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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Stochastic semi-continuous simulation for extreme flood estimation in catchments with combined rainfall-snowmelt flood regimes" *by* D. Lawrence et al.

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In the paper is presented the application of the semi-continuous simulation framework called SHADEX for estimating extreme floods. This combines a probabilistic model for generating synthetic storms, based on a weather-type classification procedure, with a lumped conceptual rainfall-runoff model, accompanied by a snow modeling component. The methodology is tested in three Norwegian catchments and compared with two alternative approaches, i.e. a simplified engineering method, based on the classi-

cal event-based approach, as well as a fully-continuous method, employing the HBV model. They are also compared with the GRADEX method for flood frequency analysis. The proof of concept is very comprehensive and provides useful lessons, not only to the scientific community but also to engineers.

It is an excellent paper, well-written, very interesting and within the state-of the-art topics of hydrological research. Although the reader cannot follow all details of the methodology, the authors make significant effort to summarize the key concepts and clarify them as much as possible. I strongly recommend for publishing this article, taking into account few minor comments that are listed below.

1) The key message of this paper is summarized in the following phrase (p. 6808, line 28 to p. 6809, line 2): "Of primary interest to the practitioner is the capacity to generate a large range of possible rainfall magnitudes and catchment conditions that can produce an XX-year discharge, rather than requiring the assumption that an XX-year precipitation event produces the corresponding XX-year flood." To my opinion, this should be further highlighted in the introduction, also adding one or two representative citations. In particular, the significance of the temporal distribution of rainfall is rather underestimated in most of real-world flood studies, which are typically employed assuming a single design storm.

2) As mentioned in the text (p. 6793, line 5), one of the advantages of the SCHADEX method is the wide range of events that can be generated (in the particular study, $\sim$ 2 million). Could this method work similarly well in arid or semi-arid areas, where the frequency of the observed rainfall events is much lower than in humid climates?

3) I have been surprised by the peak-to-volume ratios estimated for the river basins of Atnasjø (1.04) and Engeren (1.01). The authors explain this as result of "the smaller catchment area as well as the regional precipitation regime" (p. 6797, line 26). Yet, the magnitude of the catchment areas (463 and 395 km2, respectively) cannot justify such low ratios. I do think that a more convincing physical explanation is required here. It is

interesting to notice that the simulated values are higher, thus more realistic (p. 6802, line 2).

4) For a more fair comparison, it would be useful to run the MODOR model in continuous simulation mode, instead of the HBV. The differences in the parameterization and calibration of the two models are obviously reflected in the simulated flow data.

5) It would be useful adding a comparison table with characteristic design values (e.g., Q1000, Q500, Q100), provided by the various approaches. A comment on the difficulty and computational effort of each approach would be also valuable.

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