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Atmospheric Measurement Techniques Discussions

Interactive comment on "Comparison of ozone profiles from DIAL, MLS, and chemical transport model simulations over Río Gallegos, Argentina during the spring Antarctic vortex breakup, 2009" *by* Takafumi Sugita et al.

Anonymous Referee #1

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General Summary:

This study evaluates the agreement between DIAL profiles, MLS, and CTM in austral spring in Rio Gallegos, Argentina. The material is appropriate for AMT and I have provided some comments below to improve the overall manuscript. Additional references should be added. A location map would improve the understanding of the manuscript in the context of the polar vortex.

Technical Comments:

A site lat/lon map would improve the discussion in the introduction surrounding the location of the site and vicinity to the polar vortex. Including a map with model/satellite overlay during the case studies would also improve the understanding of the horizontal scale of the variability within the latitude bands of interest.

P2L27 -It seems you have already evaluated the DIAL, this is more of an evaluation of the MLS/CTM.

P3L6 -The reference Hubert et al., 2016 is used quite extensively. As DIAL has a very robust heritage, consider referring to additional investigators in locations such as this.

P3L18-24 -This should be more concisely written as it is very qualitative. Backscatter is from the entire atmosphere, including aerosols. Consider adding in further references.

P3L28 -'horizontal spatial resolution' – what altitude are you assuming this wind field at? Later on the manuscript interprets differences due to spatial locations, this seems counter to that.

P3L30 – Total measurement uncertainty – can you describe this more? Does this involve the uncertainty from ozone absorption cross-section, Pulse-pile up, background subtraction? Are you using the retrieved MLS temperature and number density for these comparisons (i.e. ruling out metadata as a source of difference)? Is for a 3 or 5 hour measurement?

If there is large uncertainty in the DIAL measurements below a certain altitude range, consider removing them from the manuscript.

P5L14 – 'In this study step one was not necessary' - then remove this discussion, confusing for reader.

P5L16 – specify great circle lat/lon

P5L30 – Was eq.1 used or not? If so, revisit this section. If not, drop Eq. 1 entirely from manuscript.

Fig 1. – I understand the need for the MLS profiles, but are all of the CTM profiles necessary? They seem to cause more confusion and are not even compared in the difference plot. Also, the CTM profiles are significantly different above 10 hPa, this should be discussed.

P6L5 – add in plots of MLS potential temperature in Fig 1 if that is the case

P6L25 – Consider adding in a sentence for the reader to better understand PV and the relationship to the polar vortex. A map of the vortex using scaled PV would be helpful to understand why/where the boundaries were drawn on certain days.

Does MIROC-CTM provide a PV product? Is MERRA-2 meteorological variables driving the CTM? If not, couldn't differences in the modeled PV be driving large differences? MERRA-2 provides ozone as well – if this is used, why not compare it as well?

There is significant vertical motion occurring during the polar vortex breakup, is it worth looking at more vertical levels than just two to evaluate MLS/CTM? Lidar is powerful at analyzing the entire vertical profile. It would be useful to isolate a series of lidar profiles that demonstrate the variability in the polar vortex sPV regimes. Fig 5 highlights the differences that may be associated with horizontal differences, but there is no mention of how the vertical gradients may affect the overall differences between measurements.

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