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An assessment of High-Resolution regional ocean reanalysis for Northwest Pacific K-ORA22

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The Northwest Pacific Ocean has complicated ocean current systems, with numerous marginal seas interconnected through narrow straits. These marginal seas are significantly impacted by their regional surroundings and exhibit unique physical characteristics of their own. The Korea Institute of Ocean Science and Technology (KIOST) has developed the Korea Operational Oceanographic System-Ocean Predictability Experiment for Marine environment (KOOS-OPEM), which incorporates Ensemble Optimal Interpolation (EnOI), to gain a comprehensive understanding of its ocean current systems and the precise simulation of their unique physical properties. In this study, we present the KOOS-OPEM ReAnalysis version 2022 (K-ORA22) spanning period 2011 to 2022 and conduct a comparative analysis between K-ORA22 and other high-resolution global reanalyses including the Hybrid Coordinate Ocean Model (HYCOM), Global Ocean Reanalysis and Simulation (GLORYS), and Bluelink ReAnalysis (BRAN) to demonstrate its reproducibility of regional characteristics and reliability. Statistical comparisons reveal that while K-ORA22 exhibits some warm biases, its sea surface temperature (SST) correlation, standing at approximately 0.96, is comparable to other reanalysis datasets. Additionally, three reanalyses, excluding BRAN, effectively reproduce the coastal upwelling, which is characterized by a sharp decrease in SST as observed from meteorological buoys. Impressively, K-ORA22 outperforms other reanalyses in accurately reproducing the unique characteristics of East/Japan Sea Intermediate Water (ESIW), characterized by the salinity minimum layer. In addition, K-ORA22 stands out in its ability to accurately reproduce the Yellow Sea Cold Water Mass (YSCWM), outperforming other reanalyses with the lowest root mean square error (RMSE) of 0.76 in the YS region. In

comparing the monthly and annual variability of volume transport through the Korea Strait, K-ORA22 stands out among other reanalyses, achieving the lowest Root Mean Square Error (RMSE) of 0.30. In conclusion, K-ORA22 excels in reproducing unique characteristics and physical properties of marginal seas. Due to these advantages over global reanalysis, it is expected that K-ORA22 can be used for recent variability analysis of marginal seas in the Northwest Pacific as well as for initial conditions and boundary conditions of regional ocean models.