Editor comments on Manuscript. No: ACP-2018-310

Thölix et al., Linking uncertainty on simulated Arctic ozone loss to uncertainties in modelled tropical stratospheric water vapour

P1, L2: Since you are referring here to simulations I would suggest to write either at the begin of the sentence “The simulated amount of water vapour” or at the end of the sentence “between simulations from chemistry-climate models.

P1, L6: Similar here. Since you refer to model simulations “amount” should be replaced by “simulated amount”.

P1, L14: add “stratospheric winter” so that it reads “in cold stratospheric winters”

P1, L14: add “winter” after 2013/14.

P1, L15: add “formation of”, so that it reads “due to the additional formation of polar stratospheric clouds”.

P1, L16: be more precise, thus change “such as 2010/11” to “such as the 2010/11 winter”.

P1, L17: Be more precise, thus change with observed water vapour to without changing the prescribed water vapour amount

P1, L18: it should read either “an area” or “areas”.

P1, L18: could not → did not.

P1, L22: Rephrase “of ozone layer recovery” either to ”ozone recovery” or “of the recovery of the ozone layer”.

P2, L5-6: This sentence is not clear. Do you mean that there will be an additional warming of the troposphere due to higher water vapour? Does this not rather come from a future cooling of the stratosphere? Please clarify and rephrase the sentence.

P2, L8: Add comma after “However”.

P2, L12: The references of Solomon et al., 1999 and Khosrawi et al. (2016) are not adequate in this context. I would suggest to cite here the paper by Hamill et al. (1997) or Peter (1997). If you prefer a newer reference you alternatively could cite the book chapter of Peter and Grooss (2012).

P2, L15: add “that are rarely reached in the Arctic” after (below about 195 K) and add “there” after place and remove “in the Arctic” at the end of the sentence, so that it reads: “Since the formation of PSCs requires very low temperatures (below about 195 K) that are rarely reached in the Arctic, significant polar ozone depletion takes place there only occasionally.”

P2, L24-25: Change sentence as follows: “Kuttipurath and Nair (1997) showed based on ozone balloon soundings and total ozone data from satellite instruments that ozone has begun to recover.

P2, L25: remove “profile”, so that it just reads “data”.

P2, L26: showed → could show

P3, L14: “of the increase due to the increases”? Is here one of the “increases” obsolete?

P3, L20: Also Revell et al. (2016) → Revell et al. (2016) also

P3, L26: smallest → smallest was

P3, L28: skip “atmospheric”.

P3, L33: early → in early

P4, L8-9: Rephrase sentence as follows: “One may wonder what the implications of these discrepancies for stratospheric ozoone losses simulated by CCMs are.”

P4, L9: Do you refer here to simulated transport or the real transport? Please be more precise and rephrase sentence accordingly.

P4, L18: “as the” appears twice, thus one is obsolete.

P4, L32: remove “chemistry” and add “are used” or “applied” after Atkinson et al. (2007b).

P5, L3: What exactly is meant with composition? The amount of H2SO4, H2O or HNO3 in the droplets or do you mean the kind of PSC/strat aerosol particles as binary, STS etc?

P5, L24: Reference of Thölix et al. should be given here in parantheses.

P6, L2: The reference of Gettelmann et al. 2010 should be given without parantheses.

P6, L5: considered spinup → considered as spin-up.

P6, L6: add “amount” or “concentration” after “water vapour”.

P6, L19: minimum of what? Be more precise.

P6, L21: occur → occurs

P6, L26: What do you mean with lead? Is ahead, thus happening earlier? IN that case I would replace “leads” by “is ahead”.

P7, L5: correspond → corresponds

P7, L7: sufficient for → sufficient for the

P7, L7: though → throughout

P7, L13: inside → inside the

P7; L13: close to → close to the

P7, L20: due to → due to an

P7, L23: Change sentence as follows: Typically, there is a stronger increase in water vapour towards spring in the MLS observations compared to the FinRose simulations.

P7, L32: as seen → as can be seen

P8; L7: corresponded to formation → corresponds to the formation

P8; L16: Corresponding to how much HNO3 in weight percent would that be?

P9, L2: PSC → ICE PSC ? I guess you mean here specifically ice PSCs or am I wrong?

P9, L3: Add “being present” so that it reads: “Also the duration of the ICE clouds being present is comparable”.

P9, L4: add “the EMAC” so that it reads “with the EMAC model”

P9, L4: are → were

P9, L4. Change “than the observed ones” to “the ones observed with MIPAS.”

Note: In Khosrawi et al., the comparison was performed for the total PSC volume. Thus, this does not mean that ice is not correctly simulated with the EMAC model. The STS PSCs have the largest volume and our conclusion was that STS is significantly underestimated, but the other PSCs may be correct or (in case of NAT) be rather overestimated.

P9, L7: as very cold → as being very cold

P9, L8: Through → throughout

P9, L12: had → has

P9, L13: in Max → in the Max

P9, L17: PSC starts → PSCs start

P9, L28: in Interim simulation → in the Interim simulations

P9, L28: add “the” so that it reads “between the Max and…….”

P9, L29: add also here simulation, so that it reads Interim simulations

P9, L31: add “the” before 2012/13 and change were to was

P9, L32: as the decrease → decrease of what. Please clarify and rephrase accordingly.

P9, L25: add “the”, so that it reads “the Min and Interim simulations”

P10, L2: persist → persisted

P10, L3: add “winter” after 2015/16

P10, L3: area → areas

P10, L6: remove “altitude”, so that it reads “at 55 hPa”.

P10, L18: comma obsolete

P10, L20: goes back → is transformed back

P10, L29: reservoir → reservoir species

P10, L33: to → to the

P11, Table 2 caption: change → changes

P11, L1: remove “it”

P11, L3: add “the” before “chlorine activation”

P11, L4: warmed → temperature increased

P12, L3: “warmed up” should be rephrased

P12, L6: add “the” so that it reads “the Arctic winter”.

P12, L8: an STS → and STS

P12, L12: what exactly to you mean with effective processing on PSCs? Please clarify and rephrase accordingly.

P12, L21: only few percent → only a few percent

P12, L27: replace “has” by “ provides” or “contains”

P12, L29: remove “the” before smallest.

P12, L34: increase of what? ClOx?

P13, L1: change of what? Of ClOx?

P13, L9: add distribution so that it reads “ozone distribution”. It would also be worth to add “on that day” to be more precise.

P13, L16-17: delete “value” at the end of the sentence and add “value given by” before Sinnhuber et al. (2011).

P13, L20: “mid April” or “by the mid of April”.

P13, L29: replace “warmed early” by “ was ended early by a SSW”.

P13, L32: was about same → was about the same

P13, L32: add “the” before 2010/11

P13, L34: change sentence to “with a water vapour increase of about the same magnitude as considered here”.

P14, L5: is → are and change sentence as follows: The changes in the amount of water vapour are in the range that was testes here and are not very important for ozone loss in cold years."

P14, L7: change sentence as follows: "and thus did not increase the ozone depletion."

P14, L8: Strengthen → strengthens

P14, L8: at least → at least by

P14, L8: at → for

P14, L8: for 2011 → for the 2011 winter

P14, L8: is → was

P14, Table 3 caption: seperately → separately by

P14, L15: rephrase to "….ozone depletion was reduced by 6 DU."

P14, L18: separately → separately by

P14, L19: in Interim → in the Interim

P15, L2: rephrase "depletion of 56DU."

P15, L14: So → Thus

P15, L15: …..role than in colder years? What do you mean exactly? Have larger role in warmer years than in colder years? Please rephrase.

P15, L17: "part"? Do you mean contribution?

P15, L21: through → due to

P15, L25: is → was

P15, L25: "part"? Do you mean contribution?

P15, L27: eater → water

P15, L31: is → was

P15, L31: occur → occurred

P15, L31: to → into

P16, L6: clear → pronounced

P16, L10 and 11: is → was

P16, L13: the same as we found → the same as what we found

P16, L15: What exactly do you mean here with warmer climate? An increase in temperatures? This sentence is not clear and thus should be rephrased.

P16, L17: change to “enhance each other, so that the area of PSCs increases and that these can last longer in the vortex.”

P16, L23: Results → “The results” or “Our results”

P16, L23: in both occasions “a” should be added, so that it reads “a wetter/drier”

P16, L24: along → when

P17, L1-35: Here in case of a specific winter it should be written “the Arctic winter”. When you refer to the stratosphere in general it should be explicitly written “polar stratosphere”.

P17, L23: arrived to → came to a

P17, L1: Change sentence as follows: “Also in the Arctic winter 2010/11 chlorine activation in the vortex was nearly……..

P17, L1: what do you mean exactly with “complete”? This should be rephrased.

P17, L4: change to “the impact of water vapour on ozone loss”.

P27, Figure 4 caption: ares → areas

Figures: Why are there different pressure levels used which are almost the same (55 and 54 hPa)?

Text: Why are mixing ratios given in ppm? Shouldn’t it be ppmv?

References:

Hamill, P., E.J. Jensen, P. B. Russell and J. J. Bauman, The life cycle of stratospheric aerosols, Bulletin of the American Meteorological Society, 78, 1395-1410, 1997.

Peter, T., Microphysics and heterogeneous chemistry of polar stratospheric clouds, Annu. Rev. Phys. Chem., 48, 785–822, 1997.

Peter, T. and Grooss, J.-U., Chapter 4: Polar stratospheric clouds and sulfate aerosol particles: Microphysics, denitrification and heterogeneous chemistry, in: Stratospheric Ozone Depletion and Climate Change, edited by: Müller, R., RSC Publishing, Cambridge, 108–144, 2012.