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Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Quasi-stationary planetary waves in late winter Antarctic stratosphere temperature as a possible indicator of spring total ozone" *by* V. O. Kravchenko et al.

**Anonymous Referee #1**

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From many papers we know that the wintertime planetary wave activity is positively correlated with spring polar ozone. In this study a more specific relationship for Antarctica is investigated namely the specific role of the amplitude of QSPW in this context. It is found that the amplitude for mean August in the middle stratosphere is significantly positive correlated with zonal mean total ozone in September, October and November. Two relative maxima of correlation have been identified which differ in latitude and altitude. Further a positive correlation was found with the averaged South Pole temperature of the middle stratosphere and a negative correlation with the area of the ozone hole.

These are interesting results because a proxy or an empirical relationship could be created describing a significant zonal mean total ozone change in spring as a function of the annual amplitude change of QSPW in August. A disadvantage of the manuscript is that the authors did not present a clear physical interpretation of the link they have found and leave the reader with an unclear discussion about possible changes in the seasonal cycle or vertical profile. No answer is given; how do these changes explain the link. In future this link should be examined with model outputs from chemistry climate model experiments. Data are available for all from the CCMVal model groups (see their web page). I recommend this manuscript for publishing in ACP after some major and minor revisions.

Major revision: M1 - Show in addition to figure 2 the variance of the amplitude because the annual variability contributes to the correlation not the climatologically mean, determine the dominant modes of inter-annual variability.

M2 – split the section 4 into two new sections starting with the discussion in 4 and then finally in section 5 present the conclusions with an overall summary.

M3 – focus the discussion on the link you have found, give answers to following questions, Why does such a link exist? Start with the mean residual transport equation like equation 9.4.13 on page 357 in the textbook of Andrews, Holton, McIntyre: Middle atmosphere dynamics, AP 1987, which described the zonal mean total ozone tendency as function of the residual advection including Eulerian flow and wave heat fluxes as well as sources and turbulent wave fluxes plus diffusion. Further take both pathways of wave influences on the mean ozone field into account as well described recently in Albers et al. JAS 2011(http://dx.doi.org/10.1175/JAS-D-11-0126.1) . What is the cause for the temporal shift in the correlation? Take into account the role of vacillation as described by the Holton- Mass model, where for wave-1, they found about 60 days as a typical time scale of oscillation between planetary wave activity and the mean flow? Why is the phase of QSPW unimportant? This needs also a discussion because wave flux depends on phase shift.



ACPD

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Minor revisions:

m1 - p28950l23 — set a comma after e.g., “e.g., Ciasto” m2 - p28953l28 — delete S, “60°-90° S”, and later on p28957 m3 - p28954l29 — delete the big space before “The . . .”

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Interactive comment on Atmos. Chem. Phys. Discuss., 11, 28945, 2011.