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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Airborne observations and modeling of springtime stratosphere-to-troposphere transport over California" *by* E. L. Yates et al.

Anonymous Referee #2

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General comments:

This paper presents two very nice case studies of stratosphere-troposphere-transport above California using airborne in situ measurements and the Realtime Air Quality Monitoring System (RAQMS). The comparisons between the data and the RDF calculations are particularly interesting. The manuscript is well written and requires only minor revisions, primarily in the figures.

Specific Comments

1. The study emphasizes the use of CO2 as a "non-traditional" tracer for stratospheric

air. Since CO, N2O, and HNO3 have much larger gradients between the troposphere and stratosphere, these compounds provide much better tracers of stratospheric air. What is the rationale for using CO2?

2. Much emphasis is placed on the utility of in situ measurements for probing STT events. Perhaps a word or two could be inserted to contrast the relative merits of in situ measurements versus lidar soundings, which at the very least are complementary and in some cases more advantageous. For example, although aircraft can sample other tracers besides ozone at higher resolution and under cloudy conditions, ground-based lidars can provide continuous 2-D measurements of ozone structures under clear sky conditions.

3. The precision for the 2B O3 monitor is stated to be 2 ppbv for a 2-min average, but the data plotted in Figures 5 and 10 are clearly recorded at a much higher sample rate. What is this sample rate and what is the actual precision for these data? The flight speed of the Alpha Jet and the corresponding horizontal averaging time should also be explicitly stated. Do the $\pm$20 ppbv fluctuations in the ozone data near 19.0 UT in Figure 5 reflect ozone variability or measurement precision? Finally, since the 2B is sensitive to water, can the AlphaJet fly into clouds or are the measurements limited to clear sky (i.e. dry) conditions?

4. The discussion of surface impacts on pages 10172-3 is relatively weak and unconvincing compared to the rest of the paper. This section and Figure 12 should either be expanded and supplemented with additional meteorological information and trajectory calculations or deleted from the manuscript.

Technical corrections:

p10160, L: "tropospheric" is misspelled.

p10160, L10: The reference for the 15-35 ppbv background concentrations should be Fiore et al. 2003 (already in the list).

Figure 1: The legends on this figure and most of the others are too small and faint to be easily read.

Figures 2 and 7: The wind vectors and aircraft flight tracks in the upper panels are very hard to see. It would be useful if the location of Oakland were also shown on these maps.

Figures 3 and 8: Since all of the other plots use altitude as the vertical coordinate, it would be better to either change the axes in these figures or add altitude axes on the right hand side. Panel (a) would be much clearer if the potential temperature scale were expanded (270 to 340K) and water was plotted on the top axis as mixing ratios (in a different color) to make comparison with (b) and (c) easier. The green traces on (b) and (c) are hard to see. Maybe these should be changed to red? Despite the caption, the ozone scales appear to be the same.

Figures 4 and 9: The time axes should be plotted in hh:mm since these are the units referred to in the text.

Figures 5 and 10: It would be helpful if the aircraft altitude were plotted on the right axis in a new color. Also, the time axes should be plotted in hh:mm since these are the units referred to in the text.

Figure 6 and 11 (upper) A longitude scale on these plots would be helpful with a vertical line along 135° and 150°E, respectively, to orient the bottom panels.

Figure 12: A third panel with a map of the US showing the locations of these surface sites should be added.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 10157, 2013.