

From Water-Cycle Recorder to Dynamical Driver



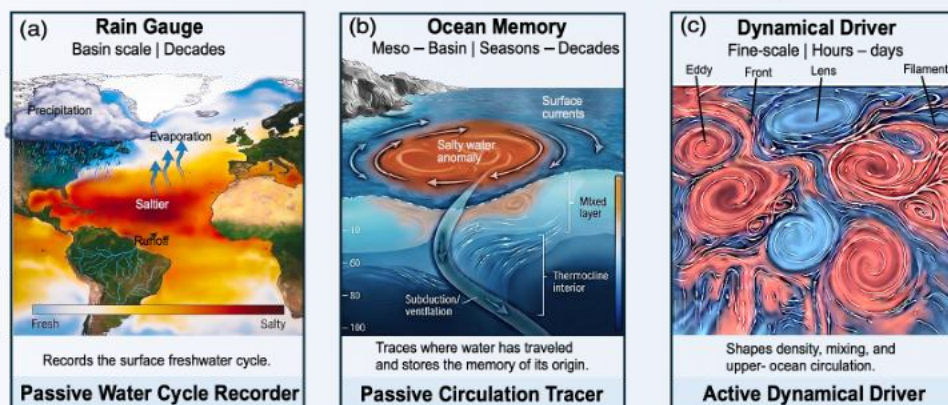
Ocean salinity across scales: the one scale our satellites can't resolve

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1 The Surprise: Salinity Isn't Passive

Classically, salinity records E – P, then traces circulation. But **0.5 shifts density like 2°C**, and salt fronts escape the air-sea damping that erodes thermal ones. They sharpen, and **drive**.

The Three Faces of Ocean Salinity

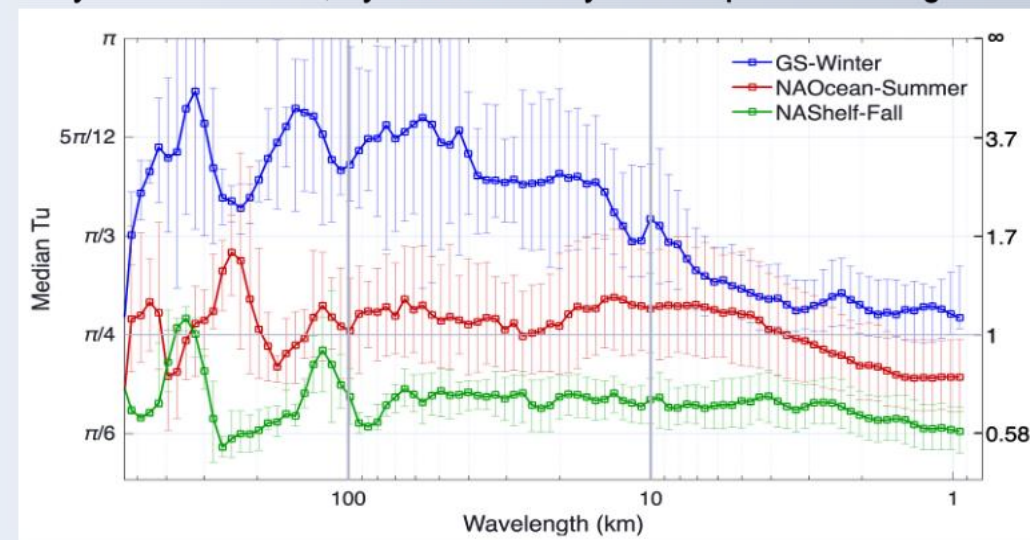


Increasing dynamical influence of Salinity

(Yu 2026; Ocean Sci.)

2 Recent findings: Salinity Control Shifts With Scale

Three regimes, three seasons, same transition: temperature governs density at mesoscales; by **10 km** salinity is co-equal or leading.



Saildrone, N. Atlantic 2019. Turner angle vs wavelength, decreasing rightward. $Tu > \pi/4$: temperature controls density; $\pi/4$: equal T and S. Deformation radius 28 km (Yu 2026 JPO)

The Missing Dimension *SWOT shows where fronts are; Salinity would show why.*

- Current observing capability resolves fronts in height (SWOT), temperature (VIIRS/SLSTR) and color (PACE). Not in salinity.
- Today's SSS resolves **~40 km**; the physics is at **~10 km**.
- Closing that gap would reveal density beneath every SWOT front, and the physics behind PACE's biology.