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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Unusual stratospheric ozone anomalies observed in 22 years of measurements from Lauder, New Zealand" *by* G. E. Nedoluha et al.

Anonymous Referee #3

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In this study, Nedoluha et al. investigate ozone anomalies in a 22 year record of ground-based microwave measurements at Lauder, New Zealand. The ground-based observations are augmented by satellite observations that provide a global perspective. Long-term ground-based observations are extremely important to provide a reference for the long-term evolution of the middle atmosphere under the influence of ozone recovery and a changing climate. Understanding how dynamical variations affect trace gases, and in particular ozone, is essential for interpreting long-term observations. The present study is a well written case study, analyzing an important data set. While there is some overlap with the earlier study of Nedoluha et al. (2015), the focus of the present

study is sufficiently different and provides enough independent evidence to justify publication as an individual paper. I recommend publication in Atmos. Chem. Phys. after consideration of the following, mostly minor, comments.

General comments:

As presented here, there is some disconnect between the shorter-lived O3 anomaly in June 2001 and the longer-lived anomaly in 2009-2013. E.g., how does the 2009-2013 anomaly behave in terms of tracer equivalent latitude? Can the event in 2001 help to better understand the longer-lived anomaly in 2009-2013?

Can you relate (directly or indirectly) the ozone anomaly at Lauder to the reported reversal in HCl columns at Northern Hemisphere mid-latitudes (Mahieu et al., Nature, 2014)? Maybe even if these anomalies are not related you may want to consider referring to Mahieu et al. in the introduction and/or in discussion of the N2O trends seen in Fig. 9b.

The ozone increase from MOPI1 measurements between ∼2005 and ∼2013 (Fig. 6) are much larger than what is seen in the MLS measurements. Is this because MLS in Fig. 6 is a zonal mean from 40-50S? How does this compare for coincident data, i.e. as in Fig. 5, but with annual averages? In general I would have expected that the lower (vertical) resoluition MOPI data would show smaller anomalies.

Specific comments:

p. 5242, l. 5: Abstract: "We will study" -> "We study"

p. 5242, l. 9: Why 35 yr period and not the 22yrs of measurements discussed here?

p.5242, l.9: better indicate "most equatorward" rather than just "highest"

p. 5242, l.15: "This latitude band": I suggest giving the latitude of Lauder already in line 3.

p.5244, l.17: "Each MOPI instrument. . .": I feel that some introduction is needed here

on the different MOPI instruments. More importantly: Is MOPI1 a single instrument, which has been used continuously throughout the 22yr record? Were there any significant modifications of MOPI1 within this period?

p. 5246, l.3: any ideas why the MOPI1 vertical resolution is coarser than MOPI2 at Mauna Loa? Is this an instrument effect (different signal-to-noise) or due to differences in tropospheric opacity? Not essential here but would be nice to know.

p.5248, l.19: You mean O3 latitudinal gradient in a climatological sense?

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 5241, 2015.