Development of a Fast Three-Dimensional Dynamic Radiative Transfer Solver for Numerical Weather Prediction Models

Richard Maier, Bernhard Mayer, Claudia Emde, Fabian Jakub

The increasing resolution of NWP models makes 3D radiative effects more and more important. These effects are usually neglected by the 1D independent column approximations used in most of the current models.

To address these issues, we present a new „dynamic“ approach of solving 3D radiative transfer. Building upon the existing TenStream solver (Jakub and Mayer, 2015), radiation in this 3D model is not solved completely in each radiation time step, but is rather only transported to adjacent grid boxes. For every grid box, outgoing fluxes are then calculated from the incoming fluxes from the neighboring grid cells of the previous time step. This allows to reduce the computational cost of 3D radiative transfer models to that of current 1D solvers.

Here, we show first results obtained with this new solver with a special emphasis on heating rates. Furthermore, we demonstrate issues related to the dynamical treatment of radiation as well as possible solutions to these problems.