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New SMOS surface salinity retrieval overcomes previous issues in the Bay of Bengal: assessment of its seasonal and interannual variability

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The Bay of Bengal (BoB) exhibits a contrasted sea surface salinity (SSS), with very fresh water induced by heavy monsoonal precipitation and river discharge to the north, and saltier water to the south. The strong northern BoB haline stratification is believed to limit vertical mixing of heat and nutrients, with strong impacts on tropical cyclones intensity and primary production. While in situ data coverage is denser since the advent of the Argo program, it is still far from sufficient to provide complete maps of seasonal SSS. Salinity remote sensing (e.g. satellites such as SMOS, AQUARIUS, or SMAP) offers a unique opportunity to provide synoptic maps of the BoB SSS every $\sim$8 days. While recent studies have shown a good performance of the so far $\sim$ 2 years SMAP record in the BoB, the Aquarius mission is now over, and previous retrievals from the longer (2010 to now) SMOS mission did not perform well in this region. In this work, we provide an in-depth assessment of the new CATDS level-3 2010-2017 SSS retrieval from the SMOS instrument. This new retrieval includes an improved bias correction and a less stringent flagging of "outliers" based on both SMOS radiometric noise and natural SSS variability. Our results indicate that this new SMOS SSS performs considerably better than earlier versions, with a 0.8 correlation and -0.07 pss bias with respect to available in situ observations in the BoB. Comparisons with RAMA data also show that this new retrieval captures the interannual variability of SSS remarkably well in the Northern BoB ($\sim$ 0.8 correlation). We further take advantage of the $\sim$7 years of SMOS data to describe interannual SSS variability in the BoB, that is strongest in boreal fall, in relation with the occurrence of the Indian Ocean Dipole. This new SMOS retrieval can now be confidently used to monitor the year-to-year SSS variations in the BoB.