# The 10-km-scale thermohaline transition

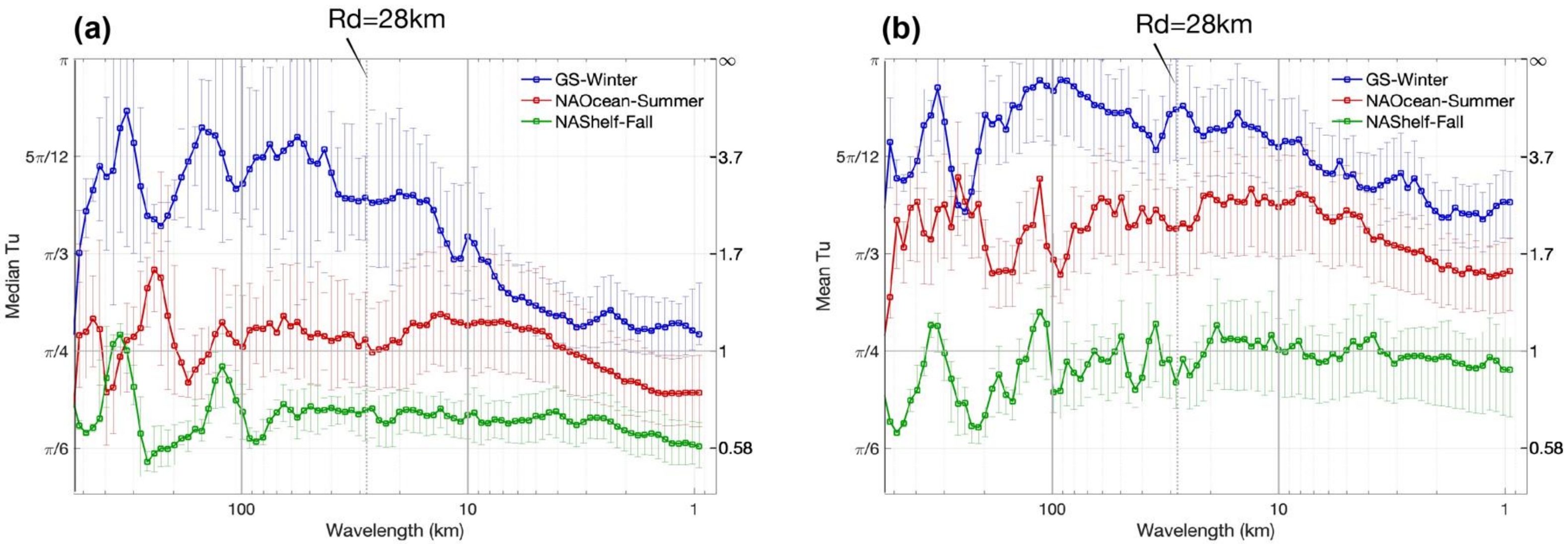
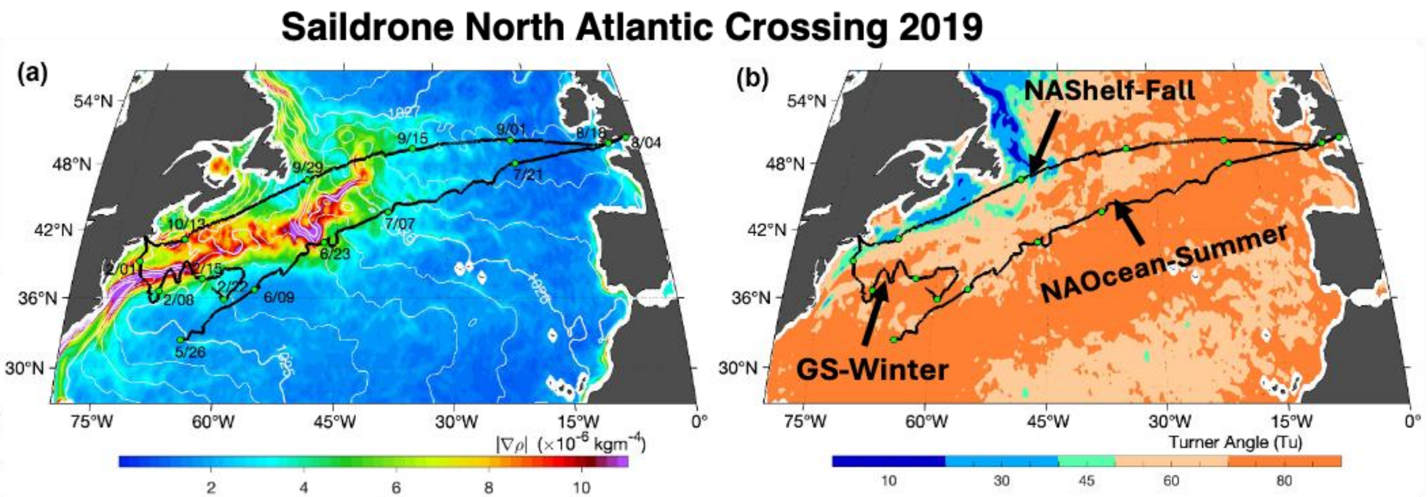



Figure (a) Median and (b) mean Turner Angle (Tu, left y-axis) and density ratio (R, right y-axis) as functions of wavelength for Gulf Stream (GS)-Winter (blue line), North Atlantic Ocean (NAOcean)-Summer (red line), and North Atlantic Continental Shelf (NAShelf)-Fall (green line). Error bars indicate the ±5 percentile range around the respective median and mean values. The vertical dashed gray line at 28km denotes the first Rossby deformation radius (Rd=28±2.3 km). Thicker vertical gray lines indicate characteristic mesoscale (~100 km) and submesoscale (~10 km) scales.




Yu, L. 2026. *Meso-Submesoscale T-S Compensation and Density Gradient Variability in the North Atlantic from Saildrone*. Journal of Physical Oceanography. Early release.

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## Main findings:

- **Scale-dependent control with regime-dependent transition:** Density is temperature-dominated at ≫28 km but shifts to salinity-dominated near ~10 km. This transition is sharp when the background is temperature-dominated (GS-Winter) and muted/weak when the background is salinity-dominated (NAShelf-Fall).
- **Spectral behavior vs KE:** Surface-density variance slopes vary inversely with published KE spectra, consistent with density reflecting an advective imprint rather than active energy conversion.
- **Forcing erodes gradients:** Wind >1 N m$^{-2}$ and heat loss >600 W m$^{-2}$ collapse density gradients; evidence favors mixed-layer shear dispersion over buoyancy, and motivates ~10 km L-band salinity retrievals.