Hydrol. Earth Syst. Sci. Discuss., 9, C998–C1001, 2012
www.hydrol-earth-syst-sci-discuss.net/9/C998/2012/

Hydrology and Earth System Sciences Discussions

Interactive comment on "Generating spatial precipitation ensembles: impact of temporal correlation structure" *by* O. Rakovec et al.

Anonymous Referee #1

Received and published: 18 April 2012

GENERAL COMMENTS AND RECOMMENDATION

The manuscript presents an exercise of geo-statistical simulation of rainfall fields conditioned to rain gauge measurements. The experiment is based on generating ensembles of rainfall fields using the well-known sequential simulation approach (Goovaerts 1997). The exercise assumes spherical variograms to model the spatial and temporal variability of the rainfall field. The generator has been applied for some synthetic and real situations in the Belgian Ardennes.

The manuscript is well written and technically correct. Also, the potential applications of the developed ensemble generator are multiple (although they could be further discussed), which makes the presented development very interesting. However, the presented study is limited to demonstrate the sequential simulation algorithm and to an-

alyze the dependence of the Coefficient of Variation on different factors (such as the time-memory of the ensemble, size of the catchment, speed of the system). However, the interest of some of the analyses is not very clear or not discussed enough, and little interpretation of the presented results is provided.

Therefore, I cannot recommend the publication of the manuscript in its present form. I encourage the authors to make major modifications to the manuscript, and in particular to illustrate the potential of the algorithm with some further application of the generated ensembles.

MAJOR COMMENTS

1) The Introduction mentions that the objective of the study is to "define a plausible precipitation ensemble generator using rain gauges". However, further justification of the interest of the developed methodology could be useful for the reader.

2) What are the parameters needed in the ensemble? I miss some further analysis/discussion on how the different parameters could be estimated in a real situation.

3) Some discussion on the implications of the used semi-variogram is needed. How would the results depend on the semi-variogram model? Would it be feasible to use sample semi-variograms? Is the spatial anisotropy of the rainfall field considered?

MINOR COMMENTS

1) Page 30, line 4: "precipitation estimates by weather radar are prone to biases". Not only to biases but, in general, prone to errors. Similarly, page 30, line 7: rain gauge measurements are not only "to adjust radar precipitation fields for bias", but to mitigate the errors in radar rainfall estimates.

2) Page 3092, line 18. Do the authors mean Eq. (1)?

3)In Eq. (3) it could be mentioned that i,j stand for the time steps.

4) The notation of Eq. (4) is not very intuitive. I was confused by sub-indices j,t.

5) Page 3095, lines 5-9: “This approach is widely employed by catchment hydrologists, who are interested in the overall uncertainty over the precipitation event (. . .). The second way quantifies the uncertainty across the ensemble for each individual time step and is more of an interest for hydrologists dealing with flood forecasting”. Could the authors develop this argument a little bit more?

6) Page 3096, line 8, and elsewhere: “a synthetic spherical rainfall cell”. Would it be a circular rainfall cell?

7) Kriging is known to produce Best Linear Unibiased Estimates. However, the simulation is done over the transformed variable. How does it affect the simulations of rainfall? Would they be biased? How would this affect the use of these ensembles?

8) Figs. 10-12. I would recommend the authors to explicitly mention in the figure captions that the different points in each panel are for different points of the basin. In the caption of Fig. 11 “for four ensemble realizations”: are not the panels for four time steps?

9) Page 3101, first paragraph: I miss some further interpretation of these results. The differences in the different panels of Figs. 13 and 14 are only due to the sampling sizes? How are the results in the smaller catchments location-dependent? Would they significantly change in other subdomains of the same size?

10) Page 3102, lines 6-10: “Nevertheless, the impact of this discontinuity decreases for larger catchments, which is caused by a limited spatial extent of the synthetic spherical rainfall cell advecting over the catchment”. It is unclear what the authors mean.

11) Page 3102, lines 9-11: Please, add a comma after “. . .using the lumped CVJ”. Lines 11-13: specify “By fitting the spherical model, the range of the variogram can be obtained”.

12) Fig. 16. How was the advection speed of the real-world cases estimated?

13) Equation (10). Please, specify that the range in the equation has units of time.

14) The authors model the time correlation of the rainfall field in fix coordinates (from the rain-gauge perspective), and equation (10) and Fig. 16 show that the slower the systems, the larger the time correlation. However, rainfall fields show significantly larger time correlation in moving coordinates (i.e. removing the effect of advection in the evolution of the rainfall field), which is independent of the advection speed. For instance, the time correlation of the synthetic experiment in moving coordinates would be exactly 1. In this sense, realistic rainfall ensembles should also reproduce the time correlation of rainfall systems in moving coordinates. Could the authors comment on this aspect?

15) It could be interesting to know the authors’ opinion on how could radar data be used to further condition the generated ensembles.

16) Some of the figure panels (e.g. Figs. 5-9, 13-15) are too small.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 3087, 2012.