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Climatic and basin factors affecting the flood frequency curve: PART II – A full sensitivity analysis based on the continuous simulation approach combined with a factorial experimental design

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Abstract. The sensitivity analysis described in Hashemi *et al.* (2000) is based on *one-at-a-time* perturbations to the model parameters. This type of analysis cannot highlight the presence of parameter interactions which might indeed affect the characteristics of the flood frequency curve (ffc) even more than the individual parameters. For this reason, the effects of the parameters of the rainfall, rainfall runoff models and of the potential evapotranspiration demand on the ffc are investigated here through an analysis of the results obtained from a factorial experimental design, where all the parameters are allowed to vary *simultaneously*.
This latter, more complex, analysis confirms the results obtained in Hashemi *et al.* (2000) thus making the conclusions drawn there of wider validity and not related strictly to the reference set selected. However, it is shown that two-factor interactions are present not only between different pairs of parameters of an individual model, but also between pairs of parameters of different models, such as rainfall and rainfall-runoff models, thus demonstrating the complex interaction between climate and basin characteristics affecting the ffc and in particular its curvature.
Furthermore, the wider range of climatic regime behaviour produced within the factorial experimental design shows that the probability distribution of soil moisture content at the storm arrival time is no longer sufficient to explain the link between the perturbations to the parameters and their effects on the ffc, as was suggested in Hashemi *et al.* (2000). Other factors have to be considered, such as the probability distribution of the soil moisture capacity, and the rainfall regime, expressed through the annual maximum rainfalls over different durations.

Keywords: Monte Carlo simulation; factorial experimental design; analysis of variance (ANOVA)

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