

## ***Interactive comment on “Large scale analysis of changing frequencies of rain-on-snow events and their impact on floods” by D. Freudiger et al.***

### **Anonymous Referee #1**

Received and published: 25 November 2013

The paper examines the occurrence and frequency of rain-on-snow events (RoS) in the major German river basins and proposes threshold values for the classification these events based on an analysis of the rain-on-snow event of January 2011. The analysis shows that upland basins are most influenced by RoS events and that there may be a shift of RoS from late to early winter. Overall I think this is a very interesting study on RoS events and a useful contribution to the literature on possible impacts of climate change.

What I do miss in the paper is a trend analysis of the related discharge events to support the conclusions. Using your classification method you can identify the relevant discharge events from the long daily mean discharge series that are available and it would be very interesting to see whether you can detect any changes in these data.

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I do not understand why you are saying that you need to calculate the runoff (page 13250, lines 21-26) when there are discharge measurements available. In the abstract you state that the occurrence of RoS events shifted from late to early winter and repeat this in the trend analysis (page 13244, lines 15-17). I think this is not visible in the results shown in Fig. 5., but there is some indication of such behaviour in the analysis shown in Fig. 6 and Fig. 7, even though many of the trends are not significant. Showing some analysis of the discharge data may help to support this statement.

Further comments:

Section 2.3: Did you validate the snow model against snow observations?

Page 13239, lines 13-15: I do understand how you define the RoS events, but not the RoS days – which thresholds are you referring to in this case? Please clarify.

Page 13242, lines 7-10: Did you use the response time of 6 days for all basins or did you use different ones (since you state in the next sentence that an event can vary from one to dozens of days). Please clarify.

Page 13243, lines 1-2: I do not understand this explanation. Is rain not already included in the equivalent precipitation depth?

Page 13244, lines 12-18: First you say that the late winter events become more frequent and then that there is a shift from late to early winter. Please clarify.

Figure 5: This analysis shows quite contrasting results. You say that there is a shift of events from late to early winter (page 13244, lines 15-18). However, especially for the upland catchments, there seems to be an increase in magnitude in the late winter events, which is also a very interesting phenomenon. Please comment on this in more detail in the paper.

Figure 1: Could you please add the river network?

Figure 1 caption: Remove the “a” before blue dots.

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Figure 2: I like this figure, but it is not so easy to read, could you please increase the diagrams a-f. It would also be interesting to see the runoff data for this flood event.

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