Geophysical Research Abstracts
Vol. 12, EGU2010-13713, 2010
EGU General Assembly 2010

Detection of dominant runoff generation processes in flood frequency analysis

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The investigation on hydrologic similarity represents one of the most exciting challenges faced by hydrologists in the last few years, in order to reduce uncertainty on flood prediction in ungauged basins (e.g., IAHS Decade on Predictions in Ungauged Basins (PUB) - Sivapalan et al., 2003). In perspective, the identification of dominant runoff generation mechanisms may provide a strategy for catchment classification and identification hydrologically omogeneous regions. In this context, we exploited the framework of theoretically derived flood probability distributions, in order to interpret the physical behavior of real basins. Recent developments on theoretically derived distributions have highlighted that in a given basin different runoff processes may coexistence and modify or affect the shape of flood distributions. The identification of dominant runoff generation mechanisms represents a key signatures of flood distributions providing an insight in hydrologic similarity.
Iacobellis and Fiorentino (2000) introduced a novel distribution of flood peak annual maxima, the "IF" distribution, which exploited the variable source area concept, coupled with a runoff threshold having scaling properties. More recently, Gioia et al (2008) introduced the Two Component-IF (TCIF) distribution, generalizing the IF distribution, based on two different threshold mechanisms, associated respectively to ordinary and extraordinary events. Indeed, ordinary floods are mostly due to rainfall events exceeding a threshold infiltration rate in a small source area, while the so-called outlier events, often responsible of the high skewness of flood distributions, are triggered by severe rainfalls exceeding a threshold storage in a large portion of the basin. Within this scheme, we focused on the application of both models (IF and TCIF) over a considerable number of catchments belonging to different regions of Southern Italy. In particular, we stressed, as a case of strong general interest in the field of statistical hydrology, the role of procedures for parameters estimation and techniques for model selection in the case of nested distributions.

References

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