Relationship between rainfall and flood frequency curves in high elevation areas

EGU23-16657, updated on 27 Apr 2023
https://doi.org/10.5194/egusphere-egu23-16657
EGU General Assembly 2023


# Relationship between rainfall and flood frequency curves in high elevation areas

**Giulia Evangelista**[1], Irene Monforte[2], Marco Dematteis Raveri[1], and Pierluigi Claps[1]
[1]Politecnico di Torino, DIATI, Torino, Italy (giulia.evangelista@polito.it)
[2]Environmental Protection Agency of Piedmont (ARPA Piemonte), Cuneo, Italy

Flood hazard assessment and its relationship with extreme rainfall probabilities is a well-addressed topic in the literature, but not enough in mountain areas, where the climate change effect can hit much more than in other physical contexts. In mountain basins, the lack of systematic data and the complexity of the rain/snow phenomena make investigations even more necessary to figure out the consequences of global warming.

This study explores how the partial contributing area effect due to snow accumulation, on the one hand, and the basin runoff coefficient, on the other hand, shape the relationship between rainfall and flood probabilities in high elevation areas. To this aim, the *FloodAlp* geomorphoclimatic model (Allamano P. et al., 2009) is used.

The model is based on the derived distribution approach, producing as a result a simplified flood frequency curve based on the intra-annual variability of the portion of the catchment area covered by snow, according to simple descriptions of the seasonal variation of the freezing elevation and of the hypsographic curve of the basin.

To model the basin hypsometric features, we propose the use of a two-parameter Strahler function, which is a more accurate and alternative formulation to the simple one-parameter function originally used in the model. The role of the extreme rainfall frequency analysis is also explicitly analysed, by applying the model using rainfall extremes recorded both in the daily and 24-hours windows. In this application, the only parameter that requires calibration is the runoff coefficient. Considering recordings of annual maximum daily discharges, the runoff coefficients for more than 100 gauged basins in north-western Italy have been calibrated. Comparisons are then possible between the shapes of rainfall and flood frequency distributions within the sample analysed, that also take into account the basin geomorphoclimatic features. Results of this application address the selection of relevant characteristics in relation to the impact of climate change on mountain floods as a result of changes in temperatures and in the statistics of rainfall extremes.