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

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The radioactive species radon (^{222}Rn) is used as test tracer to evaluate large scale transport simulation in an atmospheric GCM with a finite-difference dynamical core, the Lin and Rood (1996) advection algorithm and two state-of-the-art cumulus convection parameterization schemes (Zhang and McFarlane (1995) versus Tiedtke (1989)). Results are compared to measurements of surface radon concentration and vertical profiles.

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

The most evident changes caused by convection scheme are detected in the simulated radon vertical distribution. The Zhang-McFarlane scheme leads to stronger upward transport, thus lower concentration in the lower atmosphere and agrees better with measurements. From 6 km above we see even larger differences, but are not able to tell which simulation is better due to lack of observations.