Response to the editor, Bettina Schaefli

Dear Bettina,

thank you for your comments. We have reproduced those comments below (in normal type), with our responses (in bold) including the extraction from the manuscript with information about the page and line number.

- Intro: the references for the rain-to-snow transition zone in Switzerland are most likely not appropriate; two references (McCabe, Surflet) are not from Europe I think. Zierl & Bugmann do most likely not talk explicitely about this, neither does, to the best of my knowledge, Beniston, 2003. It is, in fact, pretty hard to find a reference for this transition zone. You can cite the hydrologic atlas (the plate on regimes) for the transition from nival to pluvial regimes; we tried very hard to find a reference, but could not find one so far. It would not be a good thing to introduce the above references as references for Switzerland.

> **Thank you for this comment. We generalized this statement and removed/added another reference p.2, L: 6:**
>
> In Switzerland, mean air temperature is predicted to increase by up to 1.6 °C by 2050 (Swiss Academies of Sciences, 2016), and in mountain regions including the Alps, climate warming is expected to make rain-on-snow events more prevalent in the future, and raise the elevation of the rain-to snow transition zone (McCabe et al., 2007; Surfleet and Tullos, 2013; Ye et al., 2008).

- HESS does not like "double letter " variable names in equations; you should not have "SE" for standard deviation in the equation, only in the text. The correct solution is to have sigma (greek) in the equations

> **We cannot use sigma due to the risk of confusing notation (sigma is used for many other equations); the notation SE should be standard in Hess; see the publication by von Freyberg et. al. 2017. However, we changed the notation of SE of the equations in section 2.5; for example (p. 11, L.16):**
>
> $\mathrm{SE}_{C^*_{\mathrm{spo}}}$ is now changed to $\mathrm{SE}(C^*_{\mathrm{spo},i})$

- I did not understand what the index j is in the equations. In fact, in eq. 2 it is not clear what you mean with "since the beginning" (of what?); it would help to say what j is explicitly

> **We clarified this, see p. 10, L. 12:**
>
> The isotopic composition of snowpack outflow at day *i* was calculated as the incremental volume-weighted mean using the measured volumes of snowpack outflow or rainfall since the beginning of the event on day *j* (McDonnell et al., 1990):

-where does equation 6 come from? I do not think it is a well-known equation; you do not say what CR star is. I can deduce of course, but it could be stated explicitly

> **We clarified this, see p. 11, L. 13:**

The standard error of the volume-weighted rainwater isotopic composition, $\mathrm{SE}(C_{\mathrm{R}}^{*})$, was estimated analogously to Eq. (5) of von Freyberg et al. (2017):

- section 3.1.2: you say that the snowpacks at MF site were 5cm and 8cm. You say, however that ROS events are identified as such only if snowpack>10cm

We clarified this, see p. 17, L. 10:

Note that for events #3 and #4 the MF site had snowpacks of only 5 cm and 8 cm, respectively (although these were still identified as ROS events because snowpacks at the reference site, MG, were 29 and 43 cm, respectively).

- you have the term "catchment recharge" somewhere; what is this?

We removed this term as it does not give any important information. See p. 25. L. 27:

Similar to other studies (Gustafson et al., 2010; Taylor et al., 2002a), our data show that snowpack outflow generation can be much more variable in time than it would be implied by weekly bulk snow samples alone.

- the conclusion starts with saying that ROS events are predicted to increase in Switzerland. I do not think that we have predictions on this for Switzerland. Could you either add a reference or remove? otherwise your paper might be cited in the future for this statement.

We generalized this statement in the revised manuscript; see p.32, L.9:

In many mountain regions, global warming is predicted to lead to more frequent rain-on-snow (ROS) events, which can enhance snowmelt and increase the risk of destructive winter floods.

References

von Freyberg, J., Studer, B. and Kirchner, J. W.: A lab in the field: High-frequency analysis of water quality and stable isotopes in stream water and precipitation, Hydrol. Earth Syst. Sci., 21(3), 1721–1739, doi:10.5194/hess-21-1721-2017, 2017.

Minor Revision

Editor Decision: Publish subject to technical corrections (22 May 2019) by Bettina Schaefli
Comments to the Author:
Dear authors

thanks for the submission of the revised version, which carefully addressed the minor comments of all reviewers. The manuscript is almost ready for publication, upon correction of some technicalities.

Non-public comments to the Author:
Dear Andrea

I went carefully throught the manuscript and have a few final comments that should/could be addressed before publication (without further review from the editor side):

- Intro: the references for the rain-to-snow transition zone in Switzerland are most likely not appropriate; two references (McCabe, Surflet) are not from Europe I think. Zierl & Bugmann do most likely not talk explicitely about this, neither does, to the best of my knowledge, Beniston, 2003. It is, in fact, pretty hard to find a reference for this transition zone. You can cite the hydrologic atlas (the plate on regimes) for the transition from nival to pluvial regimes; we tried very hard to find a reference, but could not find one so far. It would not be a good thing to introduce the above references as references for Switzerland.
- HESS does not like "double letter " variable names in equations; you should not have "SE" for standard deviation in the equation, only in the text. The correct solution is to have sigma (greek) in the equations
- I did not understand what the index j is in the equations. In fact, in eq. 2 it is not clear what you mean with "since the beginning" (of what?); it would help to say what j is explictely
-where does equation 6 come from? I do not think it is a well-known equation; you do not say what CR star is. I can deduce of course, but it could be stated explicitely

- section 3.1.2: you say that the snowpacks at MF site were 5cm and 8cm. You say, however that ROS events are identified as such only if snowpack>10cm

- you have the term "catchment recharge" somewhere; what is this?

- the conclusion starts with saying that ROS events are predicted to increase in Switzerland. I do not think that we have predictions on this for Switzerland. Could you either add a reference or remove? otherwise your paper might be cited in the future for this statement.

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