**Atmospheric
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Interactive comment on "Effects of resolution on the relative importance of numerical and physical diffusion in atmospheric composition modelling" *by* M. D'Isidoro et al.

Anonymous Referee #3

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This manuscript discusses the role of "physical and numerical" diffusion in an atmospheric model. The discussion is indeed interesting, but unfortunately this manuscript is not well written. I would recommend publication after a major revision. In the revision the authors need to address the following points

Specific Comments:-

[1] A major trouble with this paper is that it lacks rigor and clarity. Certain words used are not suitable for a scientific journal. For example, on Page-22866 ". . ... competition between physical diffusion ..", and on Page-22868, first paragraph: "spread of cloud .." , and ".. spread is referred to as ..", sound very weak. The terms diffusion (spread!), dis-

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sipation and dispersion are inter related, however, there are subtle differences; authors should consult the review paper by Rood R.B. (1987, Rev. Geophys., vol.25, p71-100). Moreover, there should be a clear explanation about the difference between "physical diffusion" and "numerical diffusion." In the manuscript these terms are introduced in a confusing manner..

[2] On Page 22866: Many practical transport schemes (including WAF) employ mono-tonic (non-oscillatory) limiters to control spurious oscillation (also to remove small scale structures). Did you mean the "smoothing" as an effect of limiting or filtering? It is not clear in the manuscript, please make it clear.

[3] Equation (4) is the advection equation in non-conservative form, however, the Toro's WAF scheme you are using is based on conservative (flux) form. Then a non-dimension version of advection equation (5) is introduced and an idealized solution is derived in terms of variance. However, authors fail (or ignore) to explain what is the purpose of this, and how this procedure is incorporated in to the WAF-based model. A more direct discussion should be given in the revision.

[4] On Pgae-22871: For the benefit of the readership, please plot the initial conditions and the final simulated solution for the numerical experiment. Also the quality of the figures should be improved (numbers & axis markings etc.) What is "BOLCHEM"? Don't expect every reader is an expert of this model, please provide more details.

[5] In the conclusion it is given that "numerical diffusion depends on only two parame-ters: resolution and Courant number". But the resolution (dx) and the Cournat number (U dt/dx) are dependent; then why not say 'numerical diffusion depends on only the resolution and the wind field (U)', which are independent. A justification is needed.

[6] Finally, I have a curious question. The Smagorinsky (1963, Mon., Wea. Rev, Vol.96, 99-165) type "physical" diffusion is widely used in many high-resolution meteorological models and engineering applications, and it appears very promising. Is it possible to apply such a diffusion scheme in your model?

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 22865, 2009.

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