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The two-way nested global chemistry-transport zoom model TM5: algorithm and applications

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Abstract. This paper describes the global chemistry Transport Model, version 5 (TM5) which allows two-way nested zooming. The model is used for global studies which require high resolution regionally but can work on a coarser resolution globally. The zoom algorithm introduces refinement in both space and time in some predefined regions. Boundary conditions of the zoom region are provided by a coarser parent grid and the results of the zoom area are communicated back to the parent. A case study using ^{222}Rn measurements that were taken during the MINOS campaign reveals the advantages of local zooming. As a next step, it is investigated to what extent simulated concentrations over Europe are influenced by using an additional zoom domain over North America. An artificial ozone-like tracer is introduced with a lifetime of twenty days and simplified non-linear chemistry. The concentration differences at Mace Head (Ireland) are generally smaller than 10%, much smaller than the effects of the resolution enhancement over Europe. Thus, coarsening of resolution at some distance of a sampling station seems allowed. However, it is also noted that the budgets of the tracers change considerably due to resolution dependencies of, for instance, vertical transport. Due to the two-way nested algorithm, TM5 offers a consistent tool to study the effects of grid refinement on global atmospheric chemistry issues like intercontinental transport of air pollution.

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