SOIL DERIVED DUST PARTICULATES OVER THE EASTERN MEDITERRANEAN

KUBILAY N.[1], SAYDAM C.[1], NICKOVIC S.[2] and DOBRICIC S.[2]

[1] Middle East Technical University-Institute of Marine Sciences, P.O. Box 28, 33731 Erdemli-Içel, Turkey

[2] ICSC-World Laboratory, Project LAND-3, Via Guarnotta 26, Erice, Italy

C

Beginning from 1991 a continuous aerosol sampling program is being carried out at a coastal location of the eastern Mediterranean (34°15'18"E, 36°33'54"N). Totally, 339 aerosol samples were collected by utilizing a hi-vol pump during August 1991-December 1992 on daily basis. Soil derived dust load (mineral particulates) concentrations in the atmosphere were estimated from the measured Al concentrations which is 8% of the average crustal material. The arithmetic average value of 1255 ng Al m^{-3} of air for the eastern Mediterranean aerosol yields an average dust loading of 15.5±25 µg m^{-3} of air over the region. The geometric mean of the dust concentration for the study period is 8.4 μm^{-3}. The wide concentration range (0.25-287 µg m^{-3}) during the sampling period is the explanation of the high standard deviation of the average concentration. Temporal variation of the dust load concentration is highly variable on a time scale of one day (Fig.1). The daily precipitation amounts obtained from the nearest meteorological office are also plotted on the same figure. Our data indicate a seasonal pattern for the dust concentrations over the eastern Mediterranean atmosphere: during wet period (December-February), the arithmetic mean concentration is 4.5 µg m^{-3} whereas for the dry summer time (June-September) it is 15.7 µg m^{-3}. As can be seen from the figure sporadic dust load concentration peaks were observed in spring and fall time. This time periods have well defined meteorological processes on synoptic scale which result in long-range transport (LRT) of soil derived dust from the surrounding deserts (DAYAN, 1986; DAYAN *et al.*, 1991). Our data suggest that precipitation and LRT of soil derived dust are the major factors causing the intense time variation. Indeed, it appears from the figure that precipitation events are systematically followed by abrupt decreases of the dust concentration. For example during October 1991 an event which has the maximum dust loading throughout the sampling period was sampled (279 µg m^{-3}). After this enormously high dust loading a local rain event caused two orders of magnitude decrease in the dust concentration (5.3 µg m^{-3}). October 1991 event is one of the episodes observed associated with LRT of dust from the desertic areas. Air parcel back-trajectory calculations are evaluated as a basic tool to detect potential remote source areas for the dust particles over the sea. The trajectory model of European Center for Medium-Range Forecasts (ECMWF) is applied to three dimensional analyzed wind fields available at the archive of the center. Calculations are performed as three days backward, starting at the mid time of the day (12 00 UT) and arriving to the receptor coordinates at 900, 850, 700, 500 hPa standard pressure levels. Examples of the trajectories originated from Saharan desert (Fig.2.a) and Arabian Peninsula (Fig.2.b) are given in Fig.2. Total (wet+dry) annual flux of the dust deposition is estimated and extrapolated to the eastern Mediterranean (320 000 km^2). The conclusion of this study served as a basis for the simulation of desert dust transport to the Mediterranean by utilizing NMC/Eta model.

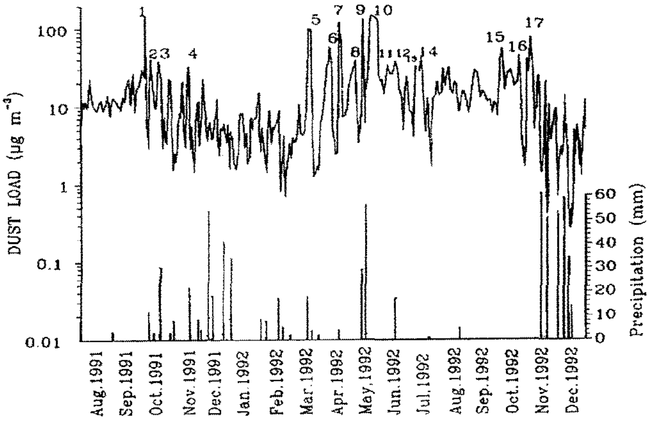
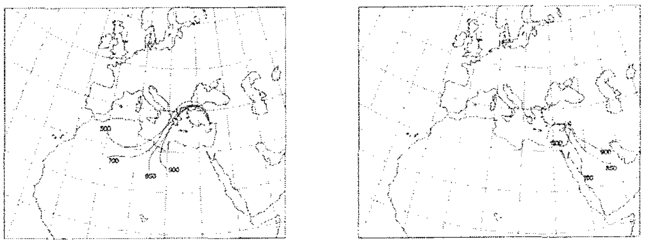


Figure 1. Temporal variation of the dust loading and local precipitation events.



(a) (b)

Figure 2. Air mass back-trajectories for the situations on (a) 6 Oct. 1992, (b) 5 Nov.1992.

REFERENCES

DAYAN U., 1986. Climatology of back trajectories from Israel based on synoptic analysis. *J. Climate Appl. Meteorol.*, 25, 5, 591-595.

DAYAN U., HEFFTER J., MILLER J. and GUTMAN G. (1991). Dust intrusion events into the Mediterranean basin. *J. Appl.Meteo.*, 30, 8, 1185-1199.