Geophysical Research Abstracts,
Vol. 11, EGU2009-12733, 2009
EGU General Assembly 2009

To clip or not to clip: are positive schemes mandatory for advection-diffusion-reaction equations in geophysical flows?

O. Lietaer (1,2), R. Comblen (1), A. de Brouwere (1,3), T. Fichefet (2), and V. Legat (1)

(1) Institute of Mechanics, Materials and Civil Engineering, Université catholique de Louvain (UCL), Louvain-la-Neuve, Belgium (olivier.lietaer@uclouvain.be), (2) G. Lemaitre Institute of Astronomy and Geophysics, Université catholique de Louvain (UCL), Louvain-la-Neuve, Belgium, (3) Analytical and Environmental Chemistry, Vrije Universiteit Brussel (VUB), Brussels, Belgium

A common constrain encountered while dealing with advection-diffusion-reaction equations (e.g., biogeochemical modeling) concerns the positivity of the numerical scheme. Most state variables represent indeed concentrations, for which negative values are not only nonphysical, but may cause the numerical integration to be unstable. Different solutions have been proposed in the litterature, often involving clipping (restoring negative values to zero) or monotone schemes. In this study, we propose an alternative approach which somehow relaxes the positivity constrain, enabling the use of much simpler advection schemes that are accurate while not monotone. We illustrate our method through idealized but realistic benchmarks coming from ecological and sea-ice modeling.