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Simulations of the impact of high pulse atmospheric deposition events on a low nutrient low chlorophyll (LNLC) marine ecosystem

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Nutrient availability controls ocean productivity and partitioning of carbon between the ocean and atmosphere, mediated by the limiting potential of macro and micronutrients such as N, P, Fe and Si. Atmospheric deposition is a major pathway for nutrient delivery with potential to alter the role of the ocean from a sink to a source of CO_2 and vice versa.

Mediterranean region is of interest for both its marine and atmospheric environments. Its Sea is one of the world's most oligotrophic regions in terms of both primary productivity and chlorophyll-a concentration. Its atmosphere is a cross road of air masses of distinct origin highly affected by both natural and anthropogenic emissions. These emissions strongly interact in the atmosphere, due to the high photochemical activity in the area, leading to the formation of nutrients such as nitrogen compounds. Dust aerosols from the African continent are also affecting the area and act as carriers of nutrients such as iron and phosphorus. In the Eastern Basin, where nutrient riverine inputs are very low, wet and dry atmospheric inputs of N and P are the main source of new nutrients in the euphotic zone of the open sea, particularly during the stratification period.

In the present study, the impact of an intense atmospheric nitrogen and phosphorus deposition pulse event on the marine ecosystem in the East Mediterranean Sea is investigated. This is achieved by coupling atmospheric and sea water observations with a 1-D ocean physical-biogeochemical model, set up for the Cretan Sea as a representative E. Mediterranean open sea area (Christodoulaki et al., 2012, Journal of Marine Systems, doi: 10.1016/j.jmarsys.2012.07.007). Atmospheric deposition measurements of Dissolved Inorganic Phosphorous and Nitrogen are obtained from the station of Finokalia, shown to be a representative background station for atmospheric observations in the area, whereas, oceanographic data are obtained from the M3A station.

Analysis of this high pulse atmospheric nutrient supply impact on ocean primary production, plankton community structure and the associated underlying biogeochemical dynamics is performed. The results are presented and thoroughly discussed.

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