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Sensitivity of climate change projections to uncertainties in the estimates of observed changes in deep-ocean heat content.

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The MIT 2D climate model is used to make probabilistic projections for changes in global mean surface temperature and for thermosteric sea level rise under a variety of forcing scenarios. The uncertainties in climate sensitivity and rate of heat uptake by the deep ocean are quantified by using the probability distributions derived from observed 20th century temperature changes. The impact on climate change projections of using the smallest and largest estimates of 20th century deep ocean warming is explored. The impact is large in the case of global mean thermosteric sea level rise. In the MIT reference ("business as usual") scenario the median rise by 2100 is 27 and 43 cm in the respective cases. The impact on increases in global mean surface air temperature is more modest, 4.9 C and 3.9 C in the two respective cases, because of the correlation between climate sensitivity and ocean heat uptake required by 20th century surface and upper air temperature changes. The results are also compared with the projections made by the IPCC AR4's multi-model ensemble for several of the SRES scenarios. The multi-model projections are more consistent with the MIT projections based on the largest estimate of ocean warming. However the range for the rate of heat uptake by the ocean suggested by the lowest estimate of ocean warming is more consistent with the range suggested by the 20th century changes in surface and upper air temperatures, combined with expert prior for climate sensitivity