A statistical approach to evaluate flood risk at the regional level: an application to Italy

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Floods are frequent and widespread in Italy, causing every year multiple fatalities and extensive damages to public and private structures. A pre-requisite for the development of mitigation schemes, including financial instruments such as insurance, is the ability to quantify their costs starting from the estimation of the underlying flood hazard. However, comprehensive and coherent information on flood prone areas, and estimates on the frequency and intensity of flood events, are not often available at scales appropriate for risk pooling and diversification.

In Italy, River Basins Hydrogeological Plans (PAI), prepared by basin administrations, are the basic descriptive, regulatory, technical and operational tools for environmental planning in flood prone areas. Nevertheless, such plans do not cover the entire Italian territory, having significant gaps along the minor hydrographic network and in ungauged basins. Several process-based modelling approaches have been used by different basin administrations for the flood hazard assessment, resulting in an inhomogeneous hazard zonation of the territory. As a result, flood hazard assessments expected and damage estimations across the different Italian basin administrations are not always coherent.

To overcome these limitations, we propose a simplified multivariate statistical approach for the regional flood hazard zonation coupled with a flood impact model. This modelling approach has been applied in different Italian basin administrations, allowing a preliminary but coherent and comparable estimation of the flood hazard and the relative impact. Model performances are evaluated comparing the predicted flood prone areas with the corresponding PAI zonation.

The proposed approach will provide standardized information (following the EU Floods Directive specifications) on flood risk at a regional level which can in turn be more readily applied to assess flood economic impacts. Furthermore, in the assumption of an appropriate flood risk statistical characterization, the proposed procedure could be applied straightforward outside the national borders, particularly in areas with similar geo-environmental settings.