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Optical and chemical characterization of underground aerosols

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Both the train and the subway are basic components of public transportation in order to limit the pollution and the greenhouse emissions by the megacities. Hence, the limitation of aerosol pollution in the underground station is one of the major stakes of our society. A first step is to identify the main sources of aerosols that are associated to the train traffic, the travellers and the outdoor pollution. In this way we performed an experiment between April 27th and May 9th 2006 and a complementary experiment during the night of October 25th-26th 2007. Experiments were performed inside the Magenta SNCF station, closed to Gare du Nord in the north of Paris. The instruments were positioned in 2 places on the station platform in order to allow the coupling between the various types of measurements. During the first experiment, the chemical composition, the size distribution, the mass concentration (PM2.5 and PM10) and the optical properties of underground aerosols have been measured. For the first time lidar measurements were performed simultaneously to test the potential interest of active remote sensing measurements to follow the spatio-temporal evolution of aerosol content over an indoor station platform. We found a bi-univocal relation between mass concentration and optical measurements that allows expecting a more general use of lidar measurement to survey the indoor air quality. Such work required the determination of the aerosol complex refractive index to perform an optical-chemical closure. The second experiment was dedicated to sensitivity study associating lidar and in situ measurements of the aerosol scattering coefficient. We will present the results deduced from the two experiments and discuss the limits of the approach.