Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2017-1190-RC1, 2018

Atmospheric Chemistry and Physics Discussions

Open Access

ACPD

Interactive comment

Interactive comment on "Comparison of ECHAM5/MESSy Atmospheric Chemistry (EMAC) Simulations of the Arctic winter 2009/2010 and 2010/2011 with Envisat/MIPAS and Aura/MLS Observations" *by* Farahnaz Khosrawi et al.

Anonymous Referee #1

Received and published: 13 February 2018

General Comments

In this new study, Khosrawi et al. evaluate simulation results of the chemistry-climate model EMAC for the Arctic winters in 2009/2010 and 2010/2011. Simulation results for temperature, HNO_3, and PSC volume density are compared with Envisat/MIPAS and Aura/MLS satellite observations.

Overall, the study fits in the scope of ACP and the manuscript is well written. However, I have a number of general and specific comments, which I recommend to be addressed

Printer-friendly version

Discussion paper

before the paper will be published.

1) In this paper you are not showing any evaluation results for stratospheric polar ozone. The fact that ozone data are available from the satellites for direct validation, but ozone simulation results are not discussed at all makes me wonder whether the simulated ozone distributions are far off reality (because the simulated PSC concentrations are too low by a factor of about 5 to 10)?

2) MIPAS also provides measurements of long-lived tracers such as N2O, CH4, and CFCs. Comparing simulation results for these tracers with the satellite observations may help to assess the proper representation of transport and mixing in EMAC.

3) The study finds good agreement between temperature distributions from EMAC and the satellite observations. However, the EMAC simulations have been nudged to ERA-Interim. From the paper I could not infer whether the nudging was rather weak or strong? Do the remaining temperature differences tell us something about the EMAC model or about the differences between the satellites and ERA-Interim?

Specific Comments

p7, l3-8: MIPAS PSC measurements during the Arctic winter 2010/11 are also discussed in a new ACPD paper by Spang et al. (2017).

p9, l14-16: The phrase saying "... PSC volume density is several orders of magnitude smaller..." is misleading. An order of magnitude refers to a change of a factor of 10. Several orders of magnitude may refer to change of a factor of 100, 1000, etc., but not to factors of 3 or 6-7 found here. This also needs to be fixed in other places.

p12, l30-32: Additionally, there might be problems because the standard flux-form semi-Lagrangian transport scheme in EMAC may be too diffusive near the transport barriers (Hoppe et al., 2014).

Figs. 6 and 12: Adding curves for Envisat/MIPAS may help to put the differences between MLS and the model into context.

Printer-friendly version

Discussion paper

Technical Corrections

p6, l2: "Arctic winter" -> "Arctic winters"

p6, l14: "orographic waves" -> "orographic gravity waves" (?)

p11, l25: "PSC seasons" -> "PSC phases" (?)

References

Hoppe, C. M., Hoffmann, L., Konopka, P., Grooß, J.-U., Ploeger, F., Günther, G., Jöckel, P., and Müller, R.: The implementation of the CLaMS Lagrangian transport core into the chemistry climate model EMAC 2.40.1: application on age of air and transport of long-lived trace species, Geosci. Model Dev., 7, 2639-2651, https://doi.org/10.5194/gmd-7-2639-2014, 2014.

Spang, R., Hoffmann, L., Müller, R., Grooß, J.-U., Tritscher, I., Höpfner, M., Pitts, M., Orr, A., and Riese, M.: A climatology of polar stratospheric cloud composition between 2002 and 2012 based on MIPAS/Envisat observations, Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2017-898, in review, 2017.

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2017-1190, 2018.