EMS Annual Meeting Abstracts
Vol. 10, EMS2013-655-1, 2013
13th EMS / 11th ECAM

Ocean-atmosphere dynamics during winter 2012 in the Northern Adriatic sea by means of a coupled ocean-atmosphere-wave modeling system

S. Carniel (1), M.M. Miglietta (2), A. Benetazzo (1), J.C. Warner (5), A. Ricchi (3), P. Falco (3), A. Russo (4), and M. Sclavo (1)

(1) CNR-ISMAR, Inst. of Marine Sciences, Venice, Italy (sandro.carniel@ismar.cnr.it), (2) CNR-ISAC, Inst. of Atmospheric Sciences and Climate, Bologna, Italy, (5) USGS, Woods Hole, USA, (3) Univ. Parthenope, DISAM, Naples, Italy, (4) Univ. Polit. delle Marche, Ancona, Italy

Coastal areas processes depend on both local scale and regional scale forcings; thus, in order to provide useful insights into how the coastal zone evolves and for managing both natural and economic resources, a thorough understanding of such processes is needed.

During late January and early February 2012, the eastern Mediterranean area was characterized by a persistent cyclonic circulation associated with an exceptional cold anomaly. This atmospheric pattern was responsible for large heat energy losses in the shallow northern Adriatic sea (NA), mostly due to cold and extremely strong Bora winds that induced a drop in sea water temperatures to about 6 [U+25E6] C and the partially icing of the Venice lagoon.

Within the framework of the activities foreseen by the Italian National Flagship Project "RITMARE", we investigated this cold air outbreak episode utilizing a coupled numerical modeling approach. More specifically, we used the Coupled Ocean – Atmosphere – Wave – Sediment Transport (COAWST) Modeling System (Warner et al., 2010) that in this configuration utilizes the Model Coupling Toolkit to exchange prognostic and diagnostic variables between the ocean model ROMS, atmosphere model WRF and wave model SWAN.

The models exchange fields of sea-surface temperature (SST), ocean currents, water levels, bathymetry, wave heights, lengths, periods, bottom orbital velocities, and atmospheric surface heat and momentum fluxes, atmospheric pressure, precipitation, and evaporation. Data fields are exchanged using regridded flux conservative sparse matrix interpolation weights computed from the SCRIP spherical coordinate remapping interpolation package. Both WRF and ROMS use the same quantities of fluxes at the ocean–atmosphere interface. If the effect of the waves is taken into account in the momentum exchange between the ocean and the atmosphere, the closure model includes several different state-of-the-art parameterizations for the surface roughness based on integral quantities of the wind wave spectrum.

The work aims at disentangling the different contributions that the complex interplay among ocean-atmosphere-wave can give origin to, by comparing different approaches available in the literature.

Comparison with results obtained for the same episode by uncoupled atmosphere modelling systems and one-way coupled models are presented and discussed. First results indicate that 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. One-way coupled model results seem to partially correct this overestimation, partly due to the exceptional cold SST not fully available to the uncoupled models. A first full bi-directional coupling between atmosphere and ocean circulation models has been implemented and analysis of the ongoing simulations will provide new insights about this discrepancy.