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Interactive comment on “Measurements of N_2O_5, NO_2, and O_3 east of the San Francisco Bay” *by* E. C. Wood et al.

Anonymous Referee #1

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General comments:

This is a brief manuscript describing a limited set of measurements of N2O5 using a prototype instrument based on LIF. In spite of the brevity, there are some important conclusions about nitrogen oxide chemistry at night. The basic approach is the thermal dissociation of N2O5 to NO3, followed by the detection of the latter by LIF. I can find no obvious errors in the experimental approach or in the general analysis of the data. There are clearly issues with the instrument sensitivity to a variety of factors, such as aerosol scattering and long term drifts in laser power, but the authors appear to have done a reasonable job of addressing these. The main scientific conclusion is that the lack of a large N2O5 signal indicates fairly rapid loss of this intermediate over night.

As noted, this is a conclusion that has been reached by other studies in the past. In this case, however, the authors show that for winter conditions in the study region, the loss of NOx by the nocturnal reaction of NO2 with O3 should be nearly an order of magnitude more important than the daytime reaction of NO2 with OH. This is an important result that highlights the seasonal variability of NOx chemistry.

Specific comments:

1. The authors should note that one reason for the dominance of the nighttime pathway is the small calculated OH concentration. In fact, the rate of both day and night loss processes for NOx are considerably smaller under these conditions than in summer. A quick estimate and contrast of the NOx lifetime in summer and winter would be an interesting addition to this discussion.

2. The interpretation of the signal, which is the sum of NO3 and N2O5, exclusively as N2O5 is reasonable under the conditions described. The authors should perhaps note more explicitly that the correction for the NO3 contribution would range from roughly 1 - 10% for the stated range of conditions.

3. The height of the inlet above the ground surface was 1.2 m. Is it possible that deposition to the ground plays a role in the N2O5 loss? If so, the lifetime of N2O5 with respect to hydrolysis on aerosol may not be as short as inferred. Previous modeling studies of Geyer, Stutz and coworkers have showed that there may be significant vertical gradients in NO3 and N2O5, especially within the last few meters above the ground surface.

4. Figure 3: Why is the NO2 concentration only displayed when there is N2O5 present? Is there a more complete time series in NO2, or was the NO2 instrument only running simultaneously with the N2O5 measurement?

Technical comments:

1. Page 8: At low NO and NO3 concentrations, the quantity F(NOSUM) =

2[N2O5]/(2[N2O5] + [NO2]) rather than 2[N2O5]/[NO2].

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 6645, 2004.