

Interactive comment on “Analysis of feedback effects and atmosphere responses when 2-way coupling a hydrological land surface model with a regional climate model – a case study for the Upper-Danube catchment” by F. Zabel and W. Mauser

Anonymous Referee #1

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General comments:

The paper discusses an interesting approach for using medium resolved RCM-data (~45km) in interaction with a high resolved SVAT-Model named PROMET (~1km). The coupling between MM5 and PROMET is organized by using a scaling tool, called SCALMET, which is developed by Marke et al. (2011). The article is structured into

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four parts: Introduction, Methods, Results & Discussion and Conclusion. The main part (Results and discussion) is divided into three, differently weighted sections with several subsections. The subsection on “Feedback effects” is the smallest of all sections, even though it has a prominent place in the title. Not only for this issue: the title’s promises remain unfulfilled by the paper’s content. The sentences are very long and leave the reader searching for the full meaning. The style of language follows a German syntax and uses colloquial wording. This leads to vagueness, which is contrasted by exaggerations, e.g.: “2-way coupling a LSHM with a RCM potentially seems to be a very powerful approach”. It is difficult for the reader to follow the red line within a sentence as well as in the whole article. For understanding it better, the reader is forced to have a detailed look into referred papers. Especially, it is necessary to know the preceding paper of the author itself: Zabel et al. (2012). It is published HESS_16 (28 March 2012, edited by van den Hurk) and is referred in the present paper for seven times. In the present paper the experimental set-up is not explained sufficiently. A list of three different names for the configurations is mentioned and refers to a figure where the names do not appear. The exact models-setup and contributing figure is only shown in Zabel et al. (2012). While reading the paper of Zabel et al. (2012), the similarities to the present paper are very high. The gain of information in the present paper is due to a description of results for a much smaller investigation area, i.e. the Upper-Danube catchment. The paper evolves more questions as it is able to answer. Disregarding the title, the aim of the paper is hardly evident.

Zabel, F., Mauser, W., Marke, T., Pfeiffer, A., Zängl, G., and C. Wastl (2012): Inter-comparison of two land-surface models applied at different scales and their feedbacks while coupled with a regional climate model, Hydrol. Earth Syst. Sci., 16, 1017–1031, doi:10.5194/hess-16-1017-2012.

Specific comments:

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1. Misleading title: the chapter on feedback effects is extremely short, but is mentioned first. the title implies the problematic of 2-way coupling no matter which RCM and LSM is used, but the article is only about one specific RCM, namely MM5 und two different land surface models: namely Noah-LSM and PROMET.

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1. Contradictory: LSHM take “soil-plant-atmosphere interaction into account”, but use “atmosphere as exogenous driver only, ...neglecting feedbacks...”. 2. “What is the impact on RCMs performance...” implies the computational performance of a model. 3. What is the difference of LSHM and LSM??? 4. “...differently applied model physics and spatial resolution of LSHMs...” – What is the role and impact of SCALMET? As I understood, the atmospheric model MM5 simulates in any case in 45x45km**2 horizontal resolution. 5. SCALMET is a coupler? 6. “...temperature significantly improves...” - is it a tested significance or a misleading adjective? 7. Contradictory: “non-bias-corrected variable” ... “ a mean annual bias”. Overall, the usage of the term “bias” is unclear. 8. 277 meteorological weather stations are mentioned without any reference. There is no explanation for the method which was used for receiving gridded data information, nor a figure representing the weather stations distribution.

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1. A common usage of the term LSHM is mixed with specific descriptions on PROMET. Is PROMET and its developments by Mauser/Ludwig able to represent the validity of all existing LSHMs?

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1. Surprising conclusion: “However, for modelling runoff over mountainous terrain with RCM forcing adequately, a bias correction of the RCM data is necessary (Marke et al., 2011b)” – this sentence might not fit in that position, and is fully unexplained. Is a so called “bias-correction” only of use for a mountainous area? What characterizes

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a mountainous terrain? And why does the author mentions explicitly in the abstract that he uses “non-bias corrected” data? 2. Following sentence comes surprisingly as well, further it is in contradiction to the abstract: “The central question concerning this study is, weather RCMs could benefit in terms of an improved modelling of atmospheric and land surface processes (e.g. temperature, precipitation, evapotranspiration, and runoff) from the spatially and process-wise more detailed land surface description when substituting the LSM of the RCM with a high spatial resolution LSHM and a spatial scaling mechanism.” – is in contrast to “ What is the impact on RCMs performance of the differently applied model physics and spatial resolution of LSHMs?”

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1. “nudge the double-nested” ???? ERA-40 is used as driving data in the first nesting step. Is it also used for the second nesting step? What horizontal resolution is hidden in the information of 79/69 grid boxes? 2. What is the authors intention by using the expression “integral component of MM5” ? 3. What is the difference of advanced physically based to physically based?

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1. What exactly are die important differences between Noah LSM and PROMET? Are those the reason for the different simulation results? 2. What is meant by “fully coupled”? 3. Does PROMET and MM5 in the two-way coupling approach via SCALMET have to run simultaneously? There is an information exchange between the two models, done by SCALMET, which is set to nine minutes. This part is confusing.

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1. Which characteristic climate between poles and tropics is meant? 2. Is offline identic to one-way coupling? 3. Figure 2 begins with evapotranspiration and sensible heat flux. The text starts with long/short-wave outgoing radiation. 4. The explanation for radiation differences should be a matter of the assigned albedo. The snow cover and calculation

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of snow-albedo drives therefore the net radiation values in winter month. For the reader it is not possible to reconstruct what kind of data is compared in figure 2. NOAH is the simulation of standard MM5 with Noah LSM in 45km resolution PROMET offline is a simulation, driven by standard MM5/Noah-LSM, in 1km horizontal resolution. The compared area means are for NOAH over an area of 45km grid boxes, whereby for PROMET it is for an area of 1km grid boxes? (if yes – Are the differences influenced by the size of area? if no: what is the influence of the transfer function?)

And so on. ... The main part is infiltrated by redundancy and also often misleading. For example, the usage of NOAH as name for a simulation comes across with the usage of NOAH as synonym for Noah LSM. The comparison of area means, monthly, yearly daily appears to be unsystematically and confuses the reader. Sometimes values are mentioned which are not related to specific resolution, area or time. It is unclear, if the mentioned values and the figures are reflecting the same statistically prepared values given in the text (e.g. 3.2.3 Temperature). Explanations on processes which are causing differences are only mentioned and seem to be a matter of speculation. For all variables the amount of differences remains unvalued. The comparison to “mystic” meteorological data is done in an uncritical manner.

Jumping to conclusion: 7555

Through that replacement, the spatial resolution of the land surface representation improved from 45 km² to 1 km², which was dealt with by a bi-directional scaling interface that arranged the 2-way coupling between the models.

Technical corrections:

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1. Misleading generalisation: What das LAND SURFACE MODEL (LSM) stands for? Not every RCM has a separate LAND SURFACE MODEL comparable to the Noah LSM. 2. Unsolved abbreviations: PROMET, SCALMET, NOAH-LSM a. NOAH-LSM is

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correctly referred as Noah LSM. Noah is no abbreviation, but a name in recognition of a multiple partnership while enhancing the OSU-LSM (Ek et al. 2003).

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1. weather RCMs – whether RCMs

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1. Upper-Danube catchment ($A=77000\text{km}^2$) versus 76653 km^2 on page 7549. 2. “our”: active and passive voice is both used in the present paper. 3. “horizontal spatial”

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1. SCALMET (Zabel et al. 2012) - does it refer to SCALMET??? 2. Stefan-Boltzmann law 3. Figure 1: Mentioned names in the text do not appear in the figure. 4. Experiment Names are not consequently used in the figures and text at all.

Jumping to conclusion: 7555

1. Surface module – surface model? 2. Is the representation in a finer scale the only improvement? 3. “dealt with by” ??? 4. “could be shown”??? Is it shown or not? 5. What is full 2-way coupling – (already mentioned)

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1. “The impact on precipitation is difficult to diagnose, due to high uncertainties induced by the complex terrain of the catchment” – This cannot be the only reason. 2. Is it theoretically allowed to compare the river runoff of Noah LSM to the other experiments? 3. How can the reader judge if a difference of $300\text{ m}^3\text{s}^{-1}$ is not even in the deviation of the observation? (What is the meaning of a surplus of $300\text{ m}^3\text{s}^{-1}$) 4. Maybe the title should hint to river runoff. 5. The last sentence of the conclusion is not true, while studying the shown figures.

Comments to figures:

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Fig1: Is uncorrelated to the text Fig2: What is the mean resolution? Fig3: a) Is not mentioned in the text. An explanation or conclusion for the shown differences is missing. b) Is it theoretically valid to compare areal means of BPL? Fig4: y-axis should be correct Fig5: a) Discrete color bar! B) Upper Danube Basin = Upper Danube Catchment? c) Downscaled to 1 km by using SCALMET??? Fig6: see Fig2 Fig7: IS NOT MENTIONED IN THE TEXT a) y-axes should be unified, b) legend is needed only once, c) Caption is unhandy (Monthly, diurnal 3hourly) Fig8: Basin/Catchment, discrete color bar, uncommented differences. Fig9: Basin/Catchment, Experiment names differently used, Mean over four years is unclearly mentioned.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 7543, 2012.

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