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Interactive comment on "The mean meridional circulation and midlatitude ozone buildup" *by* G. Nikulin and A. Karpechko

Anonymous Referee #1

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General comments:

This paper reports on the relationship between the extratropical ozone build up (mainly for mean total ozone in the 50° N–60° N latitude band) and various variables that are associated with the mean residual circulation that governs ozone transport and mixing into high latitudes. As several other studies have shown variations in the mean residual circulation is one of the major driver for inter-annual and also, possibly, decadal variability of ozone. A very popular proxy for the strength of the meridional circulation is the eddy heat flux that describes the wave forcing driving the residual circulation. It is very common to use the 100 hPa eddy heat flux averaged over middle to high latitudes as a proxy for dynamcial contribution to ozone changes. One of the major results from

this study is that other pressure levels for eddy heat flux as well as other quantities such as the residual velocities that a more directly related to the residual circulation show a different and also in several cases an improved correlation pattern with ozone tendency. Another proxy proposed is the temperature tendency. The second major result is the onset of the meridional circulation over the N-Pacific in October. I think that the abstract and the "Summary and Discussion" Section should be soemwhat more focused on these two major results that stand out from this detailed analysis. A continuation of this work could certainly be the construction of an optimized dynamical proxy for investigating ozone variability.

Specific comments:

p. 4224, line 2: "The development of wintertime ozone build up" → remove "development of" and start with "The wintertime ozone buildup over ...".

p. 4225, line 29, It is not clear here what is meant with "calculations" here, I guess the author were thinking of "dynamical models" or "models" that describes this better.

p. 4226, line 19, "examination of a spatial-time structure" → "examination of the space-time structure".

p. 4226, line 24, A link and reference to the TOMS/SBUV merged data set should be given here: http://code916.gsfc.nasa.gov/Data_services/merged/

Frith, S., Stolarski, R., and Barthia, P.: Implications of Version 8 TOMS and SBUV data for longterm trend, in Proceedings of the Quadrennial Ozone Symposium-2004, edited by C. Zerefos, pp. 65–66, Athens, Greece, 2004.

p. 4228, lines 12–13, The authors mention here larger uncertainties in the residual velocities under conditions close to radiative eqilibrium. The authors should clarify and say if these data are still be used or do they have to exclude them. They should avoid the use of "questionable results" and rather talk about "larger uncertainties".

p. 4228, "monthly zonal" → "monthly mean zonal mean".

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p. 4228, line 20, “ozone merge dataset” → “TOMS/SBUV merged ozone dataset”.

p. 4228, line 25, “and than symmetrically(?) decrease” → “and then decrease”.

p. 4230, line 1, “we take into account 1979” → “we include 1979”.

p. 4231, line 5, There were five occurences of vortex break up (or final warmings) in March between 1980–2002. Does that mean that the vortex break-up is most frequently occuring in April. if yes, that information should be given here. What defines a vortex breakup?

p. 4234, line 20, “limit the residual circulation to the region” → “limit our study of the residual circulation to the region”.

p. 4236, line 20 “similiar with” → “similiar to”.

p. 4237, line 3, “at levels presented in both datasets” → “at levels available in both datasets”

p. 4238, lines 22–26, The description of the iterative procedure to arrive at the residual velocities should be moved to the Section that describes the TEM eqations in the calculation of residual velocities (Eqs. 1 and 2) in page 4227.

p. 4241, lines 4–8 (and also at other places). The authors state that the correlation between December ozone tendency (50° N–60° N) and eddy heat flux as well as the vertical residual velocity is somewhat lower than in other winter months. One possible explanation could be that total ozone measured from UV viewing satellites (TOMS, SBUV, and GOME) under high solar zenith angle condition can have larger errors and this may affect ozone tendency for that month. However, this is also true for January.

“maximal” → “maximum” (in several places)

“optimal” → “optimum” (in several places)

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 4223, 2005.