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Observations of Small-Scale Mixing Processes in the Seasonal Thermocline. Part I: Salt Fingering

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ABSTRACT

Towed conductivity microstructure measurements are examined for evidence of salt fingering in the seasonal thermocline of the Sargasso Sea. Patches of limited-amplitude, narrow-bandwidth signals occur in particular fluid layers about 1 m thick and up to several kilometers in horizontal extent. The finger-like signals occur continuously in the patches but are incoherent between sensors spaced 30 cm apart horizontally. Conductivity gradient spectra rise above background levels in a limited range of wavelengths, peaking at 3 to 5 cm, in a fashion qualitatively similar to Schmitt's spectral model. The density ratio is made favorable for salt fingering within the microstructure patches by finescale variability in the salinity profile. This is consistent with observations by Gargett and Schmitt and also Mack. The vertical convective heat flux estimated from the $(\Delta S)^{4/3}$ laboratory law, where ΔS is the vertical salinity difference across a patch, appears too large when compared with values inferred from either the microstructure measurements themselves or with a flux law based on the vertical gradient across a patch.

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