Radiative effects of extreme Attika fires and windblown African dust, based on the synergy of CALIOP lidar and radiative transfer simulation, August 2021, Athens, Greece

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Atmospheric aerosols may be emitted by both natural and anthropogenic sources. While, large proportion of these particles are derived from traffic-related, industrial, and domestic emissions which contain abundant transition metals, however, the main sources affecting ambient (outdoor) Particulate Matter (PM) levels globally are natural, such as wind-blown soil dust and wildfires (Viana et al., 2014). The European scenario of forest fire is characterized by high frequency of the events in the Mediterranean countries, according to European Forest Fire Information System (EFFIS). More specifically, the average area annually covered by fire throughout Europe is more than half a million hectares, of which 95% occur in Mediterranean countries. At the same time, more than 1–2 Tg of dust is lofted to higher atmospheric layers on an annual rate and due to the great cyclonic activity over Northern Africa, Saharan dust intrusions frequently occur in Southeastern Europe from spring to autumn periods. The majority of these events, usually, last from a few days up to one week over the Mediterranean during these periods, emitting large number of PMs into the environment.

Aerosols have a large impact on climate through the direct and the indirect effects on the Earth's-atmosphere radiation budget. The direct effect includes the scattering and absorbing role of these aerosols on the short- and long-wave radiation emitted by the sun and the Earth, respectively. The total direct radiative effect of mineral dust is estimated to be negative with a high uncertainty, thus, with a low level of scientific understanding. On the other hand, very large uncertainties still remain regarding the aerosols indirect radiative effect, through the aerosols-cloud interactions. Therefore, is of particular importance to study their radiative effects, especially under specific extreme conditions, which are becoming more and more popular at the Mediterranean region.

This study presents the effects of aerosols from natural sources in climate. More specifically, we focus on the biomass burning (BB) aerosols emitted from the devastating wildland fires started on the 3th of August 2021 in the Attika peninsula, Greece, following a Sahara dust intrusion earlier this month. To fulfil this purpose active remote sensing information from Cloud-Aerosol Lidar with Orthogonal Polarization (CALIOP) on Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observation (CALIPSO) together with Libradtran simulations are used for the estimation of radiative effects of such aerosols.