EGU23-10639, updated on 23 Apr 2024
https://doi.org/10.5194/egusphere-egu23-10639
EGU General Assembly 2023

Updating sea-level reconstruction since 1900

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Sea-level rise integrates the responses of several components (ocean thermal expansion, mass loss from glaciers and ice sheets, terrestrial water storage). Before the satellite era, global sea-level reconstructions depend on tide-gauge records and ocean observations. However, the available global mean sea level (GMSL) reconstructions using different methods indicate a spread in sea-level trend over 1900-2008 (1.3~2.0 mm yr^{-1}). With the improved understanding of the causes of sea-level change, here we update the original Church and White (2011) reconstruction by using the latest observations, taking the time-evolving sea-level fingerprint, sterodynamic sea level (SDSL) climate change pattern and local vertical land motion (VLM) into account. The updated trend of GMSL of 1.6 ± 0.2 mm yr^{-1} (90% confidence level) over 1900-2019 is consistent with the sum of contributions of 1.5 ± 0.2 mm yr^{-1}, slightly lower than 1.8 ± 0.2 mm yr^{-1} from original reconstruction. The lower trend from the updated reconstruction is mainly due to including residual VLM correction. The trends at tide gauge locations from updated reconstruction agree better with the tide gauge observations, with comparable mean trend of 1.7 mm yr^{-1} (standard deviation; STD of 2.0 mm yr^{-1}) from observation and 1.7 mm yr^{-1} (STD of 1.2 mm yr^{-1}) from the updated reconstruction. The inclusion of sea-level fingerprint and SDSL climate change pattern are the dominant contributors for improved reconstruction skill on regional scales at tide gauge locations. This update leads to GMSL solution that are consistent with other reconstructions in terms of long-term trend and 30-year running rate.