Climate processes related to Saharan dust in the Mediterranean.

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The Mediterranean sea with its semi-enclosed characteristic is an interesting marine region with respect to the surrounding contrasting aerosol catchment areas. It is bounded in the north by industrialized and agricultural countries and in the south there are highly productive mineral aerosol sources like North Africa (Sahara desert belt) and Asia (Saudi Arabian and Syrian deserts). Thus the Mediterranean is a unique example of a marine region with a number of contrasting catchment areas separated only by a few hundred kilometers.

In the absence of clouds these different nature of aerosols control the absorption and scattering of solar irradiation which can modify the earth's radiation budget. The chemical properties of the aerosols control the pH of the rainwater and once deposited can have impact on freshwater and terrestrial ecosystems. Aerosols deposited at the sea surface can be a significant source of nonbiogenic material in ocean sediment and for the oligotrophic ocean waters like the Mediterranean, the atmospheric inputs of nutrients and other biologically important elements could have importance in promoting biological activity. The lack of long term time series atmospheric data which is prerequisite for any scientific estimations had forced us to construct and operate an atmospheric sampling tower. This work presents the results of aerosol samples collected from a 21 m height atmospheric collection tower located at the northeastern coast of the Mediterranean (34°15'18" E, 36°33'54" N). Results of the analysis of Al performed on the samples, which is a geochemical tracer of soil derived dust particles coupled with air mass back-trajectory analysis, revealed that sporadic dust intrusion events occur mainly during transitional seasons (autumn and spring). The extraordinary dust concentration (1.6 mg m^{-3}) observed on 6 April 1994, the largest ever recorded since the beginning of long-term continuous sampling programme. The Sahara origin of the dust pulse event has been verified both by air mass back trajectory analysis and AVHRR sensor in the visible band. Satellite data from the Eastern Mediterranean obtained about a week after the dust events indicated high reflectance of visible light from the sea surface at regions coinciding with dust intrusions, suggesting the creation of possible coccolithophorid blooms in these areas.

The fact that the blooms were simultaneously observed in the vastly differing environments of the Eastern Mediterranean, the Sea of Marmara and the Western Black Sea (with salinity difference of up to 23, temperature differences of up to 10°C) can only result from a common source associated with synoptic scale meteorological event. By coincidence, the research vessel RV/BILIM of IMS-METU was in the Sea of Marmara during the same time when a high reflectance patch was observed in the satellite images of 14 and 15 April, with observations reporting a very unusual and thick red tide. Analysis confirmed the presence of *Noctilucua miliaris* being the dominant type of red tide. The presence of coccolithophorid could not be confirmed, however, because the samples could not be analyzed on board, and were destroyed during storage with addition of formaldehyde, resulting in dissolution of carbonated shells. The observations were also consistent with the notion that the blooms are initiated by the photo reduction of Fe(III), which occurs in surplus amount in the dust, to bioavailable form of Fe(II) during day time, either by interaction with atmospheric humidity (clouds) or in water, after they are deposited on the sea surface. It is possible that the diel differences in the balance between different forms of iron, combined with the dust transport and humidity patterns of a moving storm can lead to the patchy distribution of blooms.

Therefore, our long-term ground truth measurement implies that firstly climate forcing due to mineral aerosol must be included in atmospheric general circulation models by taking into consideration the spatial and temporal variation of mass concentration in the atmosphere. Secondly, it can contribute to production of some species of phytoplankton by iron fertilization. This, on the other hand, is one of the most important feedback mechanisms regulating the radiation balance of the earth, because primary productivity in the ocean mediates carbon dioxide fluxes between the atmosphere and the ocean, and leads to increase in cloud albedo as a result of dimethyl sulfide (DMS) production.

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