Atmospheric
Chemistry
and Physics

Supplement of

Aerosol optical depth thresholds as a tool to assess diffuse radiation fertilization of the land carbon uptake in China

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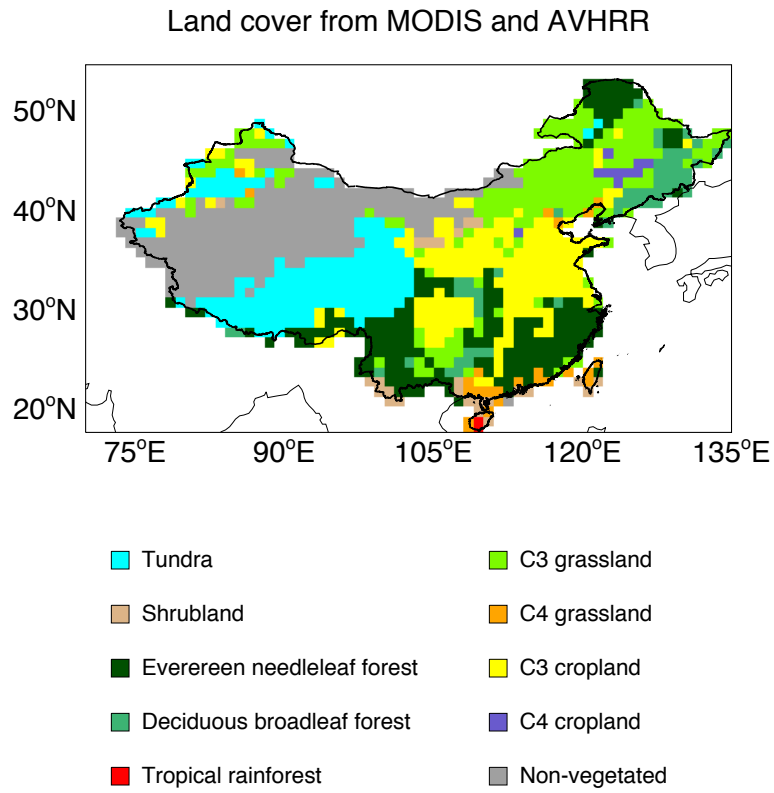
Land cover from MODIS and AVHRR

Figure S1. Land over China used by YIBs model. Each grid square has fractions of nine plant functional types (PFTs). The dominant type with the highest fraction is shown above.
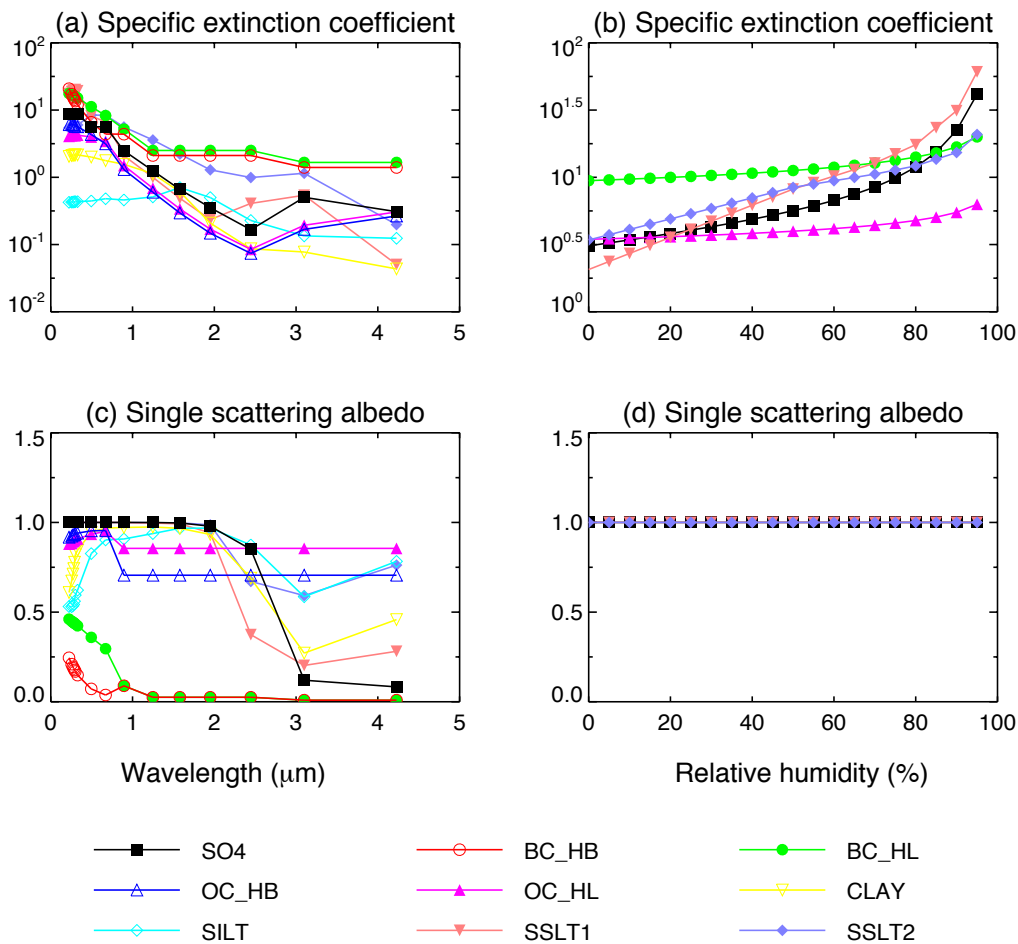
Figure S2. Optical parameters used by the standalone CRM radiation model. Panels shown are the dependence of (a, b) specific extinction coefficient (m^2 g^{-1}) and (c, d) single scattering albedo on (a, c) wavelength and (b, c) relative humidity. In total, 9 aerosol species are included in the CRM model, including sulfate (SO4), hydrophobic black carbon (BC_HB), hydrophilic black carbon (BC_HL), hydrophobic organic carbon (OC_HB), hydrophilic organic carbon (OC_HL), clay dust (CLAY), silt dust (SILT), accumulation sea salt (SSLT1), and coarse sea salt (SSLT2). Hydrophilic species are indicated with solid symbols while hydrophobic species are indicated with empty symbols. For (a, c) wavelength dependence, optical parameters at relative humidity of 50% are shown. For (b, d) humidity dependence, optical parameters at 0.35-0.64 μm are shown. The scales of top panels are logarithmic.
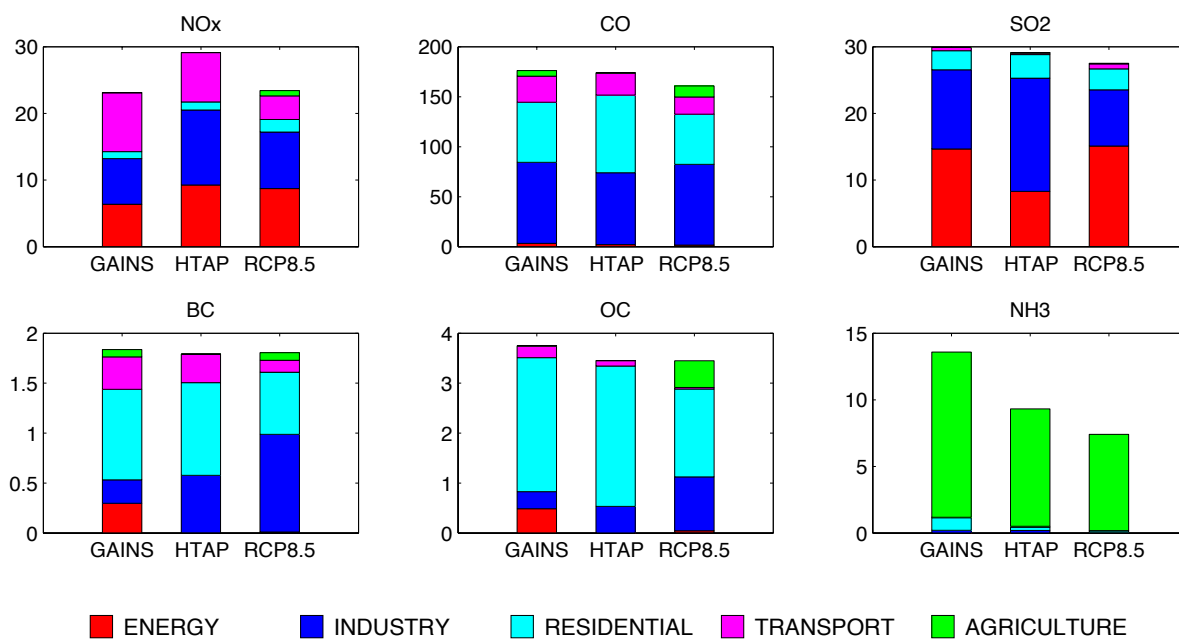
Figure S3. Chinese emissions of six pollution species for the year 2010. The GAINS, used for this study, refers to the v4a version of the Greenhouse Gas and Air Pollution Interactions and Synergies integrated assessment model (http://gains.iiasa.ac.at/models/). The other two, HTAP and RCP8.5, are used for comparisons. The HTAP inventory is adopted from the Emissions Database for Global Atmospheric Research (EDGAR, http://edgar.jrc.ec.europa.eu). The RCP8.5 inventory is adopted from the 5th assessment report of the Intergovernmental Panel on Climate Change (IPCC, http://www.ipcc.ch/). Different colors indicate emissions from different sectors. Units: Tg yr^{-1}.

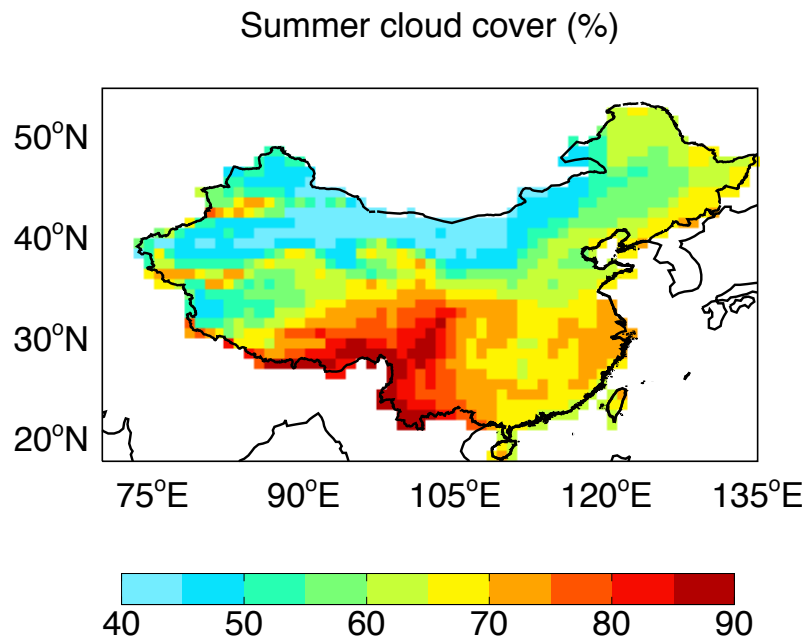## Summary cloud cover (%)

Figure S4. Mean cloud cover in summer months (June-August). Data are adopted from the Clouds and the Earth's Radiant Energy System (CERES) SYN1deg Product.
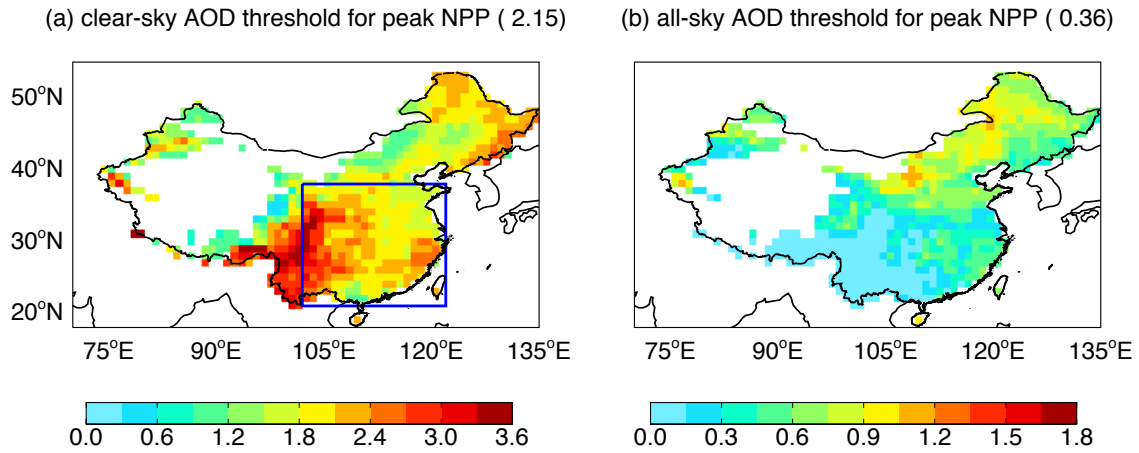
(a) clear-sky AOD threshold for peak NPP (2.15)   (b) all-sky AOD threshold for peak NPP (0.36)

Figure S5. Threshold of AOD leading to maximum NPP. Panels shown are for AOD_{t1} at (a) clear-sky and (b) all-sky conditions in summer. The average AOD_{t1} over the box domain in (a) is shown in the bracket of each title. Figure (b) is the same as that shown in Figure 6a of the main text. The color scales for the two plots are different.
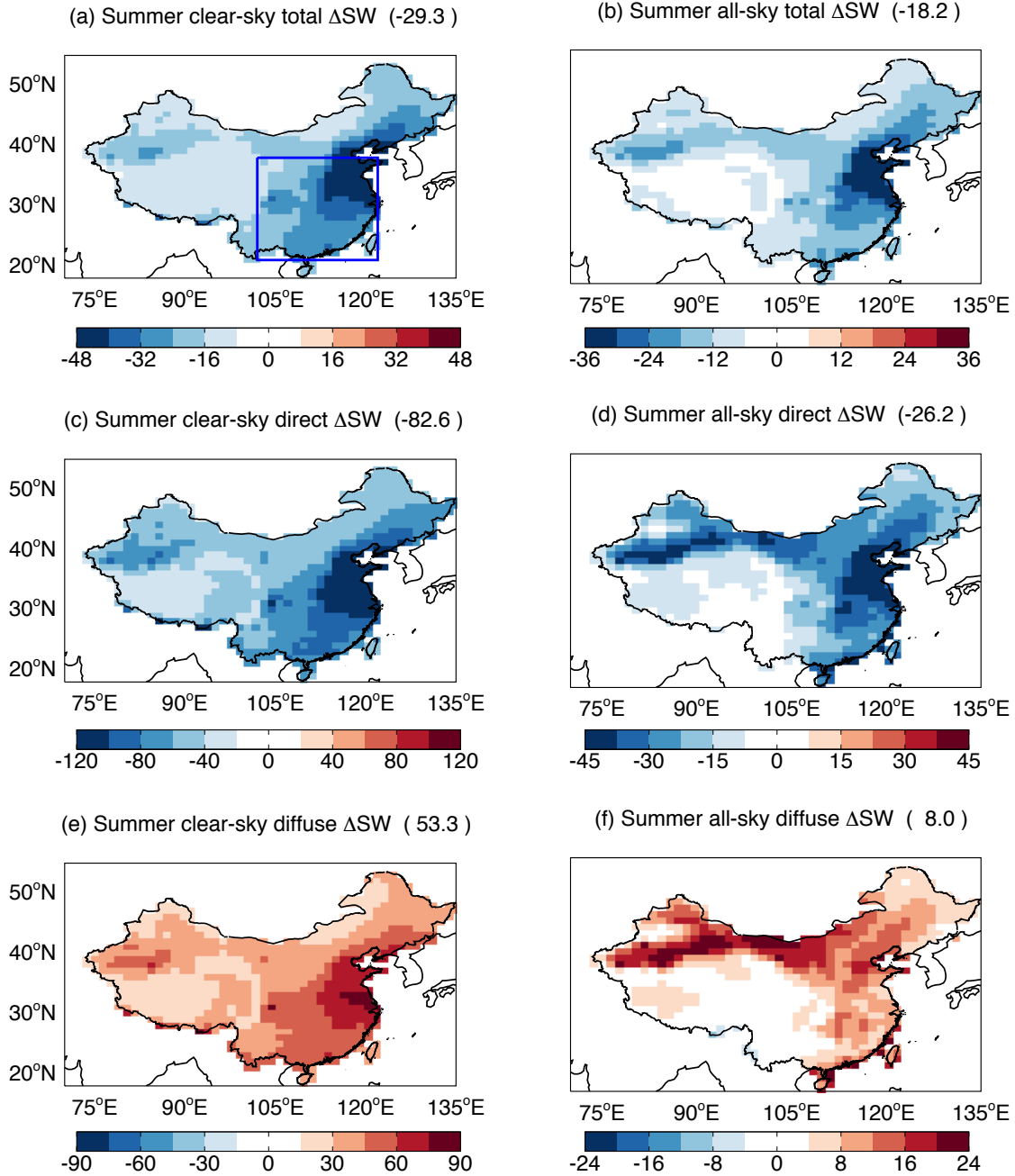
Figure S6. Simulated aerosol-induced changes in surface radiation. Panels shown are for the perturbations in surface (a, b) total, (c, d) direct, and (e, f) diffuse shortwave radiation for (left) clear-sky and (right) all-sky conditions in summer. Results for the left panels are calculated as (CLR010 – CLR000). Results for the right panels are calculated as (ALL010 – ALL000). The average values over the box domain in figure (a) are listed on the subtitles. The color scales for clear-sky conditions are usually much larger than that for the all-sky conditions. Units: W m^{-2}.
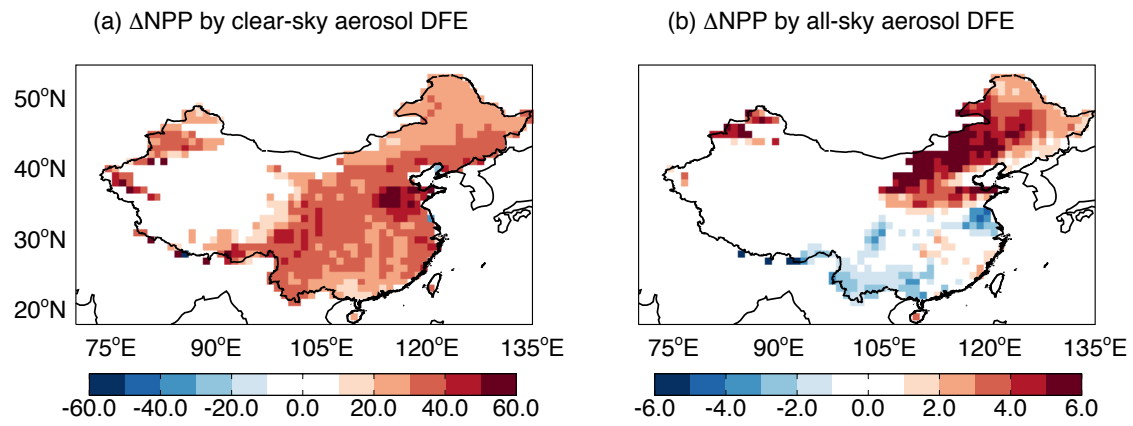
Figure S7. The same as Figure 8 but for percentage changes (units: %) in NPP caused by aerosol DFE.