Improvement of cloud microphysics in the online aerosol-climate model BCC_AGCM2.0.1_CUACE/Aero and aerosol indirect effect

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Main points

- In our study, the two-moment cloud microphysical scheme developed by Morrison and Gettelman (2008) is implemented into the online aerosol-climate model BCC_AGCM2.0.1_CUACE/Aero (Beijing Climate Center atmospheric general circulation model BCC_AGCM2.0.1 coupled with an aerosol model of China Meteorological Administration Unified Atmospheric Chemistry Environment for aerosols CUACE/Aero) instead of the one-moment bulk cloud microphysical scheme was used in the original model.

- We evaluate the simulated performances on aerosols, cloud properties and meteorological fields in detail.

- Next, we estimated the anthropogenic aerosol indirect effect on the bases of this work.

AOD

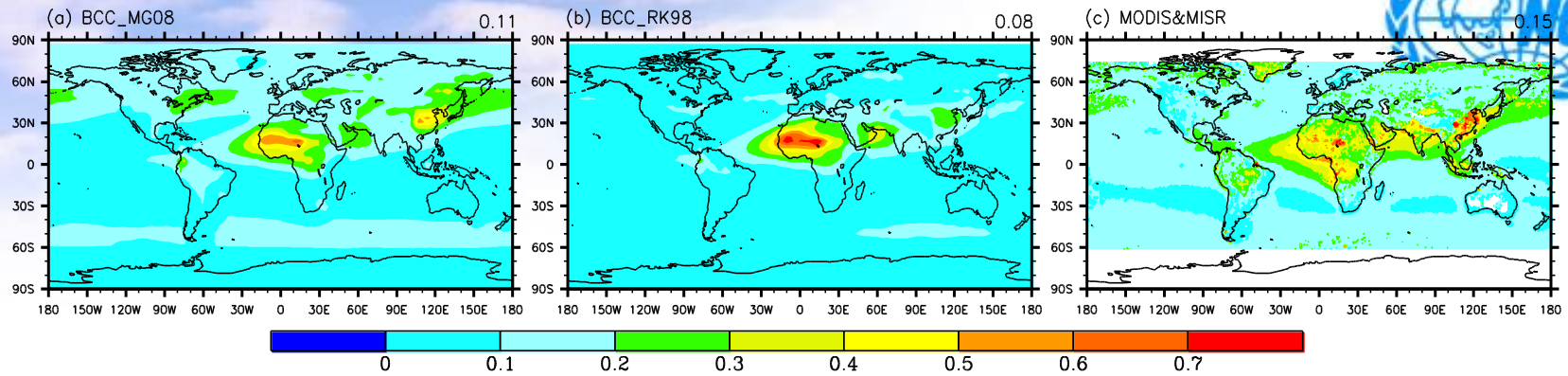

Fig. 1 Global distributions of simulated and observed annual mean AOD at 550 nm. (a) New Model, (b) Old Model and (c) MODIS&MISR.

Cloud microphysical properties

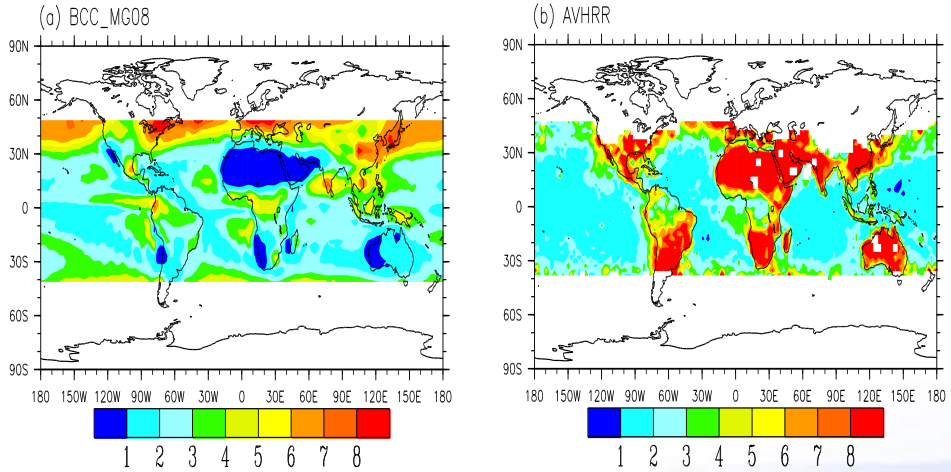

Fig. 2 Annual mean distributions of column cloud droplet number concentration (unit: 10^{10} m^{-2}). (a) New Model, (b) AVHRR.

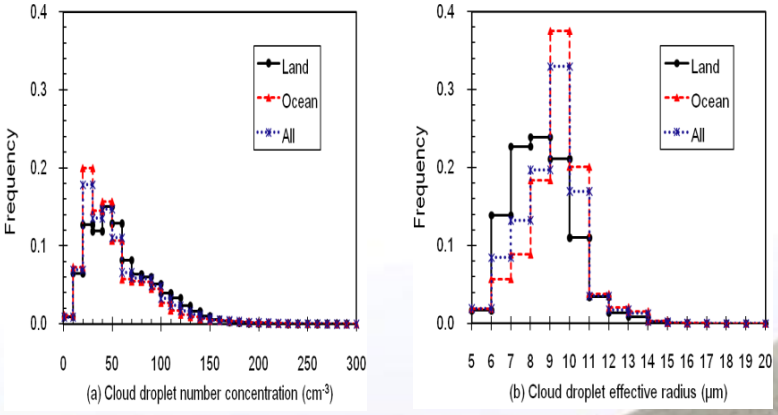

Fig. 3 Probability density functions of annual mean cloud droplet (a) number concentration and (b) effective radius in New Model.

Cloud macrophysical properties and Precipitation

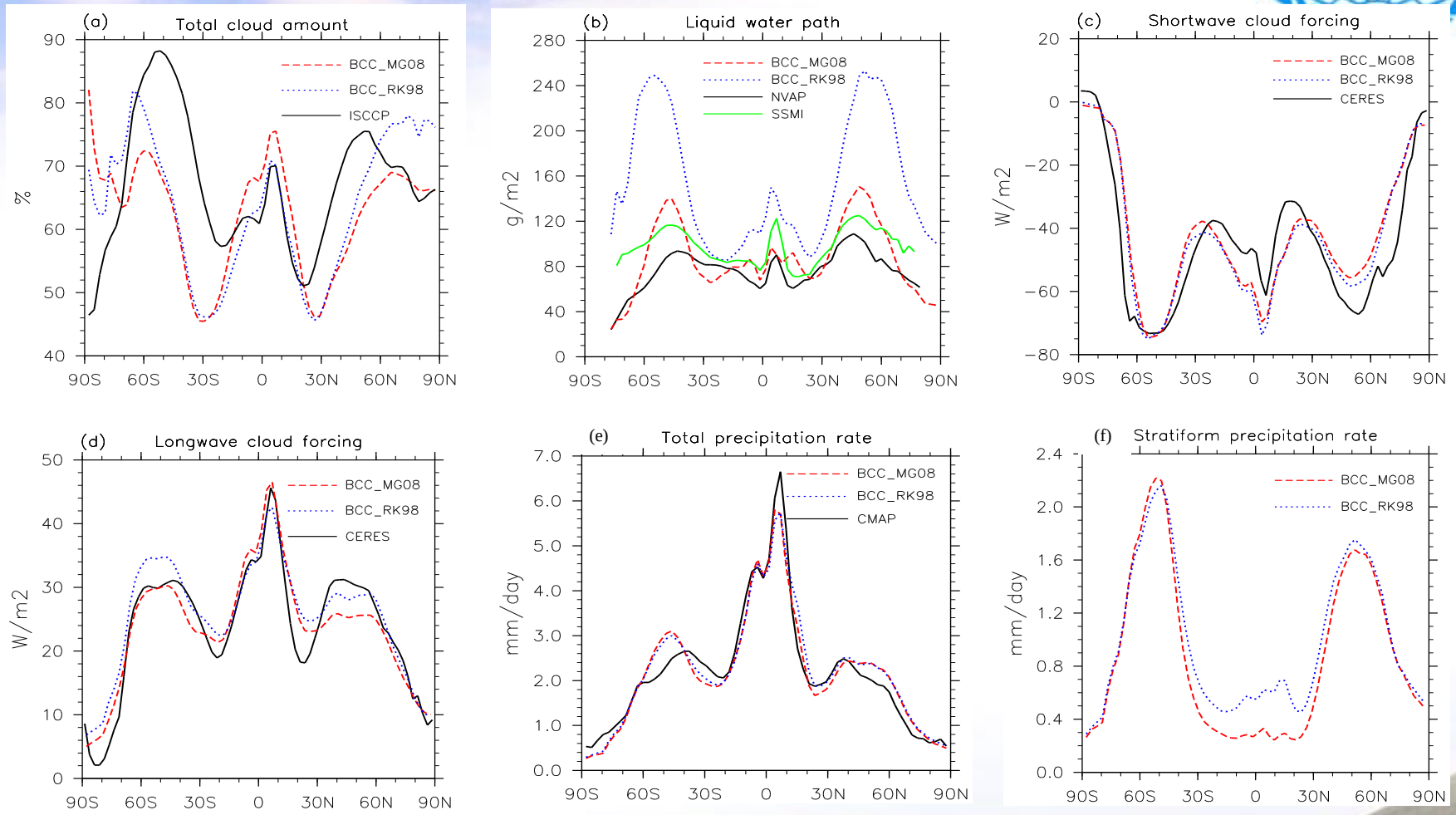

Fig. 4 Annual zonal means of total cloud cover, liquid water path, shortwave cloud forcing, longwave cloud forcing, total precipitation rate and stratiform precipitation rate from New Model (long dashed line), Old Model (short dashed line) and observations (solid line).

Anthropogenic Aerosol Indirect effect

The global annual mean values of anthropogenic AIE in shortwave and longwave are simulated to be -2.5 and 0.6 W m^{-2}, respectively. The total anthropogenic AIE is estimated to be -1.9 W m^{-2}.

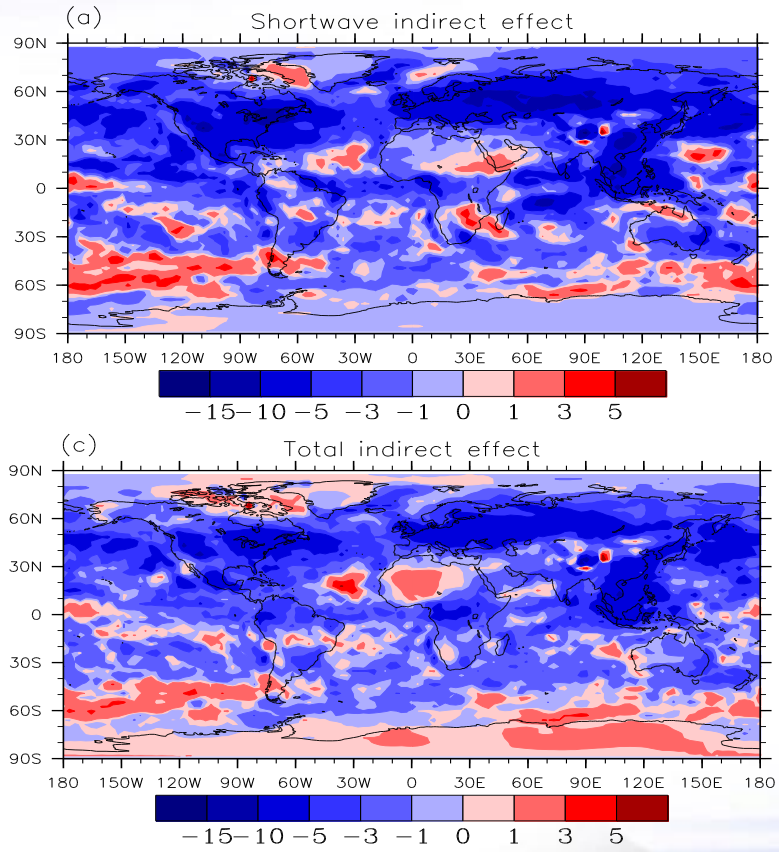

Fig. 5

Global distributions of annual mean aerosol indirect effect (in units: W m^{-2}) from PI to PD (anthropogenic AIE)

(a) shortwave AIE
(b) longwave AIE
(c) total AIE

Thank you !

Please pay attention to my poster about the details.

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