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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This paper presented a novel approach for spatial interpolation of parameter values below the detection limit, using the concept of spatial copulas which considers the spatial dependence as a function of both data configuration and data values. The methodology is well described. The application presented in the paper demonstrates the strength of this approach compared to the traditional ordinary kriging and indicator kriging method in terms of handling different degrees of censoring, interpolation accuracy and estimation of interpolation uncertainties. Given the frequently encountered detection limit problem in environmental parameter measurements and the limitations of the traditional methods in treatment of such problem, this paper is a valuable contri-

bution to the hydrology and earth system sciences. I recommend the paper should be published with minor modifications.

I have a few specific comments:

1. The derivation of Eq. (2) should be provided.

2. In Eq. (3), the meaning of the notation "n" should be clarified.

3. In Eq. (12), the second term on the right hand side of the equation is derived by integrating the bivariate normal distribution density function over the range of the detection limit of the observation value that is below the limit. I recommend this point should be mentioned in the text. In addition, in the parameter estimation, the likelihood function only consists of bivariate distributions, it should be possible to extend to higher dimensions. The reason of the restriction should be mentioned.

4. On page 5272, the multivariate part of Eq. (21) is well explained, the marginal part, i.e., $P(Y(x)=y)$ is a 1-D normal distribution. For the sake of completeness, it is better to add this explanation.

5. On page 5275, line 1, after the expression "which would correspond to $Zlim > max(z_i, i=1,...I)$", a reference to Eq. (1) should be added.

6. On page 5275, line 5 to 6, "As a rule of thumb the value of zlim was artificially chosen 50% above the largest detection limit.", adding a reference to that is more convincing.

7. On page 5275, line 18, when talking about the parameter B, Eq. (19) should be referred to.

8. On page 5276, line 6 to 8, the light blue line corresponds to the 75% quantile at each corner, while the gray line corresponds to the 75% quantile at three corners and 95% quantile at the forth. But why Figure 3 shows that the blue line is more skewed to the high value side than the gray line? Should that be the other way around? I expect that the curve should be more skewed to the high value side if there is a larger observed

value.

9. On page 5276, in the paragraph starting from line 4, the three cases listed above should be mentioned in the text for clearer descriptions.

10. In Eq. (26), the meanings of the notations (z and z^*) should be listed.

11. On page 5280, in the second paragraph, since Fig. 9 shows the result from Indicator Kriging as well, IK should also be mentioned in the text.

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