

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

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Dear anonymous Referee # 1, the submitted paper is based on the work, described in the paper of Zabel et al. (2012), published in HESS. However, the paper discussed here includes substantially important and new information – as the validation! In order to validate the bidirectional coupling approach, we focused on the Upper Danube

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catchment. Here, we showed that near surface air temperature could be improved by the use of the bidirectional coupling approach when compared with interpolated data from 277 meteorological weather stations. Further, this study includes catchment analyzes, including the impact on runoff and the water balance. The long sentences and lingual deficits, as mentioned in your comments, were corrected. Since you criticized the title of the paper: The atmosphere response to the bidirectional coupling is shown by the air temperature and precipitation, which in turn causes feedback effects at the land surface, shown by evapotranspiration and finally the water balance. Nevertheless, we suggest changing the title into: “Analysis of feedback effects and atmosphere responses when 2-way coupling the hydrological land surface model PROMET with the regional climate model MM5. A case study for the Upper-Danube catchment.”

According your minor comments: 7544, 1: The ‘soil-plant-atmosphere interactions’ mentioned here, are the basic processes of a SVAT model. The atmosphere interactions meant here, are e.g. the temperature, humidity, wind, ... that act on plants transpiration. Therefore, the land surface hydrological model PROMET needs exogenous atmosphere drivers (data from the regional climate model MM5). I cannot see any contradictory. 3: LSM = Land Surface Model or Module; LSHM = Land Surface Hydrological Model 4: SCALMET is used as a coupling tool between PROMET and the atmosphere of MM5. Therefore, it is managing the data transfer, including the downscaling as well as the upscaling, but also manages the correct synchronization between the models. 6: adjective 8: Can be seen in Mauser and Bach (2009). This citation was added in the text. Mauser, W., and Bach, H.: PROMET - Large scale distributed hydrological modelling to study the impact of climate change on the water flows of mountain watersheds, *Journal of Hydrology*, 376, 362-377, Doi: 10.1016/j.jhydrol.2009.07.046, 2009. 7545: The LSHM used in my study is PROMET. The term LSHM is used to distinguish the models from the hydrological community from land surface modules within climate models of the climate community. 7546: The bidirectional coupling approach improves temperature but not precipitation. Precipitation is little improved, but especially over mountainous terrain, bidirectional coupling did not improve precipitation.

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Therefore, for modeling runoff, a bias correction of precipitation would be necessary for a comparison with gauge data. The mountainous in the South of the Upper Danube are the Alps. 7574: ERA-40 is used in the first nesting step. There is no second nesting step. The horizontal resolution of MM5 is 45 km. With 'Integral component of MM5' is meant that Noah is an internal component of MM5. But also e.g. the OSU-LSM could be chosen as LSM within MM5. In comparison to OSU, Noah is an advanced physically based land surface module. 7548: 1. There are many important differences between Noah and PROMET (parameterization, physics, spatial resolution, input data (Zabel et al. 2012)). 2. fully coupled is synonymous to bidirectionally, interactively and 2-way coupled. 3. yes, they run simultaneously but the matter and energy fluxes are exchanged every 9 simulation minutes. 7549: 1. ? 2. yes 3. It starts with evapotranspiration, sensible heat flux, . . . 4. radiation differences are mainly due to snow cover. The PROMET topography at 1 km spatial scale has higher mountains where snow can resist longer. Consequently, more shortwave radiation is reflected. Yes, the results are the area means, whereby the areas for the 1 km and the 45 km grid boxes match.

Technical corrections were corrected.

Zabel, F., Mauser, W., Marke, T., Pfeiffer, A., Zängl, G., and Wastl, C.: 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, 2012.

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