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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Dynamical modes associated with the Antarctic ozone hole" *by* B. C. Weare

Anonymous Referee #2

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This paper uses a sophisticated multivariate statistical method, the Generalized Maximum Covariance Analysis, to investigate causes of variability in Antarctic ozone depletion. The main results are that a combination of zonal symmetric and non-symmetric dynamic and chemistry-radiation processes can explain much of the observed variability of the anomalies. This result is conforming to other theoretical studies. The results are in part new and show that the applied methodology is reasonable. There are, however, some remaining issues to be solved before publication in ACP.

A general feeling is that much of the discussion is based on by-eye comparison of patterns and lacks a thorough statistical component. This is the more astonishing as the analysis method used to determine the patterns is quite sophisticated.

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Interactive Discussion
Discussion Paper

P 5061 from L 15 on: I miss a clear indication what is described by GMCA 1 and 2. The trends can barely be seen and their significance should be tested as well as their spectral behaviour (2-3 year period?). Also a test should be provided for coupling of the variability with QBO. Otherwise these statements remain pure speculation.

P 5062: L 9/10: It is not easy to understand why the existence of (even though very weak) trends is used to exclude GMCA higher than 2. The argument is kind of hand waving and should be substantiated.

L18/19: I see positive correlation, i.e. flow away from the pole when ai is positive and this fits to rising motion (negative ).

P 5064 L 25/26: Would say the differences are much bigger in the temperature than in the wind patterns.

P5066 L 3-4: This sentence contradicts itself as it is: Either zonal non-symmetric or symmetric. I think I understand what is meant, but this must be expressed more clearly.

P 5067 L6-9: This sentence is unclear to me. It says that even though the statistically derived potential ozone anomalies should be large, observations show they are small? This is not a direct hint towards the importance of chemistry and radiation. It could be also a weakness of the analysis method.

P5069 L 13-15: In disaccord with this remark the process based analysis shows the strong impact of zonal wave one. The dynamical interpretation should be reworked. So far I understand that it is suggested that first a zonal symmetric ozone anomaly is being produced chemically, leading to radiative cooling which impacts the strength of the vortex and this induces zonal wave one disturbance by interaction with e.g. topography of the Andes. A sequence like this cannot be unambiguously derived from the presented analysis.

Minor points: 5056 L 16 and elsewhere: avoid using 2 e-6 and the like! 5059 and 5060:  used for two different things

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9, S1209–S1211, 2009

Interactive Comment

5063 L9 use zonally asymmetric

5066 L29: there is no increase but a positive difference instead since just two years are compared

5068 L 25 Weddell Sea

5069 L3: non-symmetric instead of anti-symmetric

5070 L12: Peters et al.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 5055, 2009.