According to the European Environment Agency (EIA Report No.1, 2016), a significant share of the European population is estimated to be living in, or near to, a floodplain, with Italy having the highest population density in flood-prone areas among the countries analysed. This tendency, with even frequent and substantial floods, means that the flood risk may occur at large scales and at a transboundary level, where data is often sparse, presents a challenge in the management of flood risk. The availability of consistent flood hazard and risk maps during prevention, preparedness, response and recovery phases is a valuable and important step forward in improving the effectiveness, efficiency and outcomes of any vulnerability-based flood protection measures. In this work, we present a state-of-the-art methodology for flood-prone area delineation and a novel approach to flood forecasting. For the calibration and validation steps, we used the synthetic datasets of Bates and De Roo (2000), Degiorgis et al., (2012), Manfreda et al., (2016), Samela et al., (2017) for the simplified mapping of riverine flood prone areas at large scales. The datasets were compared to the Pan-European flood hazard map (Degiorgis et al., 2012) using a set of distribution hydrological (Q2DLC), van der Knaap et al., (2016), employed within the European Flood Awareness System (www.sys-hydraulic models (LISFLOOD-FP, Bates and De Roo, 2000). - large scales (Manfreda et al., 2011, Degiorgis et al., 2012, Manfreda et al., 2016; Samela et al., 2017)

The complete workflow is composed of a pre-processing stage, calibration of output value and the final classification of flood-prone areas. The Geomorphic Flood Index (GFI) pre-processing, as proposed by Samela et al. (2017), requires a set of static inputs extracted from DEM by terrain analysis: slope, flow direction and upslope contributing area. The calibration stage is then performed using whole basins by comparing a reference flood hazard map (e.g. Dottori et al., 2016) to several Geomorphic Flood Index output values to determine the optimal one (Degiorgis et al., 2012). In our case the optimal cutoff maximizes an objective function: the Youden’s index. The final stage is a binarization of the Geomorphic Flood Index using the optimal cutoff, its output represents the flood delineation result of the flood-prone areas shown in Figure 1.

**Validation**

In this section, we summarize some of the validation results for each case study. In Figure 2, the Receiver Operating Characteristic (ROC) curve and respective Area Under the Curve (AUC) results from the calibration and validation are presented. The closer the curve is to the top-left corner of the box, the better is the performance. In Table 2, we present summary statistics in terms of hit rate, specificity and accuracy. In the next two main driving factors of riverine flooding are channel flood water heights (obtained from a hydraulic scaling relation) and elevation difference. We have demonstrated how such methodologies is useful in the identification of flood prone areas for three European basins, even at an early stage of development where other driving factors are neglected. We have derived for the first time, comprehensive large scale flood extent maps for the whole Danube, Po river and Severn river basins. Of particular interest is the opportunity to perform data driven flood classification for data-scarce regions, for the use in a machine learning framework and for effortlessly piloting future flood forecasting systems. We also emphasize that the proposed approach is a valuable step forward in the flood hazard assessment and flood risk management.

**Conclusions**

The Geomorphic Index represents a simple methodology for the quick delineation of flood-prone areas (e.g. with pre-processing accomplished, the Danube River Basin took approx. 7 min on a 2.3 GHz Intel® Core™ i7 with 16GB of RAM). The methodology reveals the potential for water conveyance from the main source of hazardally hydrologically connected cells. It implies that the two main driving factors of riverine flooding are channel flood water heights (obtained from a hydraulic scaling relation) and elevation difference. We have demonstrated how such methodologies is useful in the identification of flood prone areas for three European basins, even at an early stage of development where other driving factors are neglected. We have derived for the first time, comprehensive large scale flood extent maps for the whole Danube, Po river and Severn river basins. Of particular interest is the opportunity to perform data driven flood classification for data-scarce regions, for the use in a machine learning framework and for effortlessly piloting future flood forecasting systems. We also emphasize that the proposed approach is a valuable step forward in the flood hazard assessment and flood risk management.