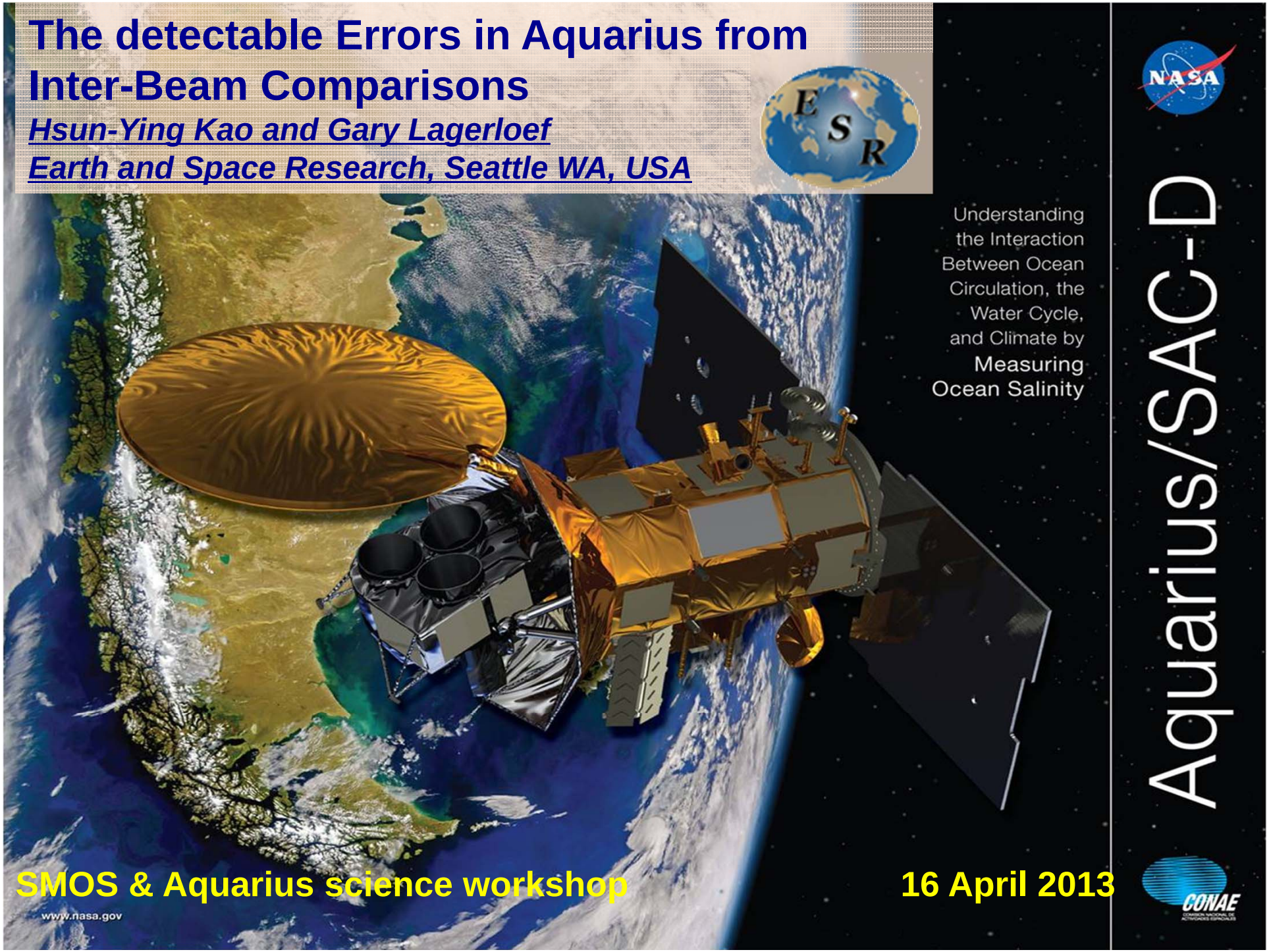
The detectable Errors in Aquarius from Inter-Beam Comparisons

Hsun-Ying Kao and Gary Lagerloef
Earth and Space Research, Seattle WA, USA



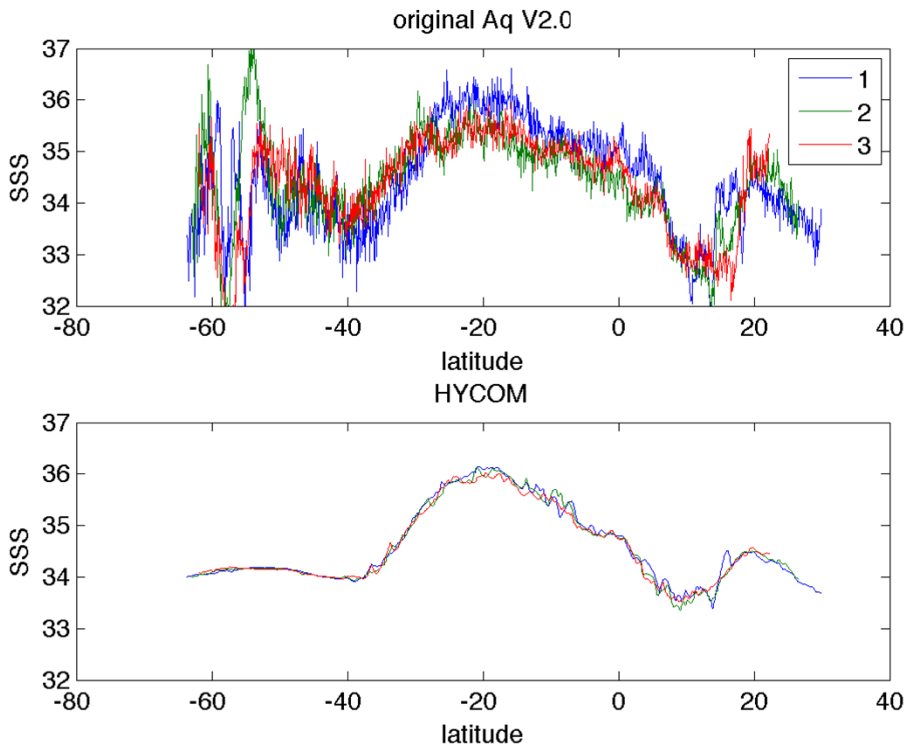
SMOS & Aquarius science workshop

16 April 2013

Outlines

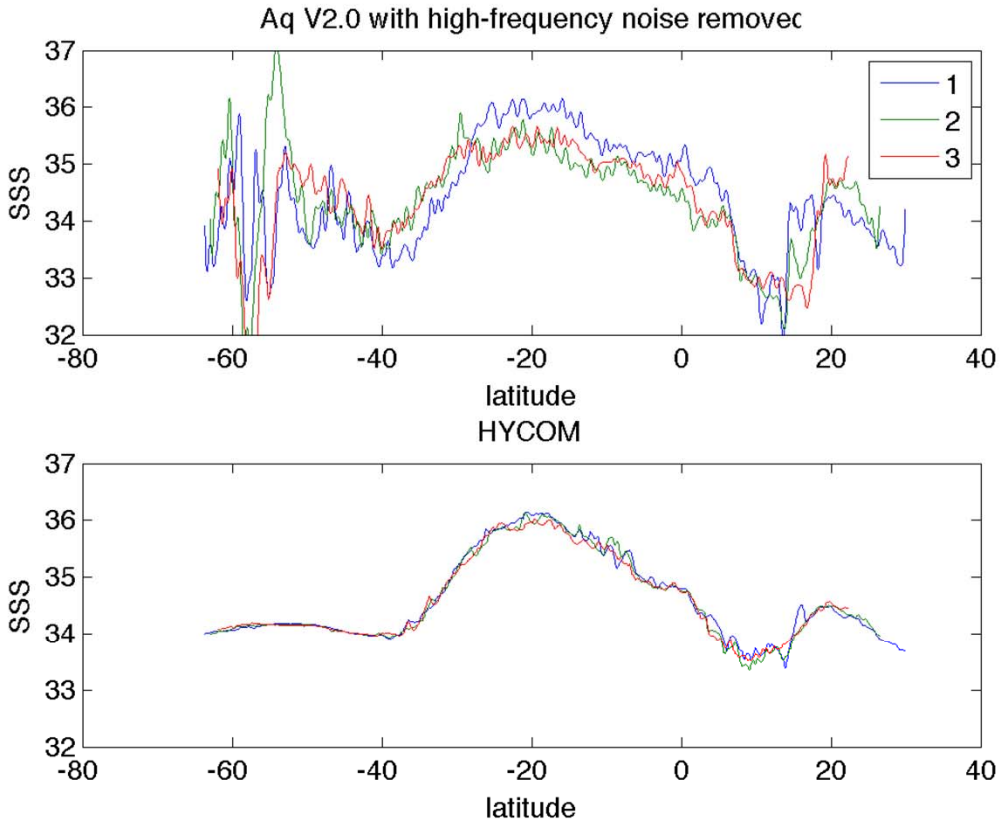
- Key: Aquarius is designed to have three horns observing the SSS at the same
- Tasks: Inter-beam comparisons with be investigating in L2 and L3 in this study
- Goal: identify the anomalous values among the three beams comparisons
- Results: smooth and improve the salinity maps without using climatology product.

Salinity values of 3 beams in 1 orbit



- Aquarius shows high frequency noise
- The 3 beams can show small-scale (short-wave) different SSS due to the geographic location
- For large-scale (long-wave), the 3 beams should have the same variations. ***With few exceptions***.

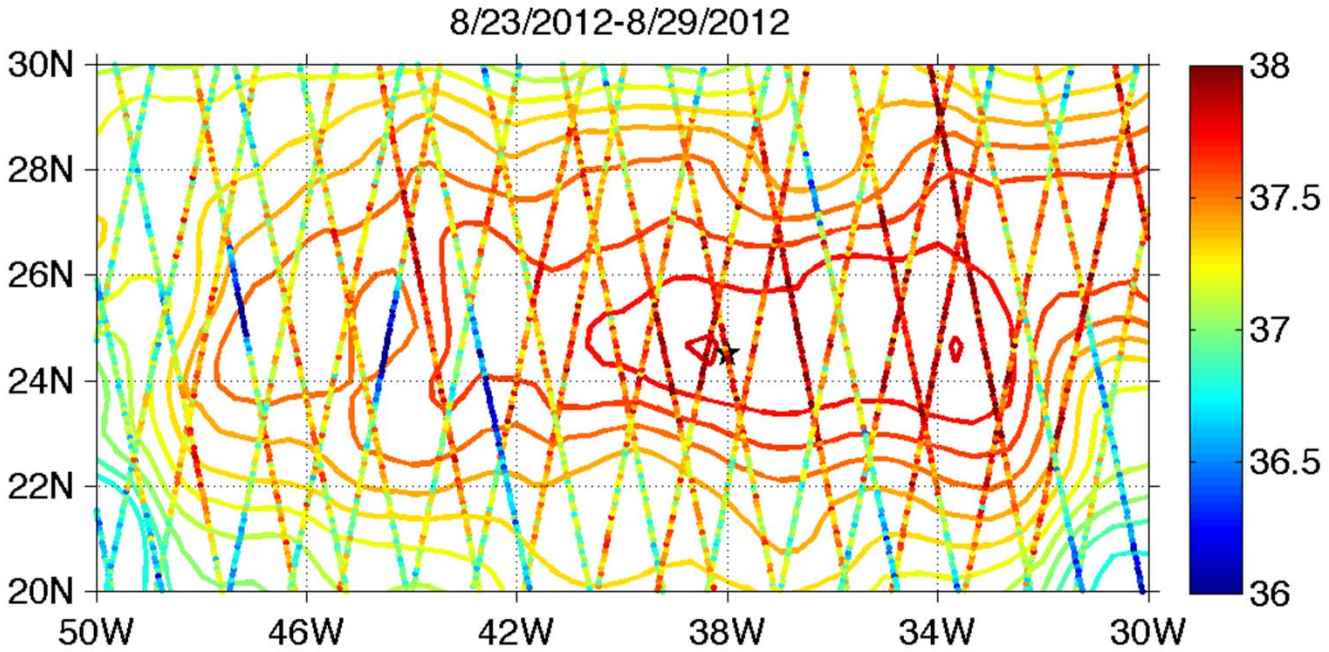
STEP1: Remove the very high-frequency variance (<10 footprints)



STEP2: keep the variance around hundred kilometers, which is around the distance among the three horns.

One-week of Aquarius salinity in SPURS region

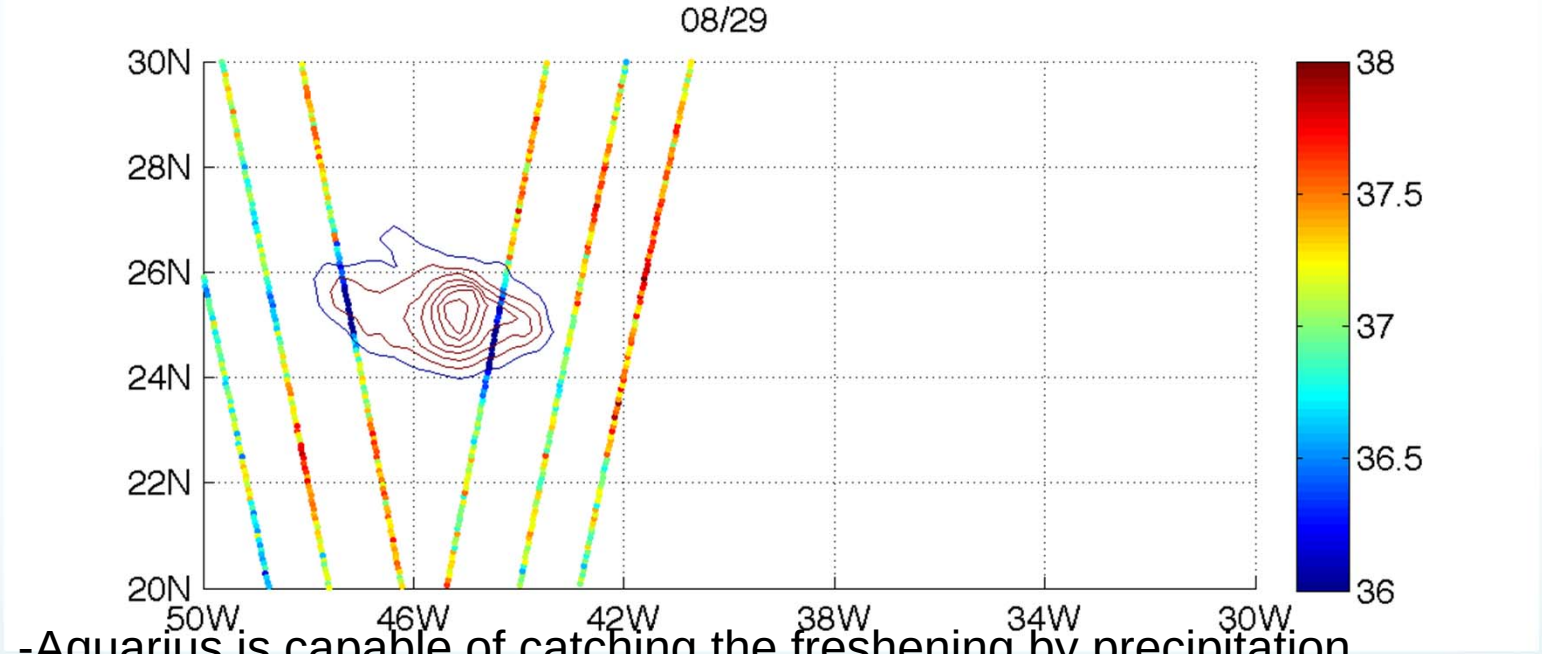
L2 (orbit) and L3 (contour)



Small segments of anomalous SSS, are they signals or noise?

One-day accumulated precipitation on 8/29/2012

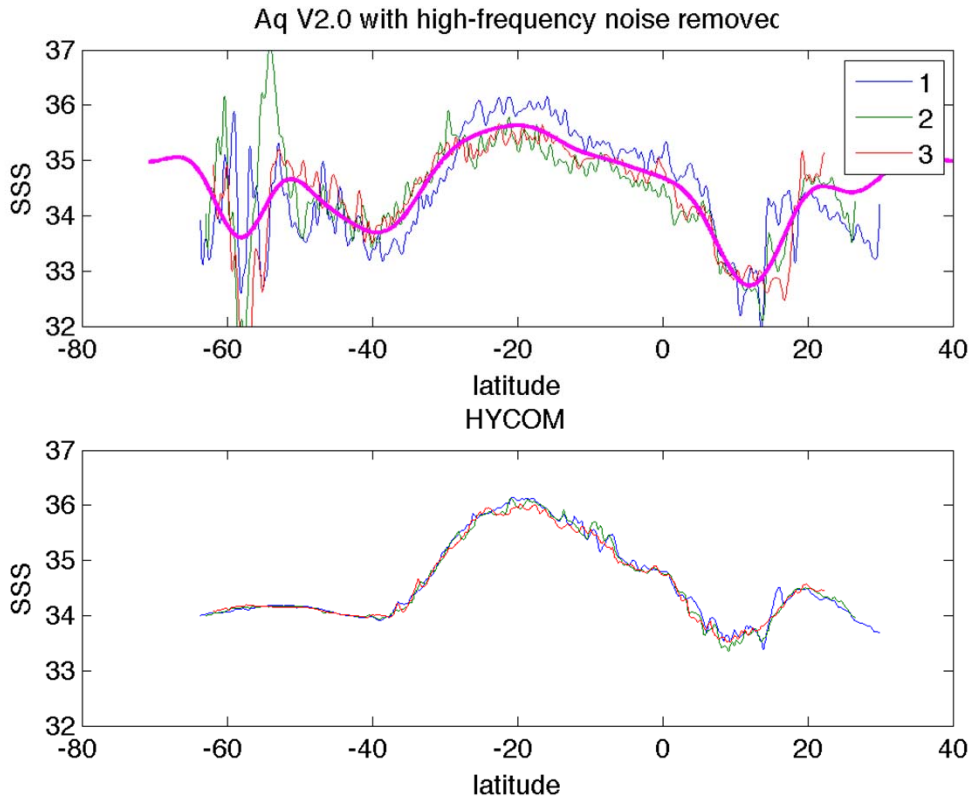
Aquarius orbit and CMORPH precipitation (contour)

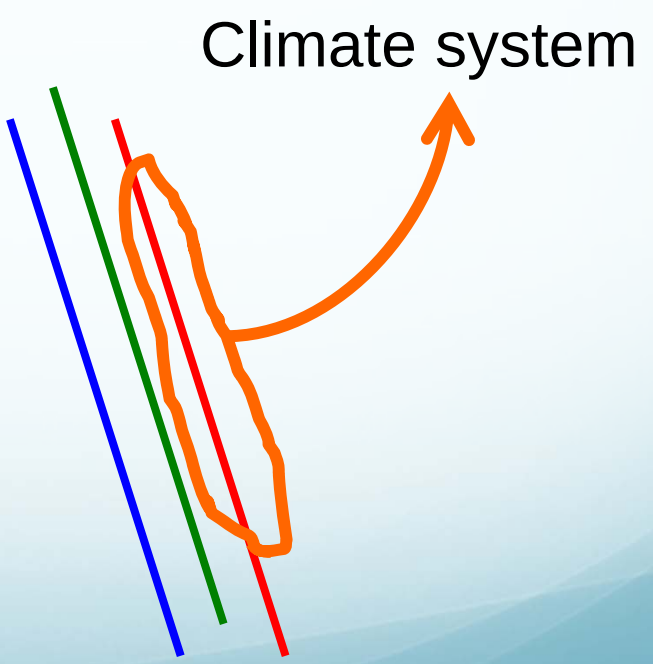


-Aquarius is capable of catching the freshening by precipitation, although we don't know yet how much is real rainfall signal and how much is biased by rain

-It's important to recognize these regional anomalies are not part of the bias when we try to do the gridding.

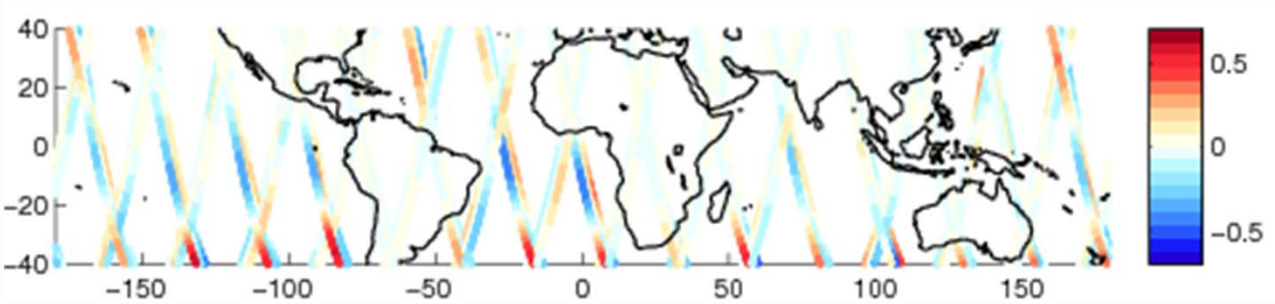
STEP3: unify the large-scale variations in three beams



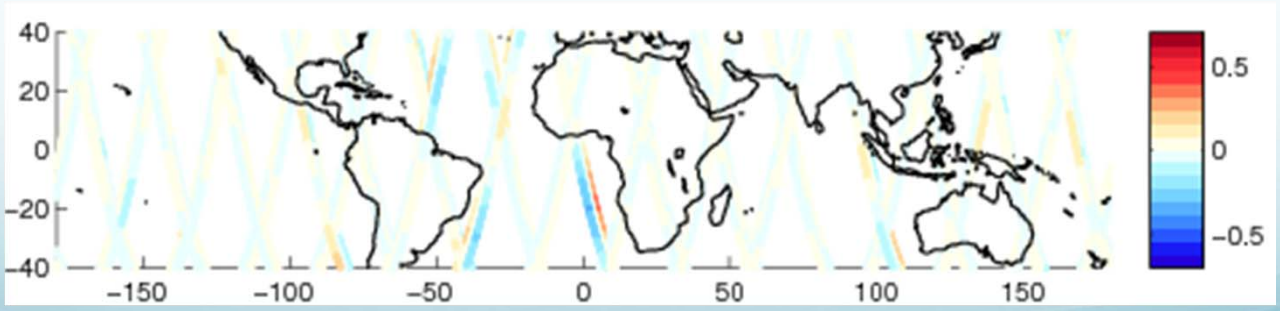


Large-scale SSS differences in three beams (psu) – *What's been removed*

Aquarius V2.0

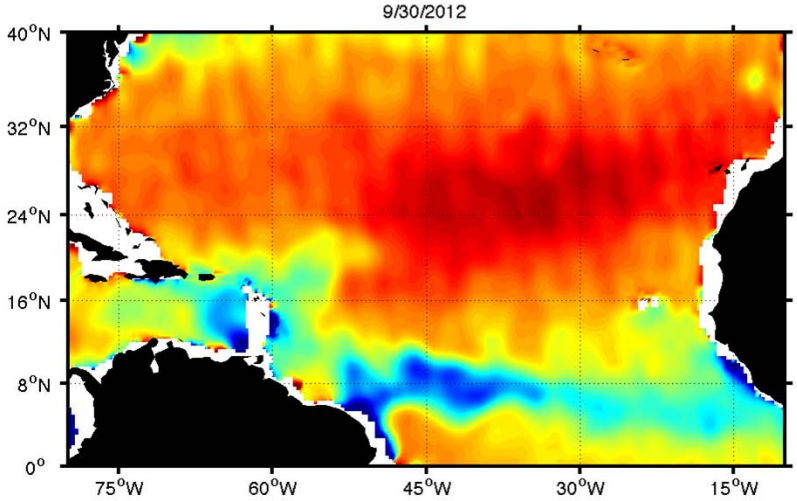


HYCOM

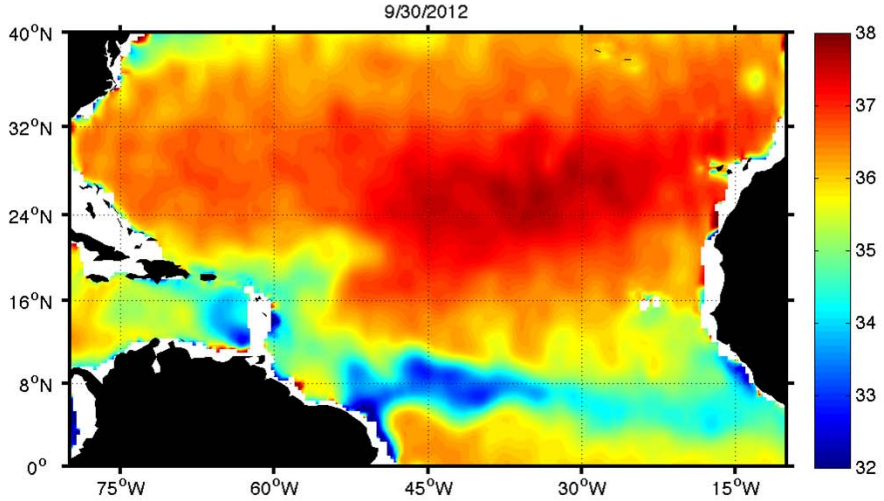


Results: Salinity maps before and after the long-wave inter-beam bias removal

Original V2.0



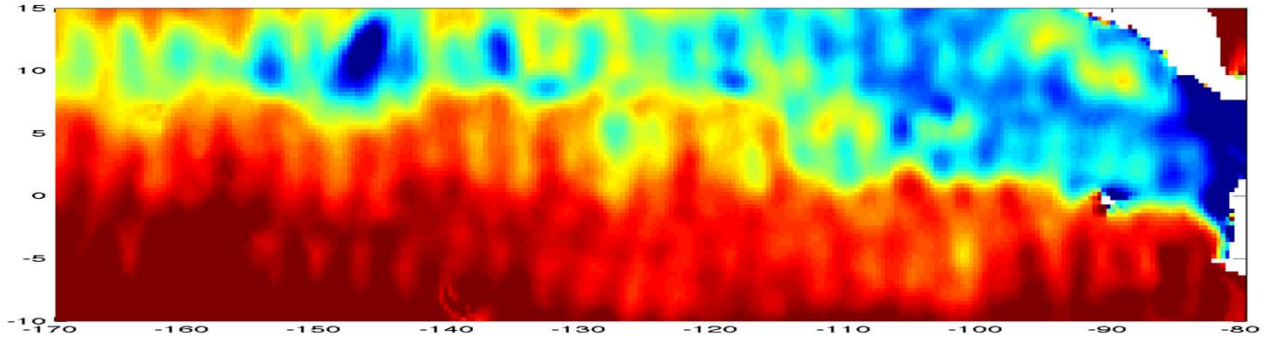
V2.0 with longwave inter-beam bias removed



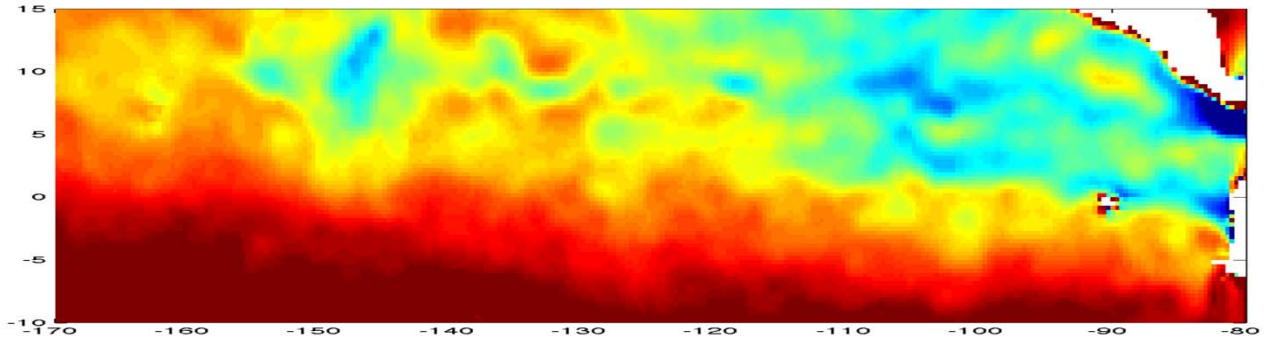
The streakiness is removed but we still keep detailed structures.

Results: Salinity maps before and after the long-wave inter-beam bias removal in eastern Pacific

Before longwave inter-beam bias removed

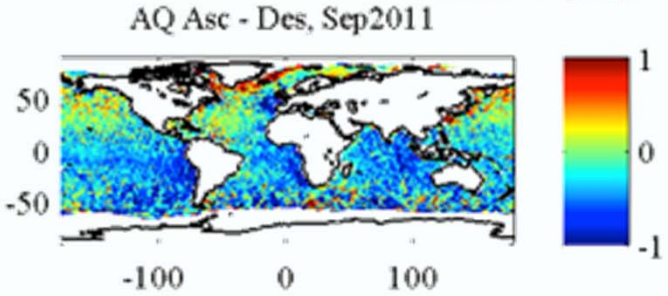


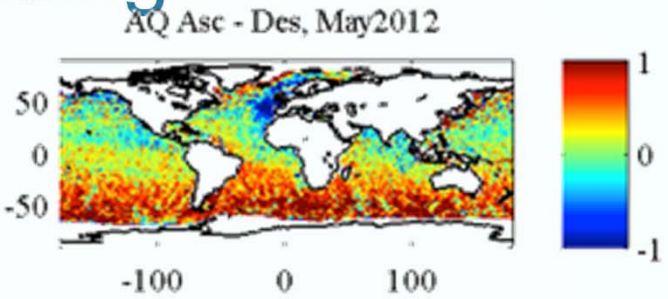
After longwave inter-beam bias removed

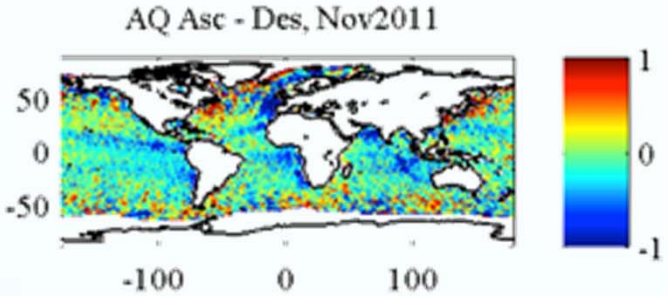


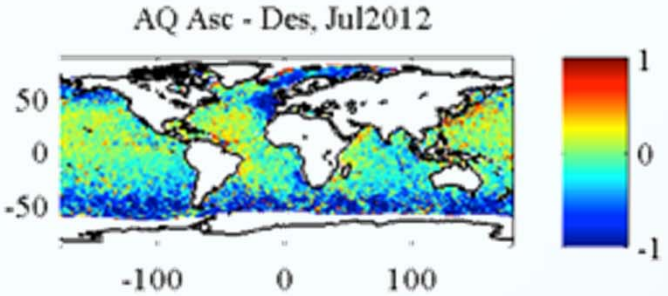
The streakiness is removed but we still see tropical instability waves.

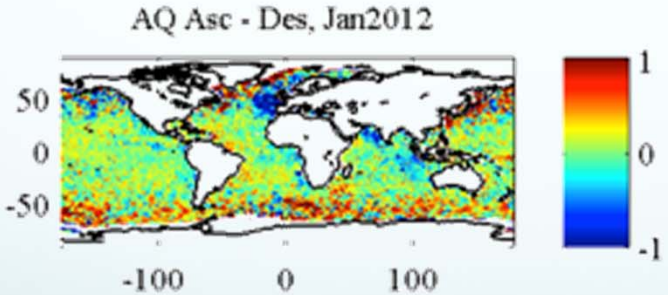
Inter-beam comparison on L3 - Ascending minus descending

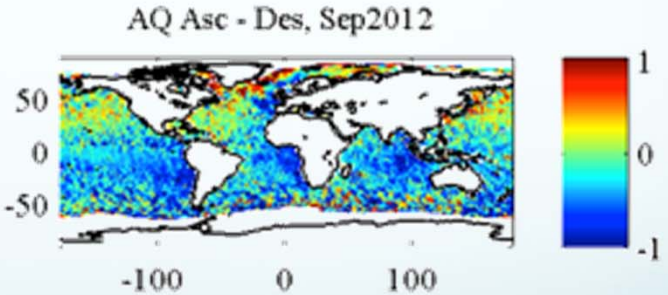


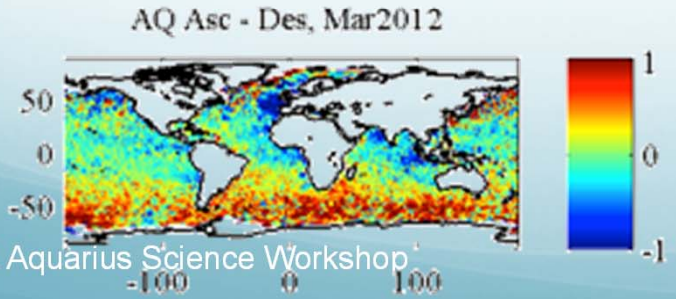


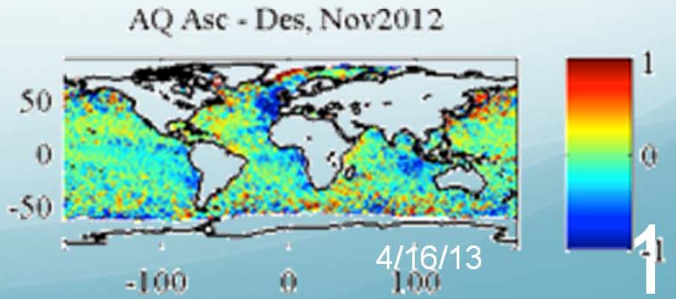






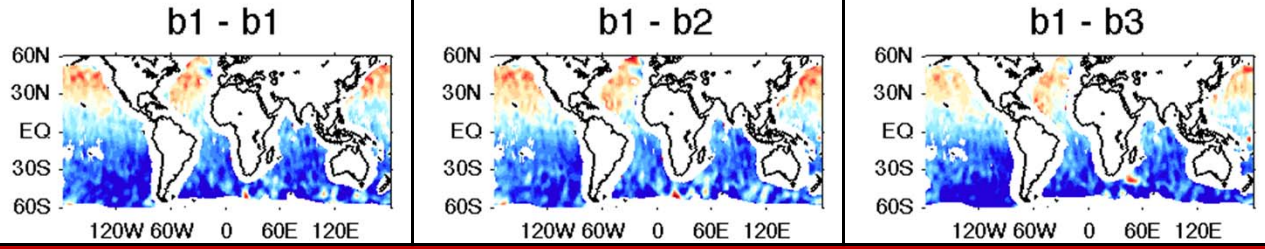






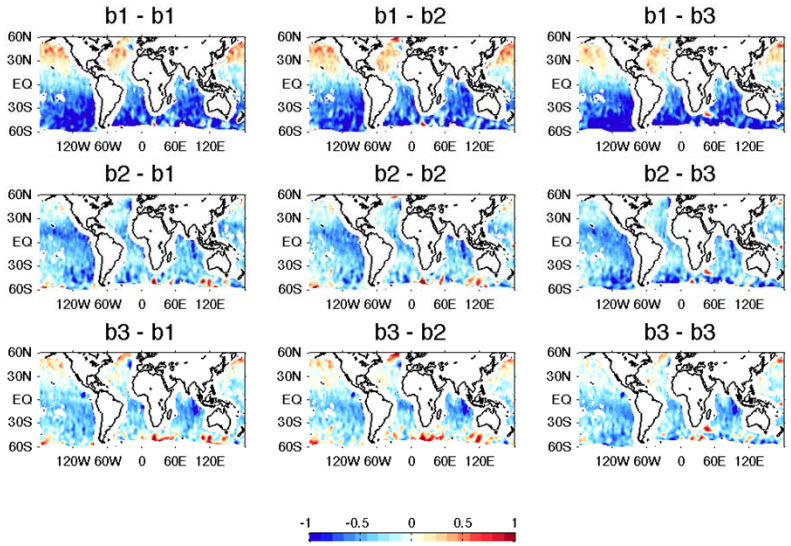
Ascending minus descending among all three beams

	Beam 1 (des)	Beam 2 (des)	Beam 3 (des)
Beam 1 (asc)	b1 - b1	b1 - b2	b1 - b3
Beam 2 (asc)	b2 - b1	b2 - b2	b2 - b3
Beam 3 (asc)	b3 - b1	b3 - b2	b3 - b3

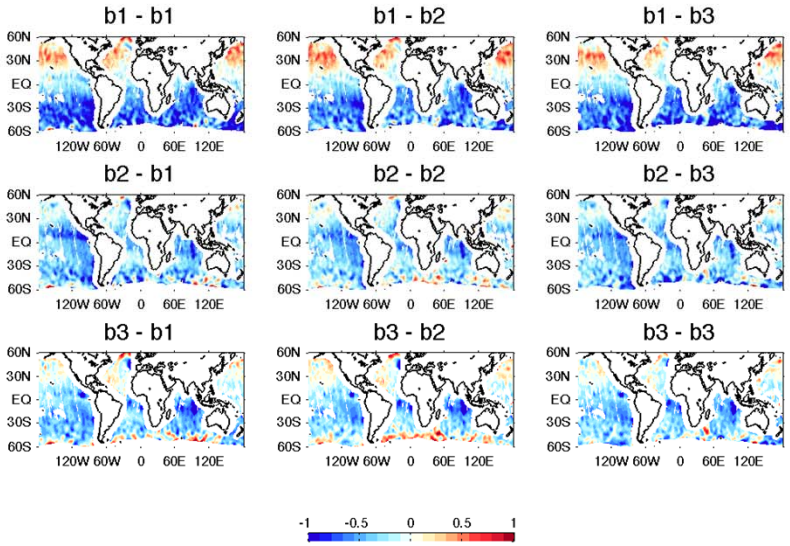


SSS - ascending minus descending
September in 2011 and 2012

September 2011



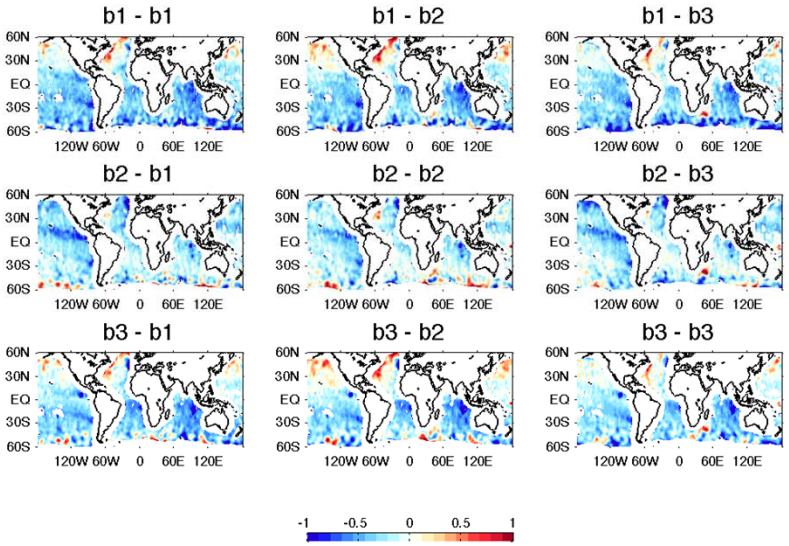
September 2012



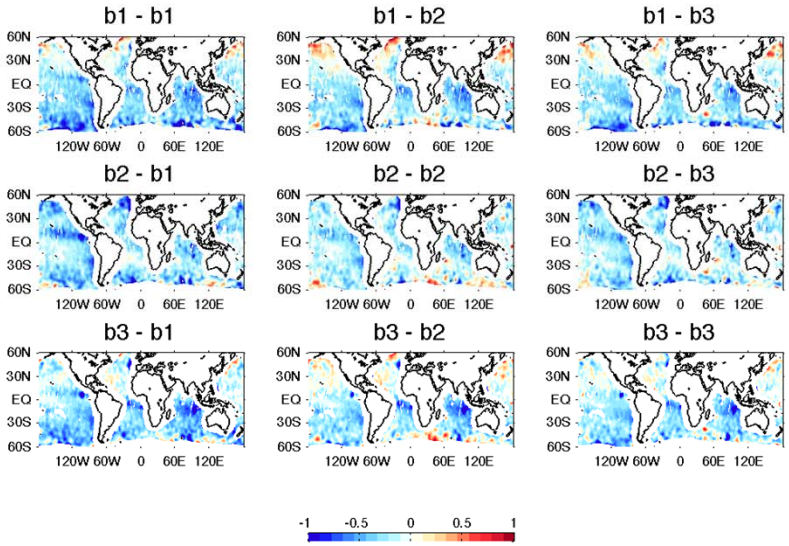
The ascending minus descending differences vary from month to month, but high similarities can be observed in the same calendar months.

SSS - ascending minus descending
October in 2011 and 2012

October 2011

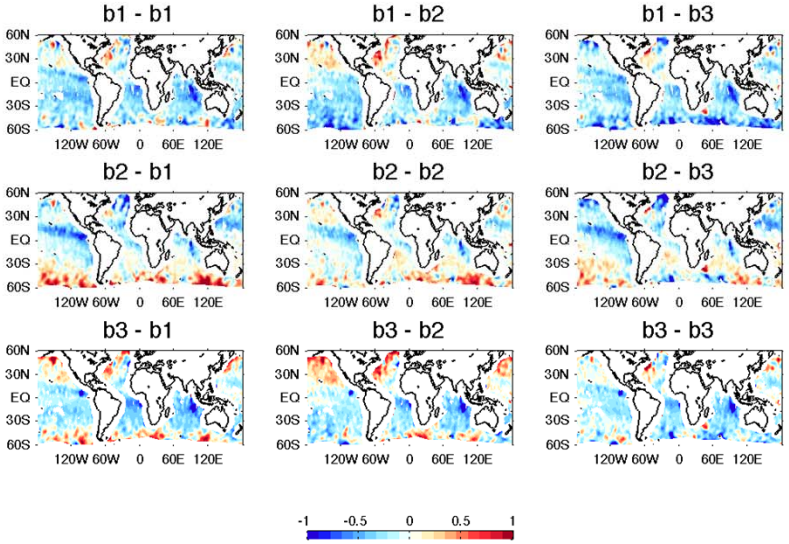


October 2012

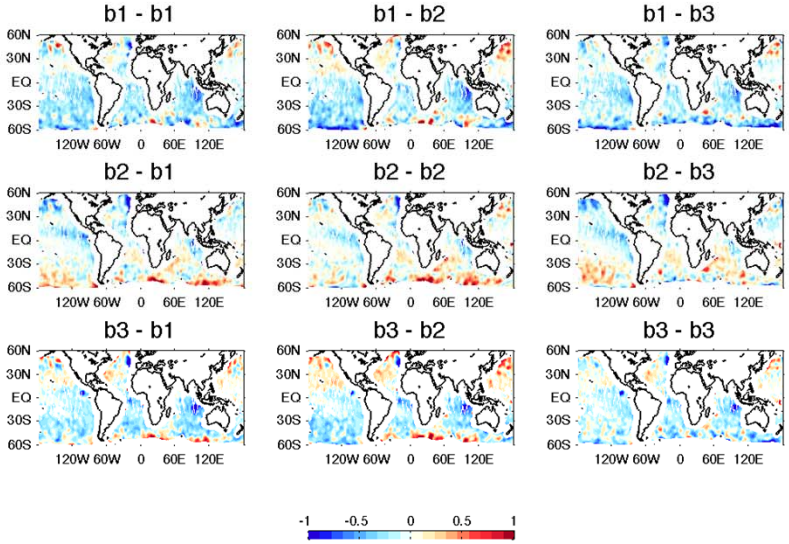


SSS - ascending minus descending
November in 2011 and 2012

November 2011

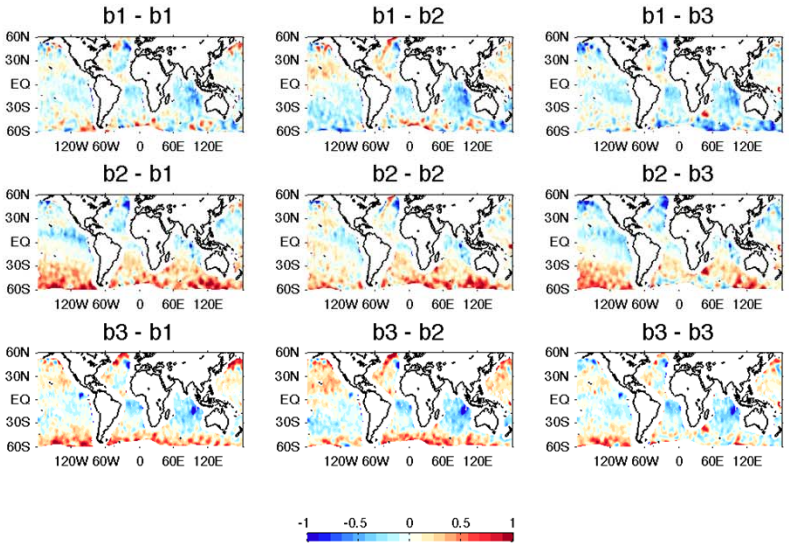


November 2012

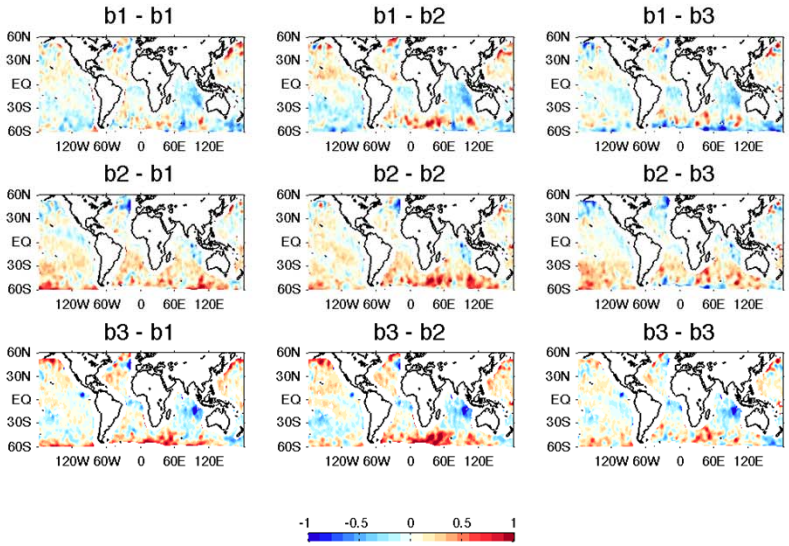


SSS - ascending minus descending **December** in 2011 and 2012

December 2011

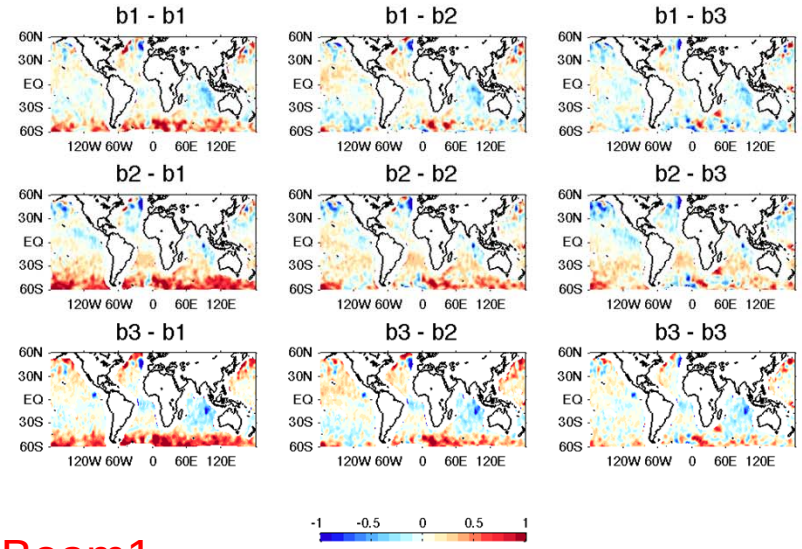


December 2012

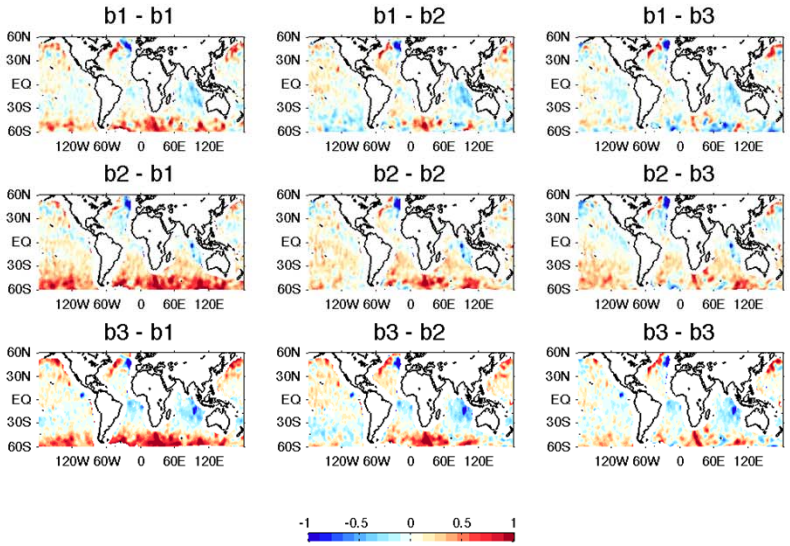


SSS - ascending minus descending **January** in 2012 and 2013

January 2012



January 2013

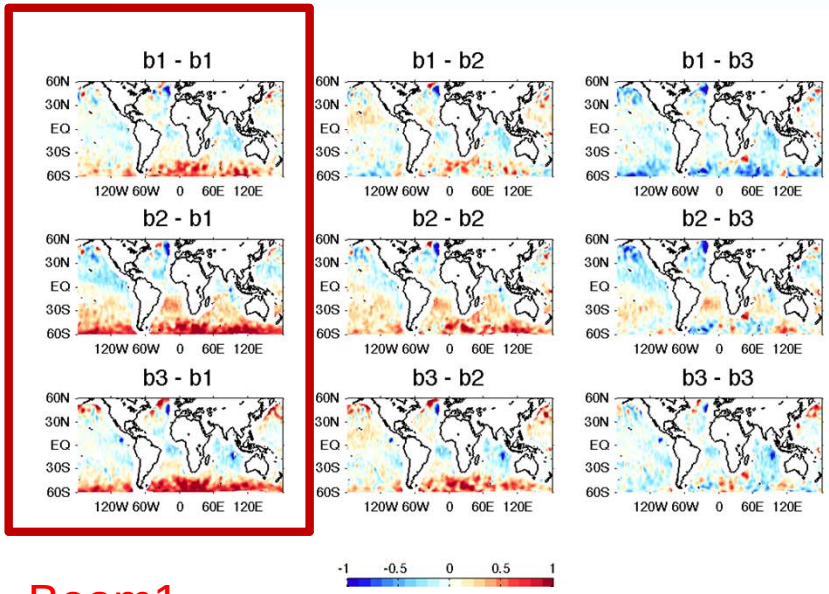


Beam1 descending

The more detailed SSS differences can be calculated from crossover difference on L2 data.

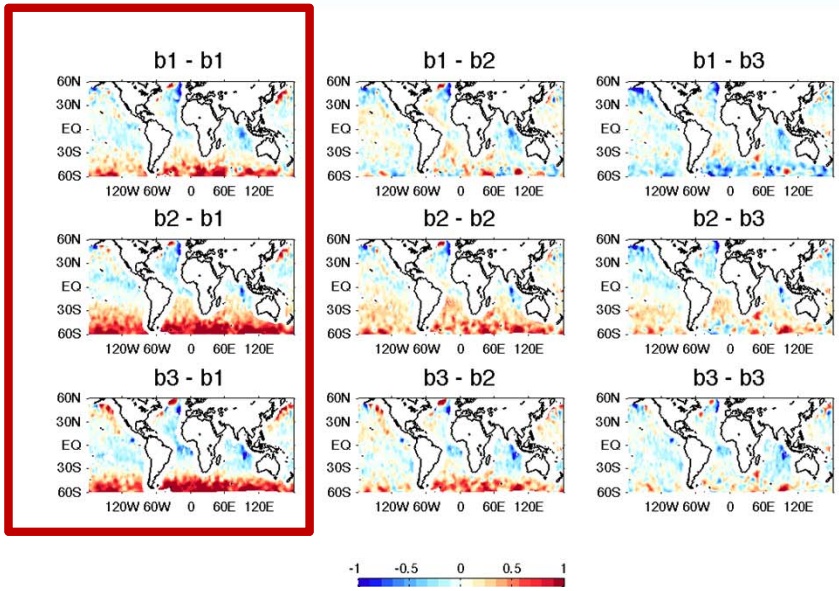
SSS - ascending minus descending **February** in 2012 and 2013

February 2012



Beam1 descending

February 2013



The more detailed SSS differences can be calculated from crossover difference on L2 data.

Summary

- The inter-beam comparisons help us find out the anomalous values among the three beams. It helps us to make the plots better, but the correction should be done in L1.
- This study helps to understand how bias may look like and to further find out the possible sources of these differences.
- The regional rain events can be well captured by Aquarius, although the actual SSS value still needs further calibration