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Dust and polluted aerosol impacts on diazotrophy during a mesocosm experiment in the Eastern Mediterranean Sea

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Atmospheric inputs of nutrients via dust and aerosols to the surface ocean layer are considered to contribute greatly to dinitrogen (N2) fixation and to primary productivity. N2 fixation rates in the Mediterranean Sea are typically low and the parameters limiting this process are still unclear. Addition of dust analogs to a mesocosm experiment in the Western Mediterranean Sea (DUNE) enhanced N2 fixation by 3 to 5 fold. However, in the Eastern Mediterranean Sea, an area highly exposed to Saharan dust and aerosol, the impact of these inputs on N2 fixation from onboard microcosm experiment are unclear and inconclusive. We examined the influence of Saharan dust (1.6 mg L-1) and polluted aerosol (1 mg L-1) additions on diazotroph populations and N2 fixation rates in nine 3 m3 mesocosms (MESOAQUA project) using the enriched seawater method of 15N uptake. The enrichments induced an immediate 2-4 fold increase in N2 fixation (measured from 6 to 48 h after enrichments). After 4 days, N2 fixation rates returned to their background level and no significant change was observed relative to the control mesocosms. The increase in N2 fixation rates were reflected in the differential composition of diazotrophs. Dust enrichment enhanced the abundance of the filamentous cyanobacterium Trichodesmium spp., while aerosol addition predominantly enhanced the presence of heterotrophic diazotrophs including Pseudomonas and Desulfovibrio. Our results indicate that sources of nutrients supplied via Saharan dust and polluted aerosol pulses to the stratified surface Eastern Mediterranean waters could increase the contribution of diazotrophs and N2 fixation in these ultraoligotrophic waters and impact productivity and biogeochemical cycling.