Supplement to:

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

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Figure S1. September 2006 8-hr max O₃ mean bias (for days when obs > 65 ppbv) in the simulation without heterogeneous CINO₂ formation (top) and change in absolute value of 8-hr max O₃ mean bias with the implementation of CINO₂ chemistry (bottom). Negative values in bottom plot denote improvements in performance and positive values denote degredations in model performance due to CINO₂ 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 degradation 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 degradations 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 CINO$_2$ formation (middle) and change in absolute value of Particulate NO$_3$ mean bias with the implementation of CINO$_2$ chemistry (bottom). Negative values in bottom plot denote improvements in performance and positive values denote degradation in model performance due to CINO$_2$ 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 SEARCH 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 degradation 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 $\gamma_{N_2O_5}$ parameterization on TNO$_3$ in February (10-days) (a) mean TNO$_3$ with $\gamma_A$ (b) mean TNO$_3$ with $\gamma_B$ (c) changes in mean TNO$_3$ with $\gamma_A$ due to heterogeneous production of CINO$_2$ (d) changes in mean TNO$_3$ with $\gamma_B$ due to heterogeneous production of CINO$_2$. $\gamma_A = \gamma_{N_2O_5}$ of Davis et al. (2008) on fine particles and $\gamma_{N_2O_5}$ of Bertram and Thornton (2009) on coarse particles and $\gamma_B = \gamma_{N_2O_5}$ of Bertram and Thornton (2009) on fine as well as coarse particles.
Figure S7: Impact of $\gamma_{\text{N}_2\text{O}_5}$ parameterization on TNO$_3$ in September (10-days) (a) mean TNO$_3$ with $\gamma_A$ (b) mean TNO$_3$ with $\gamma_B$ (c) changes in mean TNO$_3$ with $\gamma_A$ due to heterogeneous production of CINO$_2$ (d) changes in mean TNO$_3$ with $\gamma_B$ due to heterogeneous production of CINO$_2$. $\gamma_A = \gamma_{\text{N}_2\text{O}_5}$ of Davis et al. (2008) on fine particles and $\gamma_{\text{N}_2\text{O}_5}$ of Bertram and Thornton (2009) on coarse particles and $\gamma_B = \gamma_{\text{N}_2\text{O}_5}$ of Bertram and Thornton (2009) on fine as well as coarse particles.