Geophysical Research Abstracts
Vol. 12, EGU2010-5905, 2010
EGU General Assembly 2010


# Remote sensing of the aerosol in Cairo (Egypt): compositional variability and impact on the atmospheric transfer of solar radiation

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Cairo, the capital city of Egypt, is located at the southernmost tip of the Nile Delta and is surrounded on the other three sides by deserts. As is the case in several other megacities of the World, its fast increasing population already suffers from a general worsening of their environmental conditions, and in particular of the air quality. In order to investigate the reasons for this degradation and clarify the respective parts played by human activities, meteorological factors, and other natural processes, the Cairo Aerosol CHaracterization Experiment (CACHE) was designed and carried out in the city by an Egyptian-French consortium.

After a rapid presentation of the local context and of the measurements performed during CACHE, this work focuses on the results obtained by the means of various remote sensing techniques. We first present the seasonal and inter-annual variability of the atmospheric aerosol load using 8 years of measurements performed by the Aqua-, and Terra-, MODIS radiometers. In a second step we investigate the reasons of this variability observed from space by analyzing in detail the results yielded by inversion of the measurements performed with a ground-based radiometer. This automated sun-tracking photometer was of the Cimel type, included in the AERONET network, and operated in Cairo for more than one year. The month to month variations of the aerosol optical thickness (AOT) and of its spectral dependence quantified by the means of Angström's exponent ([U+F061]) can be explained by compositional changes. In particular, the proportions of the main aerosol components are sensitive to the activation of seasonal sources such as wind erosion particularly active in spring or the burning of agricultural residues by the farmers of the Nile Delta in October. Beside wind strength, whose increase triggers wind erosion in the deserts, other meteorological factors such as wind direction or more frequent precipitations in the winter months also have a direct influence on the aerosol load.

Finally, a detailed analysis of the aerosol size-distribution obtained by inversion of the sunphotometer measurements shows that the 3 main aerosol components, namely the Background pollution (BP) produced by daily basis activities (traffic and industries), the Biomass Burning (BB) plume, and Mineral Dust (MD), can be traced each by a specific mode in the overall aerosol size distribution. We use this facility for apportioning the aerosol radiative forcing between the 3 species, and this at both TOA and BOA. One of the main results of this study is that, even in such a densely populated area as Cairo, the effect of Mineral Dust on the atmospheric transfer of solar radiation is significant all year round. Including in the months when no dust event is observed.