

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 #3

Received and published: 23 March 2016

General Comments:

This manuscript provides a nice synopsis of multi-year surface ozone records at two Antarctic locations: almost 8 years at the inland Concordia Station, and almost 11 years at the coastal Dumont d’Urville Station. A comparative analysis is presented between these stations, South Pole, Syowa, Neumayer and Halley, and the role of various factors influencing the characteristics of the annual and diurnal cycles of surface ozone, such as topography, meteorology, proximity to the ocean, and oxidant chemistry, is examined. With several relatively minor adjustments, this manuscript will be appropriate for publication in ACP.

C1

The most significant issue I would like to see addressed is analysis presented in section 3.1.1. on the relationship between trajectories and ozone concentrations. This is rather unsatisfying, since it is based on a “pick and choose” approach instead of the analysis of patterns that can be rigorously generalized. It also places more trust in trajectory models than they probably deserve, particularly beyond 4-5 days out. I took the liberty of plotting the data in the first two columns of Table 1 (see attached figure). There is no need for me to expand on this plot, since it says everything that needs to be said. It is of course true that there appear to be some correlations in Fig. 4 if some periods are inspected in isolation, but this method is scientifically not terribly convincing. An analysis along the lines of what was presented in Bottenheim and Chan (2006) may, at least partially, alleviate these concerns. With 8 and 11 years of data, there should be enough material here that this type of analysis would provide further insights.

Specific Comments:

Page 1 Line 24: cycles

P1L26: but not at the South Pole, and a ... This sentence needs to be rephrased. Do you mean “far better mixed layer with higher ozone concentrations”? Also, the 250m needs to be reconciled with numbers in section 4.

P2L5: research; separate the effect

P2L15: remove “that”

P2L22: (Crawford...

P3L18: papers in

P3L32: at DDU

P4L1: were made once a month

P4L21: treat McClure et al like any other reference: just give the authors and date, the rest goes to the end of the paper

P4L28: prior to

P4L31: the upward shift: if the delay time is predictable, then the shift can be corrected.

C2

Was this done to finalize the data?

P4L33: This permitted the documentation of the ...

P5L2: proved

Section 2 should also briefly explain SAOZ (which is used in Table 1 but never spelled out until the Acknowledgements). And it needs to include some details on the trajectory model used. These models are not absolute, and some are better than others. 5 days out, most of them have rather large uncertainties.

I think p.6 can be shortened to one paragraph, and table 1 should be eliminated, because it does not provide convincing evidence of any patterns, even if the patterns the authors strain to see make physical sense.

P7L10: invariant instead of “not modified”.

P7L26: remove “neutral”; convective conditions would conceivably also produce a straight profile

P8L1: no longer

P8L2: generally several hundreds of m deep as seen...

P8L7: radiation

P8L32: Details

P9L6: remove “very”

P9L17: dependent

P8L23: lasted to the

P9L30: remove “over”

P10L19: absence of detectable increase: what about the potential role of meteorology / mixing? Also, I suspect the diurnal cycle of O3 at Concordia isn't always as nice as that shown in Fig. 7.

P11L5: radiation... acts

P11L9: dynamics

C3

P11L27: the “always” seems to contradict the statement in L19 about 25% of profiles not having significant vertical gradients

P13L5: remove the “of”s

P14L20: On the other hand,

P15L7: of diurnal

P15L8: which are

P15L15: On the other hand

The Conclusions should also mention the winter trend. This is interesting as well.

Table 1: should be removed (see comments above). If you really wish to keep it, you need to discuss the SAOZ column somewhere in the text (which is currently not the case), and explain the colour code (red/blue/black numbers).

Table 2: use standard exponential notation

Table 3: give the heights in “agl” please, so they can be related to what's in the text

Fig. 4: identify the interesting episodes discussed in the text with arrows

Fig. 10: a grey arrow is mentioned in the caption, but I can't find it

Fig. 14: give a definition of the error bars in the caption

Reference:

Bottenheim, J. W. and Chan, E.: A trajectory study into the origin of spring time Arctic boundary layer ozone depletion, *J. Geophys. Res.*, 111, D19301, doi:10.1029/2006JD007055, 2006.

Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-95, 2016.

C4

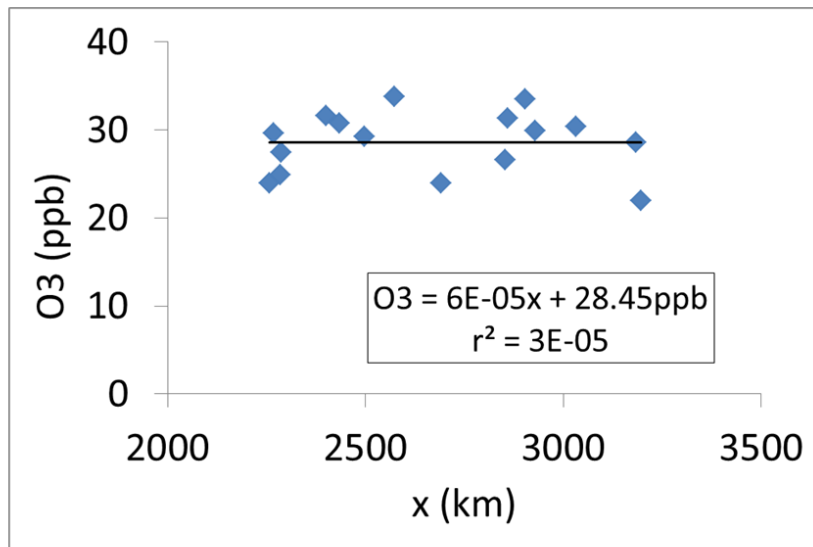


Fig. 1. Concordia ozone - trajectory relationship