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Hydrology and Earth System Sciences Discussions

Interactive comment on "Rainfall nowcasting by at site stochastic model P.R.A.I.S.E." *by* B. Sirangelo et al.

A. Montanari (Referee)

alberto.montanari@unibo.it

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The literature repeatedly considered the use of stochastic processes for performing real-time forecasting of rainfall. The present paper provides a good review of the state of the art. I think the authors could also make reference to the works of Burlando et al. (1993) and Toth et al. (2000) who performed similar analyses. Looking at the results of the previous works and in view of the tools that are today available for predicting rainfall, I believe stochastic processes can still be useful to this purpose. They also allow one to derive confidence intervals for the rainfall forecast, which are very important in the context of flood prediction. Therefore I think the present study focuses on an issue which is still topical. Moreover, the paper provides a significant new development with respect to the previous studies. A strong feature of this work is the derivation of the joint

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probability distribution of the predictand and predicted random variables, that allows one to derive the confidence intervals of the forecast. This joint probability distribution is a Weibull-Bessel bivariate probability density that is shown to well reproduce the marginal probability density of the rainfall data. I think this is an interesting development and therefore I am recommending publication of this paper.

The previous applications of stochastic processes for predicting rainfall focused on univariate and multivariate techniques (an example of application of a model of this latter type is presented by Burlando et al., 1996). Univariate models, like the one that is used here, focus on at-site prediction at a single location in space. They present the relevant advantage of a simpler application and a less intensive data requirement with respect to multivariate approaches. However, it is important to note that the forecasting provided by linear and univariate stochastic processes always converges towards the mean value (indicated with the symbol μ_H in the present paper) as the lead time of the forecast increases. This is clearly shown by the figures of the present paper. Therefore, this class of models cannot predict the time location of the hyetograph peak. For this reason I think they are better suited for predicting the shape of the recessing limb of the hyetograph, depending on the correlation structure of the current rainfall event. I think this feature of the proposed approach should be discussed in the paper, as I believe it is very relevant.

Another point that I think deserves to be discussed is related to the assumptions of linearity and weak stationarity within the rainfall event. The hypothesis of linearity is clearly not satisfied and even the assumption of weak (i.e. second order) stationarity is questionable. It is well known that the mean value, variability and correlation of rainfall can undergo significant and sudden changes, even at a fixed location and even within a persistent rainfall event. Of course these limitations do not reduce the value of the proposed approach from a technical point of view. Any assumption should not be seen exclusively as a constrain. In this case I believe linearity and stationarity constitute an asset of the proposed model. Even if these hypothesis are not fully satisfied, we

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know that they have been often introduced to be able to profit from the presence of persistence in rainfall, for the sake of predicting the future of the storm. However I think these issues should be discussed in the paper.

In the introduction of the paper, the Authors provide a description of the features of linear stochastic processes and point processes that I did not understood. They write that autoregressive processes allow one to describe rainfall at fixed locations in the time axis, while point processes allow these locations to be defined in a random way. I believe both autoregressive processes and point processes describe the stochastic process along the time axis, at discrete time steps for autoregressive processes and continuously in time for point processes. The main difference between an autoregressive process and a point process is that the former is linear while the latter not. As a consequence, the former is not intermittent while the latter is intermittent. Therefore, autoregressive processes can be applied for describing the "within storm" rainfall, while point processes can simulate interstorm periods also.

The Authors use the term "rainfall depth" and "rainfall height" as synonymous. I would suggest to use always the same term.

I believe the part devoted to the computation of the partial autocorrelation coefficients could be redundant and substituted with a proper reference. This change would probably allow the Authors to make the paper more easily readable.

I did not understand why the authors prefer to fix a threshold value for the partial autocorrelation instead of using the 95% confidence interval of the null value, in order not to reject the hypothesis of null partial autocorrelation. I also did not understand the text at page 154, lines 24-26.

I would like to congratulate with the authors for this work.

References

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