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Simulation of ocean variability in the last 40 years with a high-resolution Mediterranean basin model

B.W. AN (1), M. VICHI (1), P. ODDO (1), G. MATTIA (2), and M. ZAVATARELLI (3)

(1) Istituto Nazionale di Geofisica e Vulcanologia (INGV), Italy (an@bo.ingv.it, vichi@bo.ingv.it, oddo@bo.ingv.it), (2) Laboratorio di Simulazioni Numeriche del Clima e degli Ecosistemi Marini, Università degli Studi di Bologna-Scienze Ambientali (g.mattia@sincem.unibo.it), (3) CoNISMAa-UNIBO (marco.zavatarelli@unibo.it)

The Mediterranean Sea high-resolution model developed at INGV was run for the period 1958 - 2001 forced by the ECMWF ERA40 atmospheric forcing functions. The model is the NEMO primitive equation model with the Mediterranean Forecasting System (MFS) grid at 1/16 degree horizontal resolution and 72 vertical levels, optimized for long-term simulations in the framework of the EU FP6 project SESAME. The open boundary data in the Atlantic box are derived from global ocean analyses produced in the framework of the EU FP5 ENACT project and forced with the same ERA40 atmospheric data. The presentation focuses on the analysis of the simulated ocean variability in the last 40 years with emphasis on the reproduction of climatological features and biases with respect to the observations.

In this work, we focused on dense water formation processes in the Eastern Mediterranean Sea in related to the larger scale climatic conditions. Eastern Mediterranean Transient (hereafter EMT) was captured and evaluated by the deep and intermediate water mass pathway and the amount of their formation rate. Analysis of the main driving mechanism of this EMT was also studied. During the pre-EMT period, about 0.2 Sv of intermediate water formed in the Levantine basin at depth around 300 m and about 0.1 Sv of the deep water formed in the Ionian basin. However, during EMT, the intermediate water and the deep water paths were modified in the Eastern Mediterranean Sea because of the deep water and the intermediate water formed only in the Aegean Sea. From our results, we conclude that the general driving mechanism of EMT is mainly affected by the atmospheric forcing and the locations of dense water formation are affected by the freshwater budget.

Our results demonstrate the model skills in capturing the major climatic state and variability in the basin, which will allow us to use this model for studying the impacts on marine biogeochemistry as planned in the SESAME project.