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Case studies of modeled properties of biomass burning aerosol during SAFARI 2000

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Aerosols produced in biomass burning have considerable impact on climate. However, poor knowledge of their properties causes large uncertainties in quantifying their effect on regional and global climate. We present modeled aerosol physical and optical properties in two layers observed during the SAFARI 2000 campaign. The campaign was conducted in August-September 2000, in southern Africa, which is one of the world's main sources of savanna biomass burning emissions.

The two studied layers exhibited different levels of aerosol loading and different aerosol optical thickness wavelength dependencies. The aerosol size distributions were retrieved from optical thickness spectra measured using an airborne sunphotometer as a part of the SAFARI 2000 campaign. The aerosol refractive index model used is consistent with information on particle chemical composition. We compare results obtained using two models of internally mixed black carbon and non-absorbing aerosol component (an effective medium model and a layered sphere with black carbon core and non-absorbing shell). In addition, we discuss comparison of modeled aerosol properties with those derived from different measurement methods: the ground-based Aerosol Robotic Network (AERONET) retrievals of aerosol size distributions, and aerosol optical properties derived from ground-based and airborne measurements reported in other studies. Since the single scattering albedo is a key parameter in determining aerosol radiative effects, we examined the change in modeled aerosol radiative forcing caused by different aerosol single scattering albedo values (0.81-0.91 at mid-visible wavelengths) obtained from several measurement methods. For that purpose, the volume fraction of black carbon was adjusted to yield desired single scattering

albedo values and the calculated aerosol optical properties were used as input into a radiative transfer code. The effect of increased aerosol absorption is a decrease in negative forcing at the top of the atmosphere (TOA). The change is large enough to cause a change in sign of (instantaneous) aerosol forcing at TOA from negative to positive.