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Hydrology and Earth System Sciences Discussions

Interactive comment on "Application of Weighted Semivariogram Model (WSVM) based on fitness to experimental semivariogram on estimation of rainfall amount" *by* S.-J. Wu et al.

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This paper proposes the use of a linear combination of semivariogram models as a way to account for uncertainty attached with semivariogram parameters in spatial prediction (i.e. kriging). In a case-study, the so-called weighted semivariogram model fitted using cross-validation. I have several concerns regarding this approach: 1. It is purely empirical and the mixture of semivariogram models, albeit permissible, has no physical meaning, violates the parsimony rule and unnecessarily increase the CPU time of the kriging algorithm. Ans: The proposed WSVM intends to combine the TSVMs

by taking into account the fitness to experimental semivariogram and its advantage is without determining the best-fit model, which is generally accomplished using the cross-validation, in order to save computational time. Thus, in theory, the WSVM is an empirical model and the corresponding weights to the TSVMs desired can vary with various observation or regions. However, since this study adopts the conventional Kriging method associated with a basic assumption of the stationary covariance function, a future work on the WSVM is to demonstration its applicability in non-stationary situation.

2. Cross-validation is a hazardous way to estimate the parameters of a semivariogram model since results depend on many implementation parameters, such as the search strategy, in addition to the semivariogram model itself. In addition, results can be very unstable when few observation are available. The statement on Page 4240, line8 that cross-validation is widely used for semivariogram modeling is misleading. Ans: In this study, the cross validation is majorly used in the selection of the best-fit TSVM, and the associated parameters are calibrated by means of the sensitivity-parameter-based genetic algorithm developed by Wu et al., (2011), using the observed rainfall amount of rainstorm events. And, on Page 4240, line8, the sentence would be amended as "cross-validation is widely used for the identification of the best-fit semivariogram model". âĂć Wu. S.J., Lien, H.C., and Chang, C.H., 2011. Calibration of Conceptual Rainfall-Runoff Model using Genetic Algorithm Integrated with Runoff Estimation Sensitivity to Parameters. Journal of Hydroinformatics (in press).

3. The case-study is based an unrealistically small number of observation, which likely creates very unstable semivariogram and prediction error statistics. Surprisingly, this manuscript does not include any figure with experimental semivariograms and some models fitted using cross-validation. The main conclusion might just be that the average of poorly fitted semivariogram models provides slightly more accurate prediction than each individual. My advice would be to increase the number of observation and replace the black-box cross-validation approach by a graphical modeling strategy that

allows one to incorporate any auxiliary information available about the study area (e.g. semivariogram elevation) and phenomenon. An alternative is to use a ML and REML approach that requires fewer observation to estimate reliable semivariograms (Pardo-Iquzquiza, 1997; Lark, 2000; Kerry and Olivar, 2007). Kerry, R. and Oliver, M.A., 2007. Sampling requirements for variograms of soil properties computed by the method of moments and residual maximum likelihood. Geoderma, 140, 383-396. Lark, R.M., 2000. Estimating variogram of soil properties by the method-of-moments and maximum likelihood. European Journal of Soil Science. 51, 717-728. Pardo-Iguzquiza, E., 1997. MLREML: a computer program for the inference of spatial covariance parameters by maximum likelihood and restricted maximum likelihood. Computer and Geosciences, 23, 153-162. Ans: This study select the Shinmen Reservoir watershed as the study area, because the associated 14 rainfall gauges is approximately uniformly distributed throughout the watershed (see Figure 2), where this is hardly found in Taiwan. In fact, the more observation can obtain more accurate parameters. In addition, the uncertainty in the optimal parameters should be caused by the number of rainstorms used in the parameter calibration. Therefore, this uncertainty may be reduced using the other optimization method, such as the ML and REML approach, and this is another future work. Eventually, since this studys focuses on the comparison of estimated rainfall amount by the WSVM and TSVM, we only show and discuss the difference of the estimations of rainfall amount.

5. Technical corrections a) Page 4233, line 7. N(h) is the number of observation separated by a distance h. b) Page 4234. Interestingly, the nugget effect is missing from the list of models. Of course, nugget effect cannot be estimated by cross-validation! c) Page 4234, line 13. Use the expression “lags” instead of “distance ranges.” d) Page 4235, line 14. The correct reference is Equation (9). e) Page 4234, line 15. The notation rm,i(h) is inconsistent with the notation in Equation. Ans: The abovementioned errors would be corrected in the revision version of our manuscript.
