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Supplement of

Calibrating a global atmospheric chemistry transport model using Gaussian process emulation and ground-level concentrations of ozone and carbon monoxide

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Supplemental Information for:

'Calibrating a global atmospheric chemistry transport model using Gaussian process emulation and ground-level concentrations of ozone and carbon monoxide'

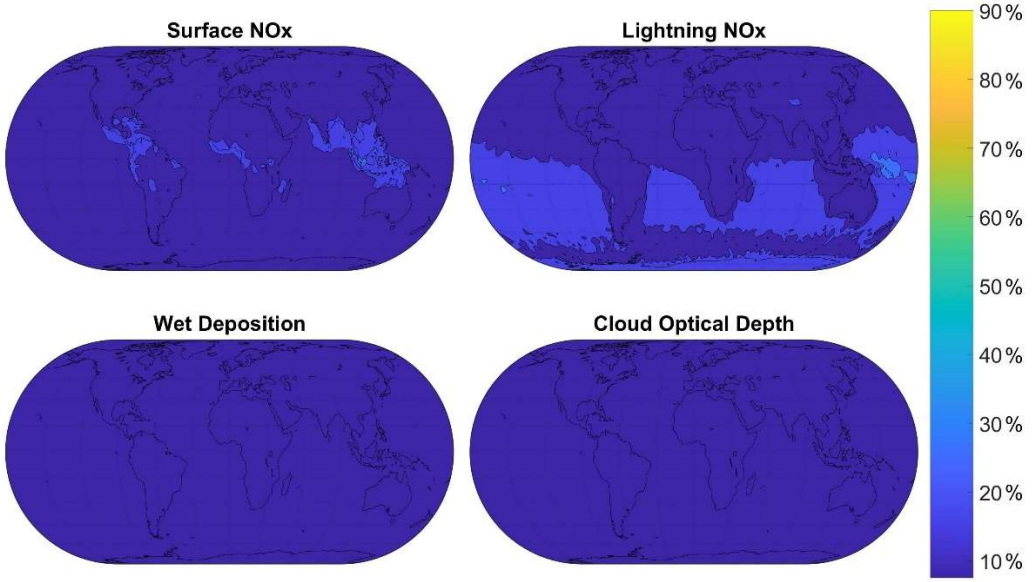

Figure S1. Sensitivity indices representing the percentage of the variance in surface O_3 in the FRSGC/UCI model output due to changes in each input parameter. The four parameters displayed here have the lowest sensitivity indices and so changes in these inputs have the smallest effect on simulated surface O_3 values.

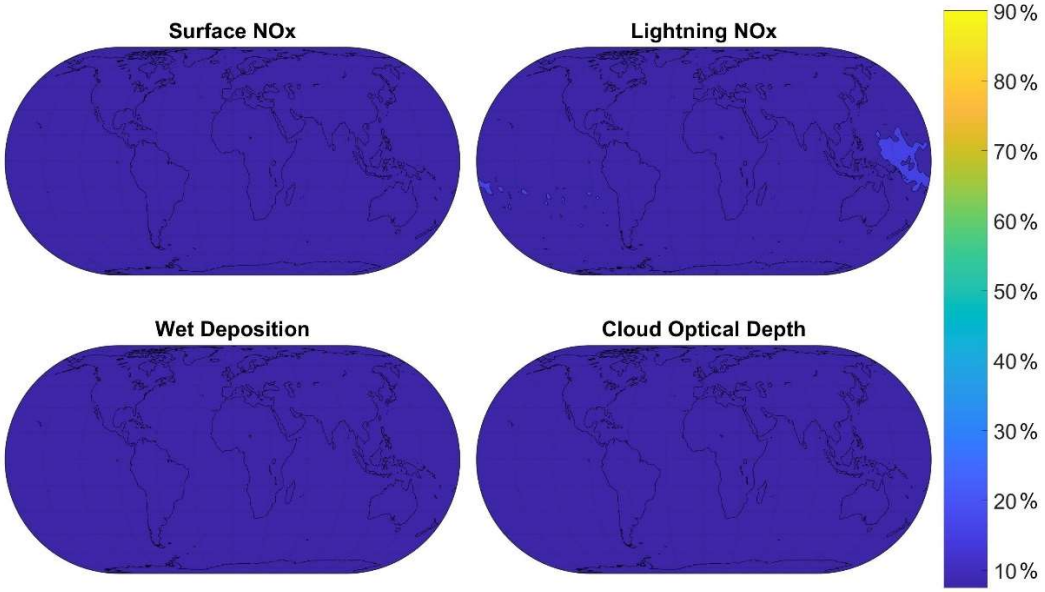

Figure S2. Sensitivity indices representing the percentage of the variance in surface CO in the FRSGC/UCI model output due to changes in each input parameter. The four parameters displayed here have the lowest sensitivity indices and so changes in these inputs have the smallest effect on simulated surface CO values.

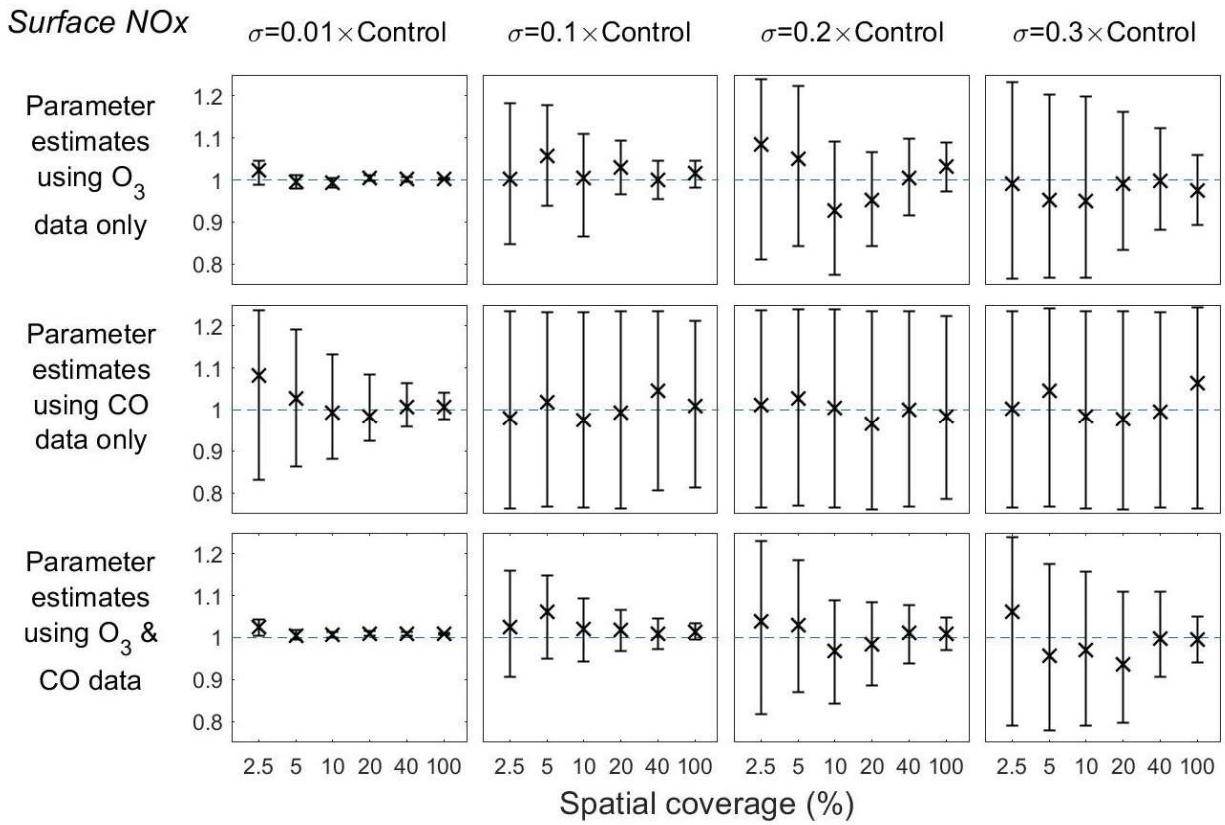

Figure S3. The means and 95% credible intervals of the 3000 samples of the **Surface NOx emission** scaling parameter from posterior distributions using the MCMC algorithm based on synthetic datasets from scenarios 1-72 (table 1). *Control* refers to the FRSGC/UCI model control run surface concentration at each output point.

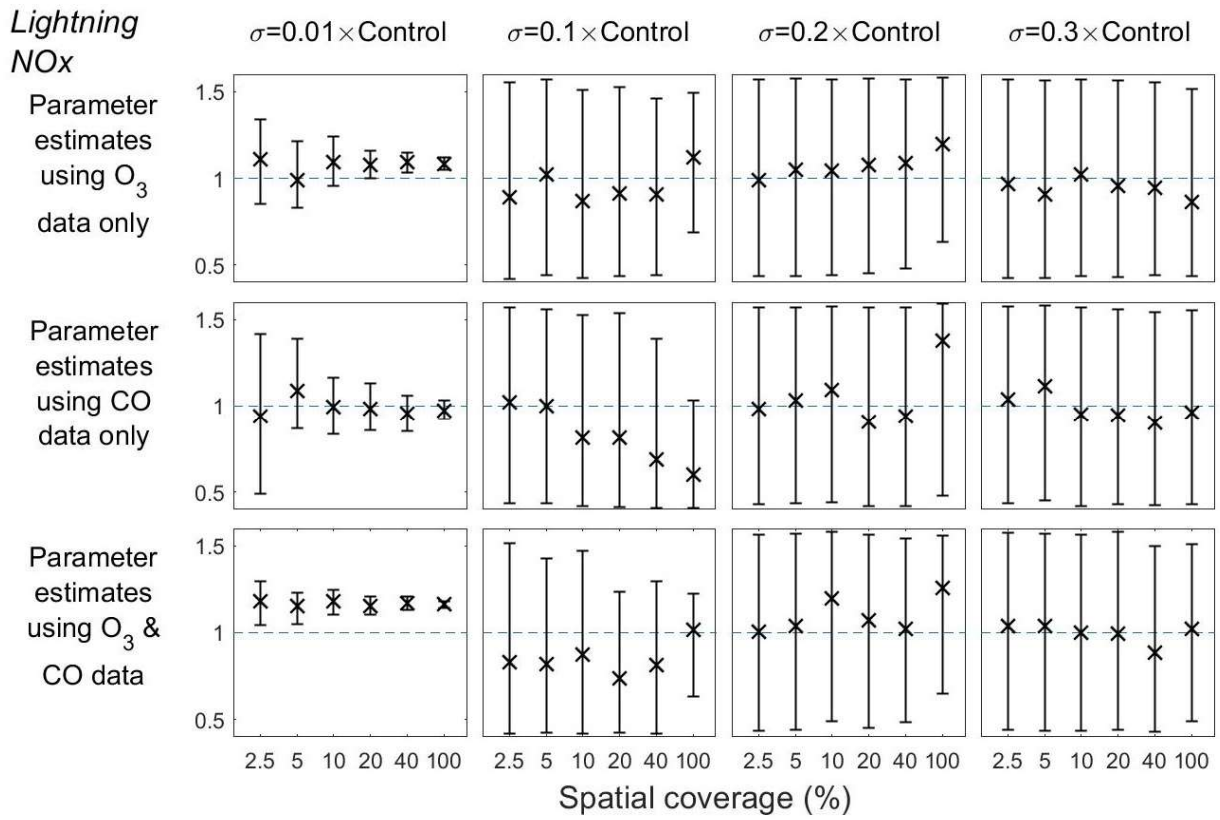

Figure S4. The means and 95% credible intervals of the 3000 samples of the **Lightning NOx emission** scaling parameter from posterior distributions using the MCMC algorithm based on synthetic datasets from scenarios 1-72 (table 1). *Control* refers to the FRSGC/UCI model control run surface concentration at each output point.

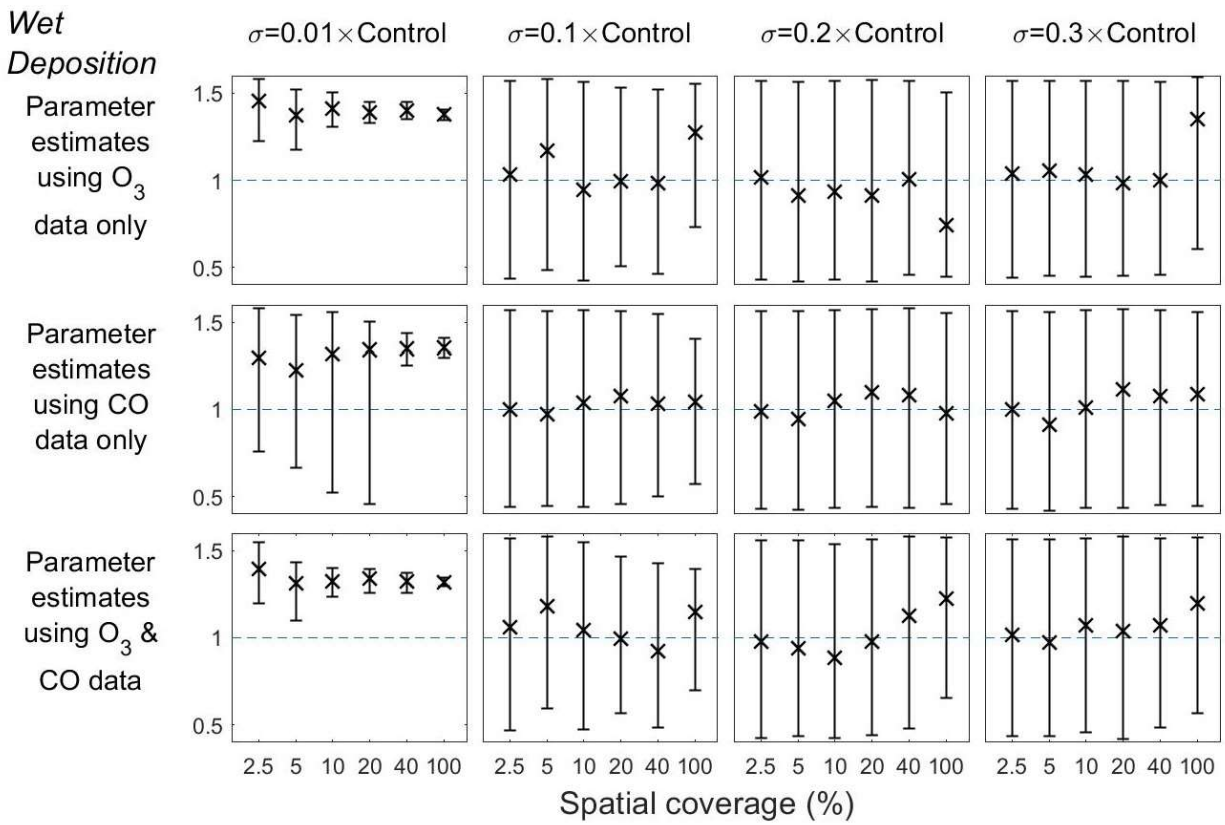

Figure S5. The means and 95% credible intervals of the 3000 samples of the **Wet Deposition** scaling parameter from posterior distributions using the MCMC algorithm based on synthetic datasets from scenarios 1-72 (table 1). *Control* refers to the FRSGC/UCI model control run surface concentration at each output point.

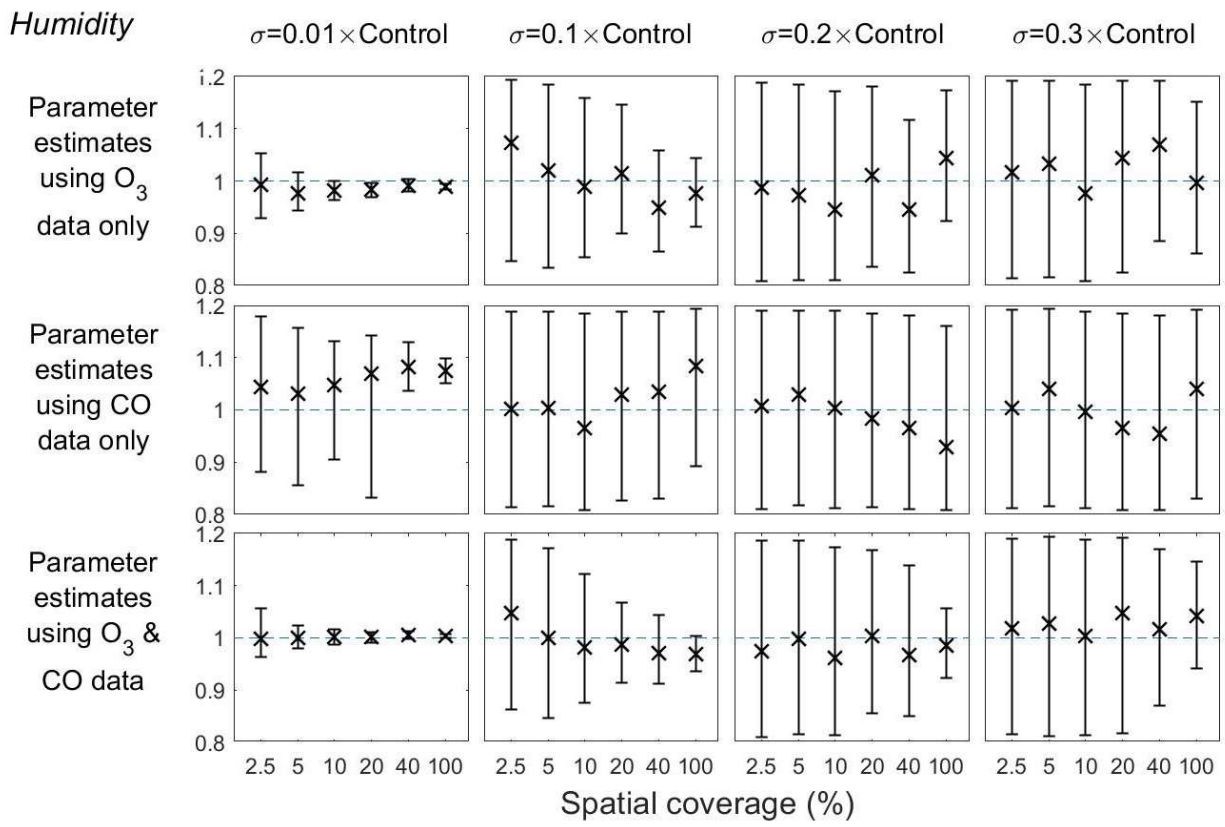

Figure S6. The means and 95% credible intervals of the 3000 samples of the **Humidity** scaling parameter from posterior distributions using the MCMC algorithm based on synthetic datasets from scenarios 1-72 (table 1). *Control* refers to the FRSGC/UCI model control run surface concentration at each output point.

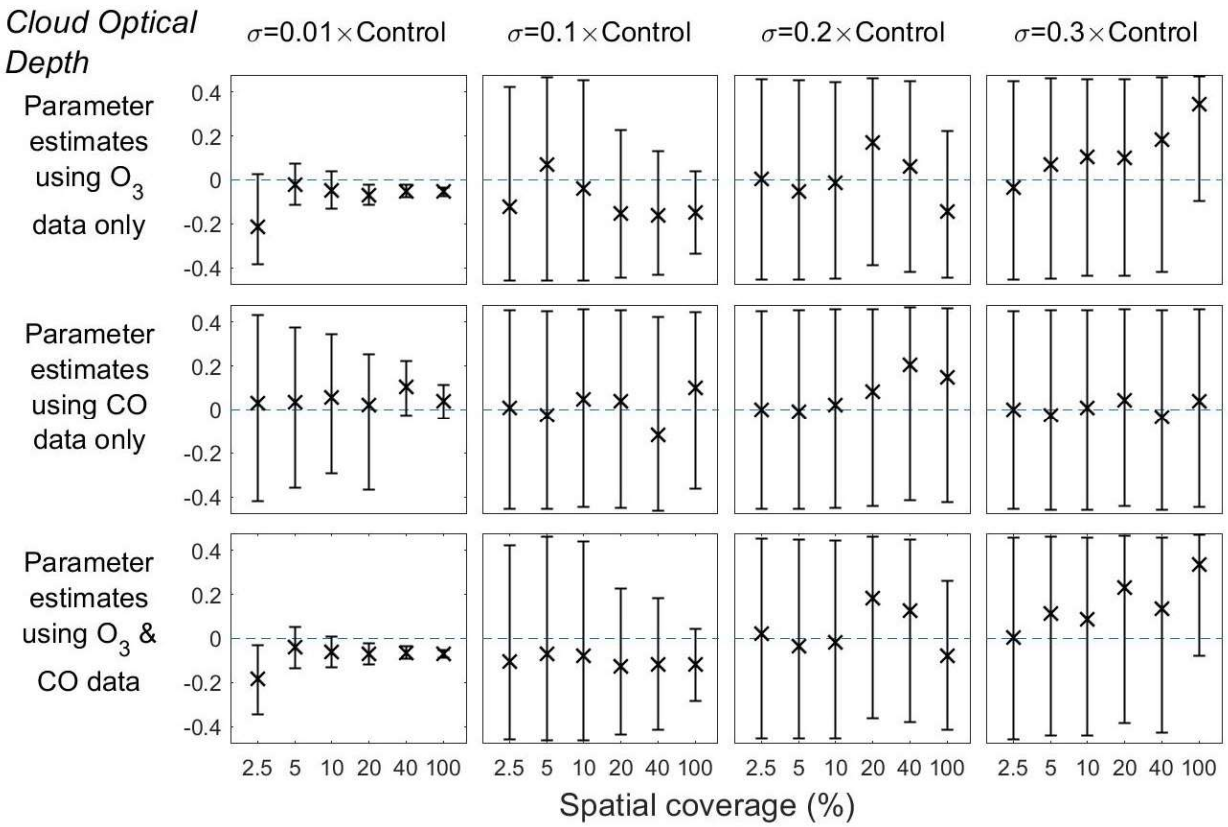

Figure S7. The means and 95% credible intervals of the 3000 samples of the **Cloud Optical Depth** scaling parameter from posterior distributions using the MCMC algorithm based on synthetic datasets from scenarios 1-72 (table 1). *Control* refers to the FRSGC/UCI model control run surface concentration at each output point.

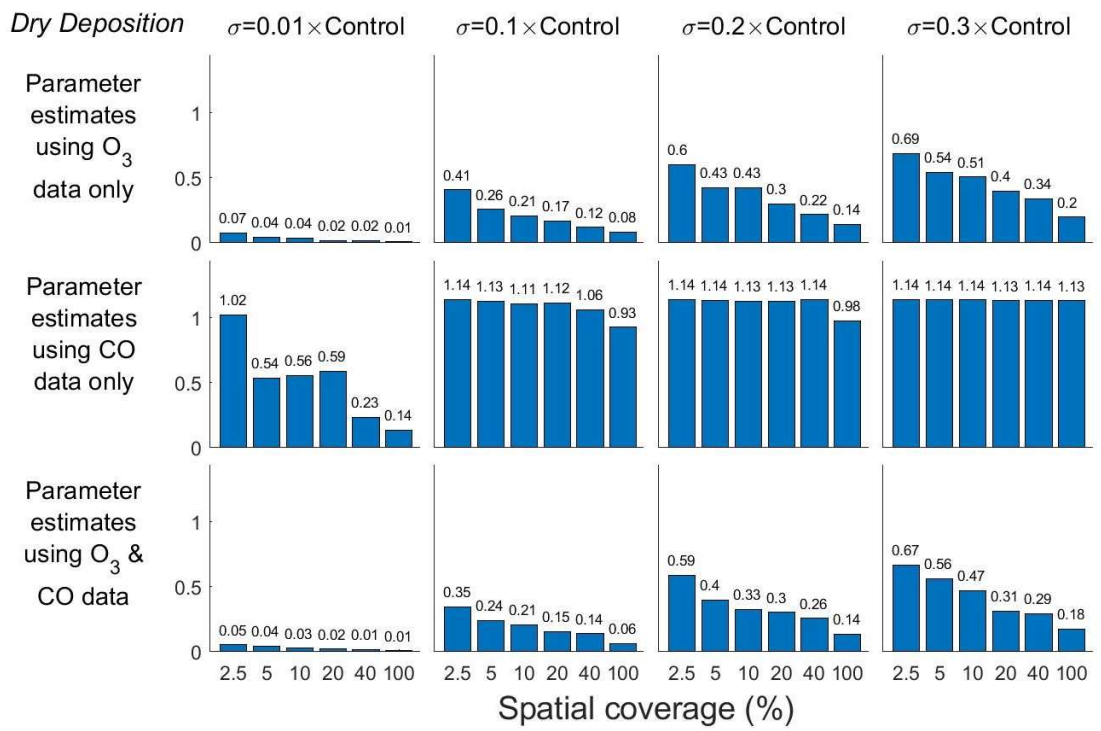

Figure S8. The length of the error bars for the Dry Deposition scaling parameter from Figure 7.

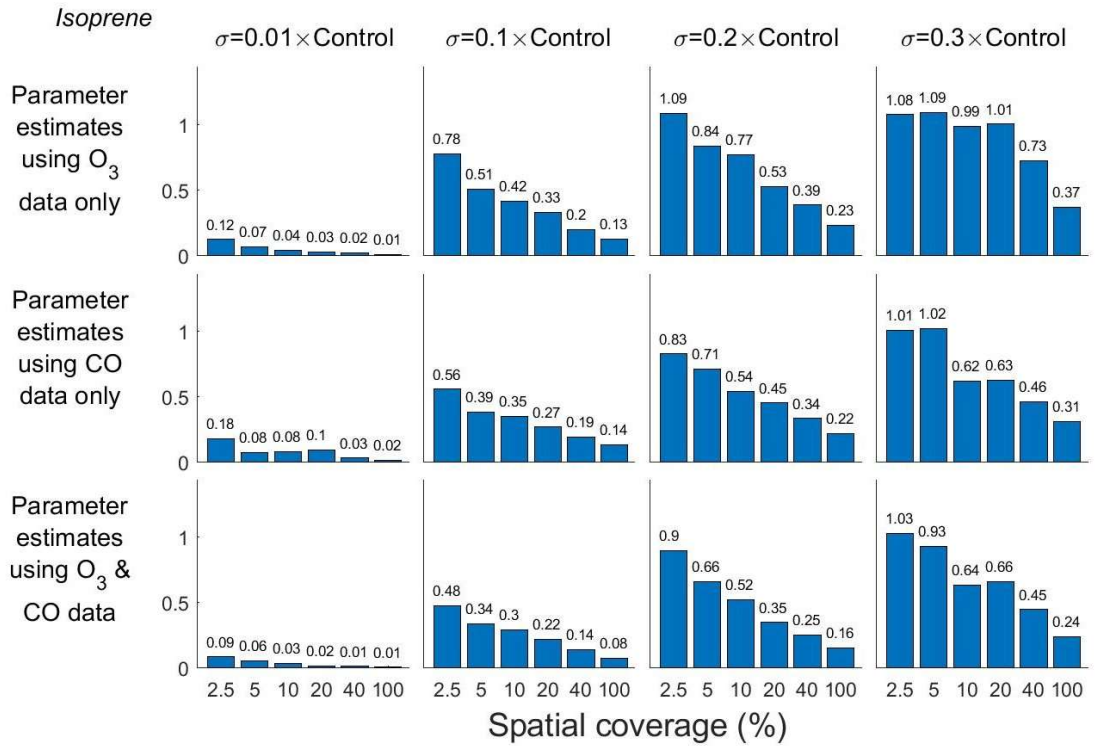

Figure S9. The length of the error bars for the Isoprene emission scaling parameter from Figure 8.

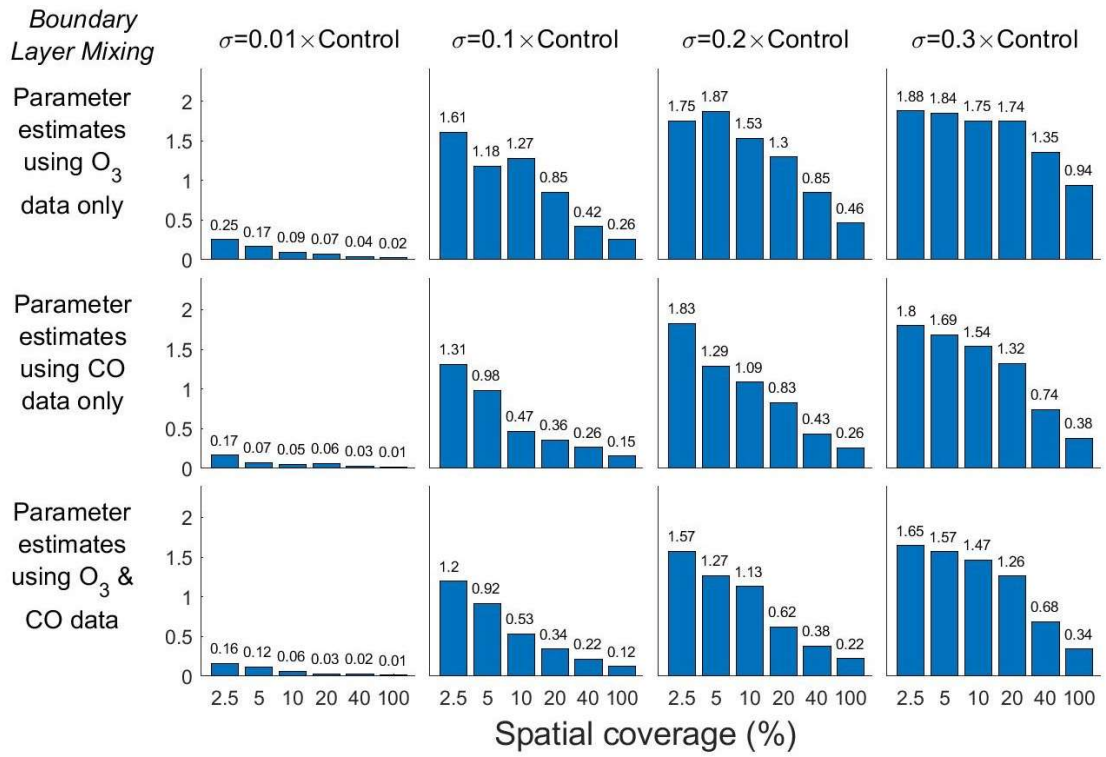

Figure S10. The length of the error bars for the Boundary Layer Mixing scaling parameter from Figure 9.

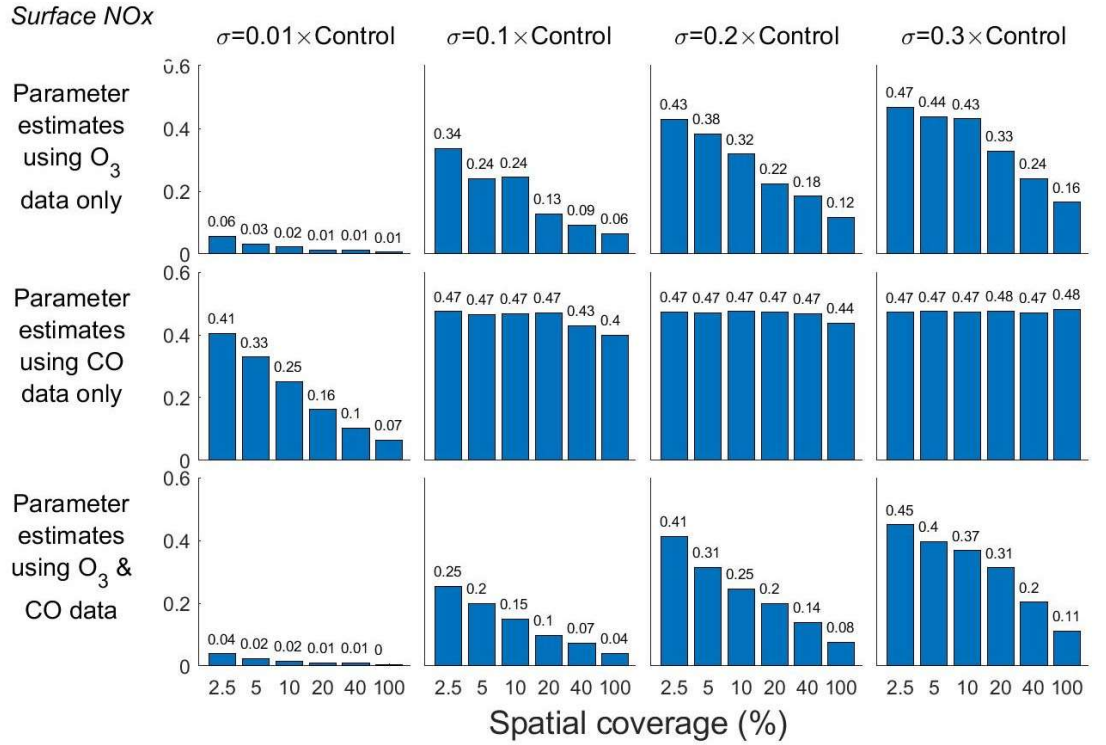

Figure S11. The length of the error bars for the Surface NOx emission scaling parameter from Figure S3.

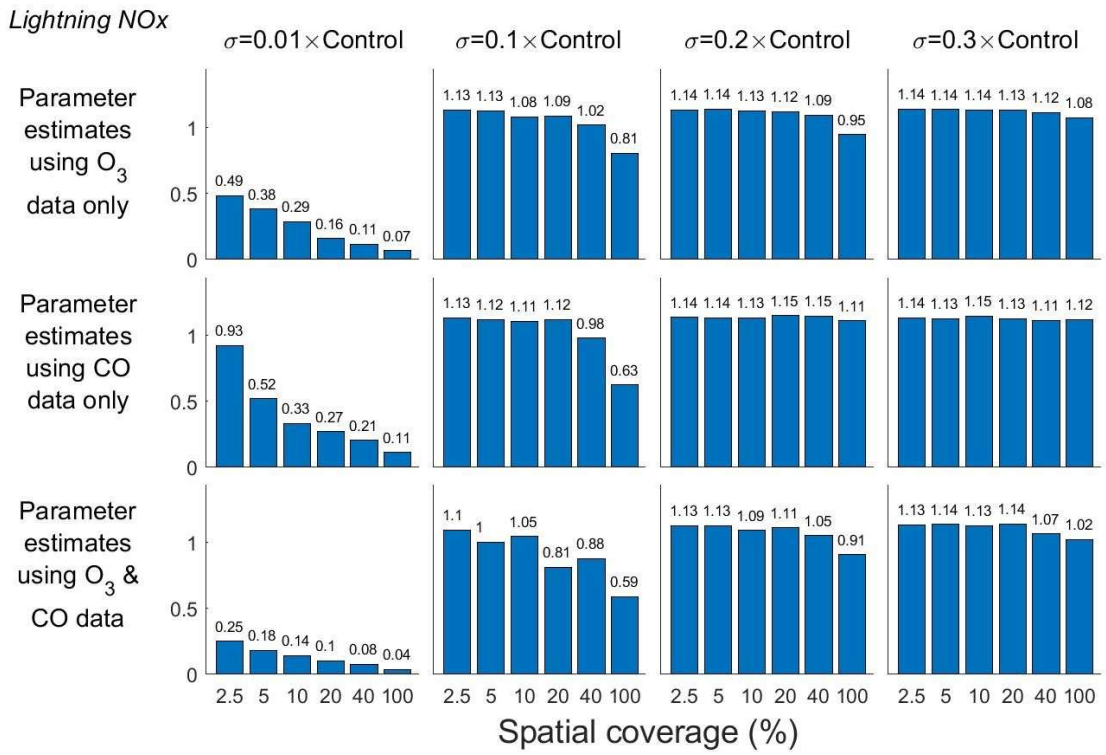

Figure S12. The length of the error bars for the Lightning NOx emission scaling parameter from Figure S4.

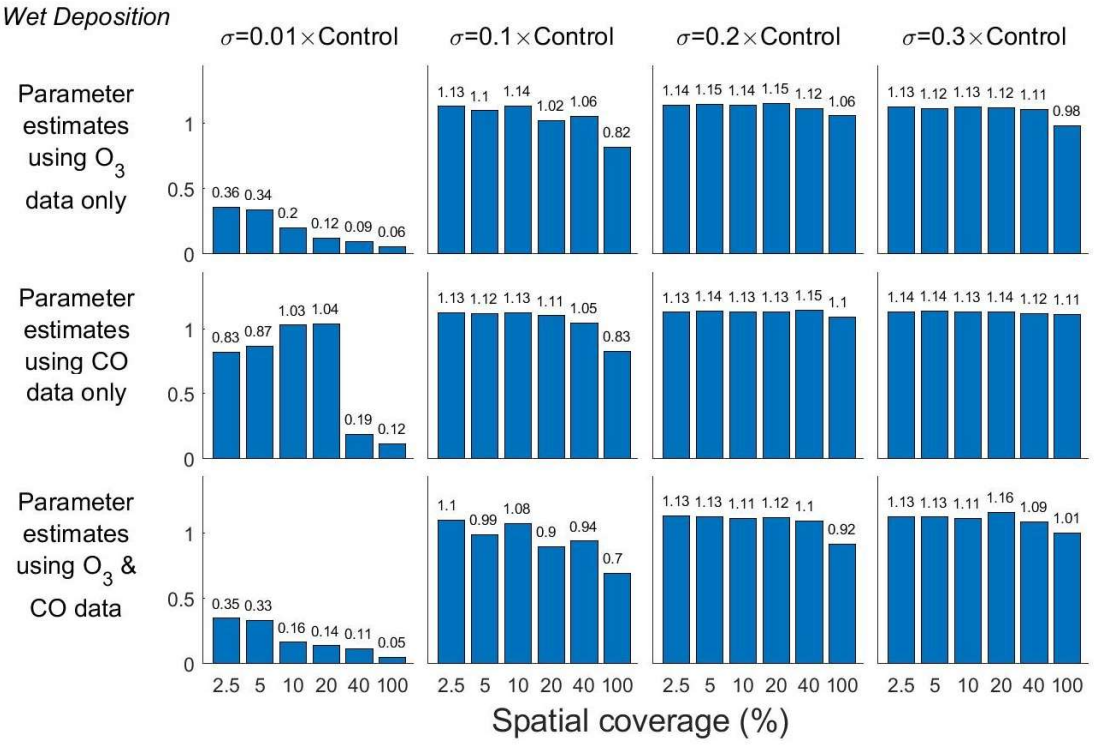

Figure S13. The length of the error bars for the Wet Deposition scaling parameter from Figure S5.

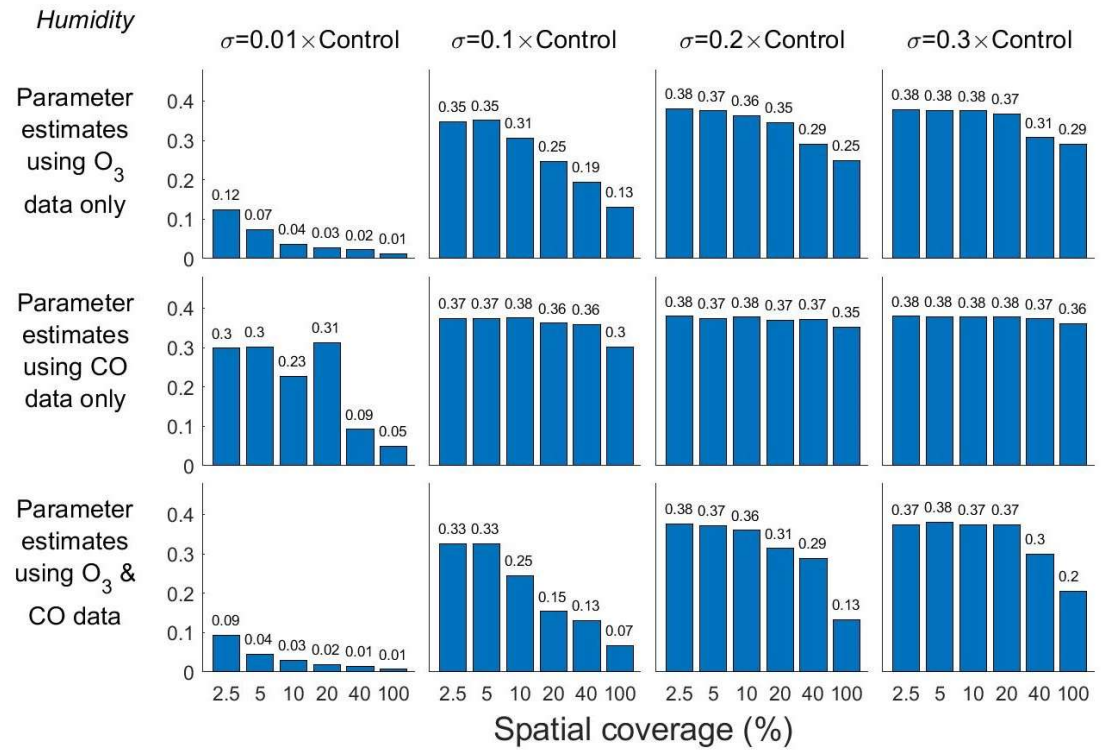

Figure S14. The length of the error bars for the Humidity scaling parameter from Figure S6.

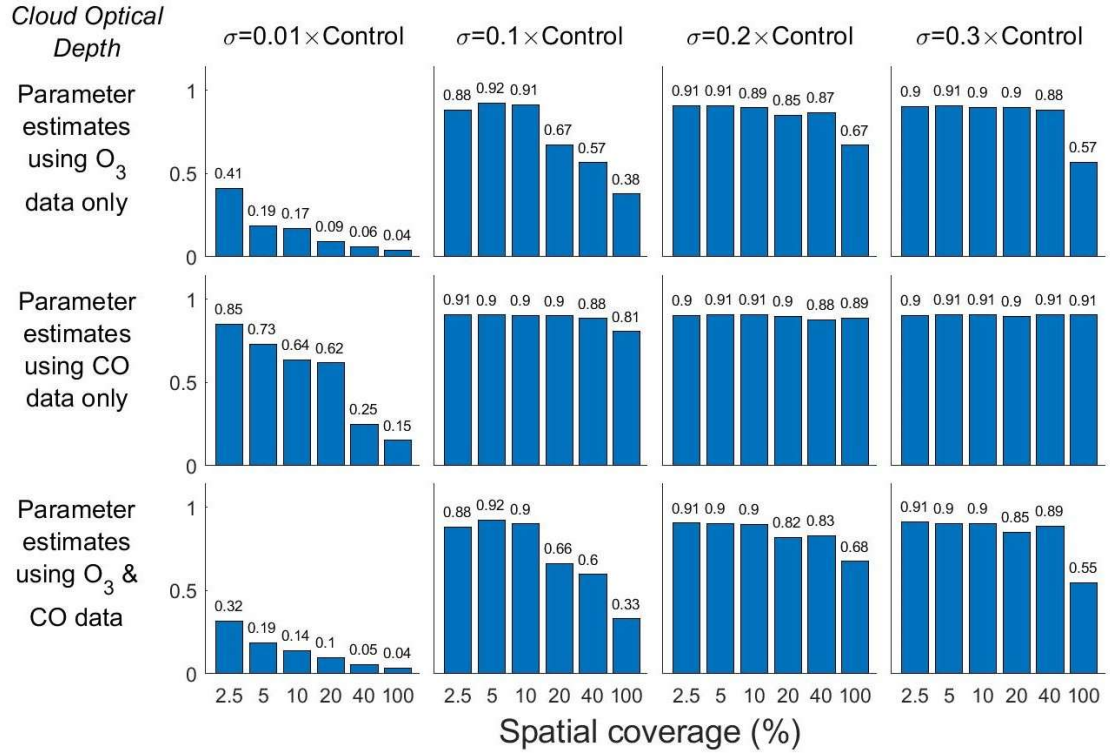

Figure S15. The length of the error bars for the Cloud Optical Depth scaling parameter from Figure S7.

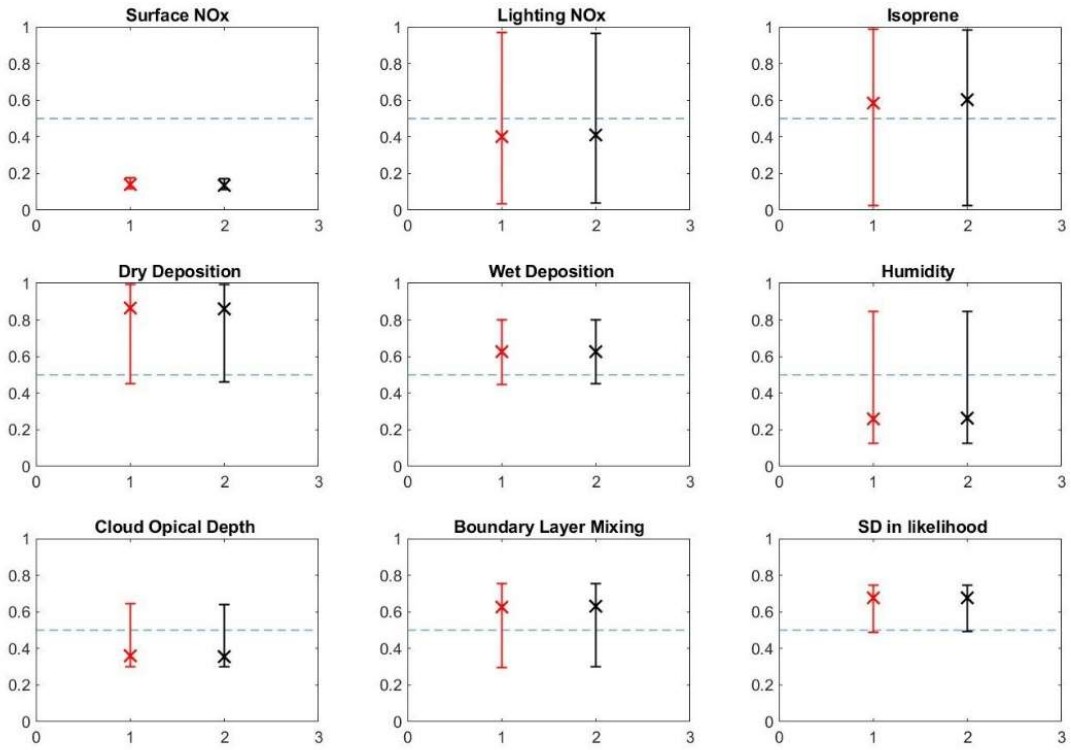

Figure S16. Mean and 95% credible interval of the marginal posterior distributions of the eight scaling parameters and the SD term, corresponding to the MCMC scenario involving surface ozone reanalysis with 2.5% spatial coverage. The red crosses and error bars correspond to the results using the discrepancy term in the emulator formulation, while the black crosses show the standard results without.