IMPACT OF SAHARAN DUST AND POLLUTED AEROSOL ON BIOGEOCHEMICAL PROCESSES IN THE EAST MEDITERRANEAN SEA, PRELIMINARY RESULTS OF A MESOCOSM EXPERIMENT (MAY 2012)

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Abstract
Recent nutrient budgets for the Eastern Mediterranean Sea (EMS) indicate a significant role of Mediterranean aerosols as a net supplier of macro- and micro- nutrients to the Low Nutrient Low Chlorophyll EMS. A mesocosm experimental study was performed in Crete during May 2012 examining the overall response of the oligotrophic EMS (Cretan Sea) to two different types of aerosol additions, “pure” Saharan dust (1.6 mg/L) and mixed (polluted and desert origin) aerosols (1 mg/L). Generally, the additions triggered an increase in several of the performed rate (primary production, bacterial production, phosphate turnover time, N2-fixation) and state measurements, showing relatively larger impacts by the mixed aerosols.

Keywords: Air-sea interactions, Cretan Sea, Aerosols, Atmospheric input, North-Eastern Mediterranean

Significant quantities of leachable nutrients from dry atmospheric inputs become potentially bioavailable and may influence bacterial production and abundance, primary production rates, chlorophyll a (or other phytopigments), diversity of pico and nanophytoplankton communities, and may also affect diazotrophs and nitrogen (N2) fixation rates [1-2]. To date, these influences were assessed by onboard dust enrichment, microcosm experiments, while no previous mesocosm experiment has been performed in the EMS. A mesocosm experiment in the Western Mediterranean examined the addition (~0.8 mg/L) of a dust analog (treated Saharan soil) to surface seawater (Corsica; www.obs-vlfr.fr/LOV/DUNE). Here we present preliminary results of a mesocosm experimental study performed in Crete in May 2012 examining the overall response of the oligotrophic EMS (Cretan Sea), during a transitional spring season, to two different types of aerosol additions, “pure” Saharan dust (1.6 mg/L) and mixed aerosol (1 mg/L) containing a natural mixture of desert dust and polluted aerosols. The second treatment represents an aerosol with more leachable nutrients and metals, and somewhat higher N/P ratios. The two treatments, run in triplicates (3 m³ each), were compared to control runs. Preliminary measurements show an average addition of approximately 2-3 and 65-75 nM dissolved inorganic phosphorous (DIP) and dissolved inorganic nitrogen (DIN), respectively, representing 30% of the ambient concentrations. Converting the estimated nutrient addition to potential carbon production (or chlorophyll a increase) reveals values similar to the observed changes. The additions triggered an increase in several of the performed rate and state (Table 1). Considering similar aerosol/dust particle concentrations, larger biological impacts were observed in the polluted aerosols treatment (Figure 1).

Fig. 1. Primary and bacterial production in the different treatments as a function of time (total of 8 days). Inserts – differences between the dust/aerosol additions and control, normalized to the addition of 1 mg particles/L. Rates of bacterial production were determined by incorporation of tritium-labelled leucine using the procedure of [3] and primary production was measured, using the 14C incorporation method of [4].

References