Variability and Uncertainty of Satellite Sea Surface Salinity in the Subpolar North Atlantic (2010–2019)

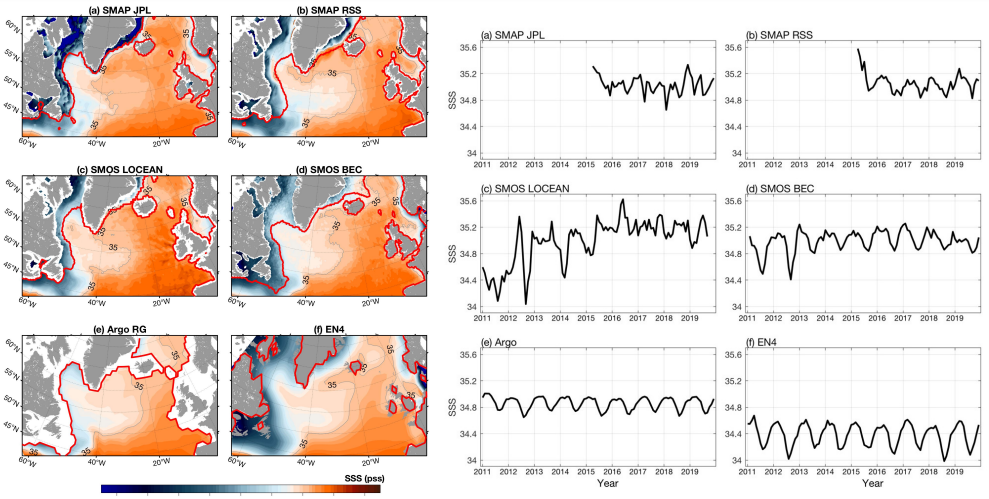

Figure 1 (left) Time-mean SSS patterns from six products. Red line denotes the boundary between the permanent ice-free ocean and the seasonal ice zone. (Right) Monthly-mean time series for the available period of each data product.

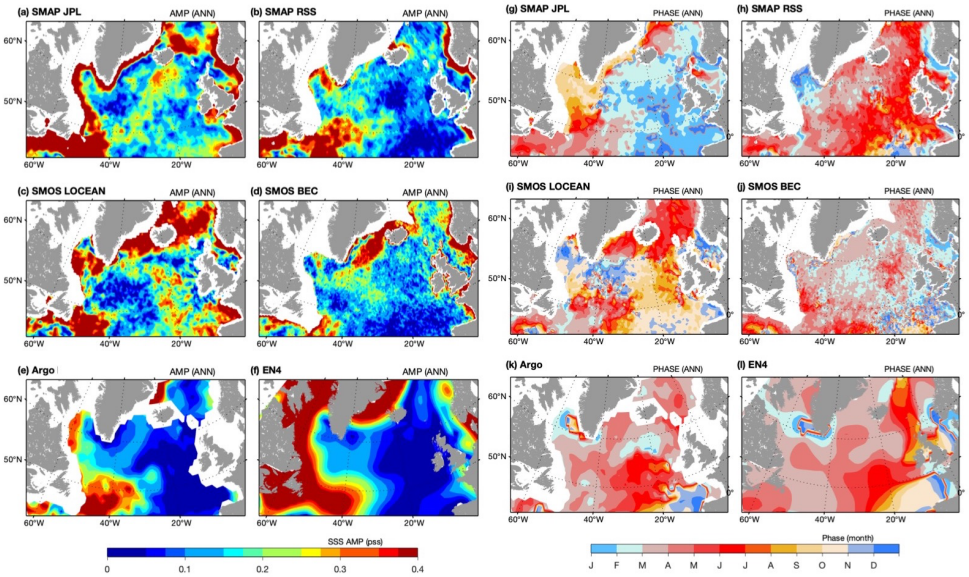

Figure 2. (left) Amplitudes and (right) phases of the estimated annual harmonic.

Problem: Satellite L-band remote sensing in the past 10 years has proven the capability of resolving SSS spatiotemporal variability in the tropical and subtropical oceans. However, fidelity of SSS retrievals in cold waters at mid-high latitudes is yet to be established. Here, SSS products from SMAP and SMOS were evaluated in the subpolar North Atlantic Ocean (SPNA; 48 – 70°N, 65°W – 0) with reference to in situ gridded products.

Datasets: Four satellite products including SMAP JPL, SMAP RSS, SMOS LOCEAN, SMOS BEC and two in situ products including Argo Roemmich-Gilson and EN4.

Finding: The six products have a broad agreement on the time-mean SSS distribution. Monthly-mean time series of the basin averaged SSS reveal a time-varying drift in the decade-long SMOS data records (Fig.1). Harmonic analysis of annual and semiannual cycles suggests large differences between in situ and satellite products (Fig.2). While in situ products show the dominance of annual harmonic with the phase of the maximum SSS progressing southeastward. Satellite SSS products have difficulty producing the right annual cycle, particularly in the Labrador/Irminger Seas where the SSS seasonality is controlled by Arctic freshwater transported by boundary currents.

Significance: SSS retrievals in the cold, fresh marginal seas in the western SPNA need to be improved to ensure an accurate representation of the seasonal cycle. The time-varying drifts in the SMOS retrievals need also to be corrected to ensure an accurate representation of interannual and decadal variability in the SMOS data record.

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