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Inherent uncertainties within altimetric Global Mean Sea Level time series

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Inherent uncertainty measures are provided for GMSL time series obtained as from altimetric sea surface height observations. For this purpose sea surface height (SSH) fields, simulated by the high resolution STORM/NCEP model for the period 1993 - 2010, are taken as the reference to define a true global mean sea level (GMSL). The truly global model SSH fields were sub-sampled along the altimeter tracks of the reference mission and were processed similar to the techniques used by six working groups to estimate GMSL, to provide an overview of the unavoidable uncertainties introduced by each method, leading to inherent artificial temporal variability in the resulting GMSL time series estimates. Comparing the resulting GMSL estimates to the model truth explains, that solely due to the limited latitudinal extend of the reference mission between 66°N and S, a 1.2 mm (rms) has to be considered as minimum inherent uncertainty for any of the resulting GMSL estimates. Further, both, the spatial and the temporal sampling of the TOPEX/Poseidon Jason-1/2 satellite series have a substantial impact on the GMSL estimates. Major impacts can also result from the interpolation technique and the amount of missing data. The choice of the mean sea surface (MSS) estimate, needed to estimate SSH anomalies, in combination with missing values, has a fundamental impact on the goodness of the GMSL estimates. Uncertainties for GMSL estimates of $\sim$0.8 mm to $\sim$4.2 mm (rms) result from the spatial and temporal sampling pattern in combination with the data processing procedures. This uncertainty is of the same order as the rms differences between the GMSL estimates available from different working groups based on real TOPEX/Poseidon Jason-1/2/3 satellite data of 1.6 mm.