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Inverse modeling of SO_2 and NO_x emissions over China using multisensor satellite data – Part 2: Downscaling techniques for air quality analysis and forecasts

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Box height

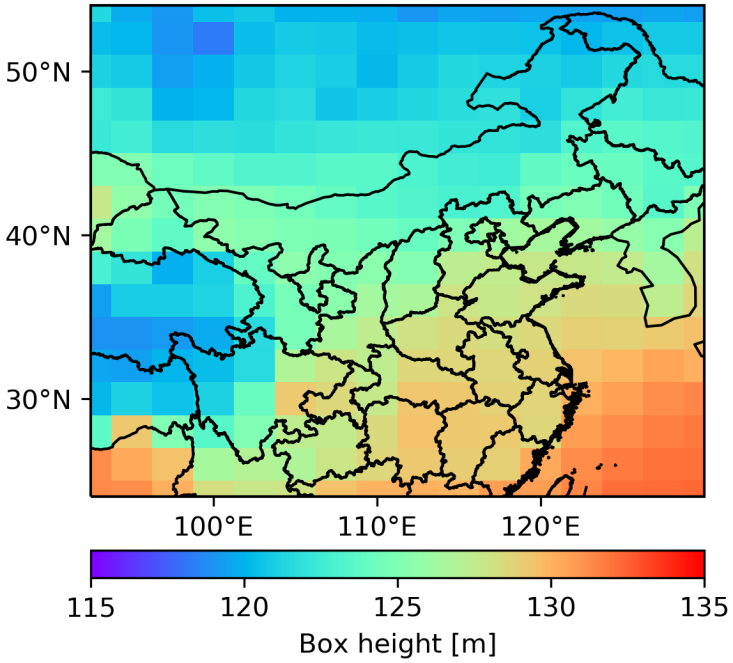

Figure S1. The box height of the lowest layer of GEOS-Chem in October 2013.

CGS and MIX-DDC for SO_2

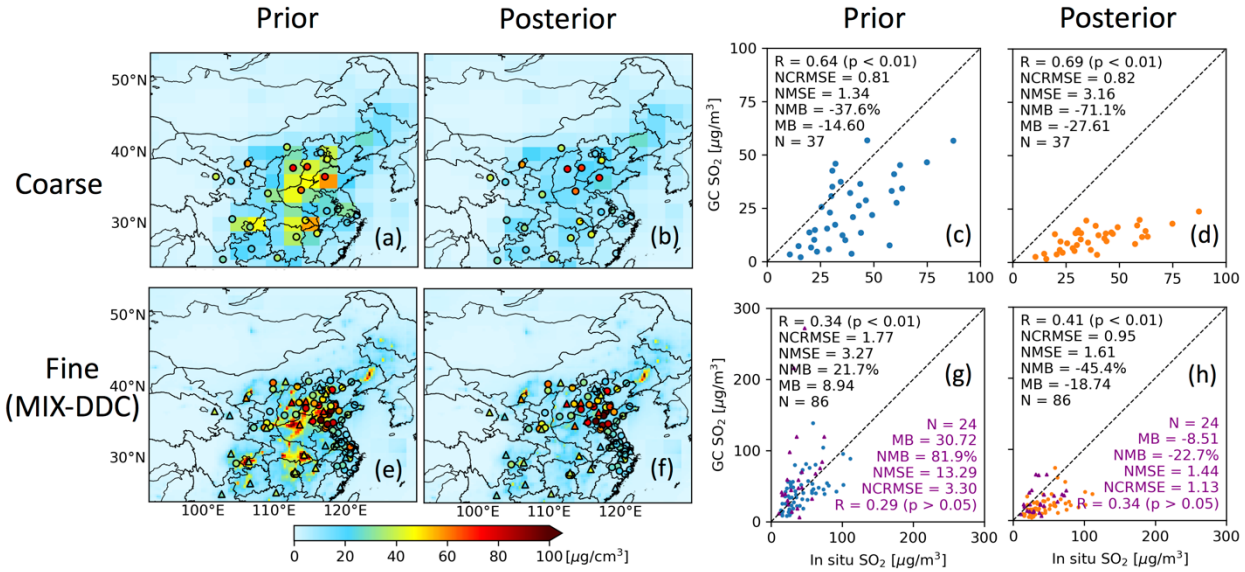

Figure S2. It is similar to Fig. 4, but GC adjoint v35m rather than GCv12.0.0 is used.

GCS, MIX-DDC and NL-DC for NO_2

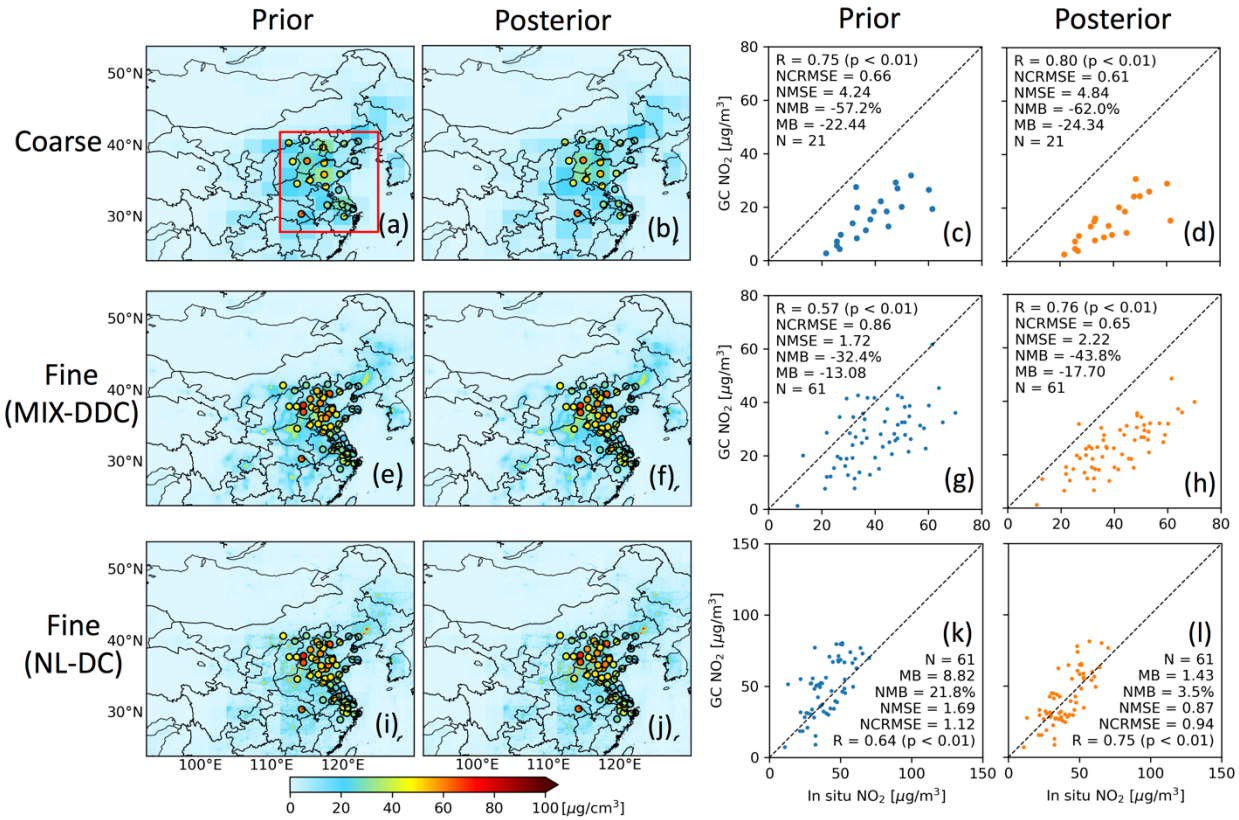

Figure S3. It is similar to Fig. 5, but GC adjoint v35m rather than GCv12.0.0 is used.

NMSE of surface SO_2 and NO_2

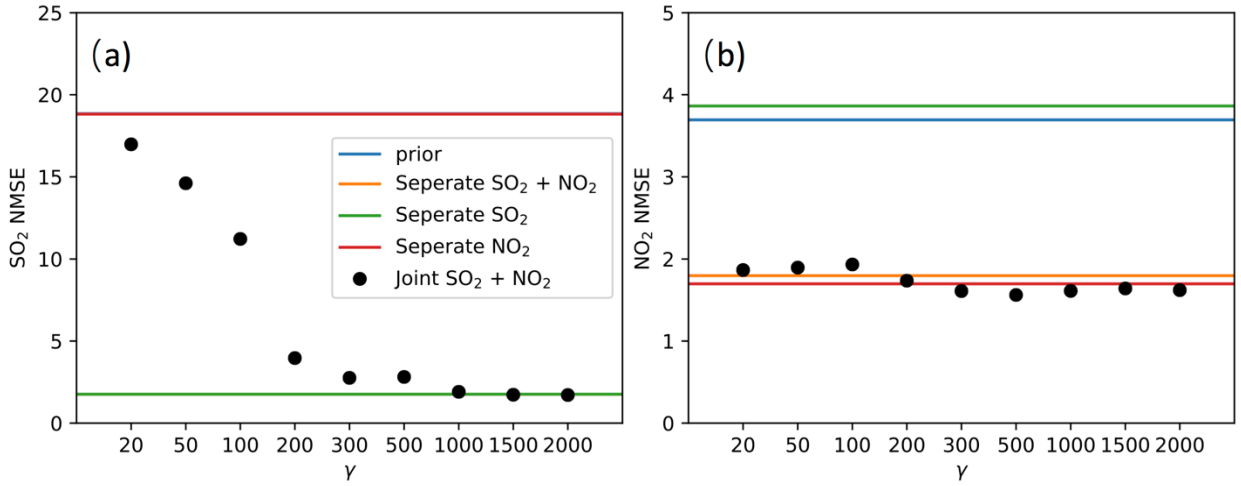

Figure S4. Normalized mean squared error (NMSE) of surface SO_2 (a) and NO_2 (b). All surface SO_2 and NO_2 simulations come from MIX-DDC and NL-DC, respectively. Black dots are posterior simulations from Joint-F-POS. The blue line is prior simulation results with SO_2 NMSE from MIX-DDC-PRI and NO_2 NMSE from NL-DC-PRI, respectively. The orange line is simulation results with SO_2 NMSE from MIX-DDC-POS and NO_2 NMSE from NL-DC-POS, respectively. The green line is similar to orange line, but posterior SO_2 emission from separate assimilation and prior NO_x emission are used. The red line is similar to orange line, but posterior NO_x emission from separate assimilation and prior SO_2 emission are used. In the figure (a), the blue line is covered by the red line, and the orange line is covered by the green line.

O_3 forecasts

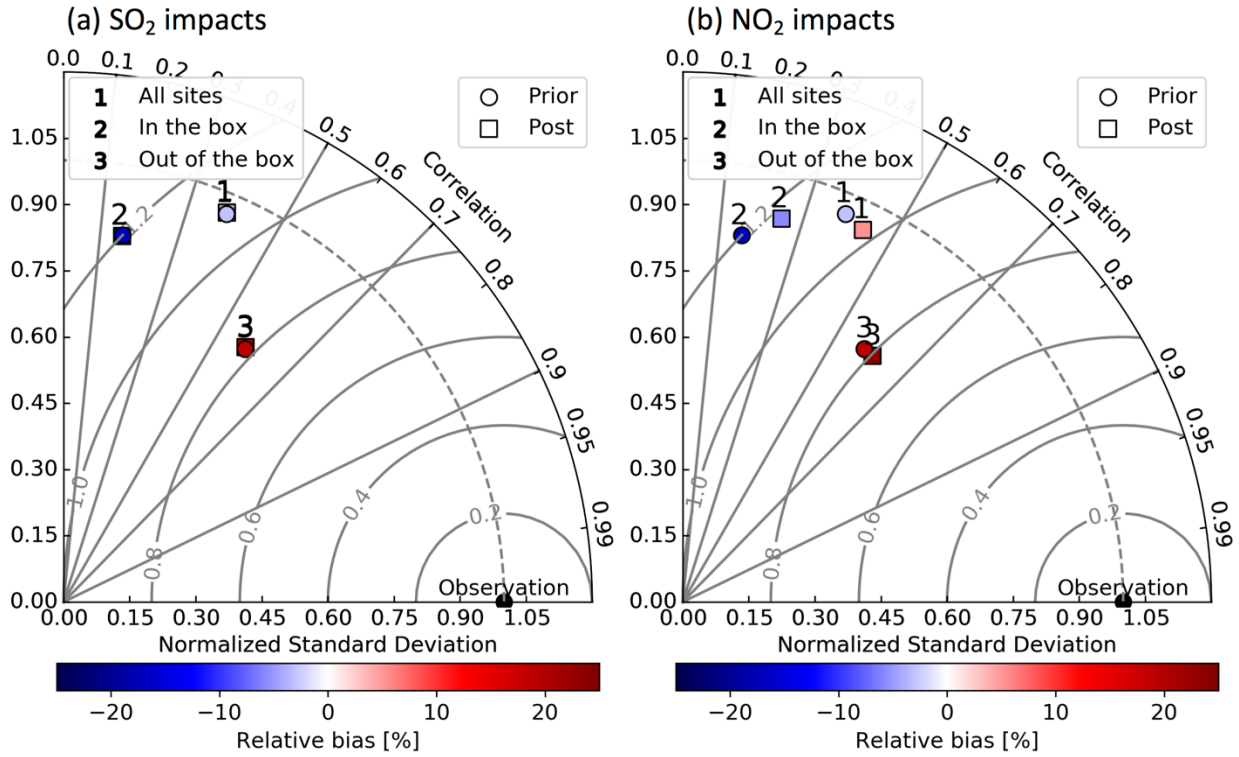

Figure S5. (a) is similar to Fig. 14c, but in the posterior forecasts, the prior MIX NO_x emission inventory and the posterior MIX-DE SO_2 emission inventory is used. (b) is similar to Fig. 14c, but in the posterior forecasts, the prior MIX SO_2 emission inventory and the posterior MIX-DE NO_x emission inventory is used.

Figure S5 shows that the improvement of O_3 forecasts is caused by using optimized posterior NO_x emission inventory; the change SO_2 emission inventory has negligible impact.