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TITLE: Dense-water bottom currents in the Southern Adriatic Sea in spring 2012

AUTHOR: ['Jacopo Chiggiato', 'A. Bergamasco', 'Mireno Borghini', 'Francesco Marcello Falcieri', 'Pierpaolo Falco', 'Leonardo Langone', 'Stefano Miserocchi', 'Aniello Russo', 'Katrin Schröder']

ABSTRACT:

In February 2012, a severe cold spell in the European region triggered a massive production of very dense water on the northern Mediterranean Sea shelves. The spreading phase of the newly formed dense water was extensively studied in the Adriatic Sea by means of 2 ship surveys and 5 moorings fully equipped to monitor the flow of the bottom layer. For the Adriatic Sea, opposite to the Gulf of Lions, the area of cascading is far from the source area and this implies substantial modifications, adjustments and dilution of the source water mass along its path, with a spreading phase lasting several months. Indeed all the moorings detected events, although weaker than in the preceding months, until June 2012. The surveys detected 2 branches of NAdDW on the shelf, the first branch not denser than 29.7 kg/m³ and the second branch not denser than 29.5 kg/m³. Despite the extremely dense water generated in the Northern Adriatic, during events of dense-water flow, moorings recorded temperatures generally between 12.5 and 13 °C, seldom less. Temperatures along the shelf break also did not fall below 13 °C at depths greater than 400 m. Turbulent mixing, therefore, heavily modified the cascading plumes, which left the shelf with thicknesses between 10 and 30 m. Mooring data in the lowermost 100 m suggest that the thickness of the cascading layer increased by several tens of meters downslope, as a consequence of entrainment. Detraining frictional layers as well as locations of active cascading were identified mostly by isolated casts, highlighting the submesoscale domain of the downsloping plumes. The use of LADCP data allowed identification of very energetic bottom flow (40–50 cm/s in many locations), with otherwise little signature in tracers, not previously observed. The Bari Canyon System (BCS) was so far recognized as a hot spot for cascading in the Southern Adriatic. However, during the 2012 event, this is not the only preferred site for cascading. Significant dense flow was detected in other locations. The northernmost mooring site, closer to the inception of the cascading process, in particular showed active cascading and several dynamical differences from the BCS: denser water with thinner boundary layer, events organized in multiple pulses with sub-inertial periodicity and with very short duration (12 h to 1 day) that is generally not seen in other locations.

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