**Atmospheric
Chemistry
and Physics
Discussions**

Interactive comment on "Two adaptive radiative transfer schemes for numerical weather prediction models" *by* V. Venema et al.

Anonymous Referee #3

Received and published: 13 September 2007

GENERAL COMMENTS

I found this paper to be very interesting, highly relevant and useful for the development of radiative transfer schemes in NWP and Climate Models. I would recommend this paper for publication subject to only a few minor comments.

The paper provides a proof-of-concept that adaptive radiative transfer schemes of two kinds are workable and accurate enough to be used in todays models. As a proof-of-concept, I think it is acceptable that a simple evaluation of surface fluxes is used, although there will clearly need to be a more complete validation, using full profiles of heating rates, before the schemes can be considered for implementation into full models.

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One concern with regard to the spatial local-search scheme is how this may be combined with the increasingly more sophisticated use of surface properties in todays models (ie sub-grid "tiles" of different albedos/temperatures in Climate Models, or the interaction of direct short-wave radiation with surface slopes in NWP models). There may also be problems in coastal regions where not only the surface properties change, but other factors such as the number of cloud condensation nuclei will change. Will this scheme not cause problems for the better resolution of the surface? The temporal scheme would have no such problems (which may perhaps be pointed out in its defence). With the use of a more sophisticated extrinsic parametrisation such as a neural net or a simple physical parametrisation that takes proper account of clouds, I can see good potential for this scheme.

The layout of the paper focuses heavily on the results and discussion and would benefit from a clearer and more detailed description of how the adaptive schemes work. In particular, the description of the spatial local-search scheme should explain what the generalisation algorithm does with the results from the selected intrinsic calculation (does it simply correct for solar zenith angle?).

In general, I find the paper to be written with reasonable clarity, and is sufficiently complete in its analysis.

SPECIFIC COMMENTS

1. For the temporal perturbation scheme, is there a maximum time between calls to the intrinsic scheme for a given grid-box? If not, it appears this would be a simple solution to the errors produced by this scheme and alluded to in the first paragraph of section 5.3.

2. At the end of section 5.4 you mention that the ice water path was found to be insignificant as a selection parameter. I find this quite surprising, especially in the longwave where I have found variations in the ice condensate to have a greater impact than variations in the liquid water condensate. It may be that the models for which

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your scheme was tested did not contain a significant amount of ice, and this should be mentioned if it is the case.

3. In the discussion, p. 7254, line 12, you state "An extension to the full vertical profile is trivial for the spatial local-search scheme". While it may be trivial to expand the technique, it is far from obvious that this will work particularly well. It will be a lot harder to find a similar profile that produces similar heating rates than it is to find similar integrated quantities. I think this point should be mentioned.

4. Discussion p. 7257, line 24. I find the example of a McICA scheme slightly anomalous in that this need be no more computationally intensive than a conventional two-stream scheme. Although, I do see that it is possible to have a more rigorous McICA scheme (ie that uses more than one "k-term" for each sub-column) that would be more computationally expensive and may prove beneficial.

TECHNICAL CORRECTIONS

In addition to those expressed by the 1st referee:

1. Table 1. Headings (cloudy etc.) should be clearly separated from the table contents.

2. Table 3. The different sections of the table should be more clearly separated.

3. p. 7257, line 20. "The smarter and [more] adaptive the generalisations are, the less [often] computationally expensive intrinsic calculations [will be] needed." (Otherwise this reads as if the intrinsic parametrisations should be less computationally expensive.)

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 7235, 2007.

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