



## **Implications of using direct or indirect approaches on design flood assessment in urbanized river basins**

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A number of approaches are possible for estimating design floods. In cases where long records of measured streamflow data are available, a direct statistical analysis of the data may be feasible. However, the streamflow data series are often too short to perform robust statistical inference.

In many circumstances no measured streamflow data are available at the site of interest. Moreover, in urban area, when natural development of the watercourse is significantly altered by anthropic constraints such as bridges, detention ponds, and levees, design flood estimates may result significantly lower than natural discharge, with dangerous impact on downstream sections in case of further modifications of upstream river.

Under such conditions the design flood can be assessed from rainfall-runoff transformation, under the assumptions that the Depth Duration Frequency curve characterizes the rainfall regime and assuming the critical flood design method.

This work presents the application of distributed hydrological model FEST for the assessment of design flood of Olona river basin, a small watershed in northern Italy. The significant heterogeneity of river Olona basin is enhanced by the presence of a mixture of forest, natural landscapes, and highly urbanized areas that, despite small extent of the basin, require use of a spatially distributed hydrological model.

The work shows that indirect method provides design discharges significantly greater respect to direct method when discharge measurements are strongly affected by upstream river overflows like in highly urbanized area.