



National Aeronautics and  
Space Administration

**Jet Propulsion Laboratory**  
California Institute of Technology  
Pasadena, California

# *Intercomparison of error characteristics across remote sensing salinity products in the Gulf of Mexico, a river-influenced system*

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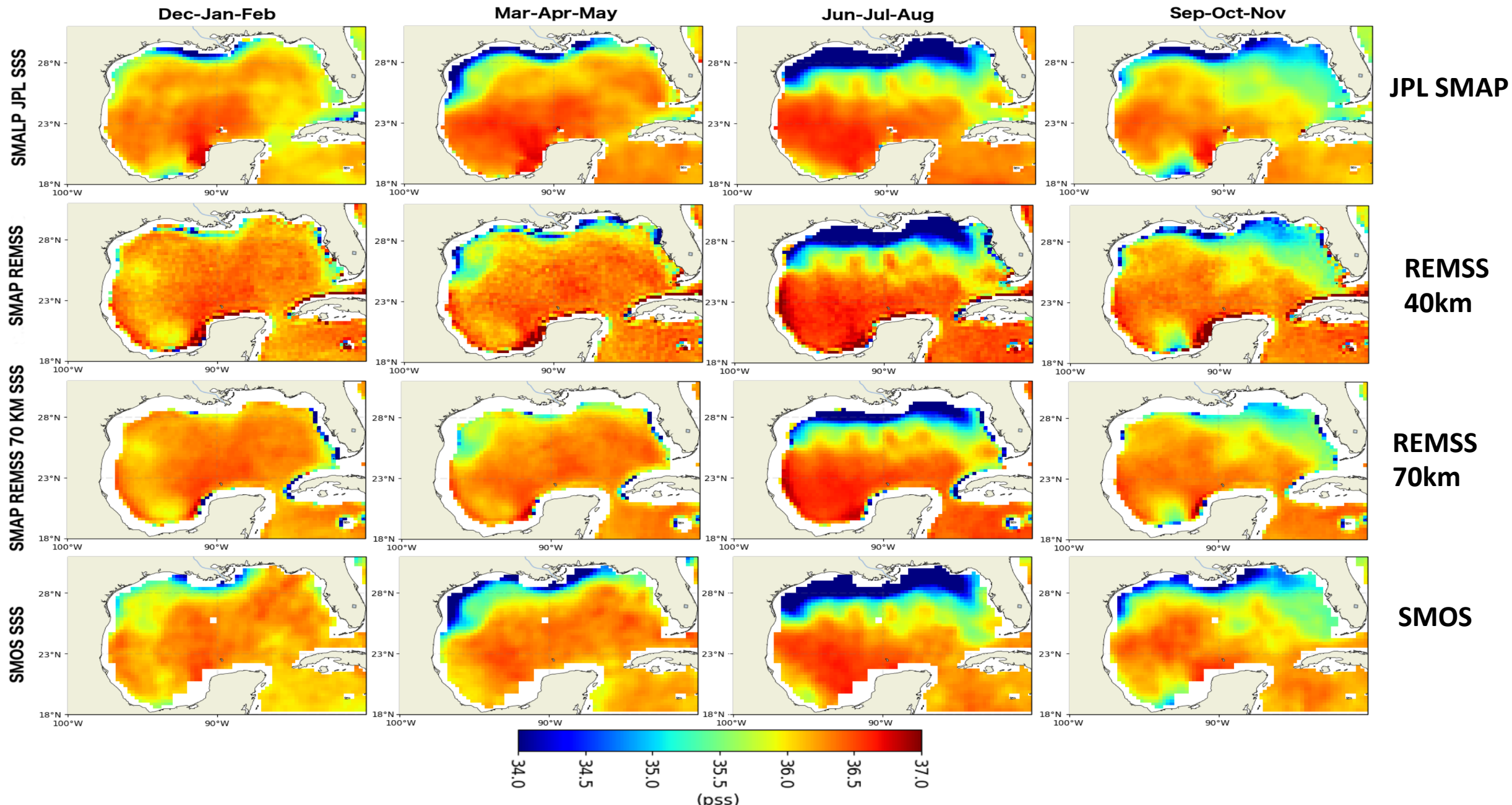
## *Motivation & GOAL*

- **Coastal Ocean: a region of growing interest for users**
- **Characterize the overall performance and errors of four popular sea surface salinity data sets in the Gulf of Mexico**

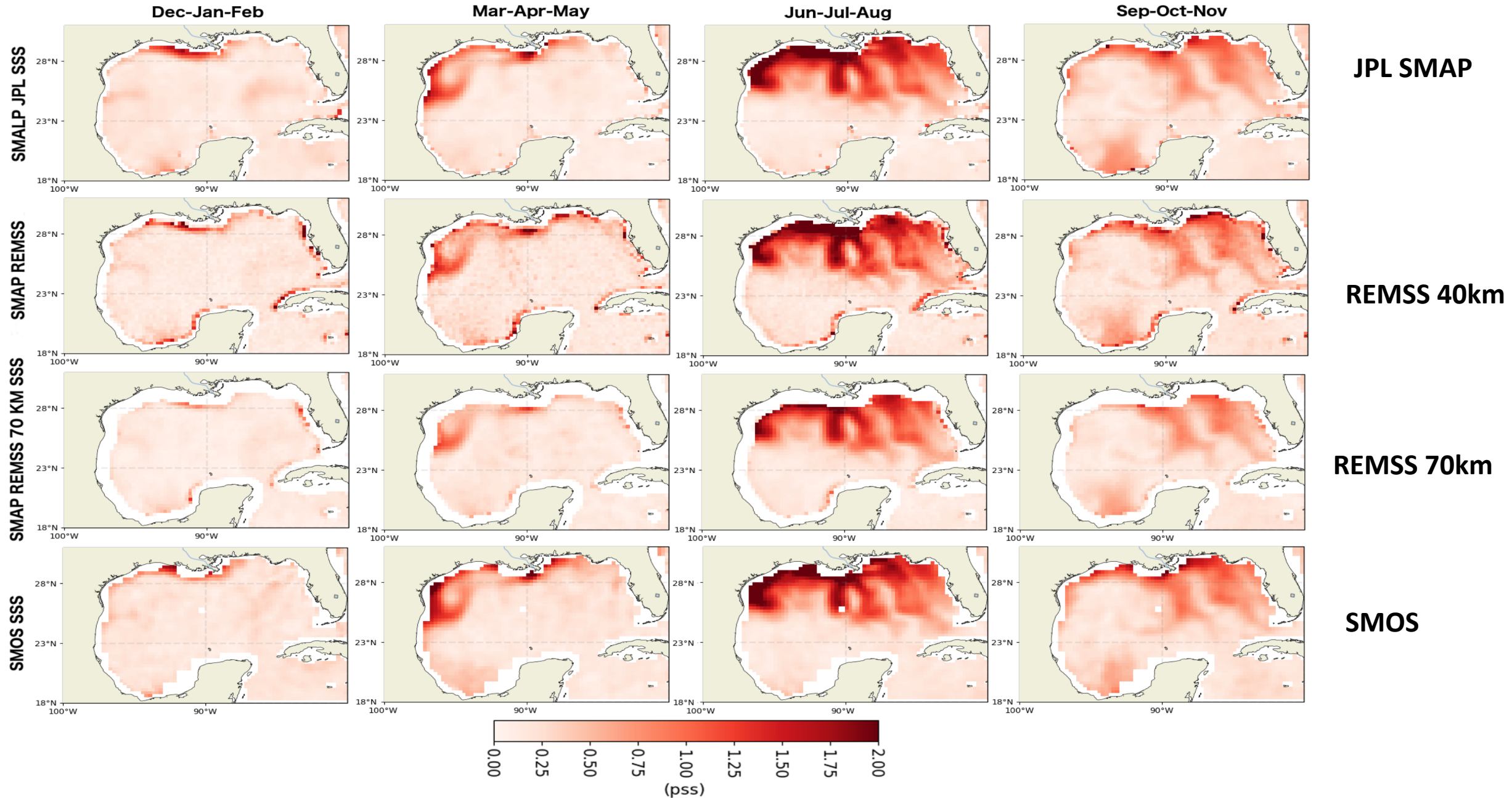
# Approach

- Four popular SSS datasets were evaluated in the Gulf of Mexico (GoM)
  - Jet Propulsion Laboratory Soil Moisture Active Passive (SMAP) 60km version 4.0 – JPL SMAP
  - Remote Sensing Systems SMAP 40km Version 4.0 – REMSS 40km SMAP
  - Remote Sensing Systems SMAP 70km Version 4.0 – REMSS 70km SMAP
  - European Space Agency (ESA) Soil Moisture and Ocean Salinity (SMOS) debiased 40km Version 3.0 - SMOS
- Climatologies and their variability for all the products were compared.
- All four products were compared with data from the World Ocean Database and 7 buoys located in the Eastern and Western Gulf of Mexico.
- Biases, Root Mean Square Error (RMSE), and Signal to Noise Ratios were examined for dependence on closeness to land, salinity value, smoothness, and seasonality.

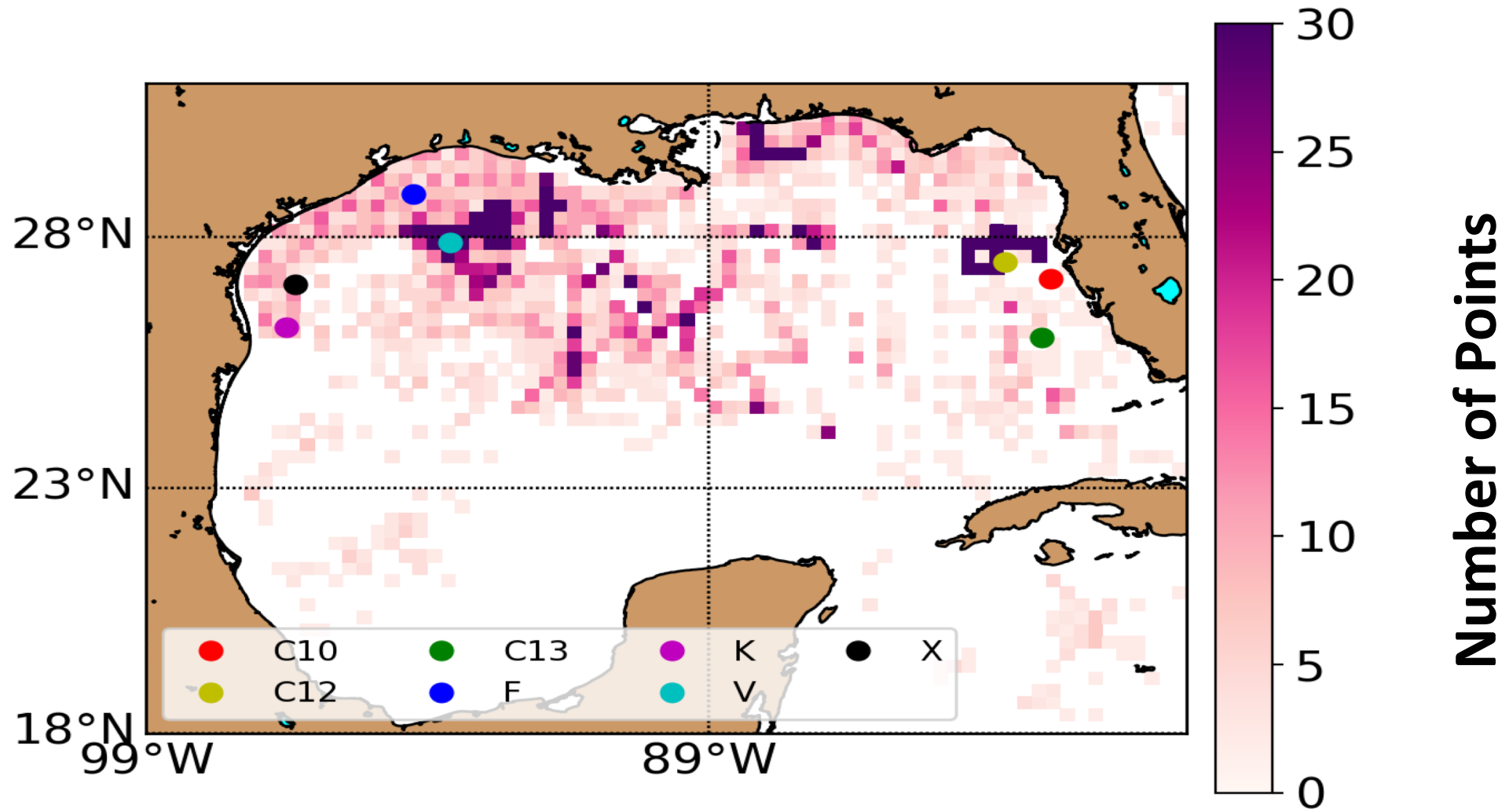
# Seasonal Climatologies based on data from 2015-2017



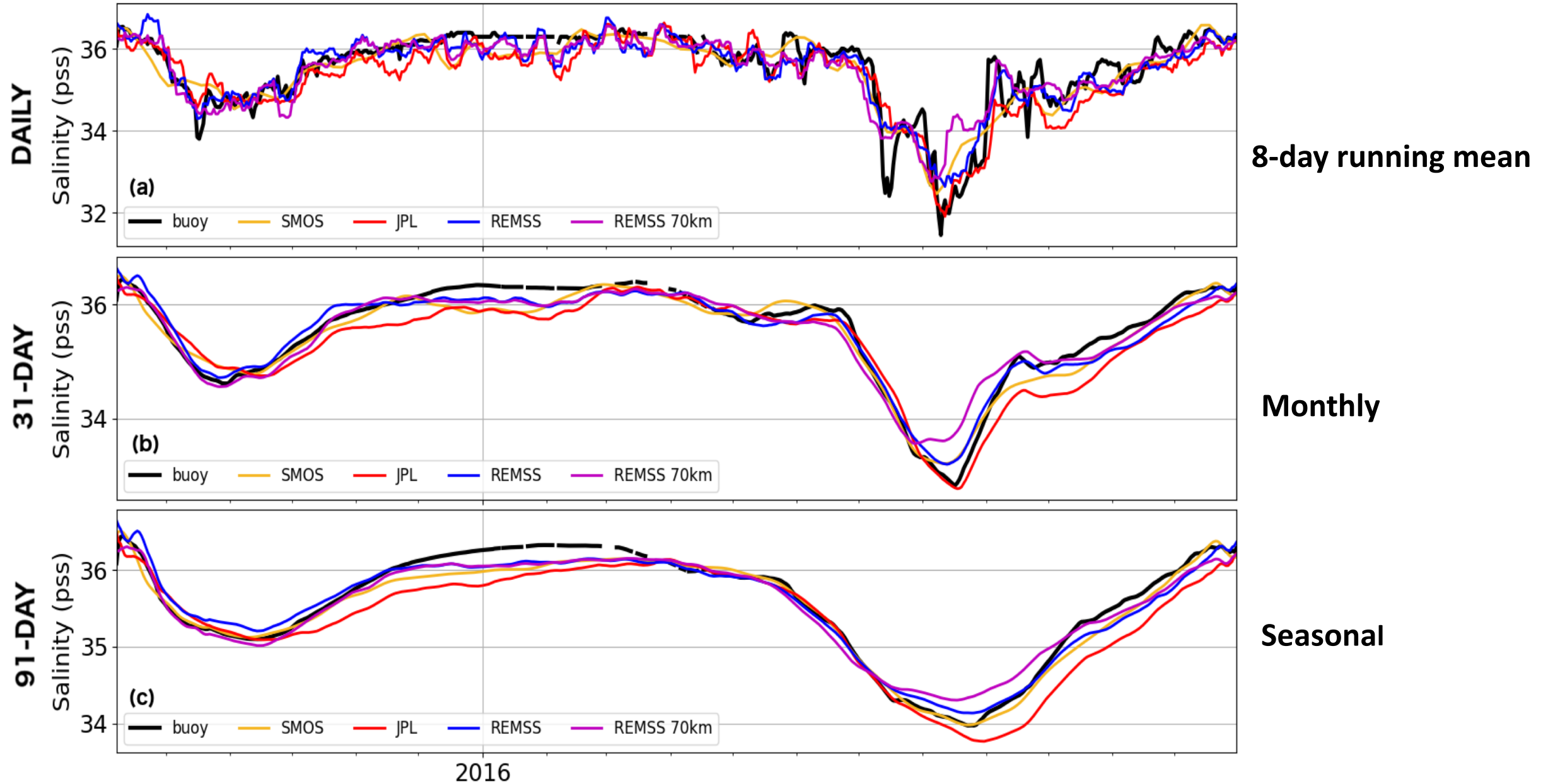
# Seasonal Variability based on data from 2015-2017



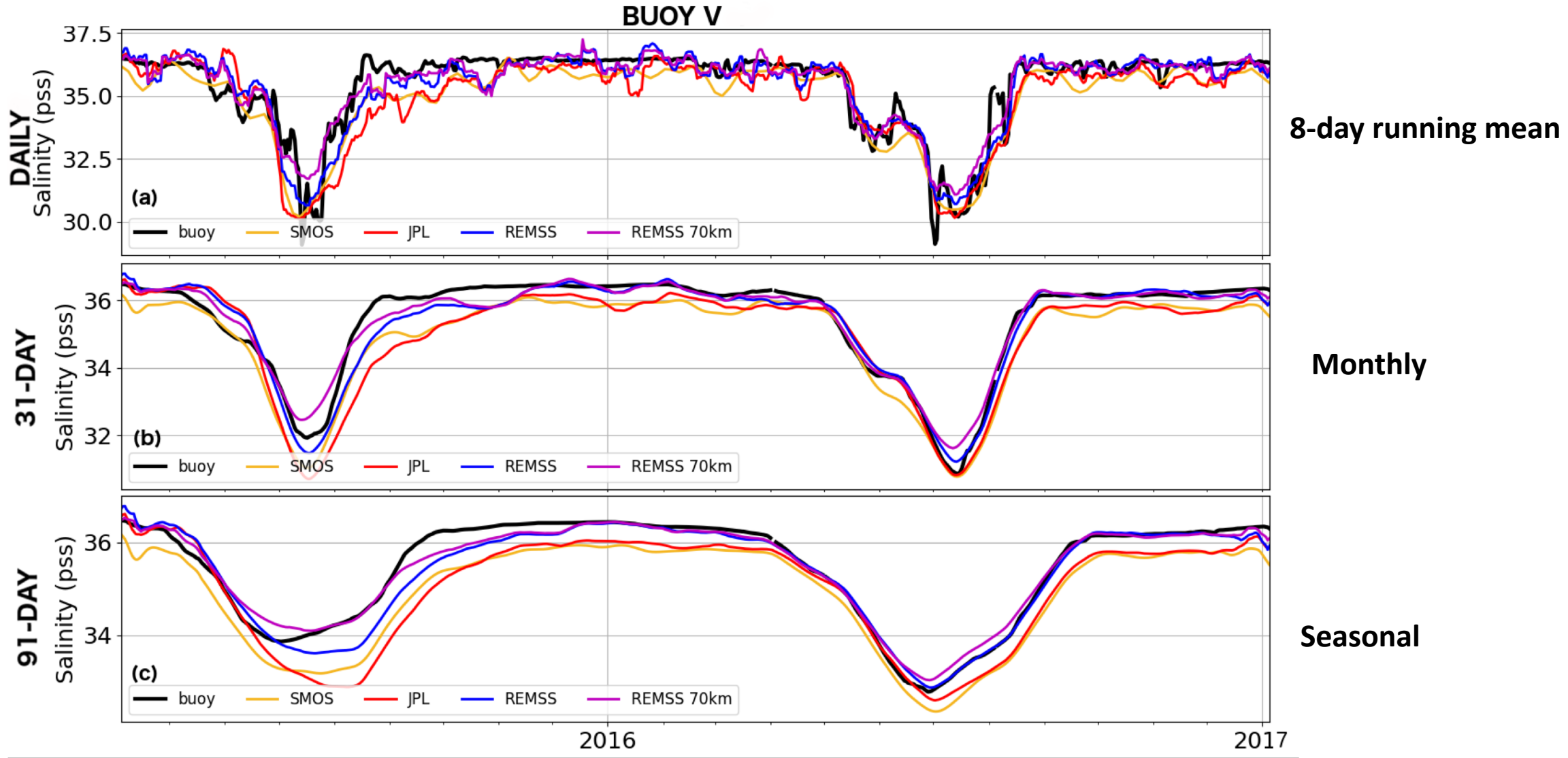
# Locations of World Ocean Database and Buoys



***Time series comparison: All Satellite products for buoy C12 in the Eastern Gulf off Florida Coasts***  
**reproduce Seasonal Variability due to freshening events/river discharge**  
**BUOY C12**



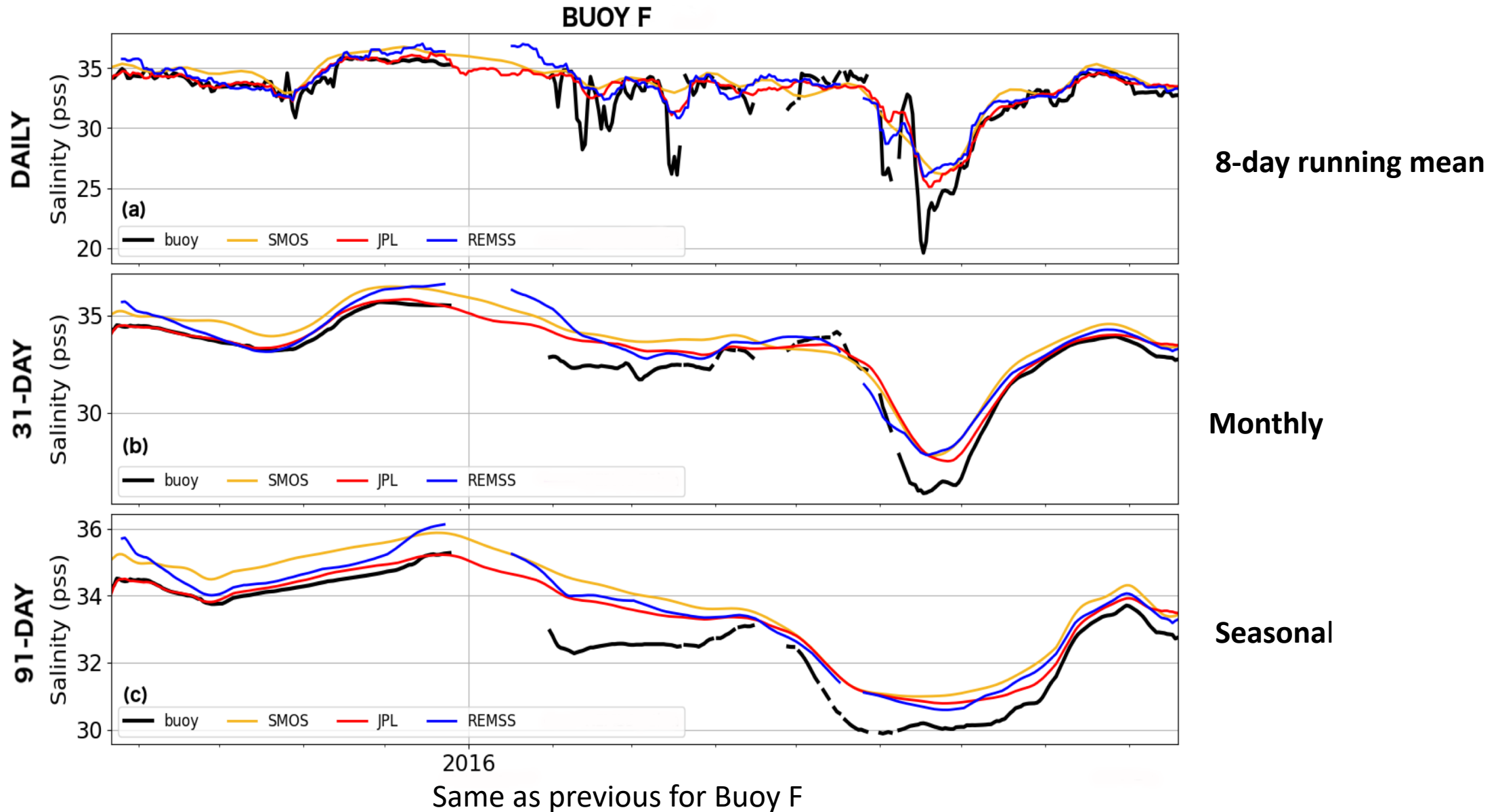
# Time series comparison: Offshore Texas Coast



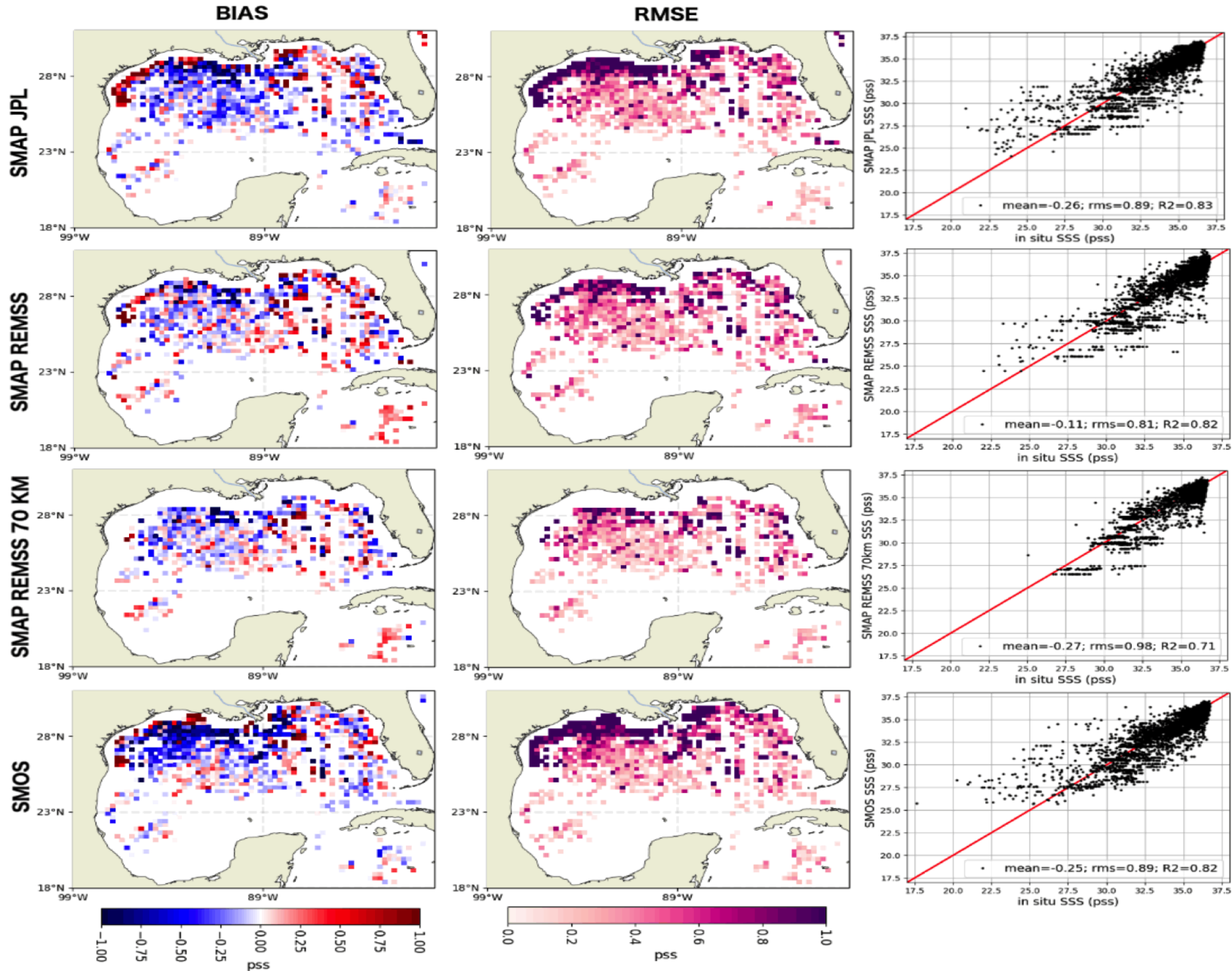
Same as previous but for Buoy V



# Time series comparison: Nearshore Northwest GoM



# Spatial Distribution of Statistics



JPL SMAP  
RMSE 0.89 PSS

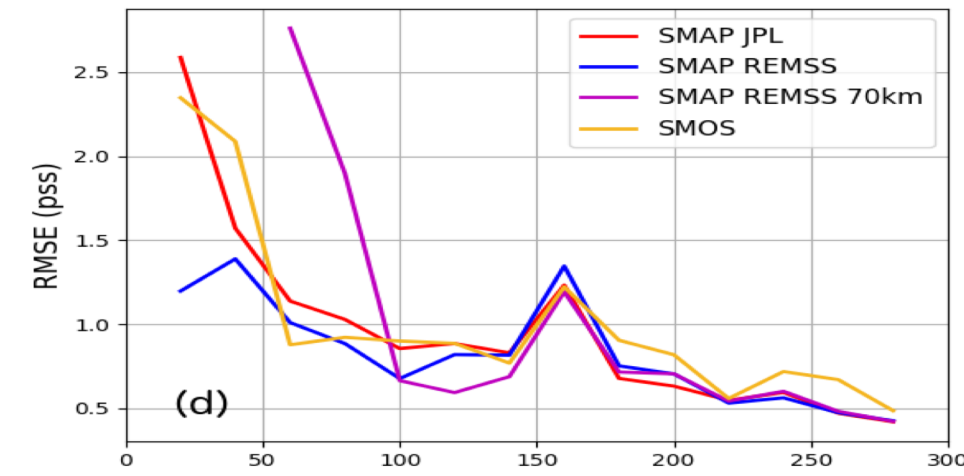
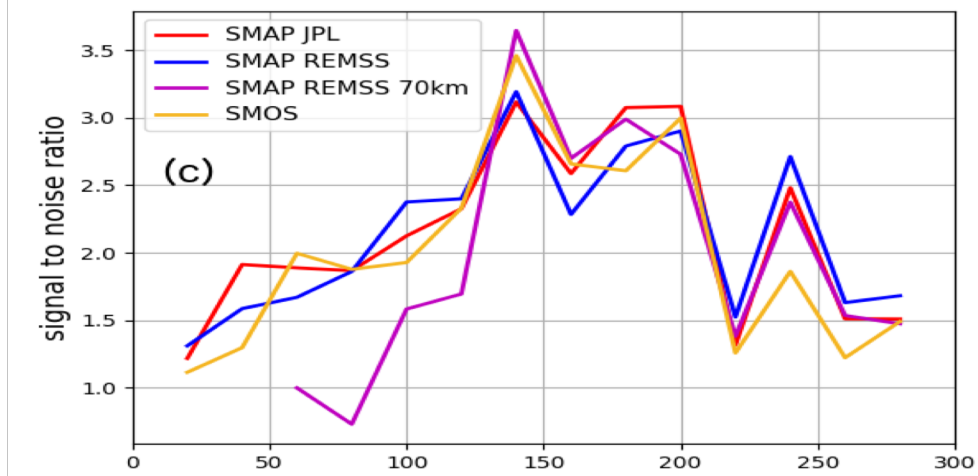
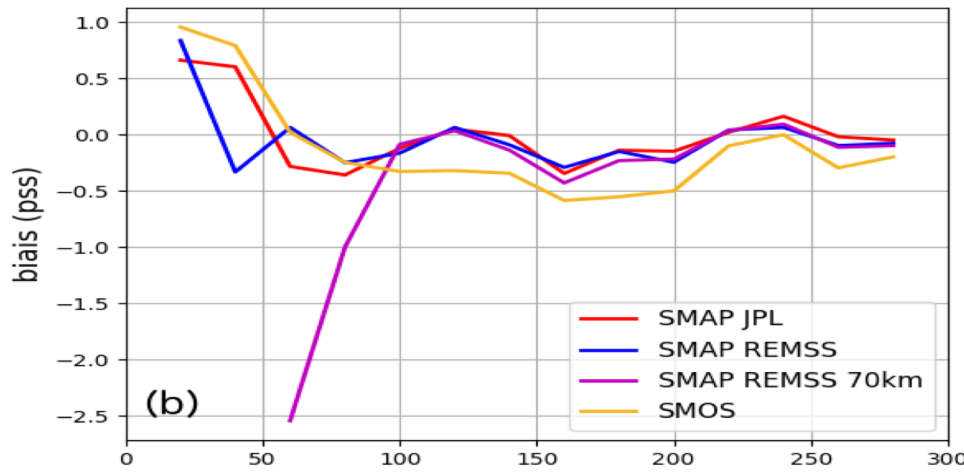
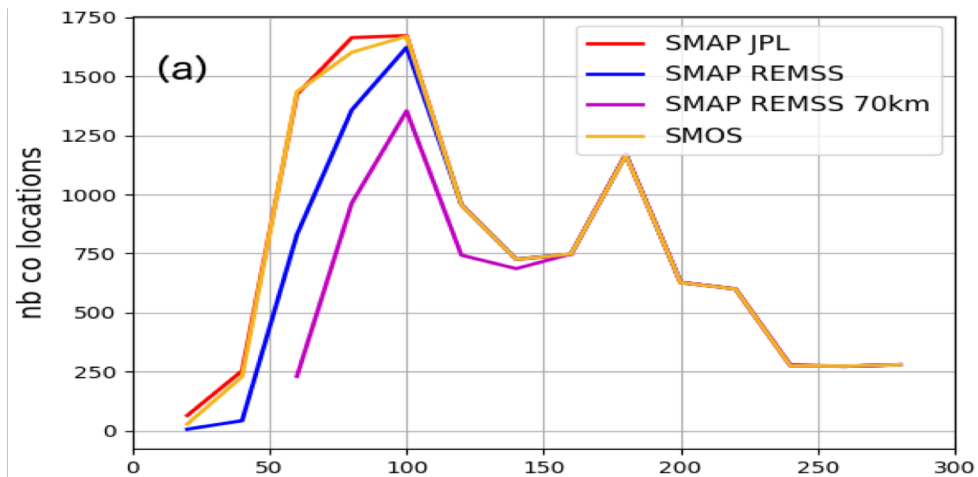
REMSS 40km  
RMSE 0.81 PSS

REMSS 70km  
RMSE 0.98 PSS

SMOS  
RMSE 0.89 PSS

# Dependence of statistics on distance from Shore:

a) Number of co-located points, b) bias c) Signal to Noise d) RMSE



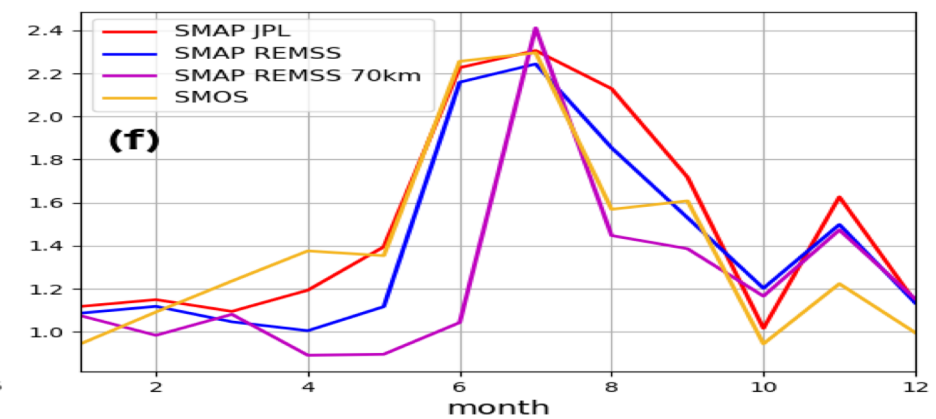
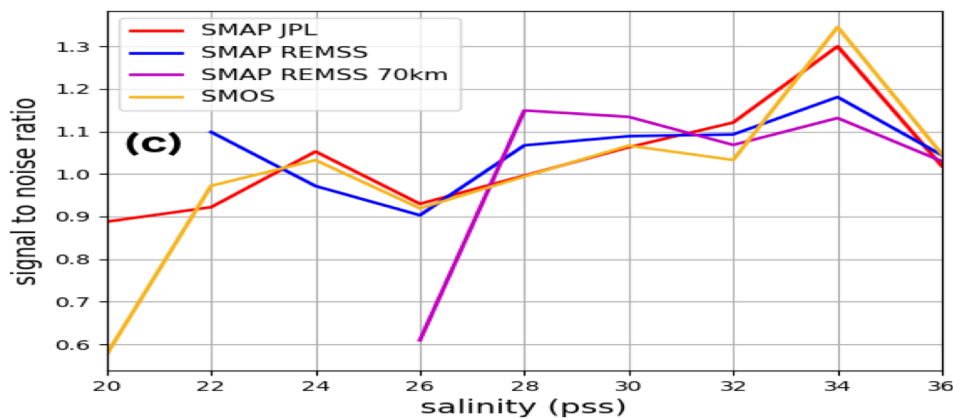
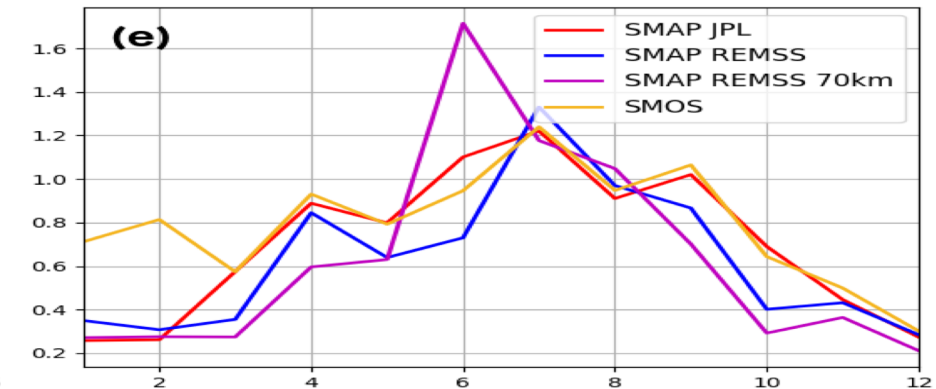
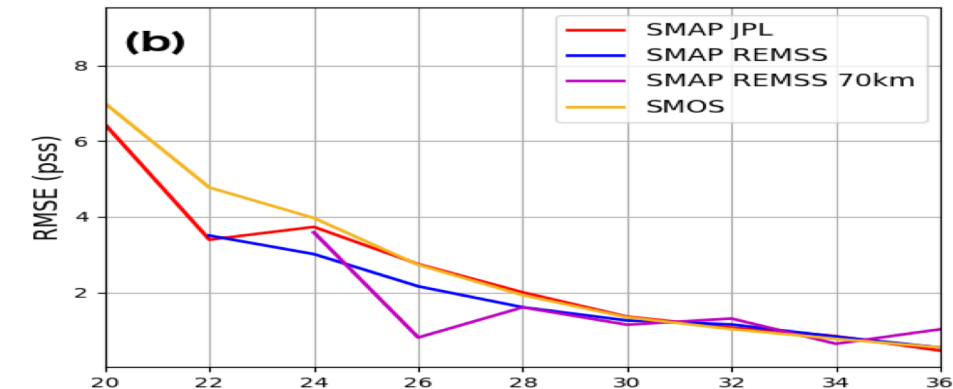
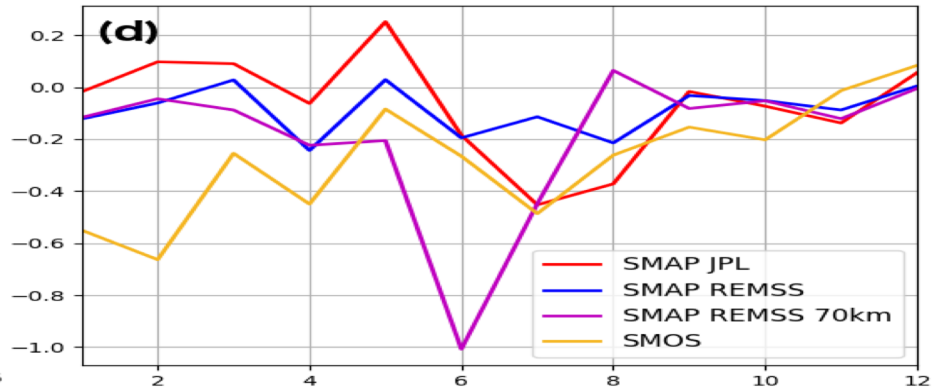
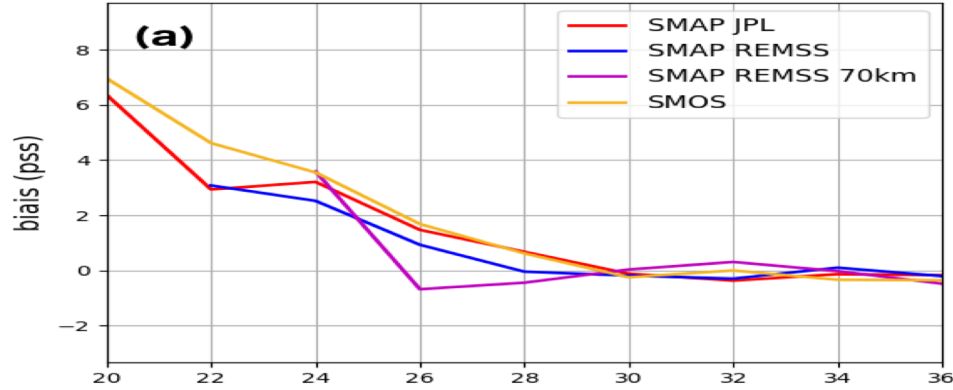
Distance from the coast (km)

Distance from the coast (km)

Overall statistics at distances less than 100km from the coast driven primarily by:

1. increased biases (saltier 1.0 PSS)
2. RMSE (>1.0 PSS)

# Statistics as a function of Salinity and Month of Year



1. Biases and RMSE are consistent in showing maximum values at minimum salinity values of 20 PSS.
2. Values decrease with increasing values of salinity.
3. Results consistent with climatologies that show major freshening events in the summer time frame.

# Conclusions

- First known regional comparisons of the four SSS products
- Remarkable consistency of the four products at the seasonal time scale with respect to the climatologies and their variability.
- Based on biases and RMSE as a function of distance from the coast, the JPL SMAP, REMSS 40km, and SMOS products compared well:
  - Saltier biases were found at distances less than 100km from the coast
  - SMOS bias larger at distances less than 100km from the coast
  - JPL SMAP and SMOS have similar RMSE at distances less than 50km
  - REMSS 40km SMAP has a lower RMSE at distances less than 50km (fewer in-situ co-locations -> more aggressive land mask?)
- The three products also exhibit a similar signal to noise ratio which peaks at 150km from shore
- All four products exhibit decreasing bias and RMSE in going from the 8-day running mean to the seasonal time scale. Results are consistent in showing (for buoys further from shore) RMSE of less than 0.2 PSS. 0.2 PSS is comparable to accuracies of Aquarius at the global/monthly time scales.
- The increased interest by users in coastal applications indicates a need to improve the accuracy of the products at distances < 100km from the coast