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An assessment of ten ocean reanalyses in the polar regions

Petteri Uotila and the Polar ORA-IP Team
Finnish Meteorological Institute, Climate Research Unit, Helsinki, Finland (petteri.uotila@fmi.fi)

Ocean reanalysis (ORA) combines observations either statistically or with a hydrodynamical model, to reconstruct historical changes in the ocean. Global and regional ORA products are increasingly used in polar research, but their quality remains to be systematically assessed. To address this, the Polar ORA Intercomparison Project (PORA-IP) has been established following on from the ORA-IP project (Balmaseda et al. 2015, with other papers in a special issue of Climate Dynamics). The PORA-IP is constituted under the COST EOS initiative with plans to review reanalyses products in both the Arctic and Antarctic, and is endorsed by YOPP - the Year of Polar Prediction project. Currently, the PORA-IP team consists of 21 researchers from 15 institutes and universities. The ORA-IP products with polar physics, such as sea ice, have been updated where necessary and collected in a public database. In addition to model output, available observational polar climatologies are collected and used in the assessments. Due to the extensive variety of products, this database should become a valuable resource outside the PORA-IP community.

For a comprehensive evaluation of the ten ORA products (CGLORSv5, ECDA3.1, GECCO$_2$, Glorys2v4, GloSea5_GO5, MOVEG2i, ORAP5, SODA3.3.1, TOPAZ4 and UR025.4) in the Arctic and Southern Oceans several specific diagnostics are assessed. The PORA-IP diagnostics target the following topics: hydrography; heat, salinity and freshwater content; ocean transports and surface currents; mixed layer depth; sea-ice concentration and thickness; and snow thickness over sea ice. Based on these diagnostics, ORA product biases against observed data and their mutual spread are quantified, and possible reasons for discrepancies discussed. So far, we have identified product outliers and evaluated the multi-model mean. We have identified the importance of the atmospheric forcing, air-ocean coupling protocol and sea-ice data assimilation for the product performance. Moreover, we are investigating co-variability between the Arctic Ocean heat content and the North Atlantic heat transport, and between the mixed layer depth, oceanic convection, the upper ocean hydrography and sea ice. We will also present other diagnostic results which provide closely related information for those interested in enhancing model predictive skill over a range of time scales, including seasonal to decadal.