Supplement to:

Examining the impact of heterogeneous nitryl chloride production on air quality across the United States

G. Sarwar[1], H. Simon[2], P. Bhave[1], G. Yarwood[3]

[1] National Exposure Research Laboratory, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina, USA
[2] Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina, USA
[3] ENVIRON International Corporation, Novato, California, USA

Figure S1. September 2006 8-hr max O_3 mean bias (for days when obs > 65 ppbv) in the simulation without heterogeneous $ClNO_2$ formation (top) and change in absolute value of 8-hr max O_3 mean bias with the implementation of $ClNO_2$ chemistry (bottom). Negative values in bottom plot denote improvements in performance and positive values denote degredations in model performance due to $ClNO_2$ chemistry.

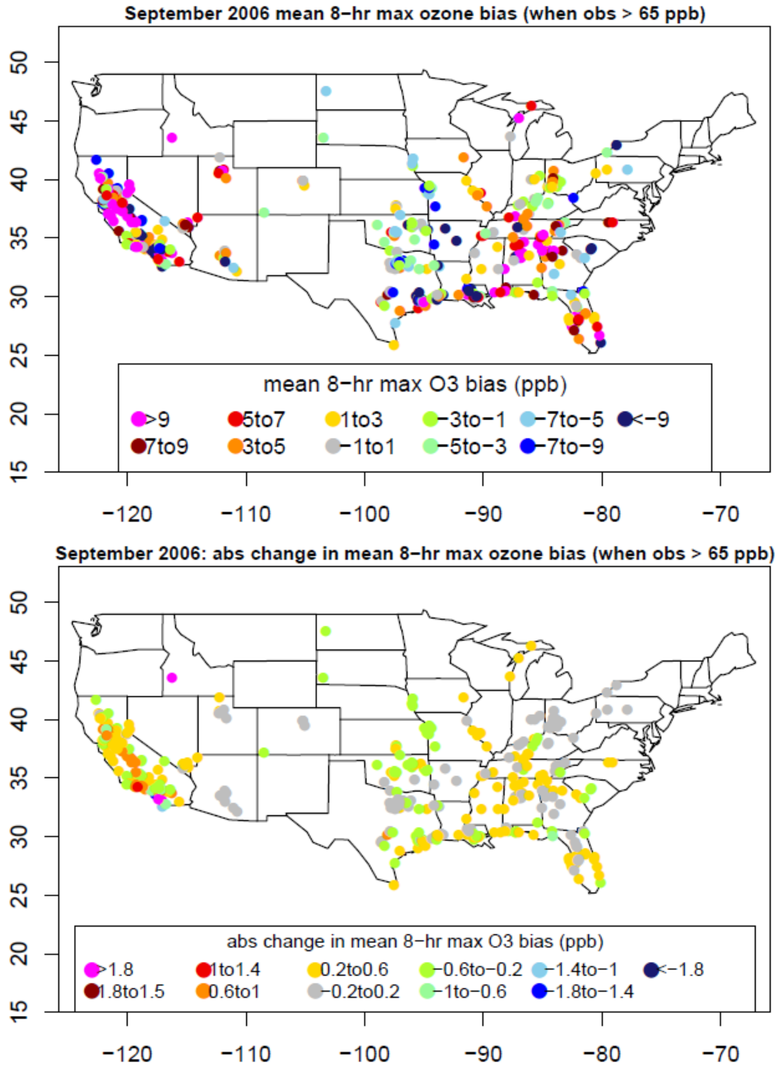

Figure S2. TNO_3 mean observed concentration (top), TNO_3 mean bias in the simulation without heterogeneous $ClNO_2$ formation (middle) and change in absolute value of TNO_3 mean bias with the implementation of $ClNO_2$ chemistry (bottom). Negative values in bottom plot denote improvements in performance and positive values denote degredations in model performance due to $ClNO_2$ chemistry. All plots show comparisons of weekly average values at CASTNet monitoring sites during the month of February 2006.

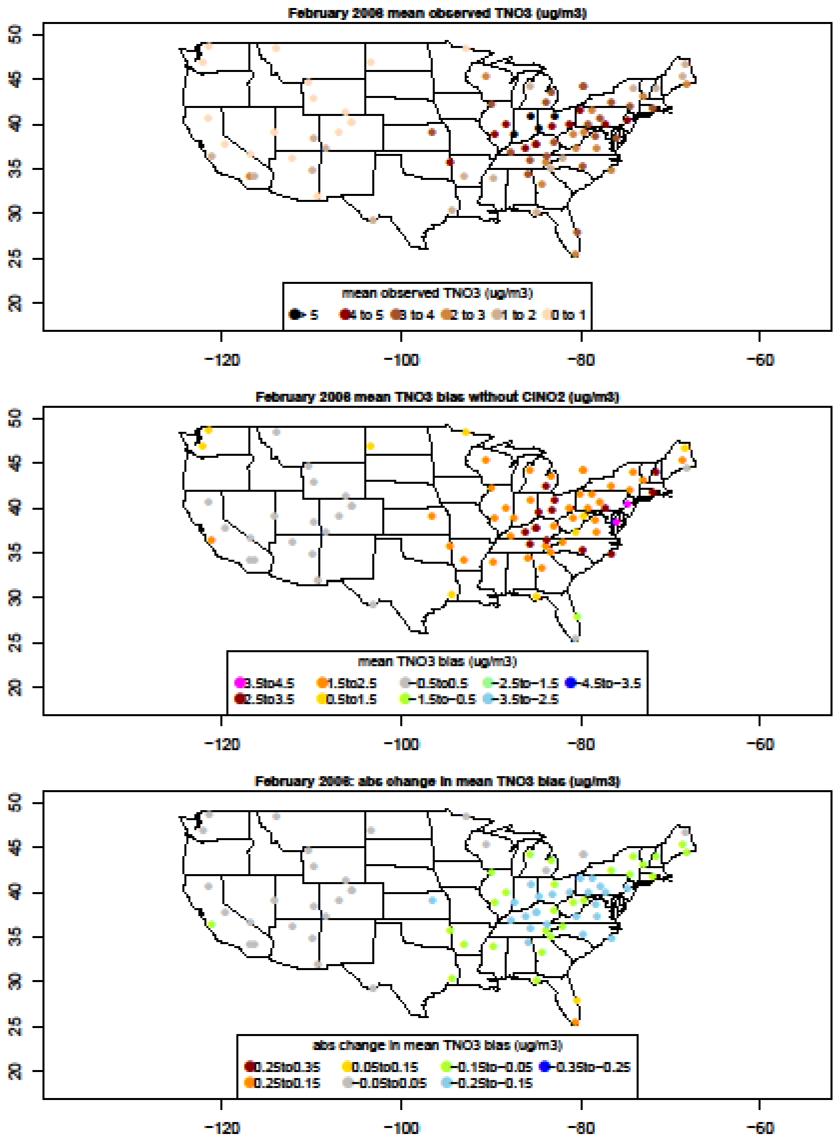

Figure S3. TNO_3 mean observed concentration (top), TNO_3 mean bias in the simulation without heterogeneous $ClNO_2$ formation (middle) and change in absolute value of TNO_3 mean bias with the implementation of $ClNO_2$ chemistry (bottom). Negative values in bottom plot denote improvements in performance and positive values denote degredations in model performance due to $ClNO_2$ chemistry. All plots show comparisons of weekly average values at CASTNet monitoring sites during the month of September 2006.

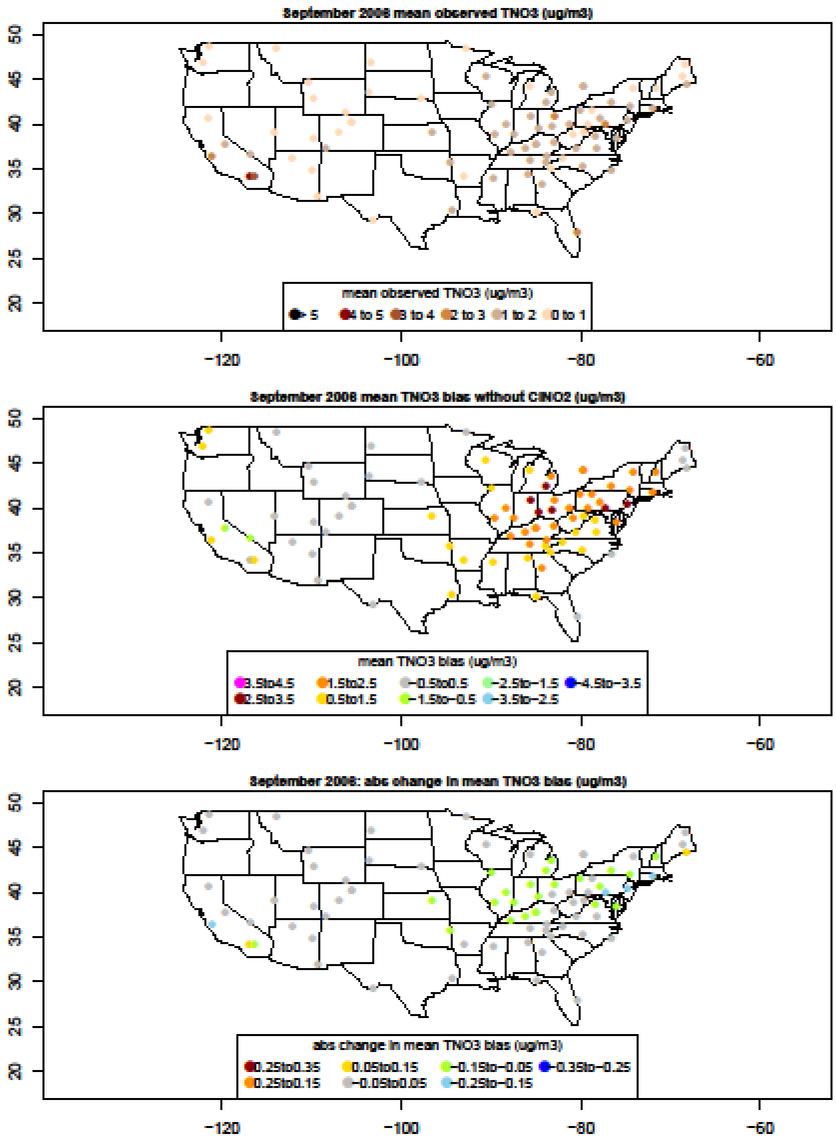

Figure S4. Particulate NO_3 mean observed concentration (top), Particulate NO_3 mean bias in the simulation without heterogeneous $ClNO_2$ formation (middle) and change in absolute value of Particulate NO_3 mean bias with the implementation of $ClNO_2$ chemistry (bottom). Negative values in bottom plot denote improvements in performance and positive values denote degredations in model performance due to $ClNO_2$ chemistry. All plots show comparisons at CASTNet, CSN, IMPROVE, and SEARCH monitoring sites during the month of February 2006. Note: CASTNet comparisons are made for weekly average concentrations while IMPROVE, CSN, and SEARC comparisons are made for 24-hr average concentration.

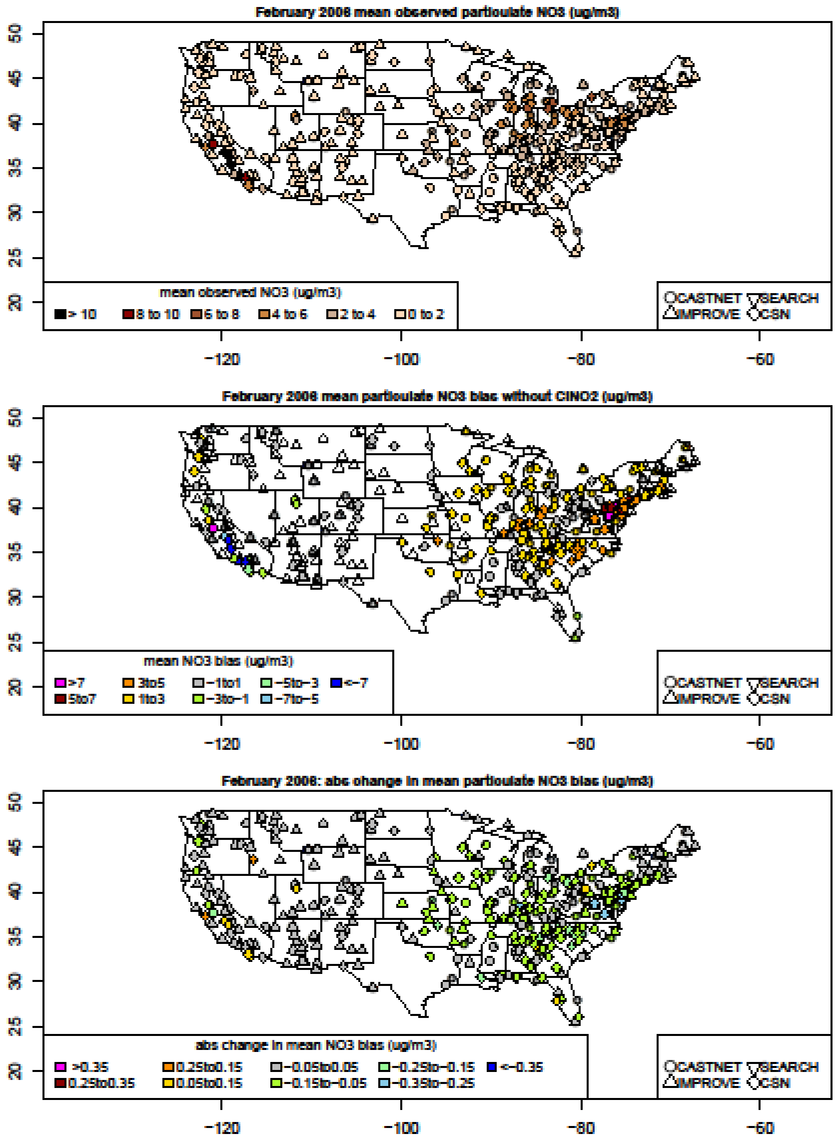

Figure S5. Particulate NO_3 mean observed concentration (top), Particulate NO_3 mean bias in the simulation without heterogeneous $ClNO_2$ formation (middle) and change in absolute value of Particulate NO_3 mean bias with the implementation of $ClNO_2$ chemistry (bottom). Negative values in bottom plot denote improvements in performance and positive values denote degredations in model performance due to $ClNO_2$ chemistry. All plots show comparisons at CASTNet, CSN, IMPROVE, and SEARCH monitoring sites during the month of September 2006. Note: CASTNet comparisons are made for weekly average concentrations while IMPROVE, CSN, and SEARC comparisons are made for 24-hr average concentration.

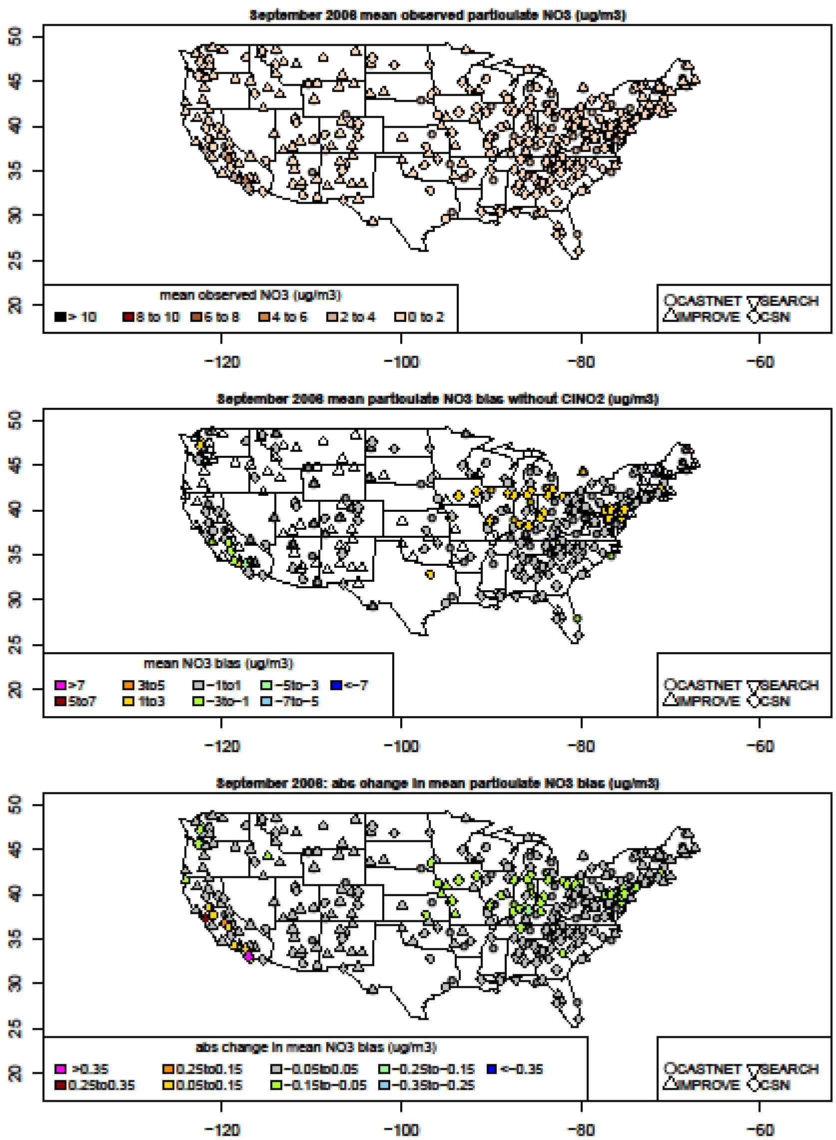

Figure S6: Impact of γ_{N2O5} parameterization on TNO_3 in February (10-days) (a) mean TNO_3 with γ_A (b) mean TNO_3 with γ_B (c) changes in mean TNO_3 with γ_A due to heterogeneous production of $ClNO_2$ (d) changes in mean TNO_3 with γ_B due to heterogeneous production of $ClNO_2$. $\gamma_A = \gamma_{N2O5}$ of Davis et al. (2008) on fine particles and γ_{N2O5} of Bertram and Thornton (2009) on coarse particles and $\gamma_B = \gamma_{N2O5}$ of Bertram and Thornton (2009) on fine as well as coarse particles.

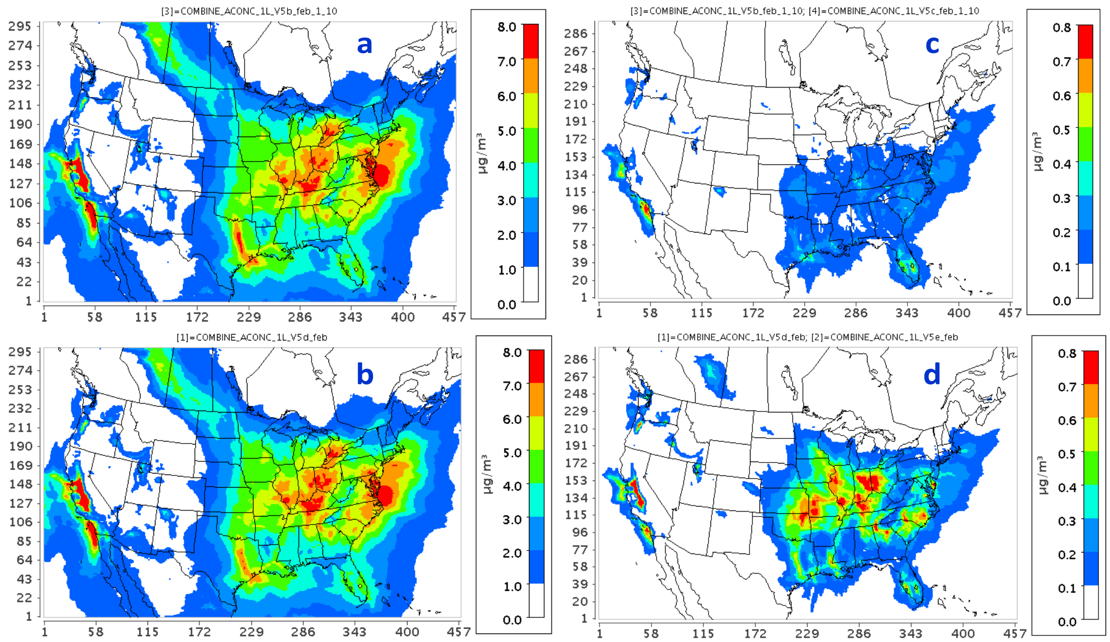

Figure S7: Impact of γ_{N2O5} parameterization on TNO_3 in September (10-days) (a) mean TNO_3 with γ_A (b) mean TNO_3 with γ_B (c) changes in mean TNO_3 with γ_A due to heterogeneous production of $ClNO_2$ (d) changes in mean TNO_3 with γ_B due to heterogeneous production of $ClNO_2$. $\gamma_A = \gamma_{N2O5}$ of Davis et al. (2008) on fine particles and γ_{N2O5} of Bertram and Thornton (2009) on coarse particles and $\gamma_B = \gamma_{N2O5}$ of Bertram and Thornton (2009) on fine as well as coarse particles.