**Why high-frequency winds?**

- Winds modulate air-sea exchange and directly impact mixed layer processes, yet high-frequency winds (gusty, intermittent) are still poorly understood.
- The stormy Southern Ocean is a perfect natural laboratory for investigating high-frequency winds.
- We combine observations + 1-D model to explore impacts of high-frequency winds on upper ocean stratification in the Southern Ocean.
- First, is our model fit for task?

**Our tool belt: mooring observations and 1-D process model**

**summer (DJF) mean MLD**  
**winter (JJA) mean MLD**

**Why does GOTM fit for task? Yes!**

- Assessing the January 2016 heat budget terms from the Biogeochemical Southern Ocean State Estimate (B-BOSE; Figure 5) reveals that both mixing and advection (mostly driven by horizontal, right panel) are critical at the depths of MLD variability (40-100 m) at the OOI site.

**What's next?**

- Project to-do list:
  - Assess model fitness for our regions of interest.
  - Explore impacts on upper ocean in GOTM through idealized wind experiments.

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**References**


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**Figure 1:** Locations of two Southern Ocean moorings used to assess fitness of 1-D process model overlain on seasonal mean mixed layer depth (MLD; Holte et al., 2017). On the impact of high-frequency wind variability on upper ocean stratification in the Southern Ocean.

**Figure 2:** Forcing variables from the Southern Ocean OOI mooring (dashed), either directly measured or calculated according to the COARE 3.5 algorithm (Edson et al., 2013; Ogle et al., 2018) as well as output from the (left) January 2016 and (right) June 2016 GOTM simulation (solid). We initialize a January 2016 GOTM simulation with a precipitation rate (10 cm vertical resolution) being evaluated; schematic below and Southern Ocean Flux Station (SOFS) mooring (open magenta circle; 46.8°S, 93.3°W; currently being evaluated; schematic below) and Southern Ocean Flux Station (SOFS) mooring (open magenta circle; 46.8°S, 142.2°E; to be evaluated in future).

**Figure 3:** Potential temperature (left) and salinity (right) as observed by the OOI CTD package (colored markers; at 12 m, 20 m, 60 m, 80 m, 100 m, and 130 m) overlain on the corresponding January 2016 GOTM simulation (colors). This material is based upon work supported by the National Science Foundation under Cooperative Agreement No. 1743430 (which supports the OOI) or other relevant NSF award number. Ogle et al., 2018, doi:10.1029/2017GL076909; Verdy & Mazloff, 2017, doi:10.1029/2016JC012680

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**Figure 4:** Potential temperature (left) and salinity (right) as observed by nearby (within ~230 km) Argo floats (colored markers) overlain on the corresponding June 2016 GOTM simulation (colors). However, the 1-D nature of GOTM precludes the representation of horizontal advection so we will confidently move forward armed with this knowledge.

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**Figure 5:** Biogeochemical Southern Ocean State Estimate (B-BOSE; Verdy & Mazloff, 2017) upper 150 m heat budget at OOI mooring site (54.4S, 270.8E; iteration 133 available at http://sose.ucsd.edu/ BSOSE6_iter133_solution.html) on January 15, 2016. Left: Heat budget terms include total tendency (dark blue), air-sea flux (orange), shortwave radiation (yellow), mixing (purple), advection (green), correction due to a linear surface (cyan), and the residual (dashed black). Right: Advection (green) and its components, vertical (black solid) and horizontal (black dashed).

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**Table:**

- ** setup GOTM mixing parameters.