



Fluvial flooding hazard assessment in Northern Italy: potential and informativeness of different geomorphic classifiers

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The steady increase of economic losses and social consequences caused by flood events in Europe, as a result of the combined effects of anthropization (e.g. land-use and land-cover changes) and climate change, calls for updated and efficient technologies for assessing pluvial, fluvial and coastal flood hazards and risks. In this context, the EIT-Climate KIC SaferPLACES () project aims at exploring and developing innovative and simplified modelling techniques to assess and map flood hazard and risk in urban environments under current and future climates. Concerning fluvial flooding, detailed inundation maps can be accurately obtained by means of hydrological and hydraulic numerical models, whose application, though, is often very resource intensive. For this reason, consistent and harmonized national flood hazard maps are still lacking in many countries of the world. Several studies have proved that flood-prone areas can be delineated by considering linear binary geomorphic classifiers, which are computed by analysing Digital Elevation Models, DEMs, and whose threshold values are calibrated relative to existing hydraulic flood hazard maps. One of these indices, the so-called Geomorphic Flood Index (GFI), was recently shown to be cost-effective, reliable and efficient for identifying flood-prone areas in several test sites in the United States, Africa and Europe. As part of the activities of SaferPLACES, in this study we test different geomorphic classifiers (GFI included) for the identification of flood-prone areas in a wide area in Northern Italy (c.a. 100000 km², including Po, Adige, Brenta-Bacchiglione and Reno river basins). We refer to the recently compiled MERIT (Multi-Error-Removed Improved-Terrain) DEM, a 3sec-resolution (~90m at the equator) DEM developed by removing multiple error components from existing spaceborne DEMs. As reference maps for the calibration, we select the flood hazard maps provided by (i) the Italian Institute for Environmental Protection and Research (ISPRA), and (ii) the Joint Research Center (JRC) of the European Commission. Our study confirms the better performances of GFI compared to other geomorphic classifiers, also providing useful information regarding the sensitivity of GFI threshold values relative to different reference hazard maps; it also suggests as a promising avenue for future researches the combination of multiple geomorphic indices through data-driven approaches and artificial intelligence.