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Ocean-bottom deformation due to present-day mass redistribution and its impact on sea-level observations

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Present-day mass redistribution increases the total ocean mass and, on average, causes the ocean bottom to subside elastically. Therefore, barystatic sea-level rise is larger than the resulting global-mean geocentric sea-level rise, observed by satellite altimetry and GPS-corrected tide gauges.

We use published estimates of mass redistribution from ice-mass loss and changes in land-water storage to quantify the resulting ocean-bottom deformation and its effect on global and regional ocean-volume change estimates. Over 1993-2014, the resulting globally-averaged geocentric sea-level change is 8 percent smaller than the barystatic contribution. Over the altimetry domain, the difference is about 5 percent, and due to this effect, altimetry reconstructions underestimate barystatic sea-level rise by more than 0.1 mm/yr over 1993-2014.

The deformation pattern shows distinct spatial features and hence, regional differences are often larger than the global-mean difference: up to 1 mm/yr over the Arctic Ocean and 0.4 mm/yr in the South Pacific. Hence, ocean-bottom deformation should be taken into account when regional sea-level changes are studied in a geocentric reference frame, as used by satellite altimetry or GPS-corrected tide gauges.