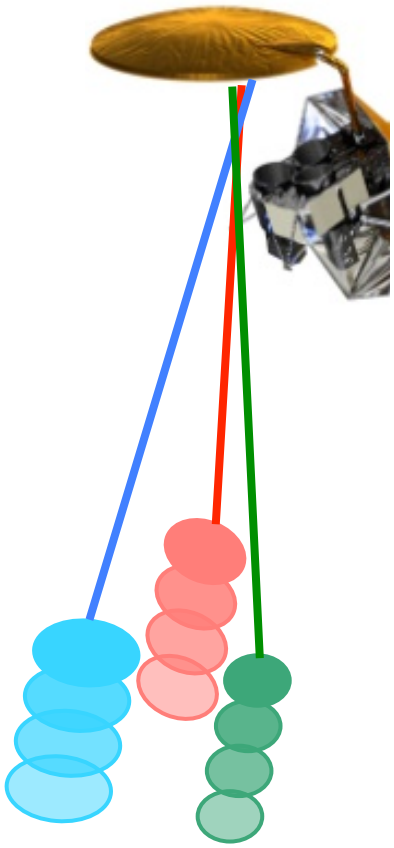
Upper Ocean Salinity Stratification: Challenges to validate satellite remotely sensed sea surface salinity

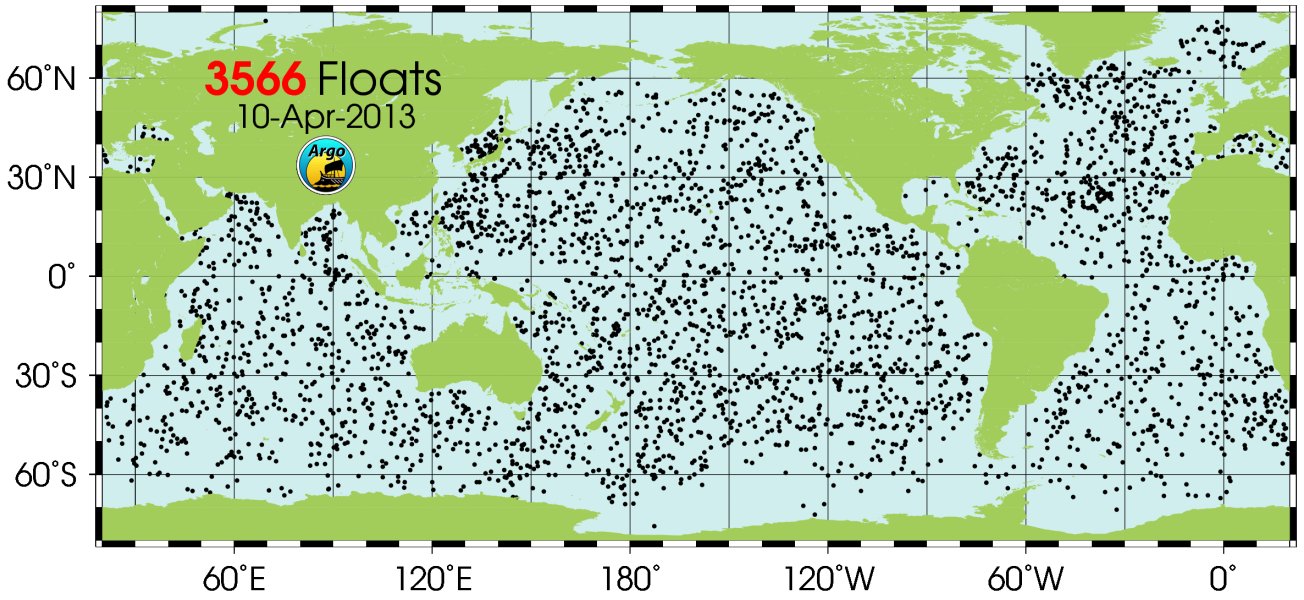
Yi Chao[1,2] and Carrie Zhang[2]
[1]Remote Sensing Solutions, Inc. (RSSI), Pasadena, CA
[2]University of California, Los Angeles, California

Thanks to Aquarius Project and SPURS Team

April 15-17, 2013

Aquarius data are validated against Argo floats

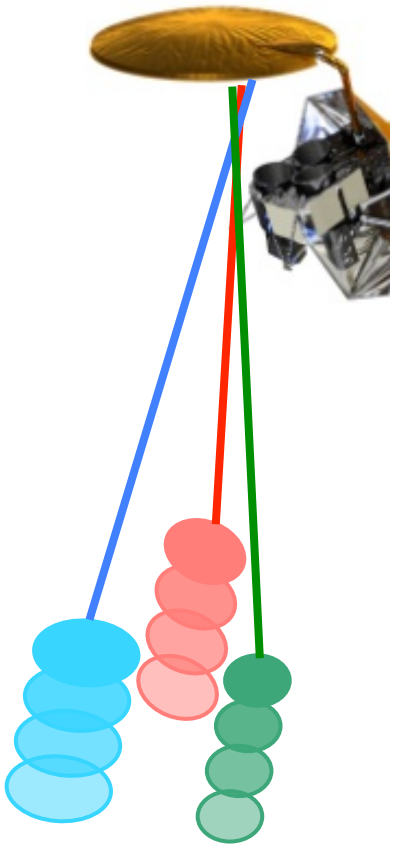




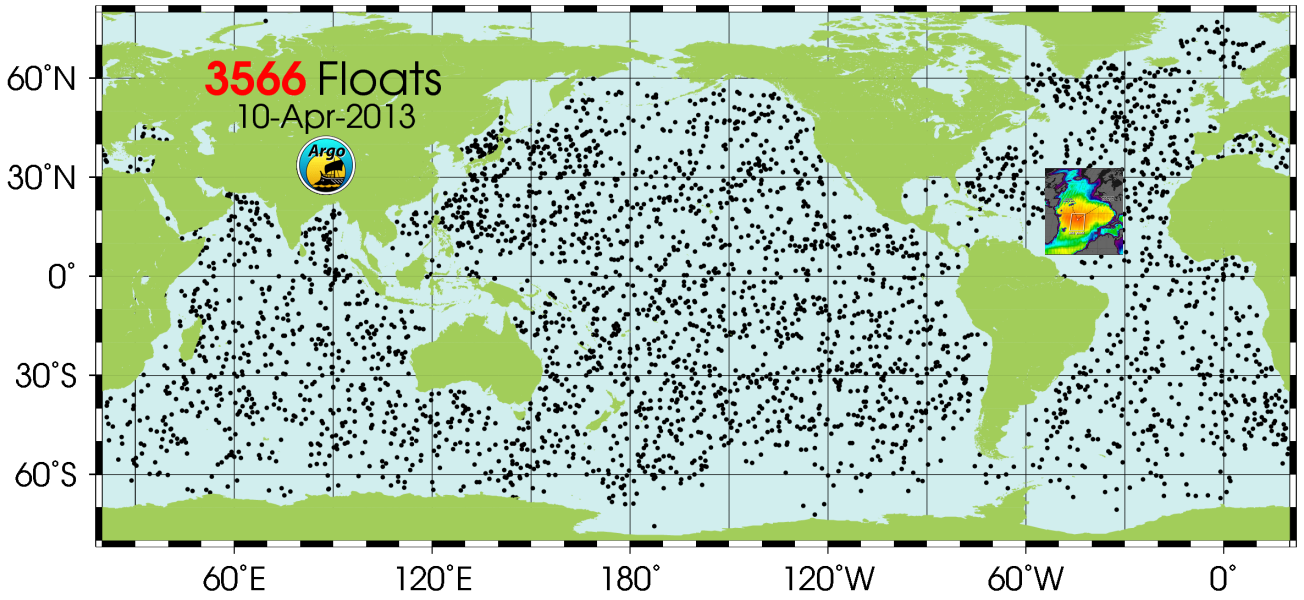
Mismatch between Aquarius and Argo measured salinity

Mismatch	Aquarius	Argo
Measurement Depth	~1 cm	~5 m
Spatial scale	50 – 150 km	Single point
Temporal scale	7-day repeat	10-day repeat

Aquarius data are validated against Argo floats



390 Km (242 Mi)



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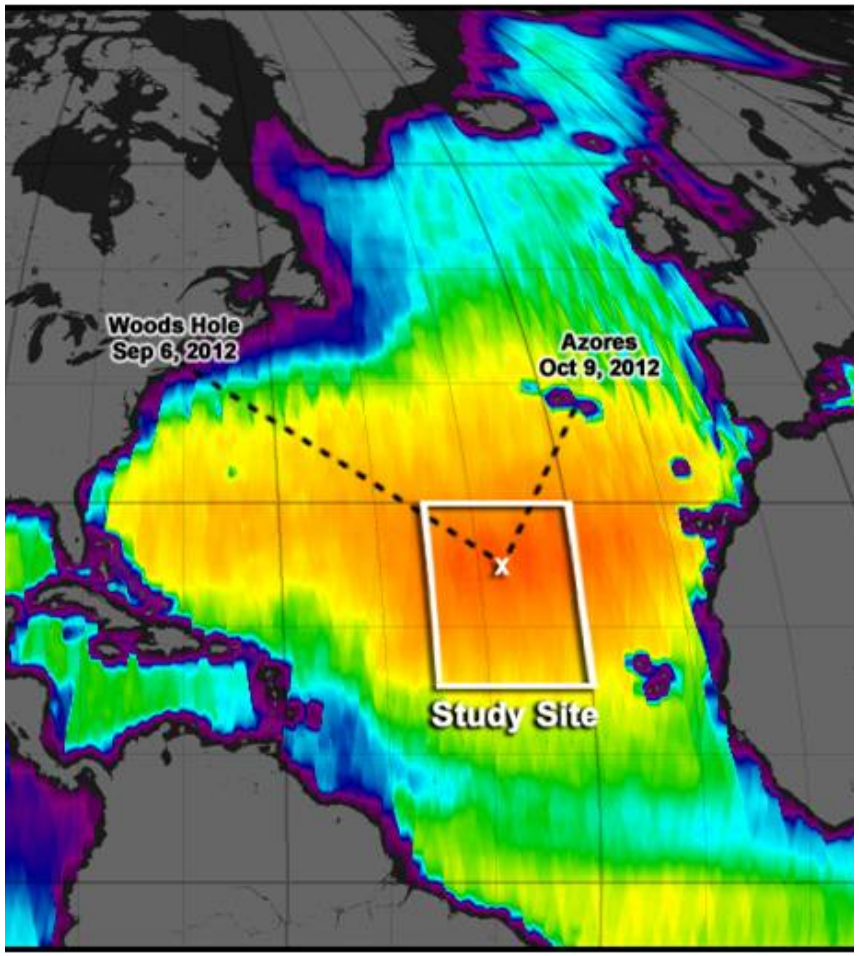
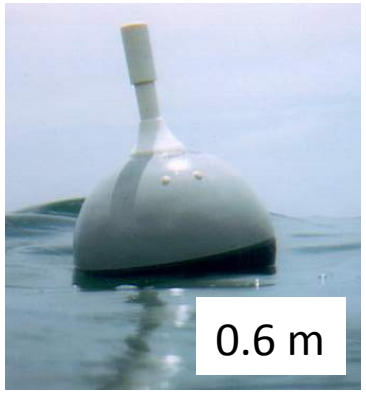
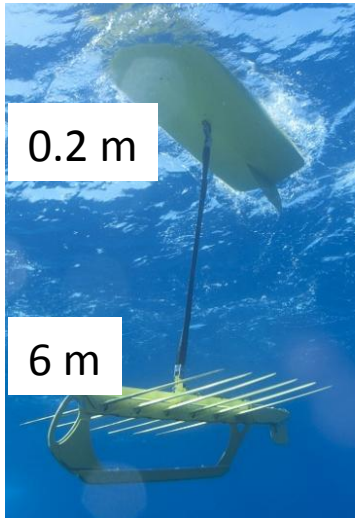
SPURS: Collect as many SSS data as possible over the Aquarius footprint as close to the surface as possible



5 cruises Sept. 2012 – Sept. 2013



Drifter



Wave Glider

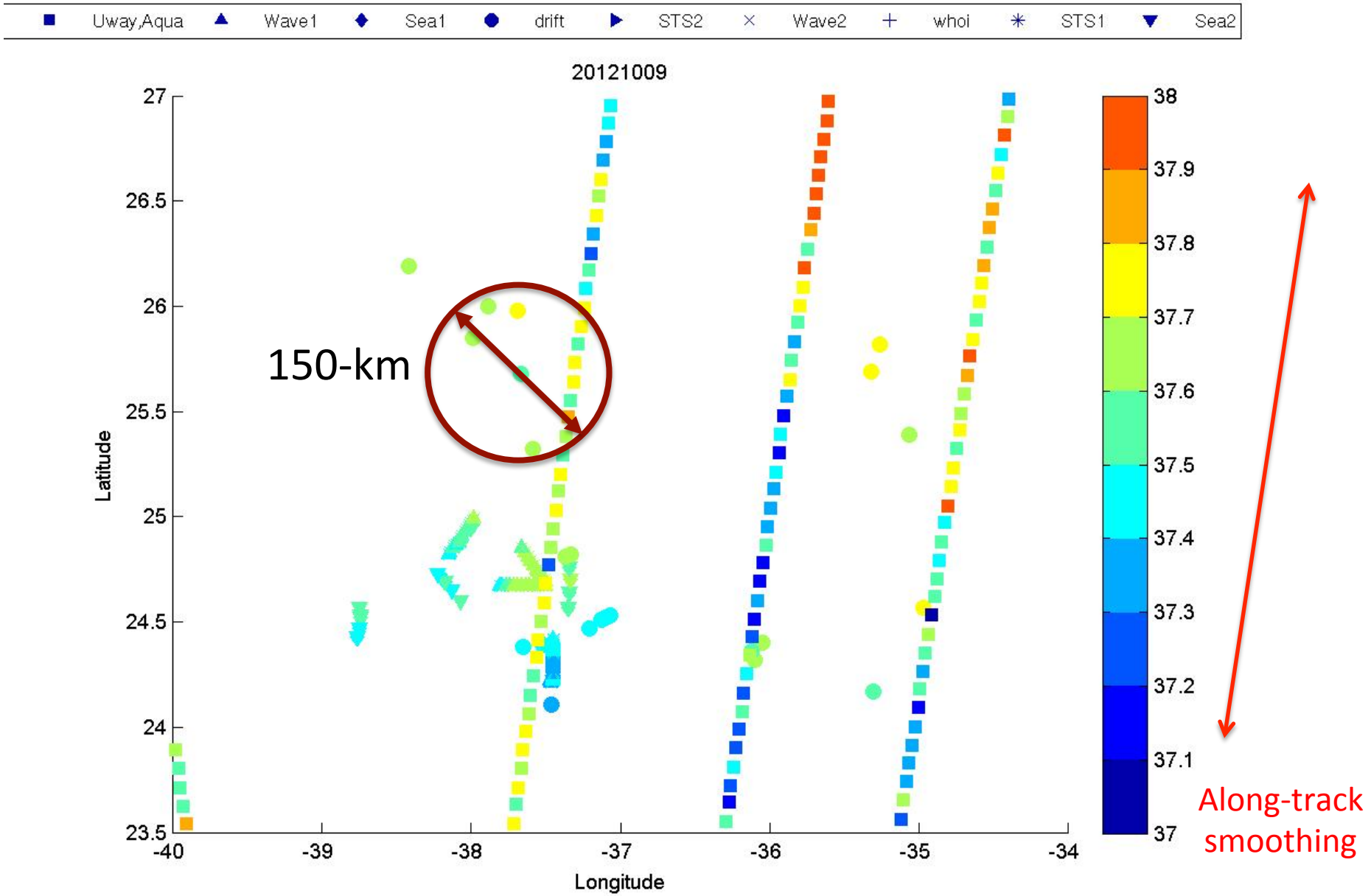
STS Argo Float

S(z)
Z=
0
cm
m
…

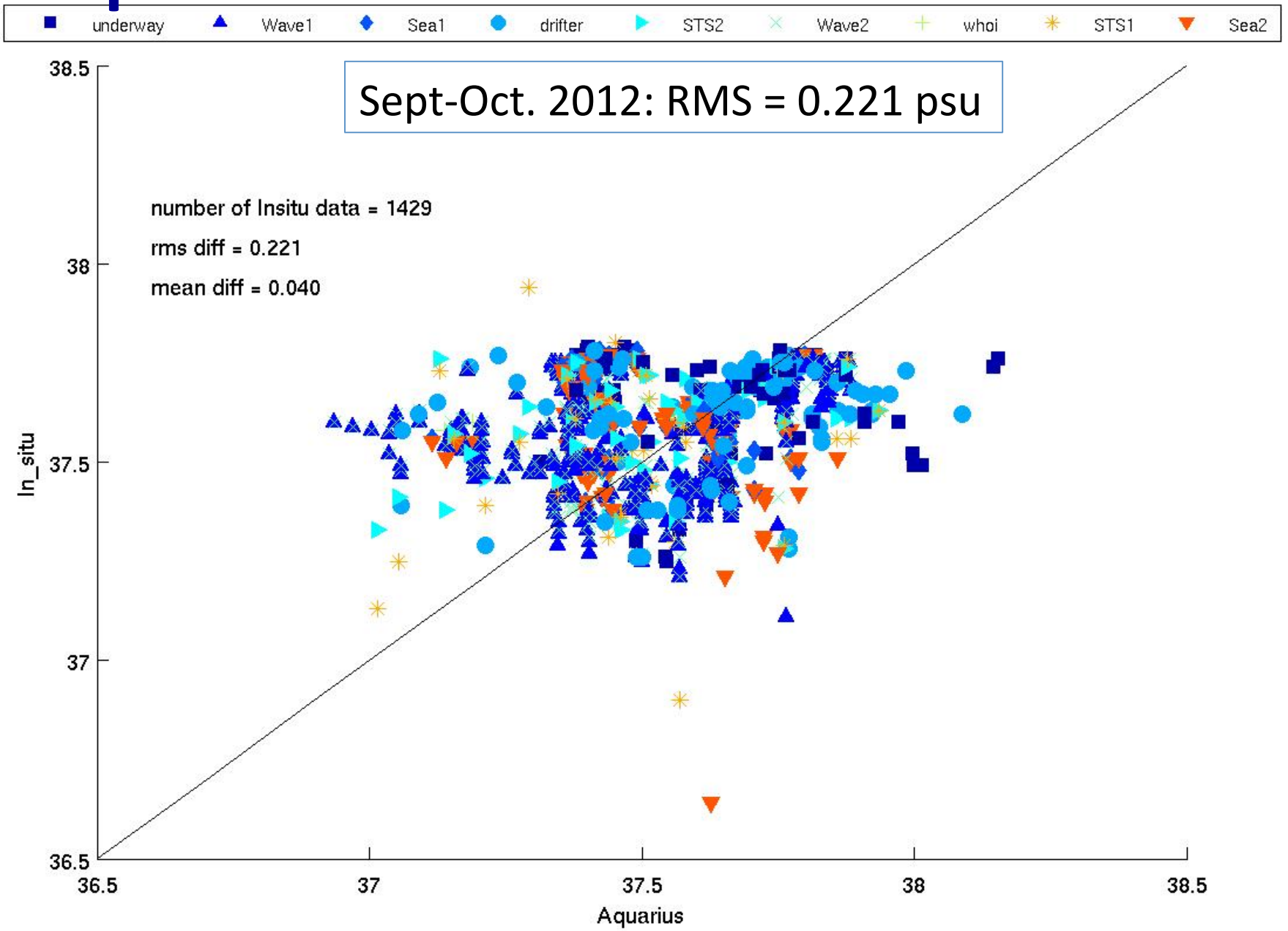
2000 m

Seaglider

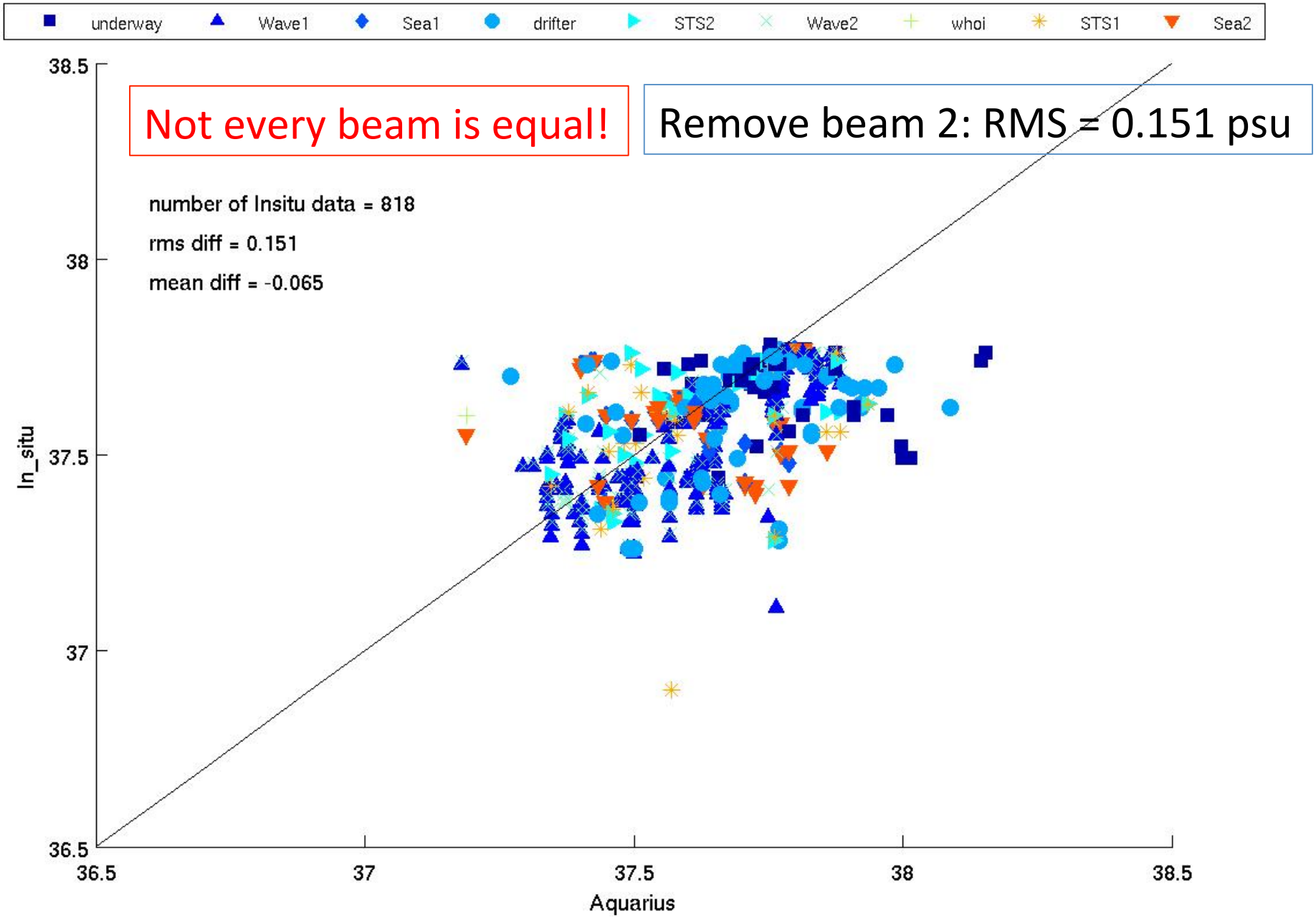
Daily Co-Located Data from Aquarius and SPURS



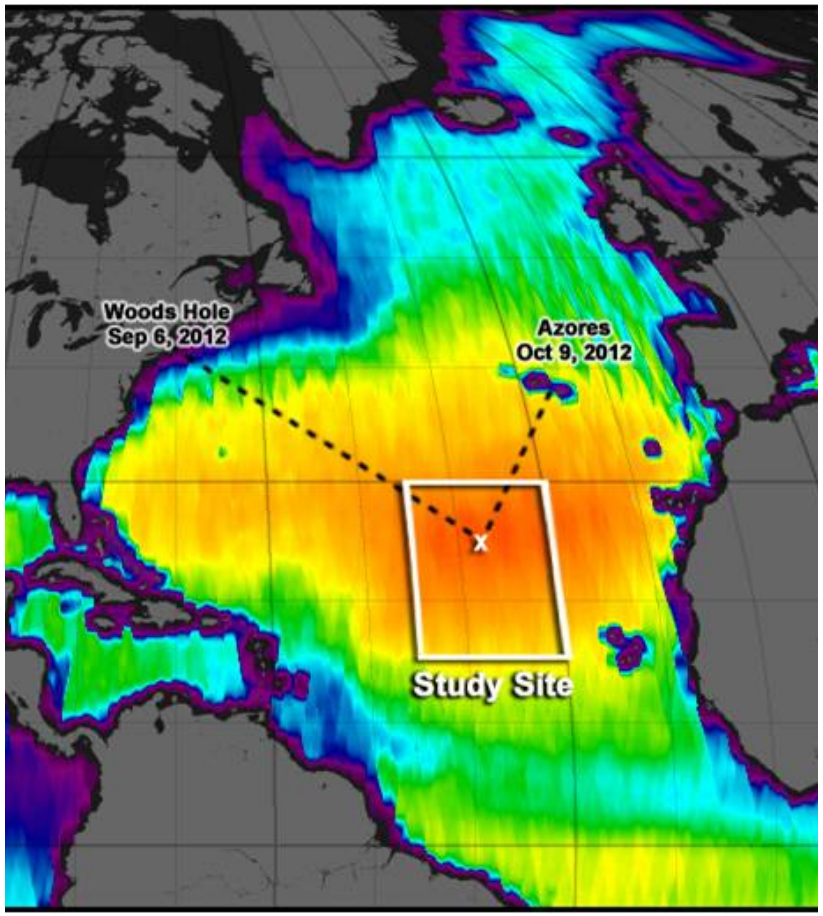
Aquarius V2.0 vs SPURS In Situ Data

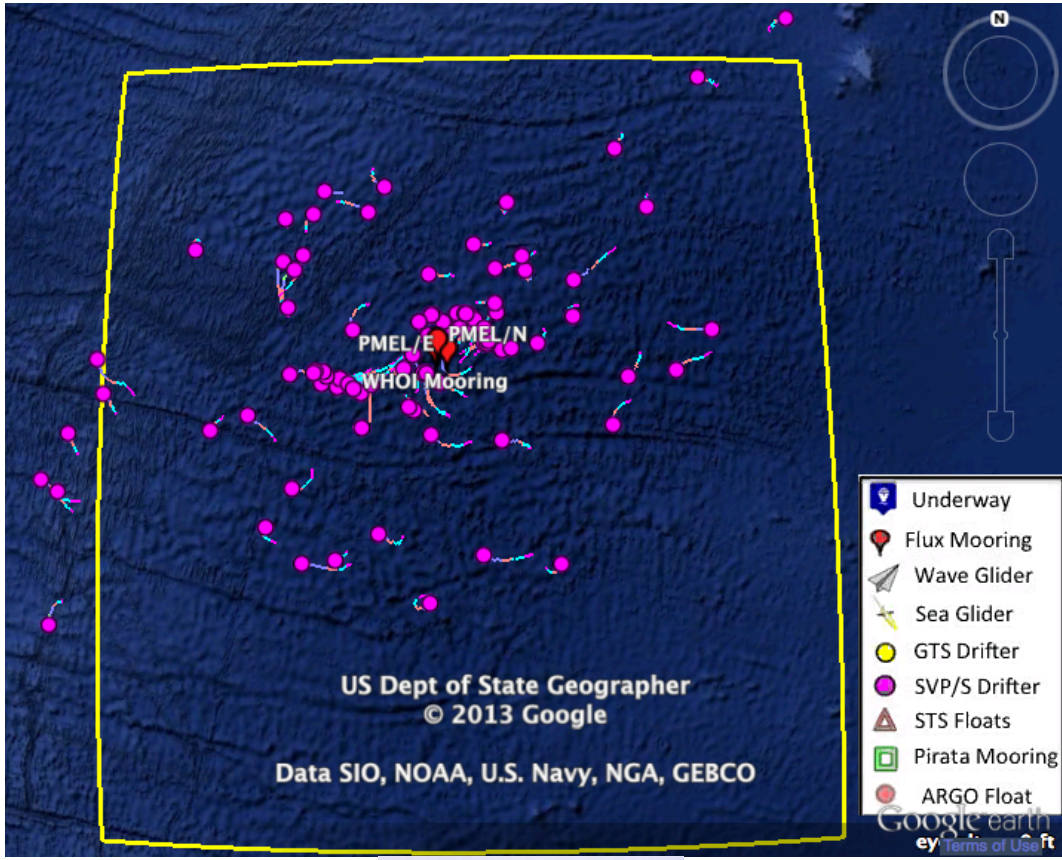


Aquarius V2.0 (beam1+3) vs SPURS In Situ Data

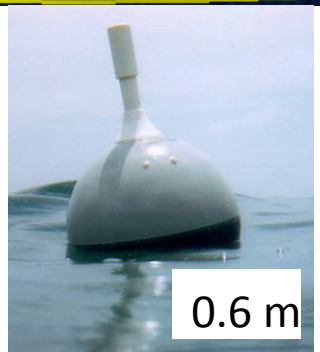


Drifter (0.6m) vs. Aquarius



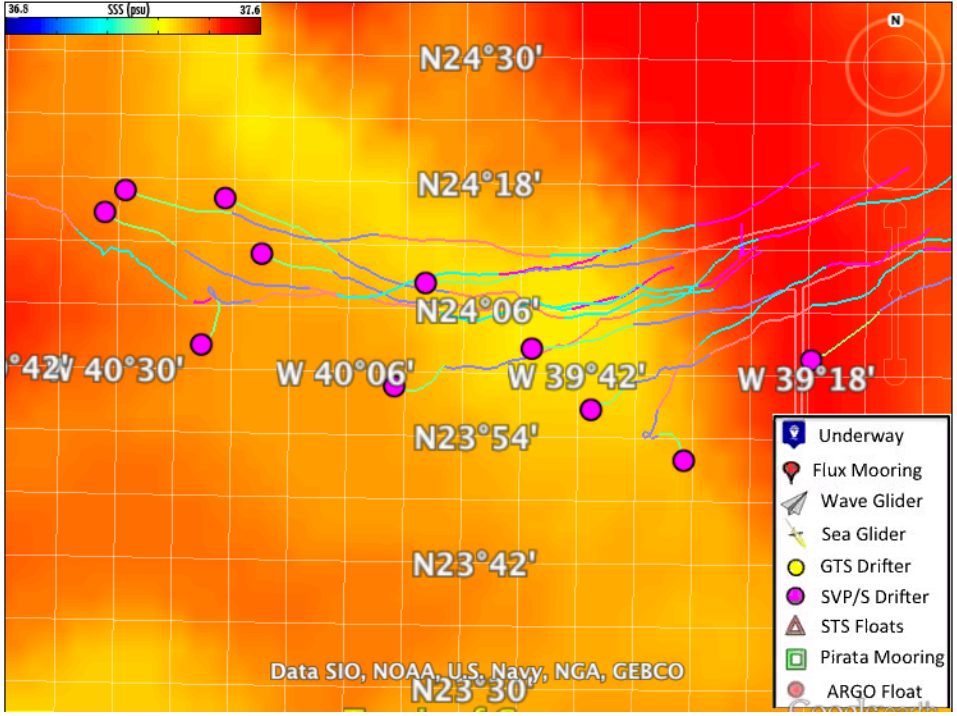


5 cruises Sept. 2012 – Sept. 2013

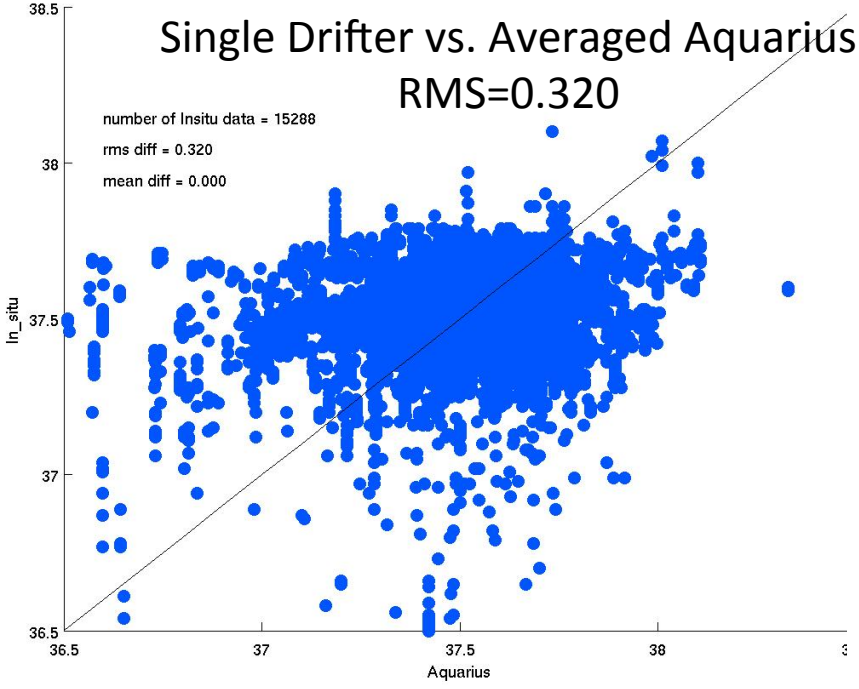


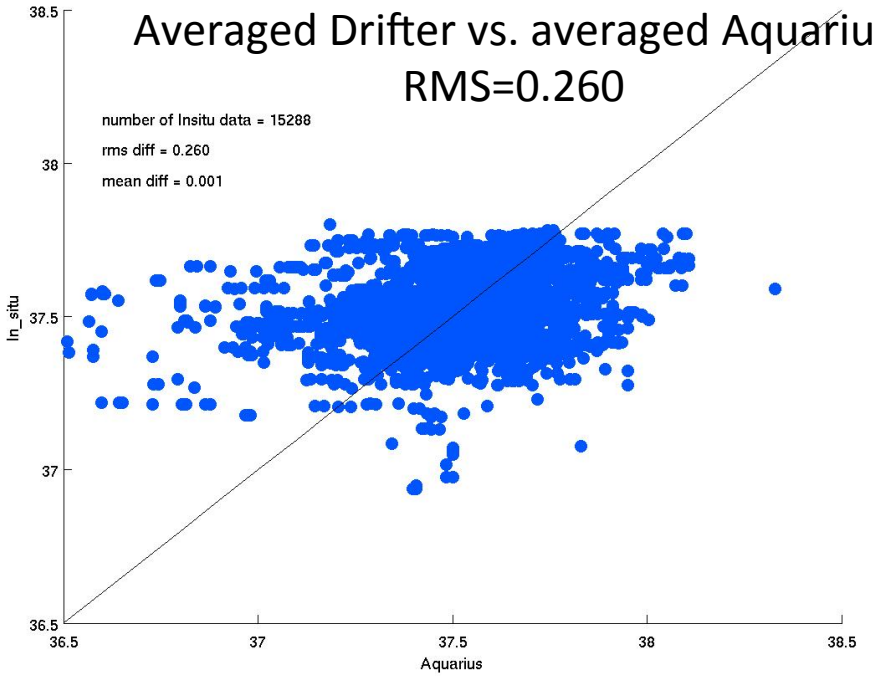
SVP/S Drifters

HYCOM SSS
&
Drifter Trajectories



Averaging single-point data significantly improves the agreement with Aquarius (averaged) data



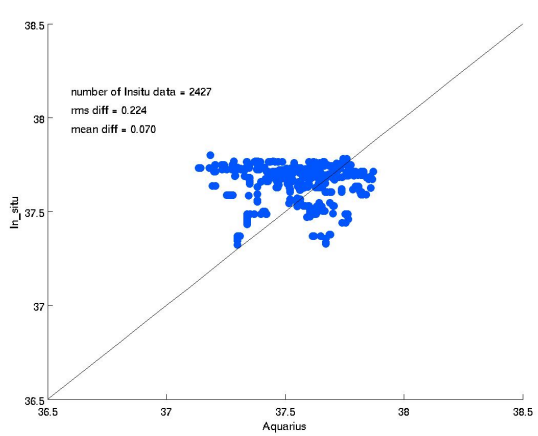


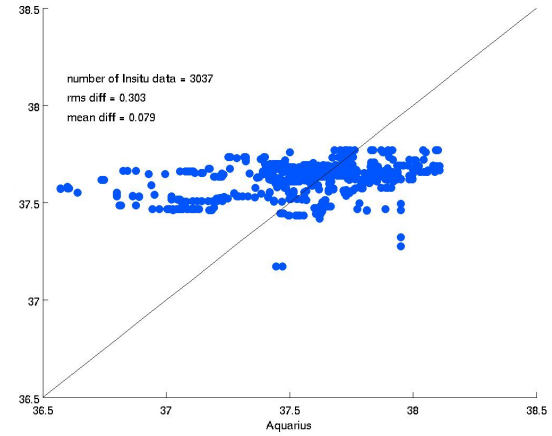
Drifter vs. Aquarius

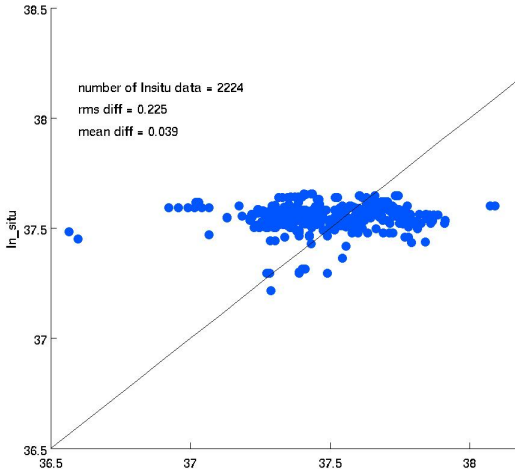
MM/YYYY	RMS	Bias
09/2012	0.224	0.070
10/2012	0.303	0.079
11/2012	0.225	0.039
12/2012	0.293	0.033
01/2013	0.216	-0.108
02/2013	0.276	-0.138

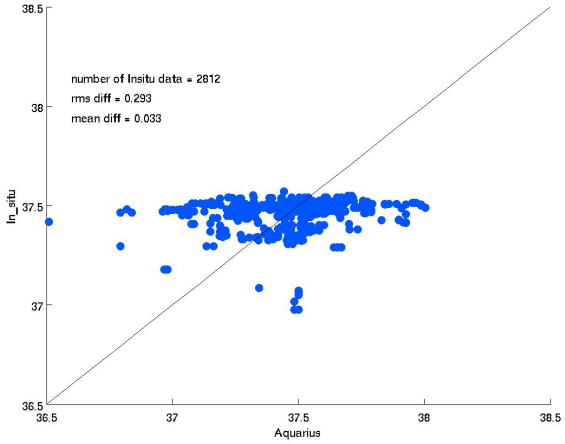
Bias = In Situ – Aquarius
-0.2 psu/6-month

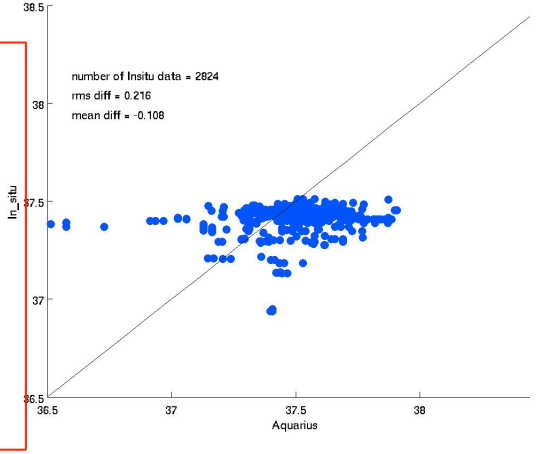
Drifter CTD gets fresher or Aquarius gets saltier?

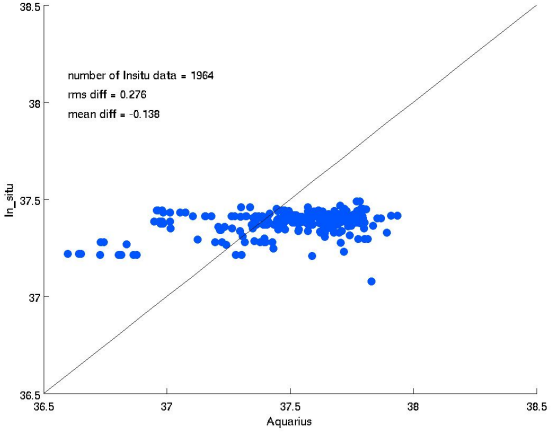




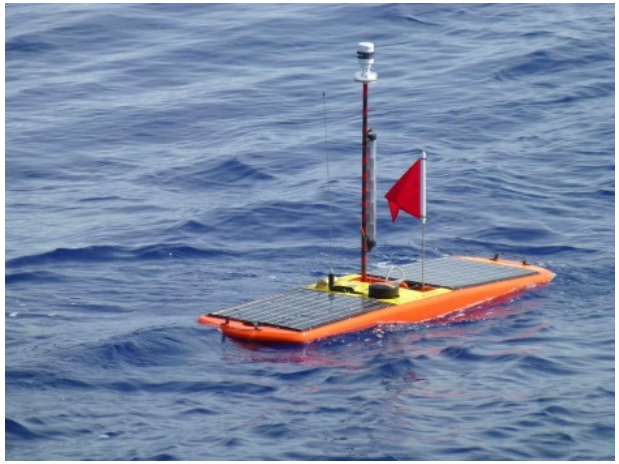


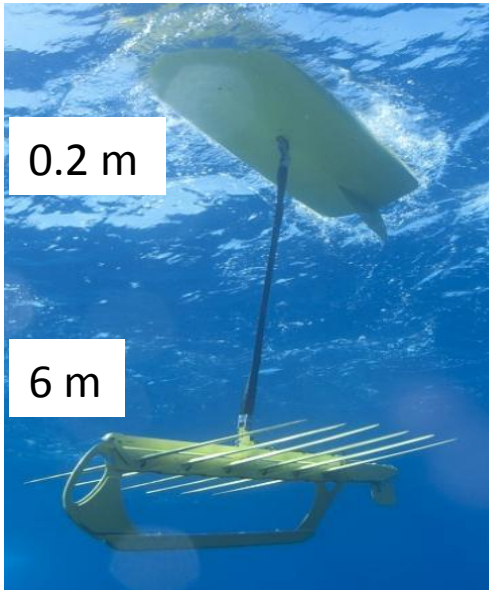




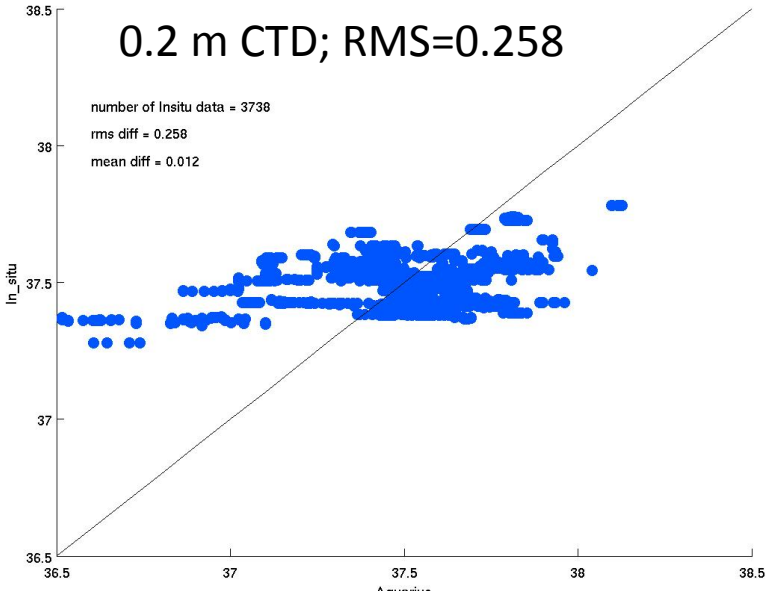


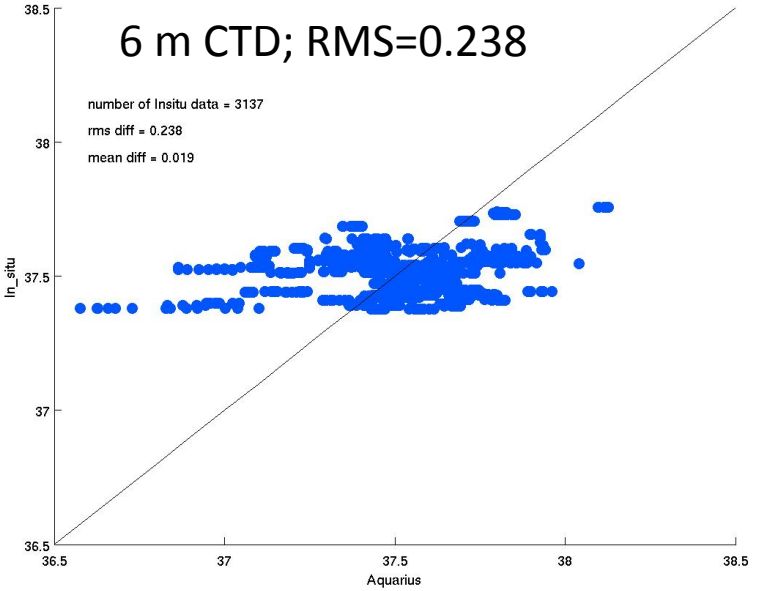
Wave Glider (0.2m & 6m) vs. Aquarius





Wave Glider





Wave Glider vs. Aquarius

0.2 m CTD

Bias = In Situ – Aquarius
-0.125 psu/6-month

Aquarius is getting saltier!

Bias = In Situ – Aquarius
-0.146 psu/6-month

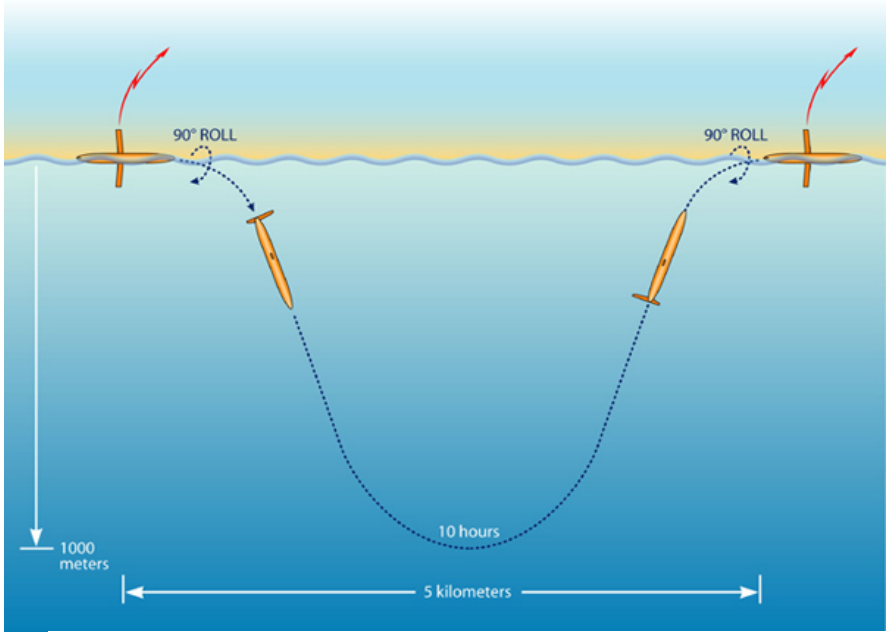
Aquarius is getting saltier!

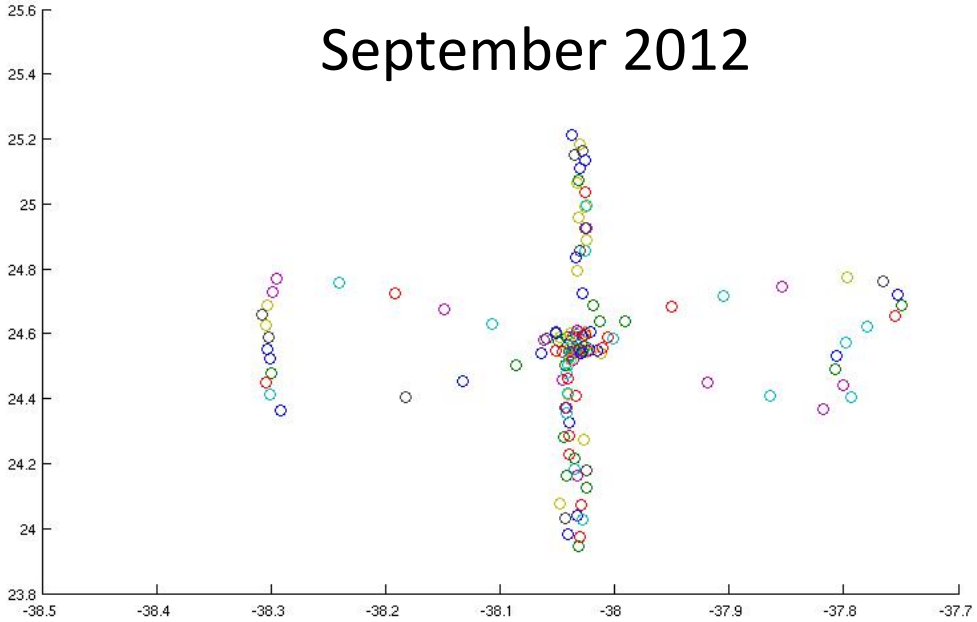
6 m CTD

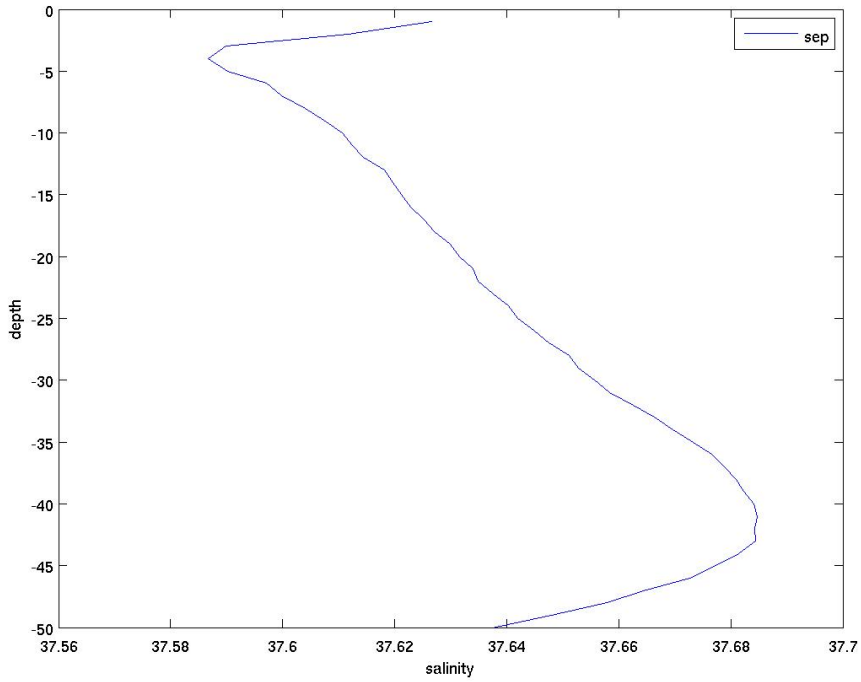
MM/YYYY	RMS	Bias
09/2012	0.153	0.038
10/2012	0.249	0.055
11/2012	0.226	0.030
12/2012	0.327	0.042
01/2013	0.248	-0.022
02/2013	0.281	-0.087

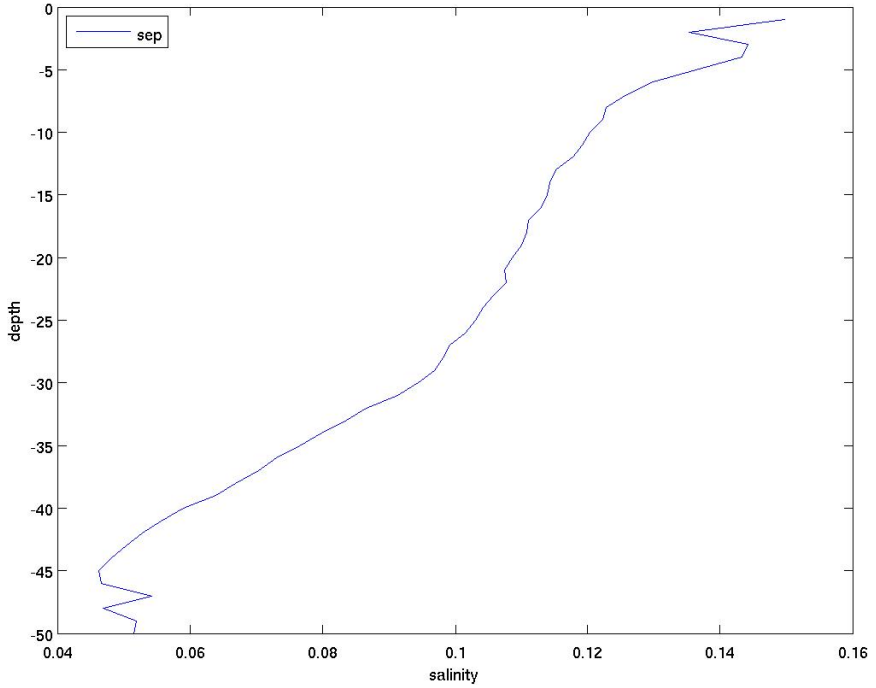
MM/YYYY	RMS	Bias
09/2012	0.154	0.044
10/2012	0.259	0.065
11/2012	0.227	0.043
12/2012	0.232	-0.016
01/2013	0.255	-0.004
02/2013	0.274	-0.102

Seaglider vs. Aquarius



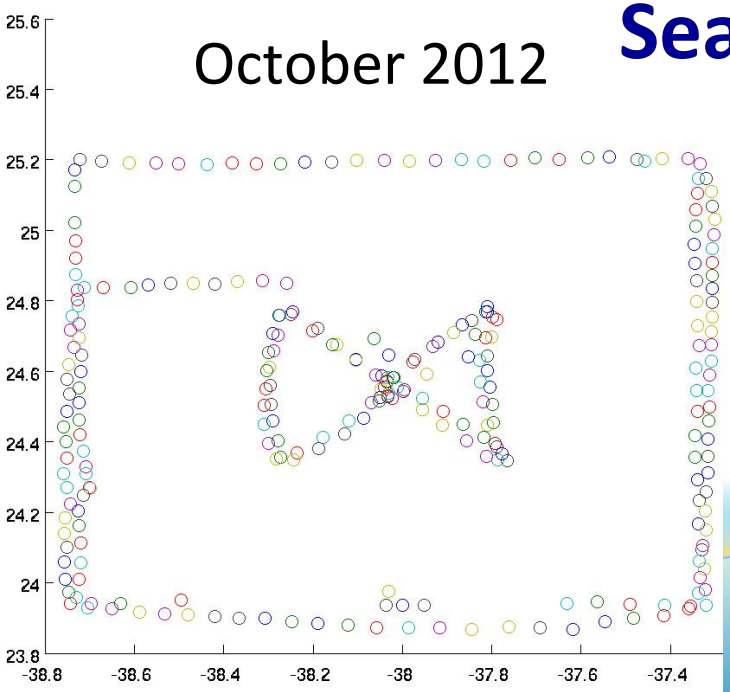






Seaglider

October 2012



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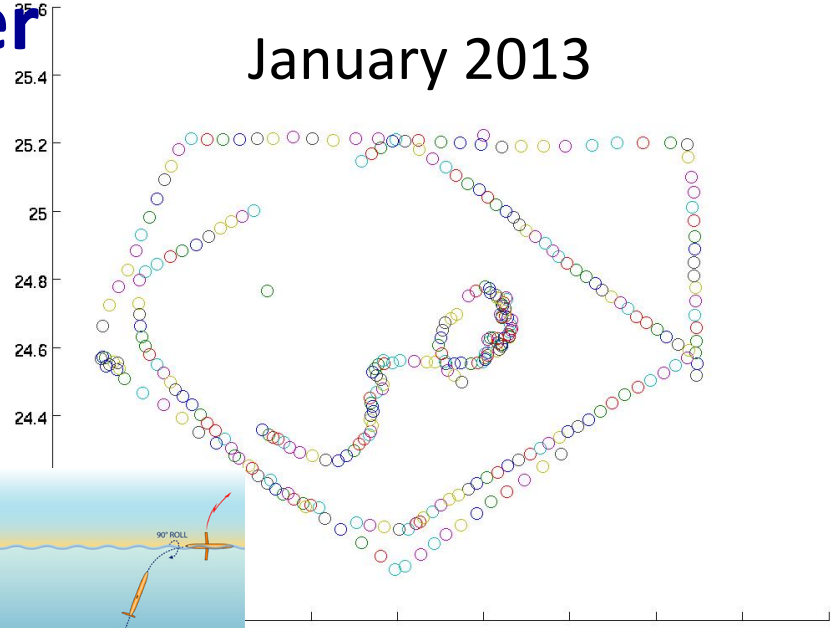

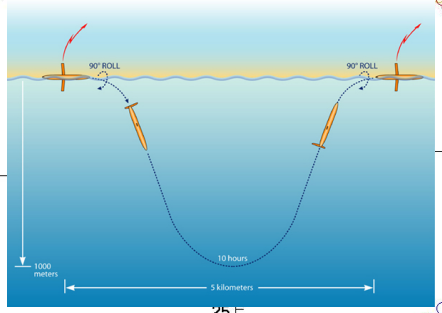

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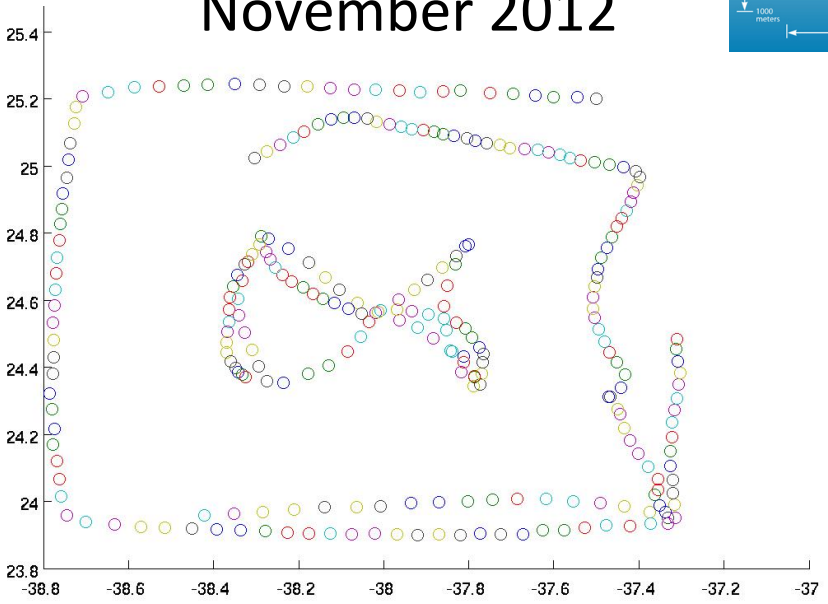
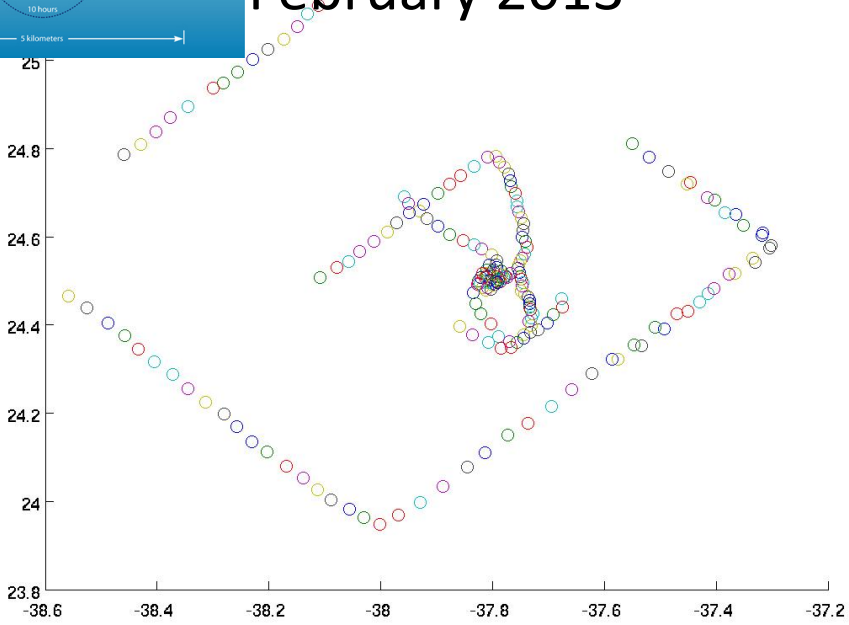
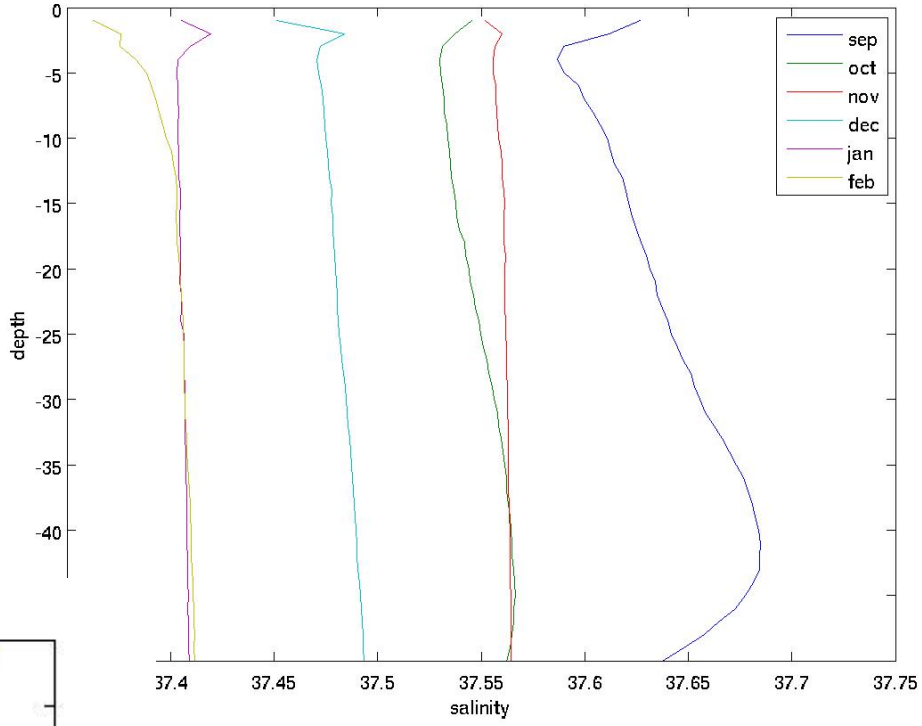


February 2013

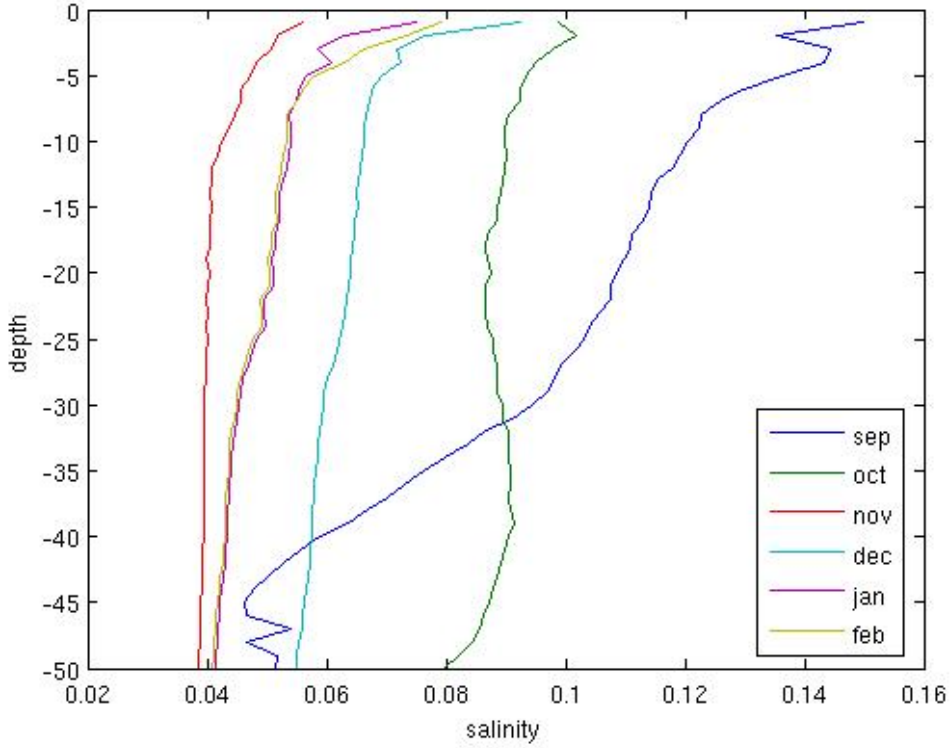


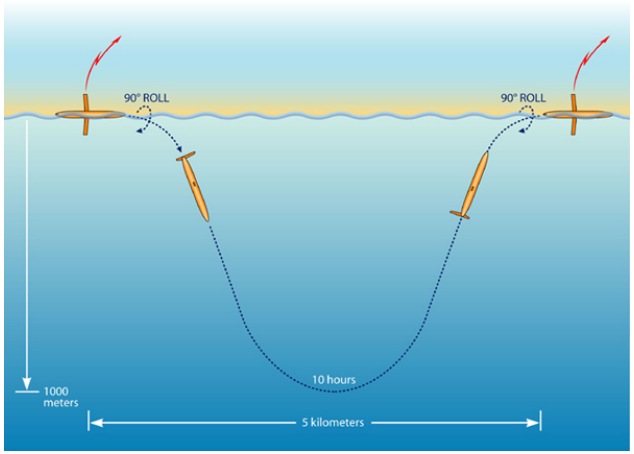
Seaglider vs. Aquarius



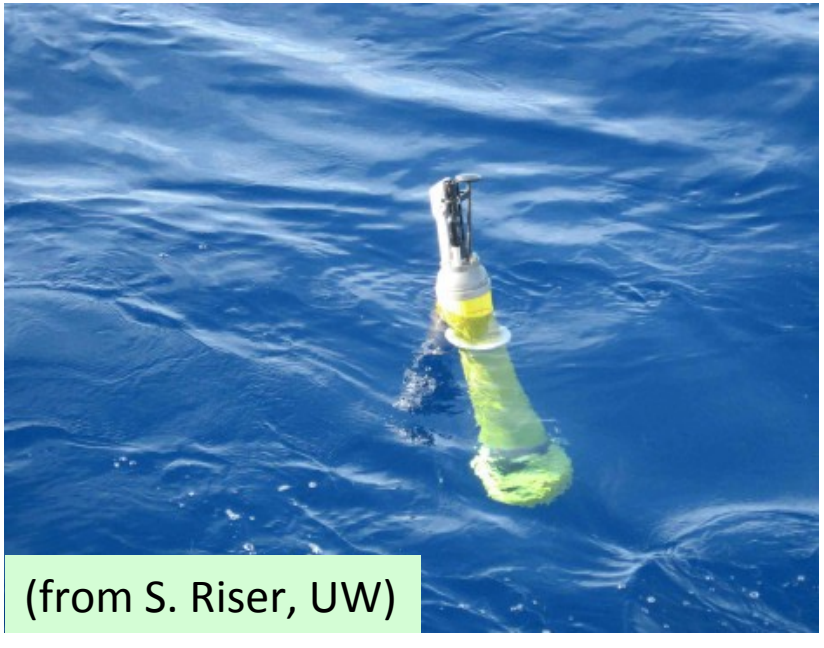
Monthly Mean Profiles

Monthly Standard Deviations

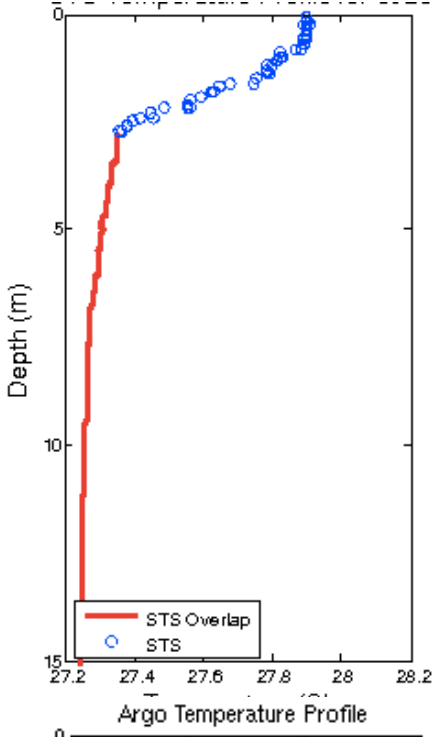


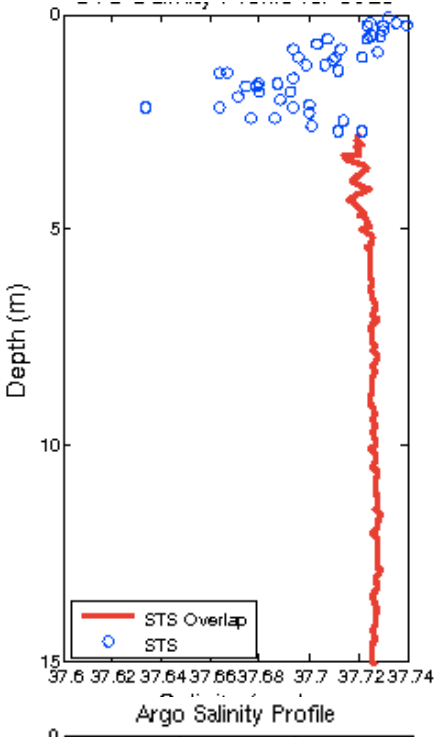


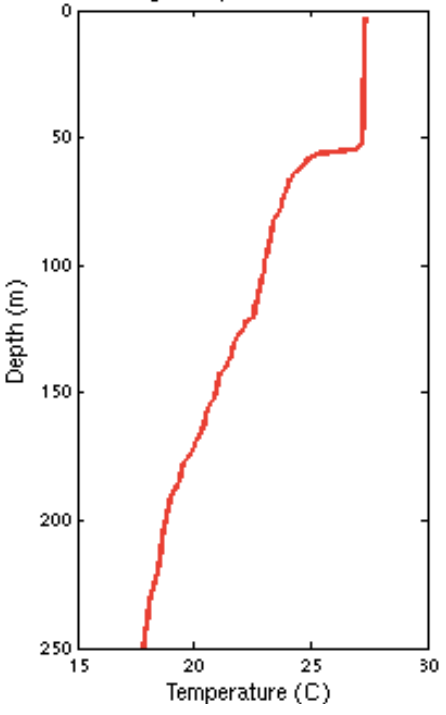
Argo Floats with STS (Surface Temperature Salinity) Sensor

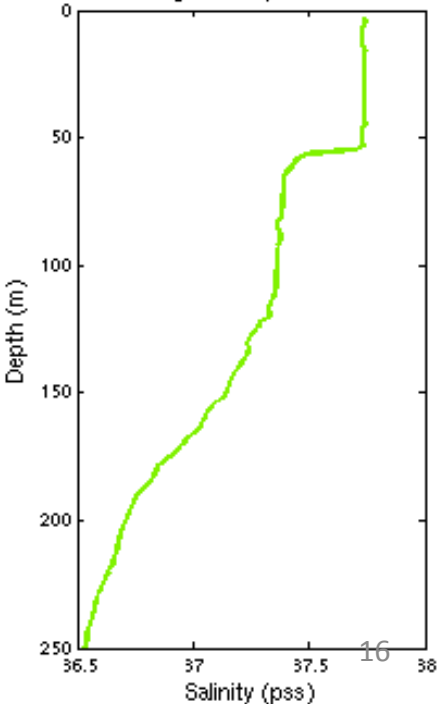


(from S. Riser, UW)





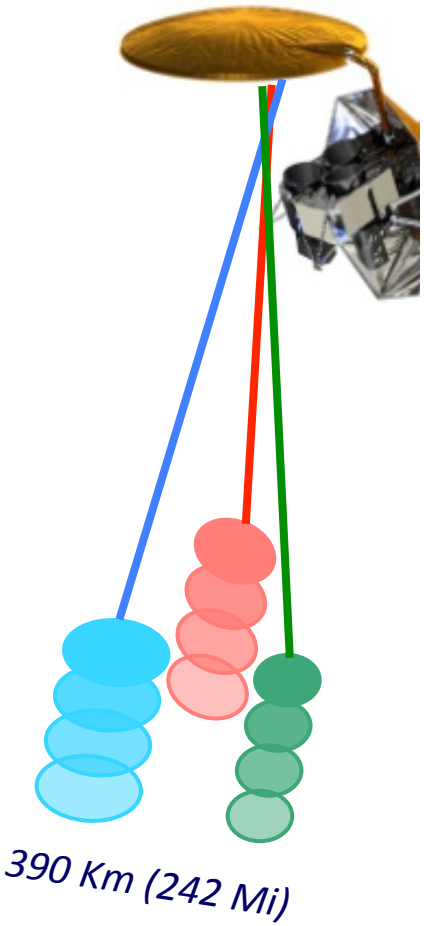


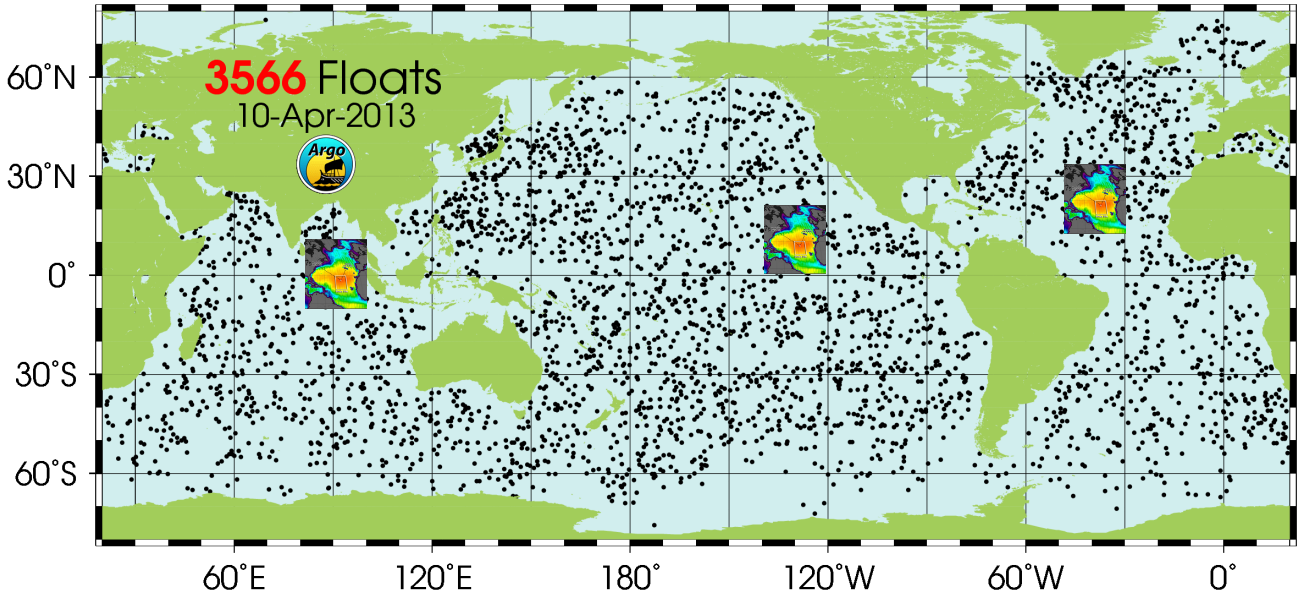


SUMMARY: Aquarius vs SPURS

- Aquarius compares well with SPURS: RMS~0.2 psu; RMS~0.15 psu when beam 2 removed
- SPURS provides the opportunity to study the mismatch between the Aquarius and In Situ data
  - Drifters @ 0.6m: Averaging drifter data over 150-km reduces the RMS to 0.26 psu (single drifter RMS=0.32)
  - Wave glider @ 0.2m & 6m: RMS changes by 0.02 psu
  - Aquarius retrieved salinity is drifting ~0.2 psu in 6 months from Sept. 2012 to Feb. 2013!
  - Seaglider & Argo STS floats: S(z), z=0,50m
    - Subgrid scale variability within 100-km Aquarius footprint is in the range of 0.05 to 0.15 psu near the surface, suggesting the upper limit RMS expected for Aquarius

Validating Aquarius (SMOS) needs SPURS type data
SPURS success! SPURS-2! SPURS Everywhere!

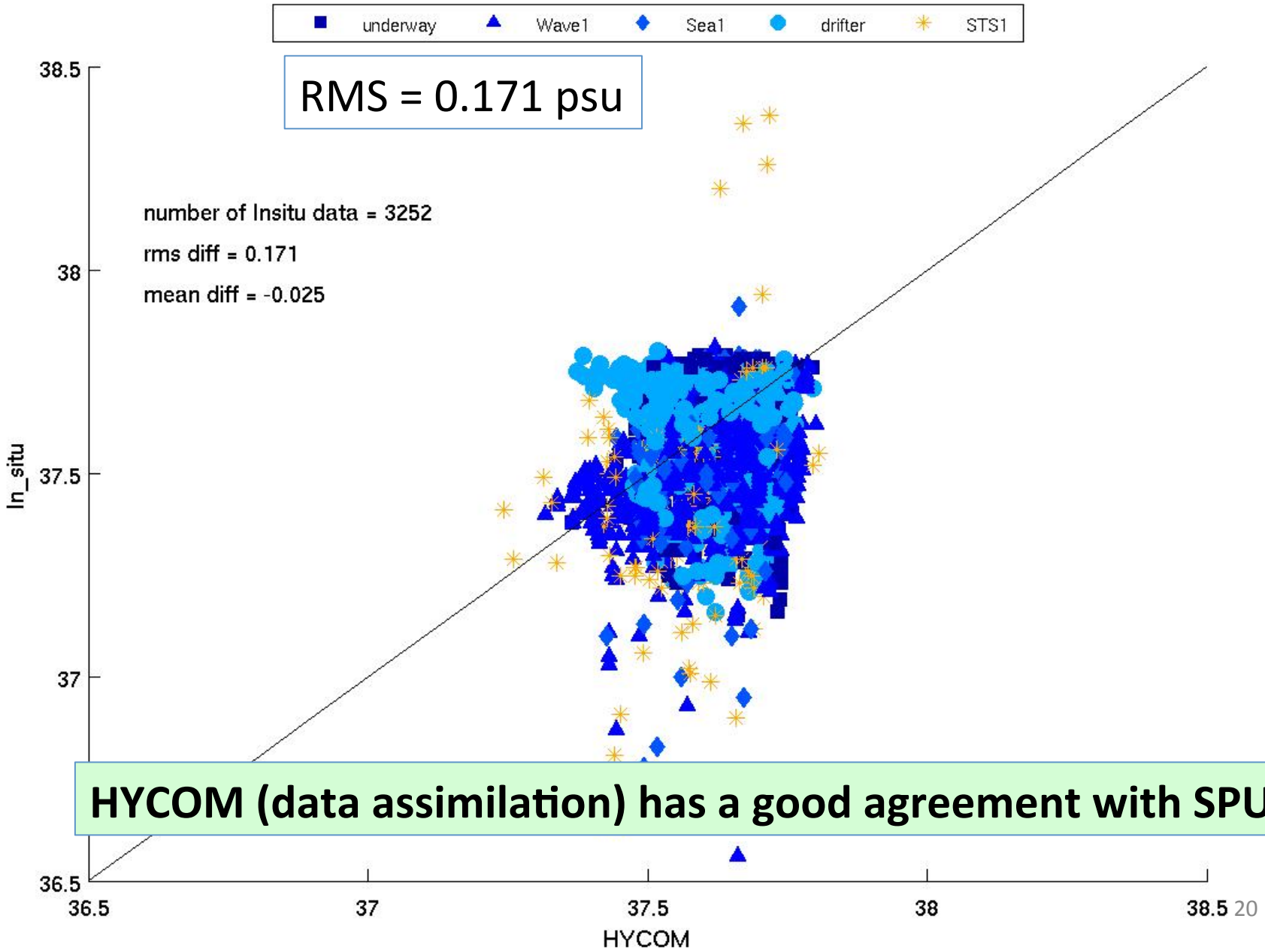


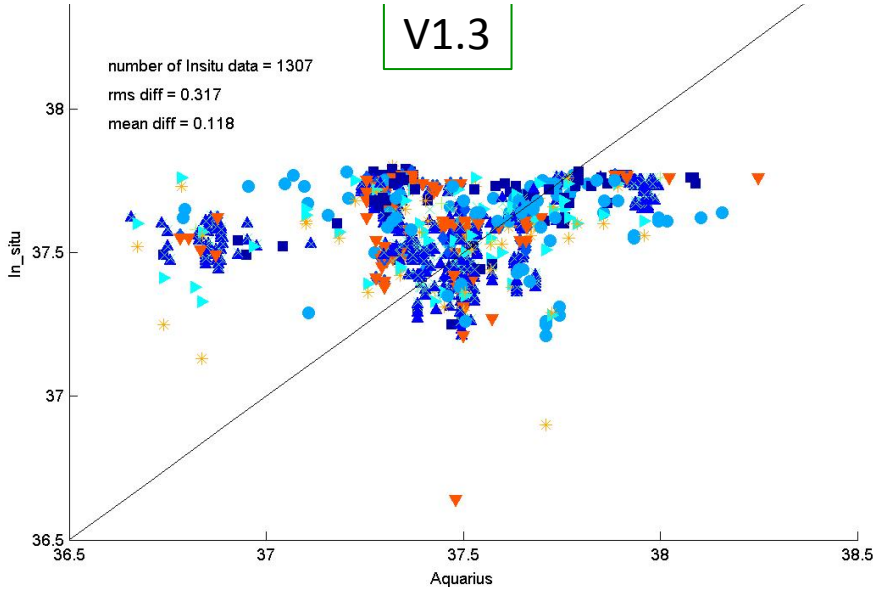
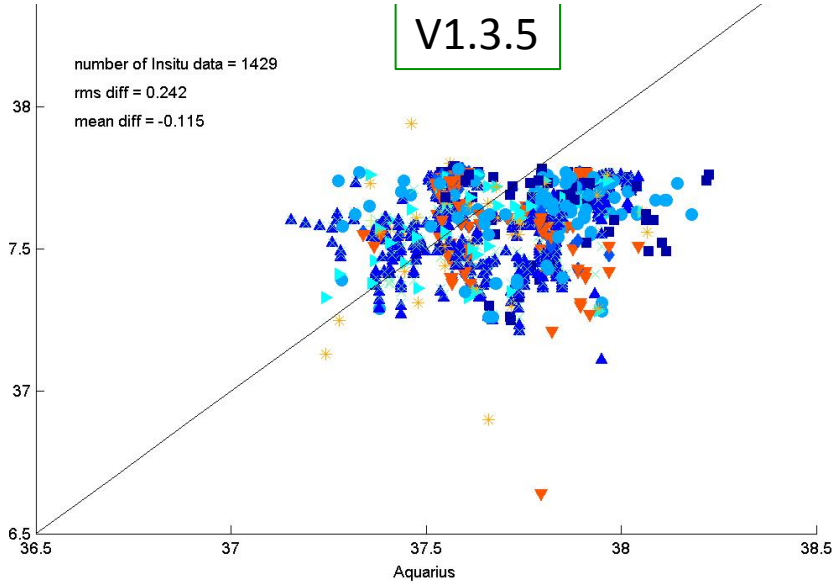
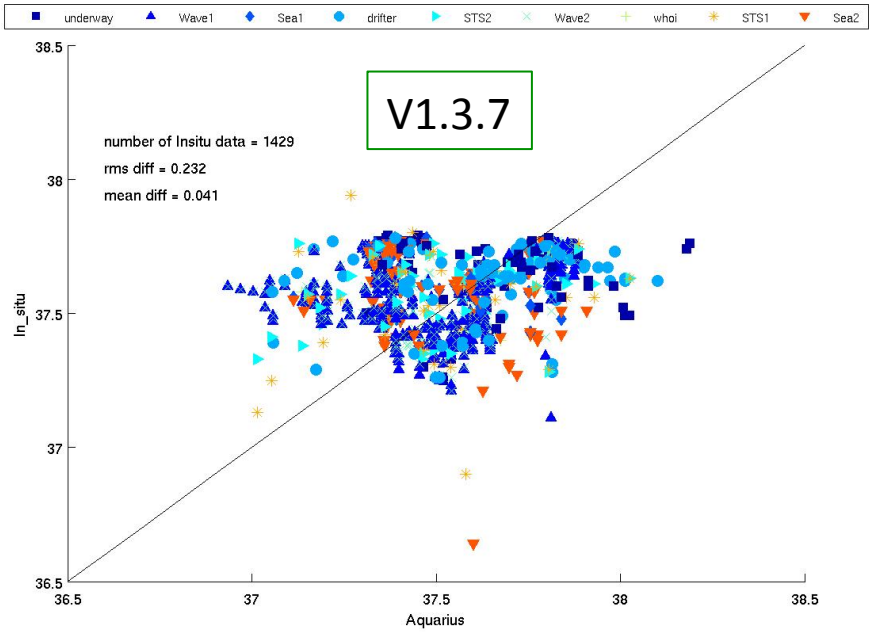
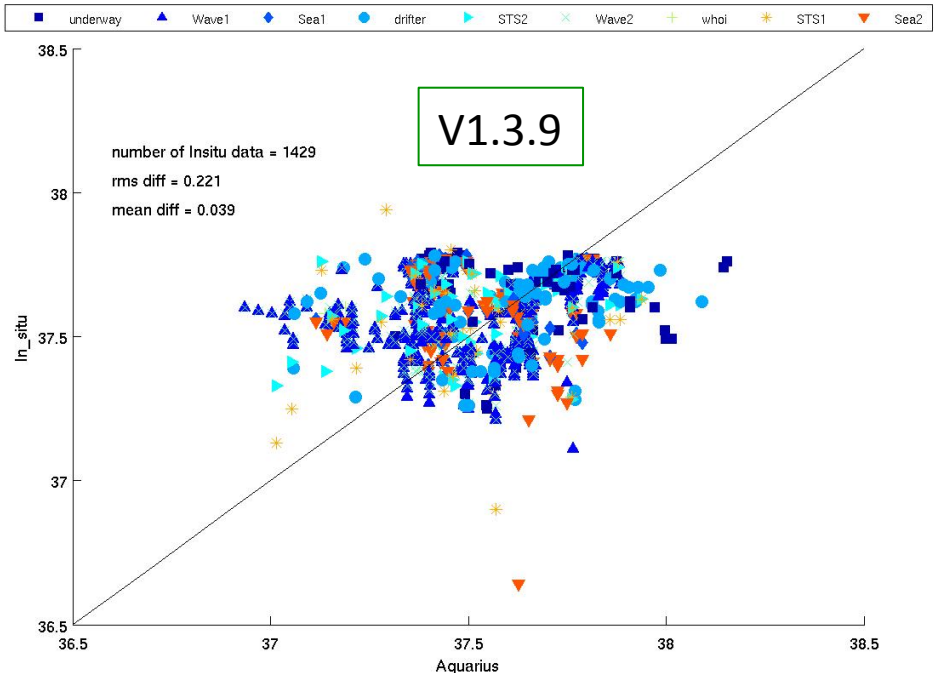


Mismatch between Aquarius and Argo measured salinity

Mismatch	Aquarius	Argo
Measurement Depth	cm	m
Spatial scale	50 – 150 km	Single point
Temporal scale	7-day repeat	10-day repeat

Reference HYCOM SSS vs SPURS In Situ Data



HYCOM (data assimilation) has a good agreement with SPURS

Improved Retrieval from V1.3 to V2.0