

Interactive comment on “Incorporating landscape characteristics in a distance metric for interpolating between observations of stream water chemistry” by S. W. Lyon et al.

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General comments

This paper presents a method for incorporating landscape characteristics in a geostatistical interpolation approach for stream water chemistry. The paper is generally well written and the method is appealing due to the conceptually simple approach. Instead of only using the spatial distance between observations as in traditional kriging, the authors suggest to an adjusted distance metric that also takes the difference in one or more attributes into account. The authors present cross-validation results indicating that the method reduces the prediction errors. Although I do believe that the method

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can improve the results, I suggest that the authors show this in a different manner than they have done in this discussion paper.

An interesting side-effect of the method is the possibility to test which landscape characteristics are most influential for the spatial patterns of stream water chemistry.

I recommend the paper for publishing, but would like to make a few remarks, most of them minor.

Specific comments

Page 1292

It seems to me like the authors are trying to give a review of different methods for taking non-euclidian distances into account for interpolation of stream-flow related variables.

There are then a few other methods that could be relevant for this study:

- Directional trees (Bailly, et al., 2006; Monestiez, et al., 2005)
- Physiographical space based interpolation (Chokmani and Ouarda, 2004)
- Regularization of point variogram/correlogram (e.g. Gottschalk, 1993a; b; Gottschalk, et al., 2006; Sauquet, 2006; Skøien and Blöschl, 2007; Skøien, et al., 2006)

Table 3 and description of cross-validation

If I understand the method for selecting the best adjusted distance metric correctly are the results in Table 3 a bit deceiving. For the EUC and INS methods, K_{RMSE} describes the results from leave-one-out cross-validation. However, for the ADJ method, K_{RMSE} seems to be the calibration RMSE, not the validation RMSE, as it is the K_{RMSE} resulting from a calibration of the weighting factor in the method. I would suggest redoing these analyses in the following manner:

- a remove one observation
- b use the suggested method (including cross-validation) to identify a proper distance metric
- c make a prediction at the location from a) and compare with observation to get the

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squared error

d repeat for all observations

This will give the correct cross-validation K_{RMSE} for the ADJ method. If the cross-validation was actually done this way, this is not clear from the text.

Additionally, it would have been interesting to see other quality measures of the method, including ability to estimate extremes (does the method give smoother results than ordinary kriging?) and eventual biases.

p. 1294, lines 22-23

I think the authors could add a sentence to explain the use of median instead of mean and maybe also consider the effect of different probability distributions for the distance measure a .

Section 2 (and subsection 2.2)

I find the organisation of section 2 a bit confusing, as subsection 2.2 appears to be a data section between different method sections. I would advise a different order of the subsections.

p. 1296 and table 1

Table 1 indicates that most of the variables have highly skewed probability distributions (lognormal?). Although this does not affect the method in itself, a log transformation of the data would maybe strengthen the conclusions of the paper. RMSE of predictions of highly skewed data will usually put most of the emphasis on the largest values.

p. 1301, line 10 and Table 4

The table indicates a reduction both in sill and range for all three constituents. This could be mentioned.

Technical corrections:

p. 1292, line 2

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Should "on the landscape" be changed to "in the landscape"?

p. 1292, line 5-6

I find this sentence unclear.

p. 1298, line 26

For consistency, consider using indices also for x , as x_{ij} . Give a reference to E_{ij} , d_{ij} and h_{ij} .

p. 1299, line 5

Length should probably be distance

p. 1303, line 14-15

End of the sentence starting with "This shortcoming of..." is clumsy and should be rewritten.

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