Anthropogenic emissions enhance the biogenic SOA formation and its radiative cooling effect

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Abstract

Organic aerosols play an important role in climate change through their radiative forcing. Here, we use a fully explicit secondary organic aerosol (SOA) formation model to investigate the change in SOA between present day and pre-industrial conditions and to assess the radiative forcing associated with SOA. Anthropogenic emissions of NO_x, CO, sulfate, biomass burning and fossil fuel organic aerosol are shown to influence the formation rate of biogenic SOA substantially, causing it to increase by 18.6 Tg/yr (23.3%) since pre-industrial times. The increase of SOA results in a global direct forcing ranging from 0.06 to 0.21 Wm^{-2} and a global first indirect forcing ranging from -0.24 to -0.32 Wm^{-2}, with the range due to different assumed size distributions for SOA and different refractive indices. The uncertainties associated with the estimate of radiative forcing from this model are also discussed.