

***Interactive comment on “Impact of transported background ozone inflow on summertime air quality in a California ozone exceedance area” by D. D. Parrish et al.***

**Anonymous Referee #2**

Received and published: 23 August 2010

Review of “Impact of transported background ozone inflow on summertime air quality....”

This is an interesting analysis and there is possibly an important result at its core. However the author's analysis leaves me puzzled at many points. The conceptual model and the analysis approach are strange and, to me, not reasonable. I do not recommend publication in anything resembling its current form, but I believe that a redone analysis could be very valuable. The errors described below on pages 16239 and 16240 are critical and must be corrected prior to publication. Specific comments below.

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Pg 16233, Line 14: Prevailing winds are westerly in the free troposphere, especially during winter and spring. They show much greater variability at the surface.

Pg 16235, line 18: What time are sondes usually launched? This is important for correlation analysis.

16236, line 12: I assume winter is DJF. Please state.

16238, line 25: This is an odd statement. The eureka site is clearly an urban site.

16239: I find this “conceptual model” very strange. I understand “O<sub>3</sub> (background)”, especially the marine background, where surface deposition is relatively minor. But the separation between “local” and “regional” is artificial and not useful. Ozone is not an inert gas that can be divied up this way. The factors are not independent. For example net ozone production (dO<sub>3</sub>/dt) is a function of NO<sub>x</sub> and O<sub>3</sub>, which partly explains its non-linear behavior. The model is not only unrealistic, but also not necessary for their analysis or results.

16240, line 12: I cannot understand why one would take an hourly dataset, throw out 70% of the data and then interpolate between the remaining points to regenerate an hourly dataset. I can see no physical basis for doing this. While it is true that the nighttime data is highly influenced by local deposition and removal, it is a huge assumption to say that the nighttime data can be interpolated between successive 8-hour averages. This very odd interpretation of the hourly data can be completely avoided. The authors only need to examine the correlation of the sonde data with the maximum daily 8-hour average. The sonde data may or may not show a lag. This is the key analysis that the authors must show for their results to be believable.

Line 27: I do not believe the lag times calculated from this massively modified hourly data are believable.

16242, line 0-5: I don't understand why the slope is fixed. Let the data speak for themselves.

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16244, line 3: The sondes are launched weekly, so I do not believe you can get an autocorrelation that is smaller than one week. This section is poorly explained.

16245, line 1-2: This weak correlation is important. It indicates a clear problem with the method of using the interpolated one hour data. It is a big red flag that the surface data and the sonde data in the boundary layer show such a poor correlation.

Line 15: The lag times of 20-30 hours is not consistent with transport. Based on a very rough view of the trajectories, I guess the transport time to be 6-12 hours at most.

16248, lines 0-5: I think the authors have the mechanism wrong. Air subsides around a high pressure center, but only to the top of the boundary layer. At this point getting the air into the BL requires growth in the afternoon boundary layer and entrainment of this free tropospheric air.

16249, lines 17-20: This entrainment fraction is not correct. The problem stems from the fact that "fraction of air" is undefined. All air has come from everywhere if you give it enough time. Without considering daytime photochemical production of ozone, it is impossible to get this "fraction of air" from the correlations alone.

16252, lines 18+: These summary statements are fairly reasonable.

Figure 2: I can not see the sonde data on this figure. Please revise.

Figure 3: I don't get much from the winter data. It would be better to just include summer.

Figures A1 and A2 don't tell us much. They would be more useful if they showed ozone on the highest days.

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Interactive comment on *Atmos. Chem. Phys. Discuss.*, 10, 16231, 2010.

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