

Evaluation of ocean reanalysis datasets from 2001 to 2020 for the East Sea and Yellow Sea

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The Korea Hydrographic and Oceanographic Agency (KHOA) has used the Regional Ocean Modeling System with a 3 km horizontal grid spacing to forecast ocean circulation in the East Sea (ES3K) and in the Yellow Sea (YES3K). To produce ocean reanalysis data using ES3K, temperature and salinity profiles from research vessels and Argo floats, as well as SST data from satellite observation from 2001 to 2020, were assimilated using an Ensemble Kalman filter. YES3K assimilated SST data from satellite observation using an Ensemble Optimal Interpolation. To evaluate these regional reanalysis data, ocean essential variables were compared with other global ocean reanalysis datasets, including HYCOM and Mercator Ocean model (GLORYS12V1), as well as global observation objective analyses datasets such as EN4 and WOA2018. Ocean essential variables, such as ocean heat content (OHC), depth of 10°C isotherm, mixed layer depth (MLD), salinity, and steric height, were calculated from the ocean reanalysis datasets and then compared with observation datasets. In the East Sea, OHC was lower in 2006, 2015, and 2018 but increased from 2016 to 2020 in EN4, Mercator, and ES3K. The depth of 10°C isotherm was shallower in 2006, 2015, and 2018 but increased from 2016 to 2020 in EN4, Mercator, and ES3K. MLD was thicker from 2009 to 2013 while it was thinner from 2014 to 2017 in all three reanalysis datasets. Salinity decreased from 2009 to 2016 and then recovered from 2017 to 2019 in EN4, HYCOM and Mercator. EN4 has an excessive low salinity in the northeastern East Sea. Steric height was lower in 2006 and 2018 in all datasets but increased from 2016 to 2020 in EN4, Mercator, and ES3K. Sea level increased from 2008 to 2016 in all reanalysis datasets. It increased from 2016 to 2020 in satellite altimeter observation and Mercator, while it decreased in HYCOM and ES3K. In the Yellow Sea, Sea level increased from 2005 to 2020 in satellite observation, Mercator, and ES3K, but it decreased from 2014 to 2020 in HYCOM. OHC rapidly decreased from 2007 to 2011 and then slowly

increased from 2012 to 2020. Interannual variations of ocean essential variables will be further examined, and the responsible dynamics will be investigated using the ocean reanalysis datasets.