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Examining the impact of ocean observation system change in ocean heat content estimates using Synthetic Observations

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Ocean heat content (OHC) is a key indicator for monitoring global warming and evaluating climate models because of ocean's large heat capacity and volume. Due to insufficiency of subsurface observation, there is large spread among different ocean analyses and how to quantify the associated uncertainty is still quite a challenge. Mapping method, used to infill the data gap, is the major source of uncertainty in ocean analysis. As it is impossible to re-observe the historical ocean, ocean re-analyses or models, with full global ocean coverage and coherent dynamics, could be used as "truth" to evaluate performance of mapping method. Here we re-sample the C-GLORSv5 ocean re-analysis according to spatial-temporal locations of in situ ocean observations based on EN4.2.0 datasets, which forms the "Synthetic Observations", and then we fill the data gap through two mapping methods- Simple Grid Average (SGA) and Cheng et al. 2017 EnOI-DE method separately. How well the two methods can reconstruct historical OHC change is examined firstly. Potential influence of observation system change from ship-based system to Argo system will be investigated. How Argo network improves the global and regional subsurface thermal structure and global ocean heat content changes will be shown. Clarifying the locations of the error gives important implication to the future observation system design.