

Interactive comment on “Inter-annual variability of surface ozone at coastal (Dumont d’Urville, 2004–2014) and inland (Concordia, 2007–2014) sites in East Antarctica” by M. Legrand et al.

Anonymous Referee #2

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General: This is a reasonably constructed paper largely focused on comparison of ozone measurements over the high plateau versus those in coastal areas over a period of less than a decade. A significant amount of text addressed ozone production versus loss terms in the context of several case studies from balloon profiling. Section 5, describing observations at other sites on the coasts, could be in Supplemental material so that the paper stays focused on high plateau (DC and SP) and provides a comparison with a coastal site (DDU). In a number of cases, it was hard to identify the “bottom line” or how robust the conclusions were. In terms of trends, in the face of decadal variability in the circulation around Antarctica, it would be useful to show some composite synoptic maps (e.g. high and low ozone at DDU) and assess if the

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patterns have changed. In some of the discussion, it was easy to get lost in the details. It would also be nice to have some plots from ERA-I showing synoptic patterns rather than abstract statements of trajectories originating from x, y, or z (I looked at vector wind plots and maps of GPH for some of the examples.)

Specific areas for improvement: P4, L9 and L12: “Adjustment” or “change” are probably better words than “correction.” P6, L7-20: The trajectory length analysis should be supported by a cluster plot showing the actual trajectories (or trajectory origins) overlain on the Antarctic region. This might help identify preferred source areas, if any. For example, do the trajectories follow terrain isopleths to DC or do they originate over the high terrain around Dome A? This could be a supplemental figure. P6, L21-23: This deserves some discussion of the high NO_x fluxes in early December reported by Frey et al and the high surface nitrate at that time vis-à-vis the NO_x-to-O₃ conversion process. It is also unfortunate that the Gallee et al. modeling work for OPALE did not include O₃ calculations. P6, L26+: Table I displays total column ozone with no discussion of its importance. Also there needs to be a few words explaining the red highlighted O₃ values (the highest values in each time period.) P6: Was there any evidence of stratospheric intrusions. Although rare, Crawford et al 2001 showed one case in early December with an increase in ⁷Be while Traversi et al 2014 (Tellus Series B-Chemical and Physical Meteorology) argued for such a signature in nitrate measurements at Concordia.

P7, L10: Fig. 5a only shows length of trajectory not its origin. The claim of origin on the “high plateau” needs to be supported, especially where on the high plateau.

Section 3.1.2: The discussion of cases examining the competing effects of ozone production versus dilution in a growing convective boundary took a bit to follow before a final conclusion that dilution dominated the afternoon drop of ozone. The amount of data does not justify any robust conclusions. This should be emphasized. The authors should also look at the changing meteorology 1-4 January 2010 as a strong ridge developed over DC by 3 January (I looked at ERA-I results). The associated subsidence

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might account for the shallow mixing layer on 3 January compared to 31 December.

P11, L9: "...difference in the dynamic of the lower atmosphere..." is vague.

P13, L4-5: This is confusing: "The time contact of air with sea-ice shown by backward trajectory was twice of 10 hours, twice of 20 hours, and once of 60 hours"

Section 5: This section should discuss the differences in the area of the topographic features that channel air from the interior to the coastal areas. Each of the stations may have distinctly difference source regions associated with local topography.

P12, L12,L20: "downslope" is more general. Low pressure systems on the coast can produce similar downslope conditions. It would be interesting to do a composite synoptic map for high and low ozone conditions at DDU etc.

Section 6. This section is rather speculative and could be tightened up considerably.

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