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Topic: Critical drivers for ocean salinity science and applications and the future need for high-resolution technologies

Title: Toward An Interferometer for Absolute Salinity

Abstract: We have developed an optical sensor for measuring millimeter-scale thermohaline density variations in the ocean. The instrument is based on a fiber Fabry-Perot "white light" interferometer which can resolve the refractive index of water to better than 2 x 10-8 within a sample volume smaller than 1 mm^3 at a sample rate of 500 Hz. This equates to detectable absolute salinity variations of 0.0001 g/kg, temperature variations smaller than 0.0007°C, and density variations of 0.00007 kg/m^3. Data collected from laboratory characterization and a field deployment suggest the sensor could be useful as a gradiometer for measuring density and salinity microstructure down to sub-millimeter scales (Kapit, Farr, and Schmitt, 2025). While obtaining high absolute accuracy in refractive index and density was not a primary consideration for this microstructure instrument, we are in the process of evaluating a new design with longer path length. Since refractive index corresponds closely with density it represents an attractive alternative to conductivity-based salinity estimates (which correspond more closely with "Spice") for determining Absolute Salinity, which differs from Practical Salinity due to the non-ionic silicate and carbonate constituents of seawater.

Kapit, J.A., Farr, N.E. and Schmitt, R.W., 2025. A Refractometer for Measuring Thermohaline Density Microstructure in the Ocean. Journal of Atmospheric and Oceanic Technology, 42(11), pp.1369-1379.

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