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The winter 2012 cold outbreak over the Northern Adriatic Sea: preliminary comparison among data and high resolution operational atmospheric models

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Shelf types of dense-water formation (DWF) processes occur frequently in the Northern Adriatic Sea (NA), due to specific synoptic conditions and wind patterns, mostly related to the blowing of cold and severe Bora winds, advecting cold and dry air from north-eastern Europe, down the Dinaric Alps. The use of low-resolution modelled winds is not able to properly reproduce the fine scale features typical of this basin, particularly in the case of the cross-basin Bora patterns, being the complex Adriatic orography ioften poorly reproduced in atmospheric models.Therefore, in order to understand and model the processes of DWF in the NA, it is mandatory to use high-resolution meteorological and circulation models.

Within the framework of activities of the Italian flagship Project “RITMARE” and of the FIRB “DECALOGO”, several numerical meteorological models at high resolution are made available to describe events of exceptionally dense water formation, such as that registered during the winter 2012 in the NA region, when large energy losses were registered due to cold and extremely strong Bora winds. Available measurements in the NA (temperature, salinity, density, wind speed, direction and inferred heat fluxes) are used to carry out a first semi-quantitative comparison among existing meteorological models implemented over the region.

Specifically, two uncoupled meteorological modelling systems (BOLAM/MOLOCH and WRF) and one one-way coupled (COSMO/ROMS) have been implemented for the simulation of this cold air outbreak. The uncoupled models are able to capture well the low level cold air intrusion, modulated by the narrow orographic gaps, and the evolution in the sensible heat fluxes intensity. However, the intensity of the fluxes results overestimated when compared to those derived from observations. Preliminary one-way coupled model results seem to partially correct this overestimation, most likely due to the exceptional cold SST not captured by the ocean climatological values adopted by the uncoupled models. A full bi-directional coupling with ocean circulation models, as planned within RITMARE project, will allow to better investigate the reasons of this discrepancy.