

Global ocean heat content and freshwater content changes 1948-2009 from the GECCO2 Ocean Synthesis

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We provide estimates of the warming and freshwater content changes of the world ocean for 1948-2009. The output fields analyzed here are from a new synthesis (GECCO2), which covers the years 1948-2009 employing a similar configuration of the Massachusetts Institute of Technology general circulation model as the previous 50-yr run (1952-2001) of the GECCO model. In the new synthesis, the resolution was increased and it now includes the Arctic Ocean and a dynamic/thermodynamic sea ice model. The estimation of the control parameter was changed from a direct estimation of the fluxes to the estimation of daily atmospheric state variables, which include surface air temperature, humidity, precipitation and the 10 m wind speeds; surface fluxes are now derived by the model via bulk formulae. The synthesis uses the adjoint method to bring the model into consistency with available hydrographic and satellite data as well as prior estimates of surface fluxes. We present estimates of global changes of ocean heat content and freshwater content. Changes of the global heat content are largely consistent with other estimates but show as was visible before in GECCO a small reduction until 1970 and a slightly larger rise thereafter (particularly after the mid 1990s) than those reported by other estimates. Global freshwater content changes are as previously reported from GECCO too large to be considered reliable. Reasons for this include large biases of the net freshwater flux in NCEP and the insufficient data base of salinity data. Additionally, estimates of regional changes and trends over the decades from 1950 to now are presented. Regional changes of freshwater and heat content include redistributions of water masses as a response to circulation changes and are therefore much larger than the global changes and only minor affected by the global change.

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