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Atmospheric oxidation in the presence of clouds during the Deep Convective Clouds and Chemistry (DC3) study

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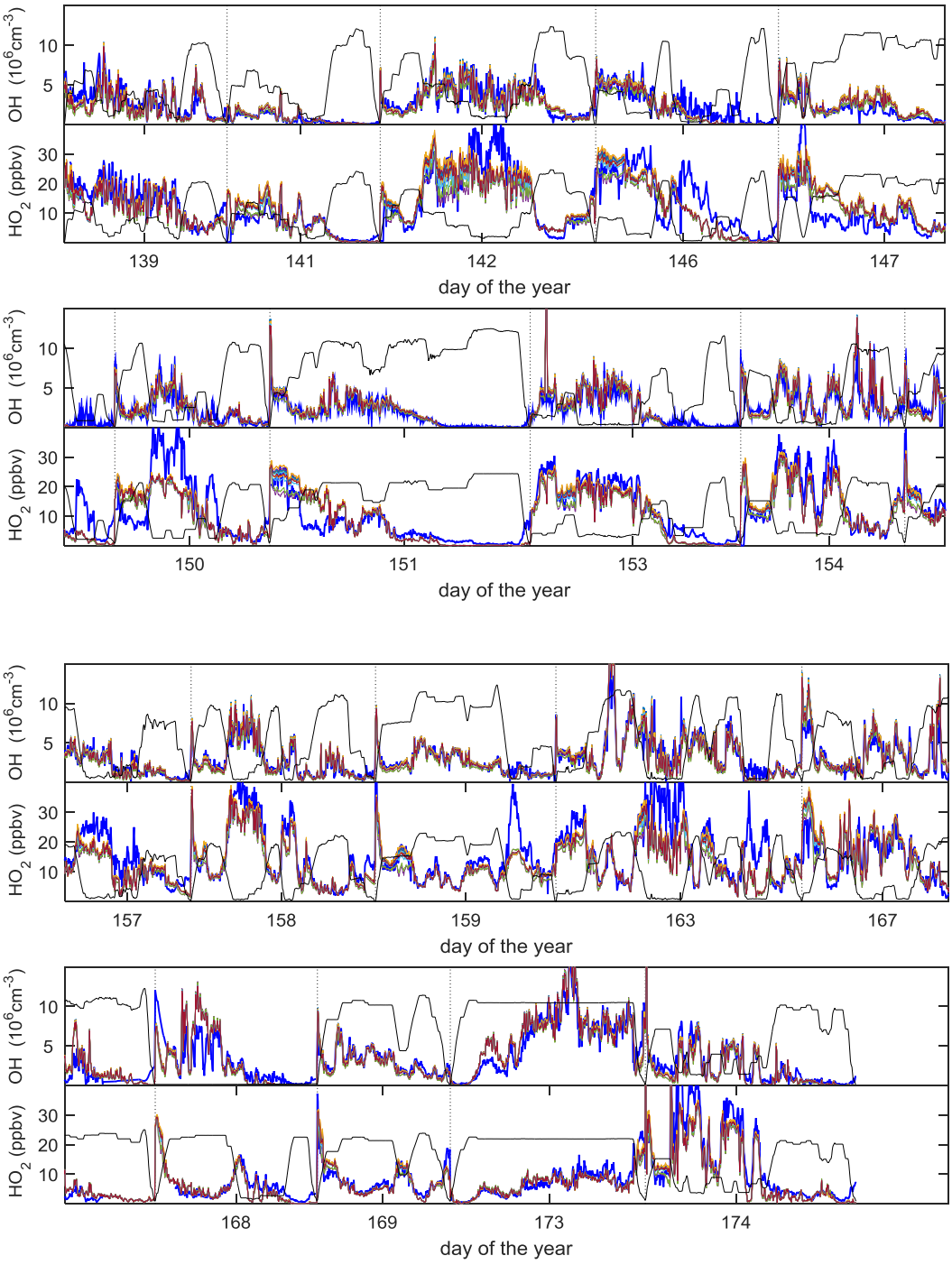

Figure S1. Comparison of observed and modeled OH and HO_2 as a function of time. Blue lines are observations. Models with different integration times, dilution times, and with and without added RO_2+OH chemistry are plotted in different colors to show the range of modeled OH and HO_2 values for these different model scenarios. Scaled altitude (black line) and separation between flights (vertical dotted lines) are added for clarification. If the observed blue line cannot be seen, then observed and modeled values agree.

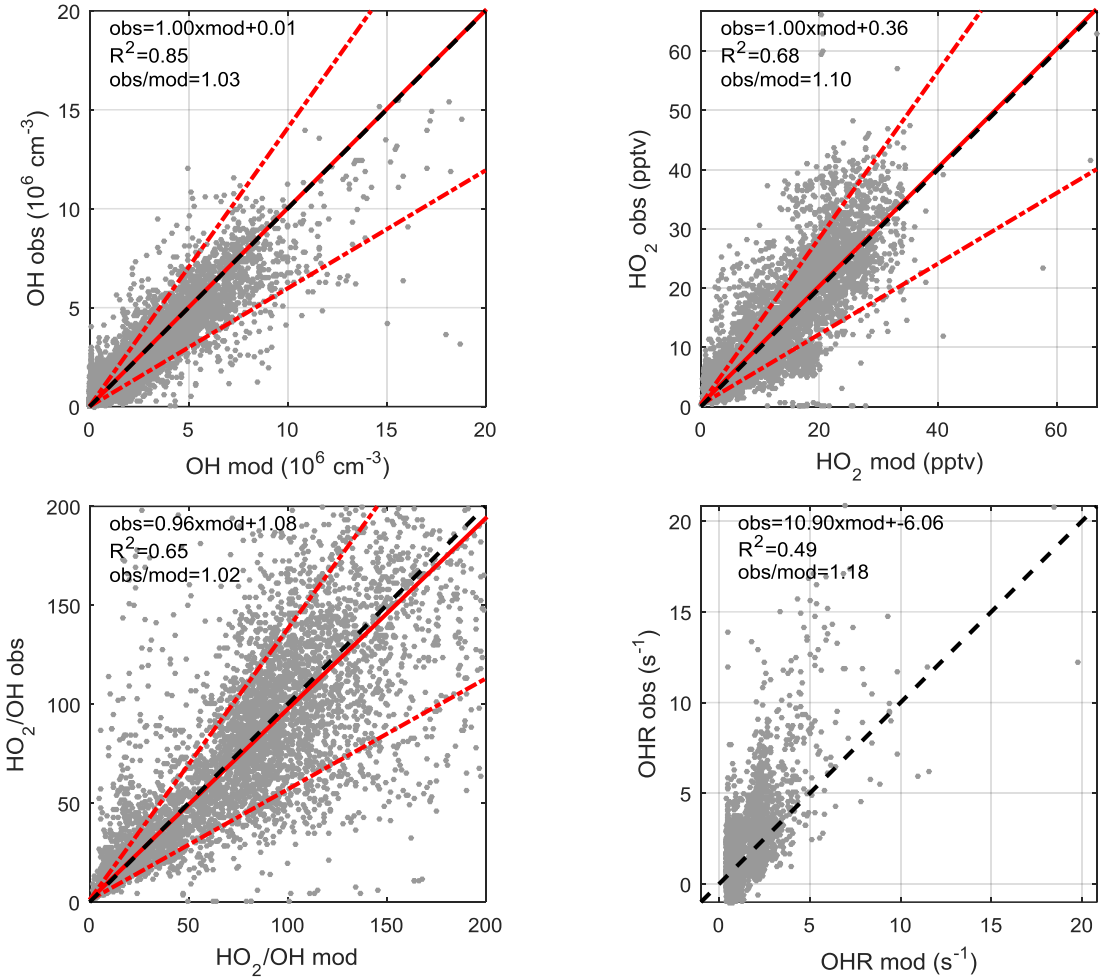

Figure S2. Observations versus the no-het model. Scatter plots of observed versus modeled OH (upper right), HO_2 (upper left), HO_2/OH (lower left), and OH reactivity (lower right). Gray points are one-minute averages. Dashed red lines are factors of 1/1.4 and 1.4 times the fitted line (solid red).

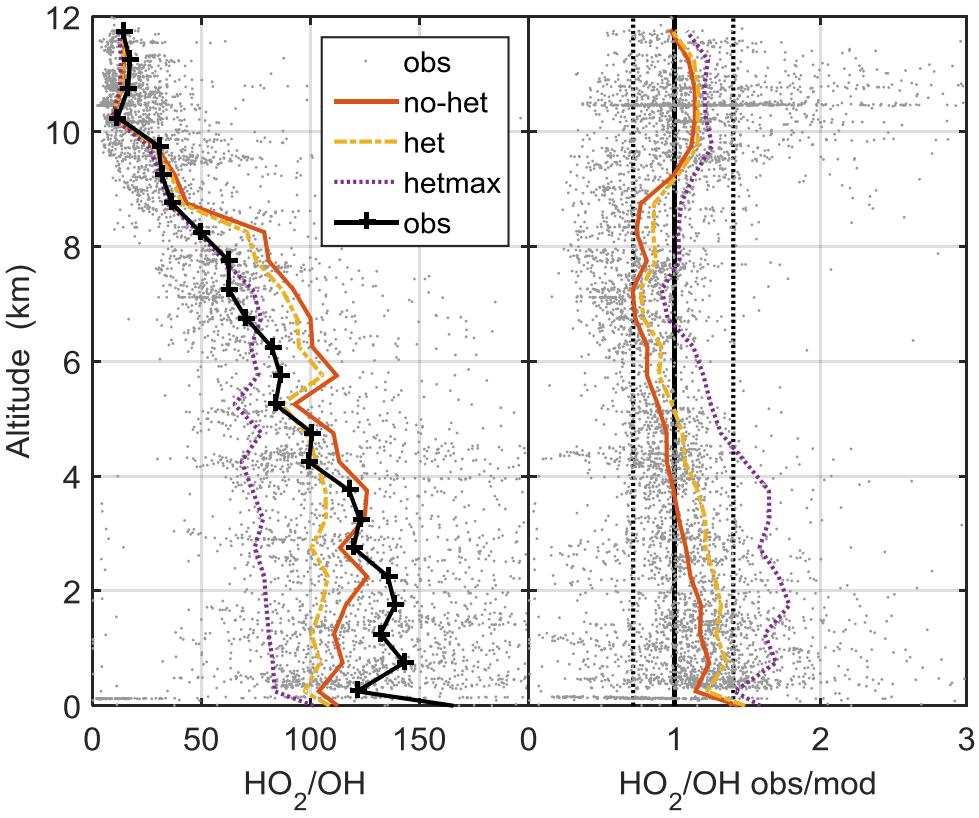

Figure S3. Median observed and modeled HO_2/OH as a function of altitude (left); median ratio of observed-to-modeled HO_2/OH for the three models as a function of altitude. Gray points are individual 1-minute HO_2/OH observations and ratios of observed-to-no-heterogeneous modeled HO_2/OH. Dotted vertical black lines on right are approximate indicators of observation and model agreement.

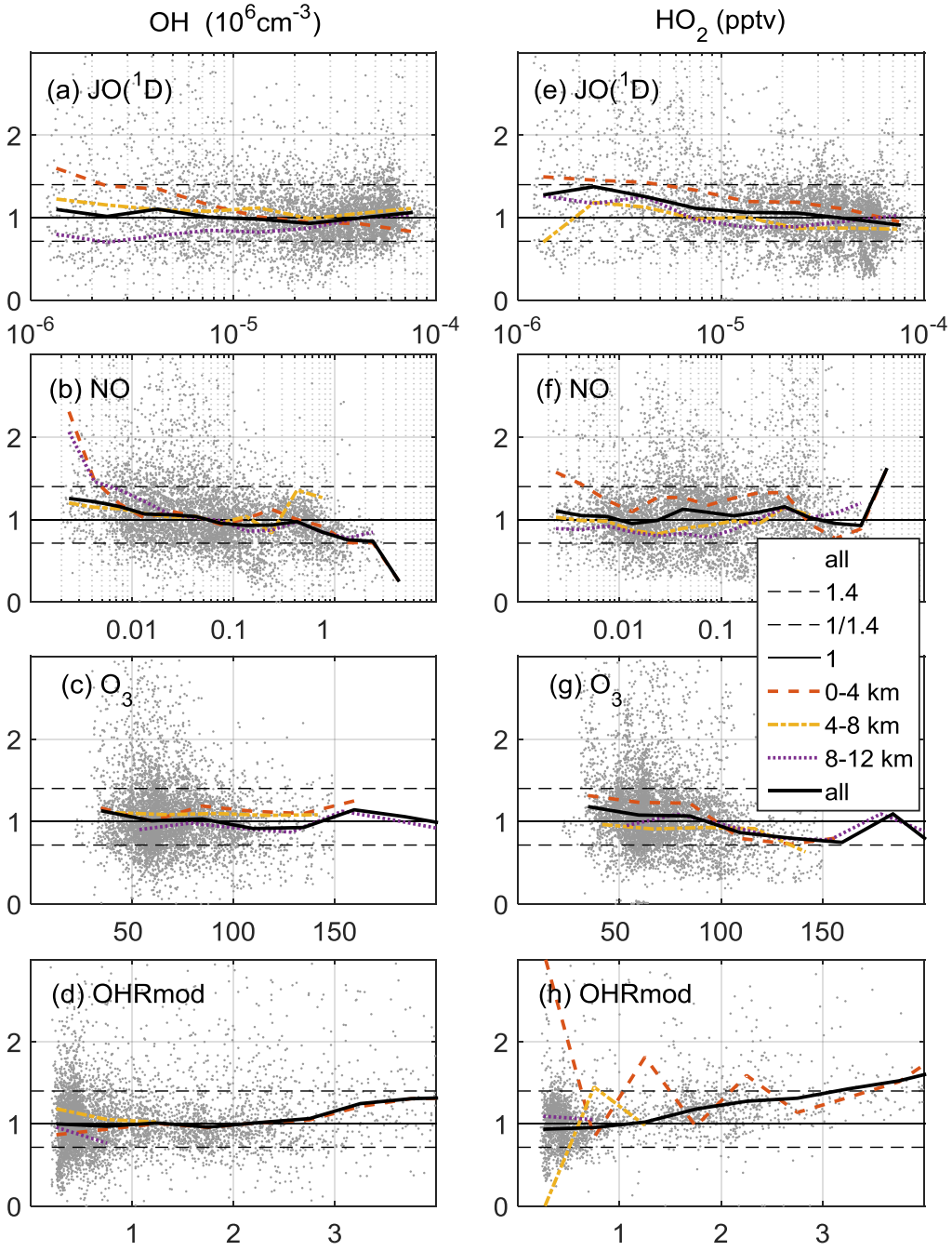

Figure S4. Measured/modeled OH (left) and HO_2 (right) as a function of controlling variables: $JO(^1D)$ in s^{-1}, NO in ppbv, O_3 in ppbv, and modeled OH reactivity in s^{-1}. Ratios are averaged for three different altitude bands and all the data. Dotted horizontal black lines are approximate indicators of observation and model agreement.

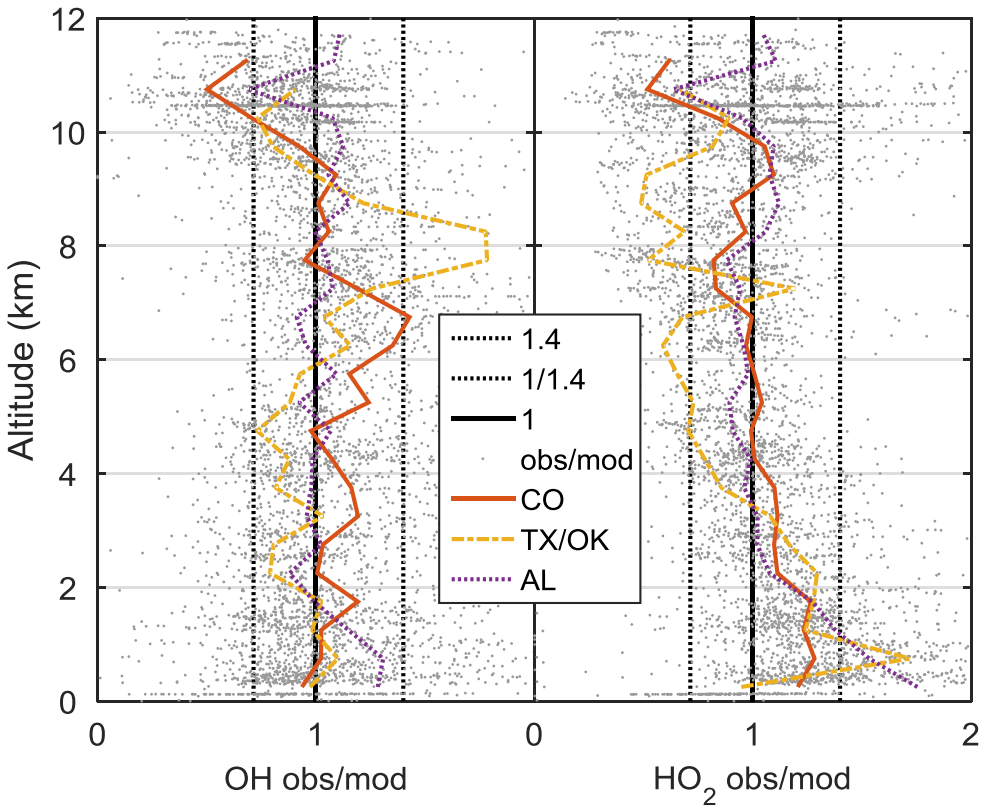

Figure S5. Median observed-to-modeled OH (left) and HO_2 (right) with the no-het model, as a function of altitude for the three regions: Colorado, Texas/Oklahoma, and Alabama. Dotted vertical black lines on right are approximate indicators of observation and model agreement.

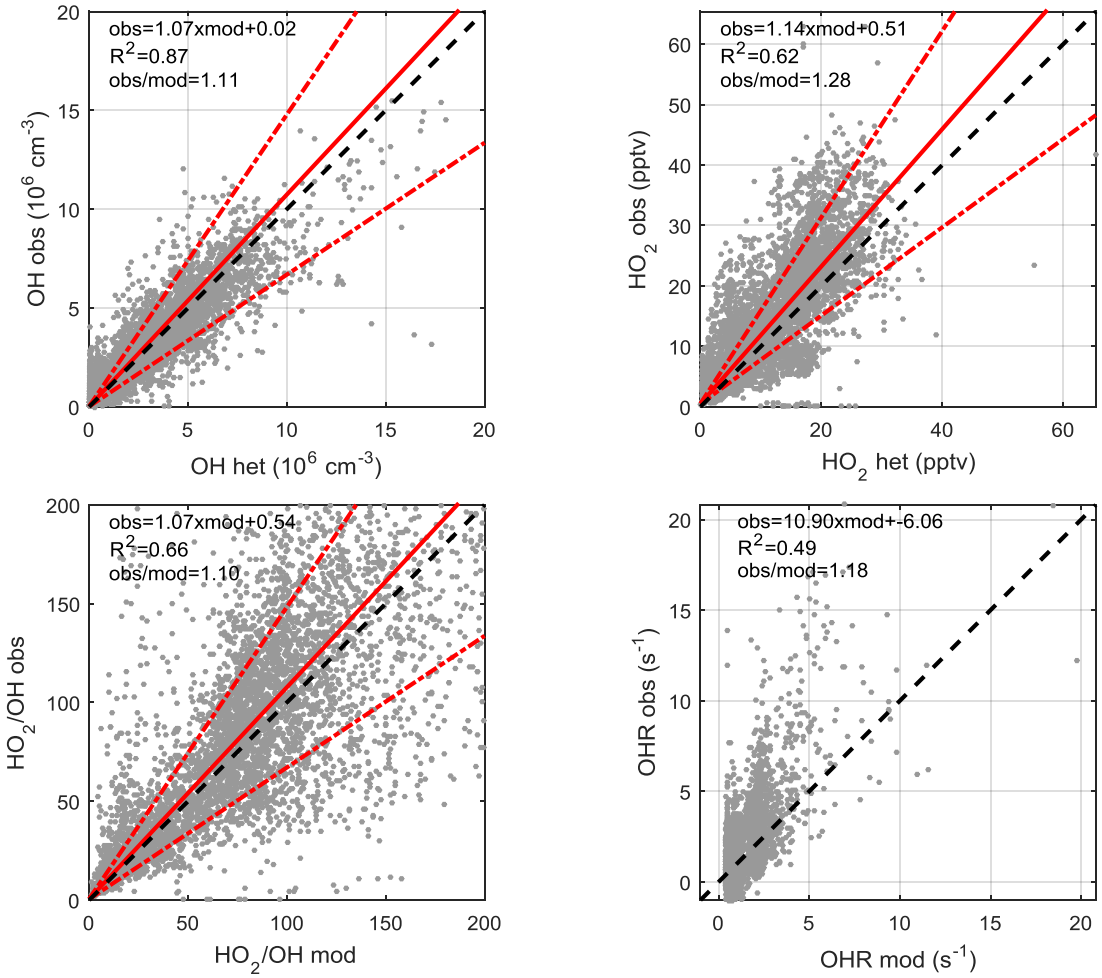

Figure S6. Observations versus the het model. Scatter plots of observed versus modeled OH (upper right), HO_2 (upper left), HO_2/OH (lower left), and OH reactivity (lower right). Gray points are one-minute averages. Dashed red lines are factors of 1/1.4 and 1.4 times the fitted line (solid red).

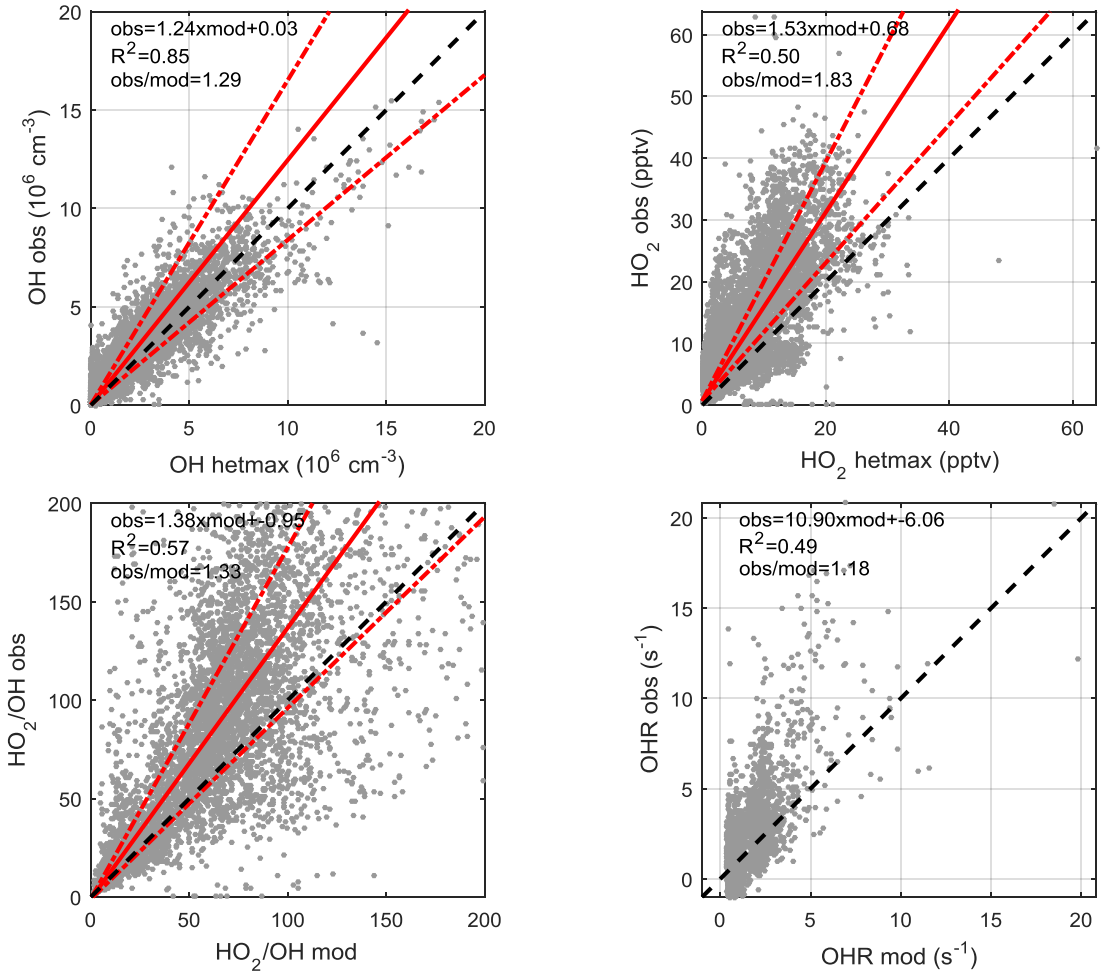

Figure S7. Observations versus the hetmax model. Scatter plots of observed versus modeled OH (upper right), HO_2 (upper left), HO_2/OH (lower left), and OH reactivity (lower right). Gray points are one-minute averages. Dashed red lines are factors of 1/1.4 and 1.4 times the fitted line (solid red).

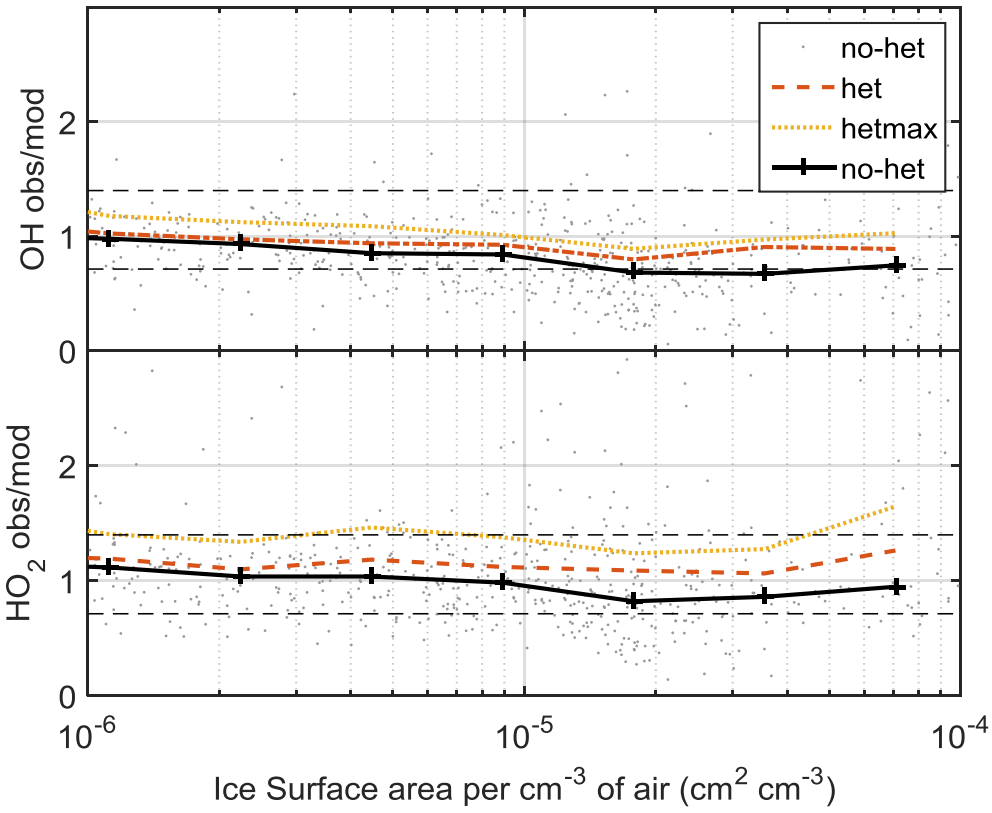

Figure S8. Median observed-to-modeled OH (top) and HO_2 (bottom) versus ice surface area concentration. Dotted horizontal black lines are indicators of observation and model agreement.

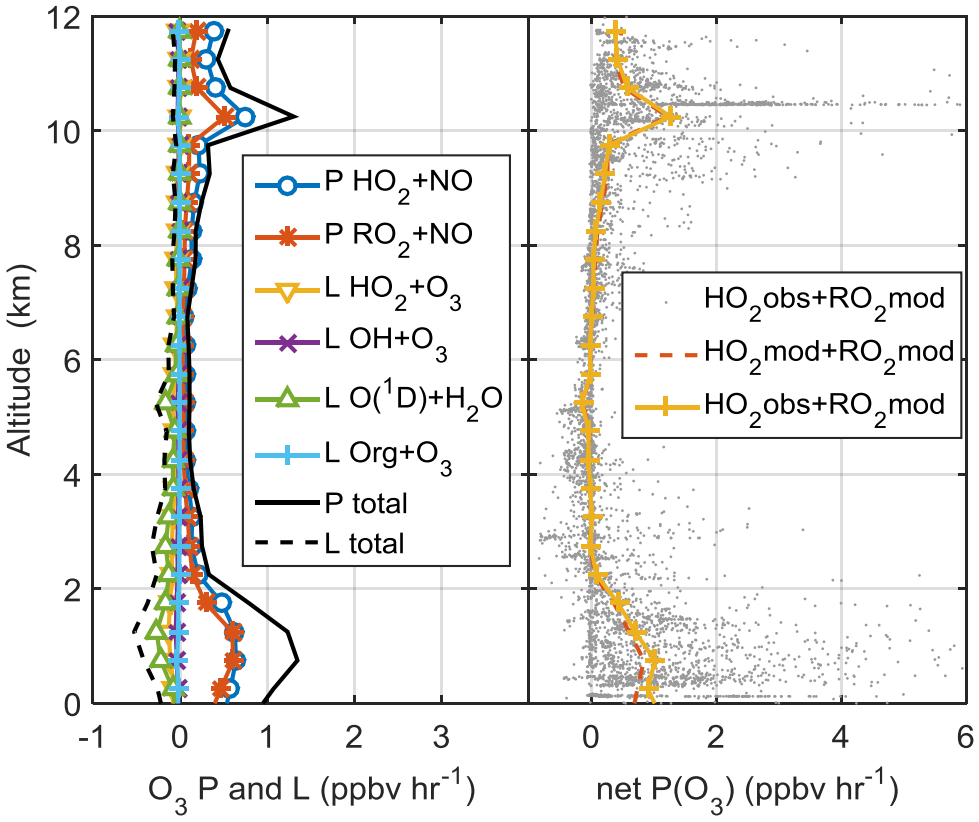

Figure S9. Calculated ozone production ($P(O_3)$). Rates of production (P) and loss (L) are on the left. Individual rates are shown, along with the total. Net $P(O_3)$ is shown on the right.

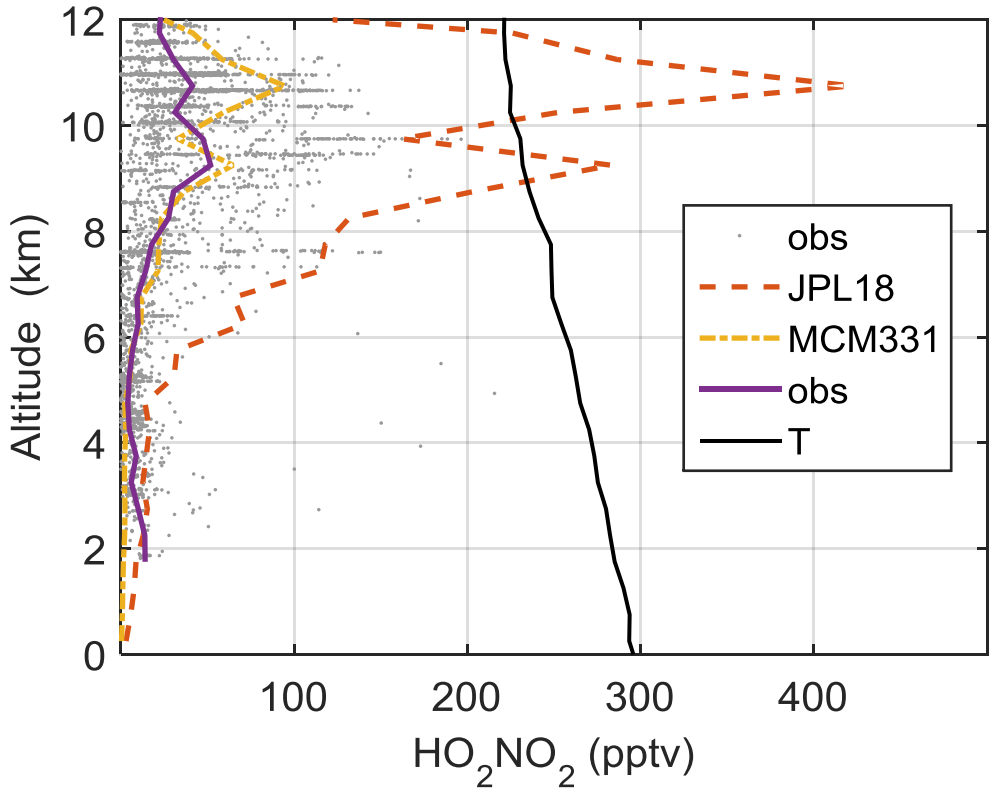

Figure S10. HO_2NO_2 (pptv) and temperature (K) as a function of altitude. MCM331 was run the reaction rate coefficient for HO_2+NO_2+M from JPL18 (Burkholder et al., 2015) and from MCMv3.1.1 (Saunders et al., 2003).

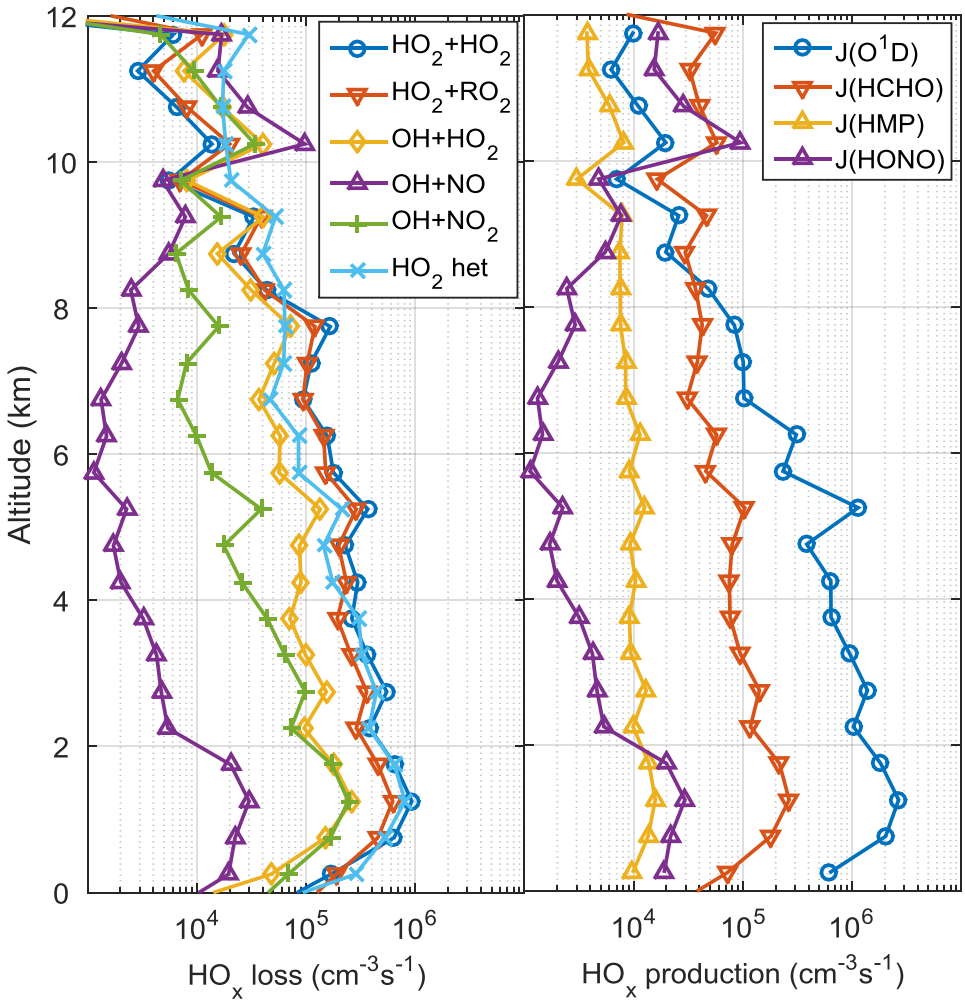

Figure S11. Median modeled HO_x loss (right) and production (left) as a function of altitude. MHP is methyl hydroperoxide. The HO_2 heterogeneous loss was calculated with the het model.

Table S1. Scatter plot statistics for OH and HO_2 with ~10% of total one-minute data (661/6817)

case	molecule	units	slope	intercept	R^2	ratio
no-het	OH	10^6 cm^{-3}	0.93	0..20	0.78	1.03
	HO_2	pptv	1.01	0.50	0.80	1.10
het	OH	10^6 cm^{-3}	1.05	0.21	0.84	1.11
	HO_2	pptv	1.19	0.75	0.74	1.28
hetmax	OH	10^6 cm^{-3}	1.28	0.22	0.81	1.29
	HO_2	pptv	1.68	0.83	0.59	1.83