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## Trace gas transport in the 1999/2000 Arctic winter: comparison of nudged GCM runs with observations

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**Abstract.** We have compared satellite and balloon observations of methane (CH<sub>4</sub>) and hydrogen fluoride (HF) during the Arctic winter

1999/2000 with results from the MA-ECHAM4 middle atmospheric general circulation model (GCM). For this purpose, the meteorology in the model was nudged towards ECMWF analyses. This nudging technique is shown to work well for this middle atmospheric model, and offers good opportunities for the simulation of chemistry and transport processes. However, caution must be used inside the polar vortex, particularly late in the winter. The current study focuses on transport of HF and CH<sub>4</sub>, initialized with satellite measurements from the HALOE instrument aboard the UARS satellite. We have compared the model results with HALOE data and balloon measurements throughout the winter, and analyzed the uncertainties associated with tracer initialization, boundary conditions and the passive tracer assumption. This comparison shows that the model represents some aspects of the Arctic vortex well, including relatively small-scale features. However, while profiles outside the vortex match observations well, the model underestimates HF and overestimates CH<sub>4</sub> concentrations inside the vortex, particularly in the middle stratosphere. This problem is also evident in a comparison of vortex descent rates based upon vortex average tracer profiles from MA-ECHAM4, and various observations. This could be due to an underestimate of diabatic subsidence in the model, or due to too much mixing between vortex and non-vortex air.

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