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
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 $\leq 75$ km for Aquarius and $\leq 50/30$ 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 $\leq 15$ m/s
  - Calculated radiometer land and ice fractions $\leq 0.001$
  - 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

median of dSSS for daily matchup

STD of dSSS for daily matchup

median of dSSS for daily matchup

STD of dSSS for daily matchup

\[
\text{median} = 0.00 \\
\text{mean} = 0.00 \\
\text{STD} = 0.67
\]

\[
\text{median} = -0.00 \\
\text{mean} = 0.00 \\
\text{STD} = 0.31
\]
Co-Located *in situ* differences by latitude bands:

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

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
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.
Differences between salinity snake data and 50km averages

Higher spatial variance in ITCZ

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

Regional freshening captured by SMAP but not 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
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
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.
Differences between SMAP 2.0 (40km/70km), SMAP2.1, HYCOM, and salinity snake measurements

Biases significantly lower in SMAP V2.1
Salinity gradients are calculated to analyze the spatial variability of salinity.

- Most of the salinity gradients are smaller than 0.2 psu/5m and strong freshening occurs over very small regions.

![Histogram of absolute values of salinity gradients]