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Estimates of long-term ocean property changes are confounded by poor spatio-temporal sampling and natural climate variability. Previous work has highlighted observed patterns of clear temperature and salinity changes which are replicated in independent analyses.

In this study, we use global climate models (from the CMIP5 and CMIP3 model suites) an observational analyses to investigate the regional distribution of temperature changes in the upper 700 dbar of the global ocean. While models do not perfectly replicate all the features expressed in observational estimates of long-term change, they highlight potential issues with current observational analyses due to the very poor spatio-temporal observational coverage.

Models suggest that inter-hemispheric warming is even in magnitude, a result not apparent in two independent estimates of observed changes. Multi-model mean maps suggest regions of maximum heat uptake occur in the North Atlantic (>20°N) and the Southern Ocean – along the path of the Antarctic Circumpolar Current (ACC; 40-50°S). This modelled coherent Southern Ocean warming is a feature starkly contrasts with observed estimates, and highlights deficiencies in the infilling methods used by current observational analyses in response to poor observational coverage.

If the regional distribution of modelled warming is taken as “truth”, models suggest that the long-term Southern Hemisphere ocean heat uptake has been underestimated, and current observed global ocean heat content estimates are 20% too low for the upper ocean (0-700 dbar) over the 1955-2004 period.

Key/words to include: fingerprint; importance of global mean;

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