

Interactive comment on “Spatial analysis of precipitation in a high-mountain region: exploring methods with multi-scale topographic predictors and circulation types” by D. Masson and C. Frei

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General comments

This well-written manuscript presents a very interesting analysis of spatial interpolation of rain gauge measurements in a high mountainous areas. While the overall conclusions are not entirely new (external drift kriging, KED, outperforms other interpolation methods), the ensemble of the presented analyses gives new insights into why or in which context other methods might (not) work. I recommend publication in HESS after moderate revisions.

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Detailed comments

Abstract: The last two sentences are difficult to understand in the context / contradict the previous statements. Is exploiting the spatial autocorrelation (i.e. KED) better or as effective as an elaborate predictor set? Do climatological background fields add something to the performance or not as suggested in the sentence stating that circulation types do not add anything (or do you mean something else than circulation types with climatological background fields?)

Introduction: As far as I see there are very few references specific for the Alps, for example for KED.

Case study:

- What are “composite means”?
- I do not understand exactly how the bootstrap experiments were completed (how is the sampling error assessed?, what is the “exact” mean referring to? For an observed sample there is no such thing as an exact mean)

Method:

- Why do you assume isotropic variograms, what could be expected from using anisotropic variograms?
- Why is the likelihood-based estimation central to the analysis (is this mentioned again)?
- P. 4651: “constant variance” is unclear here since it appears to me that you have not mentioned yet whether you estimate the variograms per time step or not (it is mentioned only much later)
- Does the transform not have some undesirable effects on high values? What is the empirical distribution of the data? Does the square-root transform suit this?

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- Math notation: HESS does not like multi-letter variable names, please use standard variable names for eq. 4 and 5.

- Bias definition: for hydrology a somewhat unusual definition, the bias is more commonly defined as a relative difference value.

Results: I think that the presentation of the results could be improved in terms of text structure; currently the fields are first described and then their performance evaluated (why not having subtitles?); combining the two might help removing the repetitions.

- I do not exactly follow what you refer to by stating at the end of 4.2 "because of the omission of stations from ...".

- It would have been nice to see somewhere a short discussion of how straight-forward KED is to apply; the estimation of variograms per time step is not necessarily a simple task; did you use any procedure to detect time steps without any exploitable autocorrelation? How were they handled?

- The readability of the figures such as Fig. 6 could perhaps be improved by replacing the squares with some other object (instead of only differentiation by colour, which is ok for the pdf)

Conclusion: Very good summary of the main findings.

Final question: was your work based on existing statistical libraries or did you code everything yourself? In the first case, a reference would be helpful.

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