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Interactive comment on "Observations of large stratospheric ozone variations over Mendoza, Argentina" *by* C. Puliafito et al.

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Puliafito et al. present ground-based millimeter-wave spectrometer measurements of strong stratospheric ozone variations above Mendoza, Argentina, at altitudes of 20-40 km. These data are interesting and illustrate nicely the strong variability of stratospheric ozone on sub-synoptic time scales. However, I can not agree with the authors' conclusion that these variations "are very likely associated to gravity waves". On the one hand, it is difficult to see how gravity waves can induce changes in the ozone mixing ratio by a factor of 4-5 (Fig. 4), and on the other hand, it is possible that quasi-horizontal transport on isentropic surfaces played an important role in producing the ozone variability. These two issues are briefly discussed in the following paragraphs.

If I understand the authors correctly they assume that vertical oscillations associated with vertically propagating gravity waves disturb the climatological ozone profile (Fig. 1) and generate ozone mixing ratio anomalies. The problem with this argumentation is the amplitude of the observed variations (Figs. 3 and 4): at a height of 23.5 km (30.5 km) the values oscillate between 2 and 9 ppmv (3 and 11 ppmv). According to Figs. 1 and 3, this would correspond to vertical displacements of air parcels between about 20 and 35 km (at 20 km the climatological ozone value is about 2 ppmv and at 35 km about 9 ppmv). Such large oscillations due to gravity waves are however rather unlikely. Furthermore, the maximum observed ozone mixing ratios (about 10-12 ppmv) are larger than the climatological peak value (about 8-9 ppmv at 35 km height, see Fig. 1) and therefore can not be explained purely by vertical motion.

The climatological ozone distribution is not only characterized by distinct vertical gradients but also by pronounced horizontal gradients (e.g. Fig. 10.4 in Andrews et al. 1987). For instance near the 10 hPa level the climatological ozone distribution has a maximum of about 10 ppmv near the equator and much smaller values (4-6 ppmv) near the poles. This indicates the possibility that alternative horizontal transport from the tropical region (high ozone episodes) and higher latitudes (low ozone episodes) contributed to (or determined) the observed ozone variability. Such transport processes and their impact on stratospheric ozone variability have been studied in detail by Calisesi et al. (2001), based upon ozone spectrometer data from the northern hemisphere mid-latitudes and diagnostic meteorological analyses using UKMO data. For the period in November 1994 discussed by Puliafito et al., cursory inspection of the potential vorticity (PV) field calculated from UKMO analysis data on the 600 and 850 K isentropes indicates indeed the presence of tongues of low and high PV. Unfortunately, UKMO analyses are only available every 24 hours and therefore a temporally detailed analysis of the air masses above Mendoza is not possible. In due time, higher resolution data from the ECMWF 40-year reanalysis project will be available, and it will be rewarding to analyze the flow structures during this episode of strong ozone oscillations with this new data set.

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Finally, the authors could discuss the possible role of chemical ozone destruction (or horizontal transport of chemically depleted air masses). The impact of chemistry can possibly not be ruled out given the extremely low minimum values of 2 ppmv between 22 and 32 km.

References:

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