The Mediterranean and Black Seas forecasting physical systems: description and validation assessment

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Abstract

The Mediterranean and Black Sea operational forecasting systems, developed within the framework of the Copernicus Marine Service (CMEMS), provide operational analyses and 10-day forecasts of the main physical ocean variables, including temperature, salinity, sea level, currents, and mixed layer depth. The Mediterranean system operates at approximately 4 km horizontal resolution with 141 vertical levels, while the Black Sea system has a horizontal resolution of approximately 2.5 km and 121 vertical levels. Both systems are based on the NEMO (Nucleus for European Modelling of the Ocean) circulation model and employ the OceanVar2.0 data assimilation scheme to integrate in situ temperature and salinity profiles, satellite sea level anomaly observations, and sea surface temperature data. Continuous validation is performed throughout both the system development and operational phases using model diagnostics and comparisons with quasi-independent and independent observational datasets. Near-real-time operational skill assessments are also routinely provided through regional websites to monitor product quality. These assessments include analyses and forecast maps at different depths, together with weekly comparisons between model analyses and available observations. This work presents an overview of the Mediterranean and Black Sea operational forecasting systems and their validation framework, with a focus on the assessment of model performance against independent in situ and satellite observations.