

Toward Improved Application of SMOS and Aquarius Level-2 Sea-Surface Salinity Products

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Aquarius Level-3 SSS

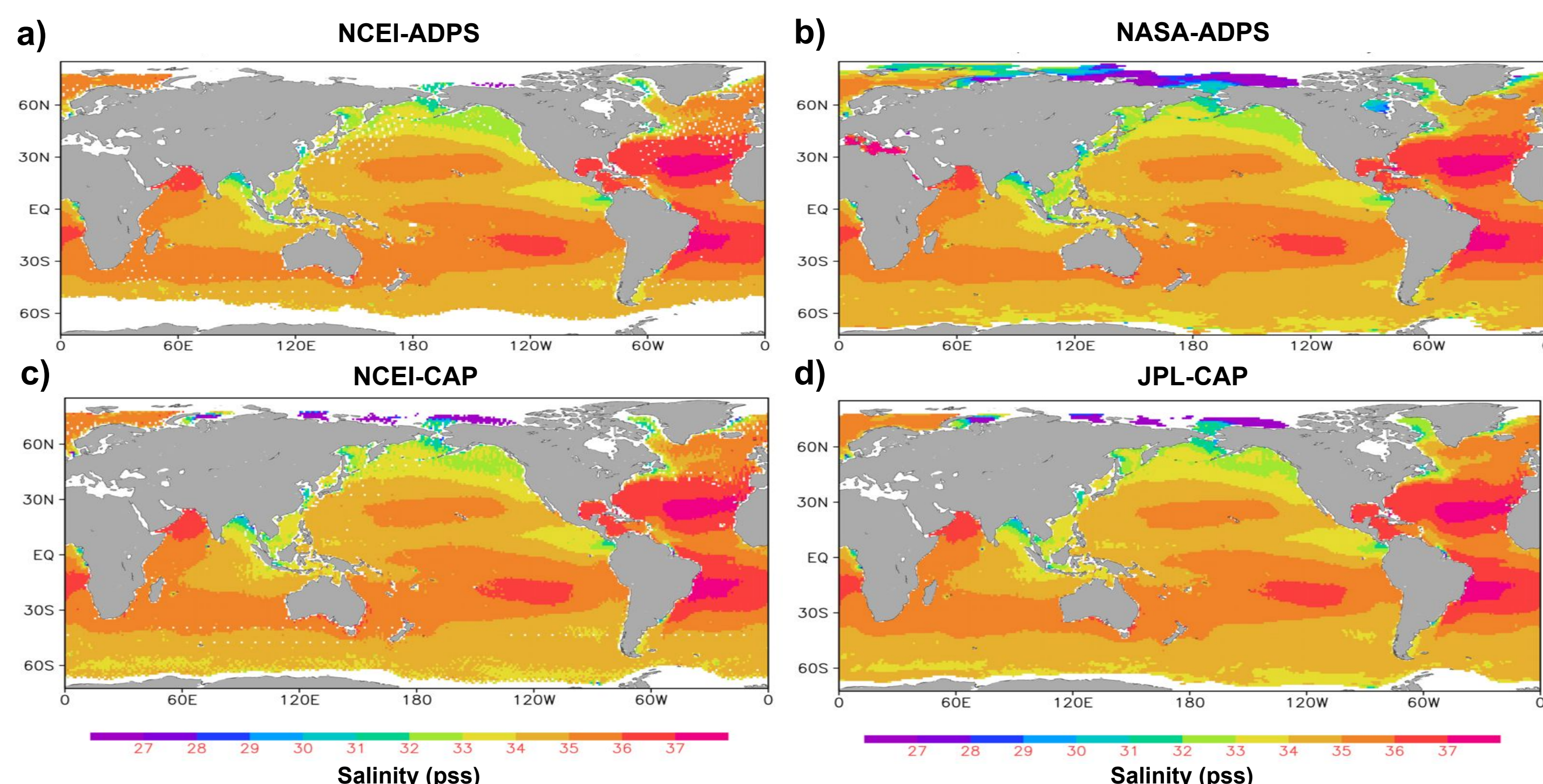


Figure 1. Annual mean Aquarius Level-3 SSS (version 4) September 2011 to May 2015: a) NCEI-binned ADPS, b) NASA ADPS, c) NCEI-binned CAP, and d) JPL CAP.

Introduction

In addition to sea-surface salinity (SSS) measurements, ESA's Soil Moisture – Ocean Salinity (SMOS) and NASA's Aquarius Level-2 SSS products provide numerous quality flags and descriptors associated with various geophysical, retrieval, and geometrical filters. Optimal application of SSS data relies on completely understanding the significance of the various filters and thresholds on the quality of the data extracted from the Level-2 (swath) datasets.

The NESDIS National Centers for Environmental Information (NCEI) generates global binned Level-3 SSS products ($1^\circ \times 1^\circ$ grid) from the Level-2 swath retrievals: a) monthly and 3-day means from SMOS V5.5 data and b) monthly and 7-day mean from Aquarius V4.0 data. NCEI's Aquarius Level-3 products include separate products built from the official NASA Aquarius Data Processing System (ADPS) data and NASA/JPL's Combined Active-Passive (CAP) algorithm fields. The SMOS 3-day mean and Aquarius 7-day mean products reflect initial global coverage intervals. Aquarius Level-3 products were generated from initial Aquarius quick-look (near-real-time) data and then subsequently replaced monthly when ancillary data was finalized. SMOS near-real-time products are updated after the end of each calendar year when the SMOS mission provides refined data for the preceding year. Relevant products are updated when mission reprocessing of the data record occurs.

NCEI's Level-3 products are compared with the corresponding products produced by NASA for Aquarius (Sep 2011 – May 2015), the ESA-supported SMOS Barcelona Expert Center (BEC; Roughness Model 3 only; Sep 2011 – Apr 2015), and NCEI's World Ocean Database (WOD) *in situ* monthly gridded SSS (Sep 2011 – May 2015).

SMOS Level-3 SSS

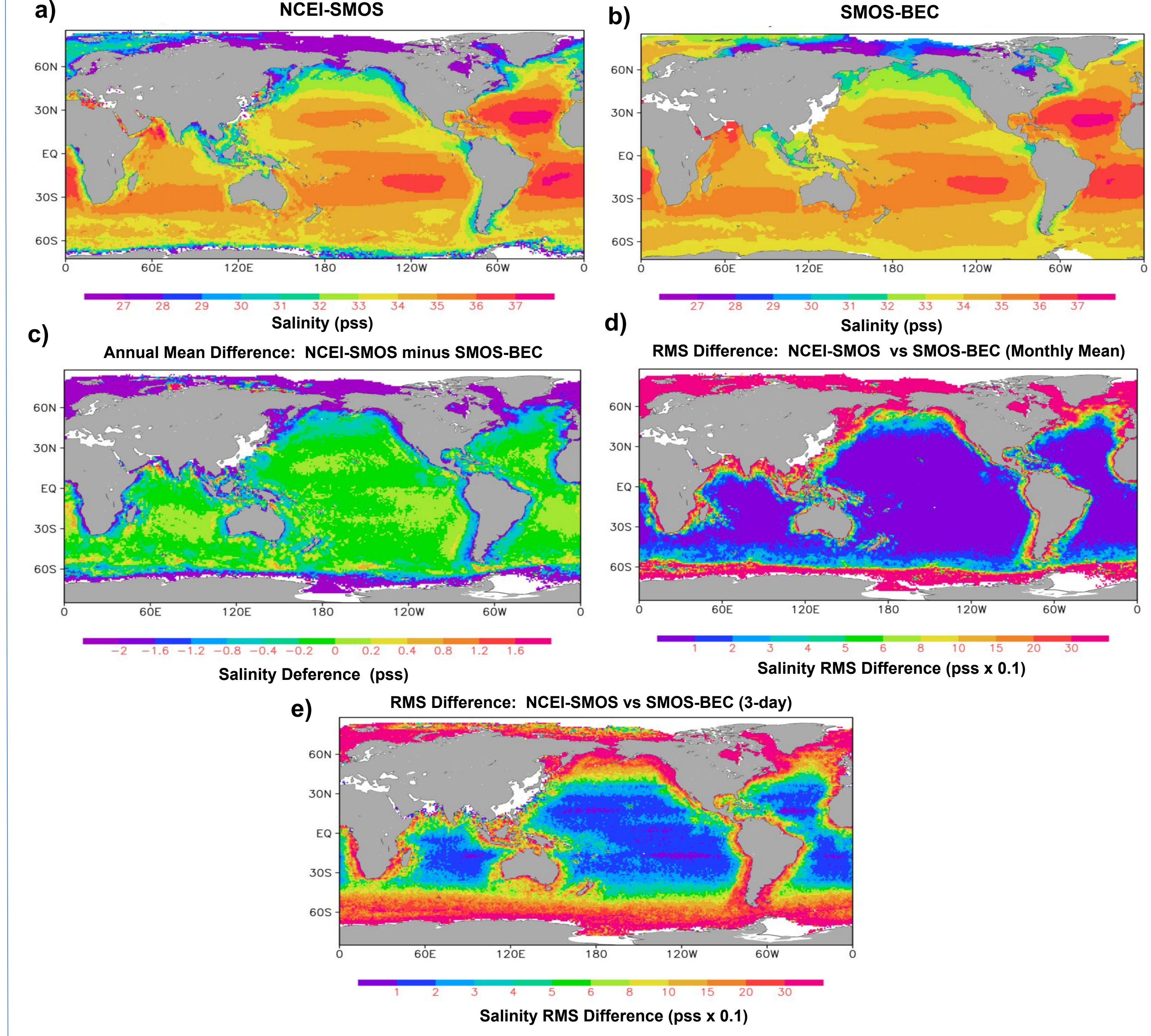


Figure 6. SMOS Level-3 Salinity (version 5.5, roughness model #3) Sep 2011 to Apr 2014: a) NCEI-SMOS monthly annual mean, b) SMOS-BEC monthly annual mean, c) Monthly annual mean difference (NCEI-SMOS minus SMOS-BEC), d) Root-mean-squared (RMS) difference of monthly means (NCEI-SMOS versus SMOS-BEC), and e) RMS difference of 3-day composites (NCEI-SMOS versus SMOS-BEC).

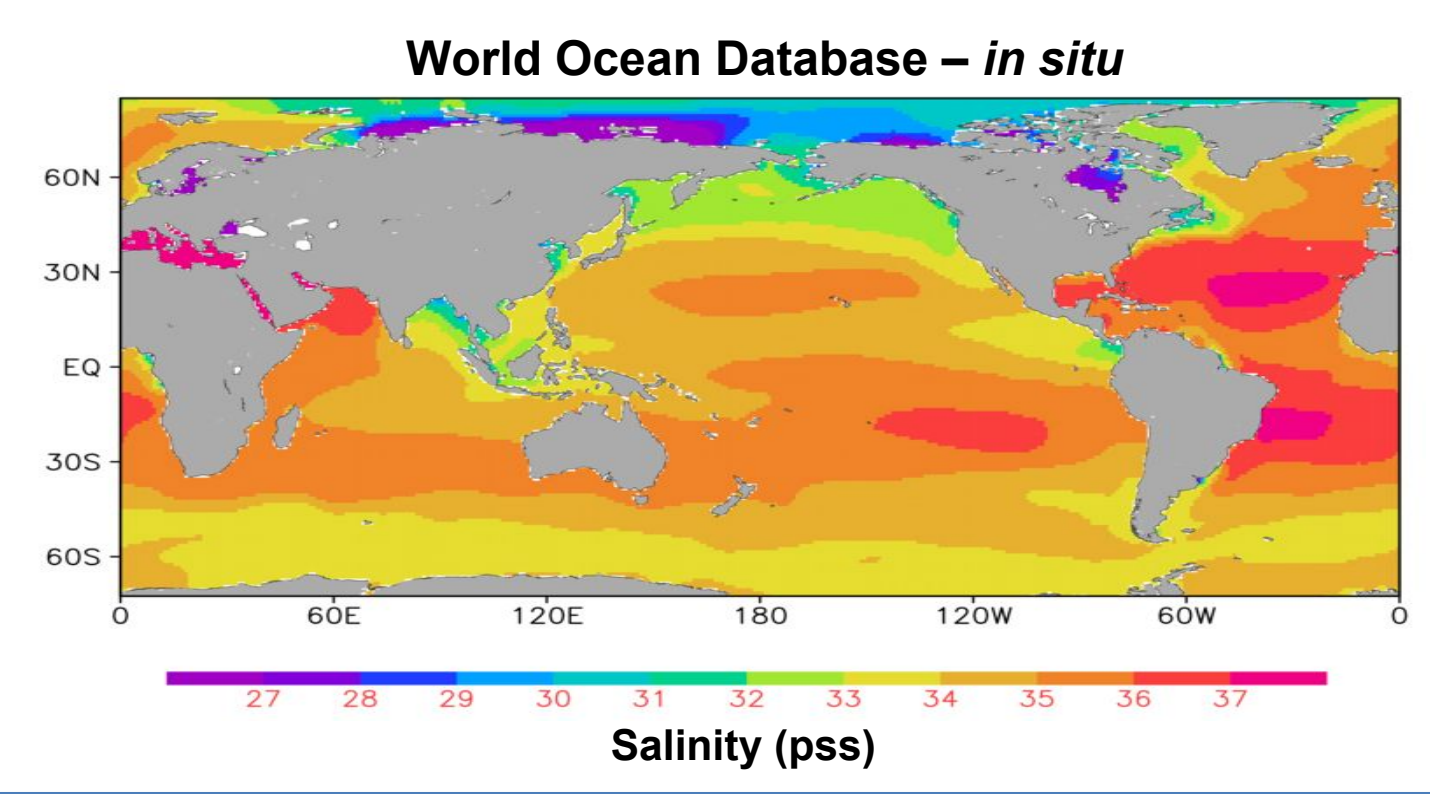


Figure 2. Annual mean SSS (pss) from NCEI World Ocean Database – *in situ* optimal interpolation (OI) analysis (September 2011 to May 2015).

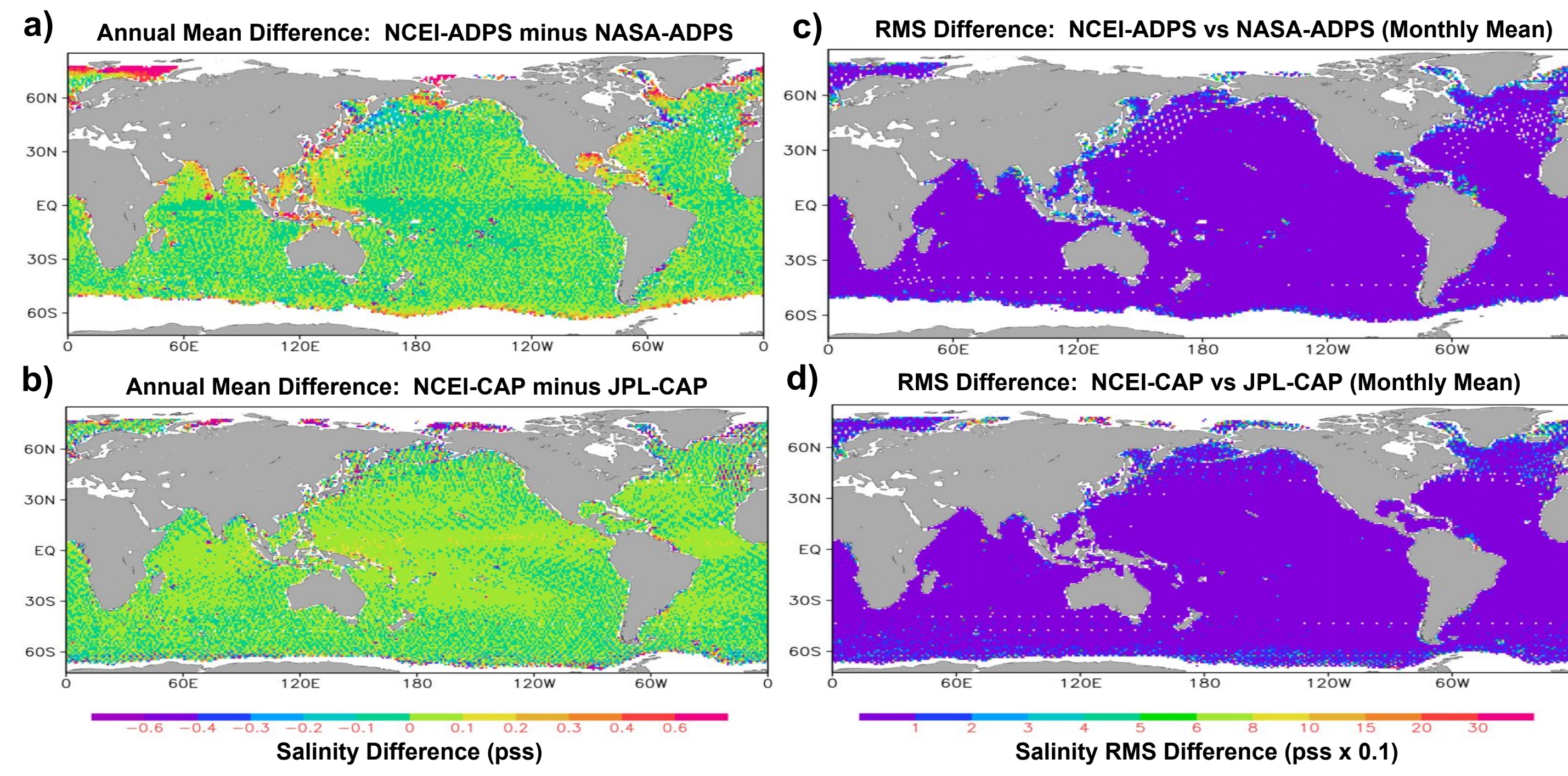


Figure 3. Salinity difference (version 4) – September 2011 to May 2015: Annual mean difference of monthly means a) NCEI-ADPS minus NASA-ADPS, b) NCEI-CAP minus JPL-CAP, and Root-mean-squared (RMS) difference of monthly means c) NCEI-ADPS versus NASA-ADPS, and d) NCEI-CAP versus JPL-CAP.

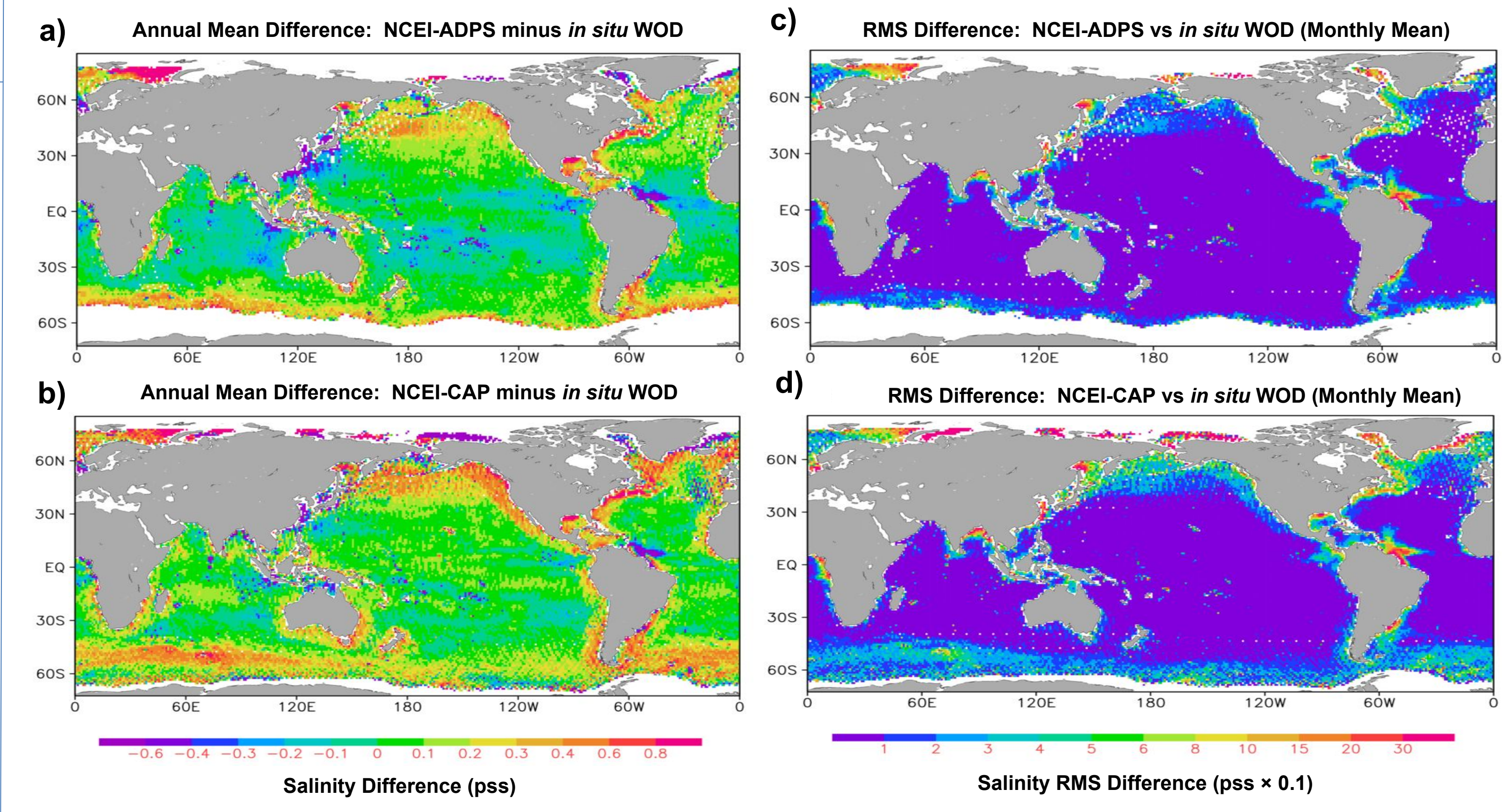


Figure 5. Salinity difference (September 2011 to May 2015) – NCEI Aquarius versus World Ocean Database (WOD): Annual mean difference of monthly means a) NCEI-ADPS, b) NCEI-CAP, and Root-mean-squared (RMS) difference of monthly means c) NCEI-ADPS, and d) NCEI-CAP.

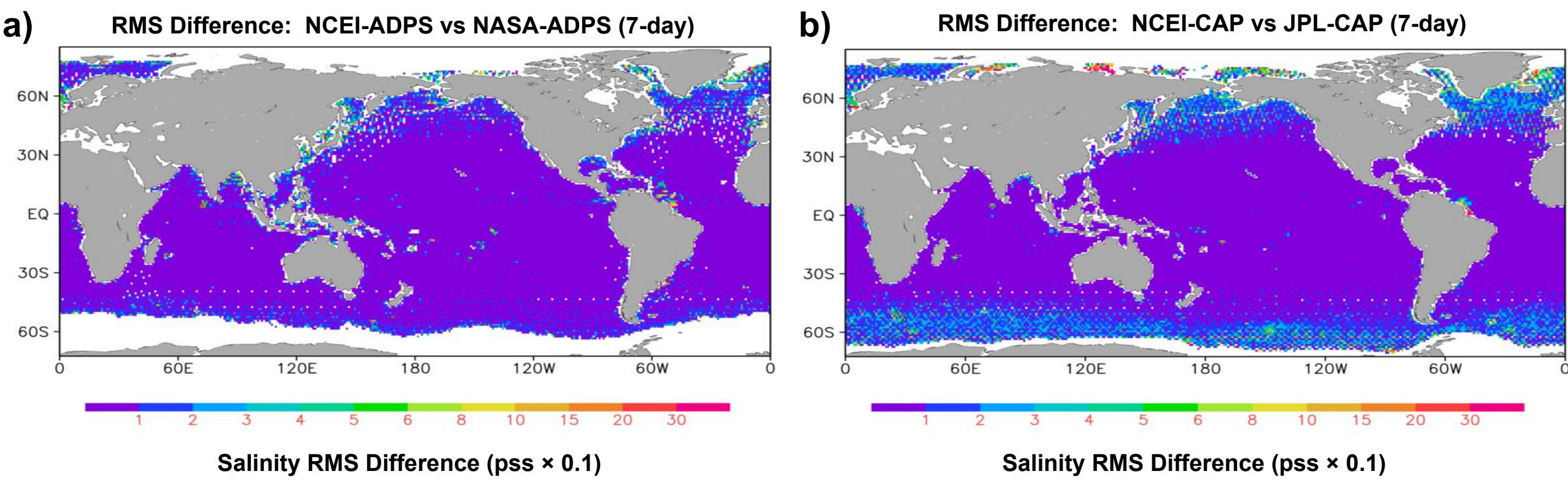


Figure 4. Root-mean-square (RMS) salinity difference of 7-day composites (version 4) September 2011 to May 2015: a) NCEI-ADPS versus NASA ADPS, b) NCEI-CAP versus JPL-CAP V4 SSS.

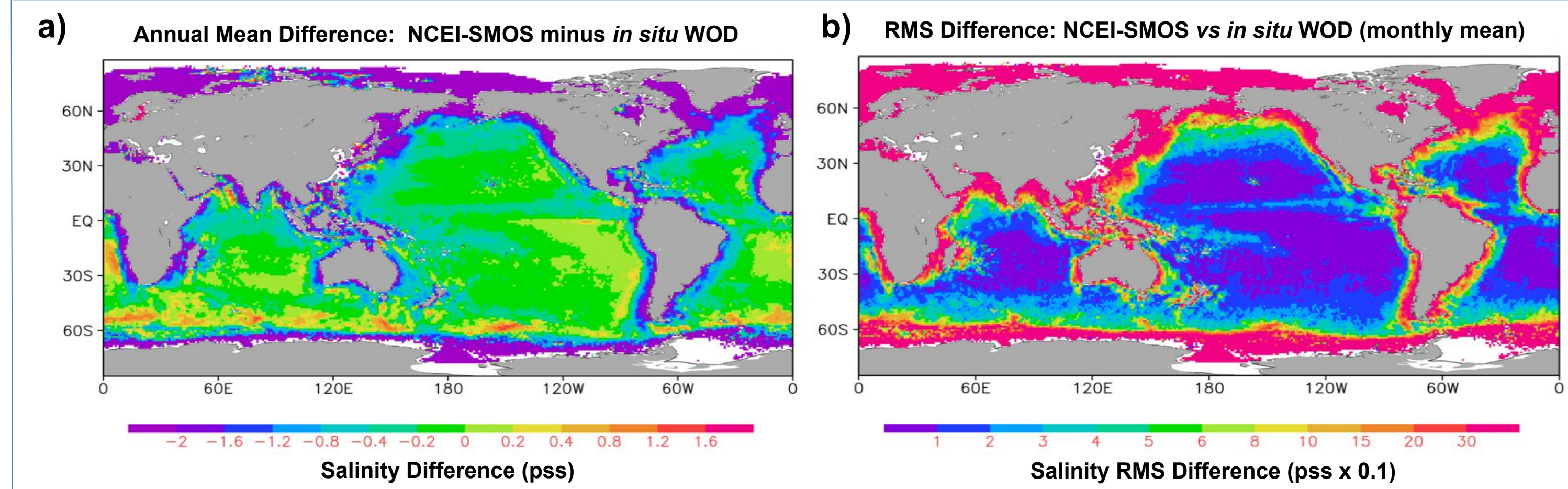


Figure 7. Salinity difference NCEI-SMOS versus World Ocean Database (WOD) – September 2011 to December 2014: a) Annual mean difference of monthly means (NCEI-SMOS minus WOD) and b) Root-mean-squared (RMS) difference of monthly means.

Summary

These comparisons demonstrate that NCEI's binned Level-3 SMOS and Aquarius SSS products, in the tropical and subtropical open oceans, agree well with the Level-3 fields produced by the NASA and ESA satellite mission programs and community experts, as well as with NCEI assessments derived from *in situ* observations. The NCEI products capture basin-wide salinity maxima and minima centers very well in both spatial extension and magnitude variability, particularly for maxima in the subtropical Pacific and Atlantic Oceans within the belts of subtropical subsidence and minima along the Inter-Tropical Convergence Zone (ITCZ). Larger biases are observed along coastal regions and within high-latitudes. These results indicate that using original satellite retrievals (Level-2 data) is complex in regard to the choice of filters (geophysical, retrieval and geometrical). To improve data quality, more investigation is needed on the filters, particularly for addressing issues with SSS retrievals at high-latitudes and along coasts. **All NCEI-binned SMOS and Aquarius Level-3 SSS data products are available via the NCEI SSS Level-2 data quality monitoring homepage: <http://www.nodc.noaa.gov/SatelliteData/sss/>.**

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