

Interactive comment on “Combining Bayesian methods and aircraft observations to constrain the HO⁺ + NO₂ reaction rate” by B. H. Henderson et al.

Anonymous Referee #2

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The authors present an interesting effort to constrain uncertainties in rate parameters from comparisons of observations NO₂ and HNO₃ from the INTEX-A campaign with models. Air parcels immediately after convection are identified from observation and subsequent trajectories are modeled for aging and removal. The authors prescreen the set of parameters to identify the 12 reactions that most influence the conversion NO₂ to HNO₃. Uncertainties are refined using Bayesian inference; from this analysis, they can constrain uncertainties in four rates, and most important, predict a small but significant overestimation in the rate constant for HO + NO₂. The work seems well done, and the authors identify the chief potential sources of error. Overall, this is an excellent paper that makes a significant contribution and should be published with minimal changes. A

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couple of remarks (which can be addressed at authors' discretion):

1) Does the analysis shed light on the possibility of a small (1-2%) yield of the HNO₃ channel in the HO₂+NO reaction, observed experimentally Butkovskaya, LeBras and co-workers? My guess is that even a small yield is inconsistent with the current results, unless offset by even larger reduction in the rate of R12. 2) there is a temperature dependence for the minor channel at low pressures, published by Bean et al. (2003), that predicts lower yields of HOONO at lower temperatures, as predicted here.

Most typo/grammar errors seem to have been corrected. Pg 14. Line 3 'was also be'

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