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Consistency of Aquarius version-4 sea surface salinity with Argo products on various spatial and temporal scales

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Understanding the accuracies of satellite-derived sea surface salinity (SSS) measurements in depicting temporal changes and the dependence of the accuracies on spatiotemporal scales are important to capability assessment, future mission design, and applications to study oceanic phenomena of different spatiotemporal scales. This study quantifies the consistency between Aquarius Version-4 monthly gridded SSS (released in late 2015) with two widely used Argo monthly gridded near-surface salinity products. The analysis focused on their consistency in depicting temporal changes (including seasonal and non-seasonal) on various spatial scales: 1˚x1˚, 3˚x3˚, and 10˚x10˚. Globally averaged standard deviation (STD) values for Aquarius-Argo salinity differences on these three spatial scales are 0.16, 0.14, 0.09 psu, compared to those between the two Argo products of 0.10, 0.09, and 0.04 psu. Aquarius SSS compare better with Argo data on non-seasonal (e.g., interannual and intraseasonal) than for seasonal time scales. The seasonal Aquarius-Argo SSS differences are mostly concentrated at high latitudes. The Aquarius team is making active efforts to further reduce these high-latitude seasonal biases. The consistency between Aquarius and Argo salinity is similar to that between the two Argo products in the tropics and subtropics for non-seasonal signals, and in the tropics for seasonal signals. Therefore, the representativeness errors of the Argo products for various spatial scales (related to sampling and gridding) need to be taken into account when estimating the uncertainty of Aquarius SSS. The globally averaged uncertainty of large-scale (10˚x10˚) non-seasonal Aquarius SSS is approximately 0.04 psu. These estimates reflect the significant improvements of Aquarius Version-4 SSS over the previous versions. The estimates can be used as baseline requirements for future ocean salinity missions from space. The spatial distribution of the uncertainty estimates is also useful for assimilation of Aquarius SSS.