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Evaluation of the atmospheric transport in a GCM using radon measurements: sensitivity to cumulus convection parameterization

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Abstract. The radioactive species radon (^{222}Rn) has long been used as a test tracer for the numerical simulation of large scale transport processes. In this study, radon transport experiments are carried out using an atmospheric GCM with a finite-difference dynamical core, the van Leer type FFSL advection algorithm, and two state-of-the-art cumulus convection parameterization schemes. Measurements of surface concentration and vertical distribution of radon collected from the literature are used as references in model evaluation.

The simulated radon concentrations using both convection schemes turn out to be consistent with earlier studies with many other models. Comparison with measurements indicates that at the locations where significant seasonal variations are observed in reality, the model can reproduce both the monthly mean surface radon concentration and the annual cycle quite well. At those sites where the seasonal variation is not large, the model is able to give a correct magnitude of the annual mean. In East Asia, where radon simulations are rarely reported in the literature, detailed analysis shows that our results compare reasonably well with the observations.

The most evident changes caused by the use of a different convection scheme are found in the vertical distribution of the tracer. The scheme associated with weaker upward transport gives higher radon concentration up to about 6 km above the surface, and lower values in higher altitudes. In the lower part of the atmosphere results from this scheme does not agree as well with the measurements as the other scheme. Differences from 6 km to the model top are even larger, although we are not yet able to tell which simulation is better due to the lack of observations at such high altitudes.

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