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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Reactive nitrogen partitioning and its relationship to winter ozone events in Utah" *by* R. J. Wild et al.

Anonymous Referee #2

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Summary and General Comments

Wild and coauthors present a multiyear analysis of measurement of speciated NOy to determine the role that NOy partitioning and loss processes has in contributing the elevated ozone mixing ratios observed in mountain valleys in winter. The manuscript primarily highlights the unique set of observations and contrasts the conditions of 2012 and 2014 that displayed varied meteorological conditions and how this translates to difference in (for example) the N2O5 lifetime. The manuscript is a nice addition to the literature and should be published following the authors attention to the following points.

Specific Comments:

Page 21385 Line 9: I am stumbling to interpret the first part of this sentence. Perhaps

split the sentence in two. Based on the prior sentence, I would expect a comparative statement regarding NOy partitioning between 2012, 2013, and 2014 in this sentence. This would be helpful. The second part of the sentence (concerning the role of N2O5 vs NO2+OH for P(HNO3) is critical, however again it would be of interest in the abstract to state how this number changed between years.

Page 21388 Line 5: Consider rephrasing "In this analysis we focus on analysis . . ." Also, shouldn't this be diel, not diurnal?

Page 21390 Reactions: The association reactions (R1, R2, R3, R5) should include M on either side of the equation.

Page 21390 Line 26: How different is the average midday OH between the three years?

Page 21391 Line 5: What does "assume unit efficiency" mean? Please be more specific.

Page 21392 Line 13: Please specify what species are assumed in steady state.

Page 21392 Line 13: Please elaborate on the growth factor calculation or provide a reference.

Page 21393 Line 15: There needs to be a better justification for the use of gamma of 0.02. Is this consistent with the composition and RH measurements?

Page 21393 Line 26: Please clarify "the change in aerosol uptake between the two years is in part due to higher relative humidity" Is this due to a change in gamma or a change in surface area?

Page 21394 Line 8: What does N2O5 hydrolysis in different situations mean? Is this implying a gas-phase hydrolysis? If so, I suggest this be omitted or a citation added that would justify that this occurs.

Page 21394 Line 21: The comparison of the NO3 loss rates and the N2O5 loss rates is for a specifc gamma (0.02), which is not known. It should be clearly stated here that

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this calculation is based on that gamma value, and an assessment of the sensitivity of the NO3 loss rate to the chosen gamma should be included. For example, if gamma was 0.005 (not unreasonable), I would expect that nocturnal nitrogen loss would be dominated by NO3 gas phase reactions. Further, is there any evidence from the VOC measuements of NO3 reactivity at night?

Page 21395 Line 17: Was the gradient in particle surface area also measured?

Page 21397 Line 27: Why is ClNO2 production a small effect on NOx? Is this because the yield was low? I would have thought the yield of ClNO2 would play an important part here due to NOx regeneration.

Figure 7: I am struggling to understand why the N2O5 lifetime increases over the night (as calculated from P(NO3)). Please expand on this point. Is this implying that particle surface area, RH, or particle composition is changing, or is this some sort of bias introduced from the analysis?

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 21383, 2015.