Response to Anonymous Referee #2

Below we respond to each of the referee's general comments:

1. Broader referencing of work conducted on the west coast of North America: The referee correctly commented that previous studies on the west coast of North America were not adequately referenced. This will be corrected in a revised MS, with reference to many of the suggested articles (e.g., Berntsen et al., Jaffee et al., Kotchenruther et al., Roberts et al., and Nowak et al.). Further, this will provide suitable context for the discussion of the ozone production rates calculated in this study and for differences in measurements made close to the continent (e.g., Mt. Bachelor, Cheeka Peak, ITCT 2K2) with those conducted over the remote Pacific Ocean (this study).

2. Role of episodic transport: The referee raises an important point. Previous analyses from both aircrcaft platforms and ground stations (e.g., Mt. Bachelor) observe trans-pacific transport in spring to be highly episodic. In a revised manuscript we provide reference to this set of work. For the INTEX-B campaign a transport event was observed between 5-9 May 2006, which was sampled by the DC-8 on several occasions. Our calculation of the NO_y flux through the meridional plane is calculated as an average for all DC-8 flights. As a result we expect this value to be much larger during episodic events. However, due to limited sample coverage we cannot construct the "curtain" with significantly shorter time resolution. Nonetheless a revised manuscript will explore deviations in the calculated flux within specific regions of the sampling region for the 5-9 May event in comparison to the remainder of the campaign

3. Role of increasing NO_x emissions on O_3 production rates: As the referee concludes, the manuscript as written primarily addresses the state of the atmosphere over the North Pacific in 2006. However, calculation of the dependence of the O_3 production rate on NO_x abundances (Fig. 5) provides an opportunity to comment on the sensitivity of the sampled airmasses to future changes in NO_x. This point will be clarified in the abstract, and in the text. As suggested, we will expand the discussion to place it within the context of previous analyses (e.g., Parrish 2004) as suggested by Referee #3).

4. PAN photolysis: We will revise the text to explicitly state the role of PAN photolysis. PAN photolysis is included in the analysis. We will adjust the manuscript with respect to the discussion of Fig. 4 and Fig. 7 as well as the introduction in Section 1 to highlight the importance of photolysis in the UTLS.

Below we respond to each of the referee's specific comments:

1. P.24956, line 20-21: Yes, these are not "oxides of nitrogen". The text will be modified to reflect this change.

2. P. 24957, line 2: The text will be modified to read as follows, "Determining the magnitude and distribution of NO_x oxidation products is critical for understanding the global distribution of NO_x in the troposphere and its subsequent effects on O_3."

3. P. 24957, line 10-23: This sentence was clearly a typo, it has been rewritten: "The concentration of NO_3 and N_2O_5 are essentially zero during daytime due to strong visible light absorption and subsequent dissociation of NO_3 as well as rapid reaction with NO."

4. P. 24958, line 9: The reference will be changed to IUPAC.

5. P. 24958, line 25-30: The paragraph is not misleading, nor is it "known" that NO_y in the free troposphere is PAN and HNO_3. We have included reference to Bertram et al (2006) and Perring et al (2010) that both provide measurements of NO_y in the free troposphere with significant contributions of ΣANs and NO_x to NO_y. Further, the sentences as written provides the caveats for when one might expect FT NO_y to be primarily PAN and HNO_3. We have updated to references in this section to further strengthen the argument.

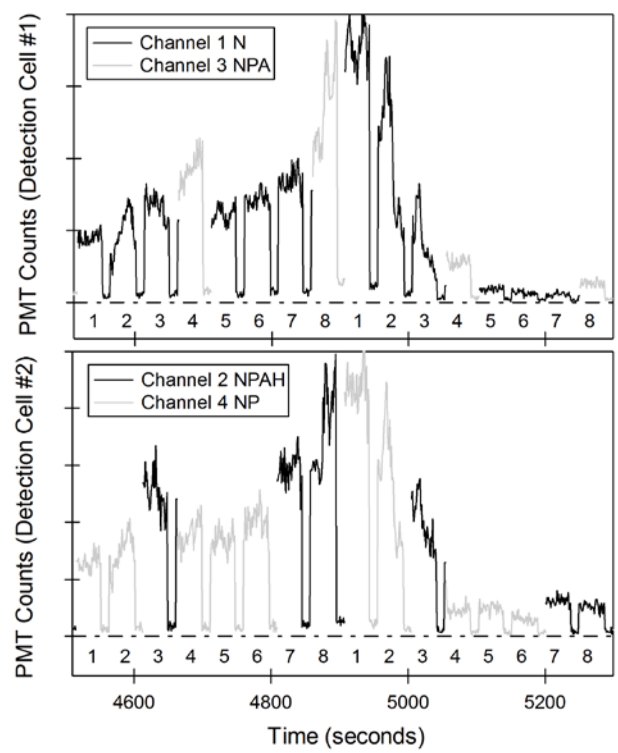
Bertram et al., Science 315, 5813, 2007.

Perring et al., Atmos. Chem. Phys., 10, 7215-7229, 2010.

6. P. 24959, line 2: The reference to Day et al has been moved to the "planetary boundary layer" and a reference to Perring et al (2010) has been added for free tropospheric measurements.

Perring et al., Atmos. Chem. Phys., 10, 7215-7229, 2010.

7. P. 24961: Since the initial writing of this manuscript two important papers have been published that both describe the application of the TD-LIF technique toward aircraft observations as well as provide comparison of the TD-LIF ΣPNs measurement with both GC-ECD and TD-CIMS techniques. Specifically, Wooldridge et al., 2010 report a slope of 0.93 ± 0.06, intercept of 0.042 ± 0.007, and R^2 = 0.77 for the in-flight wingtip-to-wingtip comparison of the TD-LIF ΣPNs and C-130 TD-CIMS PAN and PPN measurements during the INTEX-B in flight comparison of 15 May 2006. Details on all the in-flight DC-8 and C-130 intercomparisons can be found in Kleb et al (2011). Both of these important citations will be included in a revised manuscript. In the revised manuscript, we will expand the instrumental section to provide a brief description of the aircraft TD-LIF instrument at its duty cycle for measurement of NO_2, ΣPNs, ΣANs, and HNO_3. The figure to the left depicts how the two detection cells (NO_2 LIF in both cells) are used to sample four separate inlets and the resulting duty cycle for measurement of NO_2, ΣPNs, ΣANs, and HNO_3.



Wooldridge et al., Atmos. Meas. Tech. 3, 593-607, 2010.

Perring et al., Atmos. Chem. Phys., 10, 7215-7229, 2010.

Kleb et al., Atmos. Meas. Tech., 4, 9-27, 2011.

8. P. 24962, line 13: References have been included for previous observations of NO_y on both the extreme east and west sides of the sampling region (defined in Fig. 1).

9. P. 24962, line 26: The intent of this sentence is not to comment on whether the mid-troposphere (4-10 km) is net PAN production or loss, but rather to state that the lifetime of PAN in this region is long (As shown in Fig. 2). The sentence has been revised to make this clearer.

10. P. 24964, line 14: We will broaden the discussion of the calculation of the ozone production rate to include a discussion of the uncertainties derived from measurements of OH, HO_2 and NO as they most significantly impact the calculations. Assessment of the uncertainty in the measured acetaldehyde concentrations, and the impact of nitrate radical chemistry are more problematic due to limitations in measurements. Nonetheless statements on model limitations have been added.

11. P. 24965: All units have been converted to Tg N.

12. P. 24966, line 7: The referee is correct, the correct reference is Koike et al., 2003. This is discussed in detail in Section 5.6 of Koike et al. In a revised manuscript, we will define clearly how the "export flux fraction" was calculated in Koike and how it compares with our analysis.

13. P. 24966, line 23-24: Agreed. The flux measurements were calculated between 20-55 N (as shown correctly in Fig 6, although incorrectly stated in the MS as 25-55N) and 0-10km in altitude. We have included a citation to Forster et al (2004), that indicates for a 15year average from MAM along the 125 W transect (Fig 2B) that the Asian CO tracer is concentrated between 25-50N and 3-12km. In addition, the revised manuscript will discuss transport features specific to the INTEX-B campaign that have been described previously in the literature. We will include reference to the work of both Walker et al and Zhang et al that have conducted analyses of the trans-pacific transport of O_3, NO_y, and CO for this time period. Specifically, satellite observations of CO from AIRS and TES and O_3 columns from TES were used in combination with kinematic trajectory analyses. In each of these cases, the export of the Asian plume was found to be North of 20 °N at 150 °W.

14. P. 24966, line 27: Biomass burning plumes were sampled on occasion during the INTEX-B campaign. These could be identified by elevated HCN (> 500 pptv) or CH_3CN (>200 pptv). Application of these filters removes approximately 5% of the data during INTEX-B. The exact source of the BB plumes would need to be confirmed via trajectory analyses, which is beyond the scope of this paper. We have removed "Siberian" from the sentence as these plumes could have originated in SE Asia or elsewhere.

15. P. 24967, Section 4.3: PAN photolysis was included in the model calculations. This will be clearly stated in the text.

16. P. 24967, Section 4.4: This section has been deleted.

17. P. 24968, line 18: The sensitivity of $\Delta(O_3)$ to NO_x has been defined in terms of the dependence of $\Delta(O_3)$ on NO_x as determined from the slope of the linear least-squares fit to the data presented in Fig. 5.

18: References: The DOI numbers on both Day et al references will be updated.