

A non-oscillatory numerical method for the advection-diffusion equation

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ABSTRACT

We explore theoretically and numerically the application of the advection transport algorithm introduced by Smolarkiewicz [1] to the one dimensional unsteady advection diffusion equation. The scheme consists of a sequence of upwind iterations, where the initial iteration is the first order accurate upwind scheme, while the subsequent iterations are designed to compensate for the truncation error of preceding step. Two versions of the method are discussed. One, the classical version of the method, regards the second order terms of the truncation error and the other considers additionally the third order terms. Stability and convergence are discussed and the theoretical considerations are illustrated through numerical tests. The numerical tests will also indicate in which situations is advantageous to use the numerical methods presented.

REFERENCES

- [1] Smolarkiewicz PK, A simple positive definite advection scheme with small implicit diffusion, *Monthly Weather Review*, 1983, **111**: 479-486.