ATMOSPHERIC DEPOSITION IMPACTS ON NUTRIENTS AND BIOLOGICAL BUDGETS OF THE MEDITERRANEAN SEA, RESULTS FROM THE HIGH RESOLUTION COUPLED MODEL NEMOMED12/PISCES

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Abstract
We use a high resolution (1/12°) version of the 3D coupled model NEMOMED12/PISCES to investigate the effects of high resolution atmospheric dust deposition forcings on the biogeochemistry of the Mediterranean basin. Our results show that natural dust deposition accounts for 5% of global PO4 budget and that it influences primarily the southern part of the basin. Anthropogenic nitrogen accounts for 10% of bioavailable N supply for the northern part. Deposition events significantly affect biological production; primary productivity enhancement can be as high as 20% in the areas of high deposition, especially during the stratified period.

Keywords: Primary production, Mediterranean Sea, Aerosols, Nutrients, Models

Atmospheric deposition is at present not included in regional oceanic biogeochemical models of the Mediterranean Sea, whereas, along with river inputs, it represents a significant source of nutrients at the basin scale, especially through intense desert dust events. Moreover, observations [1,2] show that these events significantly modify the biogeochemistry of the oligotrophic Mediterranean Sea.

We use dust deposition simulations from an atmospheric regional models (ALADIN-Clim) [3,4] and nitrogen deposition from a global atmospheric chemistry model (INCA) [6]. We first evaluate atmospheric deposition fluxes by confrontation with observations of dust and nitrogen deposition over the Mediterranean basin. Then, we use the 3D coupled model NEMOMED12/PISCES in a high resolution (1/12°) regional configuration of the Mediterranean basin to investigate the effects atmospheric deposition forcings on the biogeochemistry. The model represents the evolution of 24 prognostic tracers in the Mediterranean Sea [5]. We evaluate the influence of deposition on the budget of nutrients in the basin on a decadal simulation (1997-2012) and its impact on the biogeochemistry (primary production, plankton distributions...). Our results suggest that nitrogen and dust deposition display different patterns. Nitrogen impacts primarily the northern part of the basin, and dust impacts primarily the south. The impacts of nitrogen deposition on nutrient budgets and biological production are greater than the impacts of natural dust deposition. Moreover, dust deposition effects are significant during the stratified period in the areas of high deposition (figure). Biological production is locally enhanced by dust up to 15% during deposition events.

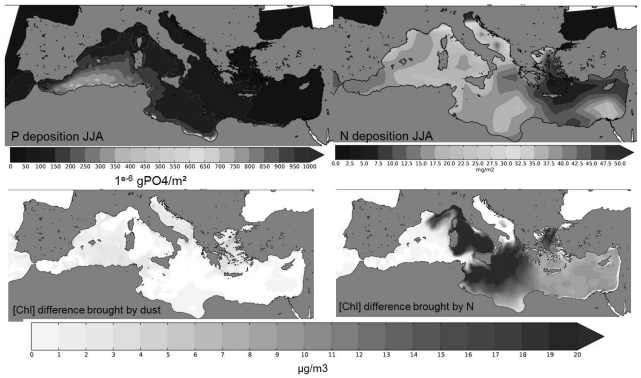

Fig. 1. Figure 1 Impacts of atmospheric deposition on surface Chla production in the summer period.

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