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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Tropospheric ozone climatology at two southern subtropical sites, (Reunion Island and Irene, South Africa) from ozone sondes, LIDAR, aircraft and in situ measurements" *by* et al.

Anonymous Referee #2

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In this paper the authors carry out an analysis of ozone profile data, primarily from but not limited to ECC ozonesondes, at sites in South Africa and at Reunion Island. Comparison of data from the multiple sources leads them to identify some inherent limitations in the observations. They also describe results on regional sources of ozone and on temporal trends. The observations and much of the analysis appear sound and in final form the paper should be a worthy contribution. There are several areas where additional refinement of the analysis and presentation are recommended. I omit suggestions on the presentation (e.g. English usage), and arrange my remarks in

parallel with the manuscript.

In the Introduction, at 11066 line 20 it is asserted that the winds aloft at Reunion Island are impacted by the subtropical jet. I question this, based most directly on a look at the results plotted in the venerable (but admittedly dated and somewhat limited) NOAA Professional Paper 14 (Rockville, MD, 1983), by Abraham Oort. (These predate and underlie the core material for Physics of Climate, AIP 1992 by Piexoto and Oort.) Winter season upper level winds near Reunion are weak in Oort’s Fig. A2, in a transition from tropical easterlies to westerly flow at higher latitudes, while there is a maximum in the westerlies above South Africa in the JJA months. The latter corroborates the point made at line 7 on 11067. While the influence of the subtropical jet is not essential to the analysis presented in this paper, available data should be used to clarify this point. One of the Reanalysis data sets could be used. While of very limited duration, the wind profiles from GPS-equipped sondes at Reunion could also be discussed.

The discussion of Regional Sources in Section 2.2.2 on page 11070 seems to me to mix surface and upper air phenomenology indiscriminately, and more care may be needed to keep the distinction clear.

The discussion in the section on Temporal Coverage needs attention; this is Section 3.4, beginning on page 11072. In Figure 3 the mean and standard deviation of the observed ozone profiles are shown. However, the distribution is not normal, and care should be used in using Gaussian statistics. Examples of the probability distribution of ozone in profiles are in Fig. 4 of Thompson et al., 2007. The distributions become “longer tailed” as the altitude increases, and some exhibit multi-modal behavior. (The fact that Thompson et al. present standard deviations in a later figure does not weaken the argument.)

The discussion of the limitations inherent in the DIAL data in Section 4.1, beginning on page 11073, provide a sobering caution against a straightforward interpretation

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of the data. Would it be possible to further document the masking effects using a conditional sampling approach? That is, could averages above mid-tropospheric levels be compiled separately for cases where low, medium or high ozone mixing ratios are observed at the mid-point of each profile? A comprehensive analysis could be based on a quantitative approach using radiative transfer techniques, but this may not be warranted.

The temporal trend analysis is weakened by the use of circulation statistics in the interpretation, with insufficient attention to their applicability to the specific periods when the ozone observations were made. Also, the variability in time of the tropopause height, both in the profile to profile variation and in the possible contribution to the longer-term trend, needs to be addressed more carefully. It would be worthwhile, for example, to transform the upper tropospheric data to tropopuase-relative heights, on a profile by profile basis, and present the trends analyzed in this coordinate space.

Thompson, A. M., J. B. Stone, J. C. Witte, S. K. Miller, S. J. Oltmans, T. L. Kucsera, K. L. Ross, K. E. Pickering, J. T. Merrill, G. Forbes, D. W. Tarasick, E. Joseph, F. J. Schmidlin, W. W. McMillan, J. Warner, E. J. Hintsa and J. E. Johnson, "Intercontinental Chemical Transport Experiment Ozonesonde Network Study (IONS) 2004: 2. Tropospheric ozone budgets and variability over northeastern North America," J. Geophys. Res. 112, D12S13, doi 10.1029/2006JD007670, 2007.

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