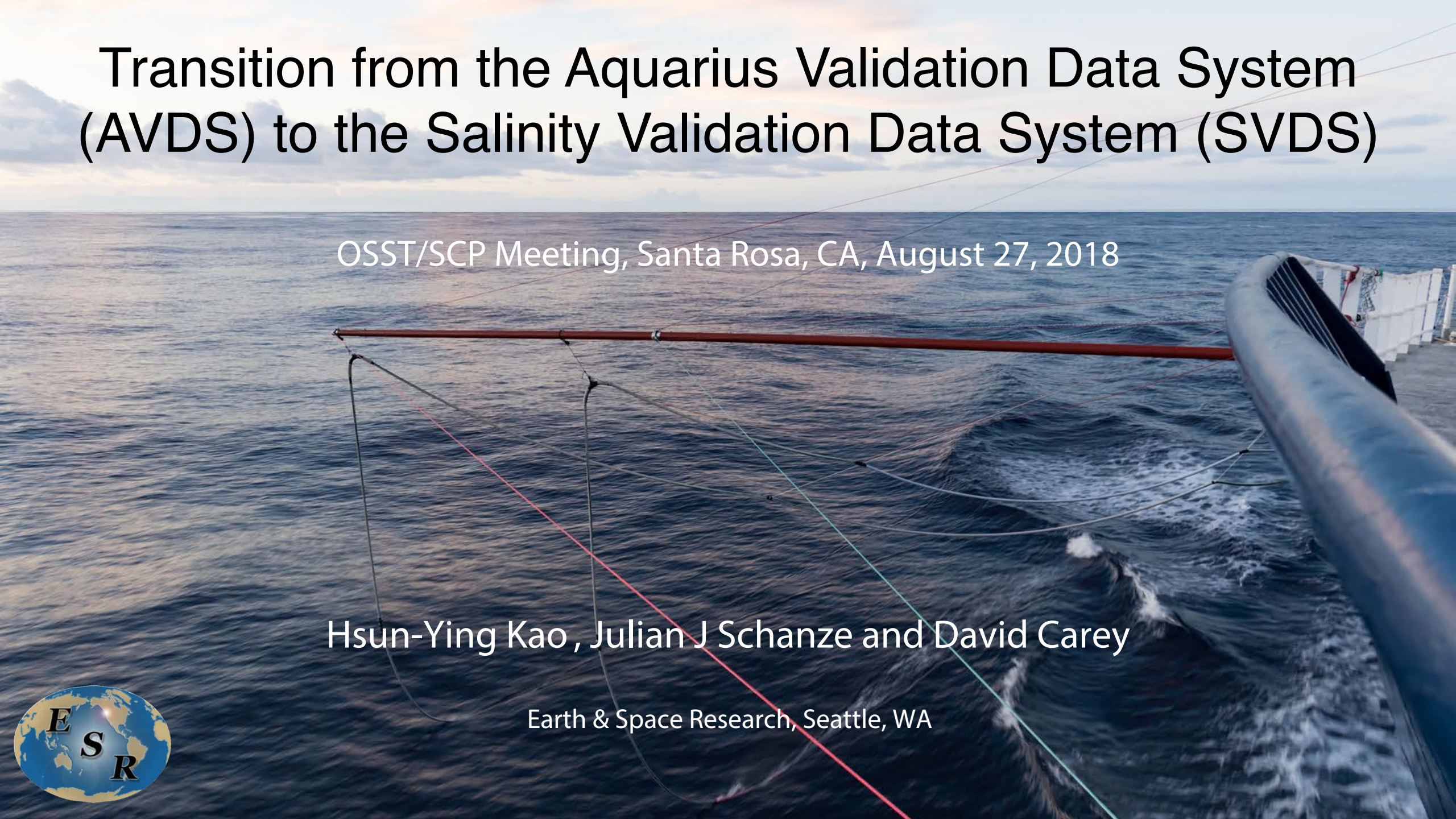
Transition from the Aquarius Validation Data System (AVDS) to the Salinity Validation Data System (SVDS)

OSST/SCP Meeting, Santa Rosa, CA, August 27, 2018



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Earth & Space Research, Seattle, WA

Goals of the Validation System

- To validate satellite salinity data (Aquarius/SMAP) in level-2 and level-3 with individual *in situ* observation (Argo and others)
- Provide a cal-val tool to quickly assess changes between (experimental) product versions

Methodology

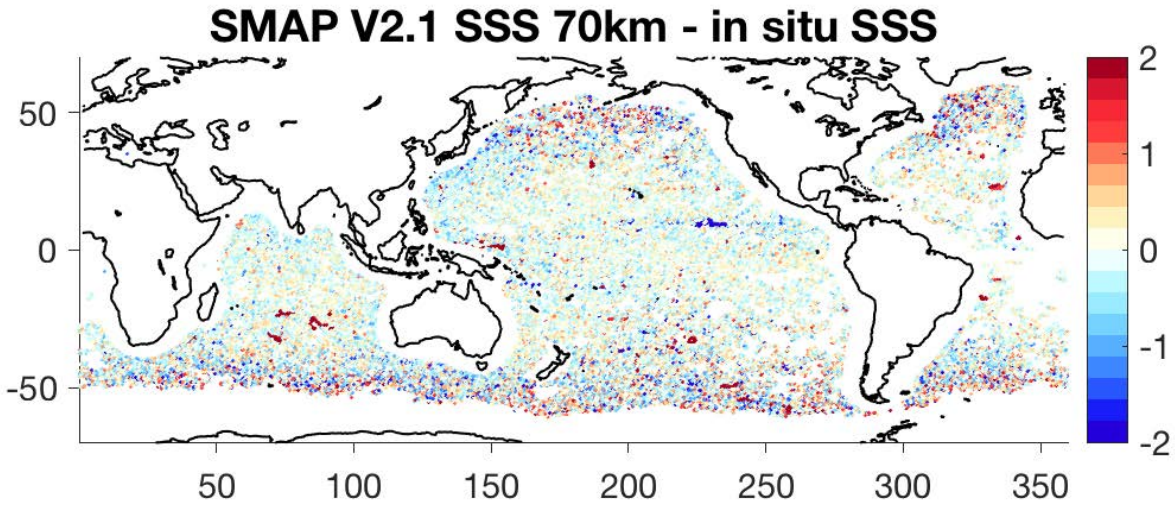
- The AVDS/SVDS matching process is "*in situ* centric". For each Argo observation, we find the closest satellite observation for match-up.
- For the match-up pairing, a 'smoothed' satellite SSS field is created
  - Aquarius: The "closest point of approach" (CPA) is found and we average forward and backward for five (5) along-track salinity measurements, yielding an averaged value of 11 measurements centered on any individual salinity measurement.
  - SMAP: The unweighted mean of measured values within the search radius (currently 30 km) is used

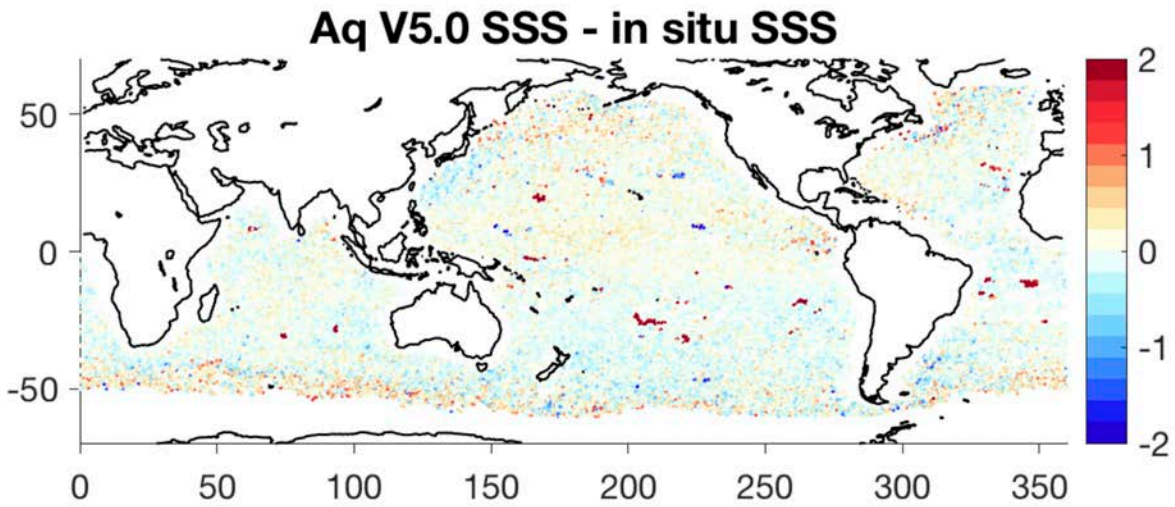
Match-Up Criteria

- Distance between satellite and in situ observations ≤ 75 km for Aquarius and ≤ 50/30 km for SMAP
- Within +/- 3.5 days from the nominal date of the *in situ* observations
- Default criteria used for standard validation analysis:
  - HH wind speed <= 15 m/s
  - Calculated radiometer land and ice fractions ≤ 0.001
  - SST > 5 °C
- Users can choose to ignore any of these criteria to check data quality in the high winds, low temperature and coastal areas

Global Maps of SSS Differences

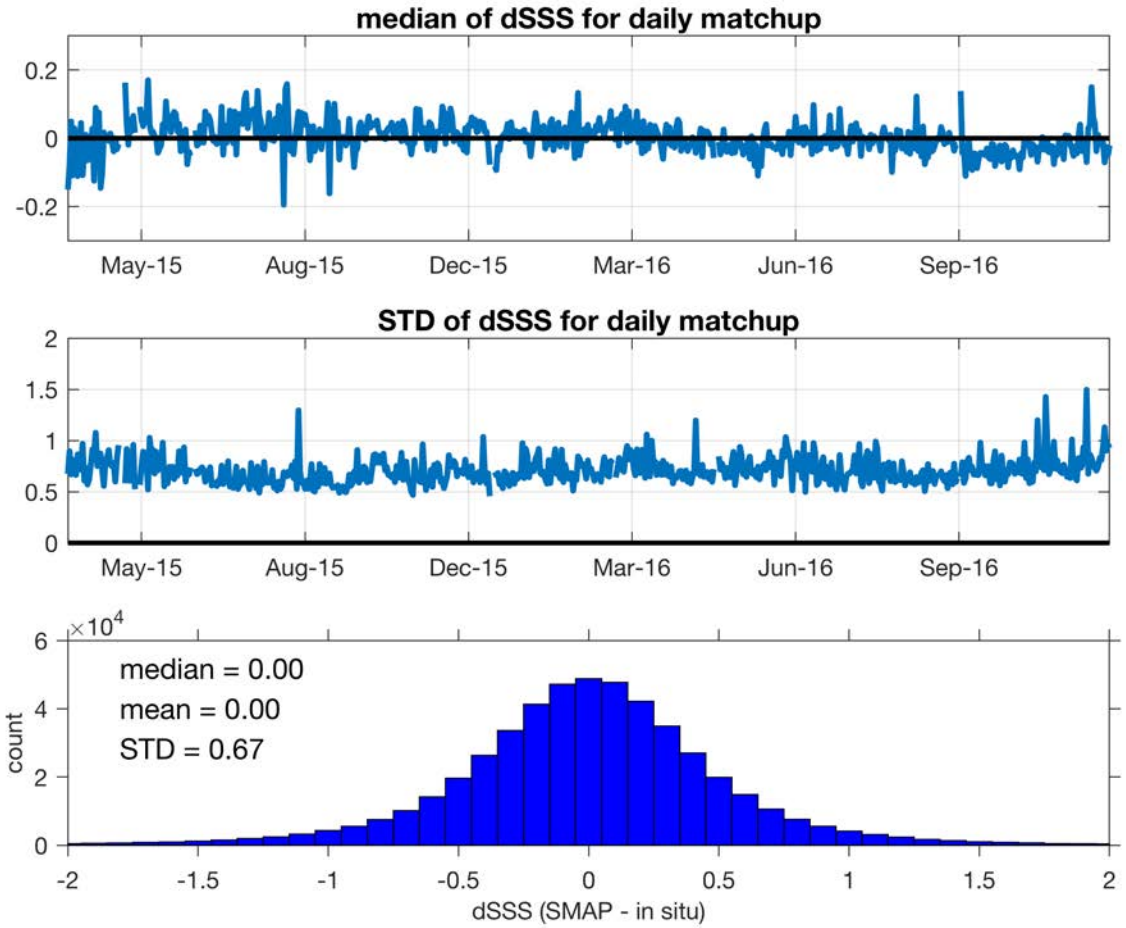
- Satellite data minus co-located *in situ* observations



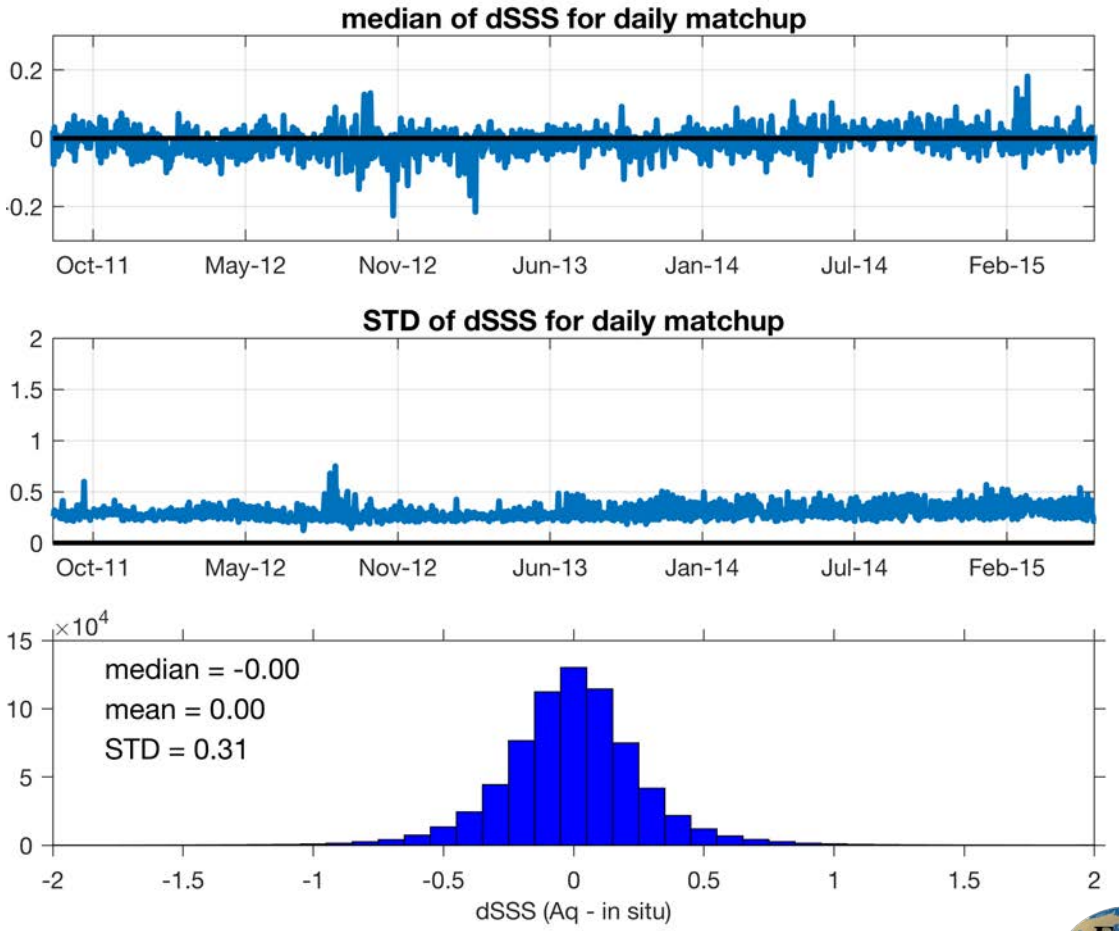


Daily Co-Located Match-Ups

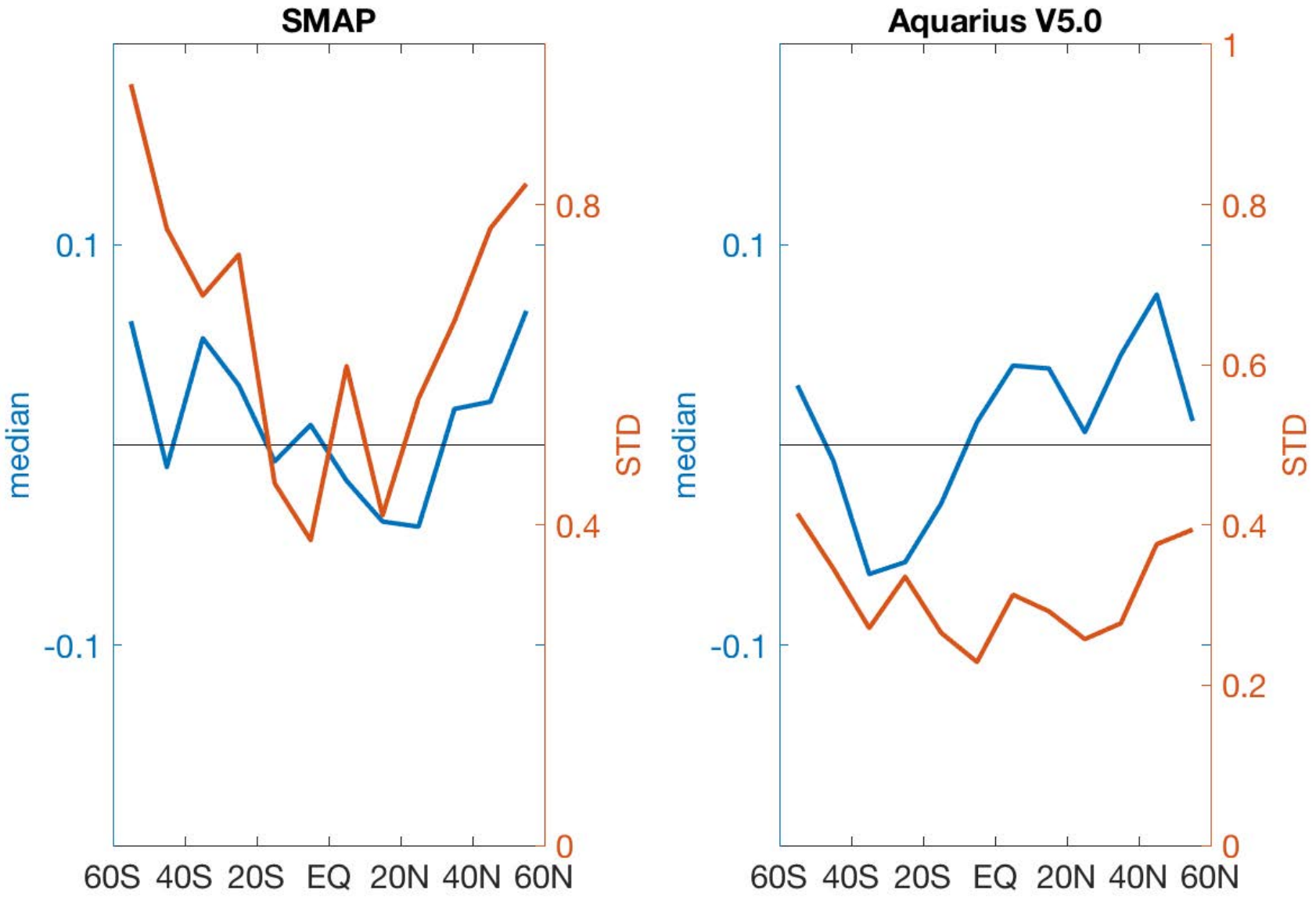
SMAP



Aquarius

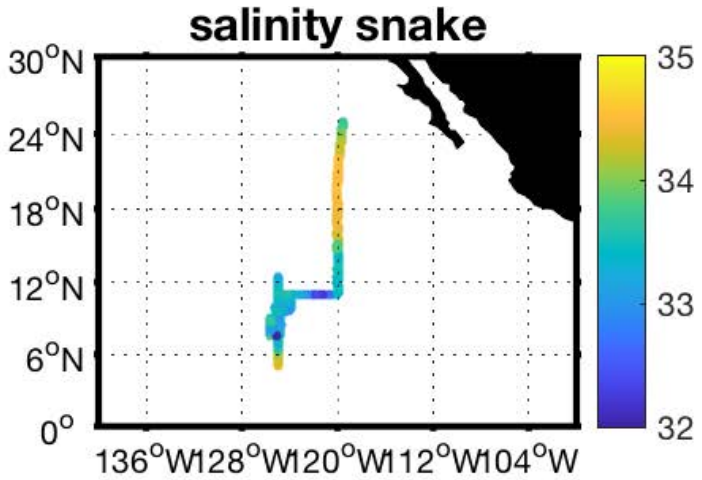


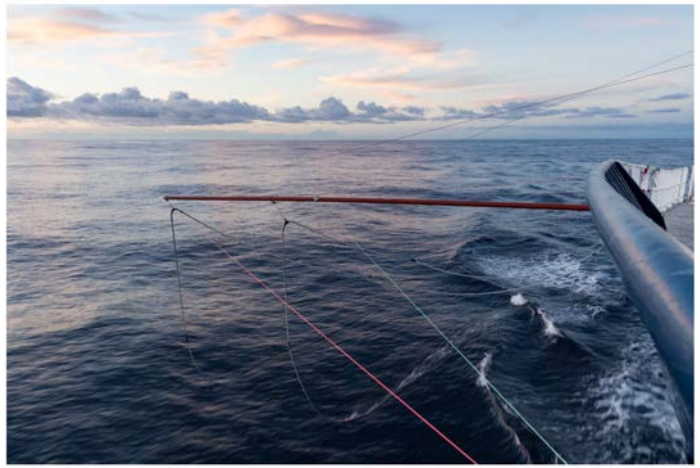
Co-Located *in situ* differences by latitude bands

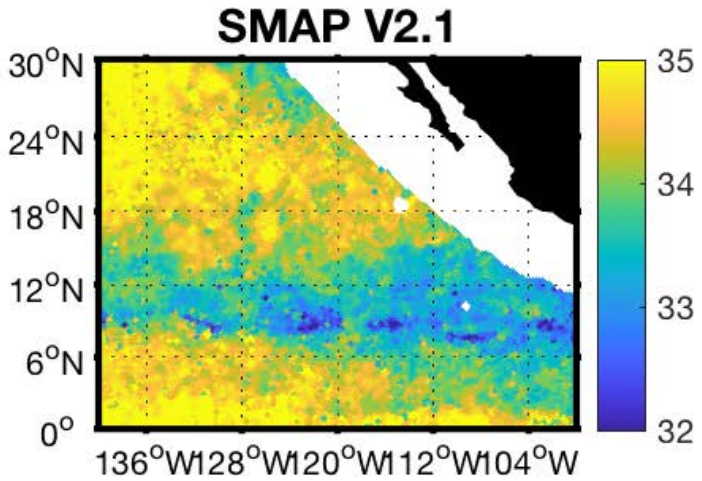


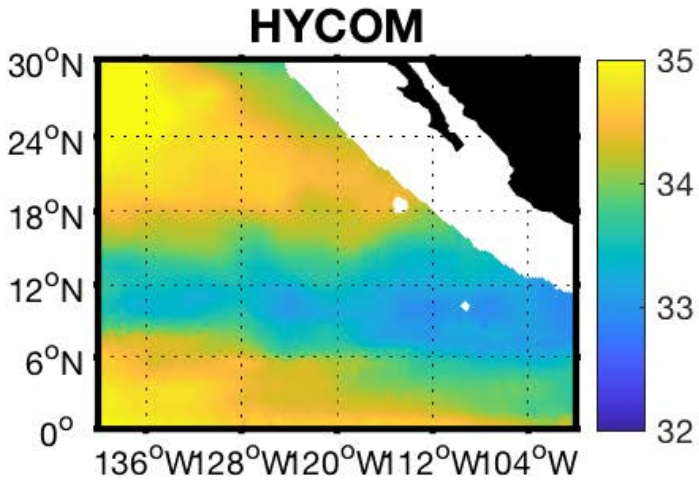
- High standard deviations at extratropical latitudes in SMAP
- Relatively low biases for both, but different pattern

SVDS and SPURS-2 Salinity Snake (RR1720)



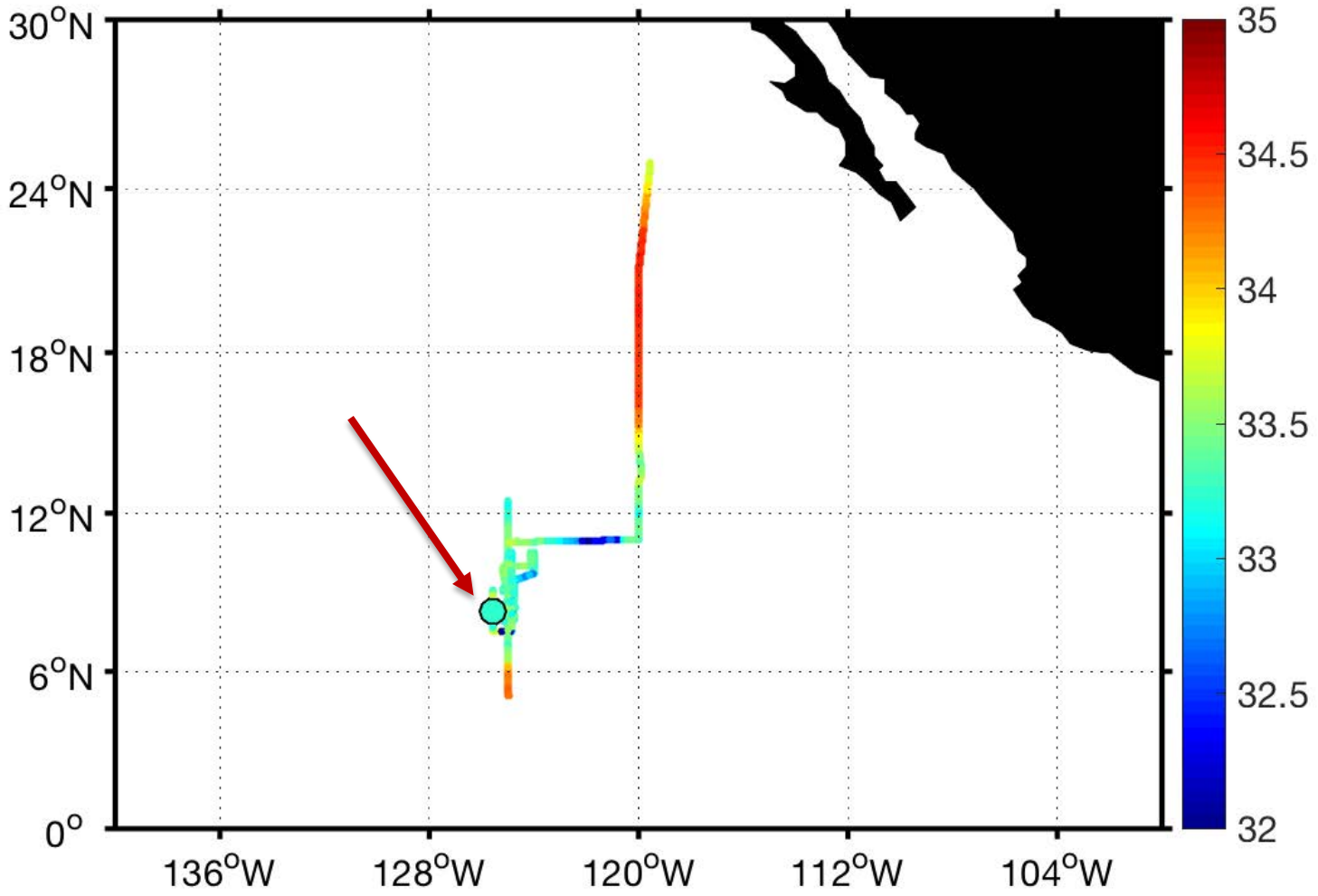






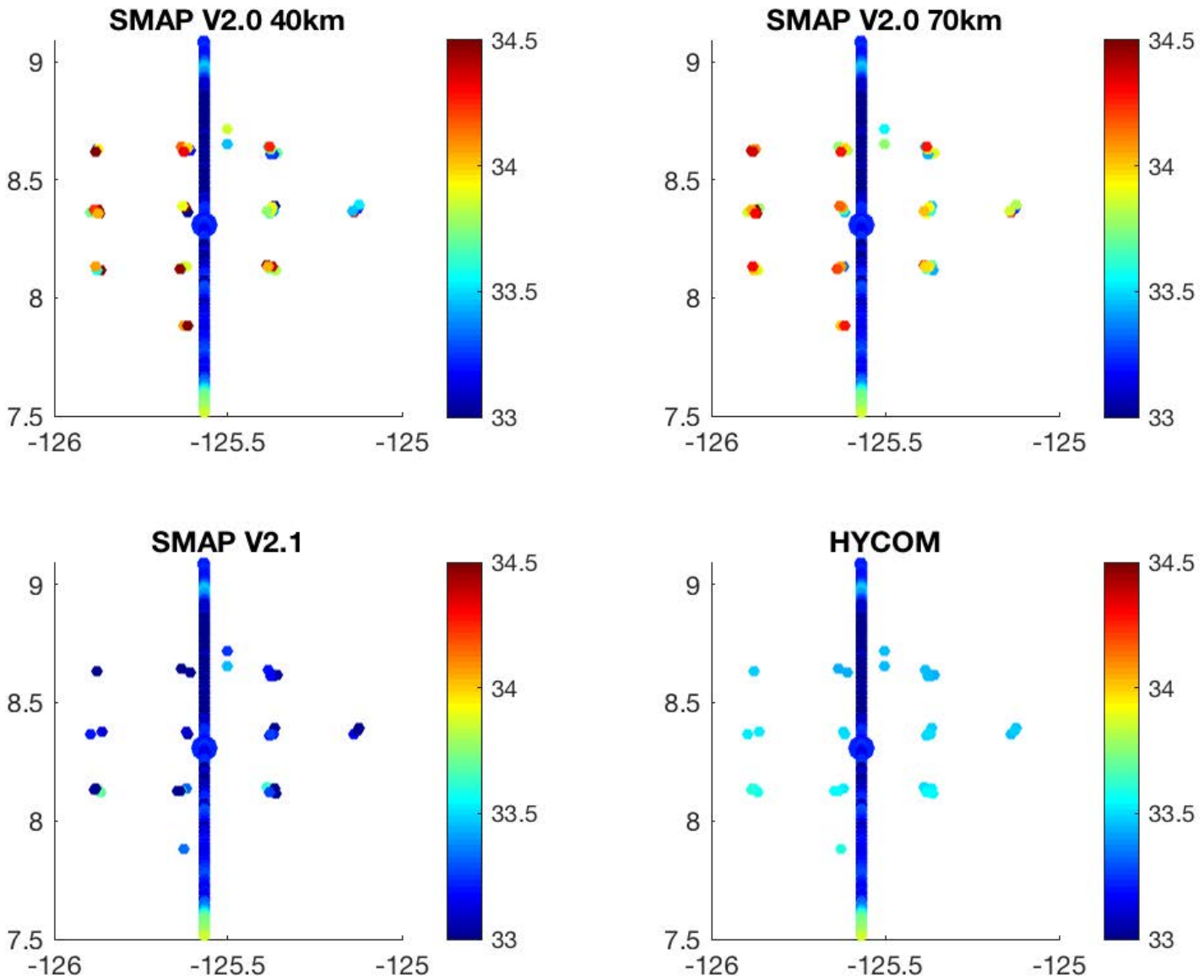
- Very-near surface salinity, essentially as observed by satellites
- High resolution can elucidate sub-footprint spatial variations

SVDS and SPURS-2 Salinity Snake (RR1720)



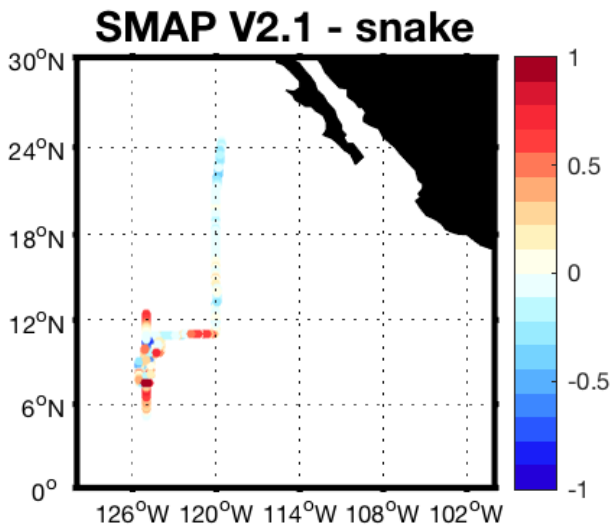
- Snake SSS observations
- SPURS-2 area centered on 125W, 10N

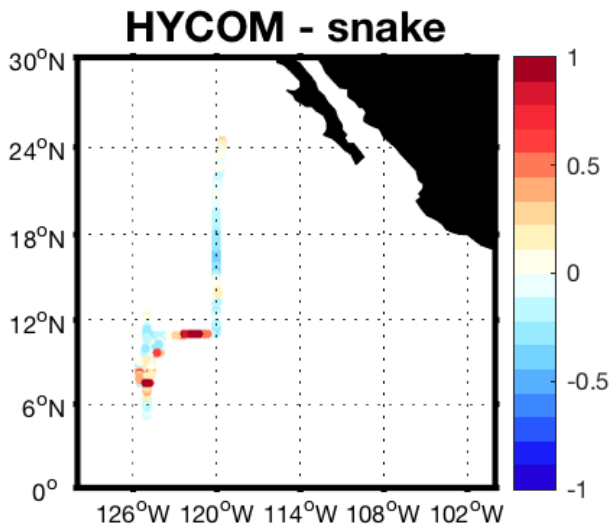
SVDS and SPURS-2 Salinity Snake (RR1720)

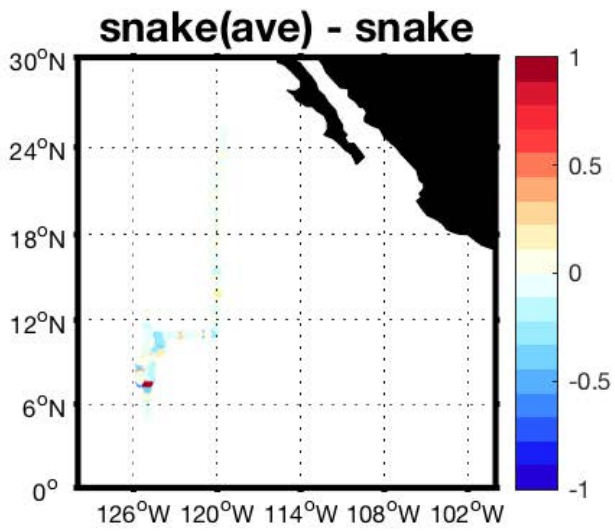


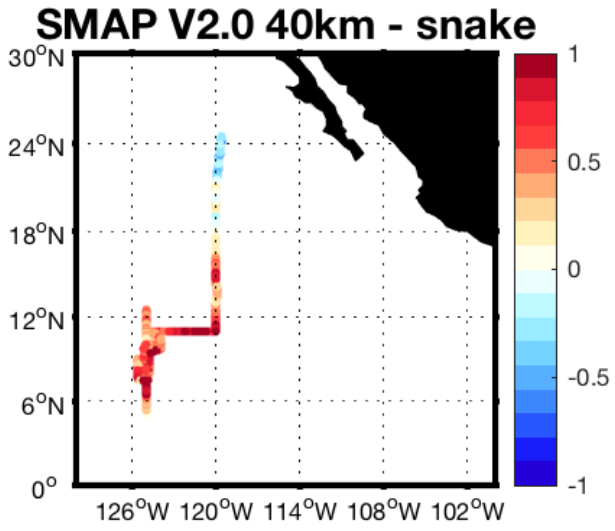
- Comparison of SMAP V2.0 (40/70km), SMAP V2.1, and HYCOM with salinity snake *in situ* data
- For each Salinity Snake measurement, we match the average SMAP observations within a radius of 50 km and within ± 3 days

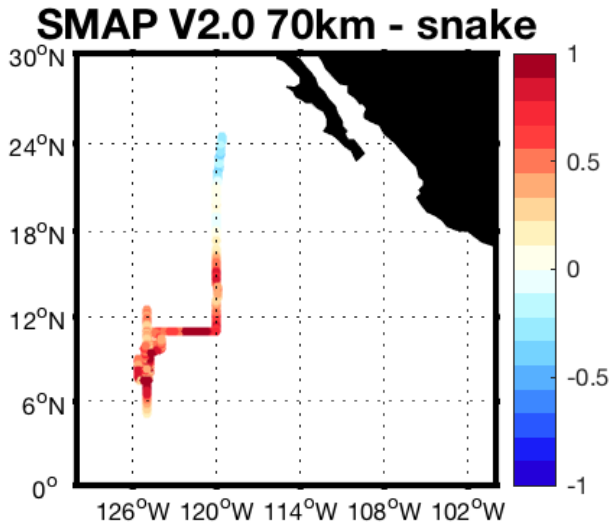
SVDS and SPURS-2 Salinity Snake (RR1720)

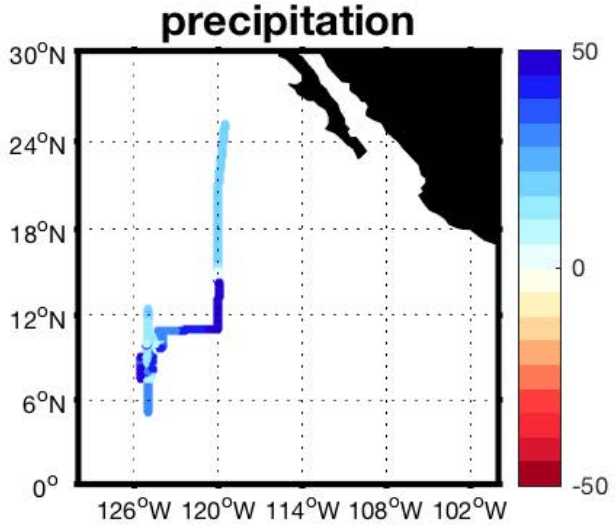






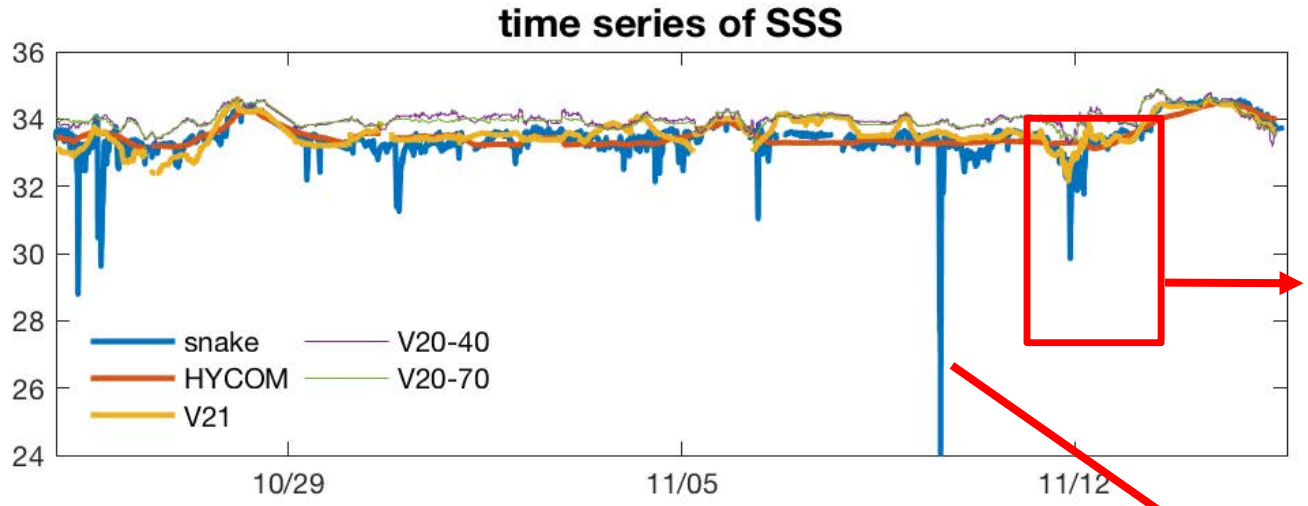




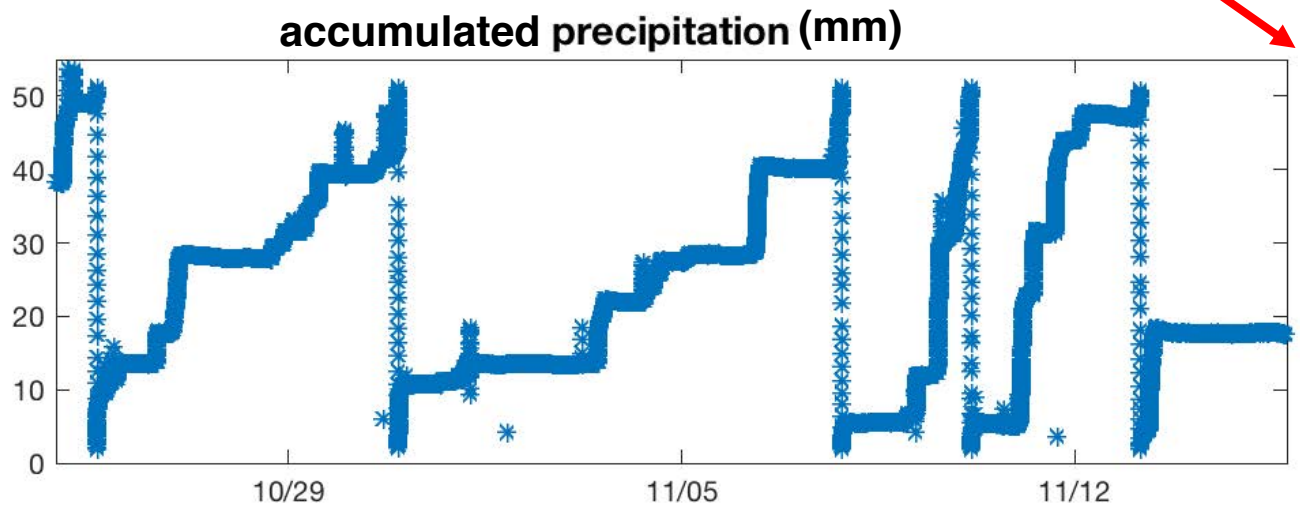


- Differences between salinity snake data and 50km averages
- Higher spatial variance in ITCZ
- Precipitation effects

SVDS and SPURS-2 Salinity Snake (RR1720)

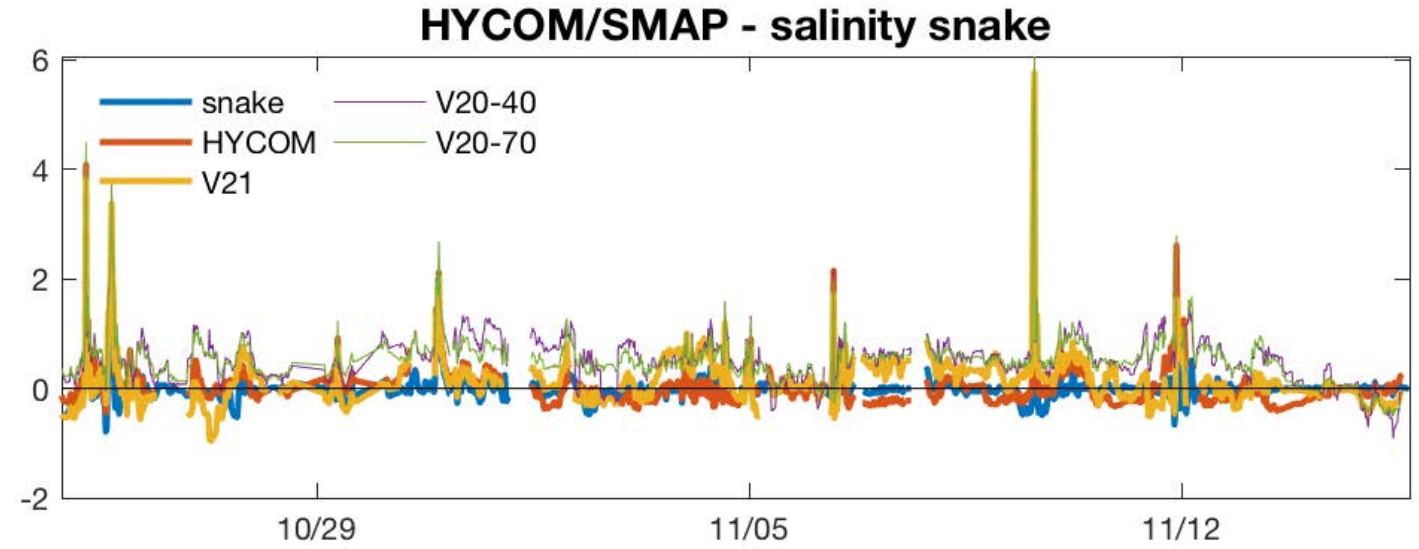


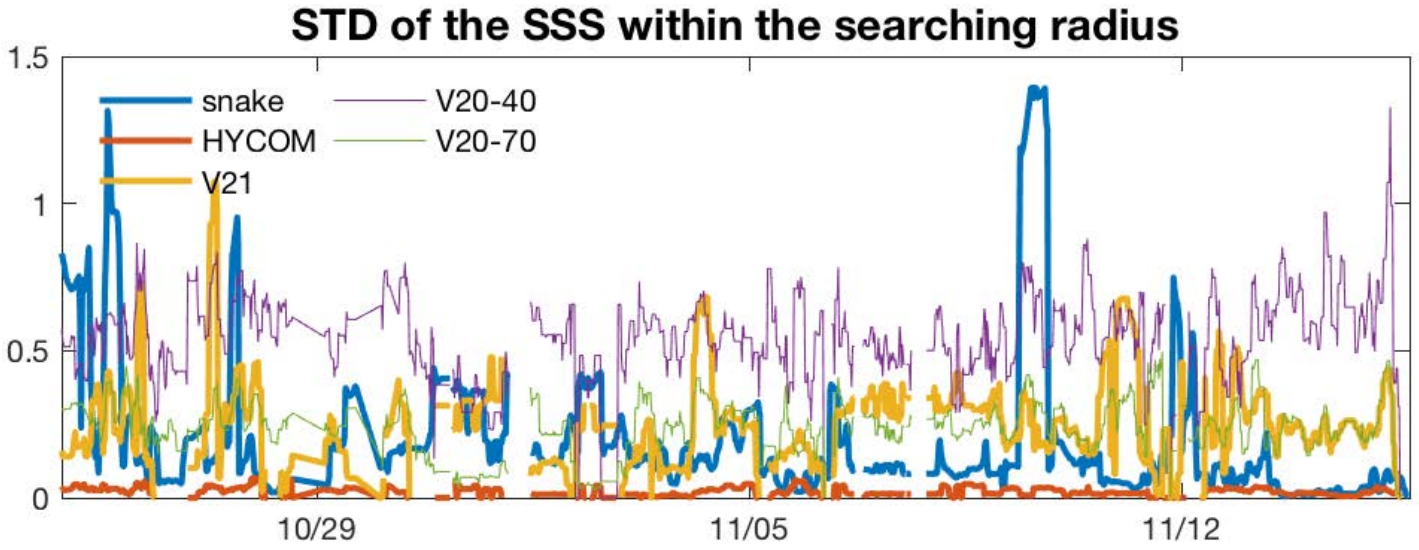
Regional freshening captured by SMAP but not HYCOM



Salinity Snake captures instant small-scale freshening due to strong precipitation which is not observed by either SMAP or HYCOM.

ΔSSS (Snake-Satellite) and STD in 50km search radius





- Top panel: difference of SMAP/HYCOM and salinity snake
- Bottom panel: Standard deviation within 50km search radius
- HYCOM is heavily oversmoothed, small-scale variability is underestimated

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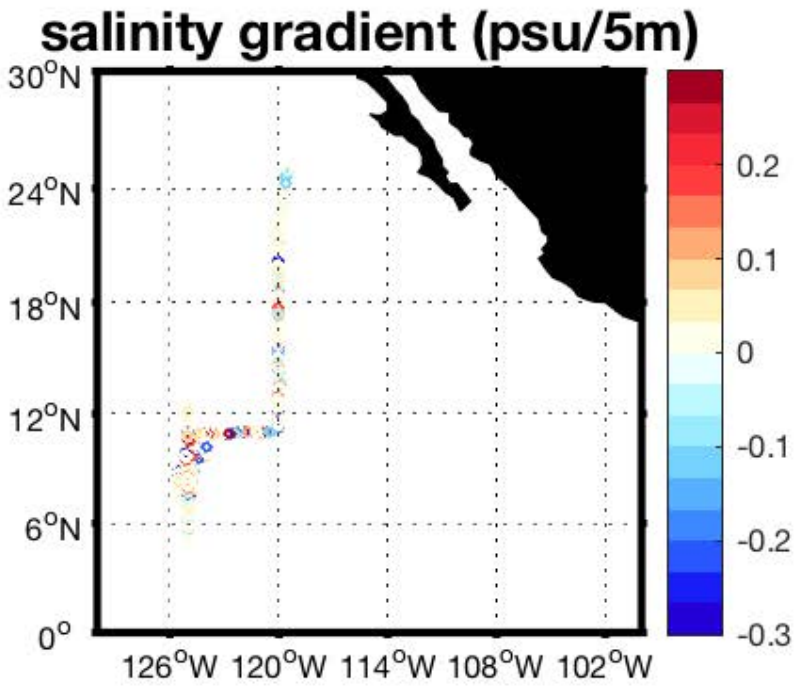
Conclusions

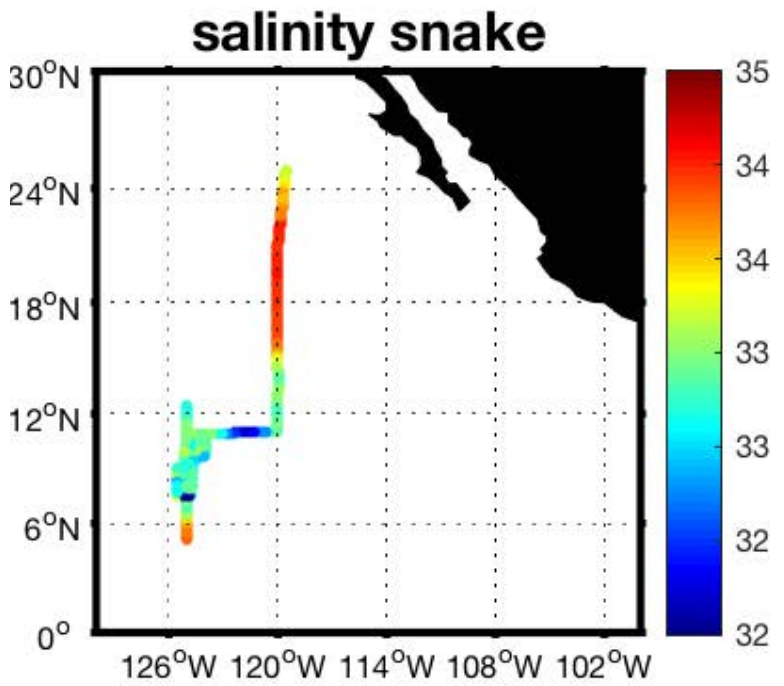
- The website for SVDS is still in progress and is expected to be completed by the end of the year.
- Scripts for SMAP validation with individual Argo floats are ready, so the validation analysis can be done quickly with each new version release.
- Salinity snake observations show sharp salinity gradients associated with freshwater lenses, but these gradients are not generally captured by SMAP due to limited spatial resolution.
- The spatial variations are too small in HYCOM compared with salinity snake observations and SMAP, showing that HYCOM salinity maps are oversmoothed.

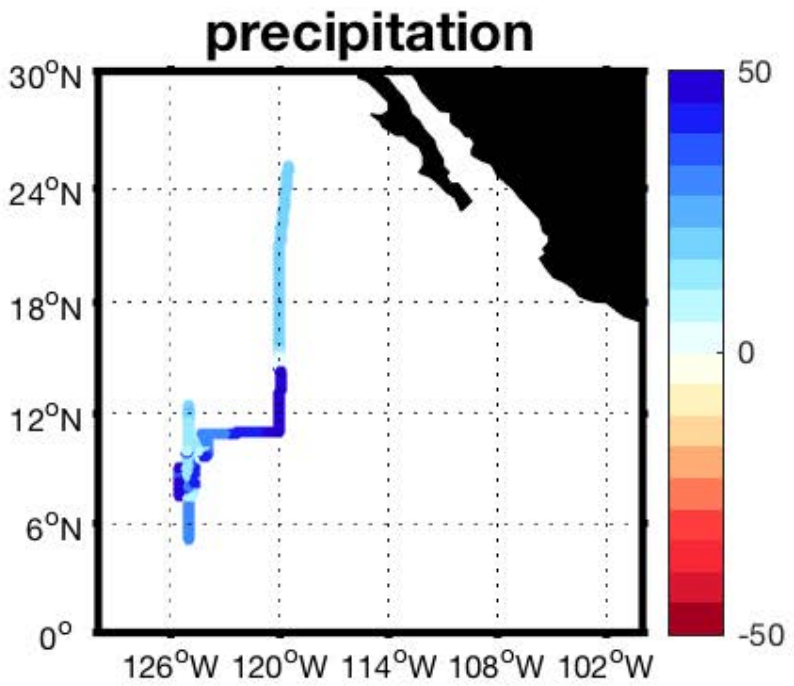

Thank You!
Questions?

Additional Slides

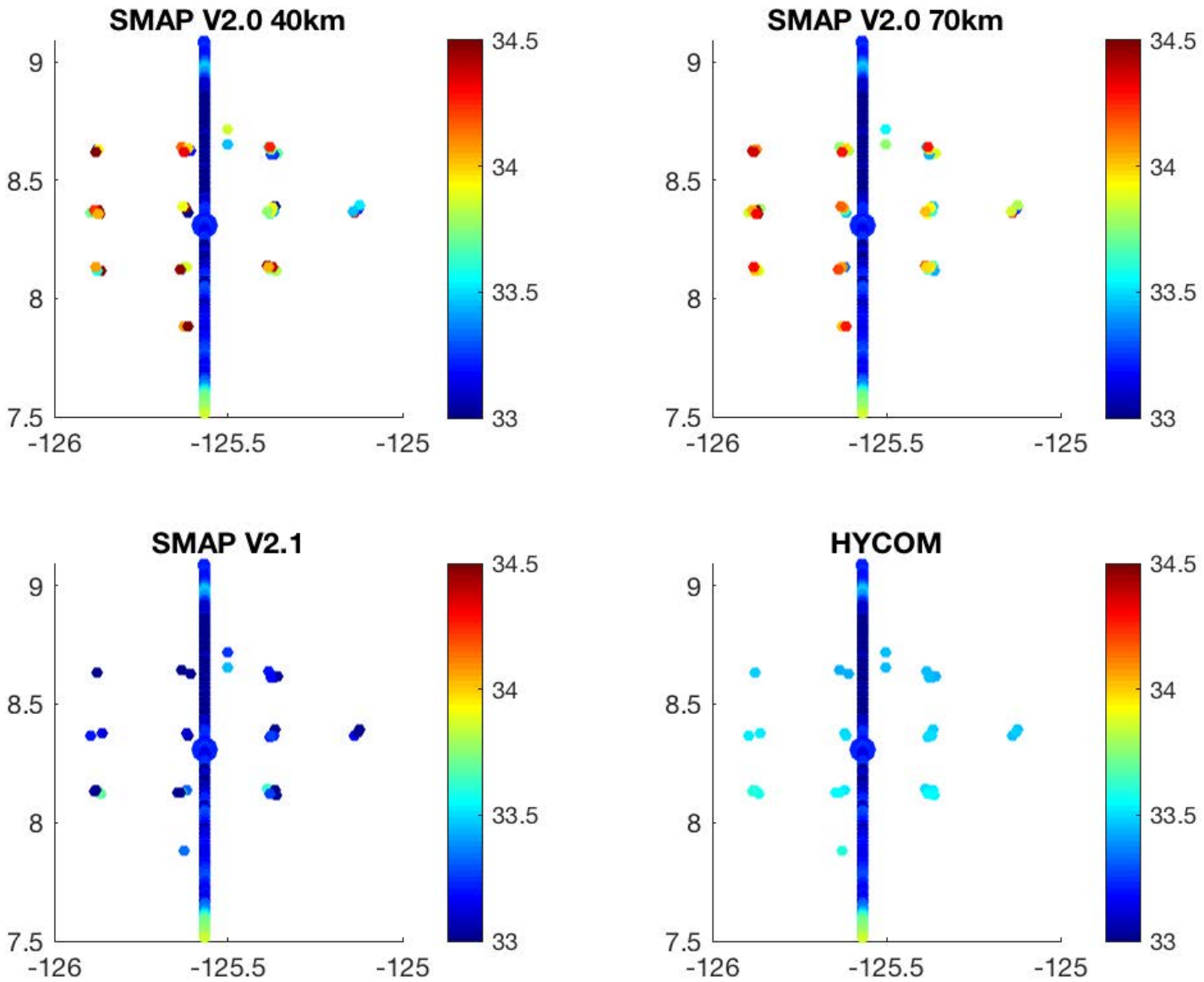
B


salinity gradient (psu/5m)
30°N
24°N
18°N
12°N
6°N
0°
126°W 120°W 114°W 108°W 102°W
0.2
0.1
0
-0.1
-0.2
-0.3


salinity snake
30°N
24°N
18°N
12°N
6°N
0°
126°W 120°W 114°W 108°W 102°W
35
34
34
33
33
32
32


precipitation
30°N
24°N
18°N
12°N
6°N
0°
126°W 120°W 114°W 108°W 102°W
50
0
-50

B SVDS and SPURS-2 Salinity Snake (RR1720)



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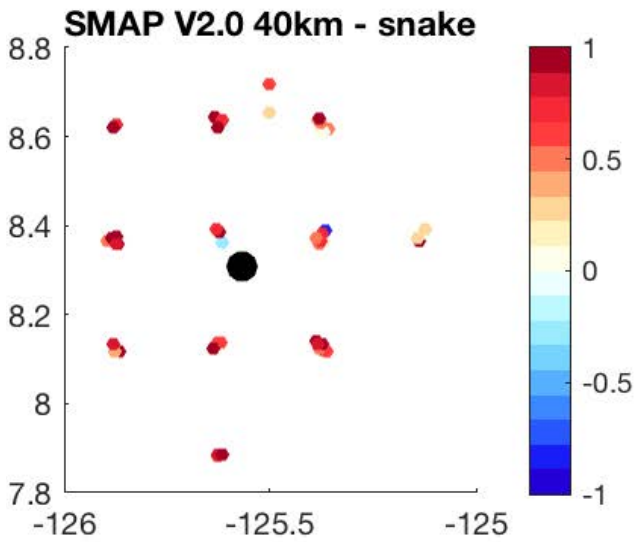

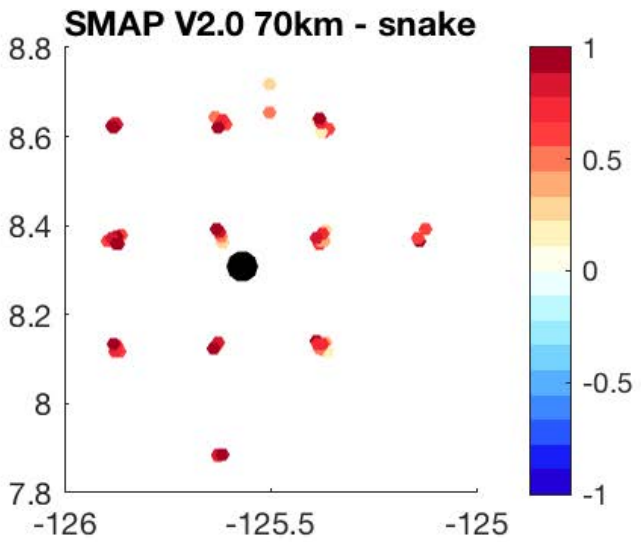

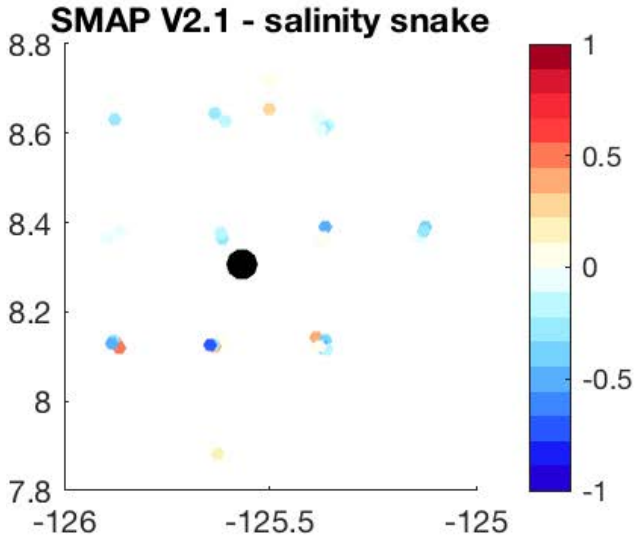

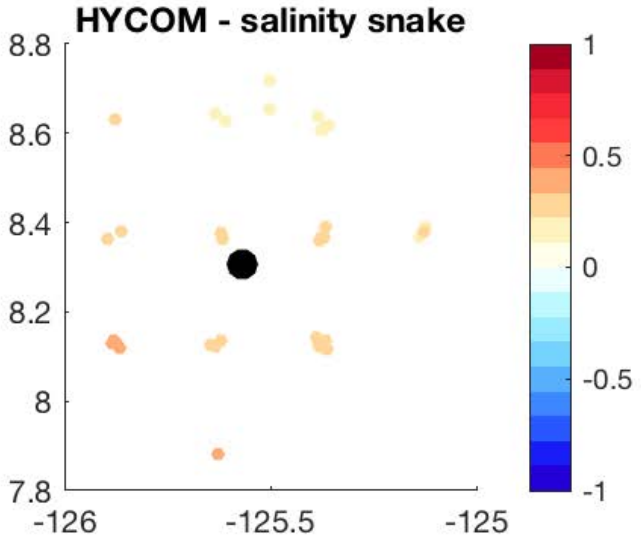

- Differences between SMAP 2.0 (40km/70km), SMAP2.1, HYCOM, and salinity snake measurements
- Biases significantly lower in SMAP V2.1

H Salinity Gradients in Salinity Snake Data

- Salinity gradients are calculated to analyze the spatial variability of salinity
- Most of the salinity gradients are smaller than 0.2psu/5m and strong freshening occurs over very small regions