OPERATIONAL FORECASTING FOR THE NORTHERN LEVANTINE, BLACK SEA AND THE TURKISH STRAITS SYSTEM: PROBLEMS AND PROSPECTS

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Abstract
Operational coastal ocean forecasts are developed for the seas encircling the Anatolian peninsula (Turkey) includig the northern Levantine Sea, Black Sea and the Turkish Straits System (TSS). An observing system of real-time coastal measurements has also been developed. Operational coupled ecosystem models are also aimed, with encouraging first results. The observational system consists of coastal sea-level and meteorological stations and an ADCP system in the Bosphorus Strait. The problems and prospects of forecasting and experiences to date are described.
Keywords: Straits And Channels, Black Sea

Coastal ocean forecasts for the northern Levantine Sea have been developed, and have been operational since 2005, driven by high resolution atmospheric forcing and nested in the MFS (Mediterranean Forecasting System) regional forecast models [1]. The model has a horizontal resolution of 1.35 km and 28 vertical sigma levels. Recently the forecast modelling has been updated to include the effects of major rivers in the Cilician basin of the northeastern Levantine, supplying the main fresh water inputs to the region, contributing significantly more than the present discharge of the Nile river into the Levantine Sea. Mersin Bay and Iskenderun Gulf, connected through a wide shelf region in the northeastern corner of the Levantine Sea alone receive most of the fresh water, therefore making it a region of freshwater influence (ROFI). On the other hand, the westerly flowing Asia Minor current is an often unstable jet that meanders and sheds eddies in the northern Levantine, and especially in the Cilician Basin, connected to the shelf that receives large amounts of fresh water, which are then dispersed by the eddies and meanders. Satellite data display the influence region of the dispersion pattern. A deep current, underlying the Asia Minor current, is generated along the steep shelf region to the west as the flow over the sill between the Cypriot and Turkish coasts induces an overflow that veers to the north, steered by the slope topography. Levantine Intermediate Water formation, also observed in continuing experimental programs, has been captured in the forecasts in several early spring cases. Convective mixing in the shallow shelf area of the Mersin Bay and Iskenderun Gulf preceeds the leakage of this water first to the west and later to greater depths. The construction of an operational coupled ecosystem model has been tested with promising first results, but presently remains somewhat prohibitive in terms of computer runtime requirements.

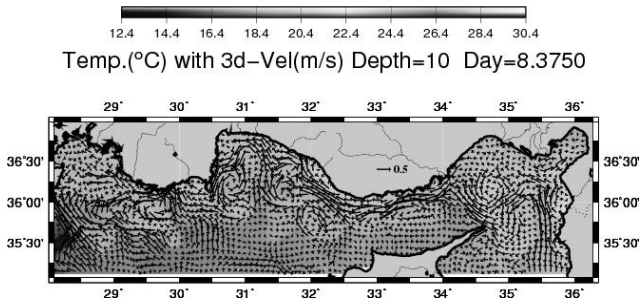

Fig. 1. Forecast sea surface temperature and currents at 90 hrs after 1st of January 2010, northern Levantine sea.

Operational forecasts have been developed for the entire Black Sea, using high resolution surface atmospheric fluxes of mass, momentum and heat, as well as the monthly fresh water fluxes of the major Black Sea rivers that dominate the behaviour of the system. Annual mean fluxes are specified at the Bosphorus with time relaxation. The model has a horizontal resolution of 2.5 km and 30 vertical sigma levels. The main double-gyre circulation of the Black Sea, the 'rim-current' structure, and major semi-permanent features such as the 'Sevastopol eddy' are well represented. The spreading of fresh water from the large rivers of the northwest shelf, primarily affects the shelf region, but also spreads to other parts of the Black Sea with the rim current.

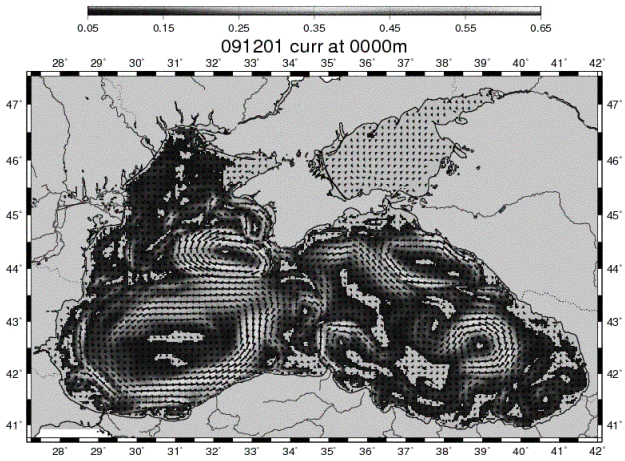

Fig. 2. Black Sea operational forecast for 1 December 2009.

The implementation of an operational model for the Turkish Straits is a formidable task, because of the major problems of multi-scale coupling between different elements of the system and with the adjacent basins. The approach for a first level of understanding has been based on decoupling and studying separate parts, which individually have sufficient complexity. Despite the prohibitive requirements for resolution and physical processes representation, a reasonably resolving model of the Turkish Straits System is also attempted, and has so far yielded promising results.

A coastal observation network consisting of sea-level and surface meteorology sensors at 14 stations along the coasts and an ADCP profiling station in the Bosphorus has been set up to collect real-time data [2]. The system has been operational for about 2 years, and is aimed to complement the forecasting systems.

References
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