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# A close look at the middle Adriatic upwelling: schematized ROMS model simulations

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Strong upwelling driven by the NNW winds was detected off the eastern middle Adriatic coast in May 2017. High resolution CTD data revealed thermocline doming by about 20 m at approximately 20 km from the coast. Main characteristics of the upwelling event are reproduced in the realistic ROMS model simulation. Adriatic scale ROMS model having 2.5 km horizontal resolution, forced by the air-sea fluxes calculated using surface fields from operational weather forecast model ALADIN-HR (Tudor et al., 2013; Termonia et al., 2018), river discharges, tides and water mass exchange through the Strait of Otranto, reproduces cold water dome and two-layer offshore flow in accordance with CTD and shipborne ADCP measurements. Significant improvement in the upwelling simulations is obtained using increased drag coefficient. The location of upwelling is correctly modelled, although with somewhat lower upper layer temperatures if compared with measurements. Moreover, the surface cyclonic circulation indicated by ADCP measurements along the cross-Adriatic transect is also evident in the model results. In order to improve understanding of the upwelling mechanism, several schematized numerical experiments are conducted. Wind fields from dynamical adaptation (Zagar and Rakovec, 1999; Ivatek-Sahdan and Tudor, 2004) of ALADIN-HR8 (8 km horizontal grid spacing) wind forecast to 2 km grid, are decomposed by the Natural Helmholtz-Hodge Decomposition (HHD) into divergence-free (incompressible), rotation-free (irrotational), and harmonic (translational) component (Bhatia et al., 2014). The components thus obtained and their combinations are used for calculation of the wind stress instead of the total wind field. Simulations with decomposed wind stress are conducted in the Adriatic domains with both flat bottom and realistic topography. Schematized simulations reveal that the positive rotational wind component is responsible for the rising of thermocline through Ekman pumping and it is more pronounced in the flat bottom basin. In the simulations with divergent wind component, the thermocline doming disappears and only coastal upwelling is reproduced. Additional idealised simulations with homogeneous NW wind stress are performed assuming both two-layer and uniform initial density field.