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Size-resolved and chemical composition of particulate matter at a background and urban site in North Africa

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Abstract. Background sites provide representative data for the lower free troposphere and various pathways for aerosol interactions, with changing boundary layer heights being useful in understanding atmospheric composition coupled to meteorology. However, only few studies exist in African regions despite its diversity in both natural and anthropogenic emissions. Within the present study, a field investigation was conducted to determine the chemical composition of aerosol particles in the Middle Atlas region, understand its variations and its importance in assessing global and regional changes in atmospheric composition. During an intensive campaign, aerosol sampling was conducted simultaneously at the two sites in the Middle Atlas region in Morocco: A background site, Atlas Mohammed V (AMV) observatory, a newly established research station located at a high altitude (2100 m.a.s.l) in the Atlas Mountains, and an urban site located at the city of Fez. Size-resolved aerosol particles were collected using a 5-stage Berner impactor and analyzed for particulate mass, inorganic ions, trace metals, organic and elemental carbon (OC/EC), and a wide range of organic species. The results show that the PM mass has a similar trend at both sites. However, mass concentration was 65% higher at the urban site of Fez than at AMV during the campaign. The SO_4^{2-} and NH_4^+ have similar trend at both sites implying that they may originate most likely from secondary photochemical processes. The organic fraction in the fine mode dominated the urban site's chemical composition resulting mainly from local primary sources. The Fez urban site is characterized by a high contribution in the fine mode of elemental carbon (0.86 µg m-3) and Polycyclic Aromatic Hydrocarbon content (3.3 µg m-3), including Benzo(b)fluoranthene and Benz(a)pyrene. These compounds are typical tracers for vehicular emission, industrial emission, waste incineration, and other combustion processes. In contrast, crustal elements and biogenic Alkanes (0.73 µg m-3), including compounds such as Nonacosane and Heptacosane, result mainly from plant wax abrasion in the surrounding forests. Nevertheless, the background site was often influenced by the long-range transport of pollutants, as indicated by the high contribution of secondary organic carbon (up to 61%). The study shows that the city of Fez is exposed to high pollution levels

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