THE 2015 NORTHERN ADRIATIC EXPERIMENT: PRELIMINARY RESULTS

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Abstract

The paper overviews research activities carried out as within the 2015 Northern Adriatic Experiment, aiming to explore wintertime processes occurring in the coastal northeastern Adriatic Sea. Field campaigns employing moored ADCPs, a towed undulator, a glider, drifters, a profiling float and ship-borne CTD were conducted in the winter/spring of 2014/2015, accompanied with coupled atmosphere-ocean high-resolution model. The dense water formation have been documented to occur in the area during several consecutive Bora wind outbreaks. Advection of open ocean waters towards the coast, mesoscale variability of a thermohaline front and high-frequency phenomena have been investigated as well.

Keywords: Coastal waters, Mesoscale phenomena, Air-sea interactions, North Adriatic Sea

Shelf-type dense water formation (DWF) has been known for a long time to occur in the Northern Adriatic, resulting in a dense water outflow and driving of the Adriatic thermohaline circulation [1,2]. However, the contribution of a complex multi-channel eastern Adriatic coastal area to the DWF has only been quantified recently during an extreme winter following anomalous preconditioning [3]. The wintertime dynamics in the area have also been known for strong frontal zones stretching in the direction of the bora jet [4,5] and for a complex small strait dynamics with gradients occurring between the open Adriatic and coastal waters.

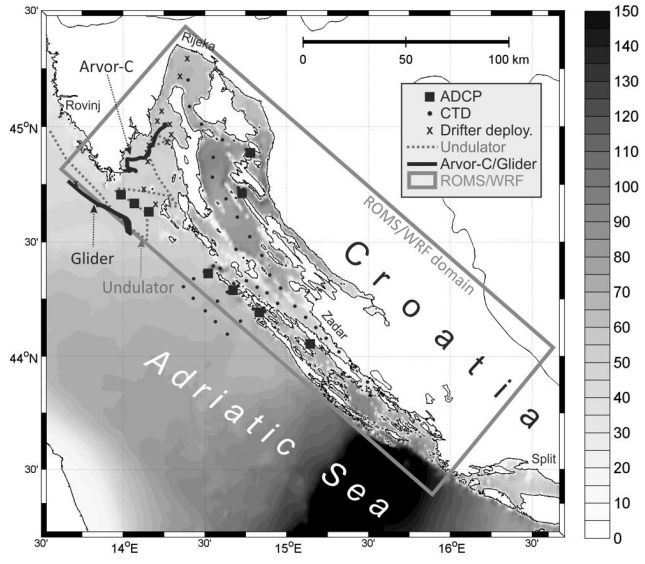

Fig. 1. The setting of the 2015 Northern Adriatic Experiment, with marked CTD lines and stations, ADCP moorings, glider and towed undulator lines, Arvor-C trajectory, surface drifter deployment positions and inner domain of the northern Adriatic modelling system.

Despite its complexity and presumed importance, the eastern Adriatic coastal area has been somehow neglected in oceanographic campaigns, and particularly its inner zone, where numerical modelling and sparse CTD campaigns have been the only tool used for quantifying the ocean dynamics. For that reason, a multi-platform oceanographic experiment was organized in the winter/spring of 2014/2015, through collaboration of several Croatian and Italian ocean research institutes and universities. The campaigns included: (1) eight-month-long monitoring of currents in connecting channels at nine ADCP stations, (2) two CTD surveys, (3) a four-day survey with a glider, (4) a survey with a towed undulator crossing the thermohaline front, (5) deployments of 13 surface drifters, and (6) CTD profiles by a Arvor-C float. High-resolution ocean model (ROMS) forced by numerical weather prediction mesoscale models (Aladin/HR, WRF) accompanied the field campaigns. The illustration of the experimental setting is presented in Fig. 1.

Initial analysis of both observational and modelling data indicates a variety of processes, of which the most interesting include: (1) the inflow of saline waters from the open Adriatic to coastal area in early winter, continued during the spring and intensified by the outflow of newly-generated coastal dense waters; (2) the DWF in the coastal area in winter that occurred during several consecutive severe bora wind outbreaks; the dense waters have been found to subsequently overflow towards the open Adriatic, and to influence the Adriatic water mass budget; (3) the formation, degradation and mesoscale variability of the Istrian thermohaline front over a daily timescale as measured by the glider; along-front change in temperature and salinity was as high as 1.5°C and 1.0 for temperature and salinity, respectively; also, a cosine-like horizontal oscillations have been found in drifter trajectories perpendicular to the mainstream, indicating mesoscale pulsations and waves along the front; (4) high-frequency phenomena of inertial, tidal (barotropic and baroclinic), topographic (the Adriatic seiche of 21.5 h) and advective origin.

An in-depth investigation of these processes will complement ongoing efforts to quantify a number of hot Adriatic topics, like the DWF and the role of the coastal eastern Adriatic in a changing Adriatic environment.

References

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