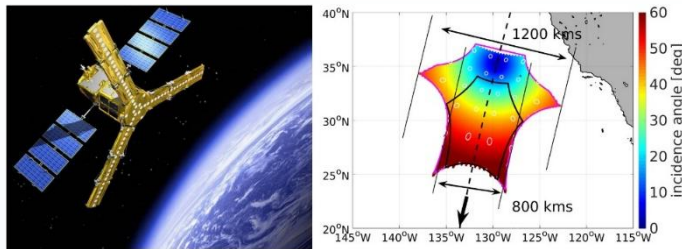


Recent updates to the multi-mission sea surface salinity optimum interpolation (OISSS) analysis version 3.0

Oleg Melnichenko (oleg@esr.org), Peter Hacker, Thomas Meissner, Frank Wentz, Julian Schanze, and Jesse Anderson

SMOS



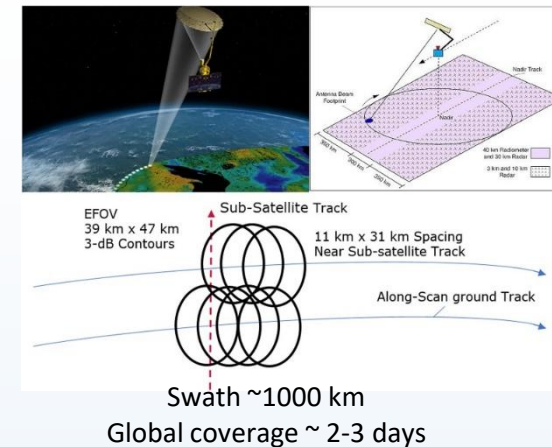
Interferometric Radiometer
 Spatial res ~ 43 km
 Swath ~1000 km
 Global coverage ~ 2-3 days

Aquarius

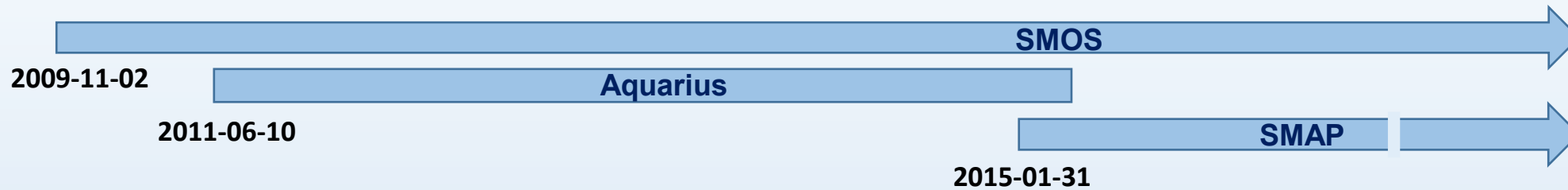


3 beams 390 km wide swath
 Global coverage = 7 days

SMAP



Swath ~1000 km
 Global coverage ~ 2-3 days



Adapted from Reul et al., 2020, Remote Sensing of Environment, 242 (2020)

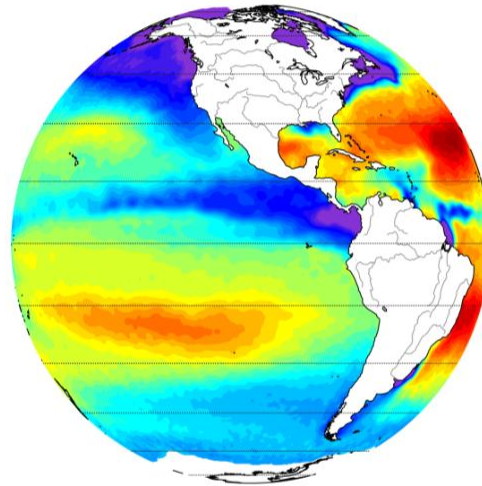


OISSS

Oleg Melnichenko

Principal Investigator

- OISSS Overview
- Algorithm Description
- Documentation
- Data Access
- OISSS Archive



Partners:

Peter Hacker, James Potemra

International Pacific Research Center, University of Hawaii, Honolulu, HI

Thomas Meissner, Frank Wentz

Remote Sensing Systems, Santa Rosa, CA

Sea Surface Salinity Optimum Interpolation analysis (OISSS) is a NASA funded research project and a global SSS dataset derived from satellite L-band radiometer measurements.

Sea surface salinity (SSS) is one of the most important climate variables and a key indicator of changes in the marine hydrological cycle. Characterizing, quantifying, and understanding the distribution of SSS and its variability is crucial for understanding changes in the regional and global climate and for climate monitoring and prediction.



Funded by NASA

Recognizing the importance of SSS data, and the need for a consistent, continuous, long-term, high-quality, and high-resolution dataset for oceanographic research and applications, the OISSS project develops such a dataset from multi-satellite measurements.

The multi-mission OISSS dataset combines observations from NASA's Aquarius/SAC-D, Soil Moisture Active-Passive (SMAP) and the European Space Agency's Soil Moisture and Ocean Salinity (SMOS)





Algorithm Description

Oleg Melnichenko

Principal Investigator

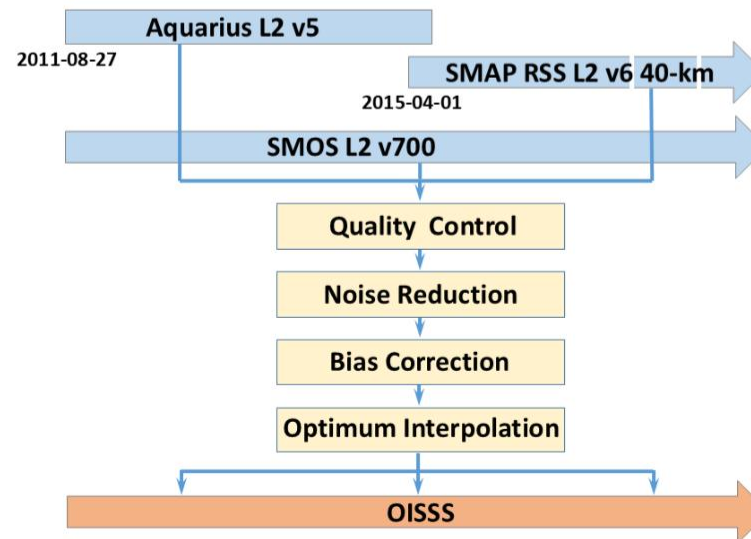
- OISS Overview
- Algorithm Description
- Documentation
- Data Access
- OISS Archive



Funded by NASA

The OISS dataset grids the Level-2 orbital data from the Aquarius/SAC-D satellite mission (25 August 2011 to 7 June 2015), the Soil Moisture Active Passive (SMAP) satellite mission (April 2015 – present) and the Soil Moisture and Ocean Salinity (SMOS) satellite mission (January 2011-present) onto a 0.25-degree spatial and 1-day temporal grid using Optimal Interpolation (OI).

OISS Processing Flow Chart



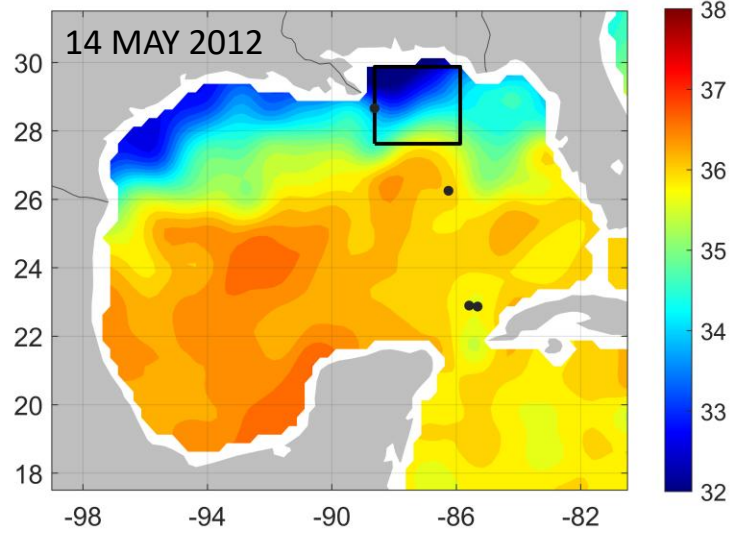
OISSS version 3.0 has been developed to improve the resolution and consistency! of the current product

Summary of updates from v2.0 to v3.0

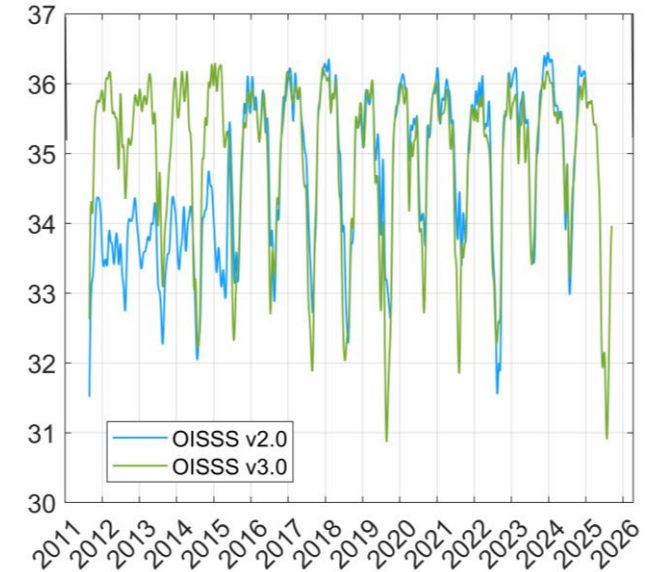
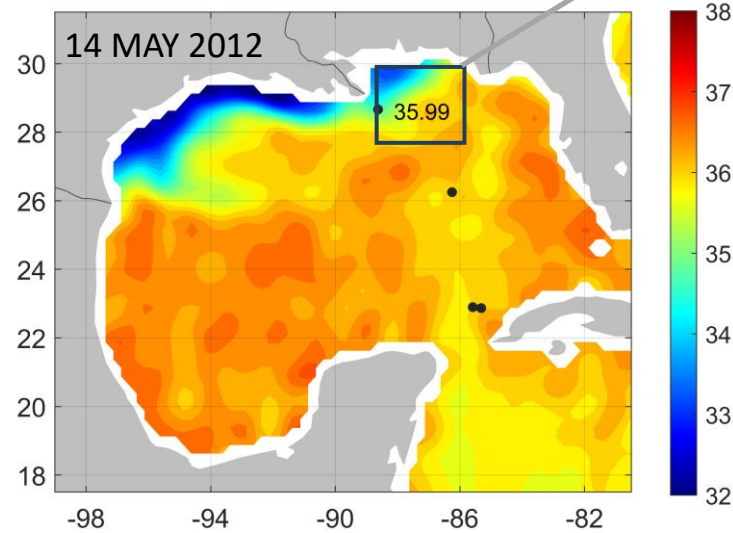
- ✓ SMOS observations (Level 2 OS version 700) are included over the entire period of the dataset (not only to fill gaps in SMAP observations as in OISSS v2.0).
- ✓ The data are processed at full spatial resolution.
- ✓ **Improved bias-correction algorithms** are implemented to account for systematic instrument biases in satellite SSS retrievals. Measurements from the SMOS satellite are calibrated relative to SMAP SSS, including corrections for spurious seasonal variability.
- ✓ **Additional noise-reduction algorithms** are implemented to reduce high-frequency instrument noise.
- ✓ Spatial OI is applied to 4-day Level 2 SSS data (instead of 8-day as in OISSS v2.0) with a 4-day time step.
- ✓ Temporal OI is applied to 4-day SSS maps to produce **daily time series**.
- ✓ **Improved estimates of the signal and error statistics** are incorporated into the OI algorithm. The correlation scales are derived from a spatiotemporal analysis of the satellite SSS data (Yi et al., 2022, Remote Sensing, 14(21), 5435).

Focus on consistency

OISSS v2.0



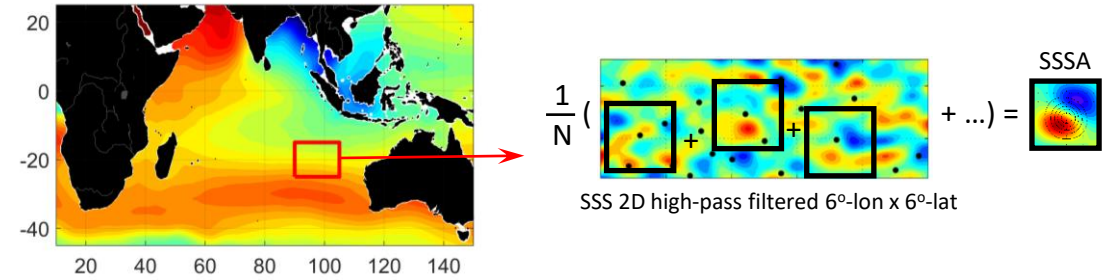
OISSS v3.0



Time series of SSS averaged over the black box (near the Mississippi River plume).

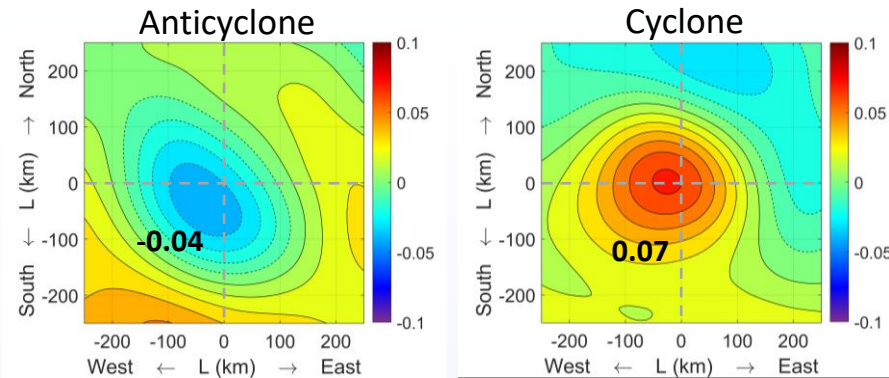
consistency - agreement or harmony of parts or features to one another or a whole (Merriam-Webster)

Composite averages of SSS anomalies associated with composite eddies in the South Indian Ocean (30°S–15°S, 90°E–105°E).

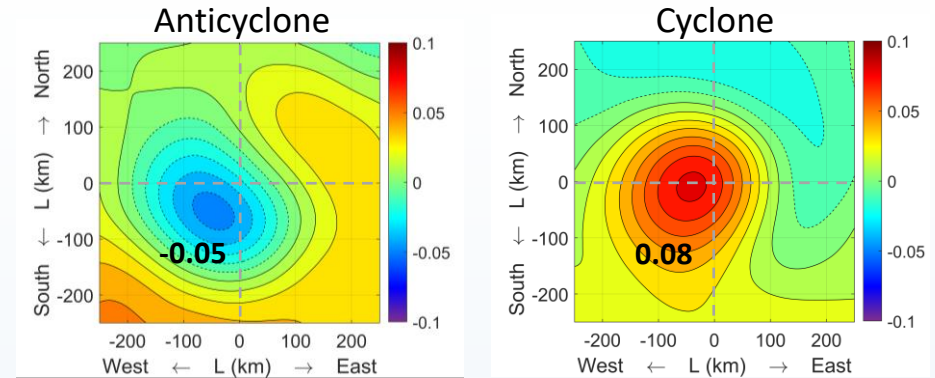


2011-2015 (Aquarius)

OISSS v2.0

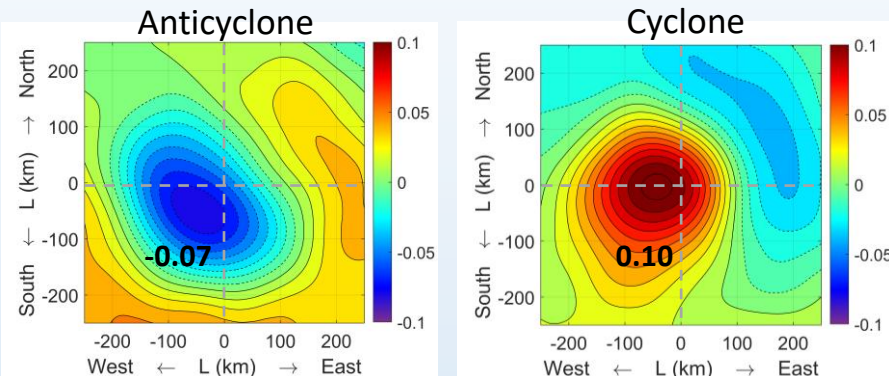


2015-2019 (SMAP)

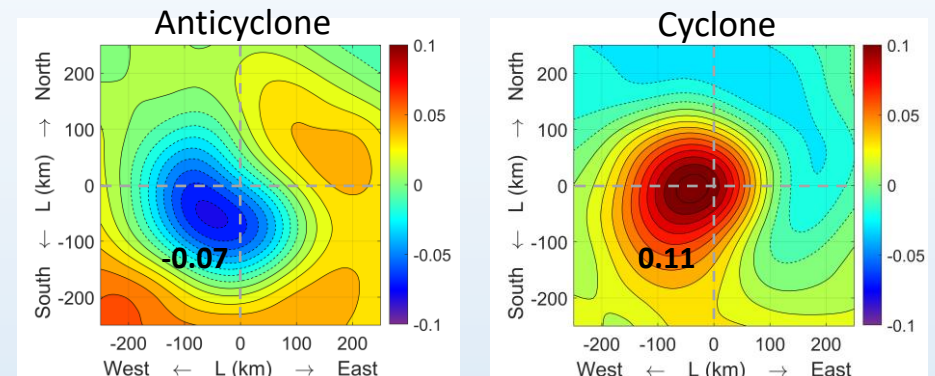


2011-2015 (Aquarius/SMOS)

OISSS v3.0



2015-2019 (SMAP/SMOS)



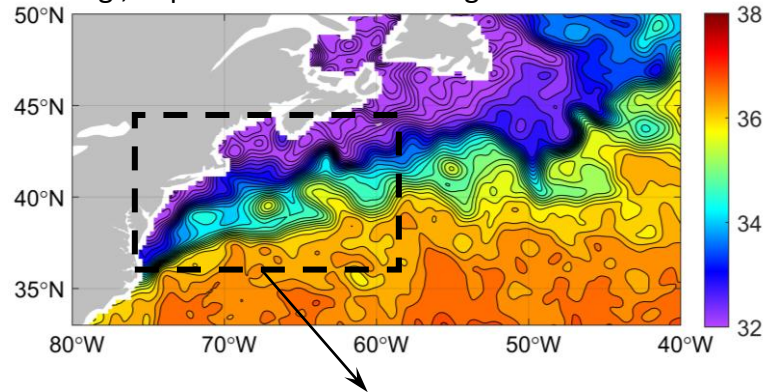
consistency - agreement or harmony of parts or features to one another or a whole (Merriam-Webster)

Multi-Mission Sea Surface Salinity Optimum Interpolation (OISSS) Analysis for Ocean and Climate Studies

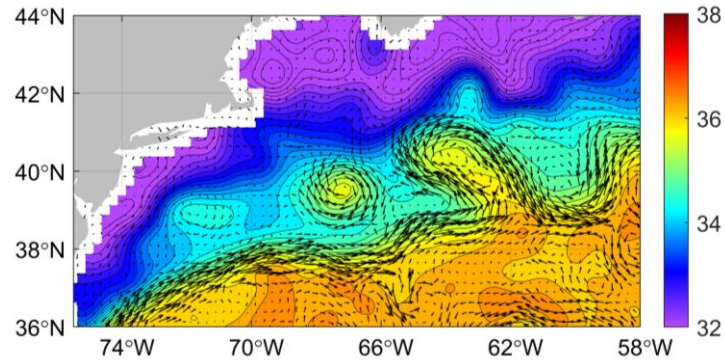
Earth and Space Research-ESR (Seattle, WA), in collaboration with the University of Hawaii-UH (Honolulu, HI) and Remote Sensing Systems-RSS (Santa Rosa, CA).

Focus on coastal areas

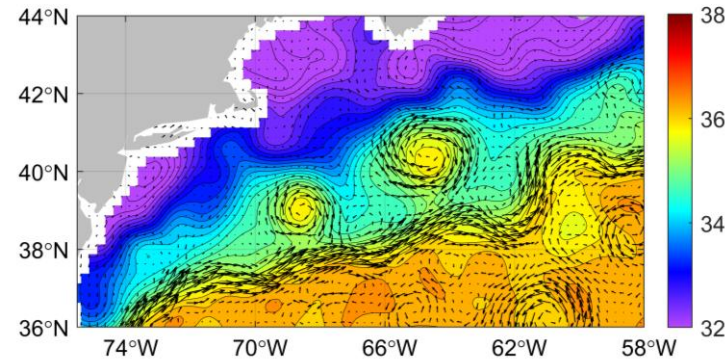
e.g., impact of Gulf Stream rings on shelf water



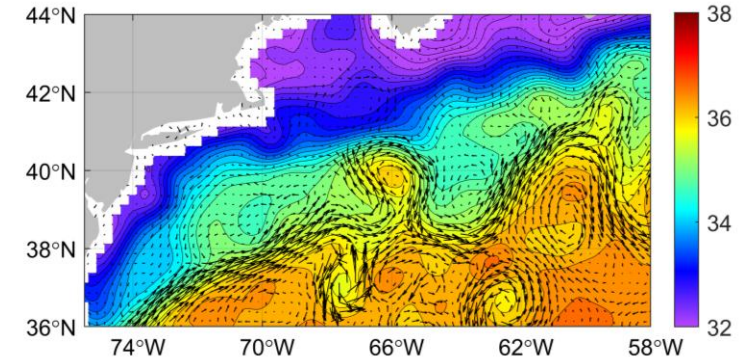
20 AUG 2020



11 SEP 2020

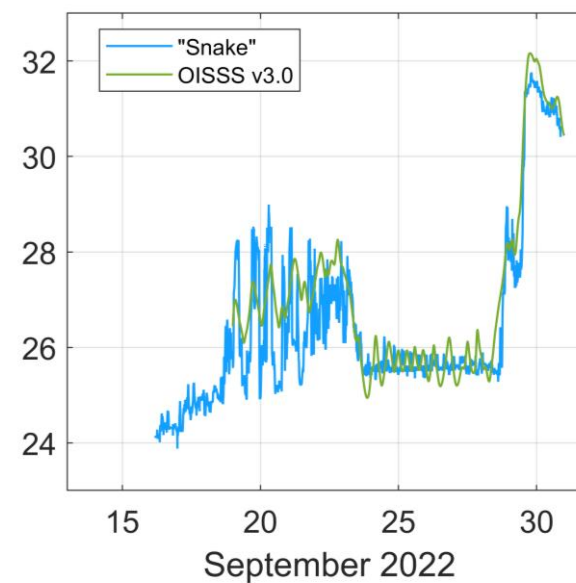
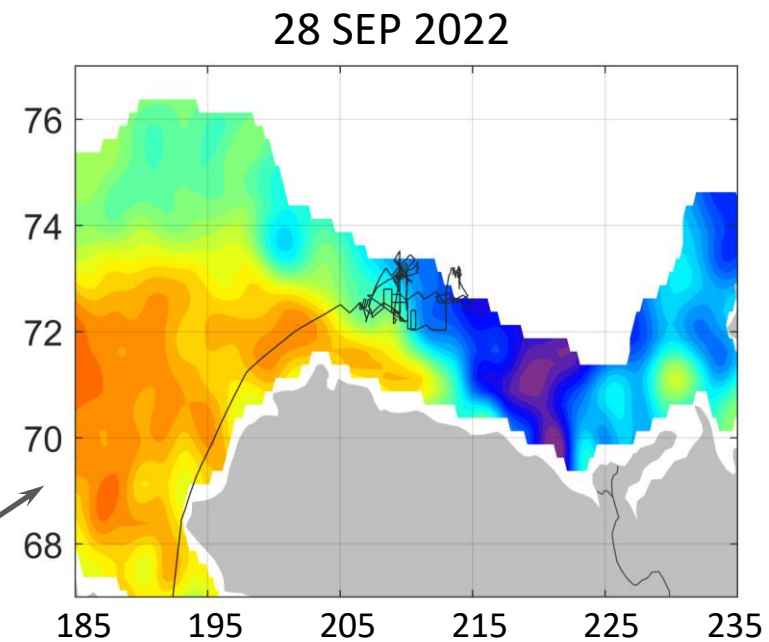
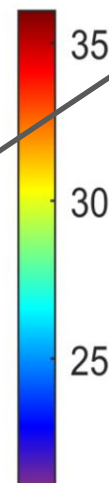
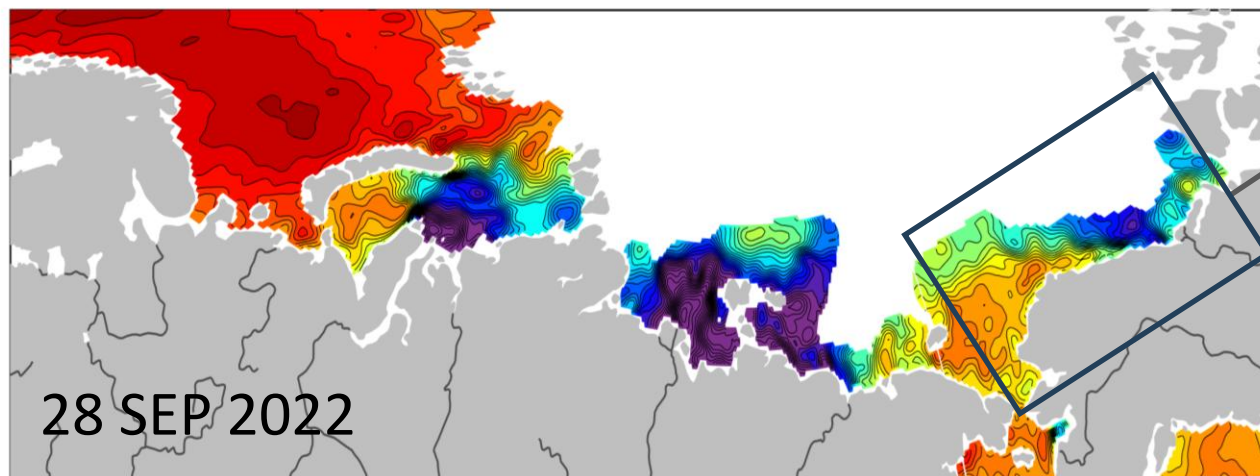


4 OCT 2020

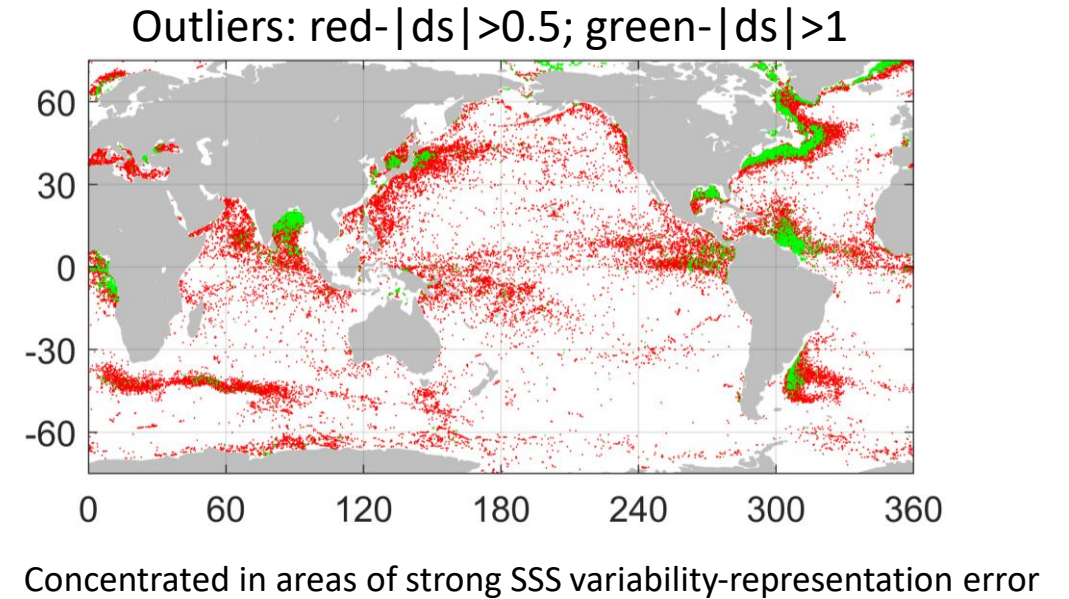
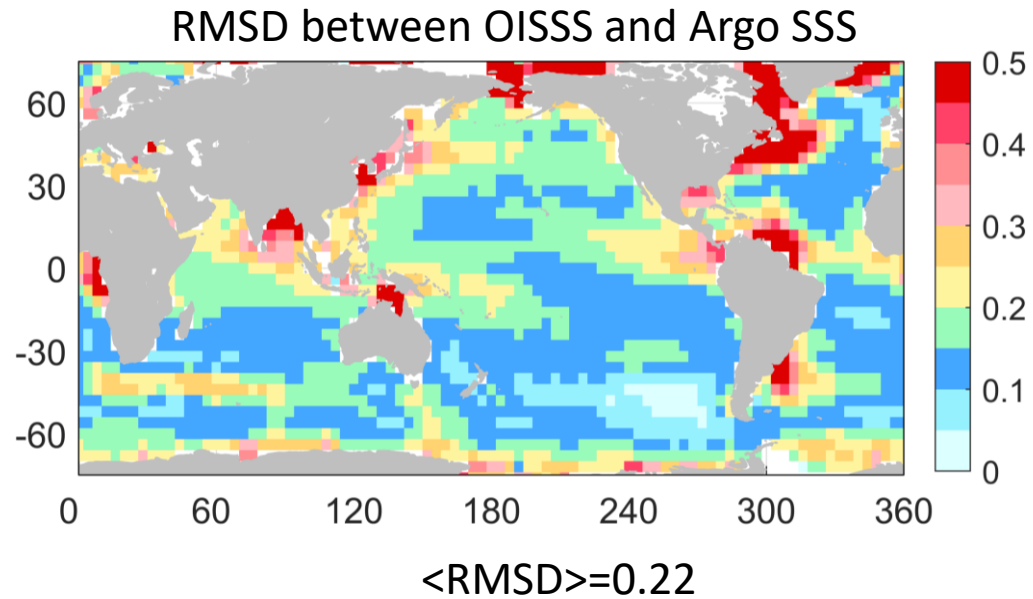


Example plots of OISSS v3. Color shades: SSS; arrows: geostrophic currents.

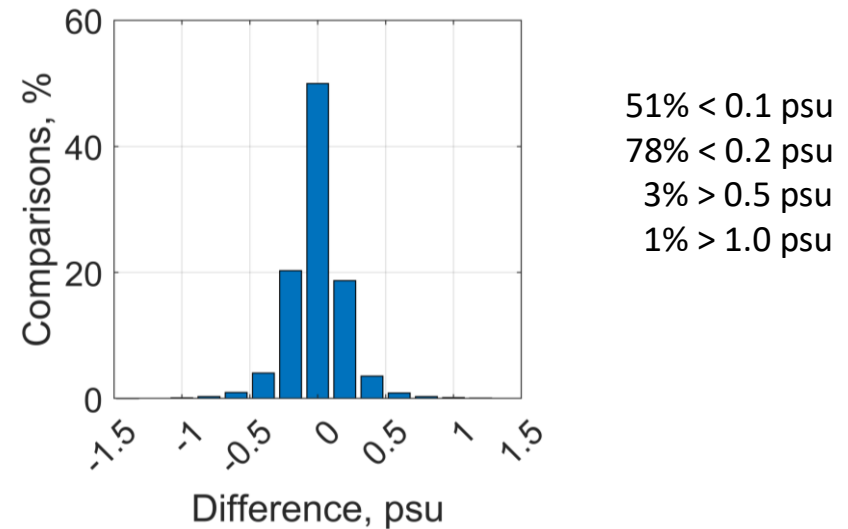
The Arctic



v3.0 matchup statistics



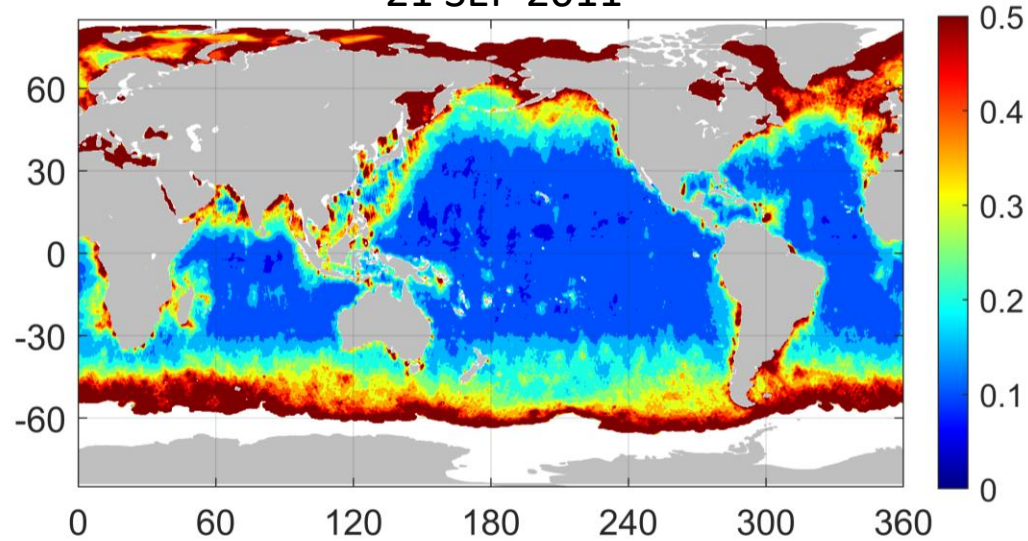
The error statistics were calculated by comparing Argo buoy measurements ($z < 10\text{m}$) for a given week with SSS values at the same locations obtained by interpolating the corresponding OISSS maps.



v3.0 formal uncertainty (example maps)

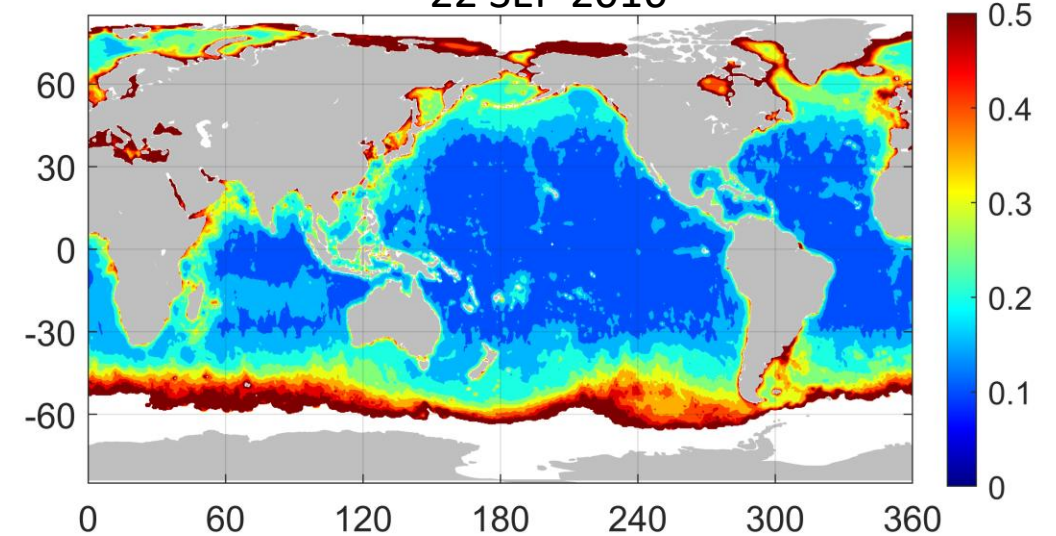
Aquarius/SMOS

21 SEP 2011



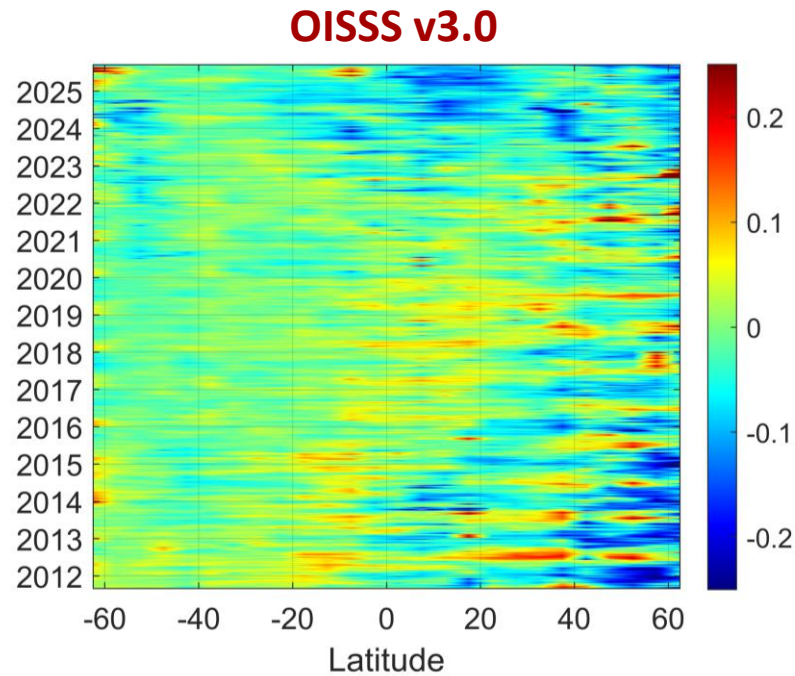
SMAP/SMOS

22 SEP 2016



The formal uncertainty for each OISSS field is estimated by propagating the uncertainties of the Level 2 SSS retrievals (as provided by the data producers) using standard error propagation techniques (Taylor, 1982).

Despite significant effort taken to reduce errors and biases in the satellite SSS data, the resulting OISSS maps may still have errors and biases, both globally and regionally.



Future work: get rid of the seasonal biases.

Latitude-time distribution of the zonally averaged differences (psu) between the weekly SSS maps and the corresponding Argo buoy data.

The error statistics were computed by comparing Argo buoy observations for a given week with SSS values at the same locations obtained by interpolation of the corresponding OISSS maps. The zonally averaged biases were computed by averaging these statistics over 5-degree latitude bands.



Data Access

Oleg Melnichenko

Principal Investigator

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- Data Access**
- OISSS Archive

Direct Access

The OISSS dataset is available to download through HTTPS. Please follow the links below to download the dataset of your choice. The dataset is in NetCDF format. For more information, see [ReadMe.pdf](#)

- [OISSS Multi-Mission Global Daily](#)
- [OISSS Multi-Mission Global Monthly](#)

PO.DAAC: TBD

Users' comments are very important.



Funded by NASA