

20th Century Observed Regional Sea-Level Changes Compared to Climate Model Simulations

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Twentieth century regional sea-level changes are estimated from 12 climate models from the 5th phase of the Climate Model Intercomparison Project (CMIP5). The output of the CMIP5 climate model simulations were used to calculate the global and regional sea level changes associated with dynamic sea level, atmospheric loading, glacier mass changes and ice sheet surface mass balance contributions. The contribution from groundwater depletion, reservoir storage and dynamic ice sheet mass changes are estimated from observations as they are not simulated by climate models. All contributions are summed including the GIA contribution and compared to observational estimates from 32 tide gauge records over the twentieth century (1900-2015). We find a good agreement between the simulated sea level and tide gauge records in terms of inter-annual to multi-decadal variability over 1900-2015. But climate models tend to systematically underestimate the observed sea level trends. The corrections based on attributable biases between observations and models that have been identified in the part-1-paper, result in an improved explanation of observed sea level trends by climate models for most of tide-gauge records. Climate models show that the spatial variability in sea level trends observed by tide-gauge records is dominated by the GIA contribution and the steric contribution over 1900-2015. Climate models also show that it is important to include all contributions to sea-level changes as they cause significant local deviations; for example, the groundwater depletion around India which is responsible for the low 20th century sea-level rise in the region.

Keywords: sea level; climate model; climate change, tide gauge