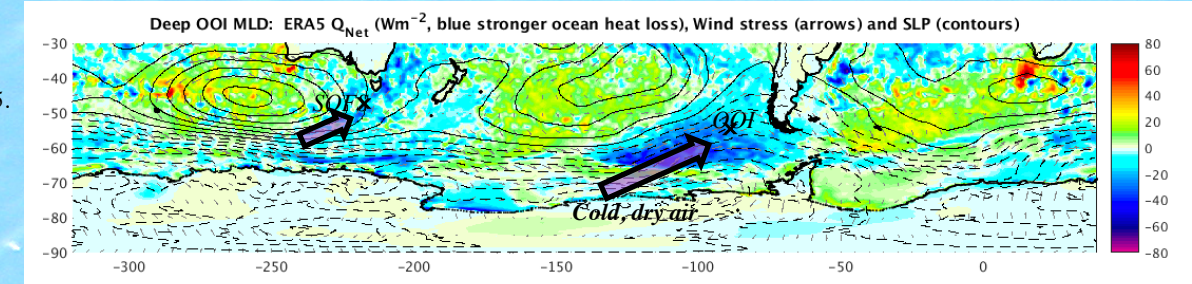


SOFS mooring. credit: MNF

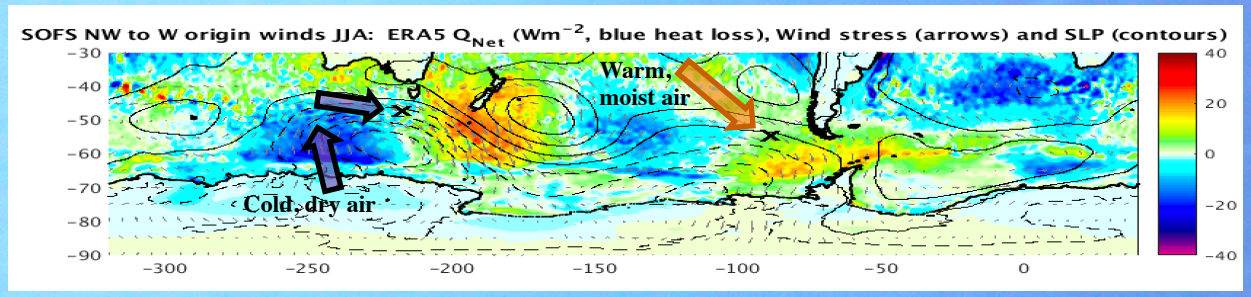
OOI Southern Ocean flux mooring

Key New Result : Heat Loss (and SAMW formation) has Two Main Wind Direction Relationships at the OOI and SOFS Sites

Deep OOI MLD winters : 2010 and 2015.



- **SW Winds - Strong Heat Loss at Both OOI and SOFS SAMW Formation Sites:** Deep Sep MLD at OOI site is preceded by strong winter ocean heat loss due to advection of cold, dry air from the SW that enhances latent and sensible heat loss. *Co-ordinated SAMW formation between sites*.



- **NW to W Winds - Strong Heat Loss at SOFS SAMW Formation Site Only:** NW to W winds give heat loss at SOFS site but not at OOI. Likely due to different origin of air masses : sub-polar (SOFS) vs sub-tropical (OOI). *SAMW formation at two sites uncoordinated*.

- **Please read full story in : Mooring Observations of Air–Sea Heat Fluxes in Two Subantarctic Mode Water Formation Region. Veronica Tamsitt, Ivana Cerovečki, Simon A. Josey, Sarah T. Gille, and Eric Schulz, J. Climate, 2020, https://journals.ametsoc.org/doi/full/10.1175/JCLI-D-19-0653.1**