

# Dissipation in the Bay of Bengal from a Seaglider



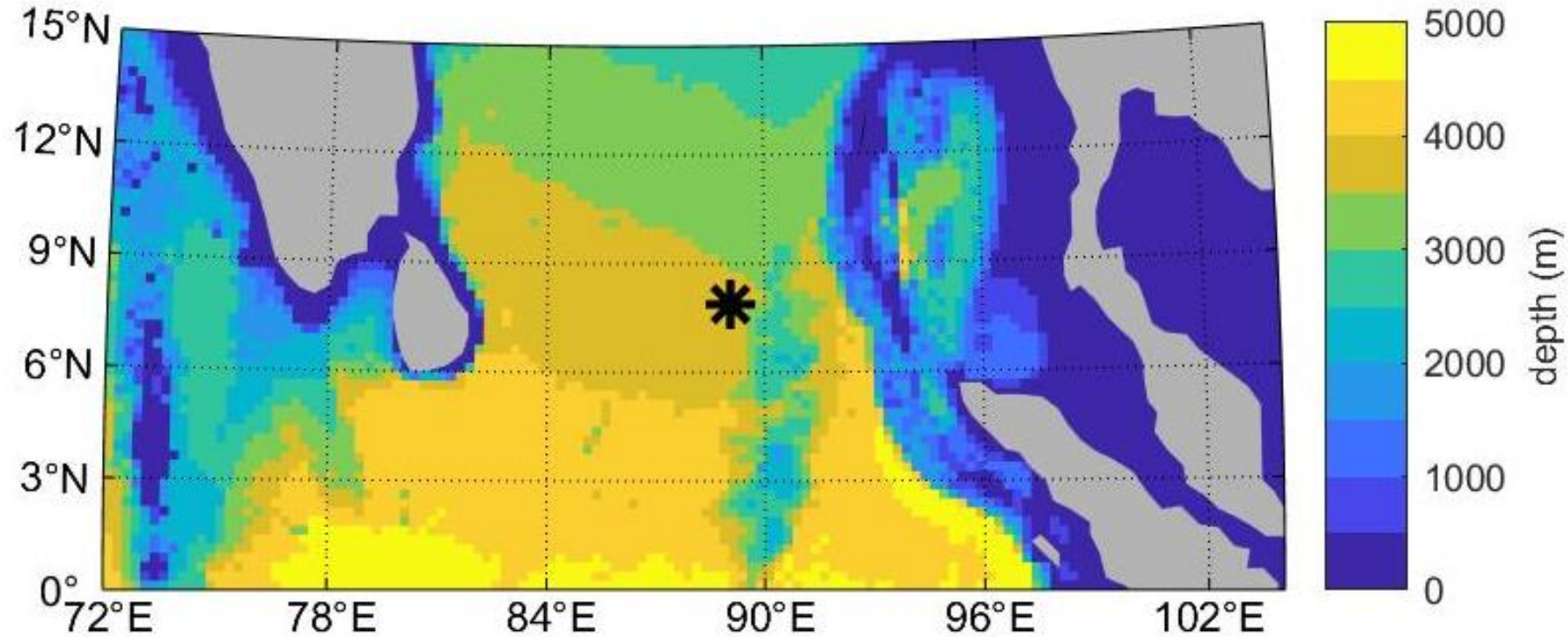
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Photo credit: Olga Flegontova

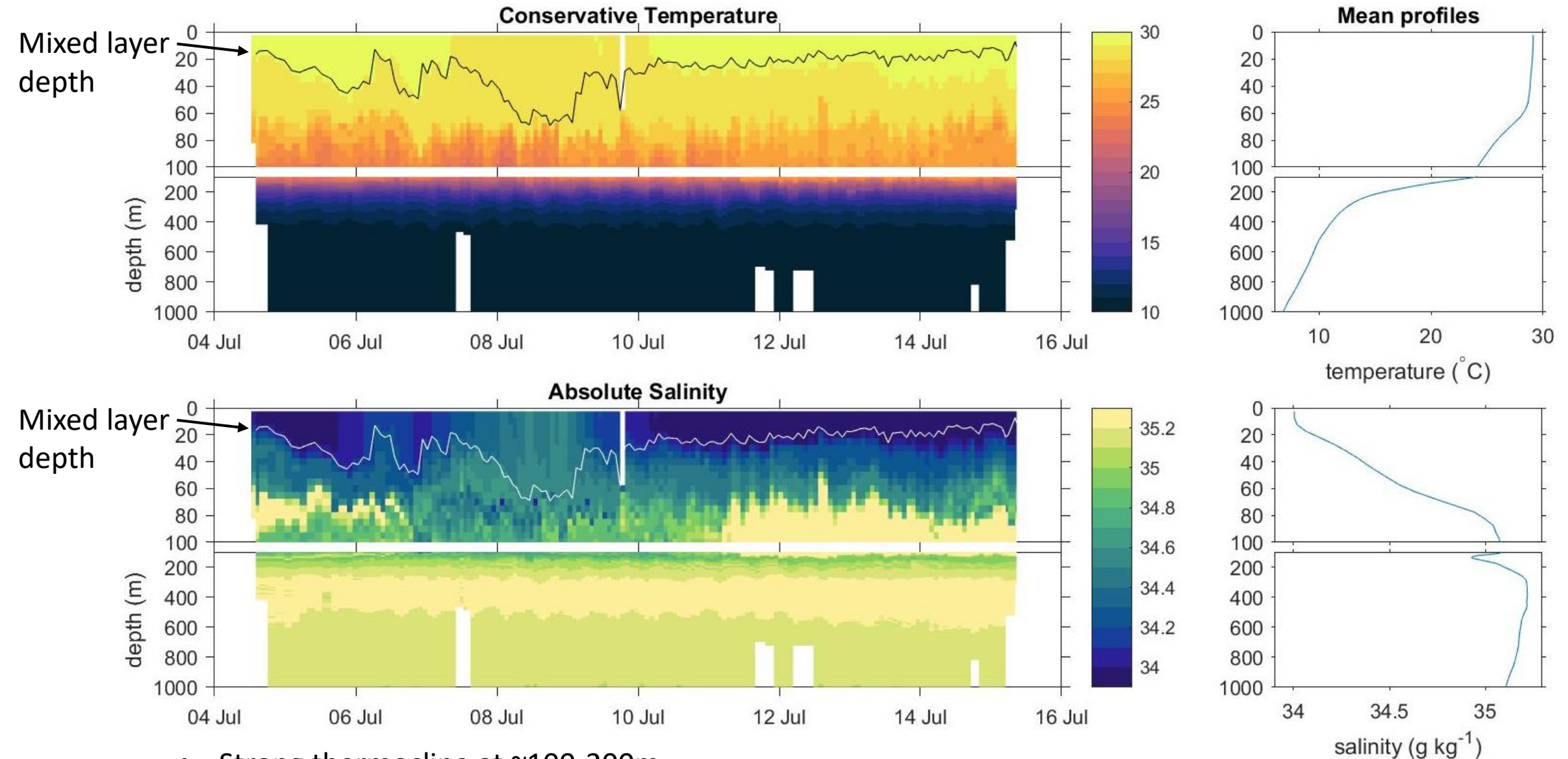
# Bay of Bengal



In July 2016, a Seaglider equipped with a microstructure sensor system was deployed in the southern Bay of Bengal at 7° 54.0' N, 89° 4.5' E.

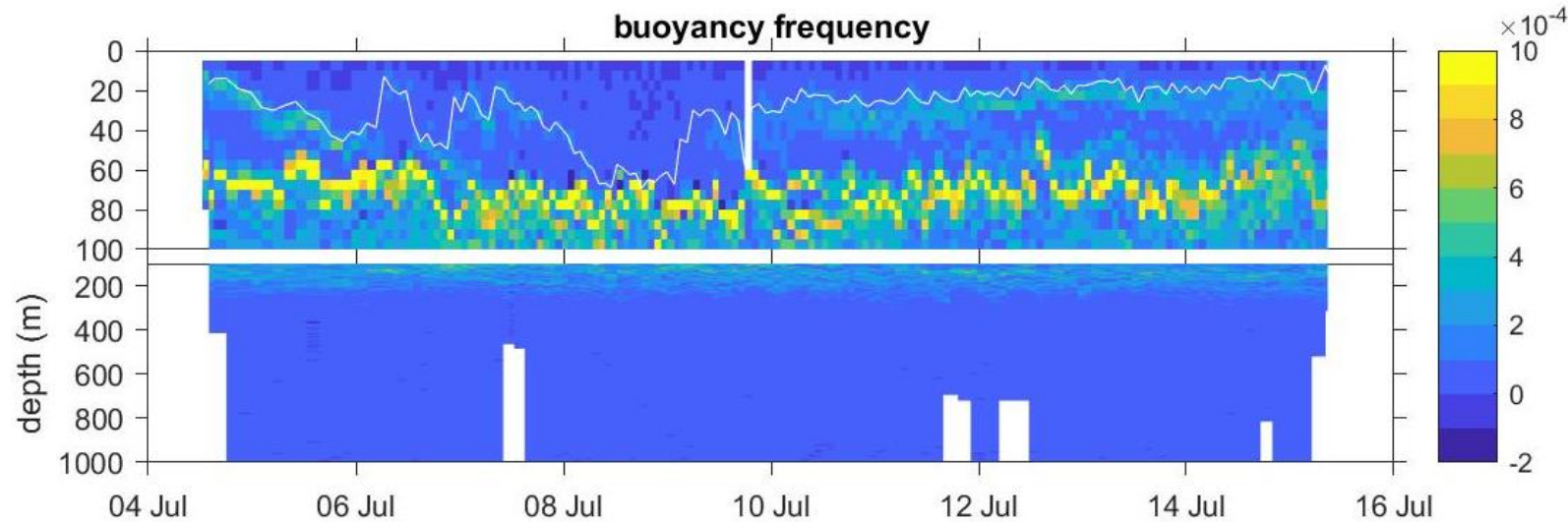
162 profiles (of which 146 were to 1000 m) of microstructure shear and temperature were collected as a time series at the same location.

# Hydrography

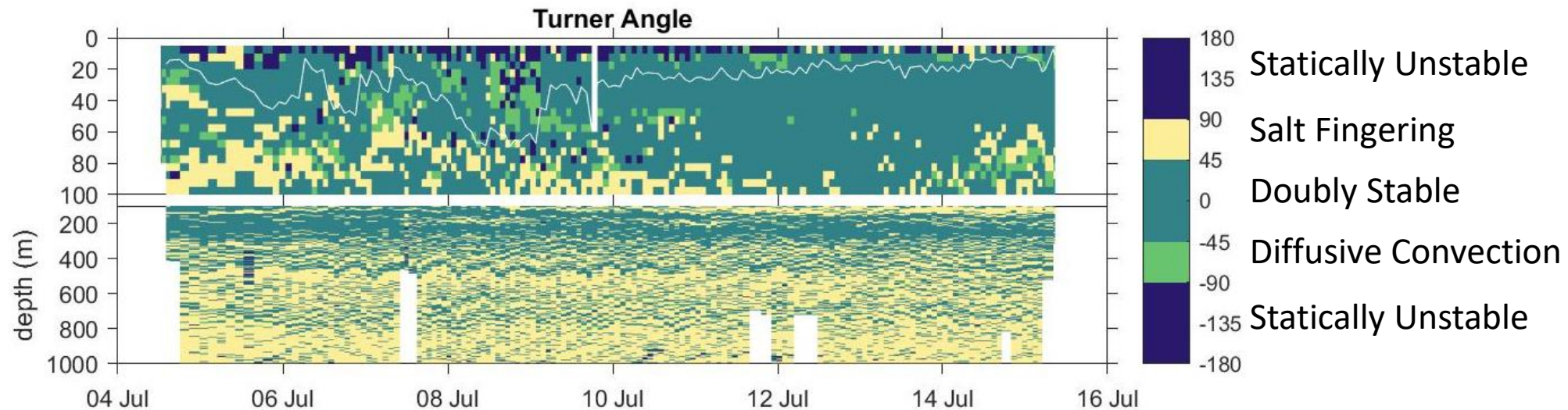


- Strong thermocline at ~100-200m
- Increased mixing between 7-11<sup>th</sup> July in top 100m, significant freshwater lenses at other times

# $N^2$ and Turner Angle

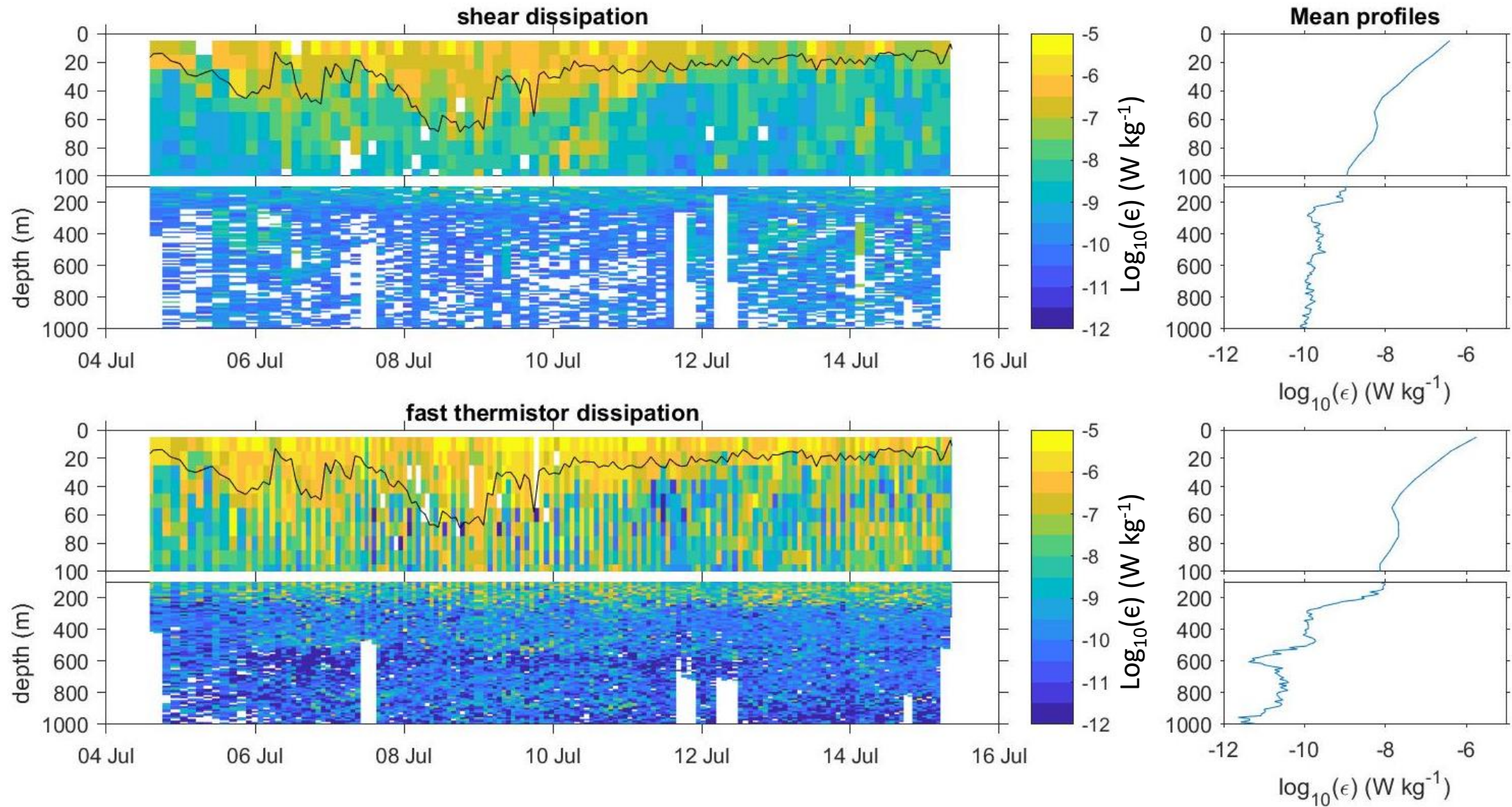


The mixed layer depth was calculated as the depth where the density is equal to the sea surface density plus an increment in density equivalent to  $0.3^\circ\text{C}$



- Note the approximately horizontal bands in Turner angle below 200m

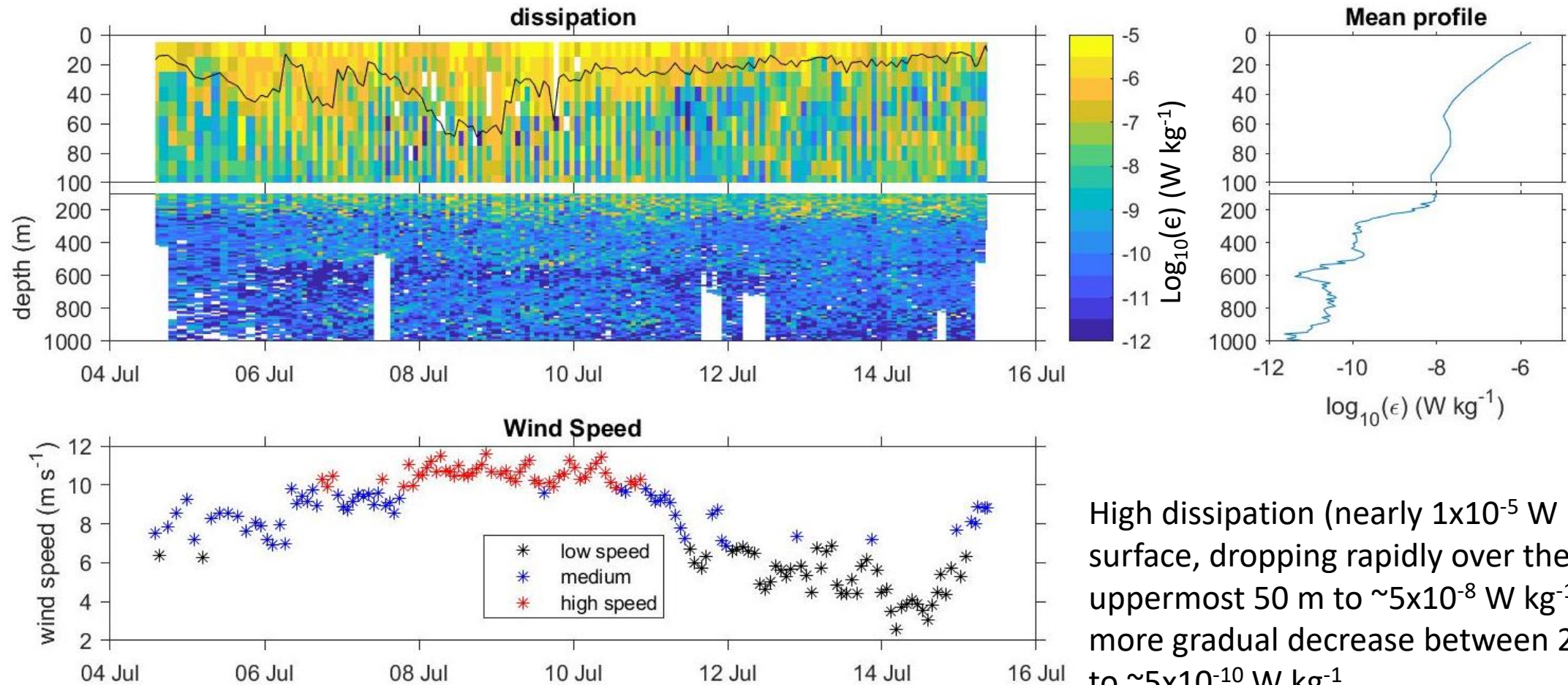
# Dissipation from shear or fast thermistor



# Dissipation from shear or fast thermistor

- Dissipation is calculated from the shear probe and fast thermistor independently, following the methods of Scheifele et al., 2018, JGR-Oceans, using the Nasmyth and Batchelor reference spectra respectively.
- During glider ascents the shear data was significantly affected by issues with the glider's flight causing vibrations, so is not included here.
- The shear dissipation hits the noise floor of the shear probe at around  $10^{-10} \text{ W kg}^{-1}$ . This is a significant problem below  $\sim 200\text{m}$ .
- Above 200m the patterns are broadly similar although fast thermistor dissipation is higher on average. This discrepancy is under investigation.
- Hereafter we use the fast thermistor dissipation in this display.

# Dissipation and wind speed

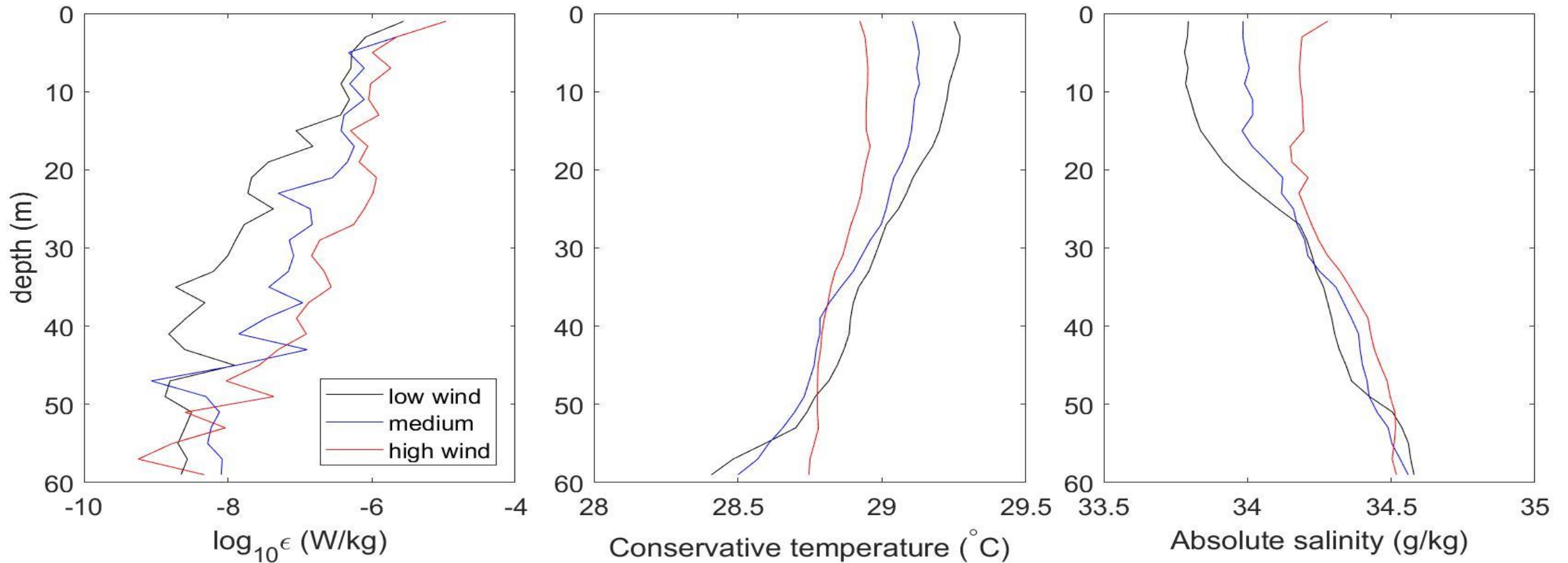


Lower wind speeds correspond to times with reduced near surface mixing.  
Divide profiles into 3 groups – low, medium and high wind speeds.

High dissipation (nearly  $1 \times 10^{-5}$  W kg<sup>-1</sup>) near surface, dropping rapidly over the uppermost 50 m to  $\sim 5 \times 10^{-8}$  W kg<sup>-1</sup>, with a more gradual decrease between 200-300m to  $\sim 5 \times 10^{-10}$  W kg<sup>-1</sup>.

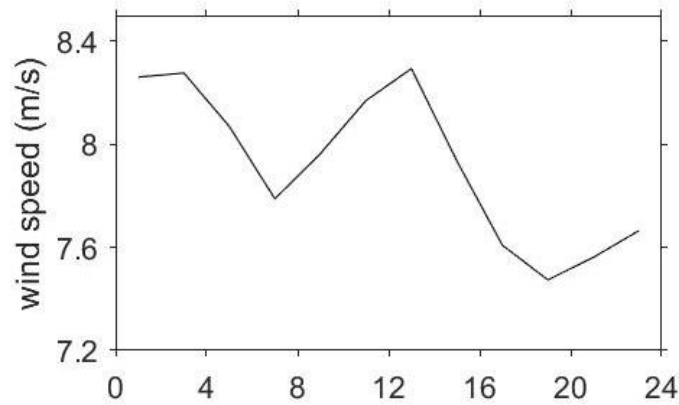
Band of slightly higher dissipation around 500 m ( $\sim 8 \times 10^{-10}$  W kg<sup>-1</sup>), and lower dissipation around 600m ( $\sim 7 \times 10^{-12}$  W kg<sup>-1</sup>) – corresponding to bands in Turner angle.

# Near-surface dependence on wind speed

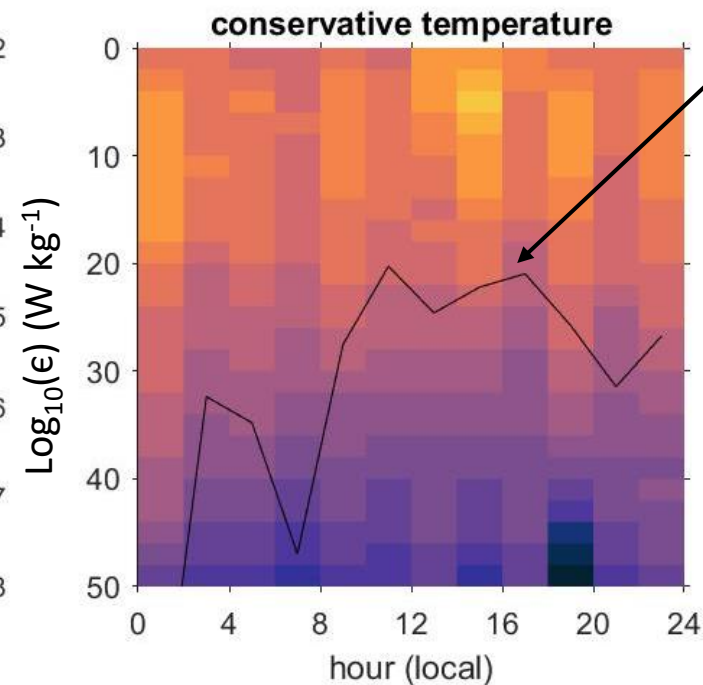
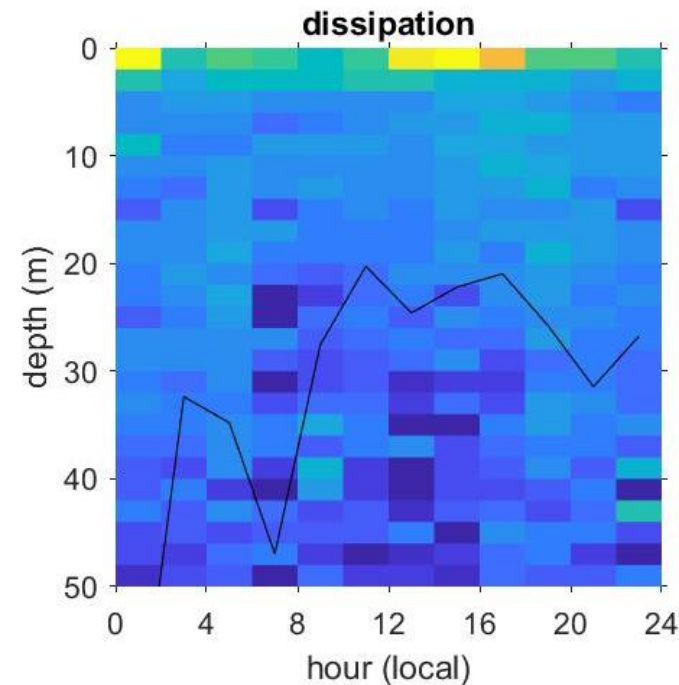


- Average profiles for the low, medium and high wind speed groups.
- Higher wind speeds lead to higher dissipation and more well-mixed temperature and salinity profiles.
- Below  $\sim 50\text{m}$  the dissipation appears independent of wind speed.
- Above  $\sim 10\text{m}$  the effect of wind speed on dissipation appears somewhat reduced because the water column is very homogeneous (see hydrographic profiles).

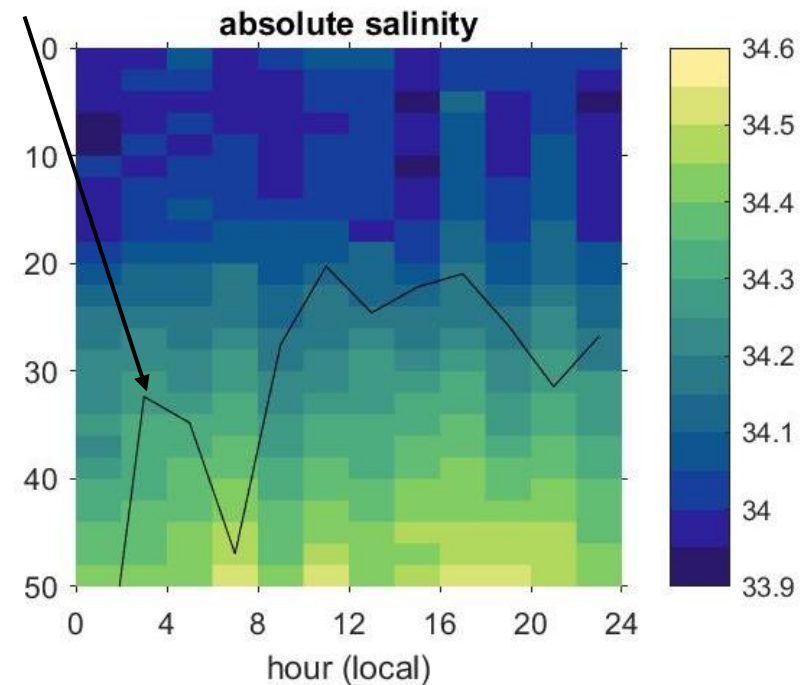
# Composites – averaged over whole mission by time of day



- Near surface dissipation shows semi-diurnal intensification, matching the semi-diurnal increase in wind speed.
- The shallower mixed layer in the afternoons may further intensify the near-surface dissipation.



Mixed layer depth



# Conclusions

- Demonstrated that a Seaglider can be used as a platform for microstructure measurements.
- High dissipation (nearly  $1 \times 10^{-5} \text{ W kg}^{-1}$ ) observed near surface, dropping rapidly over the uppermost 50 m to  $\sim 5 \times 10^{-8} \text{ W kg}^{-1}$ , with a more gradual decrease to  $\sim 5 \times 10^{-12} \text{ W kg}^{-1}$  at 1000 m.
- Semi-diurnal variability in near-surface dissipation due to winds and diurnal variability in mixed layer depth. Because gliders can take measurements very close to the surface, we are able to see that this is greatly intensified in the uppermost 2 m.
- Below 200 m, there is a suggestion of horizontal bands of slightly higher/lower dissipation, which may correspond with bands in Turner angle indicating changes from statically stable to salt fingering.