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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Influence of a Carrington-like event on the atmospheric chemistry, temperature and dynamics" *by* M. Calisto et al.

Anonymous Referee #1

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This is an interesting study on the chemical implications of a substantial solar proton event comparable to the 1859 Carrington event. The study exercises a climate chemistry model of the latest generation and is thus capable of addressing the complex interactions among chemistry, dynamics and heating.

It may help the authors to put this study in context by looking also at the JASON report (available at http://en.wikipedia.org/wiki/JASON_(advisory_group)) which offers also a historical perspective on many observations.

Specific comments and suggestions:

1. It is not clear how the ensemble simulations where generated: did the authors

perturb the initial conditions or the forcing? 2. The current simulations apply to equinox. Have the authors considered studying a similar event during boreal winter? Wouldn't one suspect that the residence of NOx in the polar vortex be much longer during boreal winter, extending to springtime? 3. The discussion of the Figures 2-6 does not explain what the "change" is, that is, compared to what? Also, the statistical significance at 95% needs to include a mention of what statistics has been used (I assume a t-test), as well as how many degrees of freedom were assumed. I strongly suggest that the figures be redrafted using the same range in each axis, otherwise it is difficult to make simple visual inferences. 4. The differences shown are zonal mean differences, which are interesting and important in their own, but do not include zonally asymmetric changes that instead average out in the zonal mean. It would be useful to know how important those are, like showing a simple difference of the zonal standard deviations. 5. Figure 8 is interesting but I suggest showing in addition also the difference of sea level pressure, which is a more direct measure of the change of the AO.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 14747, 2012.