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Regional assessment of atmospheric organic and black carbon in South Africa

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At present limited data exists for atmospheric black carbon (BC) and organic carbon (OC) in South Africa. In this paper BC and OC concentrations were explored in terms of spatial and temporal patterns, mass fractions of BC and OC of the overall aerosol mass, as well as linked to possible sources. PM10 and PM2.5 samples were collected at five sampling sites in South Africa operated within the DEBITS IDAF network, i.e. Louis Trichardt, Skukuza, Vaal Triangle, Amersfoort and Botsalano, with MiniVol samplers. Samples were analysed with a Thermal/Optical Carbon analyser. OC were higher than BC concentrations at all sites in both size fractions. Most OC and BC were present in the PM2.5 fraction. OC/BC ratios reflected the location of the different DEBITS sites, with sites in or close to anthropogenic source regions having the lowest OC/BC ratios, while background sites had the highest OC/BC ratios. The OC mass fraction percentage varied between 1% and 24%, while the BC mass fraction ranged between 1 and 12 %. The highest OC mass fraction was found at Skukuza in the Kruger National Park, which was attributed to both natural sources and anthropogenic impacts from a dominant path of air mass movement from the anthropogenic industrial hub of South Africa. The highest mass fraction of BC was found at the Vaal Triangle situated within an region highly impacted by industry and household combustion for space heating and cooking. A relatively distinct seasonal pattern was observed, with higher OC and BC concentrations determined between May and October, which coincide with the dry season in the interior of South Africa. Positive correlations between OC and BC concentrations with the distance from back trajectories passing over veld fires were observed, indicating that veld fires contribute significantly to atmospheric OC and BC during the burning months.