National Aeronautics and Space Administration
Jet Propulsion Laboratory
California Institute of Technology

Comparison of GHRSST SST Analysis in the Arctic Ocean and Alaskan Coastal Waters Using Saildrones

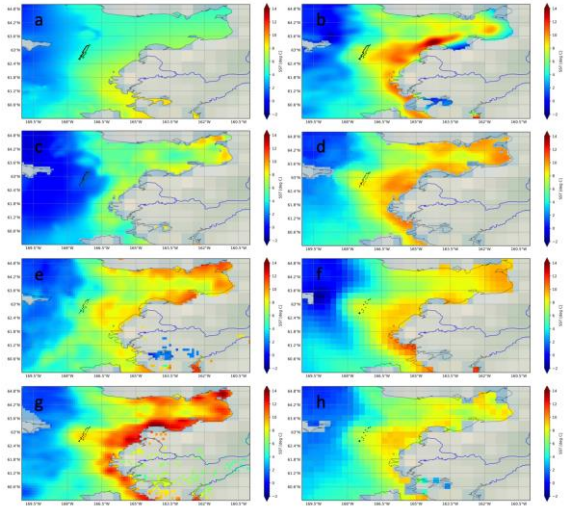


Figure upper left
L4 SST images around the Y–K delta for DOY 151 (31 May 2019) for: a. MUR, b. OSTIA, c. DMI, d. MWIR, e. K10, f. DOISST, g. CMC, and h. GMPE. The black dotted line shows the transect of SD1036 for the same day. The green dotted line shows the corresponding track for SD1037.

Figure bottom left
Shows the time series plots for the 8 GHRSST Level 4 products co-located with the two Saildrone deployments (SD1036 and SD1037)

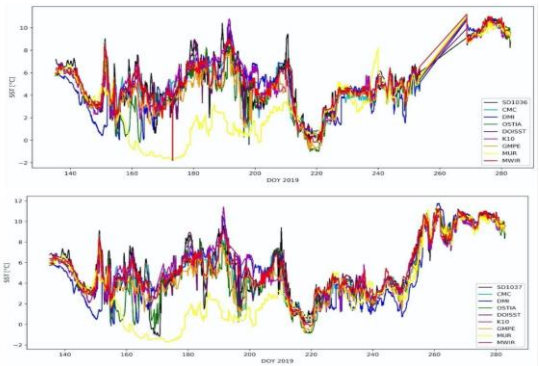
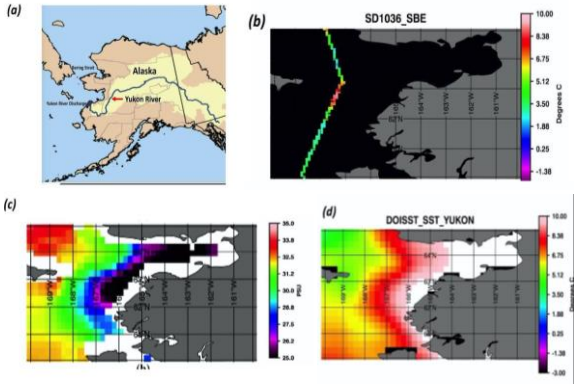


Figure bottom right
(a) Map showing the location of the Yukon River discharge into the Y–K delta along with the Bering Strait, (b) SST from SBE37 along the Saildrone deployment SD1036, (c) sea surface salinity from the RSS70 km product, averaged over the period of the Saildrone deployment, and (d) SST composite derived from the DOISST daily products, averaged over the time of Saildrone deployment.



Reference: Vazquez-Cuervo, Jorge, Sandra L. Castro, Michael Steele, Chelle Gentemann, Jose Gomez-Valdes, and Wenqing Tang. 2022. "Comparison of GHRSST SST Analysis in the Arctic Ocean and Alaskan Coastal Waters Using Saildrones" Remote Sensing 14, no. 3: 692.
https://doi.org/10.3390/rs14030692 https://www.mdpi.com/2072-4292/14/3/692

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Technology Question: There is high demand for complete satellite SST maps (or L4 SST analyses) of the Arctic regions to monitor the rapid environmental changes occurring at high latitudes. Although there are a plethora of L4 SST products to choose from, satellite-based products evolve constantly with the advent of new satellites and frequent changes in SST algorithms, with the intent of improving absolute accuracies. The constant change of these products, as reflected by the version product, make it necessary to do periodic validations against in situ data. Eight of these L4 products are compared here against Saildrone data from two 2019 campaigns in the western Arctic, as part of the MISST project.

Data & Results: Saildrone is an unmanned surface vehicle that has the capability for measuring multiple atmospheric and oceanographic parameters. Eight SST products form the Group for High Resolution Sea Surface Temperature (GHRSST) were compared with Saildrone's onboard CTD. The two Saildrone deployments were funded by NASA through the MISST project. The three products with the best performance, at this point and time, are used in a case study of the thermal features of the Yukon–Kuskokwim (Y-K) delta (see figure). Correlations of approximately 0.90 indicate overall excellent agreement between the GHRSST products and Saildrone-derived SST. The statistical analyses show that two L4 SST products had consistently better relative accuracy when compared to the Saildrone subsurface temperatures. Those are the NOAA/NCEI DOISST and the RSS MWOI SSTs. In terms of the spectral variance and feature resolution, the UK Met Office OSTIA product appears to outperform all others at reproducing the fine scale features, especially in areas of high spatial variability, such as the Alaska coast. It is known that L4 analyses generate small-scale features that get smoothed out as the SSTs are interpolated onto spatially complete grids.

Significance: The analyses here indicate that the high-resolution coverage, attainable with current satellite infrared technology, is too sparse, due to cloud cover to support very high resolution L4 SST products in high latitudinal regions. Only for grid resolutions of ~9–10 km or greater does the smoothing of the gridding process balance out the small-scale noise resulting from the lack of high-resolution infrared data. This scale, incidentally, agrees with the Rossby deformation radius in the Arctic Ocean (~10 km). Comparisons of the products at the Y-K Delta indicate results are promising for monitoring changes in river discharge along the Alaska Coast.