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Atmospheric Chemistry and Physics Discussions



# *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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Overall quality of the paper:

Pithirana, Herath and Yamada have used the MM5 Limited Area Model (LAM) to perform idealized simulations of flow over a mountain ridge. The scientific method is not new, but the scientific methods are valid and the obtained results complements previously results and are of interest to the scientific community and ACP readers, especially those involved in orographic precipitation patterns (i.e. flood forecasting in mountainous regions). The paper needs small modifications in the writing and possible an additional model scenario. The authors are kindly requested to do some literature research, which however should be straightforward and not time-consuming.



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Specific comments concerning the numerical experiments:

Why have the authors not conducted an experiment with mountain height above the standard settings: at 2000 meters? Several important mountain ranges in Europe, America, and Asia are above 2000 meters. (i.e the Alps, the Pyrenees, the Andes, the Rocky Mountains, the Himalayas, The Japanese mountains, ..). In contrast, experiments with wind speeds above and below the standard settings were performed. According to the authors a new simulation takes approx. 3 days, which is not considered a major modeling effort.

Specific comments concerning the writing:

In general the authors should be more precise in their writing. Some examples: In the abstract: "Changing topographic parameters and atmospheric parameters had clear effects on amount and pattern of accumulated precipitation." This sentence is vague, as it does not say explicitly what was changed (i.e. from 10m/s to 20 m/s) and what was obtained. Page 5628 line 14-16: "Different topographic and atmospheric parameters were each varied while keeping all the others constant...." Another formulation could be something like "By changing mountain heights, mountain width, wind speeds or moisture profiles", which is more precise. The formulation "a limited-area, non-hydrostatic atmospheric model" or similar formulations are found several times in the paper (i.e. title, abstract) could be simplified to MM5 or MM5v3, which is more concise.

The purpose of the paper is orographic rainfall. Therefore, I suggest to replace parts of the abstract concerning cloud formation (line 6-10) with the central findings concerning orographic precipitation. (i.e. ".. rainfall maxima on some distance upwind of the mountain peak", "the large scale wind speed has a dramatic effect on rainfall distribution").

The paper would benefit with a table and a little explanation describing the different experiments. Currently the only place in the paper the different experiments can be seen is Figure 6. Placement of this description could be chapter 2.



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Interactive Comment

The introduction could benefit with a little reorganization of the paragraphs. Page 5627 line 1-3 concerns general introduction, line 4-6 about the specific experiments presented in the paper, line 6-7 general introduction again. I suggest moving line 4-6 to the part of the introduction that contains the objective of the research. Furthermore I suggest make the part of the introduction concerning the objective more precise as suggested above. Otherwise the introduction is well written. It states the importance of mountain flow, orographic precipitation and why experiments with a numerical model like the MM5 are useful.

In chapter 2, the MM5 model is described. This part should preferably be extended with the model setup, which is found in chapter 3, page 5632 line 14-26. Choices of different parameterizations (i.e. PBL, Microphysics and radiation schemes) should be described in the text. The authors are kindly requested to associate the parameterizations within the physical package with the correct reference as a reference to Figure 2 does not give enough credit to the authors of the different schemes.

Within chapter 3, the simulations the reference simulation is detailed described and in chapter 4 the results from the experiments with different settings compared to the reference settings are discussed. Therefore chapter 3 could be renamed to something like "Reference simulation". On page 5633, line 21 to line 25 there is a little confusion whether the lines refers to all the model simulations, simulations and meteorological situations in general or the specific reference simulation. This should be clarified.

Within chapter 4 the results from the different experiments are discussed. This chapter could benefit from a dividing into subchapters like sections 2. Each subchapter could then be associated to the different types of simulations (i.e. changing the topography, changing the wind speed or changing the moisture profile).

Chapter 5 needs to be expanded with the conclusions based on the results by changing either the moisture profile or the wind speeds.

Minor comments:



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Are the modifications made public available to the MM5 community? If yes, please state where and how, as the MM5 model with idealized settings could be useful, also for other purposes than scientific investigations (i.e. education)

The authors are kindly requested to apply a few more references whenever there is a statement, as ACP is a scientific forum of a more general nature than the meteorological community. Examples could be when there is a statement of general nature or when there is a statement which is not a finding of this paper (i.e. page 5626 l. 19, page 5626 line 21, page 5633 line 13).

I suggest removing Figure 13, as the writings in chapter 4.1 should be sufficient comments on this part of the uncertainty. Figure 13 is not necessary to understand the general pattern in the precipitation fields.

The text underneath the Figures 1, 3, 4, 8, 9, 10, 11, 12 is too small.

In Figure 6, scenario (H-b) with mountain height 1000m. The width of the mountain seems smaller than the scenario (H-a), which again seems to have a smaller width than the control run. Is this a plotting error?

Technical correction: Page 5633 line 3. b=16km

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