Light absorbing carbonaceous aerosols: Sources, spatial distributions, and impacts

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Aerosol absorption in the atmosphere plays important roles in climate change. Light-absorbing particles warm the atmosphere that offset the cooling effects by non-absorbing aerosols such as sulfate. They also regulate the degree of aerosol-cloud-precipitation interactions. Absorption of solar radiation in urban and biomass burning environments is attributed mainly to the presence of strong light absorbing carbonaceous aerosols, largely black carbon (BC) and also the light absorbing organic carbon (OC) aerosols. Despite its importance, determining the effects of aerosol absorption remains difficult, because of large uncertainty in the optical properties of absorbing aerosols due to the limited measurements and high degree of inhomogeneity in spatial and temporal distributions.

Keeping in mind both the necessities and difficulties involved in defining aerosol absorption by carbonaceous aerosols, we present here global model simulated aerosol absorption with the Goddard Chemistry Aerosol Radiation and Transport (GOCART) model for the past decade with a purpose of quantifying the carbonaceous aerosol absorption as a function of sources and regions. We will compare the model simulated BC and OC with surface and aircraft measurements and model calculated aerosol absorption with AERONET and in-situ measurements, focusing on major anthropogenic and biomass burning source regions and remote atmosphere. We will estimate the radiative forcing of absorbing aerosols in the context of their abundance, location, altitudes, and properties, and discuss their climate and environmental impacts.