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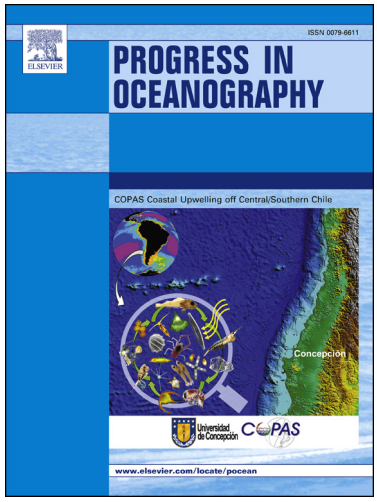

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ACCEPTED MANUSCRIPT

Modeling the impacts of atmospheric deposition of nitrogen and desert dust–derived phosphorus on nutrients and biological budgets of the Mediterranean Sea.

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Abstract

Atmospheric deposition represents a significant source of nutrients at the Mediterranean basin scale. We apply aerosol deposition fields simulated from atmospheric models into the high resolution oceanic biogeochemical model NEMOMED12/PISCES with nutrient ratios used for plankton growth set to Redfield ratio. We perform 3 simulations to determine the impact of nutrients on productivity over the period 1997–2012: (i) without atmospheric deposition, (ii) with nitrogen deposition from anthropogenic and natural sources, and (iii) with deposition of both nitrogen (from anthropogenic and natural sources) and phosphate from desert dust. Time series of modeled deposition fluxes are compared to available measurements. This comparison with measurements shows that both variability and intensity ranges are realistic enough for our main purpose of estimating the atmospheric deposition impact on Mediterranean biogeochemical tracers such as surface nutrient concentrations, chlorophyll *a* and plankton concentrations. Our results show that atmospheric deposition is one of the major sources of nitrogen and phosphorus for some regions of the oligotrophic Mediterranean Sea. More than 18 10^9gN month^{-1} are deposited to the whole Mediterranean Sea. This deposition is responsible for an average increase of 30 to 50 % in primary production over vast regions. Natural dust–derived deposition of phosphorus is sparser in space and time (0.5 10^9g month^{-1} on average over the entire basin). However, dust deposition events can significantly affect biological production. We calculate fertilizing effects of phosphate from dust to be low on average (6 to 10 %) but up to 30% increase in primary productivity can be observed during the months when surface water stratification occurs. Finally, these fertilizing effects are shown to be transmitted along the biological chain (primary production, Chl *a*,

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