

Interactive comment on “Hydrologic response of a semi-arid watershed to spatial and temporal characteristics of convective rain cells” by H. Yakir and E. Morin

Anonymous Referee #2

Received and published: 13 December 2010

This manuscript describes i) a procedure for the estimation of rain fields over a given area by using a cell-based rainfall model, and ii) the analysis of runoff response to rain cell characteristics. Runoff response is examined by means of a semi-distributed hydrologic model. In the cell-based model, the rainfall field is produced by the superposition of a sample of rain cells, each characterised by geometrical and kinematic parameters. I found this paper very interesting and potentially very useful for evaluating the detail of rainfall spatial variability required for runoff modelling, especially in semi-arid areas where convective precipitation is the dominant process for heavy precipitation events. This approach is of interest, because it allows one to isolate hydrologically-

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relevant cell properties, such as direction, location, and velocity, and to investigate the hydrologic response of watersheds to changes in these properties. The paper is well organized, concise, and scientifically sound. However, I think that with some modifications it could make a stronger point. My recommendation is that the paper is accepted for publication after a minor revision. My comments are listed below.

Technical comments

P7726, L23-25. Here the authors review previous work on runoff sensitivity analysis to rainfall characteristics. Actually, there is a large body of work on stochastic models of storm rainfall based on the theory of point processes (LeCam, 1961; Gupta and Wymire, 1979; Northrop, 1998; among others). Usually the building blocks for the spatial component of these storm rainfall model are the marked point processes, while the modeling of the cell characteristics is very similar, in many respects, to the one advanced in this work. In my opinion, this body of work is relevant for the development of the rain cell model advanced in this work. The authors should describe how their work is linked and in which respect it differs with reference to the above mentioned body of research.

P7728, L8-9. The clarity of this sentence should be improved.

P7728, L16-17: “The location of the storm over the main channel is also of great importance (Morin et al., 2006).” This is a very important point, which should be emphasized. Runoff routing through branched channel networks imposes an effective averaging of spatial rainfall excess at equal travel time, in spite of the inherent rainfall spatial variability. Previous work on this subject has been done by Sangati et al., (2010), Viglione et al. (2010) and Zoccatelli et al. (2010).

P7733, L6-8. “The cell’s parameters are assumed to remain constant in time. From the tracked cell data we computed for each parameter the median value and used it for the parameter value throughout the cell’s life span.” Please explain the implication of this assumption, which has important consequences on the physical realism of the rain

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model. Also, accordingly with Reviewer 1, please describe in more detail the tracking algorithm.

References:

Gupta, V.K., and E.C. Waymire 1979: A stochastic kinematic study of subsynoptical space-time rainfall. *Water Resources Res.*, 15(3), 637-644.

LeCam L, 1961: A stochastic description of precipitation. In Fourth Berkeley Symposium on Mathematical Statistics and Probability, vol. 3, pp. 165-186, Univ. of California, Berkeley, 1961.

Northrop, P.J., 1998: A clustered spatial-temporal model of rainfall. *Proc. R. Soc. Lond. A* 454, 1875-1888.

Sangati, M., M. Borga, D. Rabuffetti and R. Bechini, 2009: Influence of rainfall and soil properties spatial aggregation on extreme flash flood response modelling: an evaluation based on the Sesia river basin, North Western Italy. *Advances Water Resources*, 32, 7, 1090-1106.

Viglione A., Chirico G.B., Woods R., Blöschl G., 2010b. Generalised synthesis of space-time variability in flood response: An analytical framework. *J. Hydrol.*, doi:10.1016/j.jhydrol.2010.05.047.

Zoccatelli D., M. Borga, F. Zanone, B. Antonescu and G. Stancalie, 2010: Which rainfall spatial information for flash flood response modelling? A numerical investigation based on data from the Carpathian range, Romania. *J. of Hydrology*, 394 (1-2), 148-161. doi:10.1016/j.jhydrol.2010.07.019.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 7725, 2010.