Multi-sensor Improved Sea Surface Temperature: continuing the GHRSST partnership and improving Arctic

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Sea Ice Remnant Svalbard July 17, 2008
Image credit: Camille Seaman

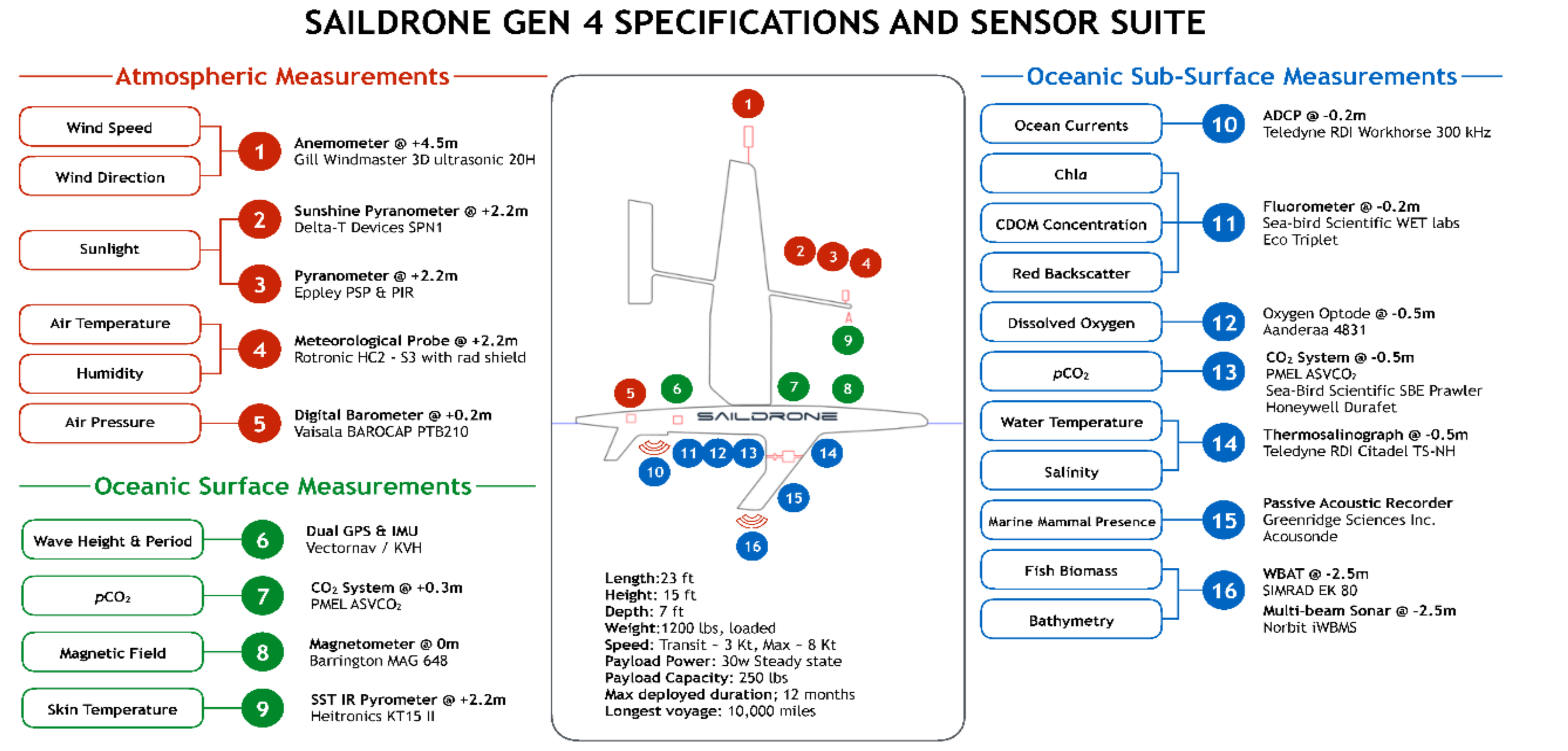
Motivation

Much of the Arctic Seas were until recently ice-covered for all or most of the year, so studies of Arctic Sea Surface Temperature (SST) were not feasible. This has changed dramatically in recent years, owing to extreme seasonal sea ice melt-back and other climate impacts. In fact, this is now one of the most exciting areas of the world to study SST, in order to understand a variety of phenomena including heat exchange in the coupled air-sea system. However, satellite SST products in this region are presently very poorly validated, and are generally tuned to lower latitude in situ observations. The time is right to address these problems, given new observations that have been collected in recent years, in concert with the advantages that come from multiple passes of polar orbiting satellites at high latitude.

5 Arctic Cruises

The MISST project has 5 Arctic 90-day cruises planned 2019 – 2022, using Saildrone unmanned surface vehicle (USVs). These cruises are aimed at addressing the paucity of Arctic data available for satellite algorithm development and validation, as well as providing new data targeted to improve our understanding of upper ocean stratification and air-sea interactions in the Marginal Ice Zone. Saildrones are wind-powered vehicles with ~20 solar-powered meteorological and oceanographic sensors that measure upper ocean currents, solar irradiance, longwave radiation, atmospheric pressure, air temperature and humidity, wind speed and direction, ocean skin temperature, bulk water temperature, salinity, ocean color (Chl-a, CDOM), atmospheric and seawater pCO2, dissolved oxygen, and pH. Data will be distributed on the GTS and will also be freely available at https://podaac.jpl.nasa.gov/Saildrone within a month of acquisition.

SAILDRONE GEN 4 SPECIFICATIONS AND SENSOR SUITE



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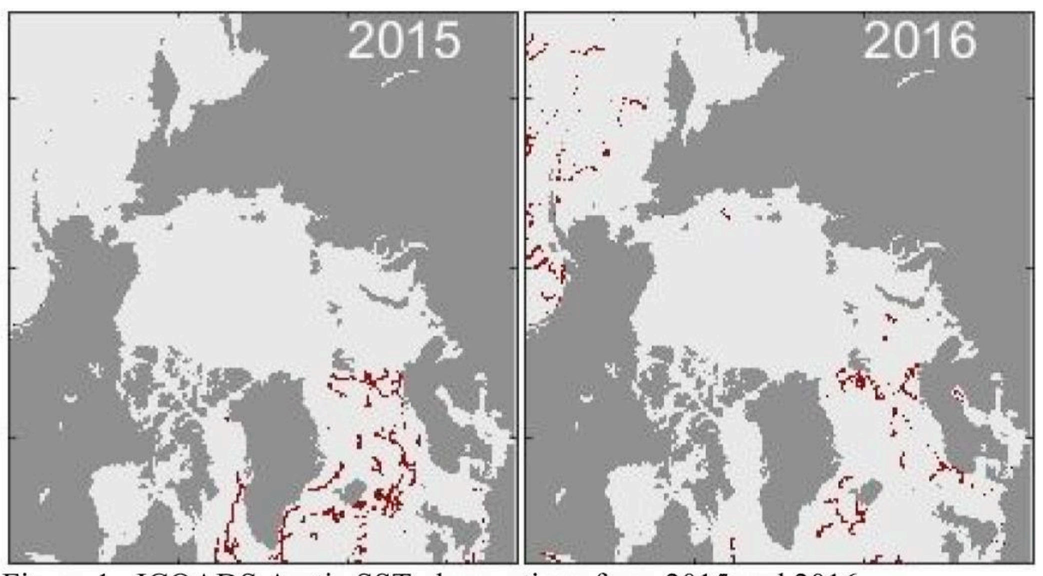


Figure 1. ICOADS Arctic SST observations from 2015 and 2016.

Explore improving SST products through improved or expanded in situ SST observations in the Arctic

Algorithm development:

- Uptempo buoys, AXCTDs, Glider CTDs, Ship temperature data, Saildrone USVs (existing & future)
- Integrate data into ICOADS & MDB

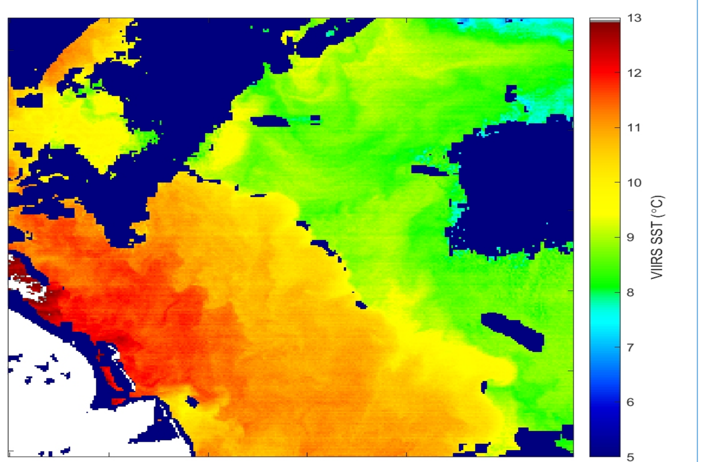
SST Algorithms: Focus on improving accuracy and uncertainty estimates of SSTs at high-latitudes

IR Algorithms:

- at high latitudes different algorithm formulations
- very dry atmosphere.
- surface emissivity more important

PMW Algorithms:

- 10.7 channel not good for SST.
- Wind speed and direction errors lead to larger errors.



Strong VIIRS SST gradients in the Arctic Ocean

Algorithm development:

- RTM simulated TB based on environmental conditions that are not well sampled
- In situ databases – not well sampled at high latitudes

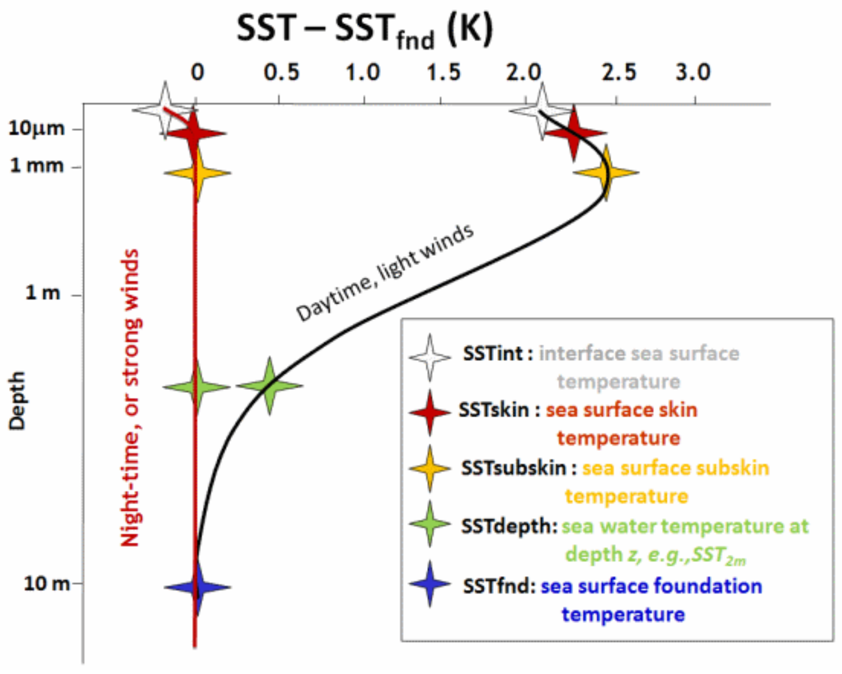


Image credit: GHRSST Project Office

Explore improving SST products particularly in marginal ice zones through research into high latitude air-sea-ice interactions and regional ocean-atmosphere-ice feedbacks

- What is a foundation SST?
- How do L4 handle SST in the MIZ?
- How do salinity layers affect upper ocean heating?
- Measure turbulent heat fluxes (in situ) at high latitudes. How does upper ocean stratification affect air-sea interactions?