

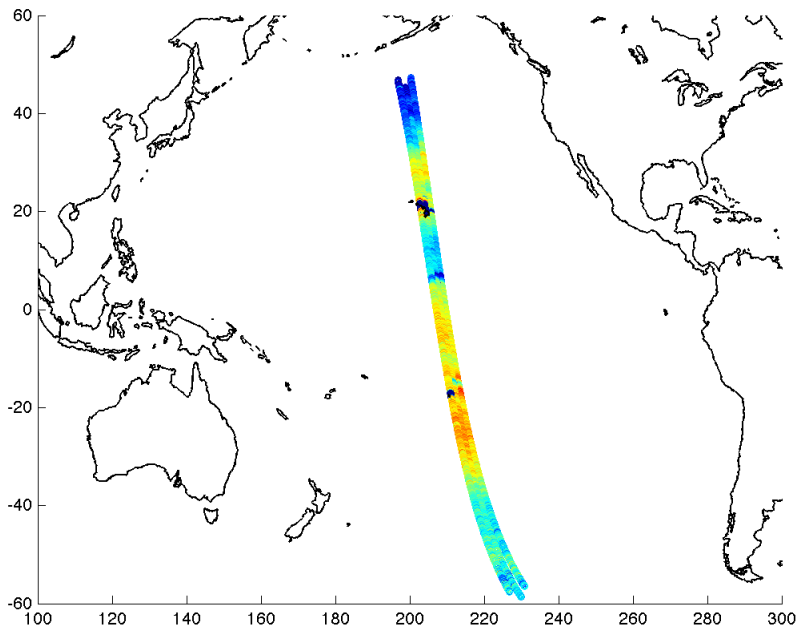
# Inter-beam differences analysis

One orbit in 2013

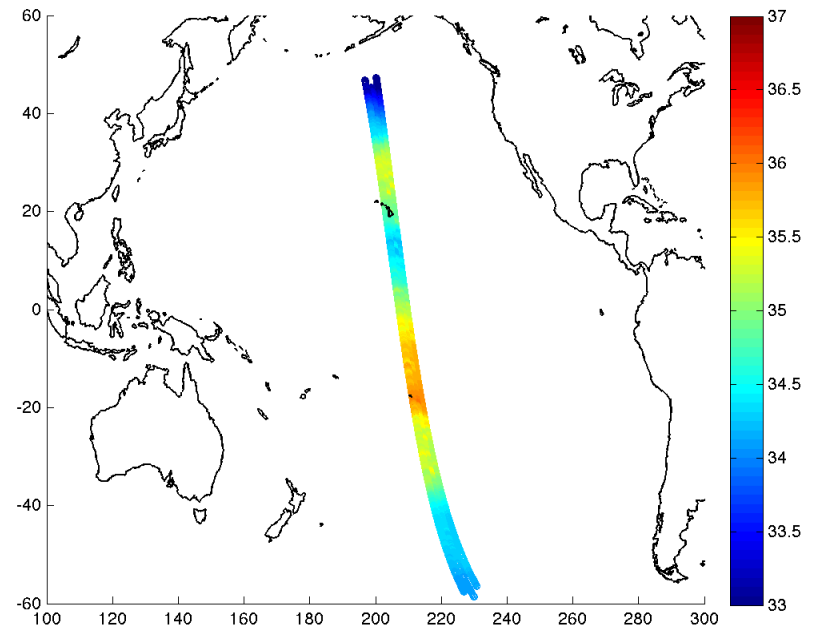
Hsun-Ying Kao and Gary Lagerloef

# The track used for interbeam difference analysis here

Aquarius

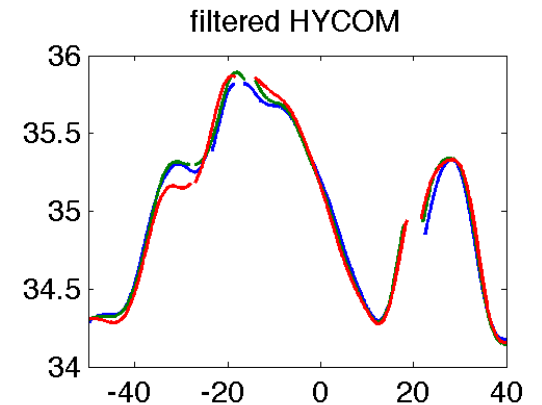
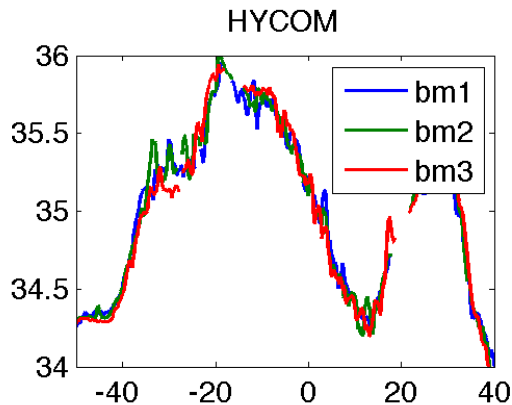
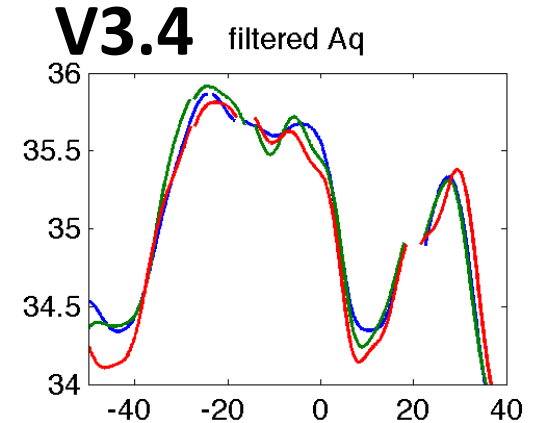
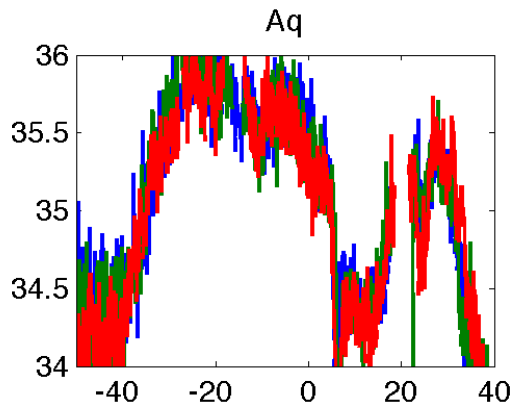
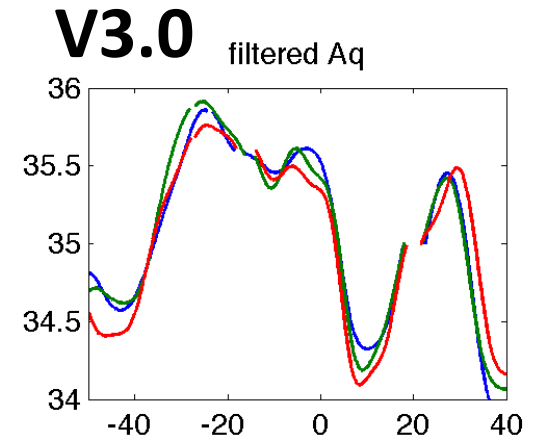
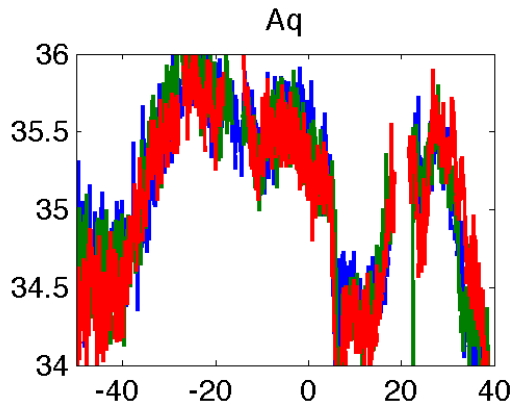
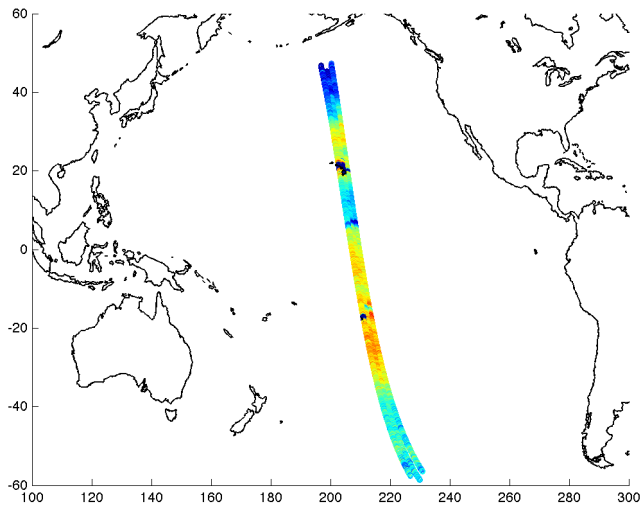


HYCOM

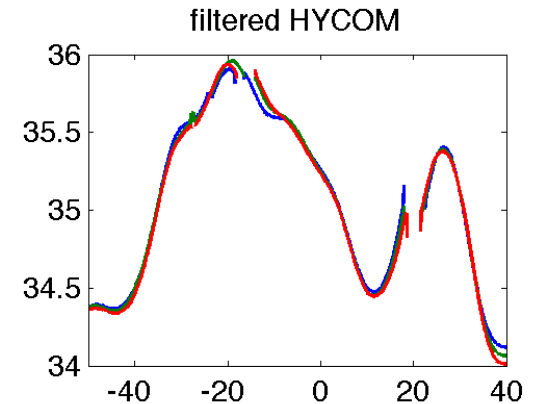
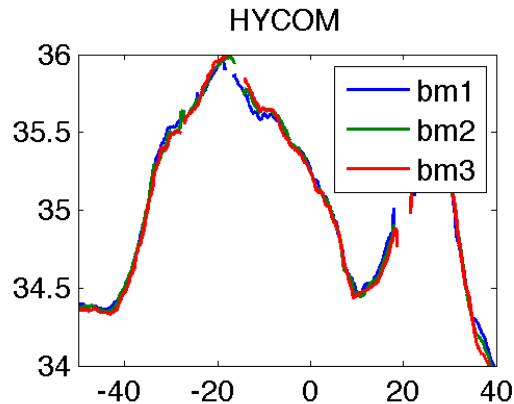
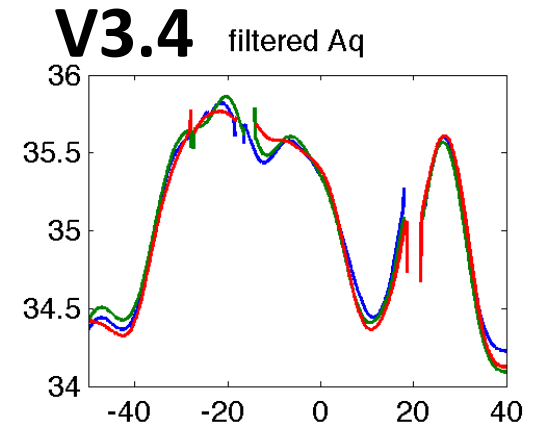
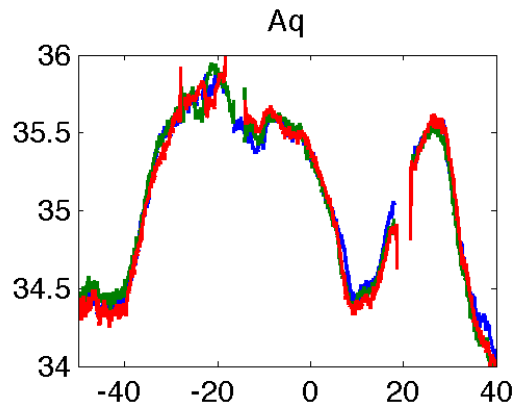
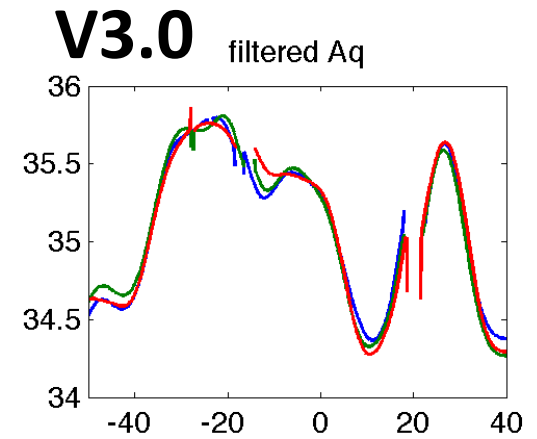
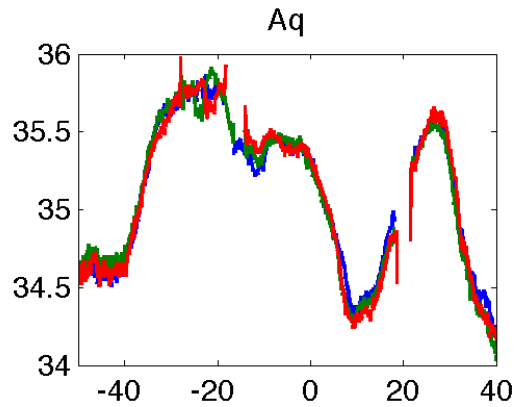


One of the longest tracks observed over the open ocean.

# SSS along one of the tracks in one day in 2013



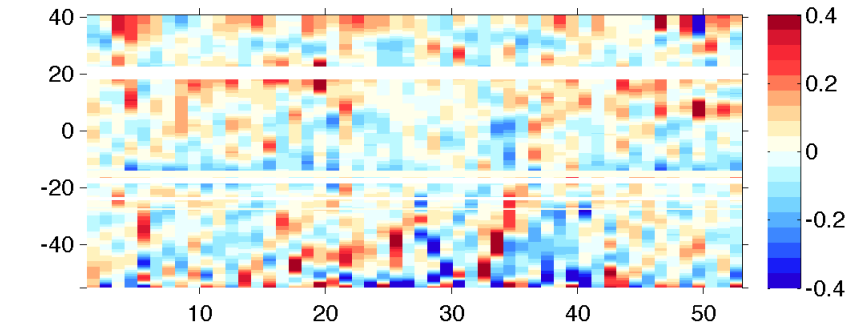
SSS along one  
of the tracks  
averaged  
whole 2013



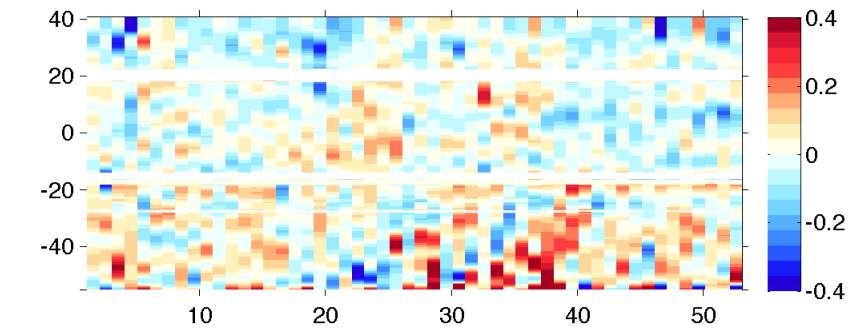
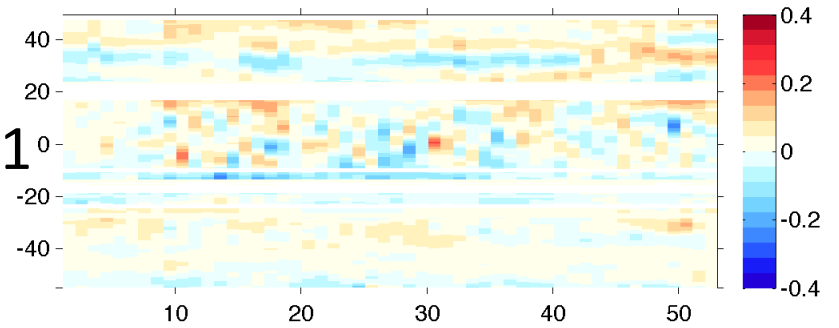
# Weekly dSSS along the track in 2013

Aquarius

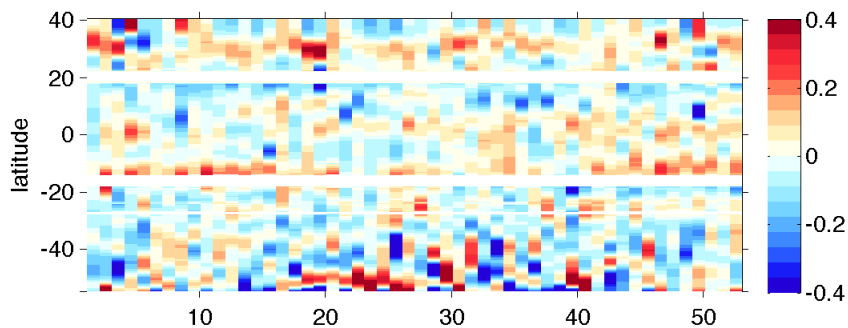
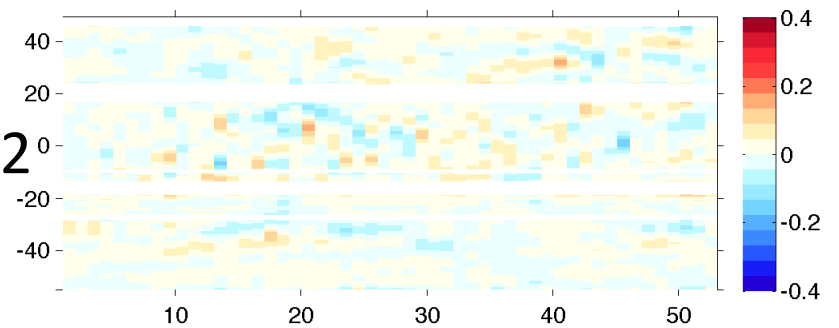
HYCOM



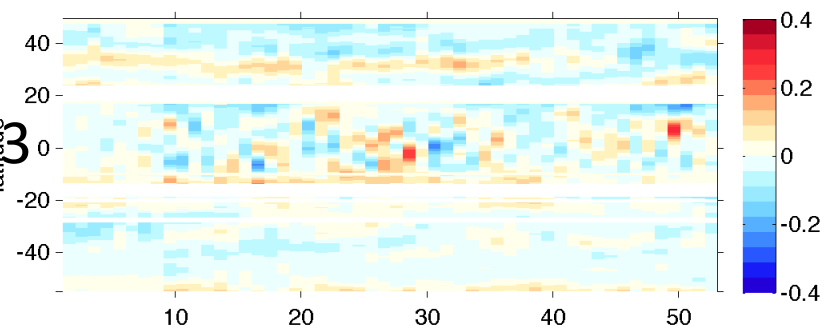
Bm-1



Bm-2



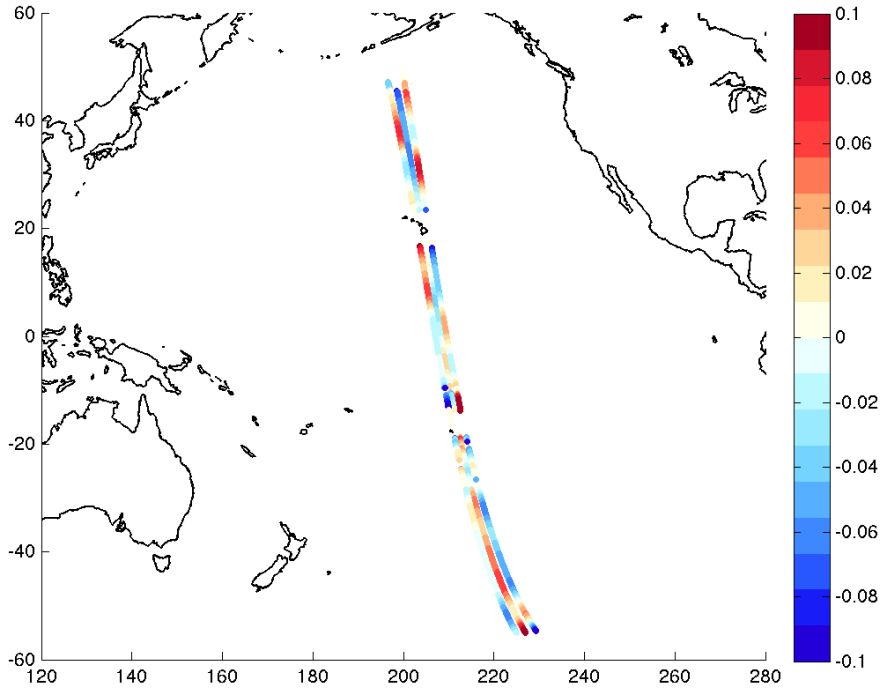
Bm-3



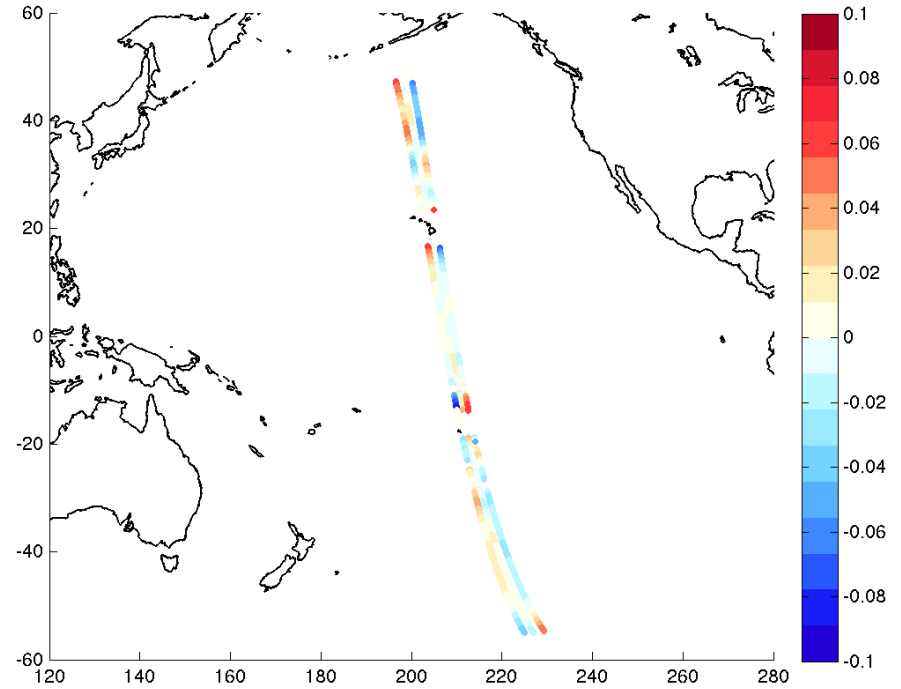
Land fraction 0.001 is used

# 1-year median of the interbeam difference

Aquarius



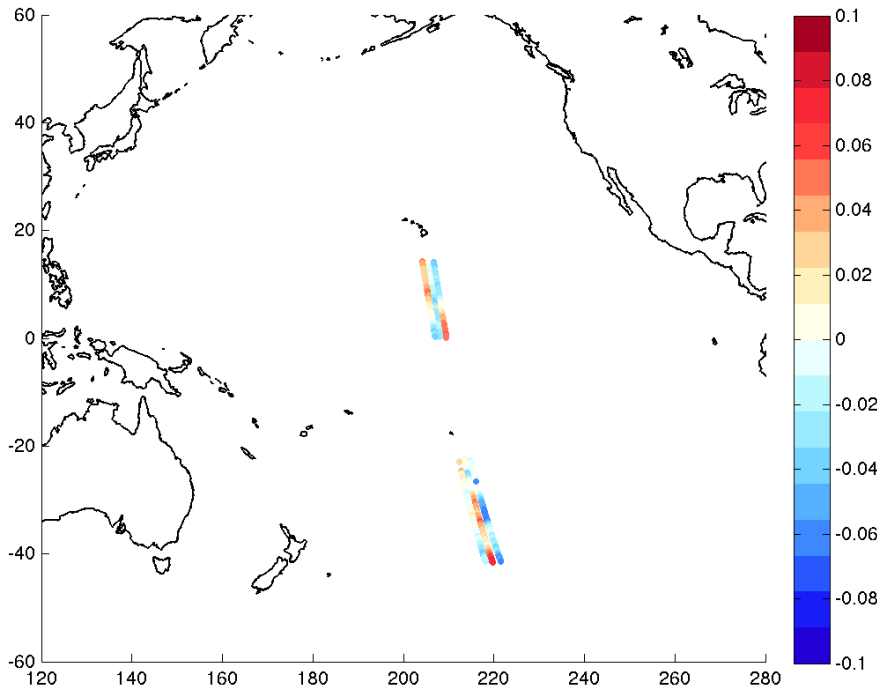
HYCOM



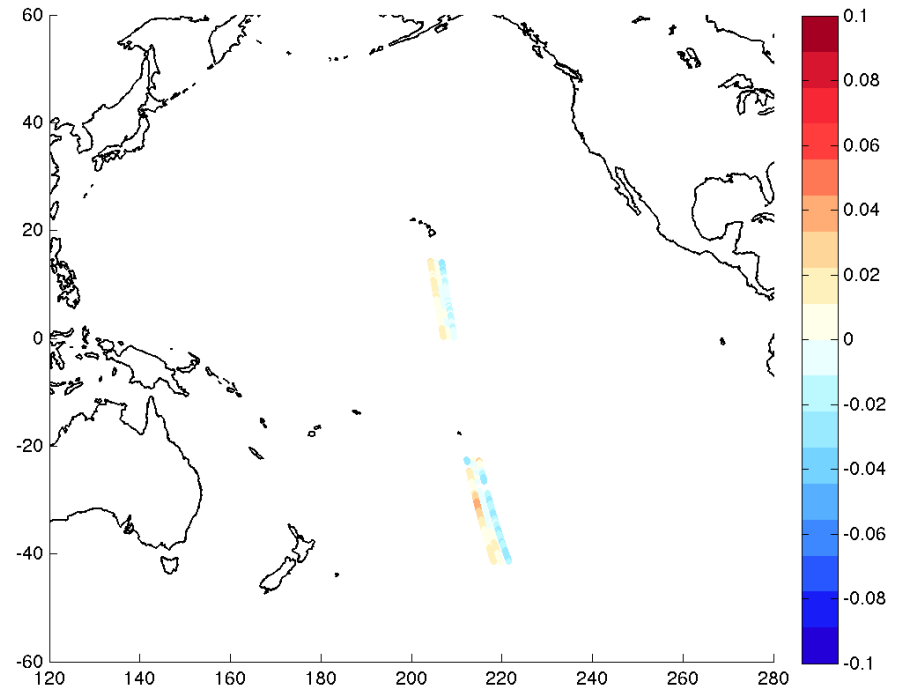
# Median of 1-year interbeam difference

## Zoom-in

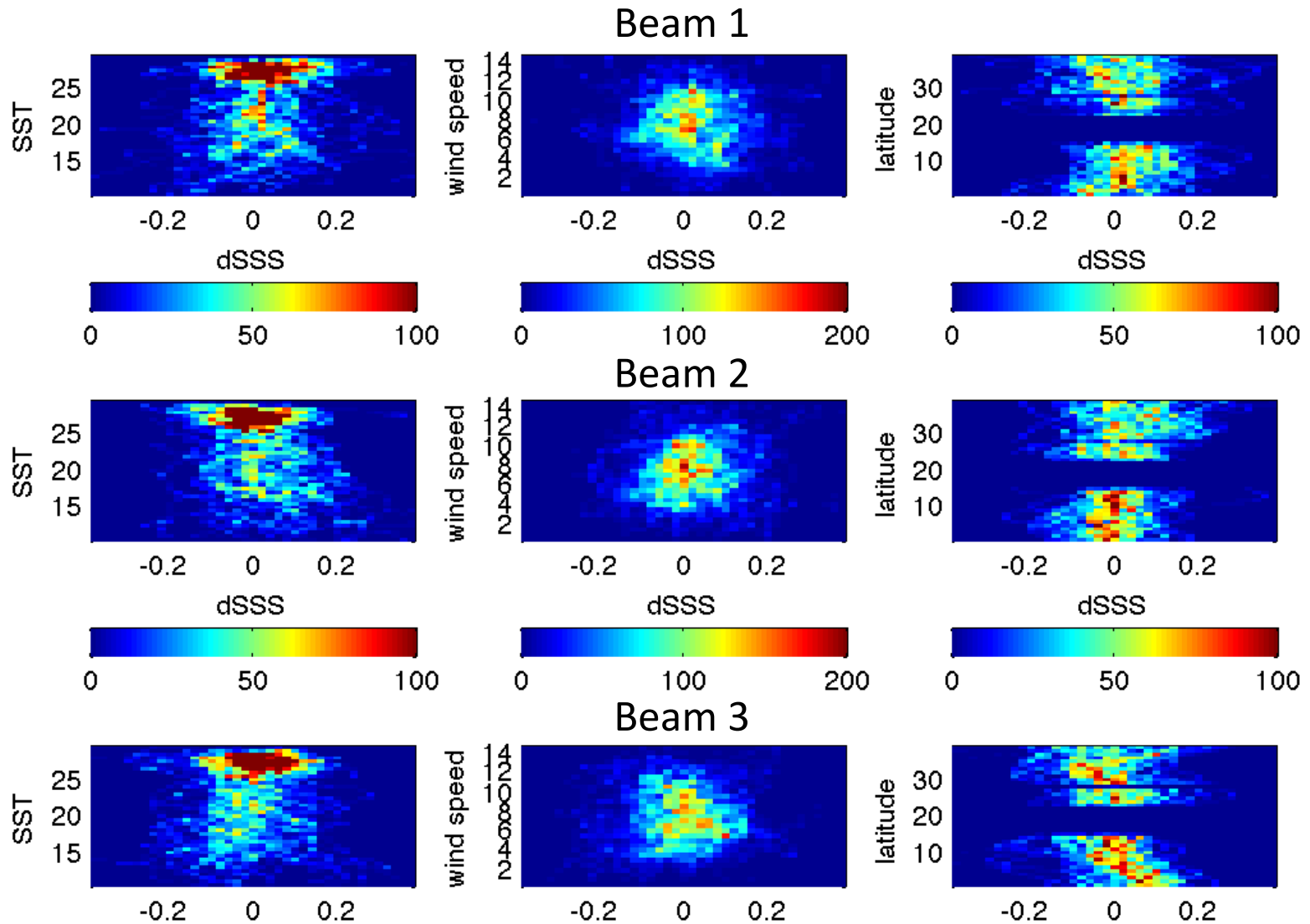
Aquarius



HYCOM



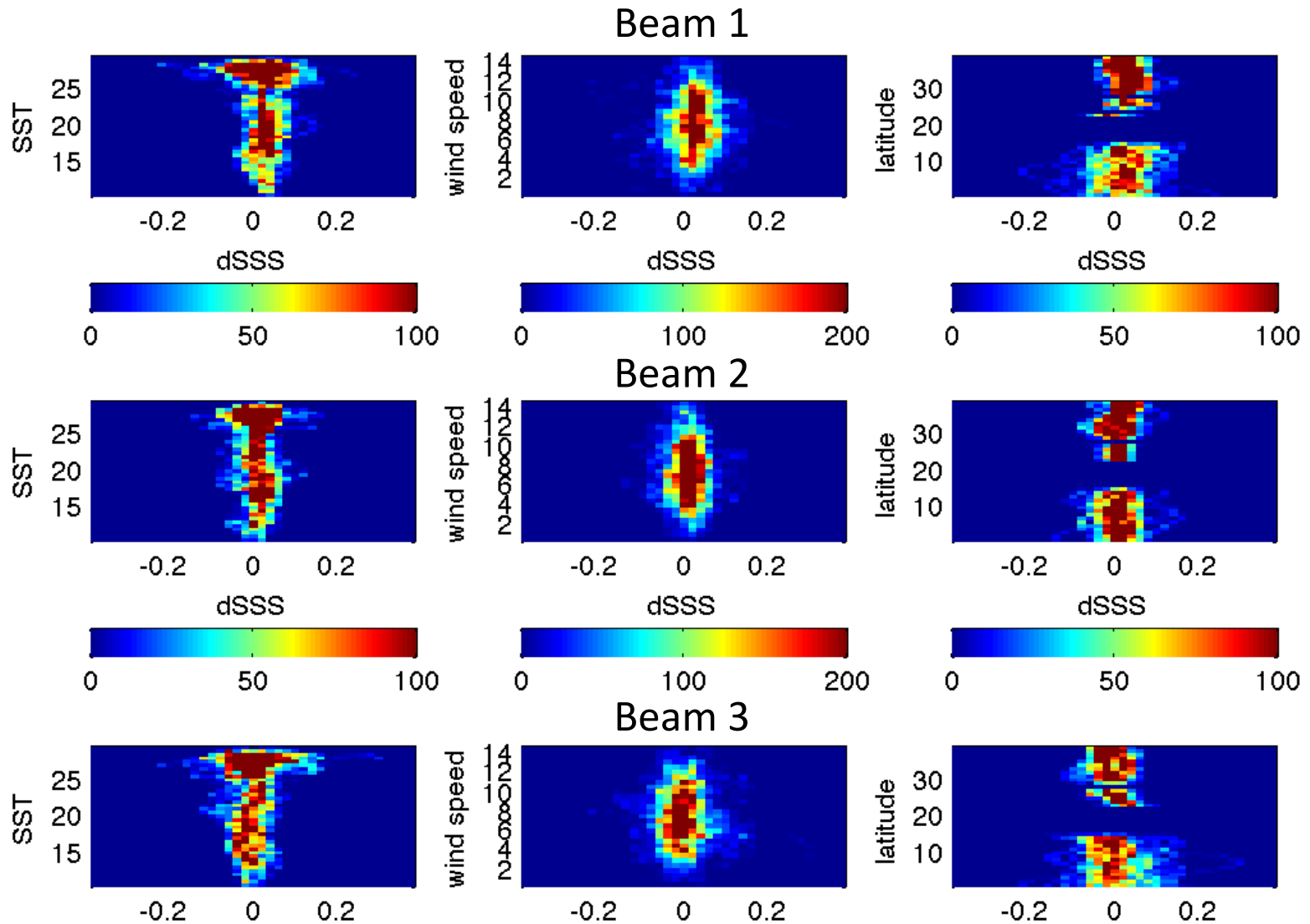
# Aquarius dSSS vs SST, wind speed and latitude



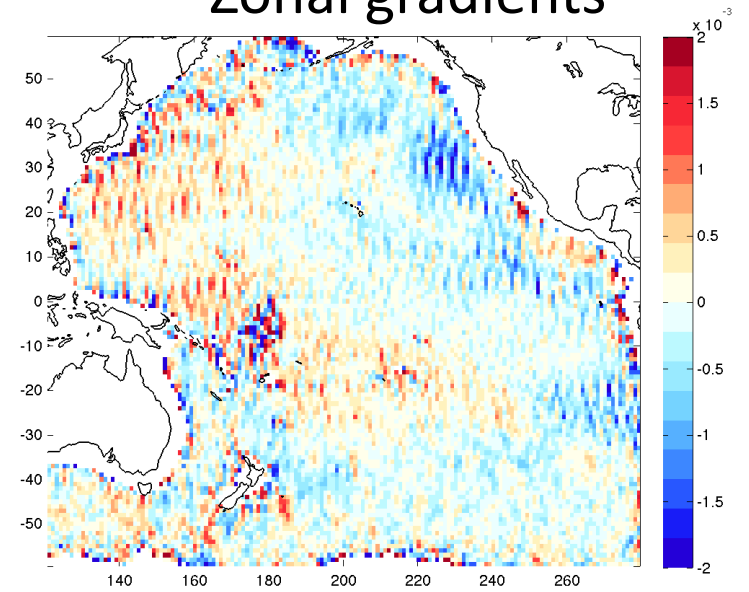
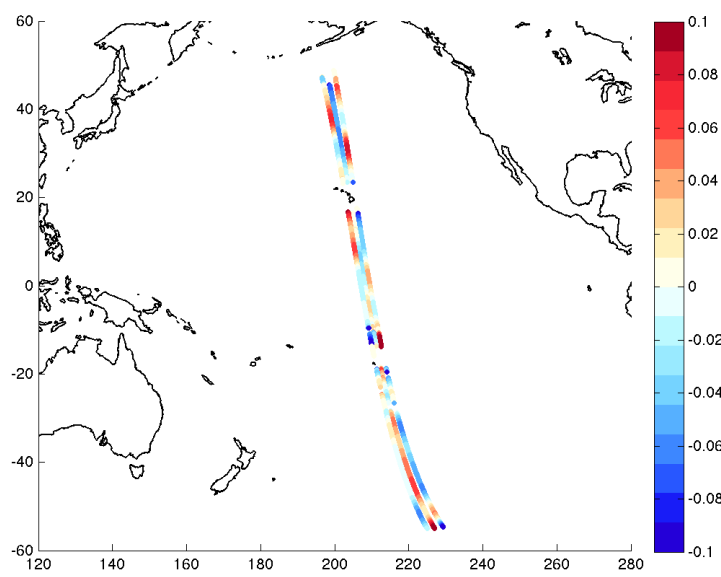


# HYCOM dSSS

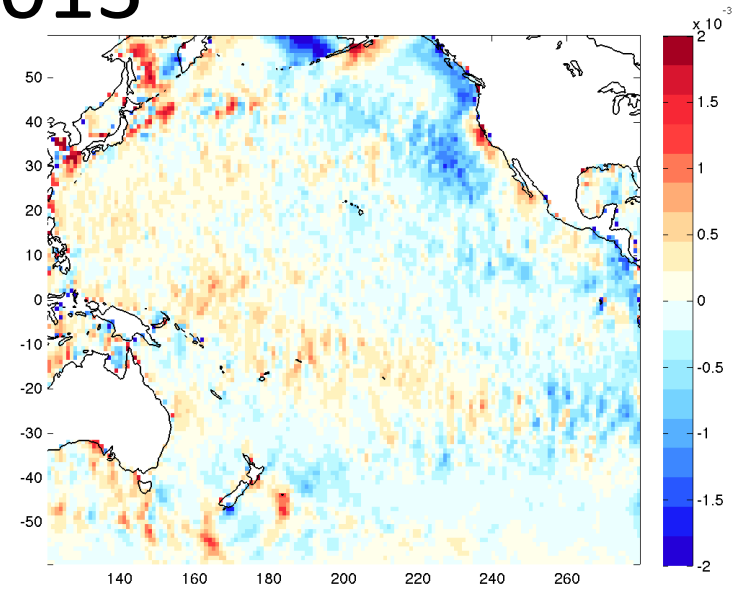
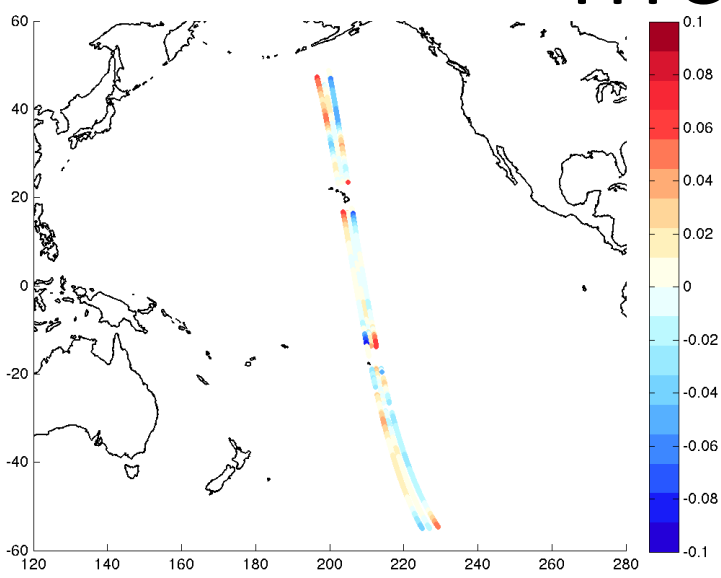
## vs SST, wind speed and latitude



# median of the interbeam difference **Aquarius 2013** Zonal gradients



# HYCOM 2013

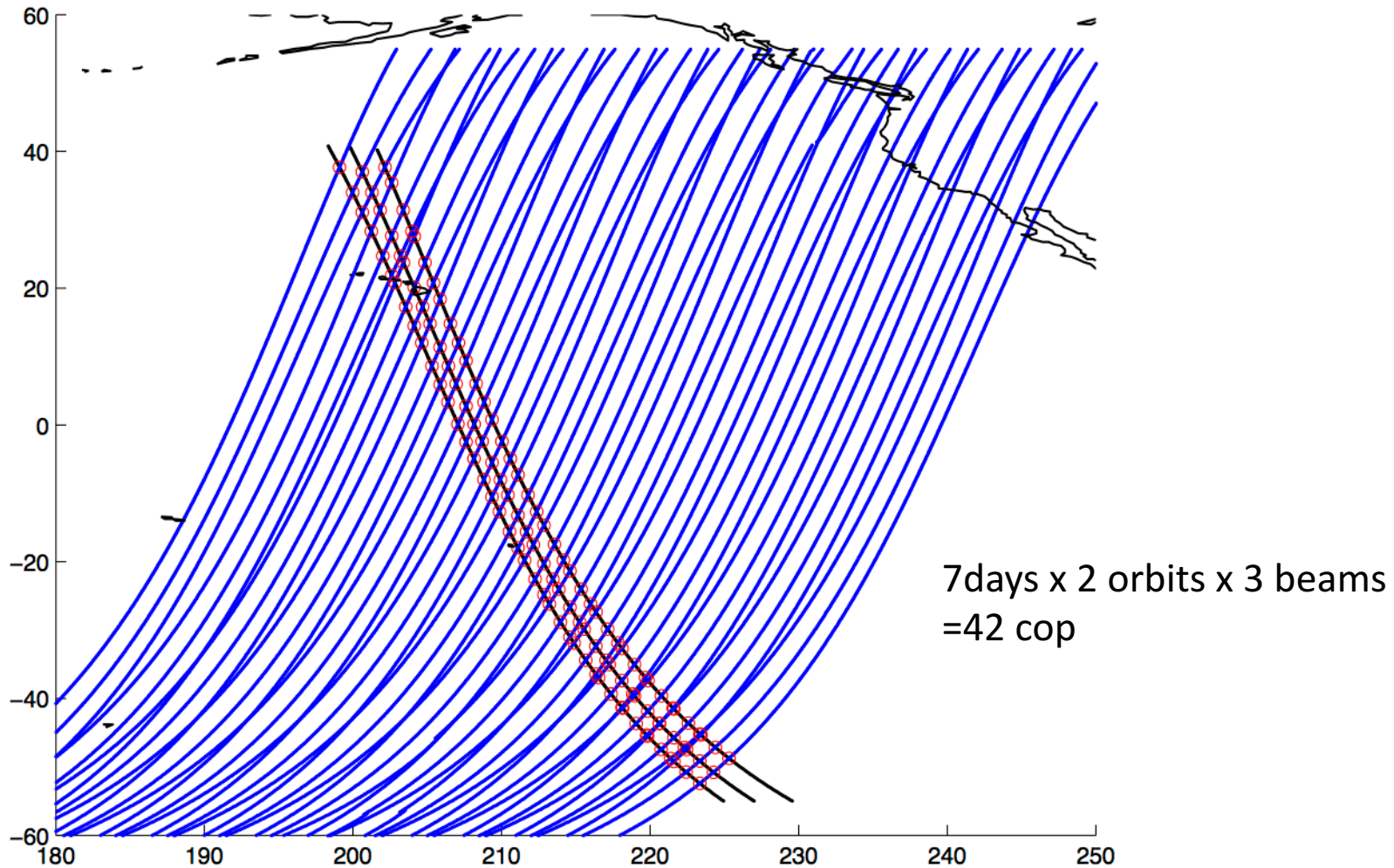


# Using crossover differences to remove the orbit errors

- Problem: Too much noise and variance that overwhelms the signal of the orbit errors
- Solution:
  1. use low pass filter to remove the high frequency noise and small-scale variance
  2. use annual mean to reduce the time variance

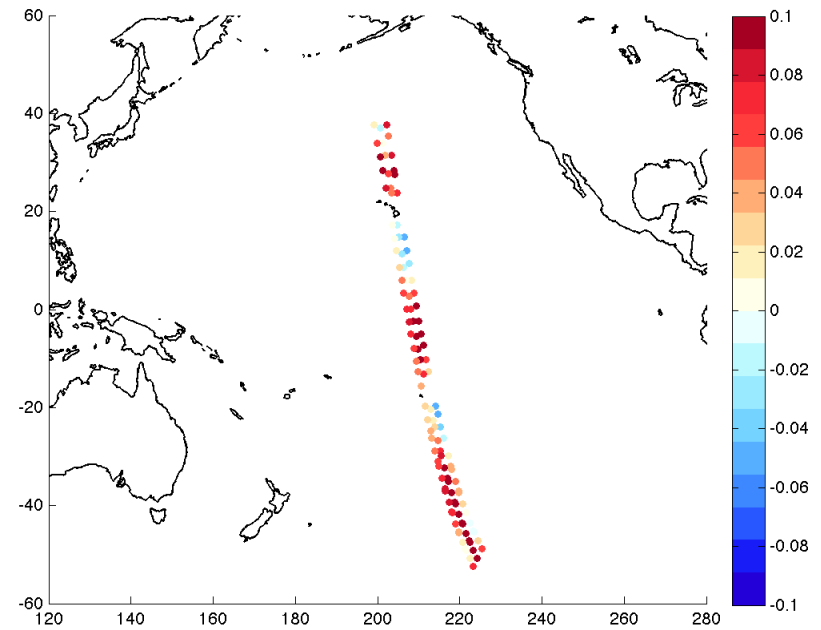
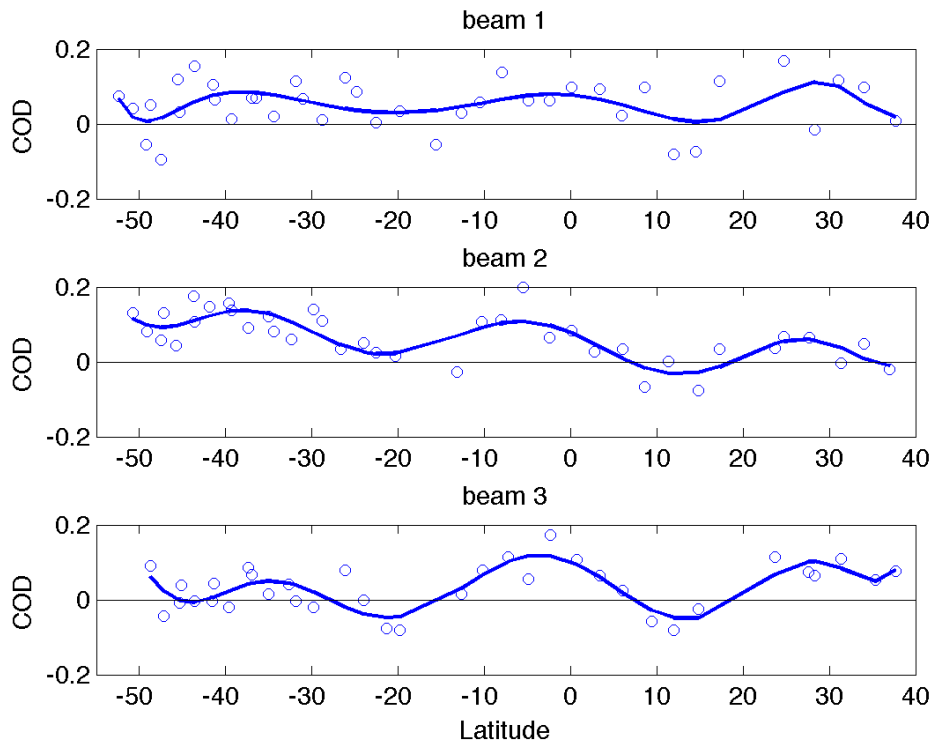
# Cross over points

assumption: at the crossover points, the SSS from the asc and des tracks should be the same (small diurnal changes)



# Cross over differences

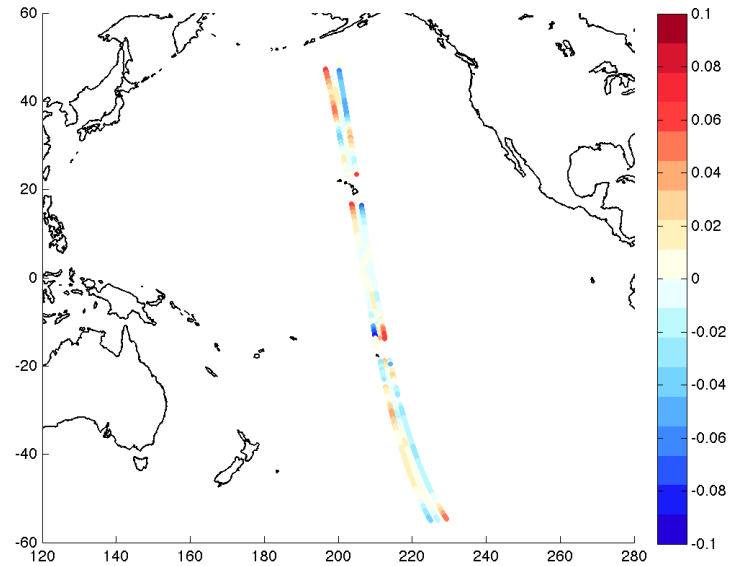
## ascending - descending



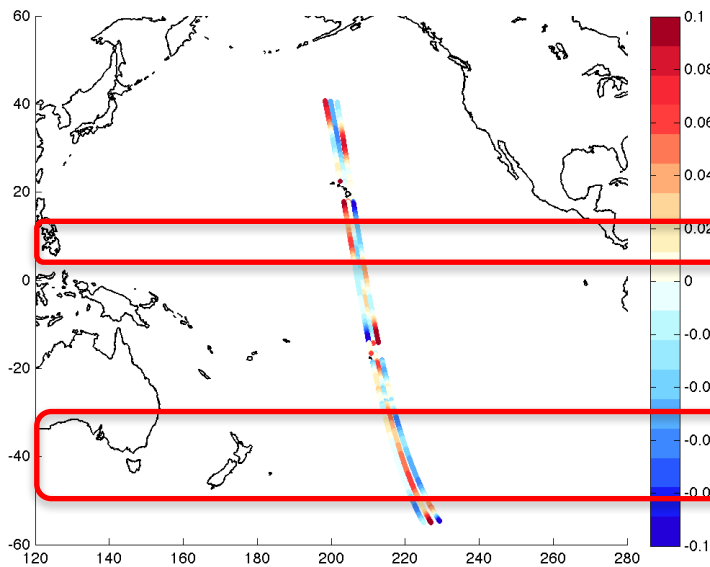
Cross over differences (circles) and the polynomial fit (lines) that represent the orbit errors

median of the  
interbeam difference

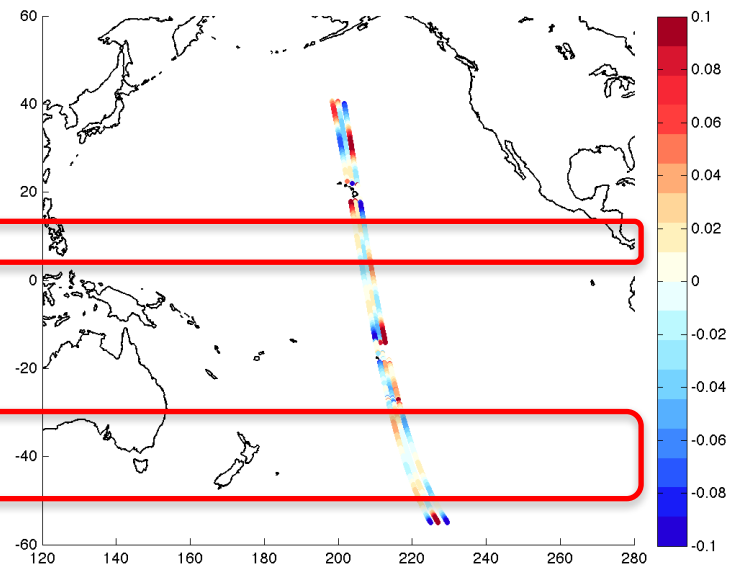
HYCOM



Aquarius V3.4



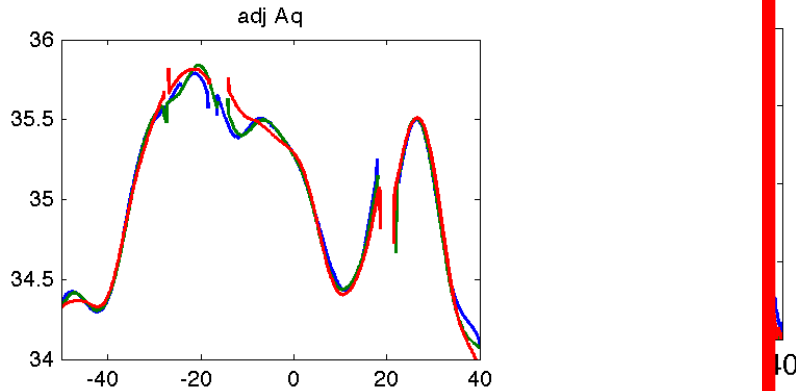
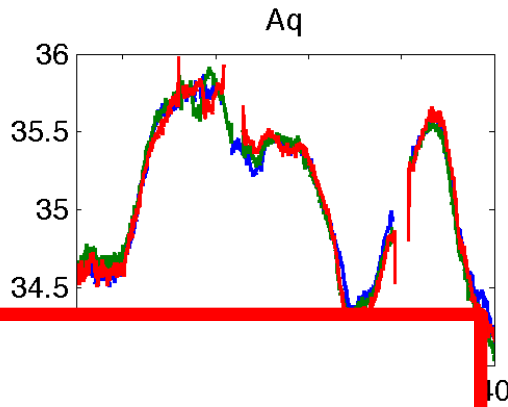
Aquarius V3.4 with orbit error removed



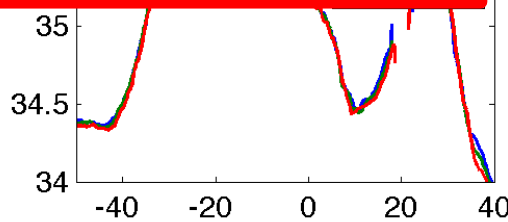
SSS along one  
of the tracks

a

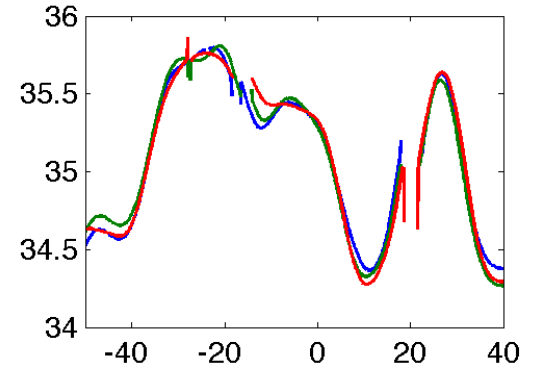
wh



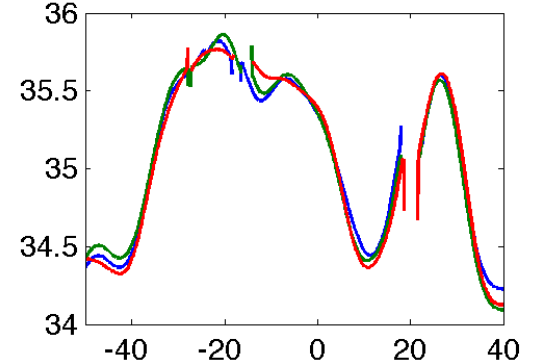
Reduced interbeam differences and  
SSS at 40N becomes closer to HYCOM



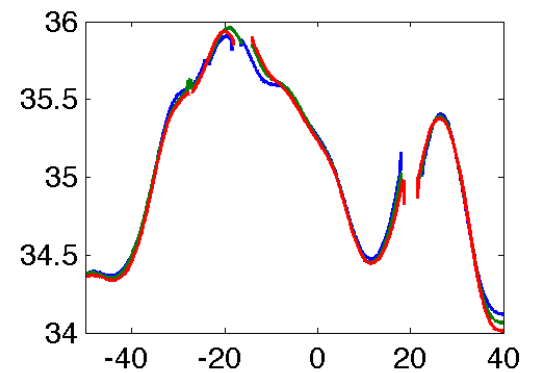
**V3.0** filtered Aq



**V3.4** filtered Aq



filtered HYCOM



# Summary

- It's unclear what causes the interbeam differences, but the cross-over differences can be useful finding the orbit errors and further reduced the interbeam differences.
- Advantage of using crossover differences is to find the actual value of the orbit errors without including any reference SSS values

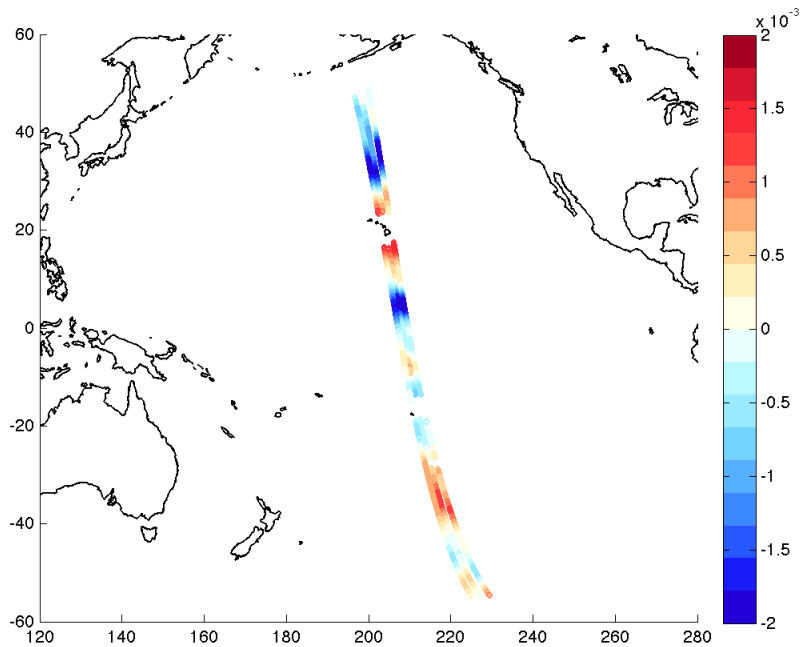


backup

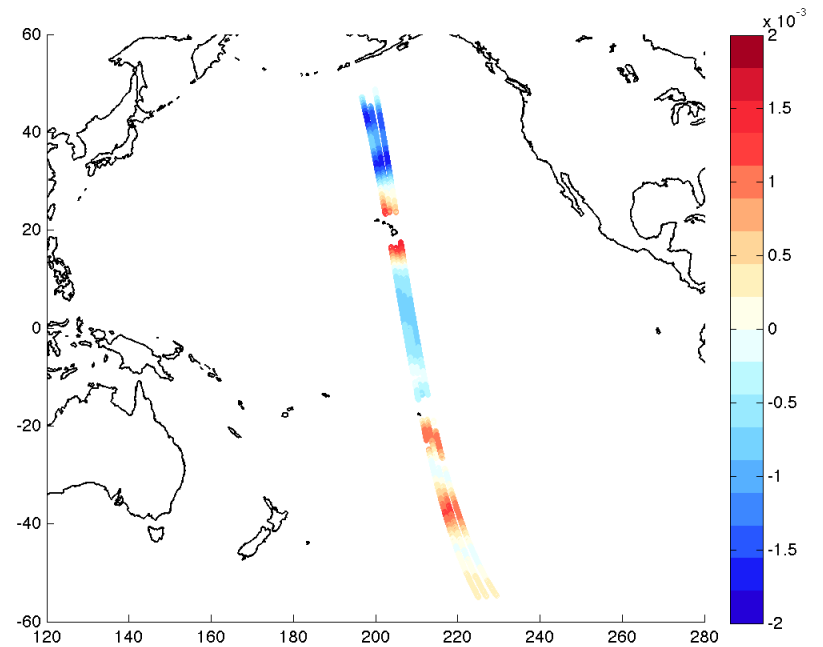
# Salinity gradients along the track

psu/km

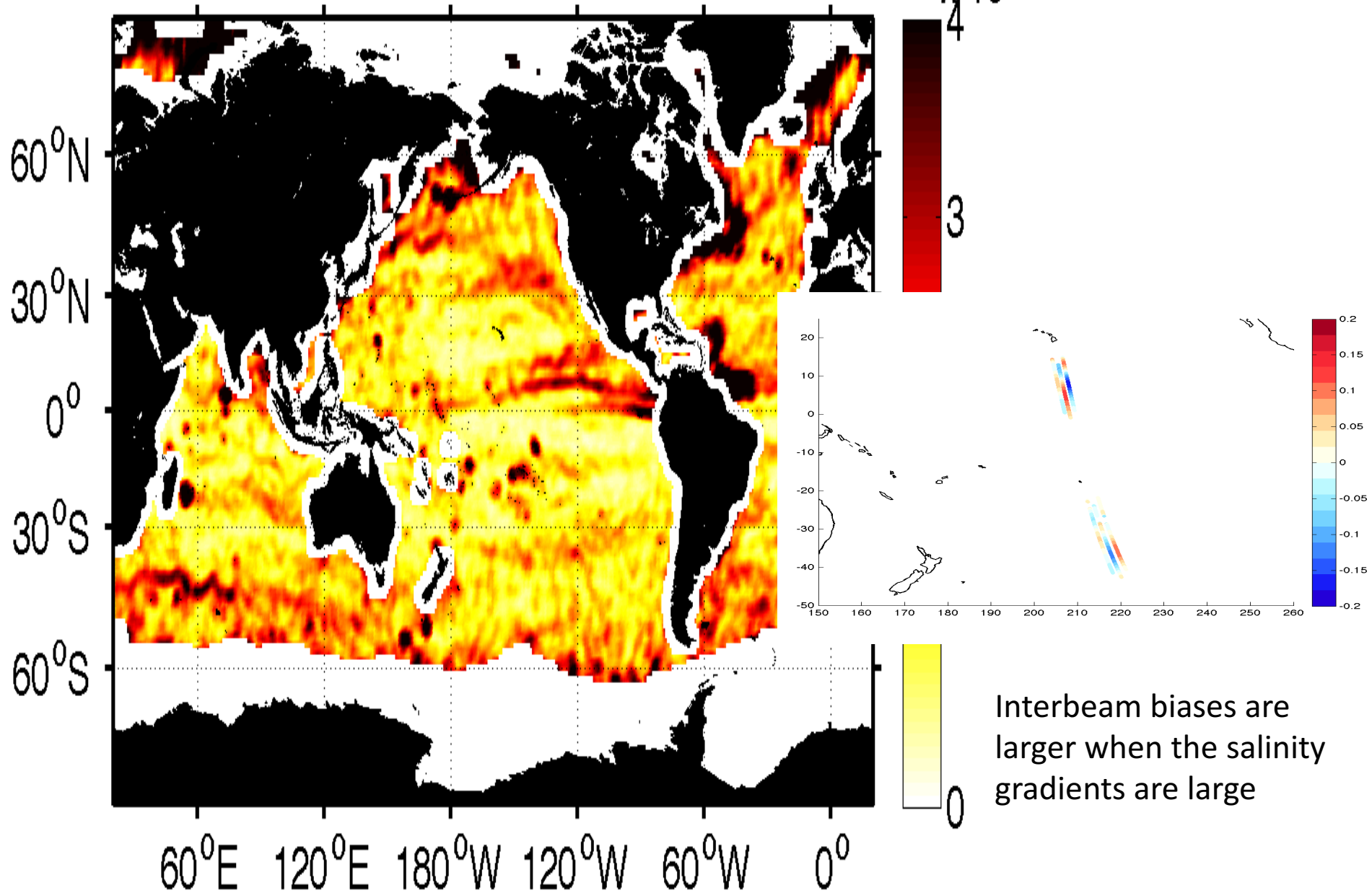
Aquarius



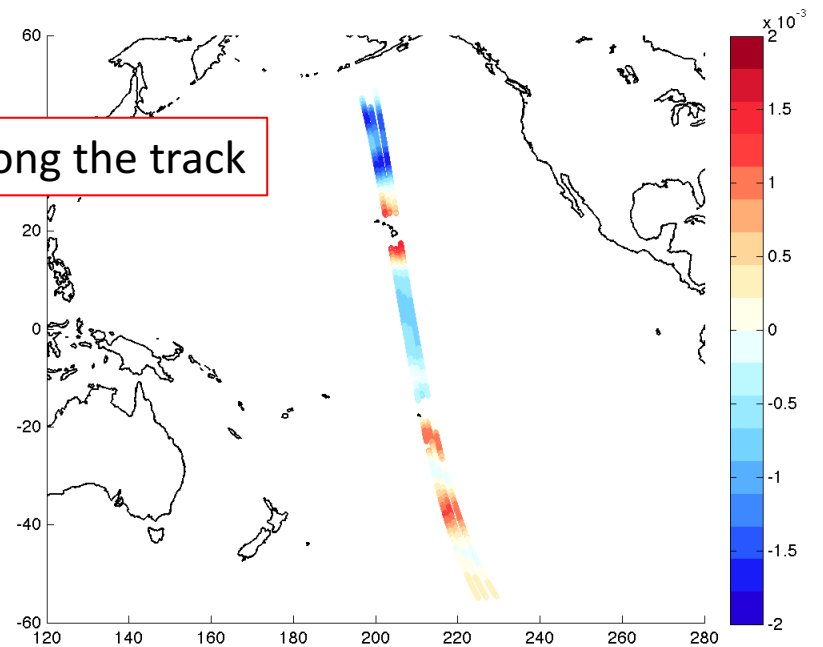
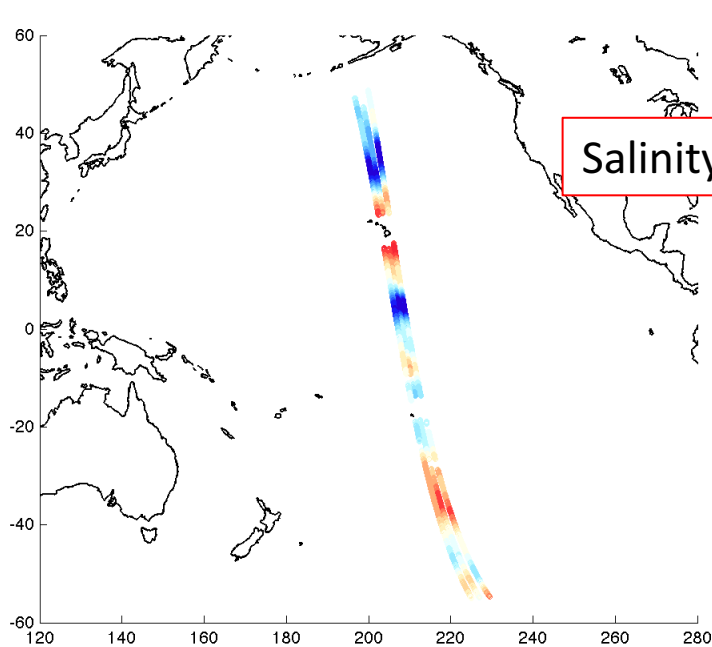
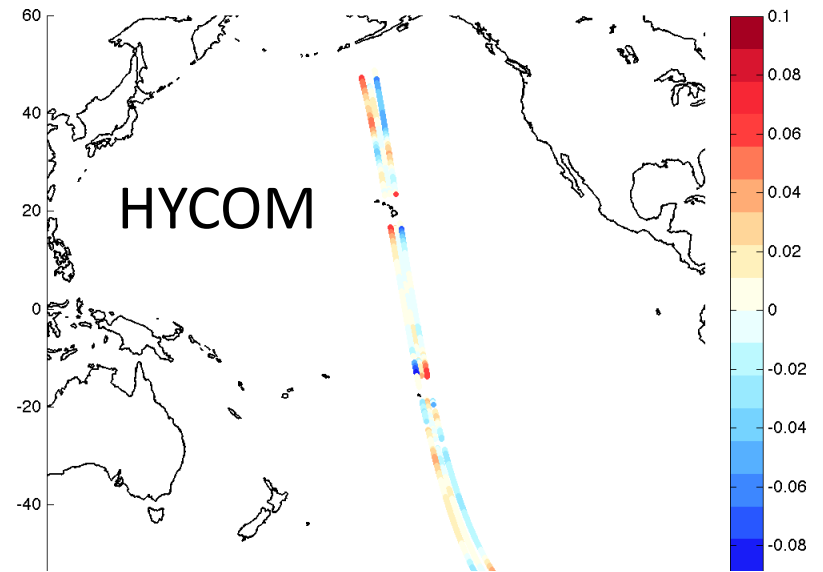
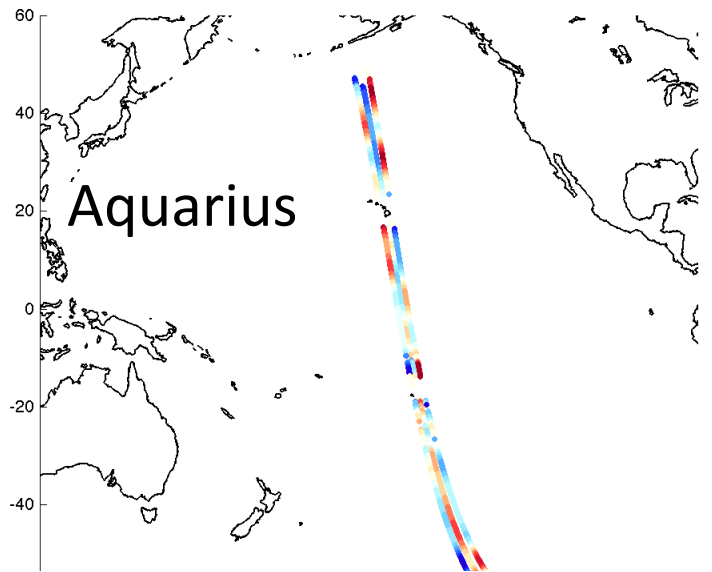
HYCOM



# Aquarius S grad SEP/2012



# 1-year mean of the interbeam difference



Salinity gradient along the track