**Hydrology and
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Discussions**

Interactive
Comment

Interactive comment on "Mapping snow depth return levels: smooth spatial modeling versus station interpolation" *by* J. Blanchet and M. Lehning

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The authors would like to thank the reviewer J. Parajka for his helpful comments.

p.6132, l.21: the terminology smooth GEV approach appears here as it is a standard (well-known) approach (which is probably not the case). Please consider to make some definition/clarification first.
Response: By "smooth GEV" we simply mean a GEV modeling in which the parameters are modeled as smooth functions in space through the use of spatial

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covariates. This has been clarified in the introduction.

What is the advantage of using both, DEM and mean snow depth, in linear regression models (from methodological and practical views)? Both are inter-correlated, so why not to use only mean snow depth (if available)?
Response: The mean snow depth is obviously very correlated with elevation. However, it gives more information than elevation: it allows us to include some information about the local to regional variability of snow depth. In the interpolation of section 5, we tested the three combinations when i) only elevation is used as a covariate, ii) only the mean snow depth is used, iii) both are used. It turns out that models when both elevation and the mean are used perform better (this is also visible in the comparison of tables 1 and 2). More precisely, in the regression models for example, the coefficient associated to elevation is always much higher than that of the mean. This suggests that annual maximum snow depth is very likely correlated to elevation, with some moderate regional variability which is captured in the mean snow depth variable.

Are there any implications of using geographical coordinates (latitude, longitude) instead of planar x,y, e.g. for distance calculation in spatial interpolation?
Response: The latitude/longitude grid distortion over a small area such as the Swiss Alps is negligible. Planar coordinates could have been used instead of geographical coordinates without affecting our results.

Kriging method: please consider to note that no nugget variance (model) is applied in kriging. Kriging is an exact interpolation only if nugget is set to zero.
Response: This is perfectly true. In this paper we do not consider any nugget and this is why kriging is an exact method. This has been clarified in sections 5.1.4 and

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5.3.4.

Section 6: It is not so clear (in the beginning of the section), how is the smooth GEV model constructed.
Response: The "smooth GEV modeling" is a method is which the GEV parameters are directly modeled as smooth functions in space. The main difference with the interpolation approach is that in the latter, the spatial information is derived by interpolating individual GEV estimates whereas in the smooth GEV modeling it can be directly estimated from the data. This is more clearly stated in the beginning of section 6.1.

Please check the uniqueness of mathematical symbols used. E.g. the N is used once as the number of years and then also denotes the number of stations.
Response: Actually in all the paper, N denotes the number of fitting stations and n the number of years. But we agree that using both N and n might be confusing. Variable "n" has been replaced by "L" in all the paper.

Are there any significant regional differences between spatial patterns of selected return level, obtained by different approaches? Please consider to add some comments.
Response: Basically, kriging method gives for the 50-year return level map the same regional pattern, but smoother: the two extreme cases of high normalized return level (the Gotthard region) and low normalized return levels (southern Valais) become with kriging method less extreme. A reason is that each kriging is applied on $N = 84$ points only, which usually produces a too smooth process. This has been added at the end of section 6.3.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 6129, 2010.

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