Geophysical Research Abstracts
Vol. 18, EGU2016-14242, 2016
EGU General Assembly 2016
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Tests of a parameterization for auroral forcing in the CCM EMAC for CMIP6 simulations

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Energetic Particle Precipitation (EPP) is well known as a source of NO_x in the middle atmosphere. Due to the quite long photochemical lifetime of NO_x in the polarnight middle atmosphere transport effects have to be considered. Therefore NO_x produced by EPP in the lower thermosphere can be transported downwards into the stratosphere where it contributes to the destruction of polar ozone. This process is also called the EPP indirect effect. Because of radiation feedbacks and stratosphere-troposphere interaction this effect can alter tropospheric climate. Here we show results for the recommendation for the implementation of this effect in chemistry-climate-models (CCM) for CMIP6 simulations.

Most of the used models in CMIP6 do not include the source region of NO_x. Therefore the EPP indirect effect needs to be considered as an NO_x upper boundary condition. Here, we use a parametrization in terms of A_p which is based on MIPAS observations. We show how to best implement the parameterization in models and how to avoid some general pitfalls. The effects in the used model EMAC (model top at 1 Pa) are compared to observations, generally showing a good agreement.