Inter-comparison of satellite and buoy salinity data sets in coastal California for environmental applications

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Background

- Circulation of the ocean is integral to planetary health. One of the drivers of fluid circulation is density gradients of seawater, being a function of temperature and salinity. There are several new observational methods of salinity like satellite remote sensing and buoys.
- Measurements obtained across different platforms do not always agree with each other. For applications of data-driven conclusions, understanding discrepancy across data is crucial.

Instruments

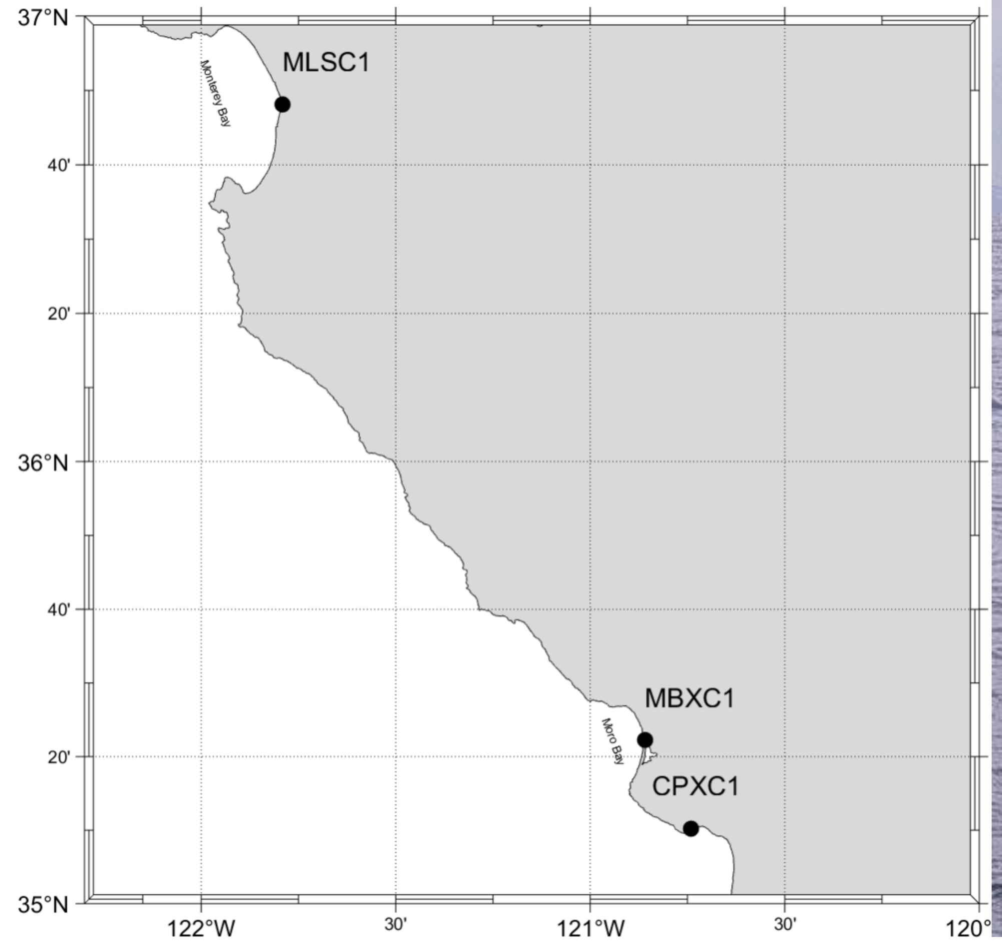


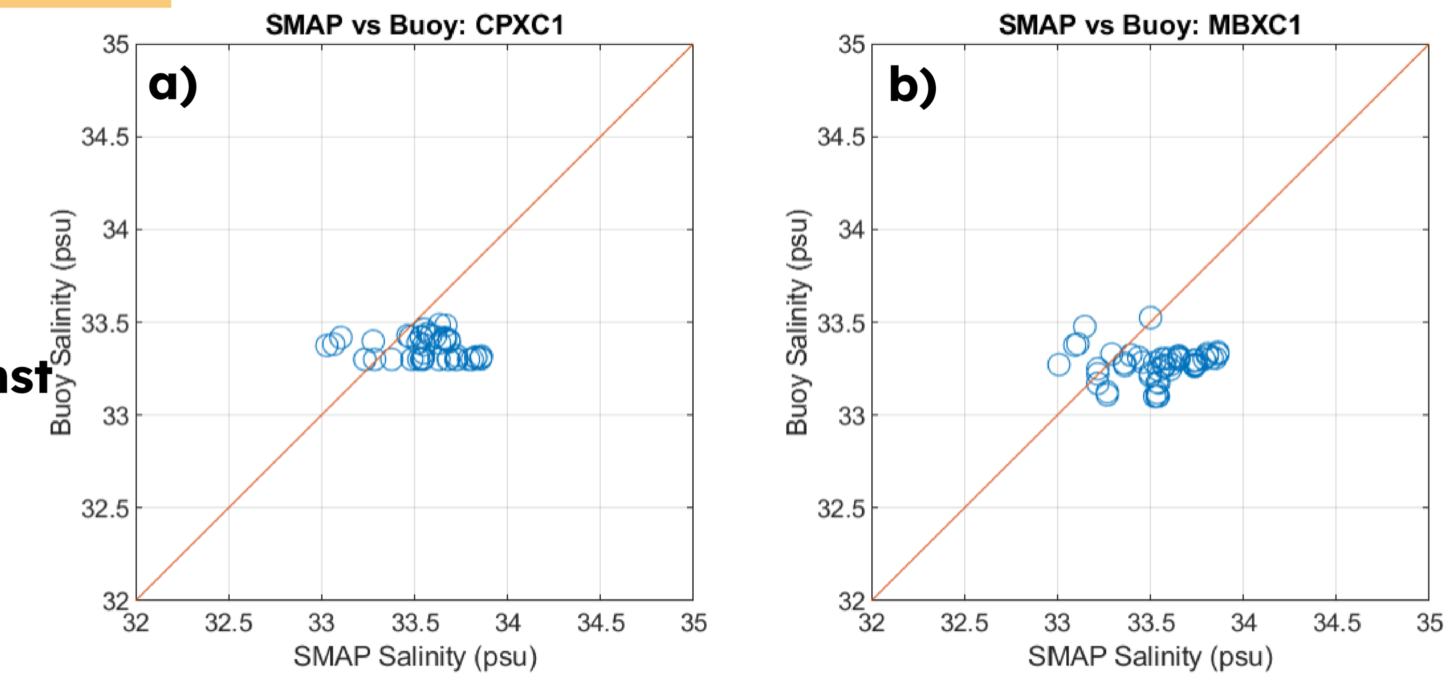
FIG. 1: Buoy Locations on the California Coast.

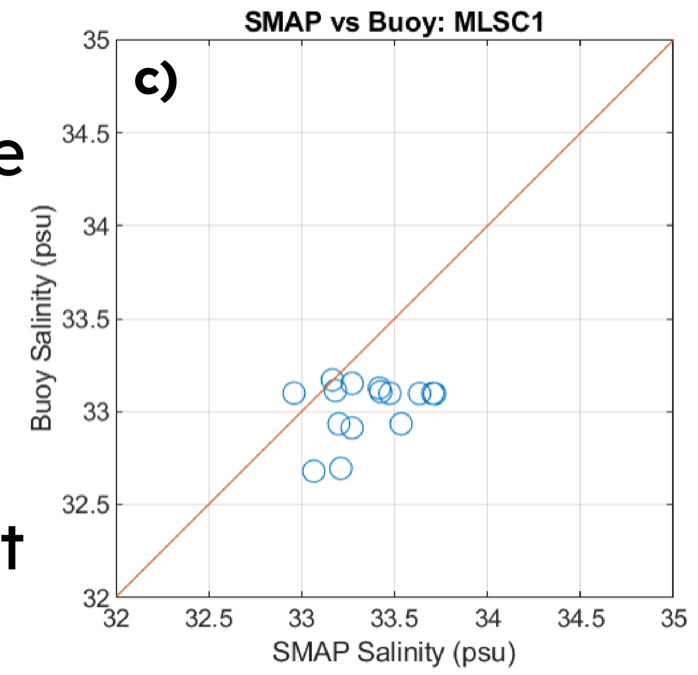
FIG 2: MBXC1 (Monterey Bay Buoy) [1]

- The instruments compared were the SMAP satellite and three different buoy locations across the california coast: Monterey Bay, Morro Bay, San Luis Obispo Bay (FIG. 1, 2).

Results

FIG 3: (a),(b),(c) Salinity data from Buoys plotted against SMAP data across space and aligned time series.





- The buoy data has more consistent data across time while the SMAP varies across a range.
- CPXC1 displays a consistent salinity, MBXC1 has more variability, and MLSC1 has the most discrepancy for the amount of data.

Conclusion

- The orbital path of SMAP does not necessarily cross the Buoy locations, leading to interpolation from open ocean salinity data points which tend to be higher in salinity.
- Since SMAP utilizes radio frequency to collect data samples, interference would occur from land masses being within the collection range.
- When drawing data based conclusions within research, these discrepancies across instruments should be taken into account when calculating error margins.

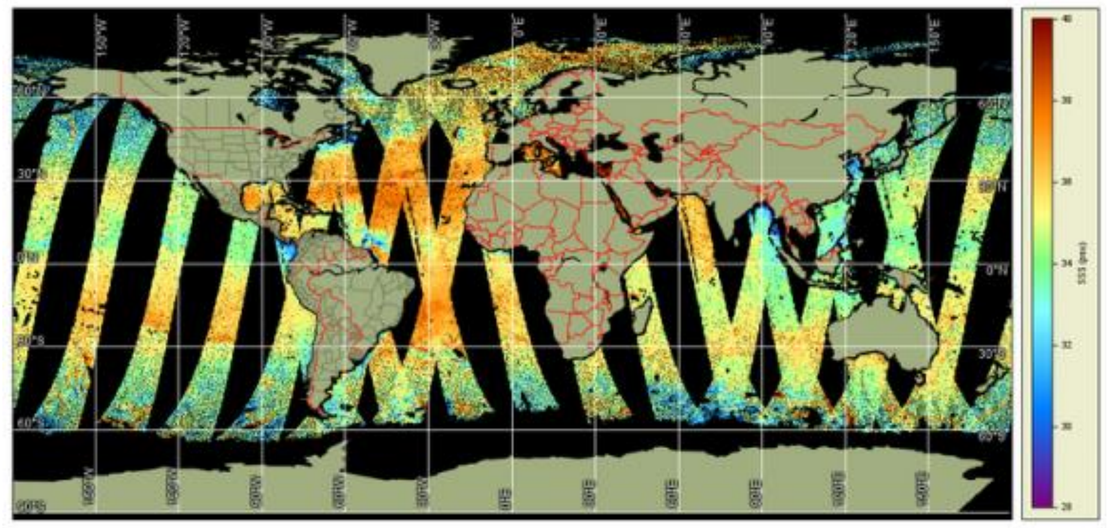
Methodology

- Buoy data was cleaned and outliers were removed using percentile based error margins.
- For each buoy, the nearest satellite grid cell from SMAP was identified (FIG 4).
- A Gaussian distance-weighted interpolation was performed to account for spatial variability in satellite data.
- Since SMAP data observations are in an 8 day average across 4 day windows, to match time series, 8 day averages were created within the window of each SMAP observation.
- All data observation and interpolation was done in MATLAB R2024.

Data

- Buoy data was taken from the National Data Buoy Center under NOAA from Monterey Bay Research Institute, Moss Landing Marine Laboratory, and California Polytechnic State University.
- SMAP Satellite data was from NASA's EarthData Search.

FIG 4: An salinity map across SMAP satellite's path [2]



References
[1] "M1 buoy data plots (last 7 days) ," CeNCOOS
[2] "Sea surface salinity - near real time - SMAP," Sea Surface Salinity - Near Real Time - SMAP | NOAA CoastWatch

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