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Hydrology and Earth System Sciences Discussions

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

S. W. Lyon et al.

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We thank Jon Skøien for an overall favorable review of our manuscript. The review puts forth several specific comments and technical corrections. All technical corrections suggested by the reviewer have been adopted for the revised manuscript. We address the specific comments in the following response.

The first general comment from this reviewer is that the manuscript should include a more thorough review of existing stream interpolation methods using non-Euclidean distances. This is a valid comment, which we partly already reacted to in response to a similar comment of the first reviewer, Juraj Parajka. The reviewer offers several additional references to be included in the introduction section. The suggested references

have been incorporated into the introduction (page 5, line 19) using the following text:

'Recent work by Skøien et al. (2006, 2007) provides a method (Top-kriging) which takes both the area and the nested nature of catchments into account to estimate streamflow-related variables in ungauged catchments. This concept focuses on manipulation of the semivariogram estimate and builds upon the early work of Gottschalk (1993a, 1993b) with extension by Sauquet et al. (2000) developing a method for calculating covariance along a river network to interpolate along the network. Directional trees corresponding to drainage network structure (i.e., channel width) have been used to modify the geostatistical framework (Monestiez et al., 2005; Bailly et al., 2006). Chokmani and Ouarda (2004) used a physiographical space-based kriging method incorporating physiographical and meteorological characteristics of stream gauging stations with multivariate analysis techniques to modify in-stream distance.'

The second general comment obviously demostrated a lack of clarity in our text. The reviewer suggests a method of computing kriging root mean squared error (KRMSE) for the adjusted in-stream distance metric that actually is the same as we already used in the original manuscript. We computed the leave-one-out cross validation error (KRMSE) for every possible combination of landscape characteristic and omega and then identified the combination that minimized KRMSE. The methodology used to do this was identical to that outlined by this reviewer. The KRMSE reported in Table 3 for each constituent, therefore, is a validation as it is minimum leave-one-out cross-validation error for all possible combinations of attribute and weighting factor. We have modified the text to help clarify this in the manuscript.

The review (similar to the first reviewer, Juraj Parajka) requests another quality measure of the method that is better able to identify cross-validation method to determine the influence of extreme values and detect existing of bias. We have computed cumulative error distributions (error defined as observed concentration minus predicted concentration) to compare the at-site interpolated values for each of the nine constituents considered in this study. These cumulative error distributions (Figure 5 in the revised

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manuscript) indicate that there are no clear effects of extreme values or strong bias in the interpolation. Text and discussion of these cumulative error distributions have been added to the revised manuscript.

The reviewer suggests some justification be included for the use of median values to scale distance and landscape characteristics and not mean values. The median may give a better indication of central tendency than mean and is typically thought of as giving a measure that is more robust in the presence of outlier values than the mean. Text has been added (page 8, line 8) to clarify. In addition, the reviewer suggests considering other probability distributions in this study. Specifically, he suggests a log transformation of data to account for the possibility of skew in observed data. Such considerations (as pointed out by the reviewer) do not influence the method proposed and as such are outside the scope of this study. Rather, we point to the inclusion of the cumulative error distributions showing no clear effects of extreme values or strong bias in the interpolation as presented in the original manuscript. This figure indicates there is no clear need for a log transformation of the observations in this study.

The reviewer recommends a rearranging of Section 2 (Methods) to help improve the presentation of the manuscript. We have, thus, moved and renamed the original Section 2.2 (Input data) to before the Methods section. This creates a new section entitled 'Data description' and removes all but methods from the methods section.

The final general comment from this reviewer points out that Table 4 indicates a reduction both in sill and range for all three constituents and suggests including direct reference to this in the text. We elect not to highlight this in the text as this trend is not clear for all nine constituents considered in this study. Also, we have (at this time) no clear justification or interpretation for such a possible trend.

References:

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Interactive Comment

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