Hydrol. Earth Syst. Sci. Discuss., 10, C7528–C7531, 2014
www.hydrol-earth-syst-sci-discuss.net/10/C7528/2014/

Hydrology and Earth System Sciences
Discussions

Interactive comment on "Retrospective analysis of a non-forecasted rain-on-snow flood in the Alps – a matter of model-limitations or unpredictable nature?" *by* O. Rössler et al.

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Received and published: 29 January 2014

Response to Editor: We would like to thank the Editor for her helpful comments and her indication of crucial aspect in the manuscript. At first, we are very sorry for misinterpreting the review-procedure in HESS. We simply were not sure, how to respond to the very detailed comments of the two referees without referring to a revised manuscript with actual changes. As the editor gave some very helpful comments on the meteorological and the hydrological section, we would like to briefly reply to these comments:

With respect to the meteorological section, the editor raised some concerns in terms

of the overuse of the terminology "atmospheric river":

EDITOR: "Besides the many detailed aspects raised by the referees, please carefully address the first referee's questioning of the "atmospheric river" actually being one and consider whether it may be fair not to overuse this term to catch attention but to be correct in describing the atmospheric situation and classify it's unusualness regardless of terminology."

Response: The use of the term "atmospheric river" was not meant to catch attention, but to i) define the narrow corridor of strong winds and moist air masses, and ii) – more importantly - to relate the present study to the context of several recent studies relating extreme events in Europe to atmospheric rivers (AR): Stohl et al. (2008), Knippertz and Wernli (2010), Lavers et al. (2011), and Lavers & Villarini (2013). We discuss this relation in the discussion and conclusion chapters. We think that this might be of additional interest for the scientific community. We carefully checked the presents of an atmospheric river in the present case and whether it affected the Alps: We used the quite common definition of Bao et al. (2006) and Ralph and Dettinger (2011) of an atmospheric river (20 mm integrated precipitable water and 12.5 m/s wind speed) and added a contour line to the previously presented panels that encompasses all areas where the AR criteria are fulfilled. The latter was done to prove that the AR actually hit the Swiss Alps (please see also the reply to the comment of referee 1).

EDITOR: "With respect to the hydrological modelling, a large number of clarifications and thorough discussion of model concepts are necessary. One particular aspect raised by the reviewer, and that I would like to reemphasise that I also think needs some re-thinking are the parameter "adjustments". Good practices for modelling as a research tool foresee calibration, validation and verification. How does your parameter adjustment fit in there? I am aware that in operational hydrological modelling e.g. for forecasting all sorts of post-calibration adjustments and assimilations are done. However, this is a research paper, and the model experiment should be designed to lead to a better understanding of processes or to the testing of hypotheses on these pro-

cesses. How does the parameter "adjustment" exactly enter the concept the modelling concept in this respect needs to be made clear and justified within the overall research concept of the study."

Response: In terms of the hydrological modelling section, we agree that the calibration approach needs revisions and clarifications as we did not used the standard "calibration-validation-verification" approach. To explain the applied approach we rephrased one aim, added a paragraph about the recalibration procedure in the method sectors and explained why we gain more information about the processes involved by comparing the standard model with the recalibrated model. We added some sentences in the result section (3.3) to clarify the approach and its results. Last, we revised the discussion and conclusion as well to improve intelligibility. Furthermore, we followed referee 2 suggestions and extended and rephrased the section about hydrological modelling and relevant model parameters to be more transparent. We added a new table 2 that summarizes the "adjustments" of the different model parameter, algorithms and input data. Finally, a new paragraph about the transferability of the model was added to the discussion section. Finally, we replaced the term "adjusted" by "recalibrated" throughout the manuscript to express that this procedure was not arbitrary, but a recalibration under a new hypothesis about underlying processes.

We hope that the approach is more transparent now and that we could show that the research approach was designed to gain knowledge about the underlying processes as well as to prove the ability to reproduce the flood.

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