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Small scale structures

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Quantifying the small scale structures

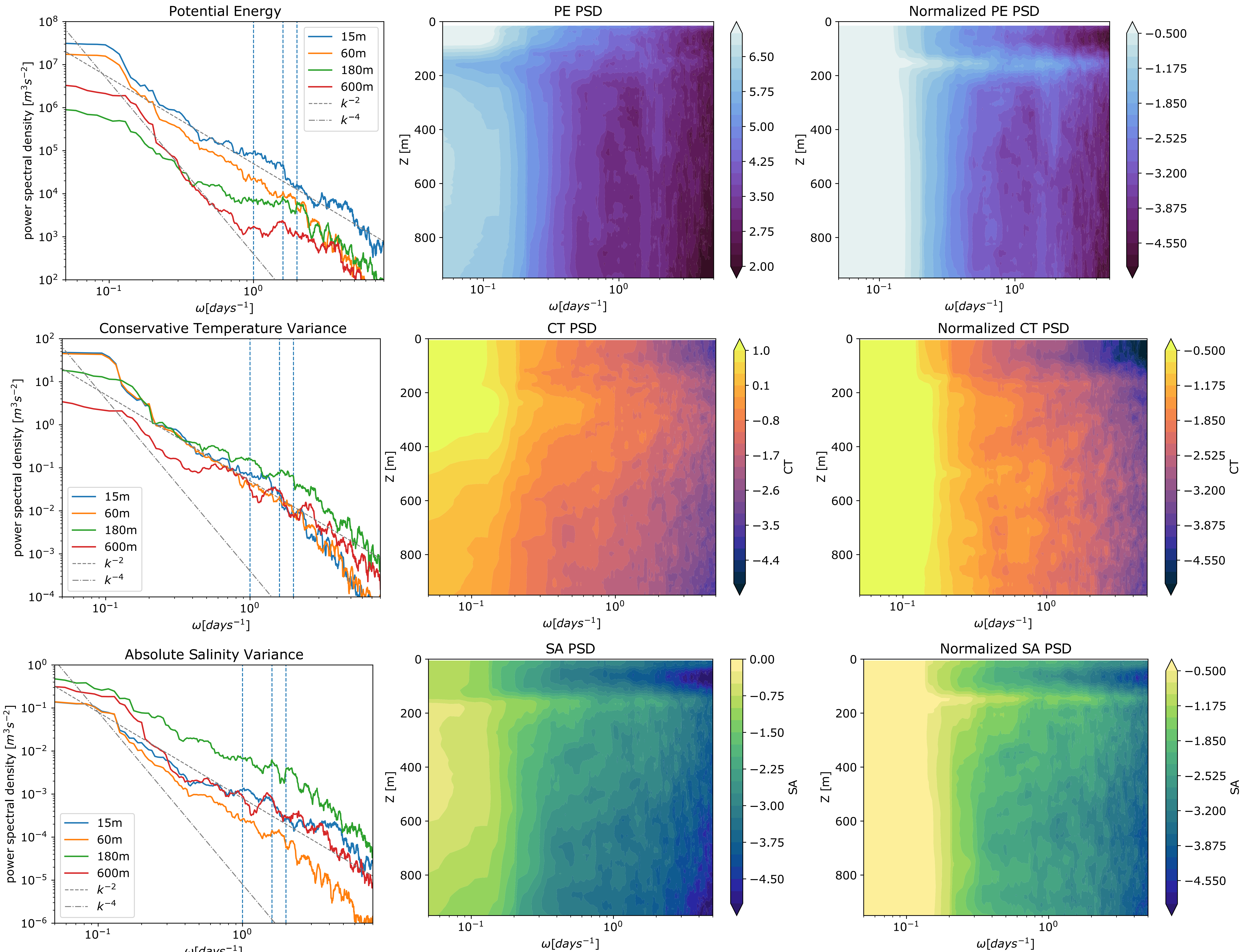
- Horizontal structure in observed properties (Z and isopycnals)
  - Frequency spectra from full glider time series
  - Wavenumber spectra over the straightish glider sections
- Mixed layer properties
  - Scale dependence of buoyancy gradients
  - Contributions of T vs S to the ML b gradients
- Vertical structure below the mixed layer
- 2D structures/ layering

Frequency spectra:

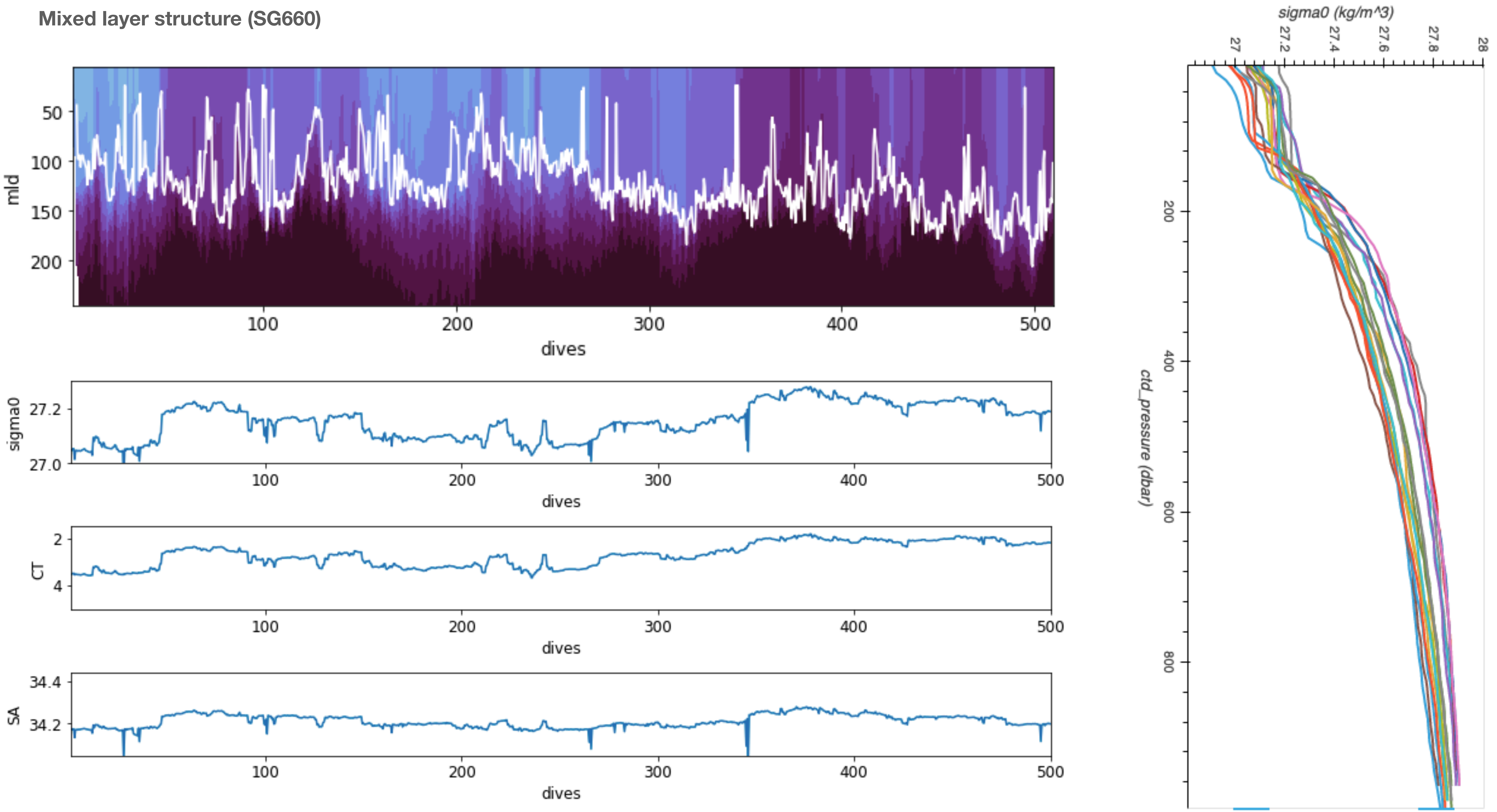
- Potential energy (0.5 b’^2/N^2)
- Temperature
- Salinity

Main results:

- Spectral slopes get steeper with depth
- Some signatures of waves/tides in potential energy
- A layer of enhanced small scale variance near the base of the mixed layer, with reduced variance in the middle of the mixed layer.
- Should not interpret spectral slopes, but the slopes do go from being close to k^-2 (frontal) in the mixed layer to k^-4 (QG interior) in the interior. Assuming a linear dispersion relationship \omega = c k.



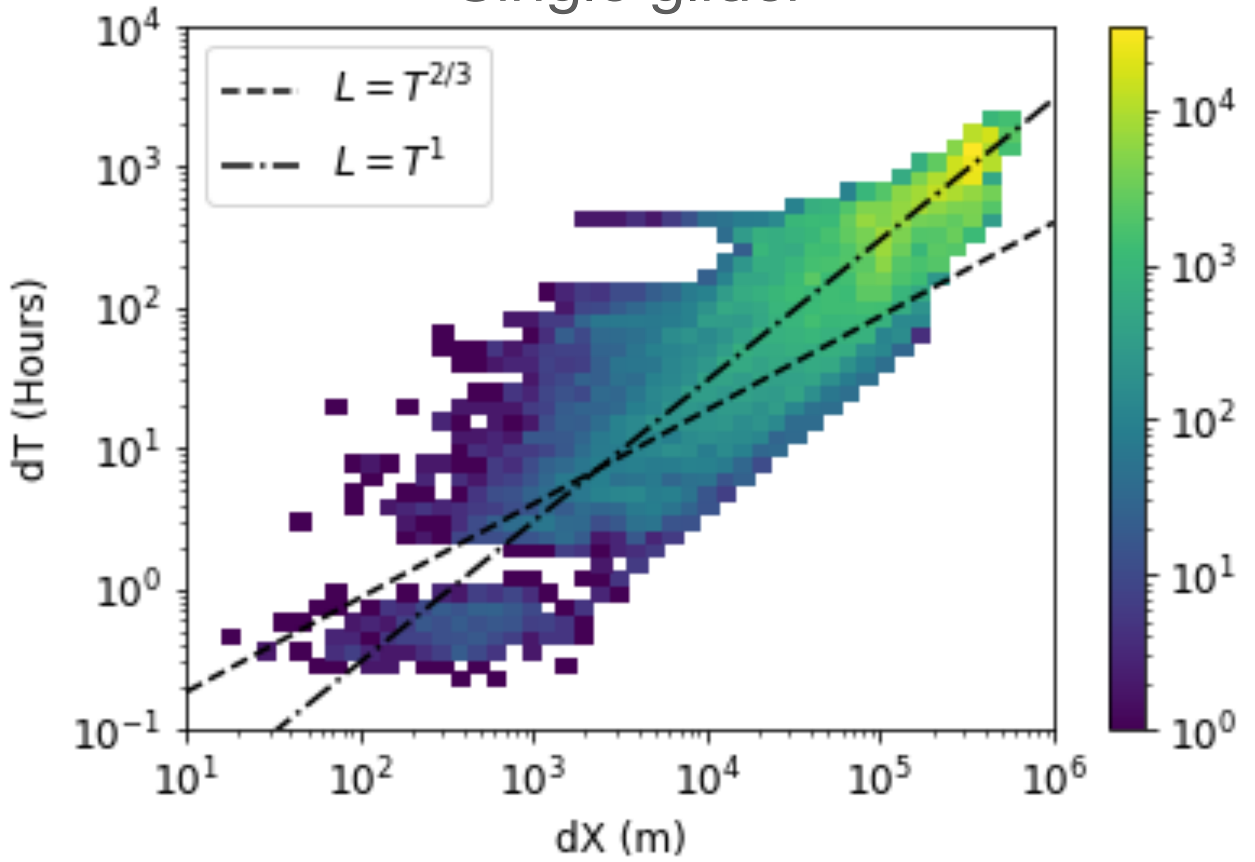
Mixed layer structure (SG660)



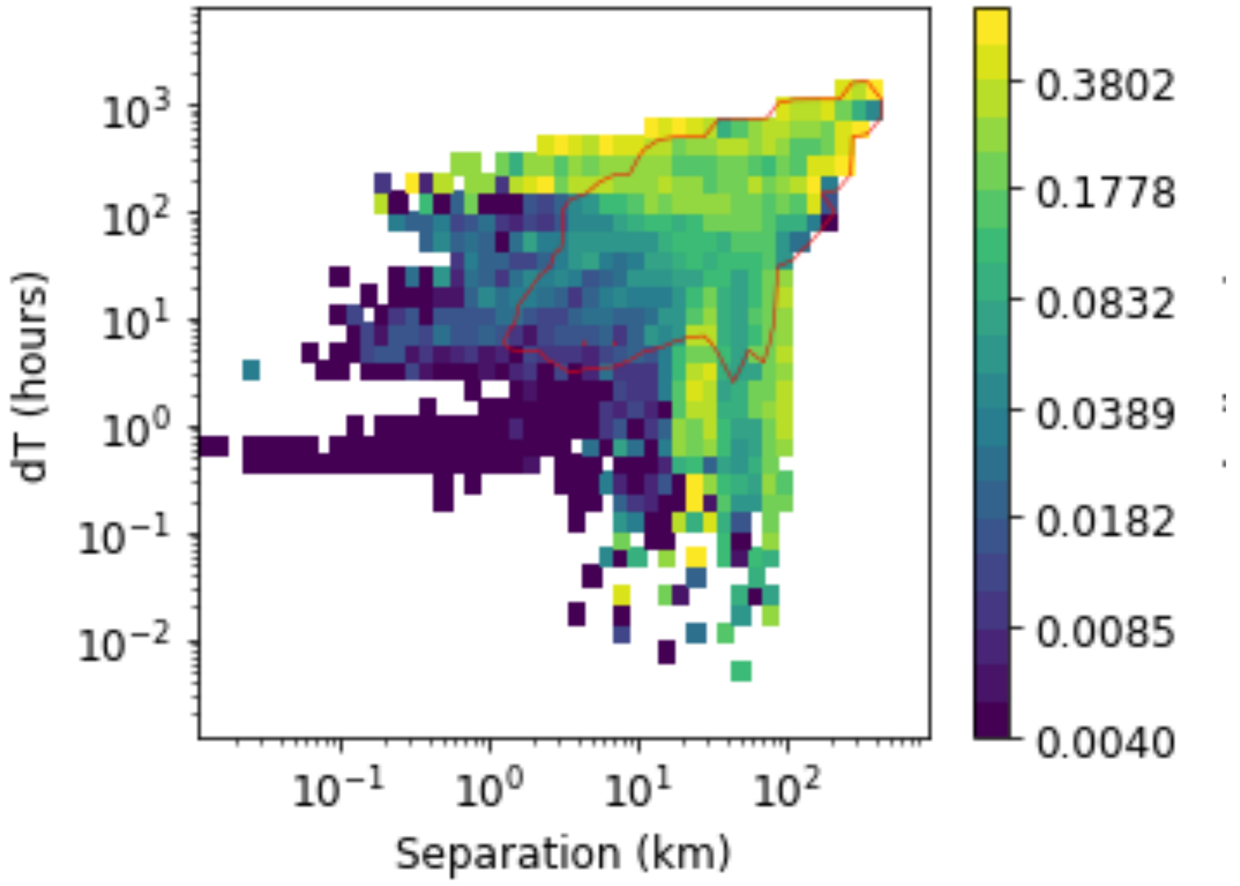
Mixed layer structure

Sampling structure

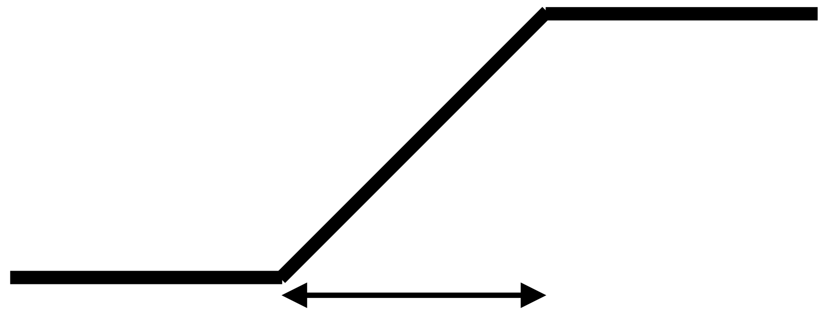
Single glider



Both gliders



$$\frac{|\partial\rho|}{|\partial x|}(l)$$



L saturation

$$d\rho = \rho_0(\alpha dT - \beta dS)$$

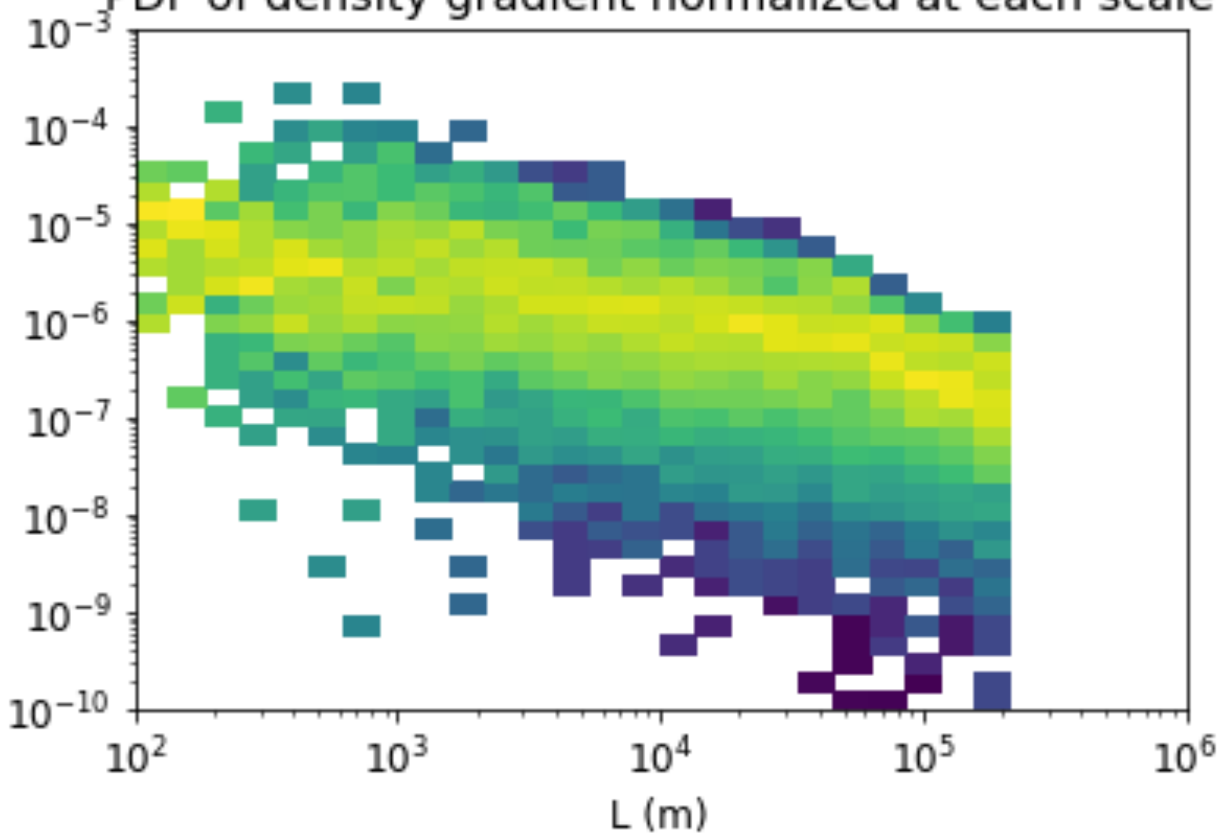
$$R = \frac{\alpha dT}{\beta dS}$$

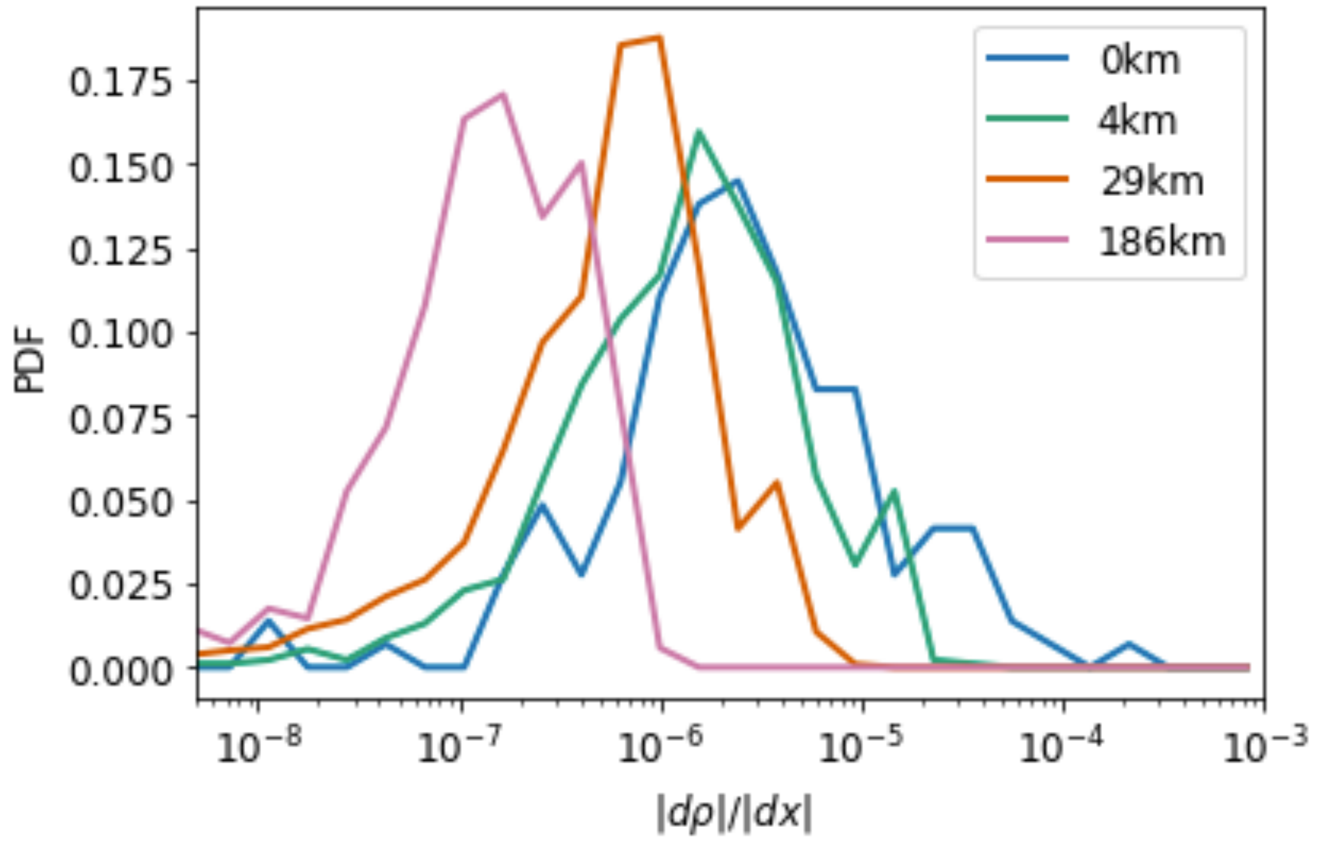
$$Tu = \tan^{-1}(R)$$

Tu>0 (compensation)
< 0 (enhancing)

Tu = pi/4 (compensation b/w T and S)
= 0 (weak T gradient)
= - pi/4 (enhancement b/w T and S)

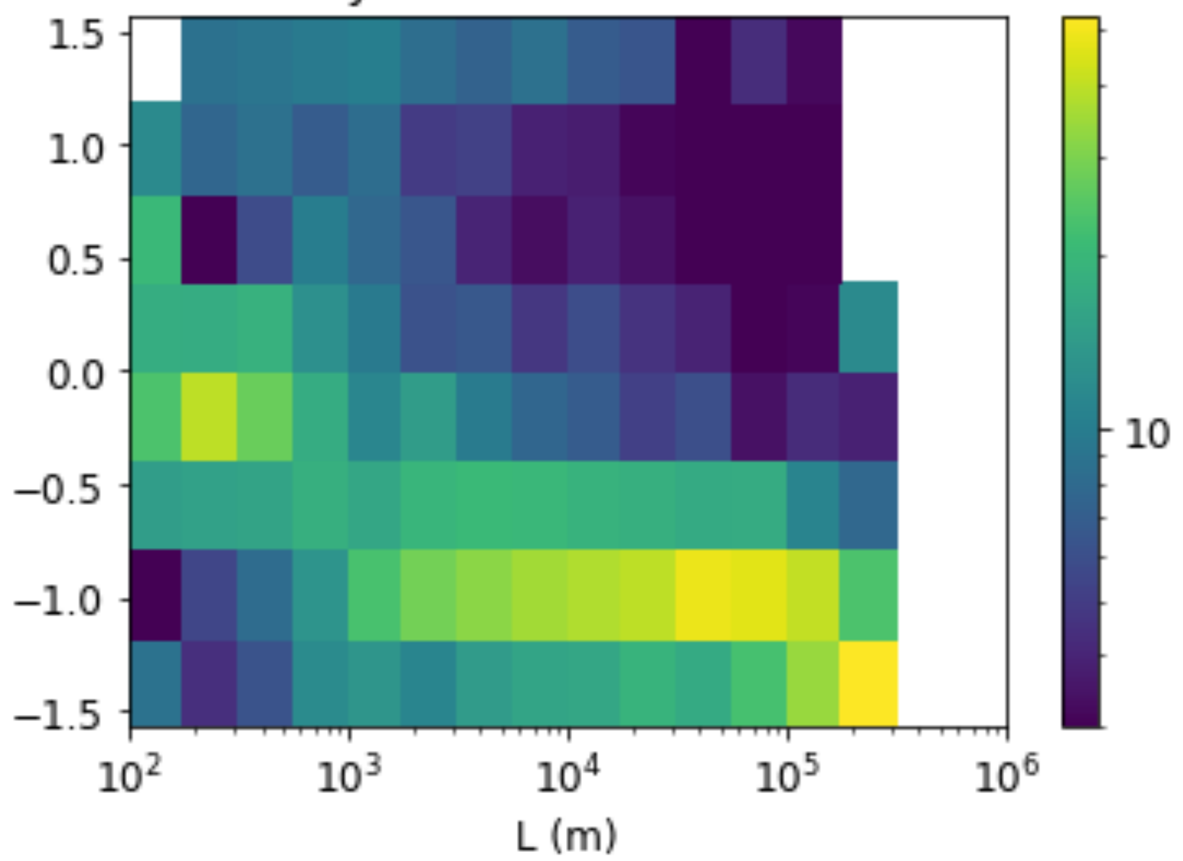
PDF of density gradient normalized at each scale

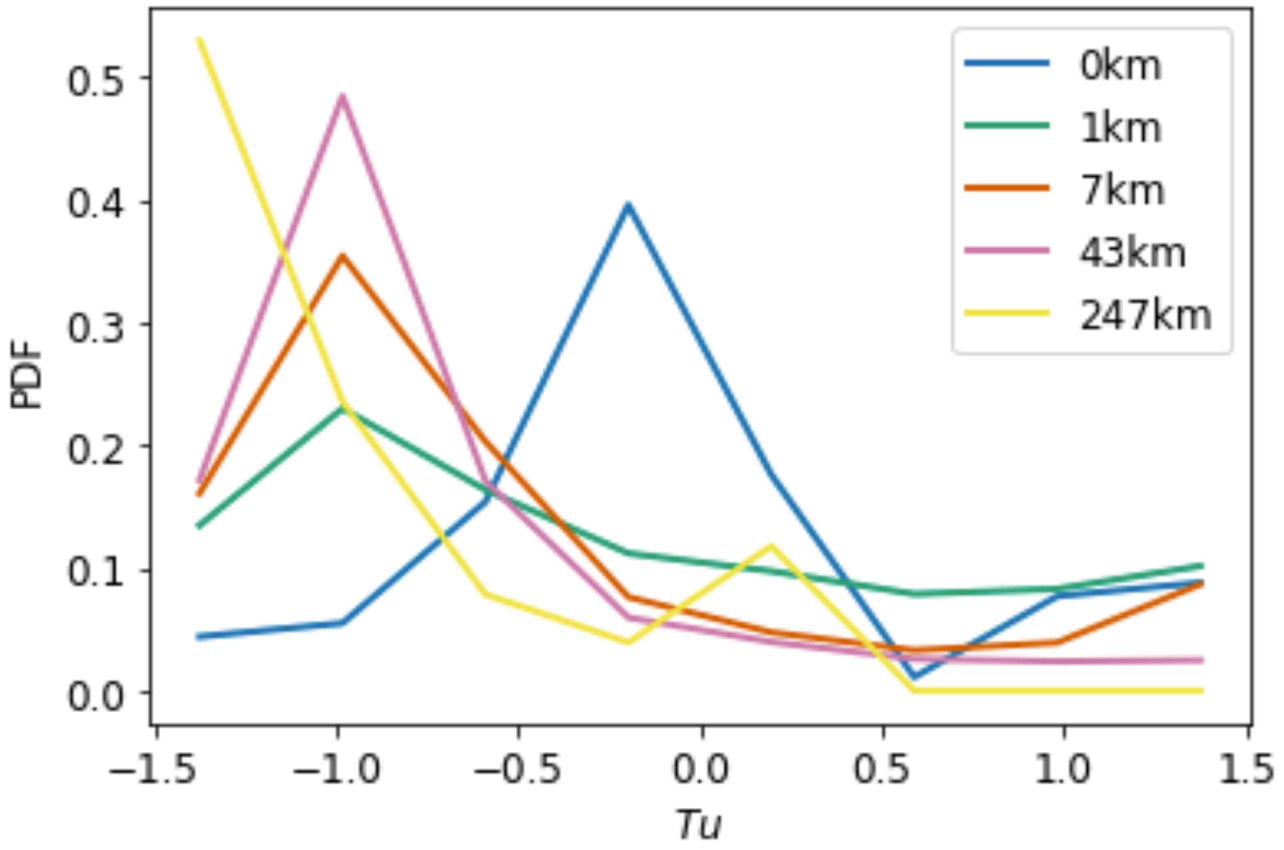




- Density gradients are a function of scale (weaker as scale increases).
- The strength saturates at scales smaller than a few km (close to the deformation radius).

PDF of density ratio normalized at each scale



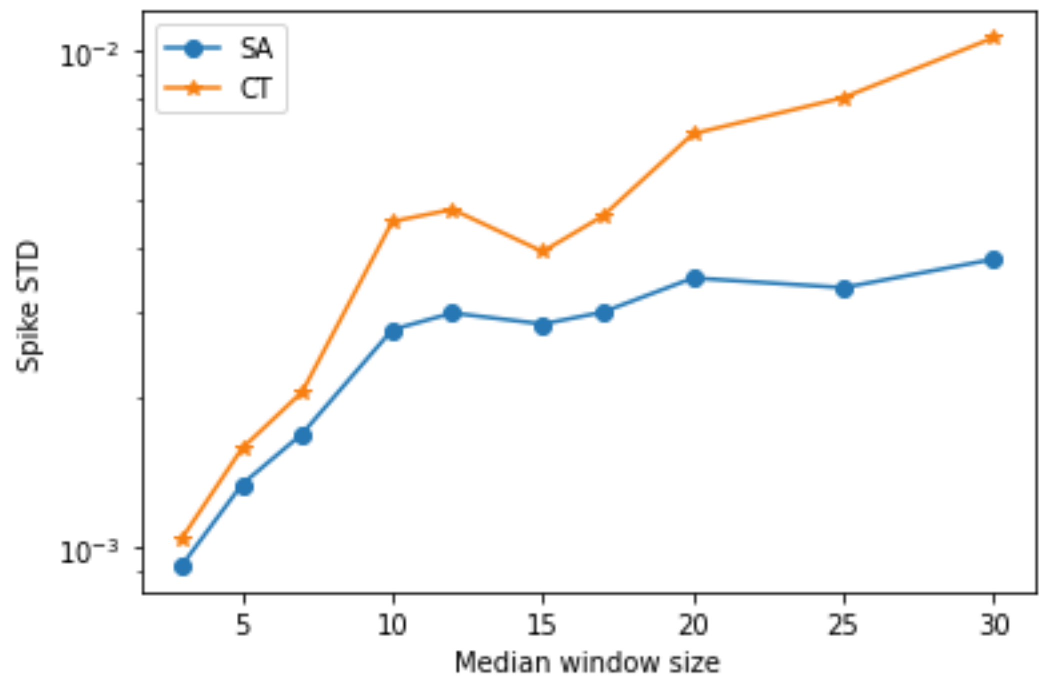


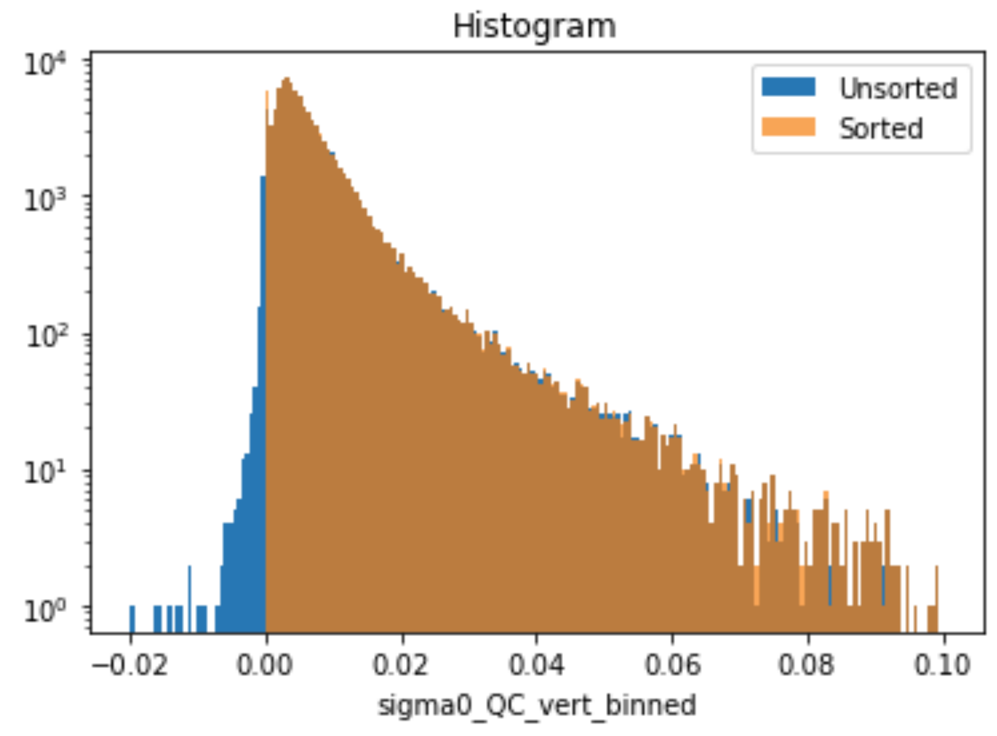
- Salinity gradients dominate density at scales smaller than 1km.
- T and S gradient contribute equally to density at scales larger than 1km.

In contrast mid-latitudes show Tu ~ pi/4 at small scales (<10km), suggesting compensation and larger scales have Tu > pi/4, suggesting T dominance.

Glider data QC

- SG660:
  - Started from per dive nc files on basestation:
    - Raw measurement to oceanographic units
    - Basic QC based on bounds
    - First-order thermistor-response lag
    - Remove trapped water anomalies near surface and conductivity anomalies
    - Thermal-inertia effects
  - Delayed mode despiking by median filter
  - Sorting density overturns
  - Vertical binning (10m bins)





- What to do for SG659?