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Hydrology and Earth System Sciences Discussions

Interactive comment on "Interpolation of groundwater quality parameters with some values below the detection limit" *by* A. Bárdossy

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1 General comments

András Bárdossy presents a novel application of copulas by taking values below the detection limit into account. Locations with these measurement contain valuable information for an interpolation. Modelling of values below the detection limit and their

influence on neighbouring locations is a difficult task and the author shows that his copula approach performs better than classical kriging approaches (indicator kriging; ordinary kriging). Some details in his approach however remain unexplained and this makes the paper less accessible especially to the non-expert reader. Besides the excelelnt comments given by Geoff Pegram, we would like to draw the author's attention to the following issues:

- The naming of cumulative distribution functions changes frequently from one equation to another. A constant notation throughout the paper would increase readability.
- Some annotations to equation (1) explaining the to some degree unusual likelihood function might help the understanding of the paragraph.
- The v-transformed variable X_j defined in equation (7) follows a non-centred χ distribution rather than a χ-*squared* distribution - unless some details have been hidden.
- Following equations (10) and (11) it is stated that "the variable y is now normal". This is true for the variables without ties, but the sample will not show a histogram close to a normal distribution. All the values set to the detection limit will result in a large fraction of ties (even though a few different detection limits may be present). How was this issue solved in the application?
- It is stated on page 5272 that the interpolation is applied to a local neighbourhood. The interested reader, though, might be interested in the actual dimension of the spatial copula used.
- Arguing why the LEPS score given in equation (26) is a useful measure in this application might clarify the choice.

- In response to p 5280, line 2-4, and in response to the widely held belief that kriging variances are not a good meaures for interpolation erroor, we would like to add that Heuvelink, G.B.M. and E.J. Pebesma in 2002 argued in "Is the ordinary kriging variance a proper measure of interpolation error?" (published in: Proceedings of the fifth International Symposium on Spatial Accuracy Assessment in Natural Resources and Environmental Sciences (eds. G. Hunter and K. Lowell). Melbourne: RMIT University, 179-186) that the kriging variance is a good measure of interpolation error for those cases where the multivariate Gaussian is a good model for the data.
- Even though Figure 11 seems mainly to be meant for showing the different spatial and measurement induced structures of uncertainty associated to the methods, an adjustment of scales should be considered to increase readability.

2 Minor, detailed comments

equation (6) there is one "(" too many

p: 5278, l: 14 the reference should probably not be given as noun here (as well as in a few other instances)

p: 5280, l: 12: *In* regions with . . .