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Global mean thermosteric sea level projections by 2100 in CMIP6 climate models

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Most of the excess energy stored in the climate system is taken up by the oceans leading to thermal expansion and sea level rise. Future sea level projections allow decision-makers to assess coastal risk, develop climate resilient communities and plan vital infrastructure in low- elevation coastal zones. Confidence in these projections depends on the ability of climate models to simulate the various components of future sea level rise. In this study we estimate the contribution from thermal expansion to sea level rise using the simulations of global mean thermosteric sea level from 15 available models in the Coupled Model Intercomparison Project Phase (CMIP) 6. We calculate a global mean thermosteric sea level rise of 18.8 cm [12.8 - 23.6 cm, 90% range] and 26.8 cm [18.6 - 34.6 cm, 90% range] for the period 2081–2100, relative to 1995-2014 for SSP245 and SSP585 scenarios respectively. In a comparison with a 20 model ensemble from CMIP5, the CMIP6 ensemble mean of future global mean thermosteric sea level rise (2014-2100) is higher for both scenarios and shows a larger variance. By contrast, for the period 1901-1990, global mean thermosteric sea level from CMIP6 has half the variance of that from CMIP5. Over the period 1940-2005, the rate of CMIP6 ensemble mean of global mean thermosteric sea level rise is 0.2 ± 0.1 mm yr^{-1}, which is less than half of the observed rate (0.5 ± 0.02 mm yr^{-1}). At a multi-decadal timescale, there is an offset of ~10 cm per century between observed/modelled thermosteric sea level over the historical period and modelled thermosteric sea level over this century for the same rate of change of global temperature. We further discuss the difference in global mean thermosteric sea level sensitivity to the changes in global surface temperature over the historical and future periods.