



Vertical Redistributions of the Global Oceanic Heat and Salt Contents

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Ocean observations are critical for describing and understanding climate change and climate variability. For instance, an increasing ocean heat content is major evidence for global warming since the 1970s; ocean salinity has been used to infer changes in the global water cycle. The existing ocean observations, however, are primarily limited to the upper ocean and recently down to about 2000m (thanks to the Argo program). It is also frequently overlooked that the global ocean is a dynamically active system and has a memory of thousands of years. Not only the exchanges between ocean and atmosphere but the vertical exchanges inside the ocean contribute to the changes in the relatively well-observed upper ocean as well. Here, I will present the global oceanic vertical heat and salt fluxes as well as the related physical processes from a dynamically consistent and data-constrained ocean state estimate – ECCO (Estimating the Circulation and Climate of the Ocean) version 4. The results confirm that the vertical redistributions of the global oceanic heat and salt contents contribute significantly to the upper ocean temperature and salinity changes. We should, therefore, consider the vertical exchanges inside the ocean when inferring climate change and climate variability from the upper ocean observations. Implications of the vertical redistributions of oceanic heat and salt contents for changes in the deep ocean, where very limited observations are available, will also be discussed.