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Chemical apportionment of southern African aerosol mass and optical depth

B. I. Magi
Atmospheric and Oceanic Sciences, Princeton University, Princeton, New Jersey, USA

Abstract. This study characterizes the aerosol over extratropical and tropical southern Africa during the biomass burning season by presenting an aerosol mass apportionment and aerosol optical properties. Carbonaceous aerosol species account for 54% and 83% of the extratropical and tropical aerosol mass, respectively, which is consistent with the fact that the major source of particulate matter in southern Africa is biomass burning. This mass apportionment implies that carbonaceous species in the form of organic carbon (OC) and black carbon (BC) play a critical role in the aerosol optical properties. By combining the in situ measurements of aerosol mass concentrations with concurrent measurements of aerosol optical properties at a wavelength of 550 nm, it is shown that 80–90% of the aerosol scattering is due to carbonaceous aerosol, and the derived mass scattering cross sections (MSC) for OC and BC are 3.9±0.6 m^2/g and 1.6±0.2 m^2/g, respectively. Derived values of mass absorption cross sections (MAC) for OC and BC are 0.7±0.6 m^2/g and 8.2±1.1 m^2/g, respectively. The values of MAC imply that ~26% of the aerosol absorption in southern Africa is due to OC, with the remainder due to BC. The results in this study provide important constraints for aerosol properties in a region dominated by biomass burning and should be integrated into climate models to improve aerosol simulations.

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