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High Frequency Fluctuations in the Heat Content of an Ocean General Circulation Model

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The transport and storage of heat by the ocean is of crucial importance because of its effect on ocean dynamics and its impact on the atmosphere, climate and climate change. Unfortunately, limits to the amount of data that can be collected and stored means that many experimental and modelling studies of the heat budget have to make use of mean datasets where the effects of short term fluctuations are lost.

In this paper we investigate the magnitude of the resulting errors making use of data from OCCAM, a high resolution global ocean model. The model carries out a proper heat balance every timestep so any imbalances that are found in the analysis must result from the use of mean fields.

The study concentrates on two areas of the ocean affecting the El Nino. The first is the region of tropical instability waves north of the equator. The second is in the upwelling region along the equator.

It is shown that in both cases, processes with a period of less than five days can have a significant impact on the heat budget. Thus analyses using data averaged over five days or more are likely to have significant errors. It is also shown that if a series of instantaneous values is available, reasonable estimates can be made of the size of the errors. In model studies such values are available in the form of the datasets used to restart the model. In experimental studies they may be in the form of individual unaveraged observations.