Abstract:

Sea level is one of the 50 Essential Climate Variables (ECVs) listed by the Global Climate Observing System (GCOS) in climate change monitoring. In the past two decades, sea level has been routinely measured from space using satellite altimetry techniques. In order to address a number of important scientific questions such as "Is sea level rise accelerating?", "Can we close the sea level budget?", "What are the causes of the regional and interannual variability?", "Can we already detect the anthropogenic forcing signature and separate it from the internal/natural climate variability?", and "What are the coastal impacts of sea level rise?", the accuracy of altimetry-based sea level records at global and regional scales needs to be significantly improved. For example, the global mean and regional sea level trend uncertainty should become better than 0.3 and 0.5 mm/year, respectively (currently 0.6 and 1–2 mm/year). Similarly, interannual global mean sea level variations (currently uncertain to 2–3 mm) need to be monitored with better accuracy. In
this paper, we present various data improvements achieved within the European Space Agency (ESA) Climate Change Initiative (ESA CCI) project on "Sea Level" during its first phase (2010–2013), using multi-mission satellite altimetry data over the 1993–2010 time span. In a first step, using a new processing system with dedicated algorithms and adapted data processing strategies, an improved set of sea level products has been produced. The main improvements include: reduction of orbit errors and wet/dry atmospheric correction errors, reduction of instrumental drifts and bias, intercalibration biases, intercalibration between missions and combination of the different sea level data sets, and an improvement of the reference mean sea surface. We also present preliminary independent validations of the SL_cci products, based on tide gauges comparison and a sea level budget closure approach, as well as comparisons with ocean reanalyses and climate model outputs.

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