

## ***Interactive comment on “Role of external factors in the evolution of the ozone layer and stratospheric circulation in 21st century” by V. Zubov et al.***

**Anonymous Referee #1**

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The authors present in their manuscript the influence of greenhouse gases, ozone depleting substances and sea surface temperatures/sea ice on the evolution of mostly stratospheric ozone, and some circulation indices in the 21st century. The manuscript is in most parts clearly written and well structured, making the study clear and understandable. The role greenhouse gases and ozone depleting substances play in the evolution of the ozone layer in the 21st century has been studied before. The interesting addition to that in this manuscript is the estimation of the importance of sea surface temperatures in comparison with the other two factors, and the fact that there is no commonly used sea surface temperature data set for chemistry-climate models which introduces uncertainty in the ozone predictions. I recommend this manuscript

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for publication after a few comments and suggestions have been addressed. These are outlined below.

General remarks:

- The description of the numerical experiments was not very clear to me. That section might be easier to understand if the description of the runs were structured somehow differently (maybe start with the fact that five times 2-year runs were done, with a 10 year spin-up)
- One main concern for me is the fact that although five ensembles have been calculated for each experiment, only two years were calculated per ensemble. This seems not enough to capture the full range of inter-annual variability. As far as I recall, in the climate modeling community, time slice experiments are calculated for tens of years to be able to obtain statistically sound results. What was the reasoning behind the chosen two years? And how big are the differences between the two years in each experiment? How big are the differences between the different ensembles of the same experiment? I would like to see some information about this somewhere in the description of the experiment set-up.
- It was very confusing for me to read about sea ice distribution and their impacts on tropical upwelling. I assume the SST/SI prescription is included in one set of boundary conditions, and therefore the explanation of the upwelling changes just includes the SI distribution. However, the changes in the ozone, zonal wind and temperature in the tropical lower stratosphere are, most likely, driven by SST rather than SI in the Arctic/Antarctic region. Maybe the authors could comment on that somewhere in the manuscript.
- Although contour lines are given in the figures, the figures would be easier to understand if either a color bar was also given, or a short comment about the reddish colors being positive etc. in the figure caption.

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- Although the manuscript is written in a clear and understandable way, some small grammar and stylistic problems remain in the text. I would recommend the have a native speaker go over the manuscript.

Specific comments:

- p. 28476, line 7-8: it is not totally clear that the cool ice covered surfaces in the Antarctic are actually the GHG molecules' surfaces. Please rephrase.

- p. 28476, line 8-9: The sentence "Below 20 hPa..." refers to the tropics, I assume. This is not clear from the sentence. Please rephrase.

- p. 28476, line 16: "the drop of ODS..." implies a sudden change in ODS where it is actually gradual. Please rephrase.

- p. 28476, line 28: sentence seems to be only fractional ("... upper flanks in vertical direction, and.")

- p. 28486: Please specify in the table heading why some numbers are in bold.

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Interactive comment on Atmos. Chem. Phys. Discuss., 12, 28467, 2012.

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