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Discussions

Interactive comment on "High-resolution modelling of interactions between soil moisture and convection development in mountain enclosed Tibetan basin" *by* T. Gerken et al.

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Response to Reviewer 1

Tobias Gerken et al.

22 July 2015

We would like to thank Reviewer 1 for their work. The reviewer's comments are much appreciated and will improve the clarity and legibility of the manuscript. We are happy to revise our text in accordance to the reviewer's suggestions.

Below is our response to all reviewer comments and proposed changes to the revised manuscript. Our response is always printed in **red**. Text modifications are put in quotation marks. Line numbers correspond the initially submitted manuscript and may change in the new document.

1. In their simulations, the authors set the initial soil moisture to 2.0 the field capacity, which corresponds in their case to realistic conditions. I wonder why the authors did not increase the soil moisture further to more humid conditions? → **During the 2012 field campaign we observed soil moistures that corresponded to values ranging from close to the permanent wilting point to circa 2 × field capacity. It should be noted that the field campaign was conducted during the summer monsoon season so that soil moistures were typically higher than during the non-monsoon season. Soil moistures exceeding 2 × FC were not observed, so that it was decided to not include these into**

the design of the simulations. The limited availabilty of fair weather days with radiosonde launches for the initialization of the simulations led to the chosing of this particular day, during which the soil moisture was to 2 $\times$ FC.

2. The only thing I was really missing in this paper is an analysis of convection indices, like CAPE and CIN. Especially, the response of CIN to soil moisture variations is decisive for convection initiation. Perhaps the authors could include some text or even a Figure describing the response of these parameters to different initial soil moisture. $\rightarrow$ **We will perform an analysis about the differences in CAPE for the different simulations**

3. P4646, L19-21: "Through changes in the Bowen-ratio, there is a strong modification of the surface energy budget due to soil moisture." As the Bowen ratio is derived from the sensible and latent heat flux, I would formulate it the other way around: Soil moisture strongly modifies the partitioning of the availabe energy into sensible and latent heat, evident in the Bowen-ratio. $\rightarrow$ **We appreciate the reviewer's comment and changed the text accordingly: "Soil moisture strongly modifies the partitioning of the available energy into sensible and latent heat, evident in the Bowen-ratio, and thus the surface energy balance."**

4. P4648, L10: "As deep convection is primarily driven by the release of latent energy..." In my opinion, this is not true. Convection is driven by boundary-layer processes or synoptic processes. The release of latent heat during condensation of water vapour gives additional buoyancy, but it is not the main driver. $\rightarrow$ **We agree with the reviewer that the original formulation is too short and thus inaccurate. What we meant to express was that the main source of the energy released stems from latent heat release. However convection and its triggering is a process driven by processes mentioned by the reviewer.**

We replace the sentence with: "As the development of deep convection is sustained by the release of latent energy, . . . "

5. P4648, L17: "The equivalent potential temperature profile (θ_e) reveals a predisposition for convection" In order to assess this, the profile of equivalent potential temperature assuming saturation should be plotted as well ($\rightarrow$ conditional instability). $\rightarrow$ **The Figure will be updated**

6. P4651, top: The authors state that the upper level wind speeds used in this work are unrealistically low. The role of the background wind on the soil moisture precipitation feedback was recently investigated by Froidevaux et al. (2014): Influence of the background wind on the local soil moisture-precipitation feedback (10.1175/JAS-D-13-0180.1). Some text relating these findings could be inserted here. $\rightarrow$ **We appreciate the suggested article, which was unknown to us and we will include this aspect to the discussion. Froidevaux et al. (2014) discuss the importance of circulation for convection development as moist air is transported to warm patches where convective initiation occurs. It should be pointed out that our simulation includes background winds as well as a lake-breeze (see. i.e Gerken et al., 2014) which performs this 'function'. We will add the following sentence: "Recent work by Froidevaux et al. (2014) investigated the importance of background wind speeds and horizontal transport of convective cells during their development. While wind speeds used in this work were lower than observed, the lake-land circulation (i.e. Gerken et al, 2014) provides the necessary horizontal propagation mechanism that allows for the development of convective cells."**

7. Figure 5: One could insert another panel (h) showing the Bowen-ratios $\rightarrow$ **During the draft stage, it was experimented with a figure showing Bowen-rations. However, due to the number of lines the legibility of the figure was low, so that we did not include this in the submitted manuscript.**

8. P4650, L17: When using 2D simulations, strictly speaking, there is no such thing as a control volume. I would prefer control domain or area. → **"Control volume" was replaced with "control domain"**

9. Fig. 3: The red contour lines for the clouds makes this figure hard to read. Perhaps only one red contour line for the cloud boundary would be sufficient? → **The Figure will be updated**

10. Fig. 8: The legend for the grey shades is missing and the number of thin black isolines it too high, they mask the grey shades. Furthermore, the upper panel showing precipitation (?) is not explained → **The Figure will be updated**

11. Additional minor technical or textual comments → **All other comments are taken into account in the revised manuscript**