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Interactive Comment

Interactive comment on "Simulating orographic rainfall with a limited-area, non-hydrostatic atmospheric model under idealized forcing" *by* A. Pathirana et al.

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We thank the referee for her positive review and the valuable input. The following sections address the specific comments (scientific) that has been raised. Technical corrections will be incorporated into the final revised article.

1. Responses

1. Q1 Why there is no rainfall in Fig. 3?

   This is just after 10 min of model start. In reality precipitation process (conversion from cloud water to rain droplets, snow or ice) is not instantaneous; the growth of rain drops takes time. However, in numerical modeling of this process, it is possible that some simple microphysical schemes spuriously generate rainfall instantaneously when no memory (i.e. dependance on the status of previous time steps) is implemented. The Goddard microphysics scheme used in the present study introduces memory to the ice and snow processes and thus can be assumed to be closer to the realistic situation above.

The rainfall (albeit small amounts, < 1 mm) do start to form after about 20min of model start. However, significant amounts of rainfall (e.g. > 2 mm) occur only after the start of convective development (after about 1 h of model start).

We have prepared a movie (movie-1, see section 2) with the cloud structure and rainfall pattern at initial hours.

2. Q2 Why precipitation gets re-evaporated?

   Inspection of the temperature and relative humidity patterns above lee-slope shows that the conditions are dry and warm. This is a result of the moisture depletion and resulting release of latent heat when the moist air passes over the mountain (classical foehn effect). However, in this particular simulation, the air aloft are much cooler and moist, resulting in precipitation hydro-meteors in large quantities. However, when it descend through the warmer lower reaches, most of it gets re-evaporated.

   Please see the movie (movie-2, see section 2) that we have prepared.

3. Q4Why may it have negative influence on organization of convective cells?

   It is a well known fact that the individual convective cells sometimes organize spatially to make systems of much larger spatial extent and in most cases this organization helps to sustain precipitation for extended time-periods (as opposed to self-limiting behavior of single convective cells) and to increase the rainfall intensities. Simply because these are of much larger scale than individual convective cells, in order to represent them, the model domain should be sufficiently

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large to accommodate these formations. (However, even with a larger domain the formation of these type of structures depend on whether the model physics can reproduce the natural conditions required for their formation.)

The present simulation domain was a rather thin one (about 40km) and allowing for the boundary effects, only a width of about 20km (10 grid cells) can assumed to be realistic. Therefore, it is obvious that large scale phenomena would not occur in this domain, even if the model physics allows it.

4. Q5 What was the computer system?

   We used two pc's (with Pentium IV processors running at 2.2GHz with 1GB memory and 1.7 GHz with 500MB memory, respectively) running Linux operating system with Portland group Fortran compilers. The faster machine took about 3 days (72h) to complete a single simulation of 48h duration.

2. Downloading the movies

Please access

(a) movie-1 http://221.186.14.54/assela/acp/h2k.init.zip

(b) movie-2 http://221.186.14.54/assela/acp/temperature.zip

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 5625, 2004.

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