A conditional probability approach to spatially distributed flood scenarios simulation

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The flooding risk impact on society cannot be understated: it influences land use and territorial planning and development both at the physical and regulatory levels. To cope with it, a variety of mitigation actions can be put in place, from the improvement of monitoring systems to the development of hydraulic structures, throughout land use restrictions and civil protection plans, involving multidisciplinary competences. All of those viable options present social and economic impacts, either positive or negative, whose proper estimate should rely on the assumption of appropriate – present and future – scenarios, i.e. quantitative event descriptions in terms of $i)$ the flood hazard, with its probability of occurrence, extension, intensity, and duration, *ii)* the exposed values and *iii)* their vulnerability. At present, initial attention has been devoted to the design of flood scenarios, or ensembles of them, and to the evaluation of their frequency of occurrence. Instead, maps which represent the union of all flood prone areas for assigned return times, are used to direct structural and non structural mitigation actions.

In the present work, a spatial model for flood scenario frequency assessment is proposed, and applied to the Italian territory. First, the study area has been divided into homogeneous regions according to their hydrologic, orographical and meteo-climatic characteristics. Then, a statistical model for flood scenarios simulation has been implemented throughout a conditional approach by using $i)$ a historical flood events dataset; *ii)* a homogeneous regions correlation matrix; and *iii)* an auxiliary variables data set.