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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The stratospheric response to external factors based on MERRA data using linear multivariate linear regression analysis" *by* M. Kozubek et al.

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I found this paper very interesting, but there are several other papers that should be discussed in the context of the ENSO/EMI results. Here is a list of some of the more salient ones. These studies tended to focus on one particular season (or analyze the response in several calendar month) as opposed to the annual average, and I strongly recommend that the authors perform their analysis for these seasons only and compare the results. In particular, the third one on the list below demonstrates that there is significant sensitivity to the precise parameters used to define the EMI, such that a slightly different EMI definition could lead one to a completely opposite conclusion as

to the stratospheric response.

Hurwitz, M.M., P.A. Newman, L.D. Oman, and A.M. Molod: Response of the Antarctic stratosphere to two types of El Niño events. J. Atm. Sci., 68, 812-822, doi:10.1175/2011JAS3606.1, 2011.

Zubiaurre I., Calvo N.: The ENSO Modoki signal in the stratosphere. Journal of Geophysical Research, 117, D06109, doi:10.1029/2011JD016690, 2011.

Garfinkel, C. I., M. M. Hurwitz, D. W. Waugh, A.H. Butler: Are the Teleconnections of Central Pacific and Eastern Pacific El Nino Distinct in Boreal Wintertime?, Climate Dynamics, doi:10.1007/s00382-012-1570-2, 2012.

Answer: We have computed the results for boreal winter only, but just insignificant differences between annual and boreal winter results were found. That is why we prefer to show annual mean results. We have added some detail about ENSO Modoki in the text.

Finally, the authors should note the limitations of a linear analysis. Several papers note that the stratospheric response to ENSO and the QBO, to ENSO and the Solar cycle, and to the QBO and the solar cycle, are fundamentally nonlinear. These subtleties will be lost given the authors' methodology. While there is still value in performing and publishing such a linear analysis, care must be taken when interpreting the results. For example, please see

Garfinkel, C.I., and D.L. Hartmann (2007), Effects of the El-Nino Southern Oscillation and the Quasi-Biennial Oscillation on polar temperatures in the stratosphere, J. Geophys. Res. Atmos., 112, D19112, doi:10.1029/2007JD008481.

Calvo N., Marsh D.R. (2011): The combined effects of ENSO and the 11 year solar cycle on the Northern Hemisphere polar stratosphere. Journal of Geophysical Research, 116, D23112, doi:10.1029/2010JD015226.

Camp, Charles D., and Ka-Kit Tung. "The influence of the solar cycle and QBO on

ACPD

14, C12179–C12181, 2015

the late-winter stratospheric polar vortex." Journal of the atmospheric sciences, 64, 4 (2007): 1267-1283.

Answer: We have added some discussion of the linear model limitations. Kuchar et al., 2014 claimed that two applied nonlinear approaches provide the results almost identical to linear.

Kuchar, A., Sacha, P., Miksovsky, J., and Pisoft, P.: Solar cycle in current reanalyses: (non)linear attribution study, Atmos. Chem. Phys. Discuss., 14, 30879-30912, doi:10.5194/acpd-14-30879-2014, 2014

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 23891, 2014.