01 | INTRODUCTION

During the past, variations of heat and water fluxes acting on the Mediterranean Sea have led to changes of the circulation state. The Mediterranean climate is expected to become warmer and drier during the 21st century, which may again modify the current state of the Mediterranean thermohaline circulation (MTHC). This response to various scenarios could be modulated by the choice of the boundary conditions such as the Atlantic hydrography, the river runoffs and the air-sea fluxes, and by the socio-economic scenarios. This study aims to investigate the changes in the MTHC, hydrographic content and mean sea level under climate change scenarios and to estimate the uncertainty linked to each boundary forcing.

02 | MODEL AND SIMULATIONS

The NEMOMED8 regional ocean model was set up for the Mediterranean region and is forced by air-sea fluxes from the regional climate model ARPEGE-Climate on a 50-km stretched grid. Fresh water inputs from the rivers are prescribed from the RivDis climatology (Vörösmarty et al., 1996) and the prescribed net Black Sea inflow comes from the dataset by Stanev et al. (2000). At the Atlantic boundary, temperature and salinity are relaxed towards climatological values (Reynaud et al., 1998). In the scenario simulations, the anomalies derived from global coupled model simulations are added to the climatological values.

From baseline simulations representing the historical period 1960-2000, we performed various sensitivity experiments for the period 2001-2099 to assess the sensitivity to (i) the Atlantic hydrography, (ii) river runoffs, (iii) air-sea fluxes and (iv) socio-economic scenarios.

03 | GENERAL FEATURES OF PROJECTIONS (1961-1990 vs. 2070-2099)

The EMT-index characterizes the strength of an EMT circulation. We manage to relate this index to the changes in Aegean buoyancy fluxes. The EMT-index values for the historical period 1960-2000, we performed various sensitivity experiments for the period 2001-2099 to assess the sensitivity to (i) the Atlantic hydrography, (ii) river runoffs, (iii) air-sea fluxes and (iv) socio-economic scenarios.

A general decrease of the Mediterranean surface potential density is simulated. However, the density over the basin increases, especially in the deep layers. This results in an increase of the stratification (IS value). This response is strongly modulated by the choice of the scenario and of the Atlantic conditions.

04 | PROJECTIONS OF MTHC AND MEAN SEA LEVEL / SENSITIVITY

Mediterranean Sea response to climate change in an ensemble of 21st century climate change scenarios

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05 | CONCLUSIONS

With our 6-members scenario simulations, we provide estimates of the uncertainties related to regional modelling, which are linked to the choice of (i) the socio-economic scenario, (ii) the surface fluxes, (iii) the river runoffs and (iv) the Atlantic hydrography. We found the largest effect on the simulated future ocean climate. Not assessed here, the uncertainty linked to the choice of the regional ocean model can only be tackled in the frame of a multi-model analysis.