KHOA's ocean forecasting activities and their applications

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Abstract

The Korea Hydrographic and Oceanographic Agency (KHOA) has operated the Korea Ocean Observing and Forecasting System (KOOFS) since 2012. KOOFS comprises three nested ocean models (regional, sub-regional and coastal area) at horizontal resolutions of 28 km to 300 m, and a nested regional atmospheric model at horizontal resolutions of 20 km and 4 km. The resultant forecasts are employed in multiple applciations, including in search and rescue operations, to produce sea condition forecast maps, as index services for marine recreational activities and for ocean forecast broadcasting.

In terms of their details, the ocean models comprise the Regional Ocean Modeling System or ROMS-based North Pacific Ocean model (NP28k_ROMS, 1/4°) and the Modular Ocean Model or MOM5-based Northwest Pacific Ocean model (NWP5k_MOM5, 1/24°) at regional scales; the ROMS-based East Sea model (ES3k_ROMS, 1/32°), the Yellow and East China Seas model (YES3k_ROMS, 1/32°), and the Ulleung Basin model (UB1k_ROMS, 1/108°) at sub-regional scales; and the MOdelação HIDrodinâmica or MOHID-based Korean Coastal model (KC300m_MOHID, 1/288°) and the ROMS-based Ulleungdo-Dokdo model (UD300m_ROMS, 1/324°) at coastal scales. The atmospheric models are the Weather Research and Forecasting or WRF-based Northwest Pacific Atmosphere model (NWP20k_WRF) at a regional scale, and the WRF-based Korean Marginal Seas Atmosphere model (YS4k_WRF) at a sub-regional scale. Every day the regional and sub-regional ocean models (NP28k_ROMS and YES3k_ROMS) generate 8-day forecasts, while the others produce 72-hr forecasts.

KHOA has implemented several proceedures to optimise its forecasts and their usage. For example, the regional and sub-regional ocean models and the regional atmospheric model are integrated along with a data assimilation system to enhance model accuracy. For NPacific28k, the 4DVAR scheme is used to assimilate satellite-sensed sea surface temperature data (OSTIA), with a 7-day assimilation window. For NWP5k_MOM5, YES3k_ROMS, NWP20k_WRF and

YS4k_WRF, the Ensemble Optimal Interpolation (EnOI) data assimilation method is employed while for ES3k_ROMS the Ensemble Kalman Filter (EnKF) method is employed, both using OSTIA satellite-sensed sea surface temperature and GTSPP T/S (temperature/ salinity) profile data inputs.

In addition, since 2015 KHOA has valuated the daily model prediction results via the Korea Ocean Modelling Validation System (KOMVAS). Via this system, forecast data are compared with real-time observation (sea-level height, temperture, salinity, and current) records from tidal stations, ocean buoys and three Ocean Research Stations, with cost functions (CF) calculated concerning forecast skill and predictability. Furthermore, to provide the prediction data in optimal formats for end-users that minimize errors and encourage usage, KHOA has constructed a grid-based display system and open API (application programming interface), enabling ready access to model outputs.