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Mediterranean biogeochemistry evolution under the A2 climate change scenario simulated with the coupled NEMOMED8/PISCES model.

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The Mediterranean Sea is a semi-enclosed basin that is particularly sensitive to external inputs of energy and material. According to different scenarios, the changes in climate conditions to come within the next century will affect the thermohaline circulation of the Mediterranean through warming of the surface waters and alteration of the freshwater balance. Moreover, the changes in circulation pattern may generate changes in nutrient budgets that control biological production. We use the A2 climate change scenario from the ARPEGE-Climat/NEMOMED8 model in order to study the biogeochemical evolution of the Mediterranean Sea for the period 1980-2100 with the biochemical model PISCES. Analysis of nutrients concentrations evolution shows nitrate accumulation in the entire basin together with a decrease in oxygen concentrations. There is, on the other hand, no visible tendency for phosphate concentrations evolution. Along with nutrients evolutions, biological production is reduced by 10% on average over the basin and up to 50% in some regions. The changes in biological production are more intense in areas under the influence of external nutrient inputs such as river mouth. Moreover, the results indicate that nitrate accumulation is due to the switch of almost all N-limited regions at the beginning of the century to P limitation. Finally, studies have shown that the Mediterranean is particularly sensitive to aerosol deposition. There is presently no scenario for aerosol deposition for the 21st century. In order to study the sensitivity of the future Mediterranean to aerosol deposition, we used present day fluxes of atmospheric nitrogen and phosphorus as sources of nutrient throughout the century. The results show that in opposition to the present situation, the future Mediterranean ecosystem is highly sensitive to phosphate deposition (because it is predicted to be mainly P limited) and insensitive to nitrogen deposition (because it is not limiting anymore according to our simulations results). The results indicate that the Mediterranean biogeochemistry is extremely sensitive to climate change, but more refined scenario would be necessary in order to account for all influencing factors.