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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Inclusion of mountain wave-induced cooling for the formation of PSCs over the Antarctic Peninsula in a chemistry–climate model" *by* A. Orr et al.

Anonymous Referee #2

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1 General comments

From the abstract, the introduction and the model description the paper promises to resolve a longstanding problem in chemistry climate models, most results are however presented just for one gridbox and for an example at an altitude and time that is not relevant for the ozone hole. In Figure 5 are more interesting cases which were not addressed.

What happens at other gridboxes shown in Figure 11 in the light of the problems shown in Figure 6 (and page 18290, lines 25ff)? Can the approach be generalized also for the

Arctic? Is the mountain wave parameterization used only for temperature or also winds and advection of chemical species? Here a lot of clarifications are necessary. To be acceptable major revision is needed.

2 Specific comments

Page 18278, line 24: This important finding is misleading here since it is confined to a special case not relevant for polar chemistry (see section 5).

Page 18279, line 15: It would be interesting to see results on this.

Page 18283, line 24: On the Peninsula or global?

Page 18285, line 7: Are these parameters specific for the Antarctic Peninsula or are they used for other mountain ranges too in the climate model?

Page 18286, line 18: Forecast from which model? A weather forecast model as on page 18283 (line 5) or the nudged climate model? Please clarify here, not one page later.

Page 18287, line 4ff: This paragraph should go at least partially to section 3, here it interrupts the flow.

Page 18288, line 12: Where? Peninsula only?

Page 18290, line 18: More quantitative information would be good here.

Page 18291, line 5f: In N96 the smoothing should not be so severe. Can the N96 results be shown too? Line 20: I don't believe that.

Page 18291, line 27ff: The selected time and altitude is not interesting for the ozone hole formation even if there are some effects on PSCs. Is it selected because of AIRS (Figure 1)? It is also odd that in Figures 5 and 6 there is a warming at this altitude due

to the parameterization. An analysis in August and September at 18km would be much more relevant for the ozone hole formation. It is odd that the PSCs increase upstream of the mountain range (Figs 9 and 11).

Page 18293, line 11: In the example most of the Peninsula is still in polar night so ozone loss and radiative heating effects should be marginal (please check and quantify). Line 22: Why is there no effect in August to October? Here (re-)formation of PSCs at the Peninsula would be important. More details please.

Page 18295, line 28ff: The beginning of this paragraph would better fit into the introduction. The end needs clarifications, e.g. where exactly the parameterization is applied in the chemistry-climate model.

Page 18305, figure caption: What is wind magnitude? The figure is difficult to read.

3 Technical corrections

Page 18288, line 25: Bad wording, do you mean sea ice fraction, thickness or what?

Page 18290, line 11: typo

Page 18294, line 29: There is a word missing or too much in the sentence.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 18277, 2014.