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# A high resolution Adriatic-Ionian Sea circulation model for operational forecasting

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A new numerical regional ocean model for the Italian Seas, with focus on the Adriatic-Ionian basin, has been implemented within the framework of Technologies for Situational Sea Awareness (TESSA) Project. The Adriatic-Ionian regional model (AIREG) represents the core of the new Adriatic-Ionian Forecasting System (AIFS), maintained operational by CMCC since November 2014. The spatial domain covers the Adriatic and the Ionian Seas, extending eastward until the Peloponnesus until the Libyan coasts; it includes also the Tyrrhenian Sea and extends westward, including the Ligurian Sea, the Sardinia Sea and part of the Algerian basin. The model is based on the NEMO-OPA (Nucleus for European Modeling of the Ocean – Ocean PArallelise), version 3.4 (Madec et al. 2008). NEMO has been implemented for AIREG at 1/45° resolution model in horizontal using 121 vertical levels with partial steps. It solves the primitive equations using the time-splitting technique for solving explicitly the external gravity waves. The model is forced by momentum, water and heat fluxes interactively computed by bulk formulae using the 6h-0.25° horizontal-resolution operational analysis and forecast fields from the European Centre for Medium-Range Weather Forecast (ECMWF) (Tonani et al. 2008, Oddo et al. 2009). The atmospheric pressure effect is included as surface forcing for the model hydrodynamics. The evaporation is derived from the latent heat flux, while the precipitation is provided by the Climate Prediction Centre Merged Analysis of Precipitation (CMAP) data. Concerning the runoff contribution, the model considers the estimate of the inflow discharge of 75 rivers that flow into the Adriatic-Ionian basin, collected by using monthly means datasets. Because of its importance as freshwater input in the Adriatic basin, the Po River contribution is provided using daily average observations from ARPA Emilia Romagna observational network. AIREG is one-way nested into the Mediterranean Forecasting System (MFS, http://medforecast.bo.ingv.it/) using daily means fields computed from daily outputs of the 1/16° general circulation model. One-way nesting is done by a novel pre-processing tool for an on-the-fly computation of boundary datasets compatible with BDY module provided by NEMO. It imposes the interpolation constraint and correction as in Pinardi et al. (2003) on the total velocity, ensuring that the total volume transport across boundaries is preserved after the interpolation procedures. In order to compute the lateral open boundary conditions, the model applies the Flow Relaxation Scheme (Engerdhal, 1995) for temperature, salinity and velocities and the Flather's radiation condition (Flather, 1976) for the depth-mean transport. Concerning the forecasting production cycle, AIFS produces 9-days forecast every day, producing hourly and daily means of temperature, salinity, surface currents, heat flux, water flux and shortwave radiation fields. AIREG model performances have been verified by using statistics (root mean square errors and BIAS) with respect to observed data (ARGO and CDT datasets)