

Interactive comment on “Anthropogenic climate change versus internal climate variability: Impacts on Alpine snow cover” by Fabian Willibald et al.

Anonymous Referee #2

Received and published: 14 May 2020

General comments

This paper presents the analysis of climate change trends of different variables related to the snow cover. This analysis includes data coming from a rare (if not unique) high resolution RCM large ensemble. It explores the inclusion of the Internal Climate Variability (ICV), available with such an ensemble, into the analysis of the trends of the variables and their significance. The paper also takes quick a look at the effect of climate change on the Inter Annual Variability (IAV). The analysis is done for 6 Swiss alpine stations and uses bias corrected RCMs fields used to drive the SNOWPAK snow model to obtain the snow-related variables.

I really enjoyed this paper. I thought it was very well done and I recommend its publication as I think it contributes to the general knowledge about the effect of climate change

C1

on snow.

Specific Comments

In the Introduction, the authors write about “downscaled model” but they do not specify that it is a Regional Climate Model (RCM). I think it should be corrected. In fact, RCM appears first on line 58 and is not defined.

On line 72 it is written that “Again, a single model large ensemble can help answer how inter-annual variability might respond to changes in climatic forcing”. I do not disagree but a single model simulation could do the trick or an ensemble of one member simulations of different RCMs could also do the trick. This ensemble does not strike me as ideal for that task.

On line 184 the authors write, “The same scaling factors are transiently applied to the distribution functions of 25-year slices of each ensemble member and pushed into the future by a ten year moving window.” I am not sure I understand what it means.

On figure 2, is it me or the colours of the lines are inverted from left to right (i.e. blue on left is red on right)? I also wonder what the monthly mean figures add to the daily ones.

For figure 7, I did not understand why the variable presented is snowfall fraction instead of snowfall. I understand the presentation of the validation of SNOWPAK is done with that variable but we have opposed trends for snowfall fraction and a signal for the total precipitation and we are interested into the mean and max snow depth. It seems to me it would be natural to look at total snowfall trends. I also think the sign of the trend should be visible on the figure or at least in the legend. For now we have to go look into the text to see if the trend is positive or negative.

For section 3.5, it was not clear to me if the mean used to compute the relative IAV is the mean of the reference period or the mean of every period. Generally speaking, this section was interesting but a bit light and unclear at the same time. I also think the

C2

relation between ICV and IAV could be better explored.

On line 368 it is written "From Fig. 6 and Fig. 9 we can see that a gradual decrease of winter mean and maximum snow depth leads to a decrease in absolute IAV". What does this mean? I have problems with the "leads" word.

Line 414: "temporal variability was validated in Sect. 3.1". That is not clear to me, Sect. 3.1 presented the validation of snow depth time series for SNOWPAK (fig. 2), there is no question/measure of temporal variability, no?

Technical corrections

I do not have any purely technical corrections to report.

Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2020-84>, 2020.