Geophysical Research Abstracts
Vol. 13, EGU2011-11742, 2011
EGU General Assembly 2011

Flood frequency estimation for ungauged basins through A spatially distributed continuous simulation approach

Stefania Camici (1), Angelica Tarpanelli (1), Luca Brocca (1), Florisa Melone (1), Tommaso Moramarco (1), and Marco Franchini (2)

(1) Research Institute for Geo-Hydrological Protection, National Research Council, Perugia, Italy (s.camici@irpi.cnr.it), (2) Department of Engineering, University of Ferrara, Ferrara, Italy

The high floods occurred in the last years have increased the interest of local, national and international authorities on flood risk assessment. In this context, the design flood estimation represents a crucial factor, mainly for ungauged or poorly gauged catchments where sufficiently long discharge time series are missing. To address this issue the "continuous simulation" approach, based on stochastic rainfall and temperature generation models in conjunction with a continuous rainfall-runoff model, has been recently proposed.
Generally an approach of lumped type is used for inferring the flood frequency distribution of small-medium catchments (∼ 10-300 km2). In particular, the methodology was found robust and reliable in reproducing observed data in several catchments located in central Italy and, hence, for estimating the design flood values for high return periods (100-500 years) (Camici et al., 2011). However, for large basins (>500 km2), a spatially distributed scheme both for stochastic generation of rainfall (and temperature) and for continuous rainfall-runoff modelling should be employed. Unfortunately, due to the model increased complexity, it is not fully clear to what extent the distributed approach can provide reliable simulations.
This issue is investigated here by applying a semi-distributed continuous simulation rainfall-runoff model (named MISDc, "Modello Idrologico SemiDistribuito in continuo") along with a novel and fast procedure for stochastic generation rainfall patterns. In particular, long stochastic rainfall time series are generated through the single-site Neyman-Scott Rectangular Pulses (NSRP) model for several sites within the catchment and the Iman-Conover method is then applied to introduce the spatial correlation on these rainfall time series.
Since the methodology can provide the estimation of flood frequency not only at the catchment outlet but also for internal subcatchments, several subcatchments of the Upper-Middle Tiber River (Central Italy) with drainage area ranging between 100 and 2000 km2 are used as case studies. For the study area, more than 20 years of observed rainfall, temperature and discharge data at sub-hourly time resolution are available for both rainfall and rainfall-runoff models calibration.
Being aware of the good quality of the hydrometeorological observations, it is expected that the analyses proposed here can give useful outcomes. In particular, the effects on the simulated flood frequency distributions of the rainfall spatial variability and the hydrological model parameters are investigated at different spatial-scales. Results demonstrate the reliability of the distributed continuous simulation approach for large basins, thus providing a valuable tool for flooding risk analysis. Moreover, by comparing the results provided by the semi-distributed and the lumped approach, it is possible to assess up to which scales the simple lumped approach can be applied with sufficient accuracy. Finally, interesting perspectives for the application of spatially distributed models to infer flood frequency distribution in ungauged catchments, a topical issue in applied hydrology, are highlighted.

References

Camici, S., Tarpanelli, A., Brocca, L., Melone, F. Moramarco T. (2011). “Design soil moisture” estimation by comparing continuous and storm-based rainfall-runoff modelling.” Water Resour. Res. (in press).