Al, Automation & Optimization

Thu. Nov 12, 2026 4:00 PM - 5:30 PM JST | Thu. Nov 12, 2026 7:00 AM - 8:30 AM UTC | Room C (201) (2F)

Oral C3 Al, Automation & Optimization

Chair: Di Wan, Justin Buck, Yosuke Fujii

4:15 PM - 4:30 PM JST | 7:15 AM - 7:30 AM UTC

[GW9BIT7e-02] Uncertainty-Aware Satellite-to-Profile Mapping for Ocean Data Assimilation

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Satellite-derived surface observations provide broad constraints on ocean variability, but inferring subsurface temperature and salinity (T/S) remains challenging because the surface-to-subsurface relationship is nonlinear and non-unique. This study proposes the Temperature–Salinity Transformer (TST), an uncertainty-aware framework that generates subsurface T/S pseudo-profiles and depth-dependent uncertainty directly at observation locations from satellite-derived SSH, SST, and SSS. Unlike full-field reconstruction approaches, TST produces profile-type pseudo-observations designed for direct use in profile-based ocean data assimilation. TST was trained using GLORYS12V1 reanalysis and evaluated over the northwestern Pacific and adjacent marginal seas. Against independent in situ observations, TST achieved basin-mean RMSEs of 0.80 °C and 0.11 psu, with correlations of 0.98 and 0.90 for temperature and salinity, respectively. Empirical uncertainty calibration aligned predicted uncertainty with realized errors, providing depth-dependent observation-error estimates for uncertainty-aware assimilation. In a MOM5-based assimilation experiment, TST-only assimilation reduced both temperature and salinity RMSE relative to the control and SST-only experiments. When combined with conventional T/S profile assimilation, the TST-based experiment further improved the subsurface state and achieved lower RMSE than the K-ORA22 regional reanalysis reference in WOD-based validation. The improvements were especially clear for salinity and extended through the upper and intermediate layers, indicating that TST provides thermohaline constraints beyond surface thermal correction. These results demonstrate the potential of uncertainty-aware TST pseudo-profiles to bridge satellite surface observations and profile-based ocean data assimilation.

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