Impact of Ocean Sub-Surface Observations on Coupled Atmosphere-Ocean 15-day Predictions

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Abstract

Coupled medium range, 15 day forecasts are now relatively commonplace in oper ational centres. But the benefits of coupled forecasting at these time scales is still not well understood. In particular, the role of the ocean initialization and the role of ocean observations in ocean state estimation is an open question. The OceanPredict SynObs Project was developed to understand the importance of ocean observations to extract maximum benefit from the ocean observing system. Through a series of ocean observing system experiments (OSEs) withholding various observations from ocean analysis, the importance of those observations can then be evaluated through their effect on the analysis, and ultimately on the ocean and coupled forecast initialized through those analyses. In this study, we will investigate the role of sub-surface ocean temperature and salinity profiles– and in particular, the strong role played by Argo profiling floats in determining the ocean initial state, and ultimately the ocean forecasts emanating from them. By withholding Argo float profile observations from Environment and Climate Change Canada's (ECCC's) ocean analysis system, GIOPS, as part of our participa tion in the SynObs project, we have identified the significance of those observations on the performance of the ocean analysis system, through comparison with an experiment where the observations are not withheld. Through further 15d coupled ensemble fore casts using ECCC's GEPS ensemble prediction system, we can then identify changes to the coupled forecasts. ∗Email: andrew.peterson@ec.gc.ca 1 Through these data withholding experiments and subsequent coupled forecasts, we have shown how the Argo profiles are vital for determining the sub-surface ocean, which then improves the coupled ocean forecast of sea surface temperature (SST). Ultimately, we will show these improvements propagate into improvements in atmospheric signals (sea level pressure and geopotential height at 850hPa), particularly in the tropics.