Olivier
Henry
LEGOS/CNRS
Michael Ablain, CLS, Toulouse, France
Benoit Meyssignac, LEGOS/CNES
Anny Cazenave, LEGOS/CNES
Dallas Masters, CCAR, University of Colorado, USA
Steve Nerem, CCAR, University of Colorado, USA
Gilles Garric, MERCATOR Ocean, Toulouse, France
Oral
Determining how the global mean sea level (GMSL) evolves with time is of primary importance to understand one of the main consequences of global warming and its potential impact on populations living near coasts or in low-lying islands. Five groups are routinely providing satellite altimetry-based estimates of the GMSL over the altimetry era (since late 1992). Because each group developed its own approach to compute the GMSL time series, this leads to some differences in the GMSL interannual variability and linear trend. While over the whole altimetry time span (since 1993), good agreement is noticed for the computed GMSL linear trend (of 3.1 +/- 0.4 mm/yr), on shorter time spans, trend differences are larger than the 0.4 mm/yr uncertainty. Here we investigate what could cause these trend differences. We focus on outputs from two different groups: the Colorado University (CU) and Archiving, Validation and Interpretation of Satellite Oceanographic Data (AVISO) because associated processing of each group is largely representative of all other groups. For this investigation, we use the high-resolution MERCATOR ocean circulation model with data assimilation (version Glorys2-v1) and compute synthetic sea surface height (SSH) data by interpolating the model grids at the time and location of "true" along-track satellite altimetry measurements, focusing on the Jason-1 operating period (i.e., 2002-2009). These synthetic SSH data are then treated as “real” altimetry measurements, allowing us to test the different averaging methods used by the two processing groups for computing the GMSL: (1) averaging along-track altimetry data (as done by CU) or (2) gridding the along-track data into 2°x2° meshes and then geographical averaging of the gridded data (as done by AVISO). We also investigate the effect of considering or not SSH data at shallow depths (<120 m) as well as the editing procedure. We find that the main difference comes from the averaging method with significant differences depending on latitude: in the tropics, the gridding method overestimates the GMSL trend while at high latitudes (above 60°N/S), the along-track averaging method underestimates it. Potential causes of these differences are explored and discussed.
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