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Contribution of the shallow water areas not sampled by the Argo floats to the variability of the global ocean heat content

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The Argo hydrographic array aims at monitoring the evolution of the global ocean heat content (OHC) over a wide range of timescales. The objective of 3000 active floats over the global ocean has been reached at the end of 2007. However, the spatial coverage of the array is still inhomogeneous and some regions remain poorly or not sampled, as for example the shallow water areas (especially those shallower than 400m). We make use of a 50-year long, 1/4° global ocean/sea-ice numerical model simulation performed by the Drakkar Group to investigate the accuracy of the Argo array in monitoring the variability of the global ocean heat content. This paper more specifically focuses on the error that the non-sampling of coastal areas by Argo could induce in the estimation of the seasonal cycle of the OHC. Global model outputs are used to estimate the contribution of the shallow water areas that are not sampled by Argo floats to the seasonal signal of the OHC. It is found that omitting these regions in the calculation of the southern hemisphere OHC induces a small under-estimation of the variance of its seasonal cycle (less than 5%). In the northern hemisphere, ignoring the shallow areas results in a systematic under-estimation of the seasonal cycle of the OHC by nearly 22%. Because the seasonal cycles of each hemisphere are in opposition of phase, both errors partly compensate each other. The global error remains dominated by that of the northern hemipshere, and is therefore out of phase with the seasonal cycle of the global OHC (since this latter follows the phase of the southern hemisphere OHC because southern hemisphere oceans account for a greater volume). Consequently, the error induced by neglecting the shallow oceans in the estimation of the global OHC is a systematic over-estimation (by $\sim$20%) of the seasonal cycle of the global OHC.