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Consolidating Sea Level Acceleration Estimates from Altimetry for the 1991-2019 Period

Ole Baltazar Andersen and Tadea Veng
DTU Space, GEO, Lyngby, Denmark (oa@space.dtu.dk)

More than 28 years of high precision satellite altimetry enables analysis of recent global sea level changes. Several studies have determined the trend and acceleration of global mean sea level (GMSL). This is however done almost exclusively with data from the TOPEX/Poseidon, Jason-1, Jason-2 and Jason-3 satellites (TPJ data). In this study we extend the altimetry record in both time and space by including independent data from the ERS-1, ERS-2, Envisat and CryoSat-2 satellites (ESA data). This increases the time-series to span more than 28 years (1991.7-2020.0) and the spatial coverage is extended from ± 66⁰ to ± 82⁰ latitude. Another advantage of the ESA data is that it is independent of the Cal-1 mode issues which introduces a significant uncertainty to the first 6 years of data from the TOPEX altimeter. Resulting GMSL accelerations of 0.080 ± 0.008 mm/yr^2 (TPJ) and 0.095 ± 0.009 mm/yr^2 (ESA).The distribution of sea level acceleration across the global ocean are highly similar between the ESA and TPJ dataset.

The Pinatubo eruption in 1991 and El-Nino Southern Ocean Oscillation will both affect GMSL. Particularly so as Pinatubo erupted right before the launch of the first ERS-1 satellite. The decrease in GMSL during the first years is seen in the ERS-1 data. We conclude that the effect of the Pinatubo as well as the ENSO effect on GMSL acceleration estimates are below the noise level with the extended time series.