Geophysical Research Abstracts
Vol. 20, EGU2018-12024-1, 2018
EGU General Assembly 2018

Turkish Straits System (TSS) Forecasting System Development for the Black Sea Monitoring and Forecasting Center (BS-MFC) of the Copernicus Marine Environment and Monitoring Service (CMEMS)

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The Turkish Straits System (TSS), inter-connects the adjacent Aegean, Marmara and Black Seas through the Bosphorus and Dardanelles Straits. The TSS is a complex dynamical system providing transport of water, mass, heat and materials between these domains. The combined nonlinear response of the system is determined by, but different from, a combination of the individual responses of its elements interacting over a wide range of scales, influencing the circulation, transport and mixing processes and the hydrological cycle, with impacts on ecosystems and climate on regional scale.

The TSS model development by Gürses et al. (2016) and Aydoğdu et al. (2017) have been adopted with further improvements of operational forecasting system evolution under the CMEMS BS-MFC, geared towards eventual inter-basin coupling, as well to provide boundary conditions for the Black and Mediterranean Seas. The FESOM based model uses a high-resolution grid capturing fine local details of the TSS bathymetry, and runs with updated net water fluxes through the TSS, subject to seasonal stratification properties specified with a 15d time scale of Newtonian relaxation, based on summaries of historical data in adjacent basins. The present 5-day operational forecasts are produced under atmospheric surface conditions supplied by the European Center for Medium-Range Weather Forecasts (ECMWF), through the auspices of the Turkish State Meteorological Office.

The forecasts providing data and their displays on a web page fill an important gap in knowledge and understanding of the interactions within and across the TSS, documenting a rich sequence of readily observable meso-scale events, providing the first-time ever details of basin flushing and turbulent mixing by the jets issued from the Bosphorus and the Dardanelles Straits into the surrounding waters, their modulations by eddies and basin oscillations, while realistically preserving the sharp stratification and shear between the surface layer and the deeper waters. The TSS forecasting tool promises to avail these details for universal understanding and forecasting of the coupling between the greater Mediterranean and Black Seas - oceans.