Supporting Information for "Oceanic fronts driven by the Amazon freshwater plume and their thermohaline compensation at the submesoscale"

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Introduction

The supporting information contains text and figures aiming to highligh how we assessed that temporal aliasing is minimal compared to spatial variability in the Saildrones datasets. The Singular Spectral Analysis (SSA) which was conducted to investigate the diurnal variability of the Saildrones Sea Surface Temperature (SST) is detailed by text S1. Figure S1 shows the result of SSA applied to SD1063 SST time series. Figure S2 presents a frontal feature captured by two Saildrones navigating on parallel tracks with a given time-lag.

Text S1.

The diurnal variability of the Saildrones SST was investigated using Singular Spectral Analysis (Ghil et al., 2002; Groth et al., 2017). Compared to an averaged diurnal cycle, SSA allows us to recover a space-time varying diurnal cycle. The first step of the analysis is to build the covariance matrix between lagged version of the SST time series. We chose a window size of 4 days which was found to be a good compromise between larger values which would inevitably mixed information from regions with different characteristics and smaller values which do not allow to reconstruct any diurnal cycle given the high spatial variability observed. We then diagonalize this covariance matrix to obtain its eigenvectors and eigenvalues and compute the principal components (PCs) of the time series. The SST diurnal variations were reconstructed from the pair of PCs with a corresponding frequency of one day.

References

Ghil, M., Allen, M. R., Dettinger, M. D., Ide, K., Kondrashov, D., Mann, M. E., ... others (2002). Advanced spectral methods for climatic time series. *Reviews of geophysics*, *40*(1), 3–1.

Groth, A., Feliks, Y., Kondrashov, D., & Ghil, M. (2017). Interannual variability in the north atlantic ocean's temperature field and its association with the wind stress forcing. *Journal of Climate*, *30*(7), 2655–2678.

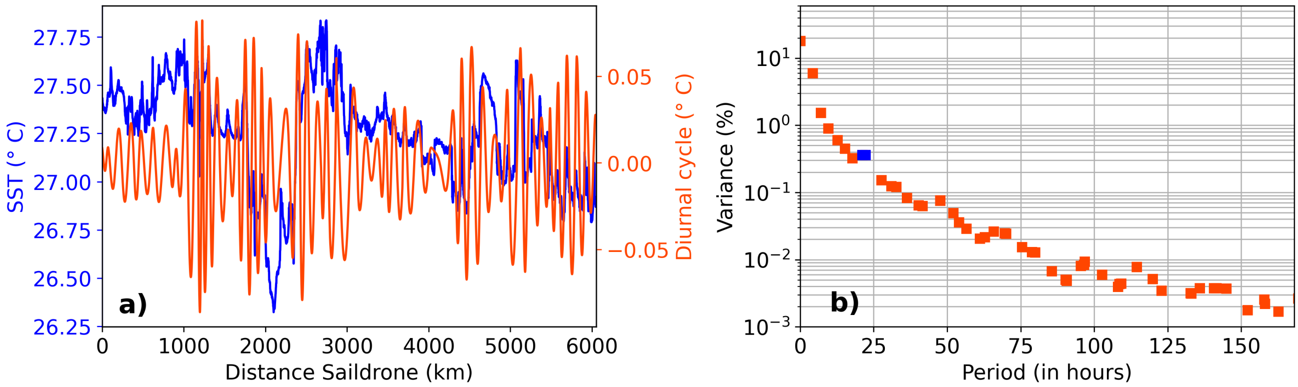

Figure S1. Result of SSA applied to the SD1063 SST time series with a 4-day window. (a): SD1063 SST time series in blue (left axis) and its reconstructed diurnal cycle in red (right axis) as a function of the distance traveled by the Saildrone. (b) The estimated variance for each of the principal components (PCs) (shown as red squares) is plotted as a function of its corresponding frequency. The blue squares indicate the pair of PCs selected to reconstruct the diurnal cycle (red curve in (a)).

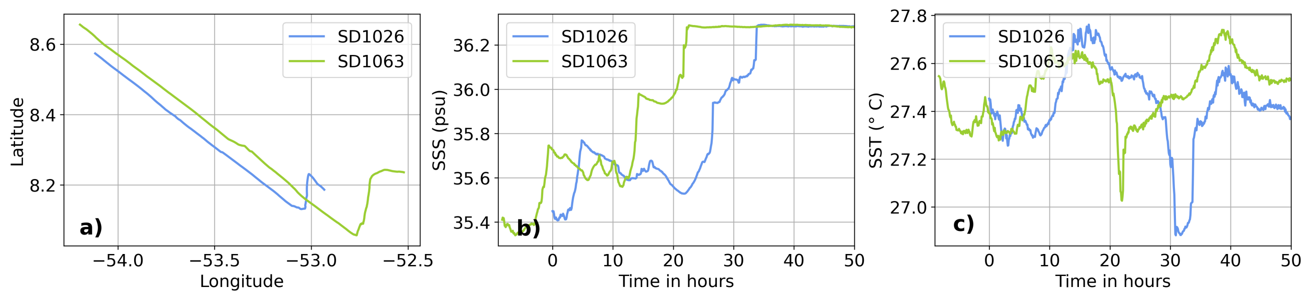

Figure S2. Segments of SD1026 (blue) and SD1063 (green) trajectories, lagged by $\sim$ 6 hours (a), SSS (b) and SST (c) time series as a function of time where time 0 corresponds to the beginning of the SD1026 segment.