Oceanic Heat Delivery to the Antarctic Continental Shelf: Large-Scale, Low-Frequency Variability

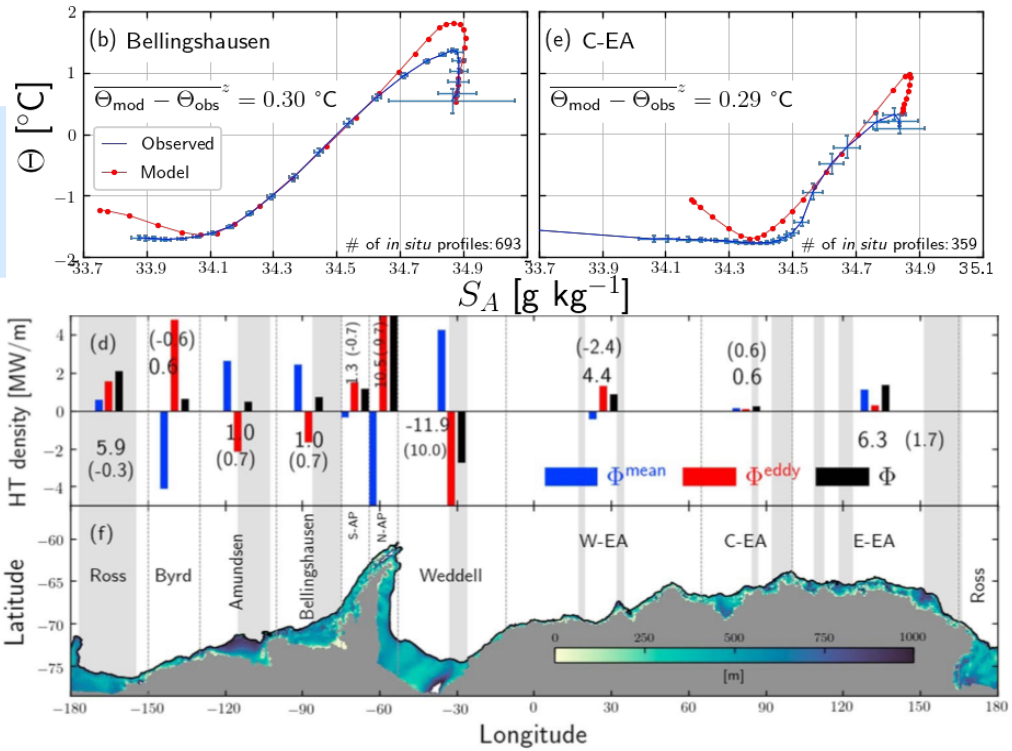
Objective

Study the seasonal to inter-annual variability of the on-shelf heat transport around Antarctica, its driving mechanisms, and its circumpolar structure.

Approach

- Evaluate model realism (POP2/CiCE4** global 0.1^o simulation) using observed water mass structure* along the Antarctic continental slope.
- Calculate the net cross-isobath heat transport (HT) as a function of time, across- and along-isobath distance, and separate HT in its time-mean and eddy components.
- Correlate the variability in HT with wind stress, surface buoyancy fluxes and climate indices (SAM and Niño 3.4).

*Temperature and salinity profiles from animal-borne instruments (Marine mammals Exploring the Oceans Pole-to-pole, MEoP).
**Parallel Ocean Program 2/Community sea-Ice CodE 4.



Upper panels: Area- and time-averaged (2005-2009) observed (blue) and simulated (red) temperature-salinity diagrams for the ACS segment Bellingshausen and Central-East Antartica (C-EA), indicated on the bottom panel. **Lower panels:** Time-averaged (1959-2009) onshore heat transports along the ACS's segments (labeled on the bottom panel). The vertical bars, un-bracketed and bracketed numbers on the top panel are, respectively, the segment-integrated onshore transport divided by the segment's length, the total onshore-integrated transport (in TW) and the convergence of the along-shelf heat transport (in TW) in each segment.

Impact

1) The data-model comparison demonstrates the usefulness of block-averaged (in time and space) sparsely-available *in situ* observations as a metric for evaluating model biases (see figure above).
2) The seasonal and inter-annual variability of the mean and eddy circumpolar on-shelf heat transport and its potential drivers are described for the first time in a realistic global model.
3) The convergence of the along-shelf heat transport rivals the ocean-shelf heat exchange (both are in the ~1 TW-10 TW range), highlighting the potential importance of the along-shelf circulation for the Antarctic shelf's heat budget.

SCRIPPS INSTITUTION OF OCEANOGRAPHY
UC San Diego

Palóczy, A., Gille, S. T., & McClean, J. L. (2018). Oceanic heat delivery to the Antarctic continental shelf: Large-scale, low-frequency variability. Journal of Geophysical Research: Oceans, 123. https://doi.org/10.1029/2018JC014345