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Effects of different representations of transport in the new EMAC-SWIFT chemistry climate model

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It is well known that the representation of atmospheric ozone chemistry in weather and climate models is essential for a realistic simulation of the atmospheric state. Interactively coupled chemistry climate models (CCMs) provide a means to realistically simulate the interaction between atmospheric chemistry and dynamics. The calculation of chemistry in CCMs, however, is computationally expensive which renders the use of complex chemistry models not suitable for ensemble simulations or simulations with multiple climate change scenarios. In these simulations ozone is therefore usually prescribed as a climatological field or included by incorporating a fast linear ozone scheme into the model. While prescribed climatological ozone fields are often not aligned with the modelled dynamics, a linear ozone scheme may not be applicable for a wide range of climatological conditions.
An alternative approach to represent atmospheric chemistry in climate models which can cope with non-linearities in ozone chemistry and is applicable to a wide range of climatic states is the Semi-empirical Weighted Iterative Fit Technique (SWIFT) that is driven by reanalysis data and has been validated against observational satellite data and runs of a full Chemistry and Transport Model. SWIFT has been implemented into the ECHAM/MESSy (EMAC) chemistry climate model that uses a modular approach to climate modelling where individual model components can be switched on and off. When using SWIFT in EMAC, there are several possibilities to represent the effect of transport inside the polar vortex: the semi-Lagrangian transport scheme of EMAC and a transport parameterisation that can be useful when using SWIFT in models not having transport of their own. Here, we present results of equivalent simulations with different handling of transport, compare with EMAC simulations with full interactive chemistry and evaluate the results with observations.