

# EVALUATION OF SEA SURFACE SALINITY VARIABILITY IN THE EAST CHINA SEA OBSERVED BY THE AQUARIUS INSTRUMENT

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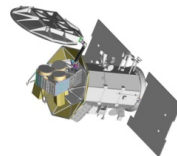
Paolo de Matthaeis (GSFC)

Data provision by I.C. Pang, Jeju Natl. Univ., S. Korea

Funded by OSST

Results available in JGR 2014 special issue.

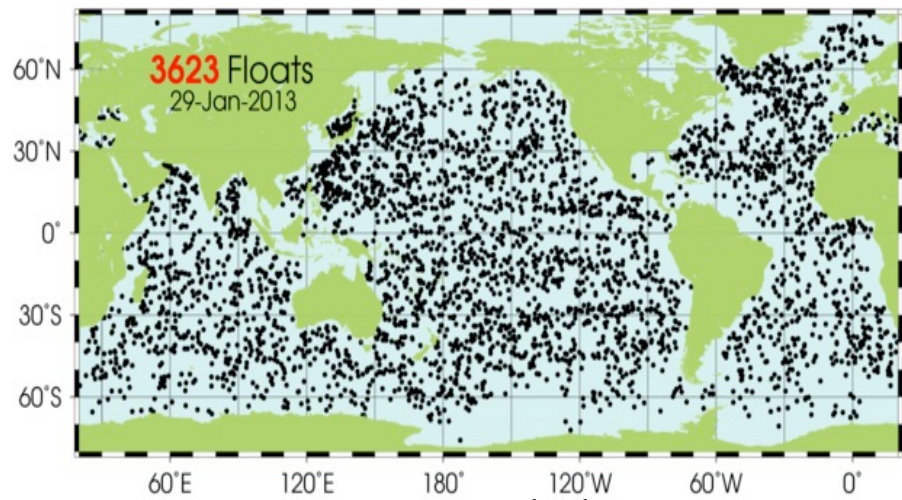
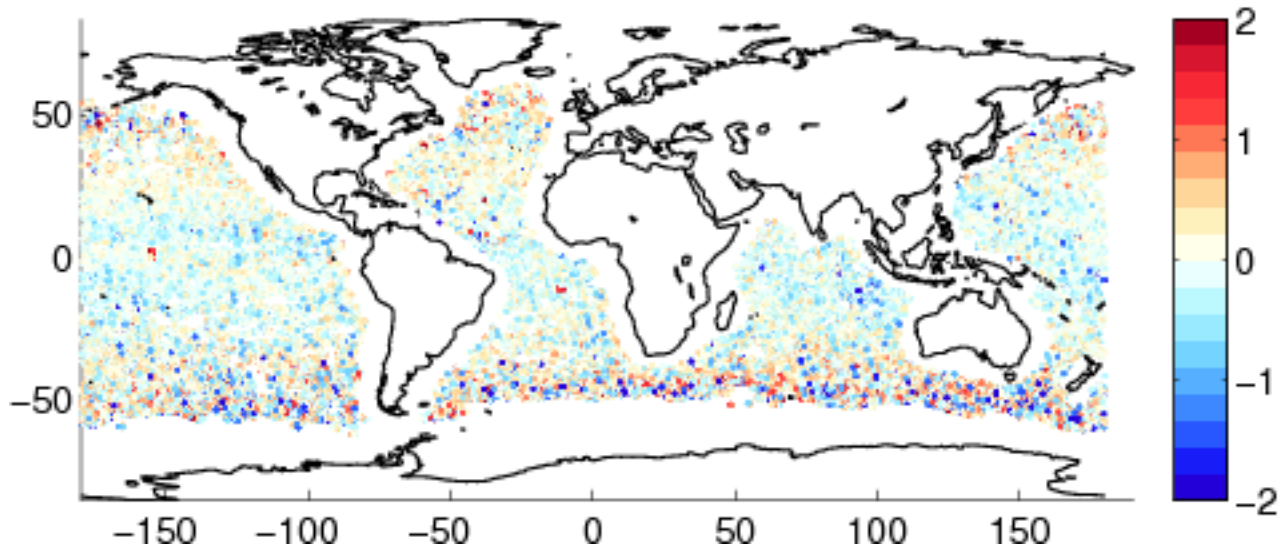
# Motivation



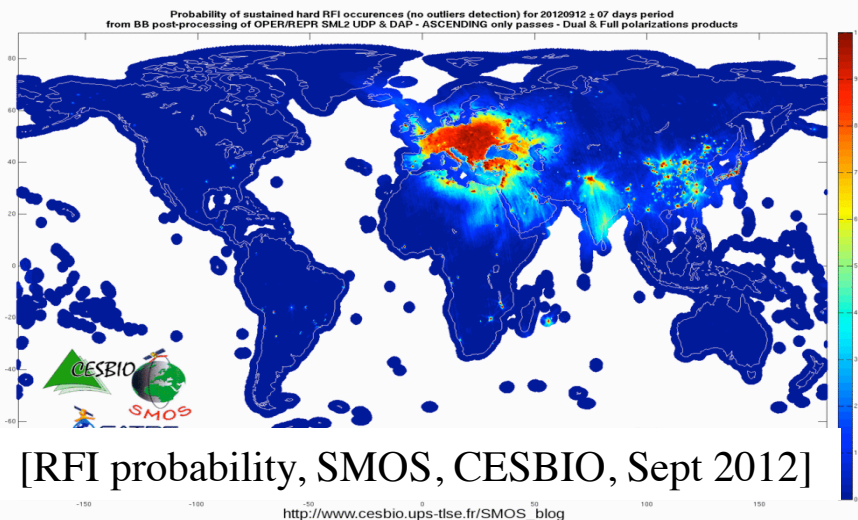
- Challenging retrieval
  - Land contamination
  - Radio frequency interference
- Routine monitoring of SSS
  - Lacking (East China Sea)
  - Discontinued
- 5<sup>th</sup> largest river runoff

Aq SSS – in situ SSS

[Lagerloef, ESR]

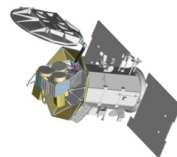


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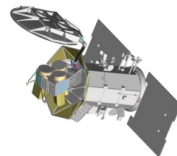


# Outline

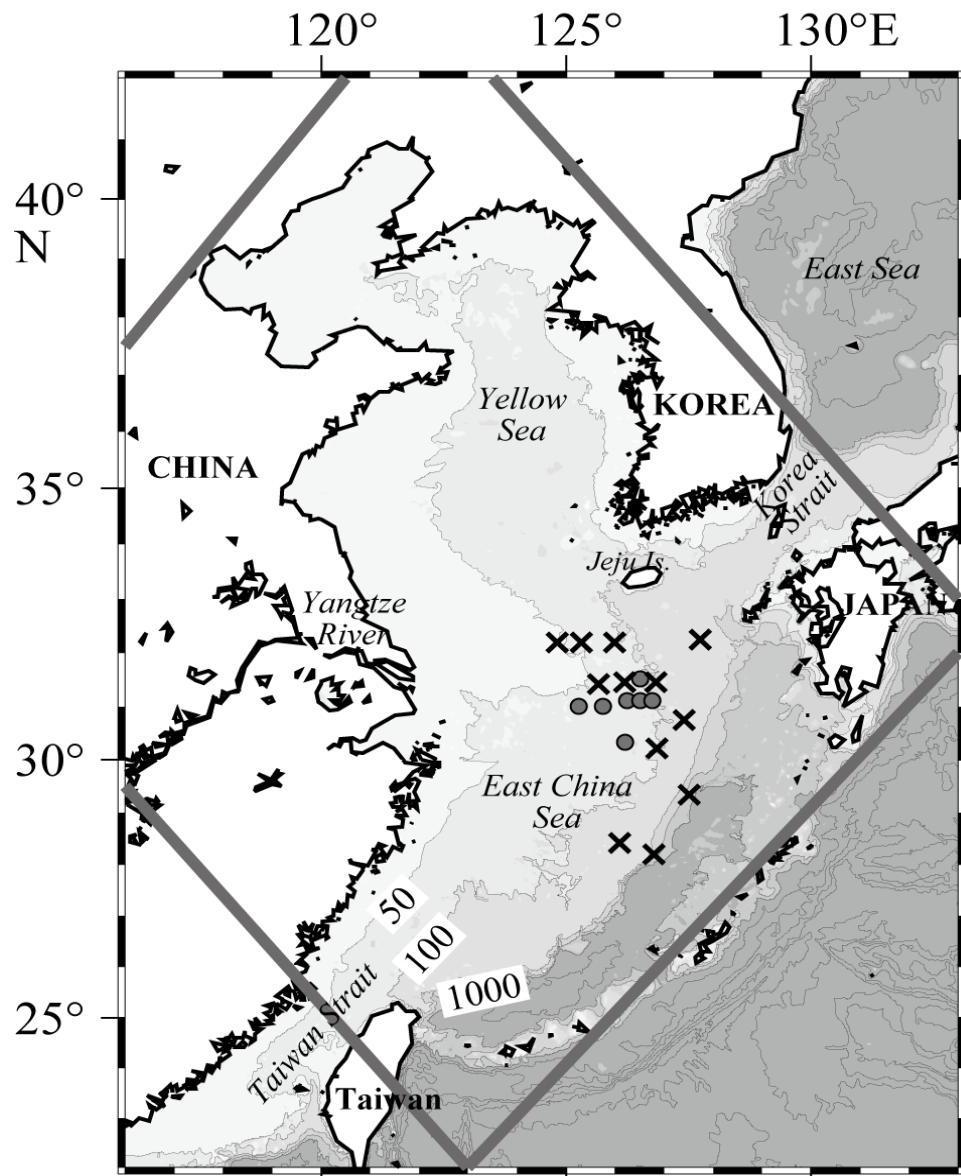


- Motivation
- Evaluation
  - Using in situ data
  - Using regional ROMS model with simultaneous river input
  - Effects of land contamination and RFI
- Science
  - Upper ocean salinity balance
  - Impact from the regional drought
- Used v2.5.1 standard product

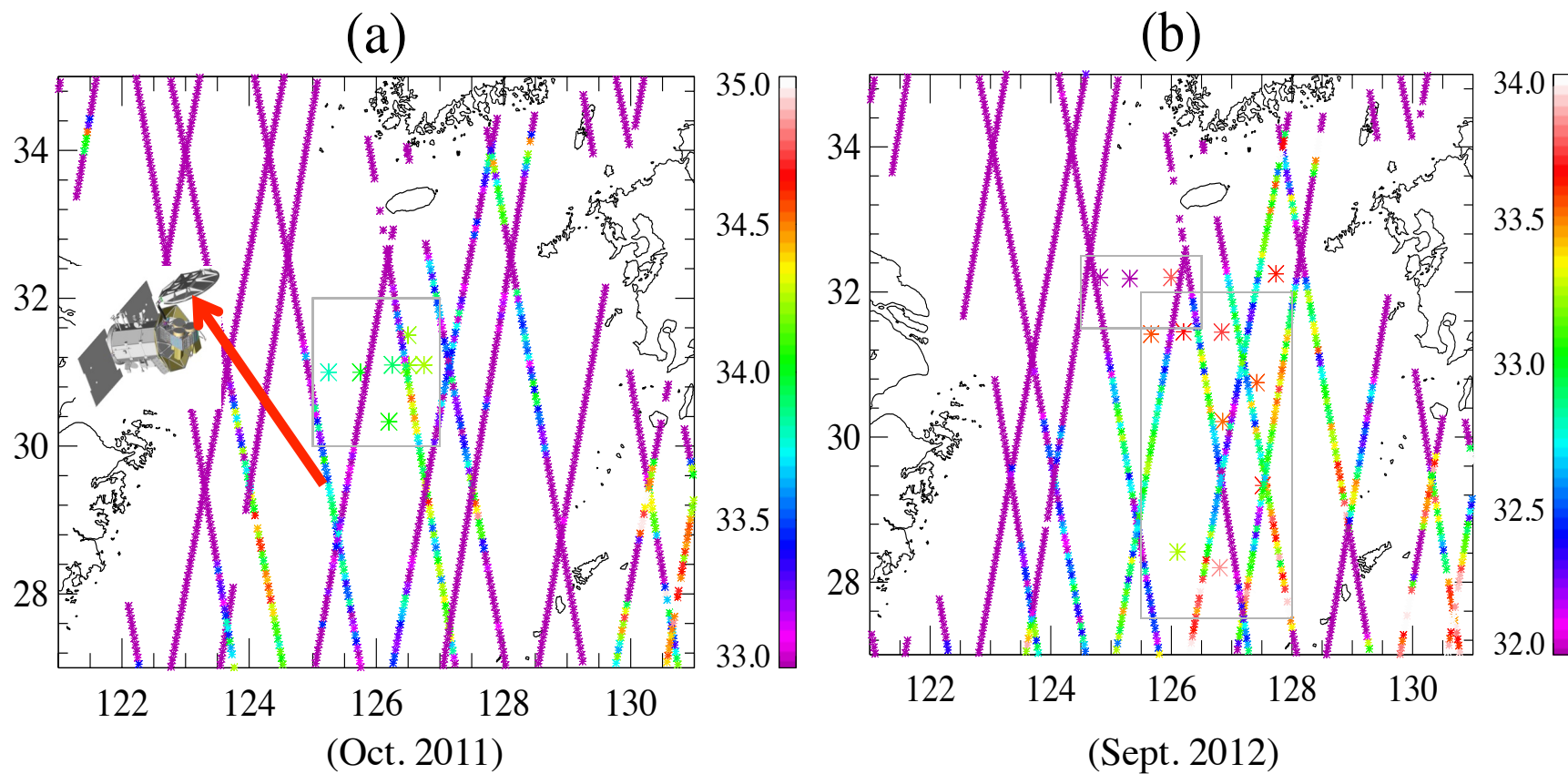
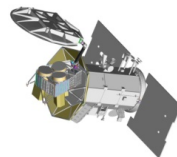
# In situ observation



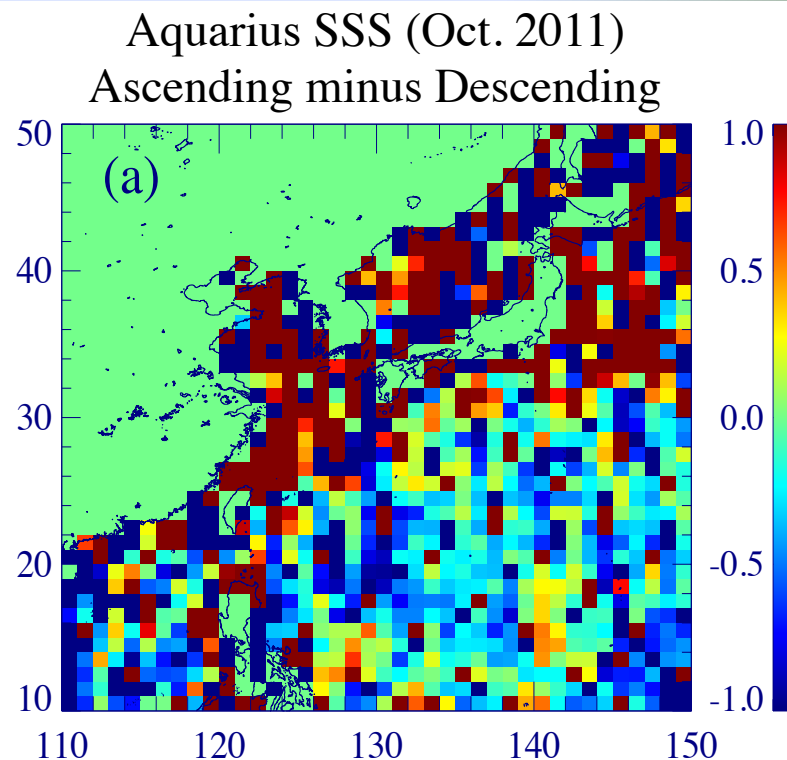
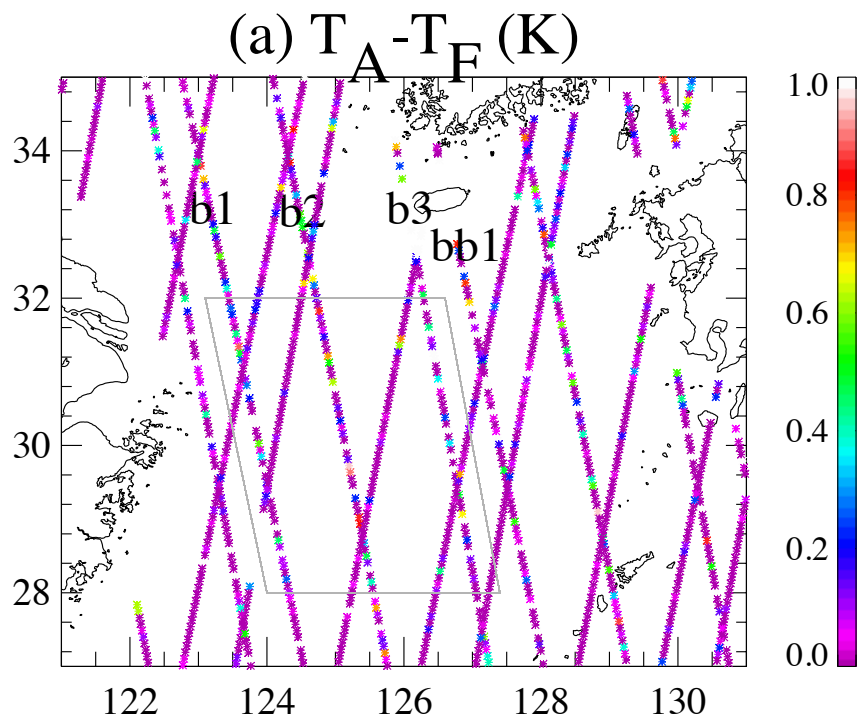
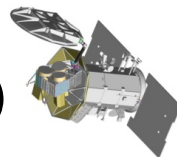
- By Korea Ocean Research Dev. Inst and/or Japanese collaborators
- CTD salinity record at 0.5m depth (2011); 2-5m (2012; three are 7-10m)
- Early October 2011 (O) ; late September 2012 (X); weak solar insolation/stratification



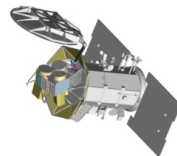
# Aquarius vs CTD



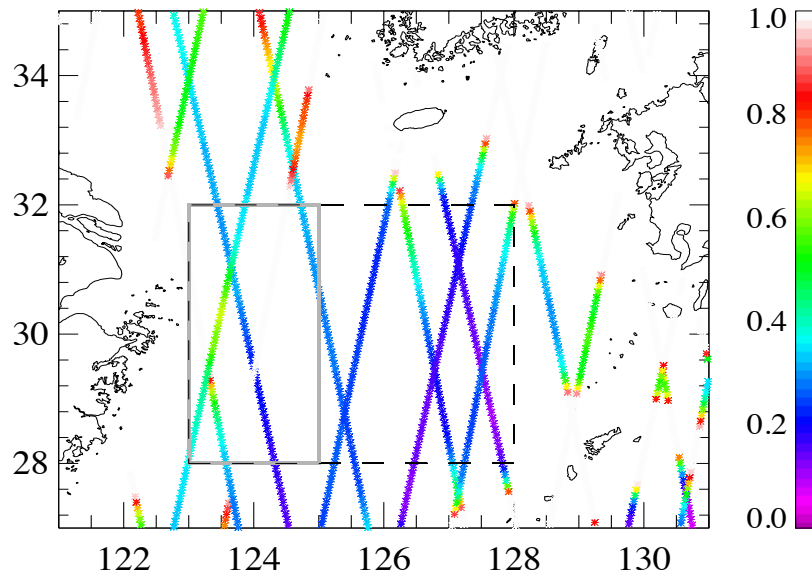
- Better match with in situ along ascending tracks



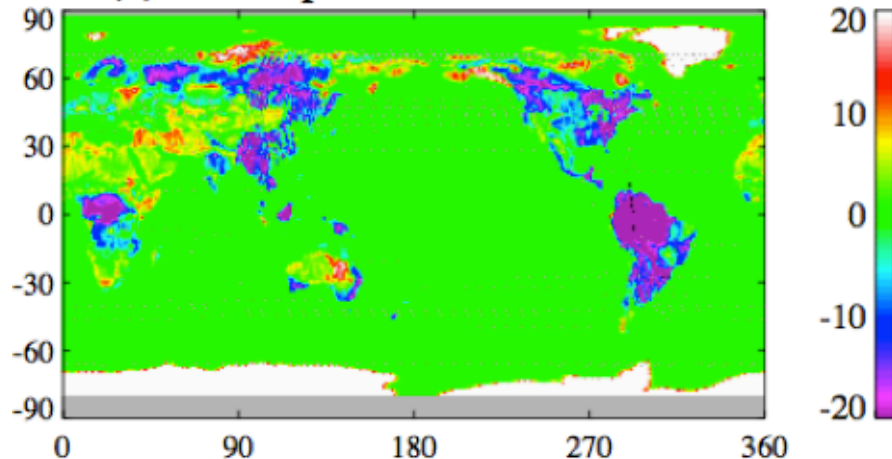
- $T_A$  and  $T_F$  are brightness temperatures before and after RFI filtering → indicates the RFI presence
- Descending tracks are contaminated heavily → choose ascending observations.



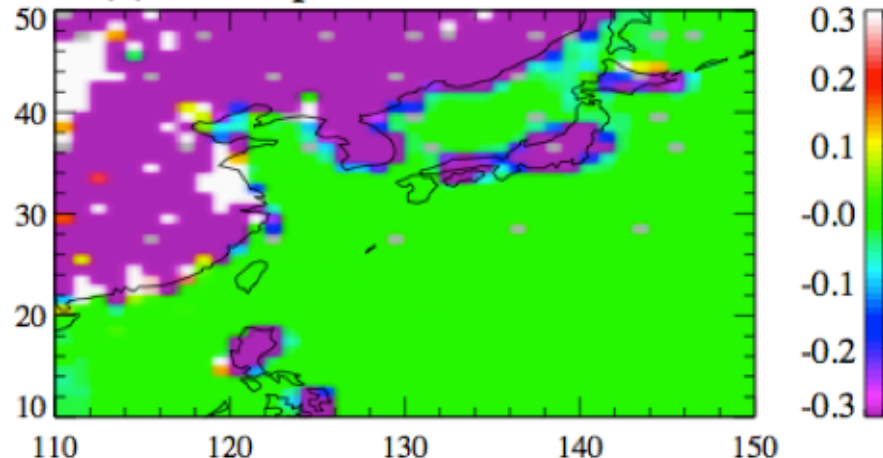
(b) land fraction (%)



(a) TaL Vpol:Sim4.03-Sim4.04

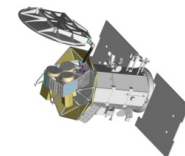


(c) TaL Vpol:Sim4.03-Sim4.04



- 0.5% land contamination
  - About 0.75 K (or 1.5 psu) perturbation to Aquarius SSS
  - Mitigated through land correction
  
- Away from the coast by 1 pixel, the correction amount is fairly insensitive to radiometric aspect of land emission modeling.

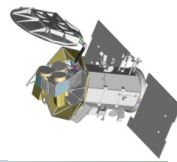
# In situ validation



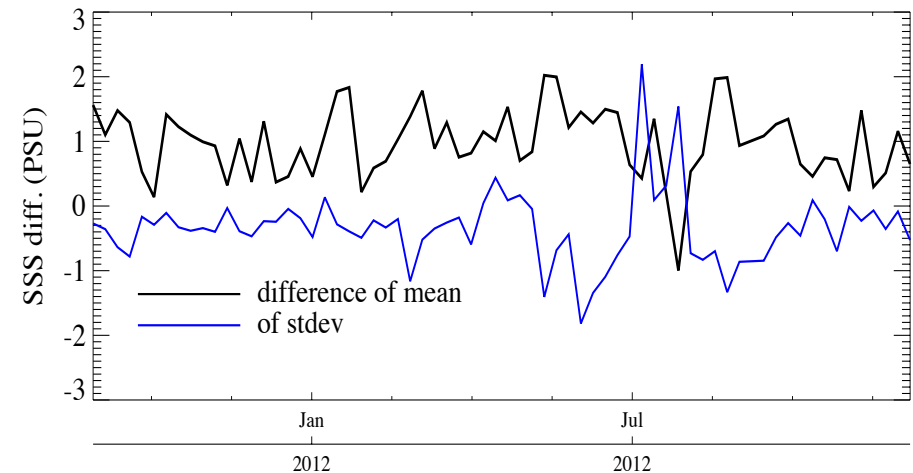
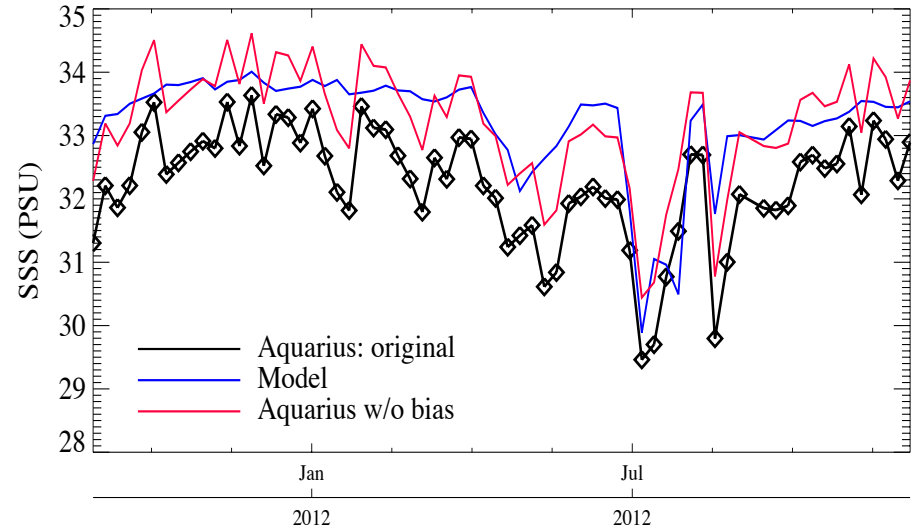
in psu	Aquarius	In situ	AQ - in situ	Dist2coast
Oct 2011 (mean)	33.71	34.07	-0.36	300km
(stdev)	0.52	0.17		
Sept 2012				
Area-north (mean)	31.450	31.455	-0.005	100km
Area-north (stdev)	0.79	2.0		
Area-south(mean)	32.89	33.66	-0.77	300km
Area-south(stdev)	0.67	0.25		

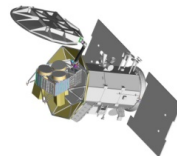
- Ascending tracks only
- Despite gaps in spatial/temporal matchup, the difference is smaller than 1 psu. There were no major rain or typhoon events.



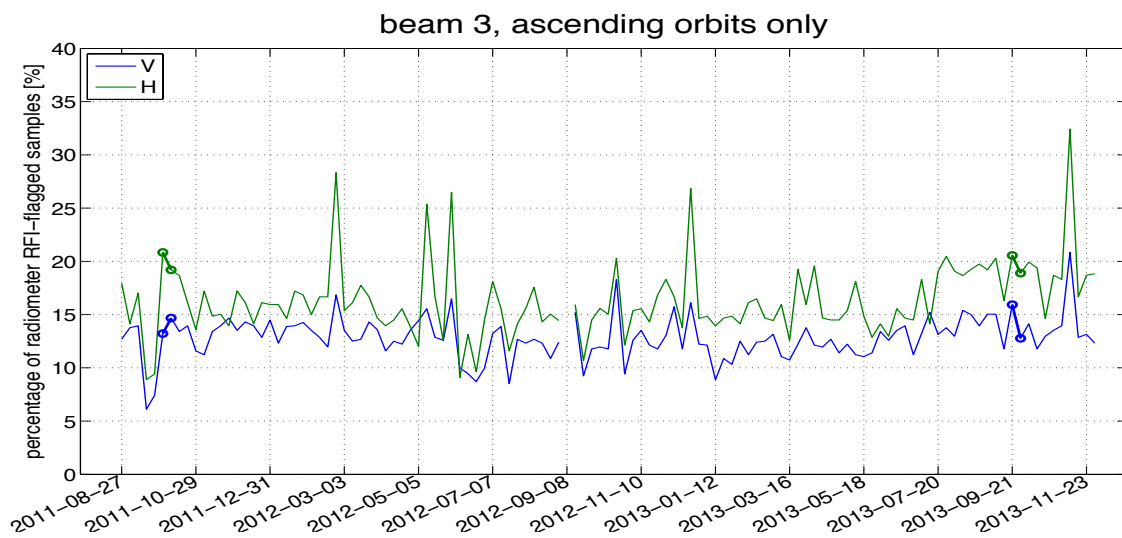
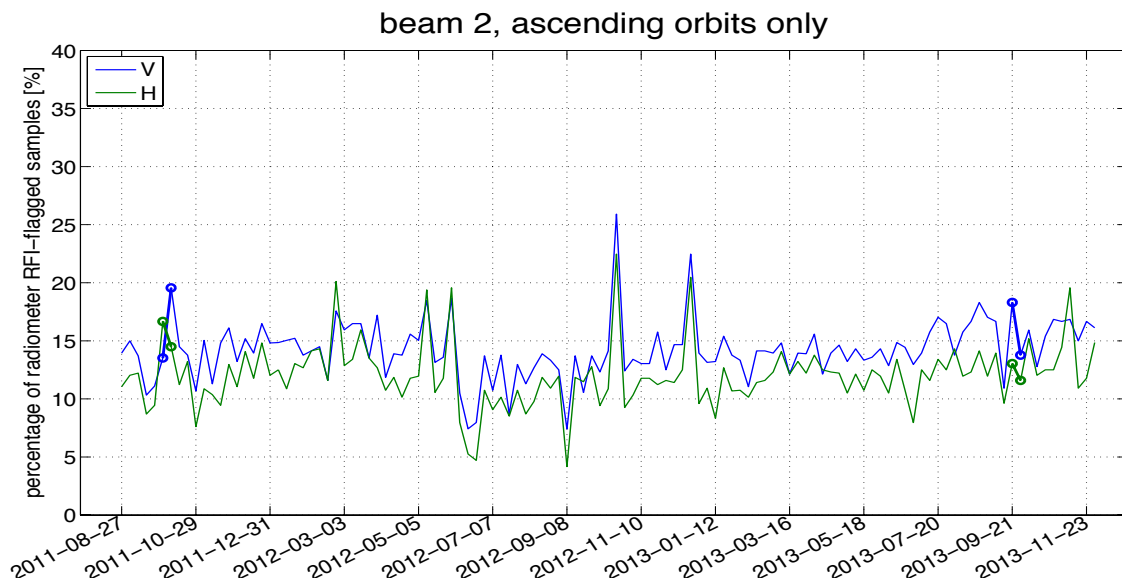


- Model: Regional model (ROMS) by Jeju Univ. Korea. 6 depth (1, 10, 20, 30, 50, 75). 1/12<sup>th</sup> deg.
- Aquarius (original) is lower than model by 0.98 psu – the bias may be due to unfiltered RFI.
- Once the bias is removed, the two matches with an RMSE of 0.55 psu (0.48 to 0.62 psu over all 3 tracks) → **0.24 to 0.31 psu over a month – close to the open ocean L1 requirement.**
- The spatial SSS variability matches well between model and data (lower panel): within 0.5 psu mostly.

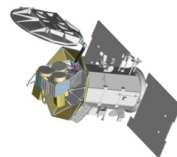




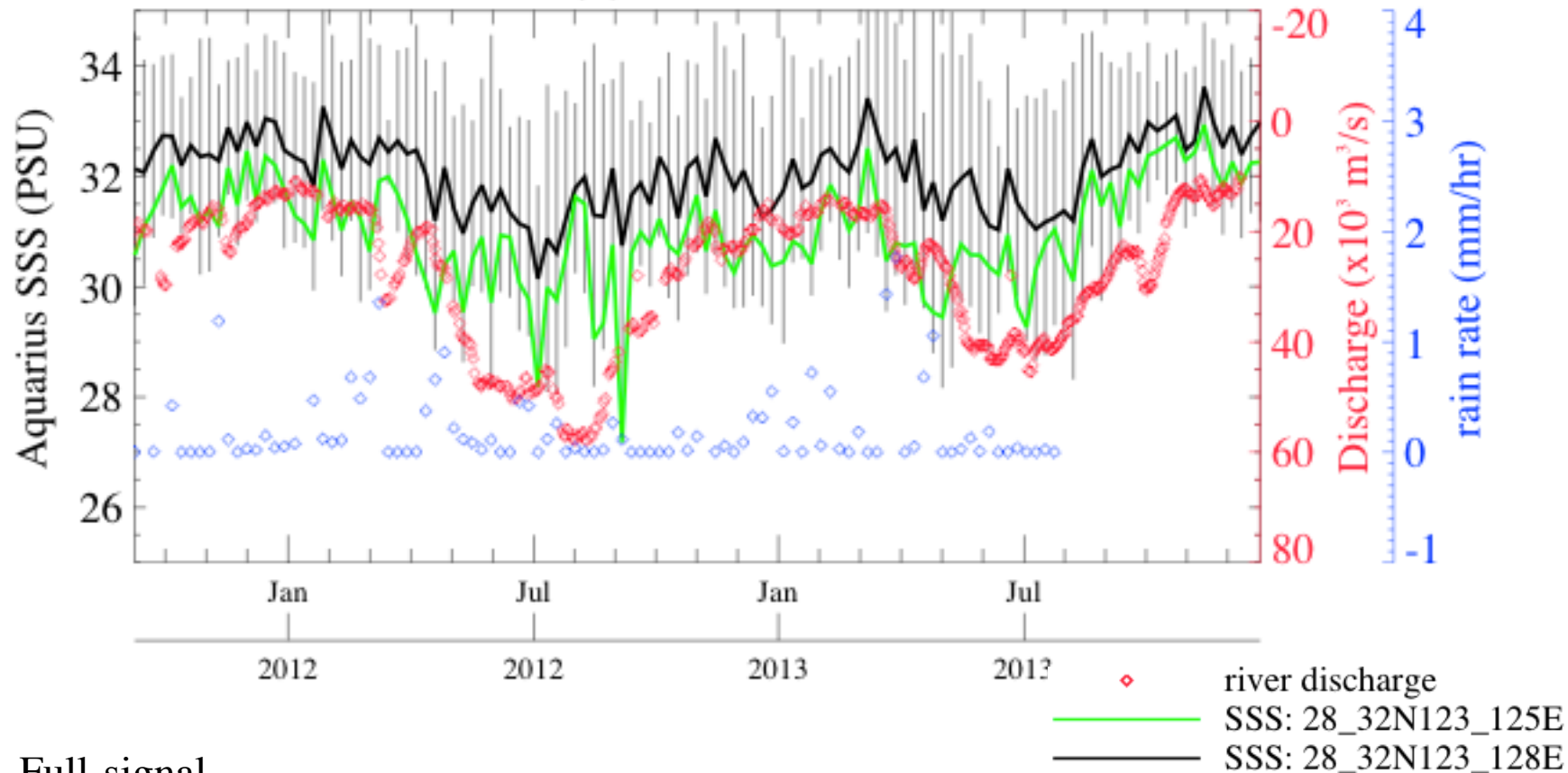
# Is unfiltered RFI a quasi-bias?



# Comparison with river discharge

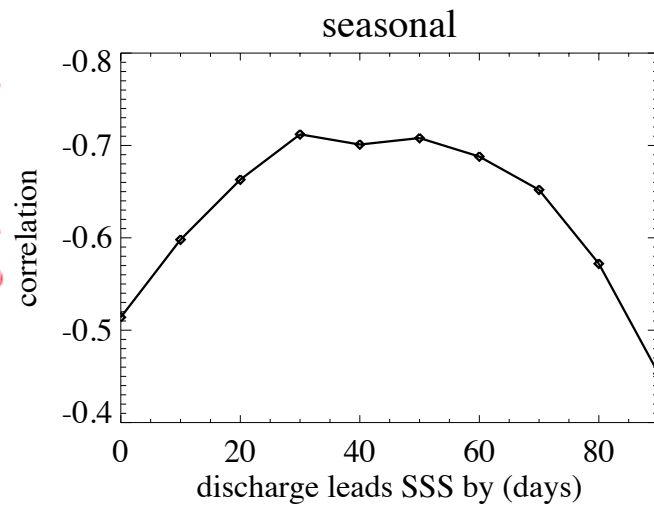
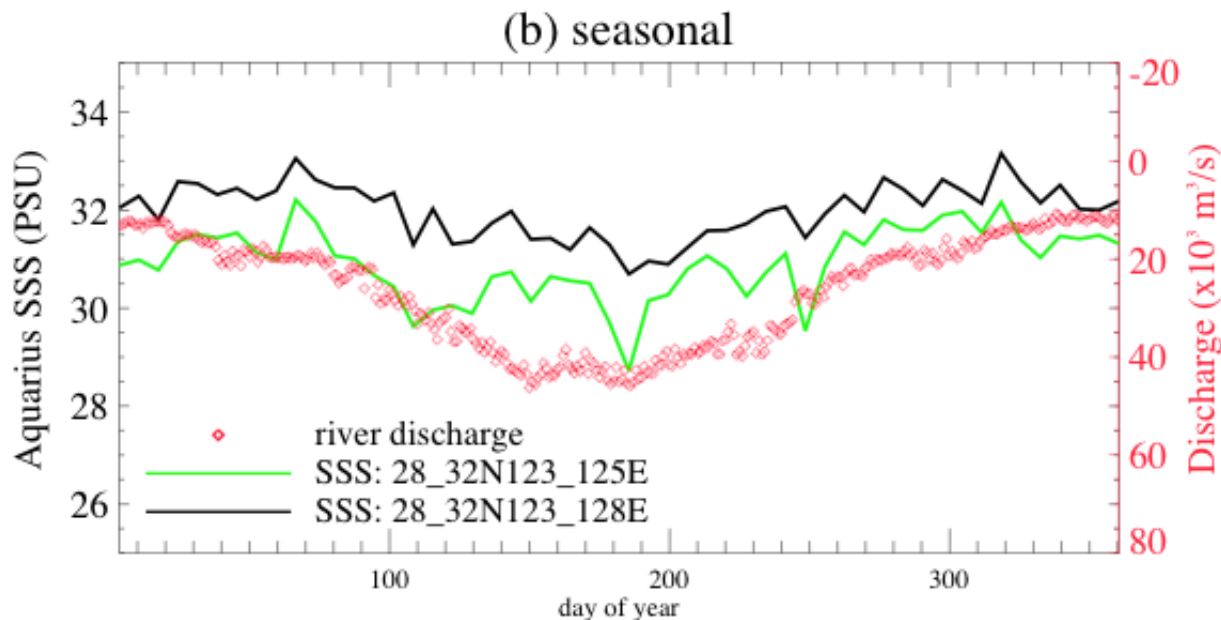
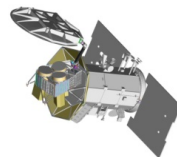


(a) raw data



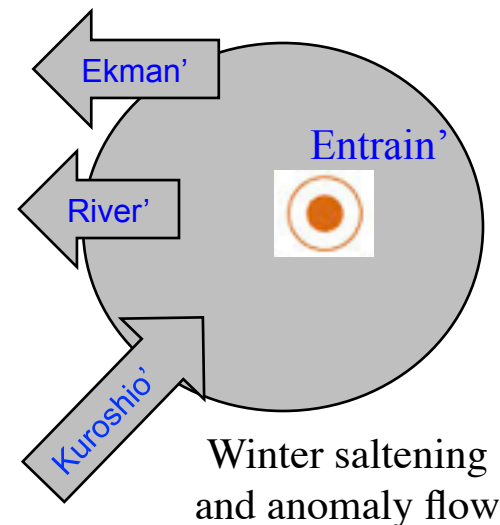
- Full-signal
  - Correlation is 0.65 with no time lag between Aquarius and discharge
  - Aquarius SSS tracks the regional drought

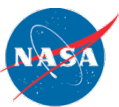
# River discharge vs Aquarius



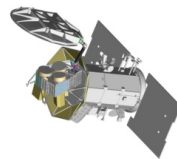
- Seasonal signal
  - Correlation is 0.7
  - discharge leading SSS by 20 to 60 days

$$dS/dt \times 1/S = (E-P-R)/H + (u,v) \cdot \nabla S + \text{subsurface} + \text{mixing}$$

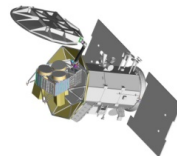




# Summary

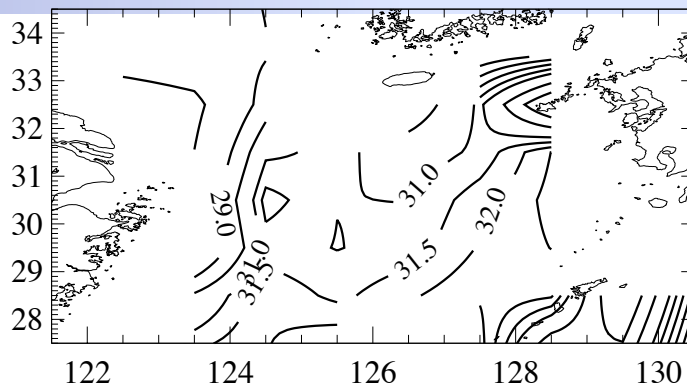


- East China Sea
  - Coastal sea with 5<sup>th</sup> largest river runoff (regional hydrology balance)
  - Land contamination
  - RFI
  - Argo non-present
  - Analysis of L2 allows SSS monitoring on challenging areas
- Aquarius vs CTD (and model)
  - Aquarius and in situ data agree within 0.3 to 0.8 psu
  - Matches with a model with 0.24 to 0.31 psu over a month – close to the open ocean L1 requirement.
  - SSS variability has strong correlation with river discharge (correlation is 0.65).
- RFI
  - Undetected RFI
    - Appears stable in time → does not affect the variability
- Science
  - River signal dominates seasonal SSS
  - Seasonal SSS lags river discharge by 30 to 50 days (0.71 correlation)
  - SSS responds to the regional drought
  - JGR special issue paper

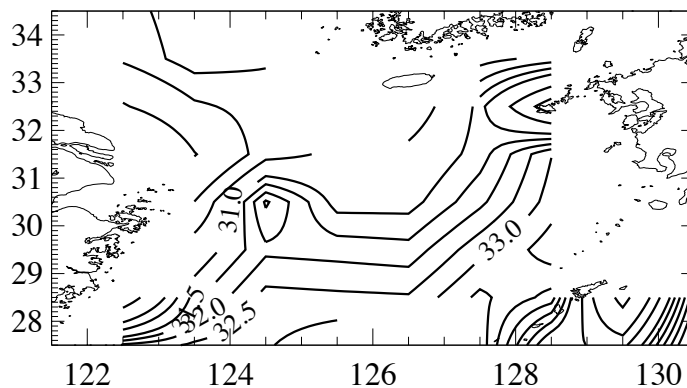


# Seasonal SSS map

2012 07



2013 07



2012 10

