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Forecasting the weather
- ensemble techniques
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Use of CALIOP aerosol optical depth retrievals for assessment of air quality in the city of Athens, Greece

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Air quality has become a major issue in the last few years, not only for the developed countries, but also for developing ones. This comes as a direct consequence of the growth of urban areas (conversion in to megacities), but is also due to increased anthropogenic emissions. For certain areas, however, such as Athens, Greece, aerosol load gets even larger due to non-anthropogenic emissions, such as dust aerosols from Sahara desert.
Recent studies have shown that aerosols, in particularly dust, can extend in many kilometers in the atmosphere being thus able to alter atmospheric dynamics and climate. Of crucial importance to human health is aerosol concentration within the boundary layer that is in the bottom 2-3 km of the troposphere. This concentration is usually assessed using surface-based particulate matter (PM) measurements. Nevertheless, PM measurements are local and thus cannot capture the strong spatial variability of aerosol amounts. On the other hand, recent advances in technology have provided us with the ability to retrieve aerosol properties, such as aerosol optical depth (AOD) from satellites, thus enabling a continuous (day and night) and complete spatial coverage of a certain area.
In this study, CALIPSO's Cloud-Aerosol Lidar with Orthogonal Polarisation (CALIOP) data from nearly 5 years of continuous measurements (June 2006-May 2011) are analysed for the urban area of Athens, Greece. Athens is a large city with a population of about 4.5 million people, with heavy emissions from industry in the suburbs, a lot of pollutants coming from traffic and on top of that it frequently undergoes dust transportation from Sahara desert, under favourable cyclonic conditions. The aerosol loads in the area are quantified using CALIOP AOD products and subsequently a correlation is attempted with PM10, PM2.5 and PM1 –particles with diameters smaller than 10, 2.5 and 1 μm, respectively, which can be inhaled by human beings. CALIOP aerosol products include an identification of each aerosol type, namely desert dust, biomass burning, polluted continental, marine and polluted dust. This enables an assessment of the certain type of aerosol that deteriorates air quality in the specific area.
An accurate relationship between AOD and PM10 can enable a near-real time monitoring of air quality over the whole greater Athens area and other megacities in the Mediterranean basin and Europe. This would further be useful for controlling population exposure to aerosols. Furthermore, the time series of AOD for the 5 years in study would be a useful assessment for mitigation strategies implemented from Greek authorities with respect to the improvement of air quality.