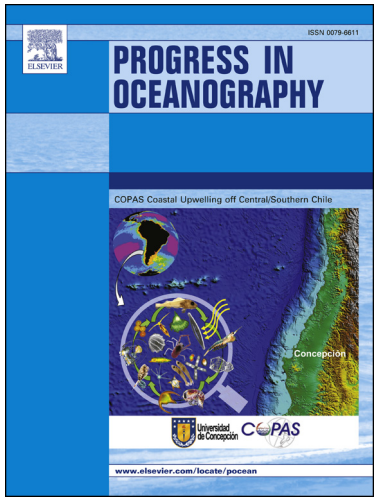
Accepted Manuscript



Response of the Adriatic Sea to an intense cold air outbreak: dense water dynamics and wave-induced transport

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PII: S0079-6611(14)00148-7
DOI: http://dx.doi.org/10.1016/j.pocean.2014.08.015
Reference: PROOCE 1469

To appear in: *Progress in Oceanography*

Received Date: 18 March 2014
Revised Date: 20 August 2014
Accepted Date: 31 August 2014

Please cite this article as: Benetazzo, A., Bergamasco, A., Bonaldo, D., Falcieri, F.M., Sclavo, M., Langone, L., Carniel, S., Response of the Adriatic Sea to an intense cold air outbreak: dense water dynamics and wave-induced transport, *Progress in Oceanography* (2014), doi: http://dx.doi.org/10.1016/j.pocean.2014.08.015

Response of the Adriatic Sea to an intense cold air outbreak: dense water dynamics and wave-induced transport.

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Abstract

The paper describes formation and spreading of dense shelf waters in the Adriatic Sea (North Adriatic Dense Water, NAdDW) during the winter of 2012 as a consequence of an intense and long cold air outbreak of northeasterly Bora winds. As a result, during February 2012 northern Adriatic Sea water temperature dropped to about 6° C and density exceeded 1030 kg/m^3, most likely the maximum value since 1929. NAdDW dynamics has been investigated by means of a 3-D ocean-wave coupled model running on a high resolution and eddy-permitting grid. The numerical experiments have relied on the Coupled-Ocean-Atmosphere-Wave-Sediment-Transport (COAWST) system forced one-way with atmospheric forcings provided by the model COSMO-I7. A suite of observational data has been used to characterize the Bora event and evaluate numerical model performance. At sub-basin scales, the newly formed waters flowing southerly have produced a water renewal of the northern Adriatic, as more than 50% of water volumes have left the basin. Dense waters volume transports, evaluated through different Adriatic cross-sections, have been modulated by tides (damped for the densest water masses) and reached about 1 Sv. The contribution of wave-induced forcings has been quantified and examined, indicating that these represent a major driving mechanism during NAdDW production and spreading phases. This work provides evidence that NAdDW is spread accordingly with two different mechanisms: at early stages of its formation, the wind-driven ocean circulation pushes newly formed