Physico-chemical characterisation of atmospheric aerosols in Tanzania, with emphasis on the carbonaceous aerosol components and on chemical mass closure

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Three aerosol sampling campaigns were conducted at two sites (i.e., Dar es Salaam and Morogoro) in Tanzania, during different seasons from May 2005 through May 2006. A Gent PM10 stacked filter unit sampler with sequential Nuclepore polycarbonate filters, providing coarse (2-10 μm diameter) and fine (<2 μm) size fractions, and PM2.5 and PM10 tandem filter samplers with pre-fired quartz fibre filters were deployed. Depending upon the season and the location, either 24-hour collections or separate daytime and nighttime samplings were performed. The samples were analysed for the particulate matter (PM) mass, total carbon (TC), organic carbon, elemental carbon, water-soluble organic carbon, black carbon, major inorganic cationic and anionic species, and 28 elements. Most aerosol components measured exhibited higher levels in the dry season campaign than in the wet season campaigns. Besides, the levels were higher at the kerbside of Dar es Salaam than at the rural site of Morogoro. The differences between the campaigns resulted from differences in meteorological conditions and anthropogenic sources. At Morogoro, the median levels of the PM10 mass for the 2005 wet season, 2005 dry season, and 2006 wet season campaigns were 23, 45, and 13 μg/m3 and at Dar es Salaam they were 46, 58, and 40 μg/m3, respectively. In Morogoro, TC accounted, on average, for 31% of the PM10 mass in the 2005 wet season, for 27% in the 2005 dry season, and for 33% in the 2006 wet season. At Dar es Salaam TC represented 29% of PM10 mass in the 2005 dry season campaign, versus 37% and 35% in the 2005 and 2006 wet season campaigns, respectively. Aerosol chemical mass closure calculations indicated that organic matter and crustal matter were the dominant aerosol types in the PM10 aerosol; at Dar es Salaam, they explained, on average, 37% and 33% of the PM mass, and at Morogoro 40% and 36%, respectively. Using non-crustal, non-sea-salt K as an indicator for biomass burning, the organic matter at Dar es Salaam was apportioned to its contributions from charcoal burning and traffic. It appeared that, on average, around 70% originated from traffic versus 30% from charcoal.