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Geoscientific Model Development Discussions

Interactive comment on "Generalization and application of the flux-conservative thermodynamic equations in the AROME model of the ALADIN system" *by* D. Degrauwe et al.

Anonymous Referee #3

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This manuscript focuses on an energetically and mass consistent physics-dynamics interface and is an extension of a previous paper by Catry et al (2007) in that it allows for an arbtitrary number of air constituents and their interactions.

This type of work is very welcome for the scientific community as it aims at standardising general physics-dynamics interfaces.

The manuscript is divided in a more theoretical part an a more applied part.

Regarding the theoretical part, as far as I could see, the statements given are all true and useful. The equation set (2-8) is only the equation set for the physics, not for the whole model. This should be made clear. It is not clear why pseudo-fluxes are

employed to describe source terms. I think that this makes the issue unecessarily unintuitive. Why the flux-conservative form is enforced here? Is there a coding style advantage?

Regarding the sedimentation fluxes in equations (9) and (10), I can't see at a glance why the rain flux Pr shoud depend on both absolute Pr* and Ps*. Could you explain this?

You also mention the relative flux of dry air to be defined as Pd=-sum(Pk) (Page 7 about lines 10). This is correct. What is about the flux of water vapour or other non-sedimenting species? It should have the same compensating velocity as dry air.

In Section 4 it is mentioned that the surface boundary condition of AROME does not allow for mass exchange between soil and atmosphere. A consequence is then, that energy exchange associated with moisture and precip is also not possible? Do I understand this correctly? Then, with regard to the cold pool example you give later on in Figure 7, which consequences would this imply? Could you try to implement this boundary condition? An why should it not be possible to implement this boundary condition?

Even if one might believe that the endeavour to introduce more consistency does not result in better overall scores, the cold pool example shows clearly the advantages in extreme weather situations. This is more than sufficient.

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