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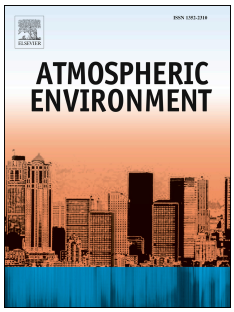

Atmospheric aerosol variability above the Paris Area during the 2015 heat wave - Comparison with the 2003 and 2006 heat waves

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Atmospheric aerosol variability above the Paris Area during the 2015 heat wave - comparison with the 2003 and 2006 heat waves

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Abstract.

The aerosol layers during the heat wave of July 2015 over Paris Area have been studied using a N_2-Raman lidar with co- and cross-polarized channels. The lidar observations are examined to allow the identification of main aerosol types and their origins, in synergy with measurements of the AERONET sunphotometer network and back trajectory studies from the HYSPLIT model. The results are compatible with spaceborne observations of MODIS and CALIOP. As for previous heat waves of August 2003 and July 2006 occurring in France, the aerosol optical thickness is very large, up to 0.8 at the lidar wavelength of 355 nm (between 0.5 and 0.7 at 550 nm). However, air mass trajectories highlight that the observed aerosol layers may have multiple and diverse origins during the 2015 heat wave (North America, Northwest Africa, Southern and Northern Europe). Biomass burning, pollution and desert dust aerosols have been identified, using linear particle depolarisation ratio, lidar ratio and analysis of back trajectories initiated at the altitudes and arrival times of the plumes. These layers are elevated and are shown to have little impact on surface aerosol concentrations ($PM_{10} < 40$ µg m^{-3} or $PM_{2.5} < 25$ µg m^{-3}) and therefore no influence on the local air quality during the 2015 heat wave, unlike in 2003 and 2006. However, they significantly modify the radiative budget by trapping part of the solar ingoing/outgoing fluxes, which leads to a mean aerosol radiative forcing close to +50±17 Wm^{-2} per aerosol optical thickness unit at 550 nm (AOT_{550}) for solar zenith angles between 55 and 75°, which are available from sunphotometer measurements. This value is smaller than those of the 2003 and 2006 heat waves, which are assessed to be +95±13 and +70±18 Wm^{-2}/AOT_{550}, respectively. The differences between the heat wave of 2015 and the others are mainly due to both the nature and the diversity of aerosols, as