Atmos. Chem. Phys. Discuss., 15, C1534–C1536, 2015
www.atmos-chem-phys-discuss.net/15/C1534/2015/

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

Received and published: 13 April 2015

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

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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

ACPD
15, C1534–C1536, 2015

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.