研究課題名：CAI 衛星解析とモデルシミュレーションの統合システムの構築（Development of a Combined System for CAI-Satellite Imager Analysis and Model Simulation）

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実施年度：平成 21 年度～平成 21 年度

1. Purpose

We want to improve global predictions of atmospheric aerosol loads by SPRINTARS (a global three-dimensional aerosol transport-radiation model, coupled to MIROC, the CCSR/NIES/FRCGC-GCM), firstly to support the GOSAT FTS retrievals, and secondly to improve our understanding of aerosol anthropogenic climate forcings.

2. Method

SPRINTARS predictions are improved in two ways: firstly by more sophisticated modeling, and secondly by assimilating observations. Sulfate modeling is improved by implementing more detailed aqueous-phase reactions. Nitrate aerosols are introduced through a thermodynamic equilibrium model for ammonium-sulfate–nitrate components. Finally, overall aerosol modeling is improved by assimilating AOT (Aerosol optical thickness) and AE (Angström exponent) observations that allow us to adjust aerosol emissions to realistic levels.

3. Results

In the previous year, we found that the AOT in SPRINTARS tends to be lower than that obtained from satellite imagers. The improvement in the sulfur module causes an increase in column SO_4 burden. The implementation of the new nitrate module also causes an increase in column aerosol burden. As a result, the newly simulated AOT is larger than that in the original SPRINTARS and closer to the satellite-observed AOT, especially over East Asia and the north Pacific (Figure 1).

In the previous year, we developed an ensemble Kalman filter for global aerosol that has now been extensively tested with AERONET, SKYNET and MODIS observations. The system uses an ensemble of SPRINTARS simulations with different emission scenarios and observations of AOT and AE to arrive at a best estimate of global aerosol loads (see Figure 2).

4. Future plans

GOSAT CAI observations will be applied in the assimilation system. The system will be used to actually estimate new emission scenarios. In addition, we will continue to improve AOT in SPRINTARS.

5. CPU use in the current year (from April to September 2009)

4 users, CPU hours <1 node: 1,785 hours,
1 node: 26,281 hours, 2 node: 0 hour, total: 28,066 hours

6. Summary in the previous year

6.1. Project

Development of a Combined System for CAI-Satellite Imager Analysis and Model Simulation

6.2. Purpose

To improve global predictions of aerosol loads, we propose to combine simulated data from a global three-dimensional aerosol transport-radiation model (SPRINTARS) coupled to the CCSR/NIES/FRCGC-GCM (MIROC) with observed data by CAI.

6.3. Abstract

We compared simulated aerosol distributions by a global three-dimensional aerosol transport-radiation model (SPRINTARS) coupled to the CCSR/NIES/FRCGC-GCM (MIROC) with observations by AERONET and SKYNET surface networks and also by MODIS and MIDORI-II/GLI satellite-borne imagers. These comparisons show that emission inventories and radii of aerosols in SPRINTARS should be modified.

6.4. CPU use in the previous year

3 users, CPU hours <1 node: 620 hours,

1 node: 72,096 hours, 2 node: 0 hour, total: 72,716 hours

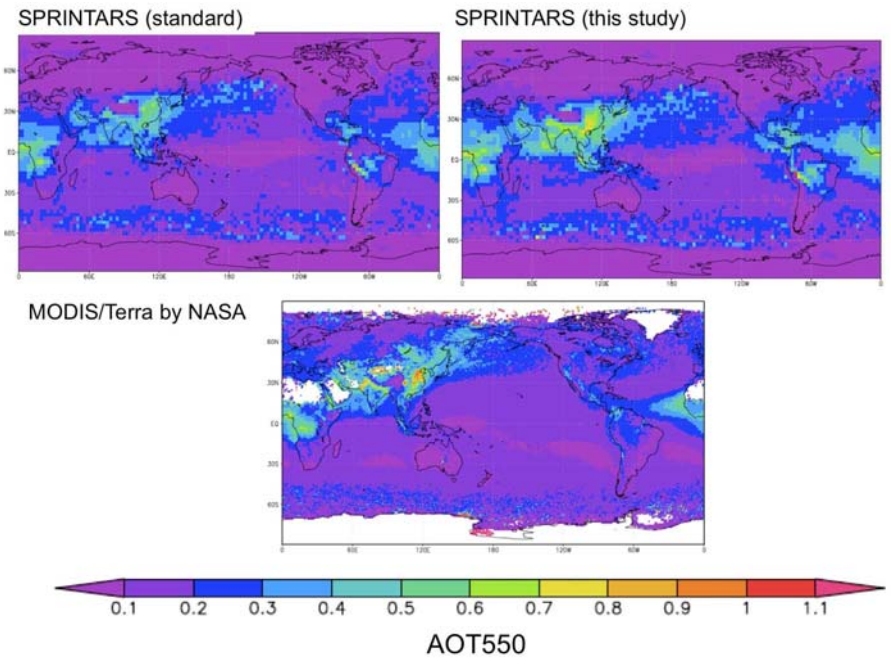

Figure 1 Annual mean AOT at 550 nm obtained by the standard SPRINTARS (upper, left), this study (upper, right), and TERRA/MODIS (lower).

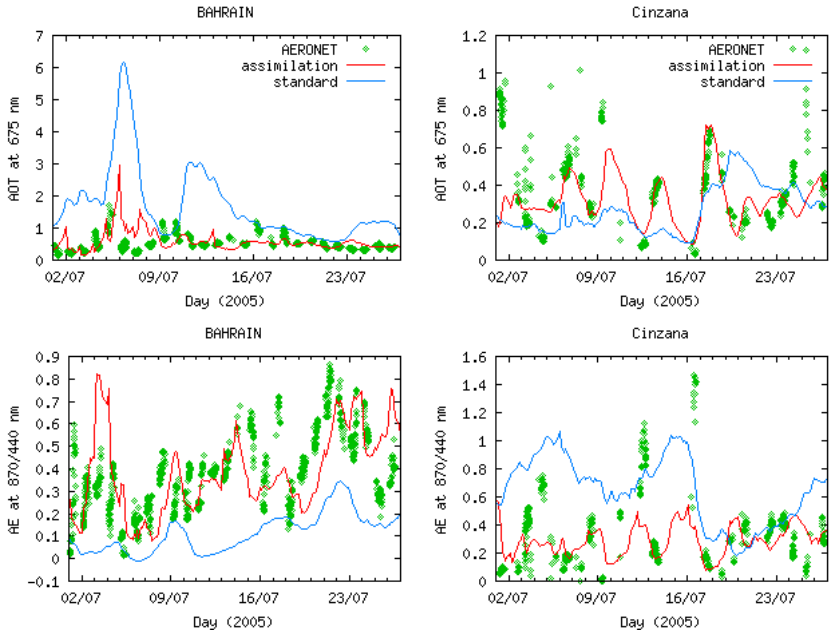

Figure 2 Effect of assimilation on SPRINTARS simulation.