中国气象科学研究院

Radiative forcing and climate response due to the presence of black carbon in cloud droplets

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Main points

- In our study, the optical properties of clouds containing BC particles in their water droplets are calculated by using the Maxwell-Garnett mixing rule and Mie theory.
- Then, the obtained cloud optical properties are applied to an interactive system by coupling an aerosol model with a GCM to study the radiative forcing and climate impact due to the changes of cloud optical properties by BC in cloud droplets.
- In contrast to previous works on this topic, we exactly calculate cloud optical properties by Mie theory instead of an empirical formula, and take into account all cloud optical properties rather than just the SSA.

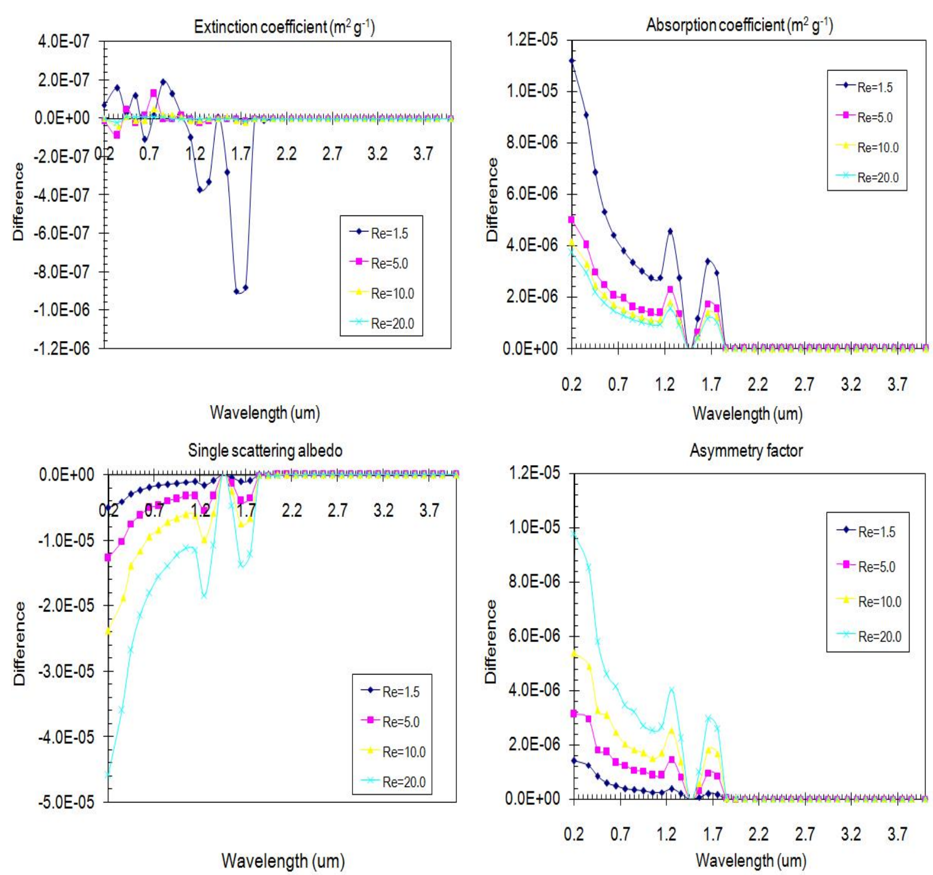

Figure 1 The absolute differences of cloud optical properties for η =10^{-7}. Re is cloud droplet effective radius (unit: mm).

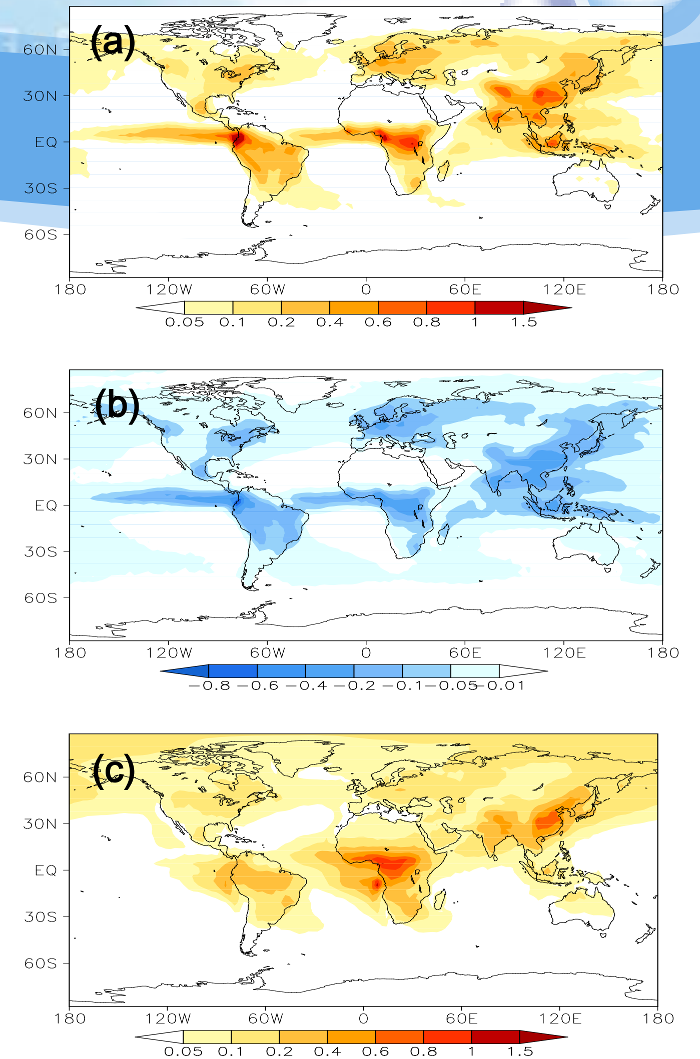

Figure 2 Annual mean distributions of simulated radiative forcing (a) at TOA and (b) surface due to the internal mixture of BC in cloud droplets and (c) direct radiative forcing of BC at TOA for all sky assuming all BC is interstitial (units: W m^{-2}).

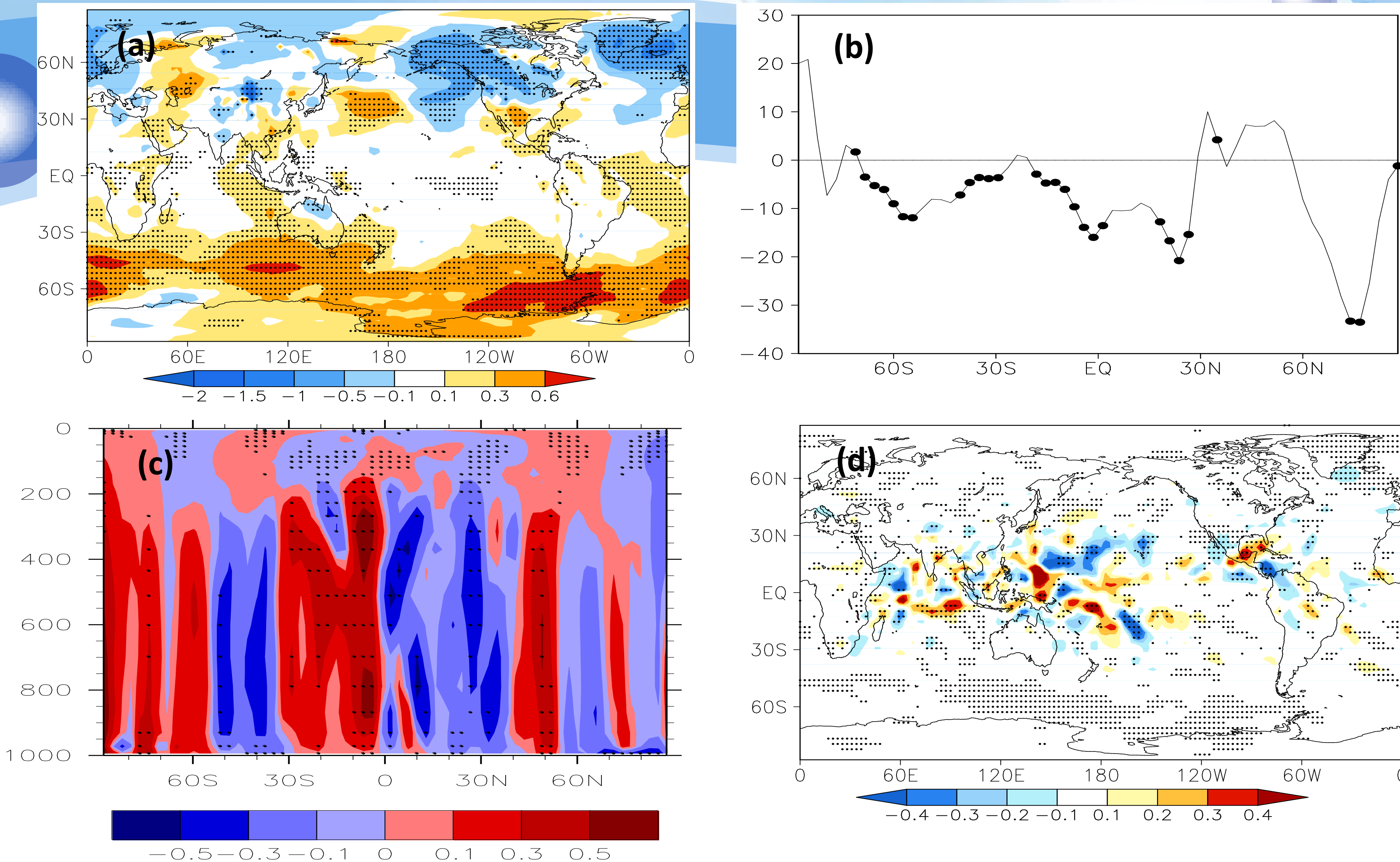

Figure 3 Annual mean distributions of simulated differences in (a) surface temperature (unit: K), (b) zonally mean total atmospheric heat transport (unit: K m s^{-1}), (c) vertical velocity (unit: -10^{-3}Pa s^{-1}), and (d) precipitation (unit: mm day^{-1}) due to BC in cloud droplets. The dots represent significance at ≥ 95% confidence level from the t-test.

Thank you !

Please pay attention to my poster about the details.