

General comments:

This paper presents a simplified chemistry-like interaction between two correlated tracers to test transport schemes. The authors particularly focused on the correlation properties of these tracers and the effect of monotonicity/limiters. Overall the paper is clear and well written and the test could be useful to chemistry transport development. Therefore, I don't have any objection for its publication in GMD.

Specific comments:

1. The mathematical equations are not easy on the eye and a bit confusing whether the l in Cl is L or I . Also I don't see why one wants to use 2 or 3 letters to define a variable while one letter will suffice. The notations would be much neater and clearer if, for example, m_1 , m_2 and m_3 are used for Cl , Cl_2 and Cl_y , respectively.
2. Section 2. The physical meanings (i.e., mixing ratios) of the three tracers should be clearly defined in this section. The section shows lot of equations without ever saying what are these Cl s.
3. Throughout the text the use of “preserve and conserve” are left somehow ambiguous and confusing as to what exactly we mean (examples: page 8772, “Another inspiration for this test is the atomic concentration is conserved.”; “... conserved the total chlorine.”). It would help the reader to define exactly what we mean by these words (i.e., tracer mass conservation, preserving a constant, preserving a relationship, etc...), especially in presence of the sources terms.
4. Section 5.3 and Fig. 5. The authors has to explain why the “default limiter” doesn't remove the overshoot in Cl (bottom-left corner picture).
5. Fig. 7. The authors has to provide an explanation as to why the error in CAM-FV is around 10 times smaller than that of CAM-SE?
6. Final thought: Let us denote the test's equations as follows: (a) $\frac{dm_1}{dt} = S_1(m_1, m_2)$, (b) $\frac{dm_2}{dt} = S_2(m_1, m_2)$, (c) $\frac{dm_3}{dt} = 0$, and (d) $m_3 = f(m_1, m_2)$. I would like to see a discussion about the over-specification of this problem (i.e., there is an arbitrary choice of how one could solve these over-specified equations set). If (d) is an important property to maintain, then one could simply solve (a) + (c) and deduce m_2 from (d), instead of the approach used in the paper [i.e., (a) + (b) and check how well we achieve (d)]. I am not asking to redo the experiments with the alternative approach but a brief discussion as to why this way and not the other way?

Minor comments:

1. Section 5.1, page 8781: There is a bit of mis-use of the word mass. Most the word “mass” in the 2nd paragraph of section 5.1 refers to “density”. We should be clear that $\rho\phi$ is the tracer density and not mass [if ρ is the density of dry air and ϕ is a tracer mixing ratio (mass = $\rho\phi V$ where V is the volume element)].