EMS Annual Meeting Abstracts
Vol. 11, EMS2014-24, 2014
14th EMS / 10th ECAC


# Identifying coupling Modes of Particulate Matter and Meteorological Fields through Singular Vector Decomposition

João Carlos Teixeira (1), Ana Cristina Carvalho (2), Maria João Carvalho (1), and Alfredo Rocha (1)

(1) CESAM – Department of Physics, University of Aveiro, Campus Universitário de Santiago, 3810-193 Aveiro, Portugal. (jcmt@ua.pt), (2) CENSE – Departament of Science Environmental Engineering, Faculdade de Ciencias e Tecnologia, FCT-UNL, Campus da Caparica, 2829-516 Caparica, Portugal.

The concentration of Particulate Matter (PM) in southern Europe is particularly important due to its closeness to the Sahara desert. The European air quality network data shows that it is one of the major sources of PM10 contributing to their high concentrations, having identified several episodes per year. Mean transport patterns and weather climatology related to high dust loads in the atmosphere have been studied in the past. However, these studies rely on different databases, time series concentration measurements and Aerosol Index form satellite and ECMWF-ERA products, which make difficult the quantification of the PM concentrations fields and the weather patterns contributing to it.
Using the MACC I and II European projects, the present work explores these variabilities by using Singular Vector Decomposition (SVD) and Empirical Orthogonal Functions (EOF), allowing for the quantification of the modes for which the spatio-temporal fields variations are strongly coupled. The SVD was applied to the reanalysis variables of the different aerosols modes, pressure and geopotential height obtained by the ECMWF Integrated Forecasting System, coupled with a global chemical transport model, using a 4DVar assimilation of meteorological and atmospheric chemical constituents. Hence, these reanalysis data include all relevant atmospheric physical and chemical processes, along with assimilated data, over a regular horizontal and vertical grid. The SVD and EOF were applied to the chosen dataset, comprehending daily fields between 2003 and 2012, in a domain covering Europe and North Africa. Results point to a significant relationship between the sea level pressure (SLP) pattern, associated with a low pressure regime over the Iberian Peninsula (IP), and a Saharan dust transport to the IP represented by the first SVD mode (72%) and associated with the fourth SLP EOF pattern (14%) and the first dust EOF pattern (37%).