



A Quasi-Conservative Adaptive Semi-Lagrangian Advection-Diffusion Scheme

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Many processes in atmospheric or oceanic tracer transport are conveniently represented by advection-diffusion type equations. Depending on the magnitudes of both components, the mathematical representation and consequently the discretization is a non-trivial problem. We will focus on advection-dominated situations and will introduce a semi-Lagrangian scheme with adaptive mesh refinement for high local resolution. This scheme is well suited for pollutant transport from point sources, or transport processes featuring fine filamentation with corresponding local concentration maxima.

In order to achieve stability, accuracy and conservation, we combine an adaptive mesh refinement quasi-conservative semi-Lagrangian scheme, based on an integral formulation of the underlying advective conservation law (Behrens, 2006), with an advection diffusion scheme as described by Spiegelman and Katz (2006). The resulting scheme proves to be conservative and stable, while maintaining high computational efficiency and accuracy.