Consistency of Aquarius and Argo SSS in depicting temporal variations on various space and time scales

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Motivation and Objectives

- The mission target accuracy of Aquarius SSS of 0.2 psu on monthly time scale and 150-km spatial scale includes time mean and temporal variations.

- It does not isolate Aquarius' ability to characterize temporal changes on various space and time scales, which is more fundamental to science requirements (in depicting scale-dependent physical phenomena).

- This presentation focuses on evaluating the consistencies of Aquarius V4 monthly gridded SSS using two Argo monthly gridded (OI) products on different space and time scales, and

- Contrasting these consistencies with those between the two Argo products.

- Important question: what portion of std. dev. of Aquarius-Argo SSS can be explained by the std. dev. between the two Argo products?

Data

- Aquarius V4 monthly gridded SSS.

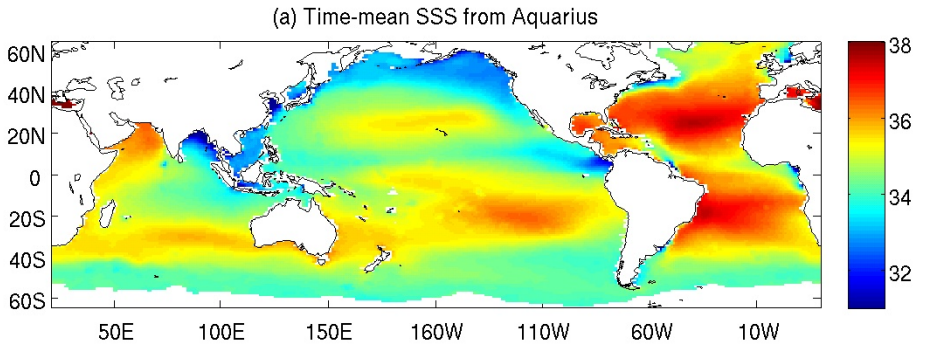
- Argo monthly 1° gridded salinity products at 2.5 m from Scripps Institution of Oceanography (SIO) and from Asian Pacific Data Research Center of University of Hawaii (UH), denoted by Argo-SIO and Argo-UH.

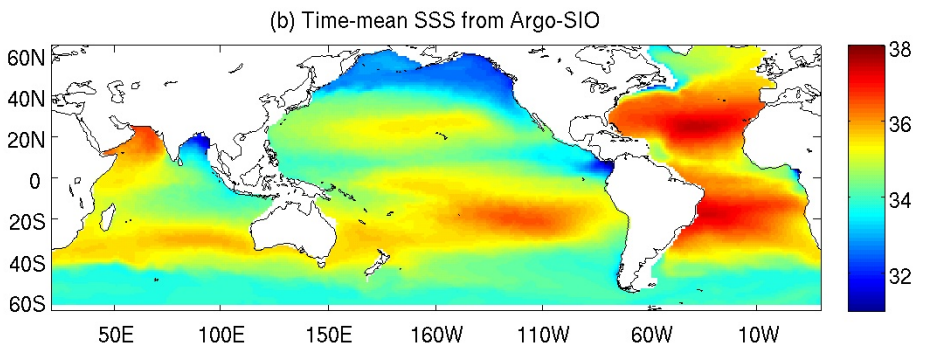
- Argo-SIO uses all data during 2004-2014 to form a gridded seasonal climatology, then add gridded monthly anomalies on top to get total salinity; small smoothing scale, noisy monthly fields, but sharp time-mean gradients.

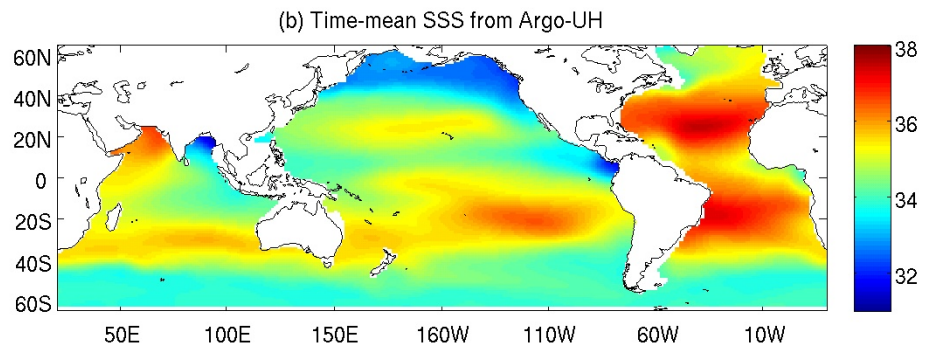
- Argo-UH uses a larger smoothing scale, giving less noisy monthly fields, but very weak gradients.

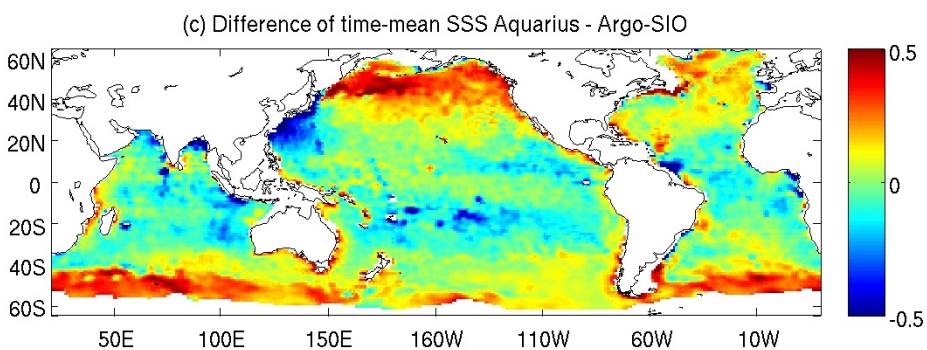
- The difference in gridding scheme between Argo-SIO and Argo-UH reflects different approaches to alleviate Argo's limited space-time sampling.

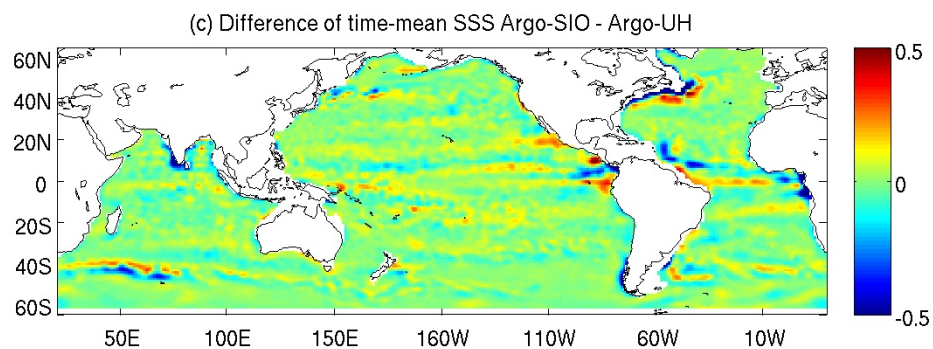
Comparison of time mean SSS (Sept.2011-May 2015)
for Aquarius vs. Argo-SIO and Argo-SIO vs. Argo-UH





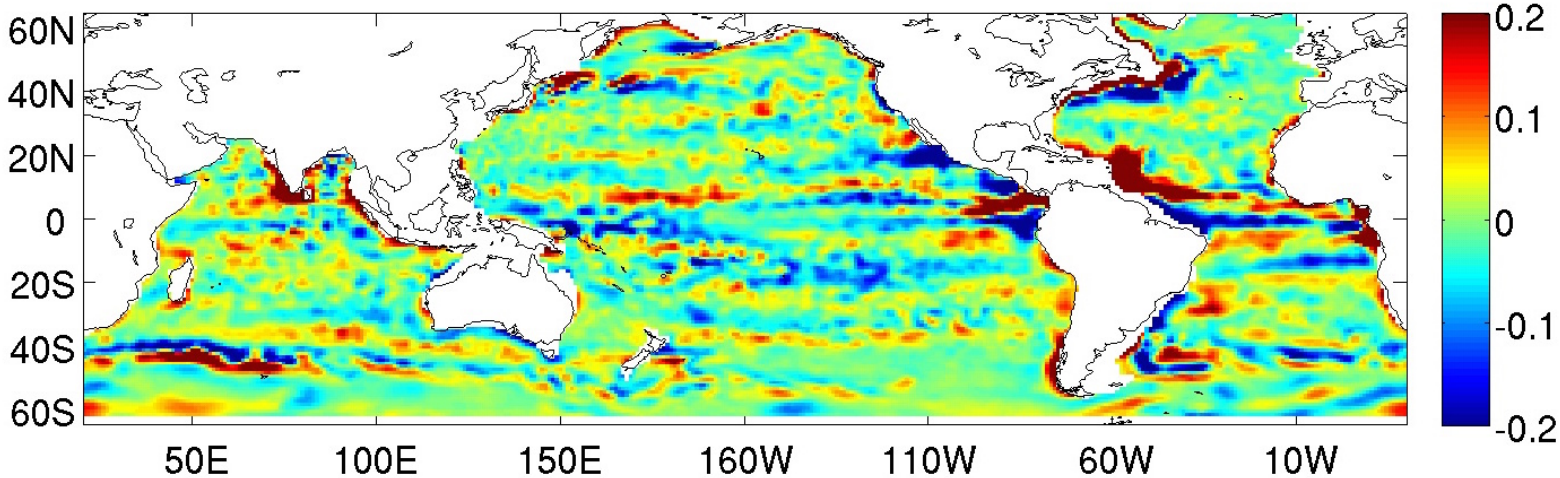




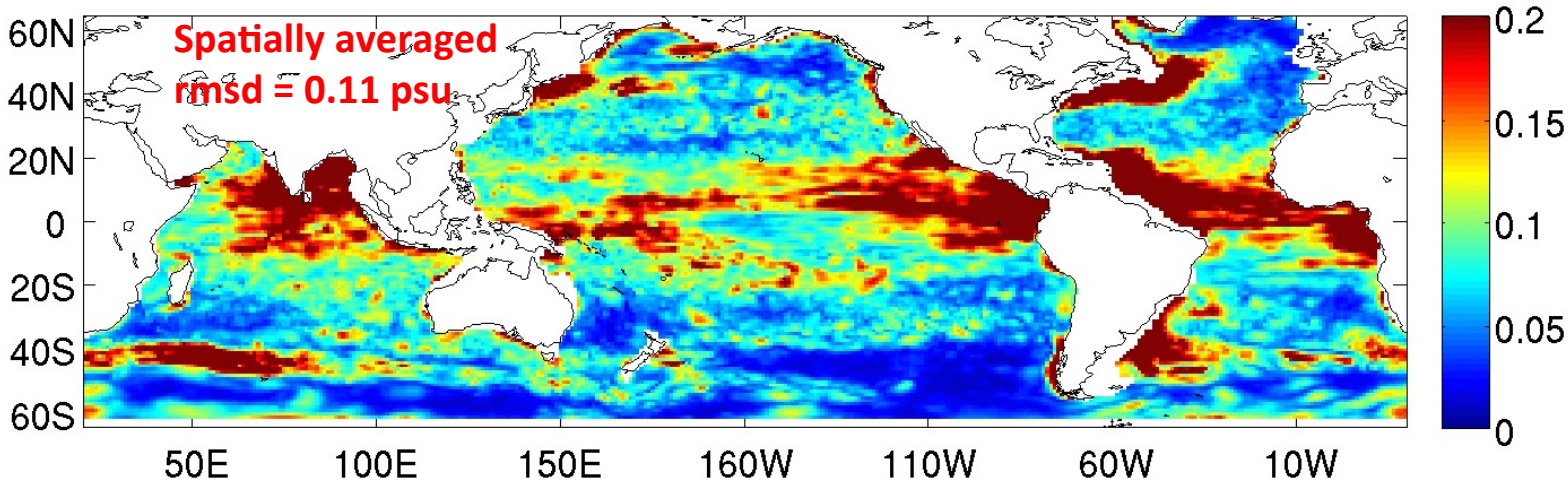


Differences among Argo monthly OI SSS products that are used to evaluate satellite SSS: examples for Scripps & UH/IPRC products (2005-2014)

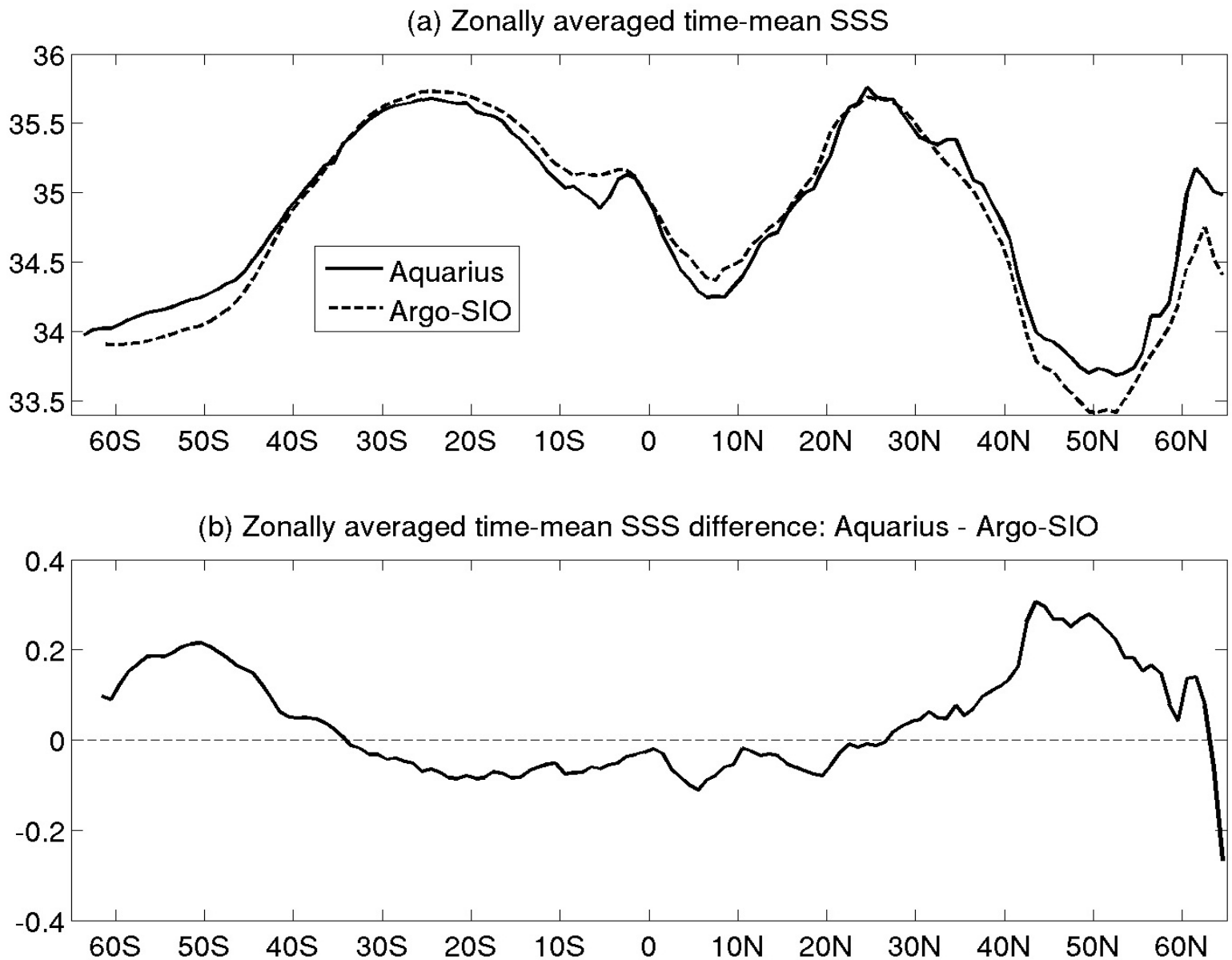
(a) Time-mean difference between SIO & APDRC monthly OI SSS products



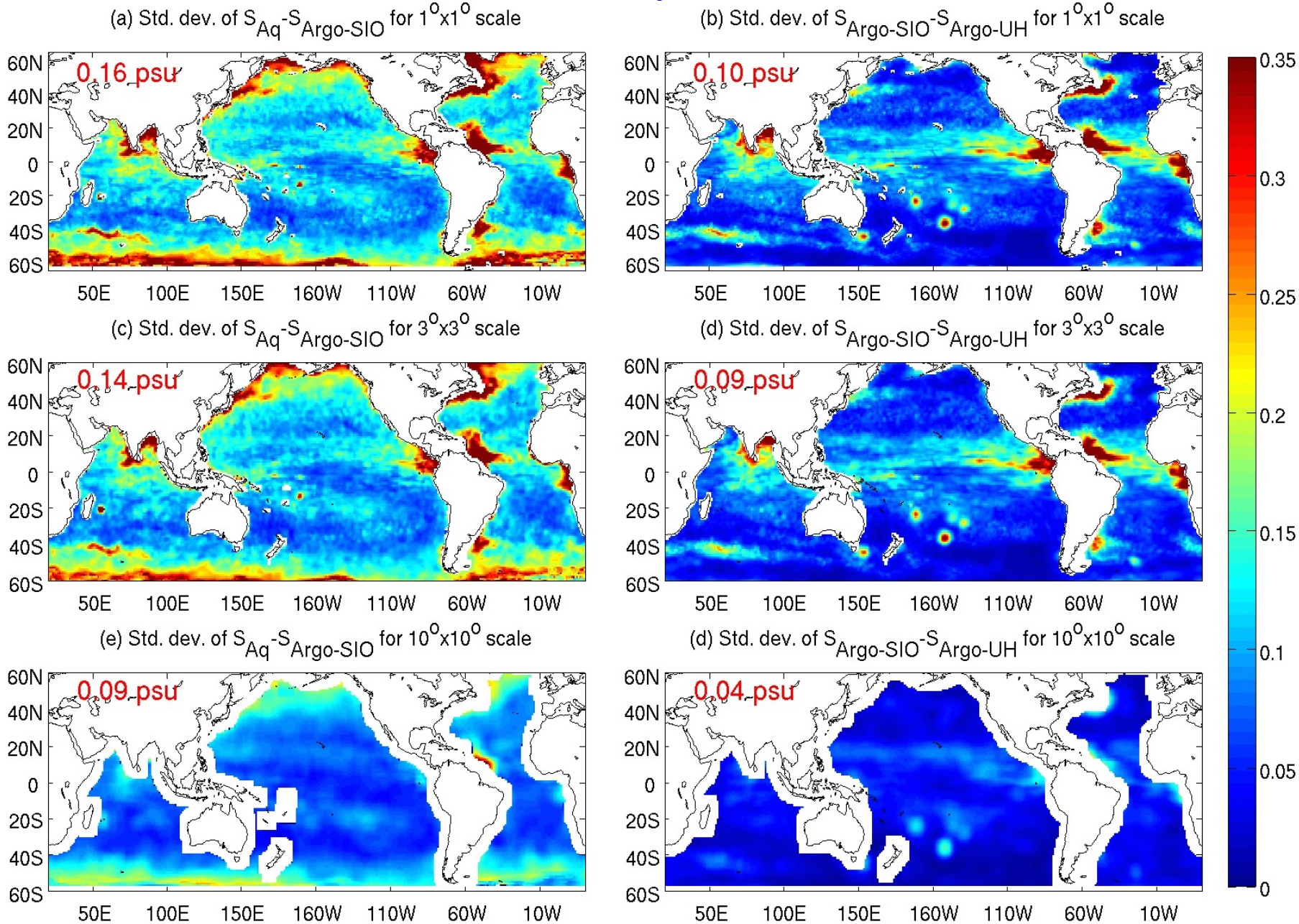
(b) RMS difference between SIO & APDRC monthly OI SSS products



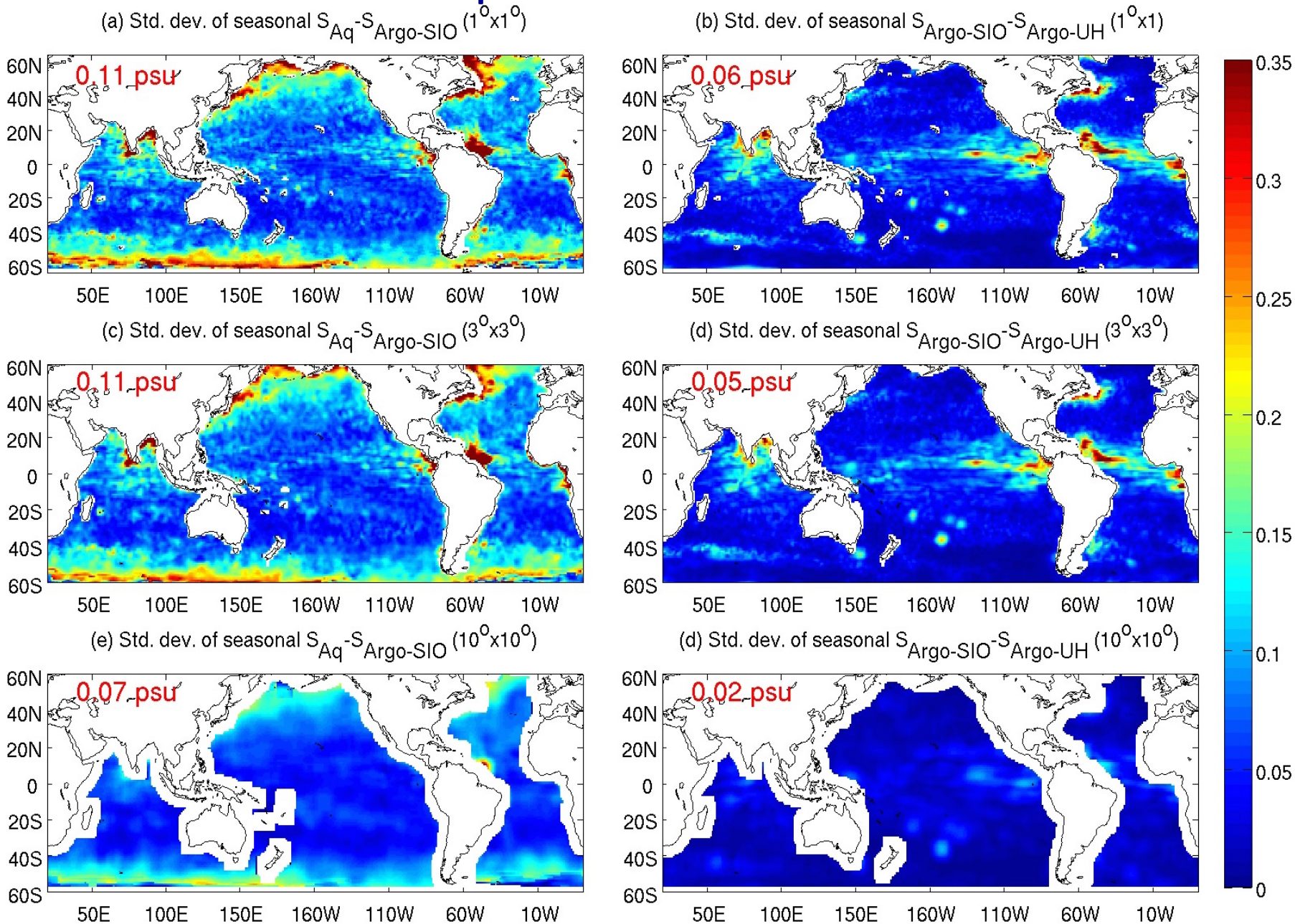
Zonally averages of time-mean SSS for Aquarius and Argo-SIO and their differences



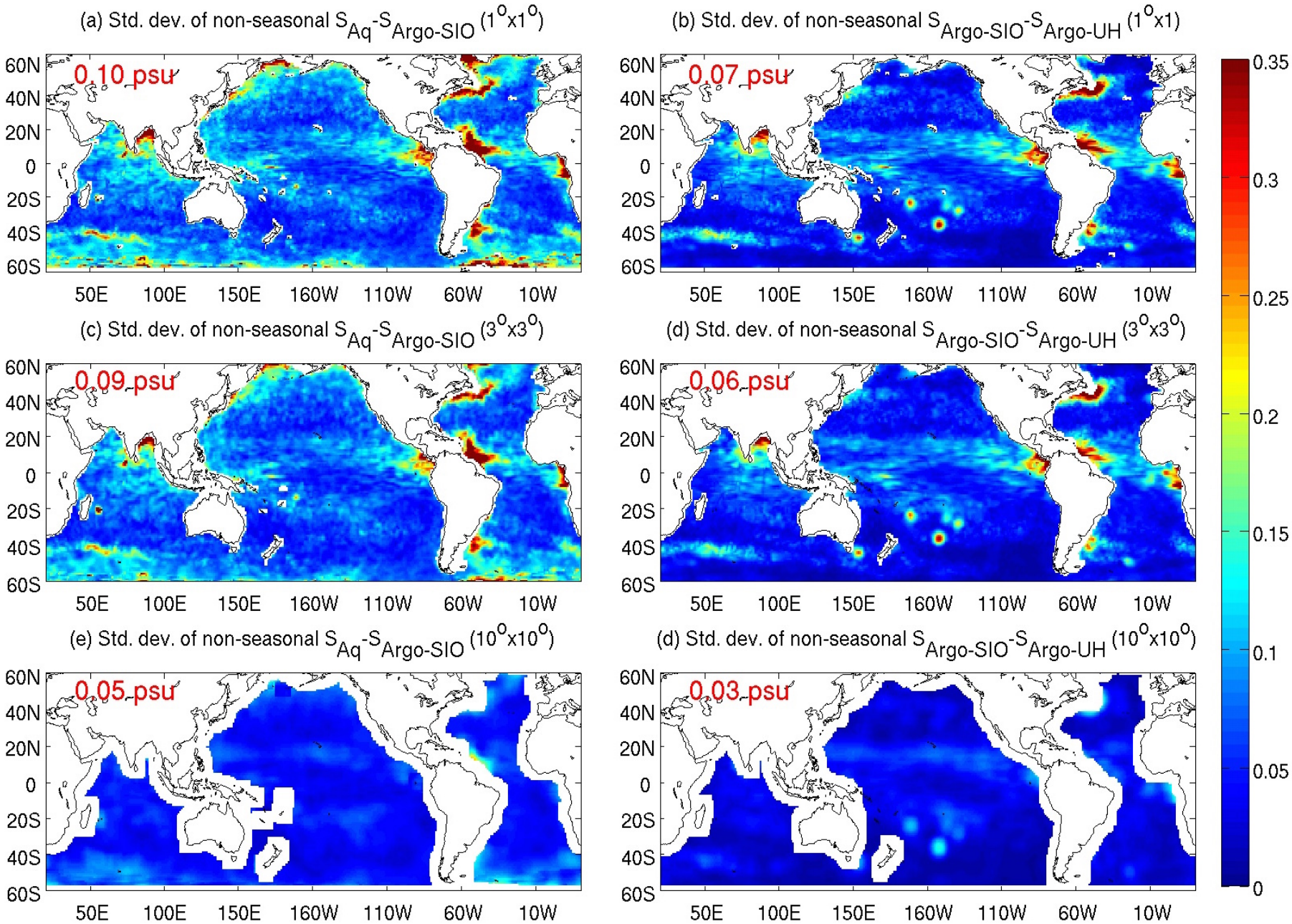
STD of SSS differences for Aquarius vs. Argo-SIO & Argo-SIO vs. Argo-UH for different spatial scales



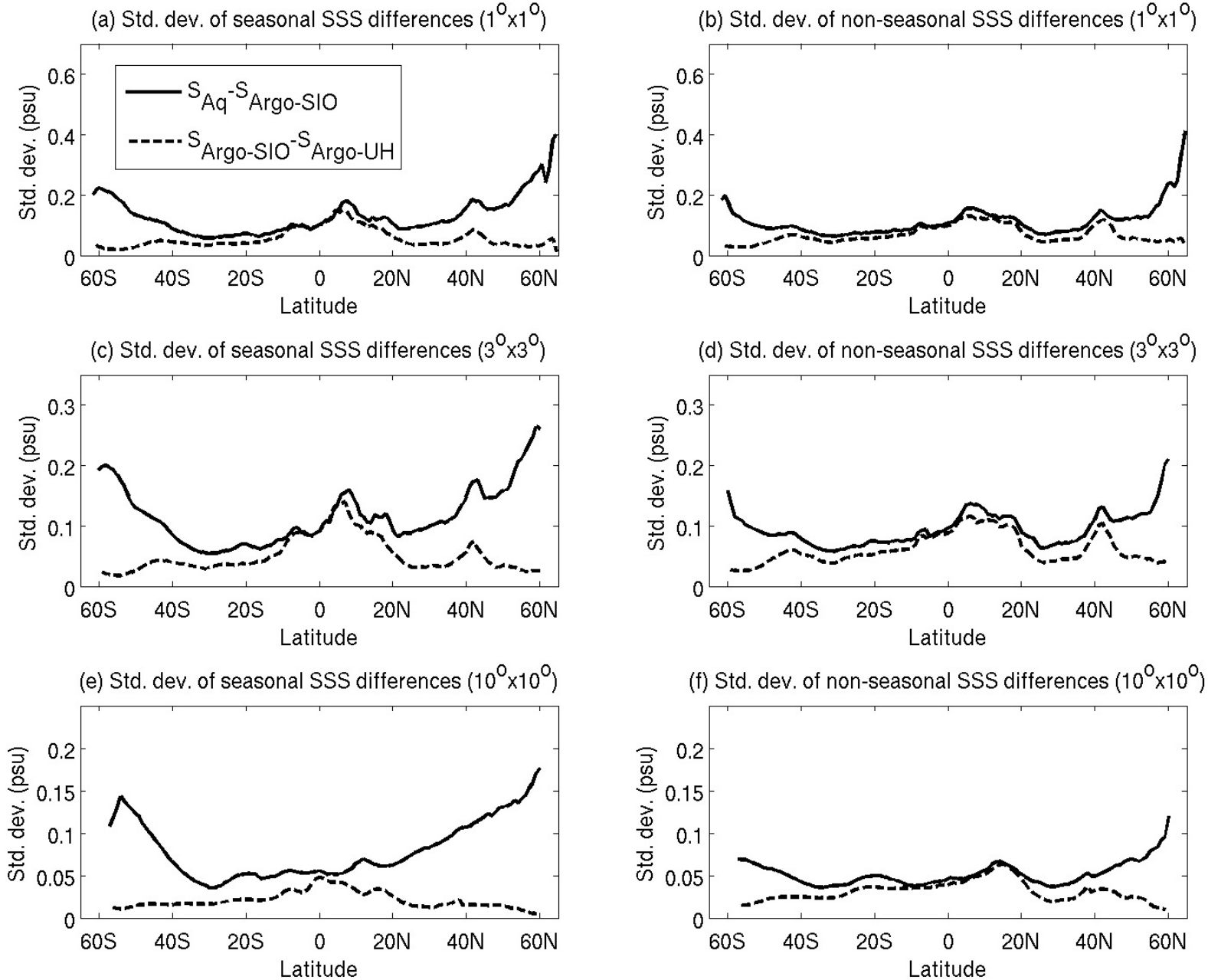
STD of SSS differences for Aquarius vs. Argo-SIO & Argo-SIO vs. Argo-UH for different spatial scales: seasonal time scales



STD of SSS differences for Aquarius vs. Argo-SIO & Argo-SIO vs. Argo-UH for different spatial scales: non-seasonal time scales



Zonally averaged STD of SSS differences for Aquarius vs. Argo-SIO & Argo-SIO vs. Argo-UH for different spatial scales (seasonal: left, non-seasonal: right)



"Global" (65N-65S) area-weighted averages STD of SSS differences for Aquarius vs. Argo-SIO & Argo-SIO vs. Argo-UH for different spatial scales: seasonal time scales

Table 1. Globally averaged standard deviation values (in psu) between Aquarius and Argo-SIO and between Argo-SIO and Argo-UH.

	1°x1°	3°x3°	10°x10°
Aquarius vs. Argo-SIO (total)	0.16	0.14	0.09
Argo-SIO vs. Argo-UH (total)	0.10	0.09	0.04
Aquarius vs. Argo-SIO (seasonal)	0.11	0.11	0.07
Argo-SIO vs. Argo-UH (seasonal)	0.06	0.05	0.02
Aquarius vs. Argo-SIO (non-seasonal)	0.10	0.09	0.05
Argo-SIO vs. Argo-UH (non-seasonal)	0.07	0.06	0.03

Summary

- The discrepancies between the two Argo OI products in depicting temporal variations of SSS on various space and time scales amount to a significant portion of the Aquarius-Argo consistency.

- The consistencies of Aquarius-Argo SSS is similar to those between the two Argo products for seasonal time scales in the tropics, and for non-seasonal time scales for the tropics and subtropics (averaged ratio of STDs of 1.2).

- Consistencies of among Argo OI products need to be considered in evaluating Aquarius SSS.

- Discrepancies between Aquarius and Argo at high-latitudes are substantial: 0.2-0.3 psu both for time mean and for temporal variations.

- Innovative technologies are necessary to improve high-latitude satellite SSS measurements, esp. in light of the ongoing changes in sea ice and the potential impacts on ocean circulation, climate variability, and water cycle.