Hydrology and Earth System Sciences Discussions

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

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This is a requested referee comment

The paper is of interest for the audience dealing with prediction of extreme snowfalls, and I suggest it should be published.

There are however a few issues that should be discussed in more depths, and in my view make the paper suitable for publication after some moderate revision.

I list these issues below.

Main issues

Page 2. Line 45.

Interpolation of a physically meaningful variable, like e.g. snow depth of a continuous field of snow cover on a given day or month, is different from interpolation of a quantile, which does not represent a continuous field in space. More subtle, your method (like other methods, e.g. regional methods) implies independence of quantiles, so that interpolation makes no sense (because interpolation based upon data in other sites can only be carried out if there is spatial correlation). Please make this clear, as the comparison seems improper here.

Page 3. Line 60

"for the first time".. please drop this sentence, which may be questionable, and doesn't either add or subtract anything to the value of your work.

Page 4 Line 98

"return levels" should be defined in the first place, as normally one deals with "return periods". Further, they are univocally linked to each other, so why is it necessary to use "return levels" ?

Page 5 Line 137

What do you mean "block maxima" ?

Page 6 Line 139

"dependent random.....dependence"

This is circular. Dependence should be demonstrated by statistical assessment (correlation coefficient, Spearman's ro, etc.....)

Page 6 Line 149

"optimization algorithms"

There are plenty such algorithms, with different performances. Please be more accurate.

Page 7. Line 172

"little interest in practice"

I don't see this point.

Page 10. Line 237

"positive correlation....as well"

It seems straightforward that mean snow depth is correlated with extrem snow depth. However, if one has no measured snow depths, both are unknown. Does this make sense to use a proxy variable which is also kriged ?

Page 10. Line 245

"To use.....43 winters"

I do not agree here. The smoothness of mean snow depth variable in space has little to do with the amount of data you have (which instead may increase the accuracy of the point site estimation). In stead, yearly averages will be more correlated in space than single daily values.

Page 12. Line 307.

" This however.....observation"

I do not agree here. You are not comparing two different parameter estimation methods here. Your estimated GEV parameters are the variables you take as "real" for Kriging, so your interpolated values should fit to those.

Page 13. Line 319

"This implies. . . . . ..shape"

Did you do this in Jackknife mode (i.e. withholding the know point site parameter value and back estimating it using only the others) ? Otherwise this makes little sense.

Page 14. Line 346

I think you should carry out the comparison by using the confidence bounds (as in figure 3) of the GEV distribution, to check whether the interpolated quantiles fit therein. The QQ plot seems not proper here.

Page 15. Line 362

"Note that....residuals"

I can't catch this point. You mean there is no estimation error ?

Page 16. line 390

"As...correlated, "

How comes so ? Why scale and position are correlated ? Please explain.

Page 16. Line 404.

"For the sake ......independent"

This may be true, but you should endeavour upon demonstrating it (e.g. by calculating correlation coefficients for annual maxima at different sites).

Page 20. Line 527

"Many studies....theory"

Bocchiola et al. (2008) studied extreme values of three day snow depth H72 within Switzerland using Mann Kendall test for stationarity, finding no evident trends, while Bocchiola and Diolaiuti (2010) studied climate change impact upon snow variables (average, snowfall days, etc....) within Northern Italian Alps.

References

Bocchiola, D., Bianchi Janetti, E., Gorni, E., Marty, C., Sovilla, B.(2008). Regional evaluation of three day snow depth frequency curves for Switzerland, NHESS, 8, 685-705. Bocchiola, D., Groppelli, B. (2010). Spatial estimation of Snow Water Equivalent at different dates within the Adamello Park of Italy, CRST, 63(3), 97-109, 2010. Bocchiola, D., Diolaiuti, G. (2010). Evidence of climatic trends in the Adamello glacier of Italy, Theor. App. Climat., 100, 3-4, 351-369.

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Discussion Paper