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Evaluation of flood risk evolution on the Murray-Darling Basin (Australia) from 1975 to 2014 combining a hydrodynamic model and remote sensing data

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Economic losses and social consequences associated with riverine inundations appear to increase worldwide and the intensification of extreme hydrological events due to climate change is often pointed out as the main cause. However, flood risk results from the combination of different components (such as hazard, vulnerability and exposure), which have controlled and impacted on different dynamics of flood risk evolution. Although needed, a comprehensive long-term analysis of all these components is not straightforward, perhaps due to the lack of hydrological data, exposure information, or long computation efforts required for the hydraulic simulations. This study tries to overcome these limits and attempts at investigating the dynamics of different flood-risk components in the Murray-Darling basin (Australia) during last 40 years. The study basin is the largest Australian river catchment, with a drainage area of about 1 million of square km. The proposed analysis combines flood hazard and exposure information, both available at 1 km resolution. Riverine hazard is retrieved by means of a 2-D hydrodynamic model built from freely available Shuttle Radar Topography Mission (SRTM) products and based on recorded streamflow for the Australian continent from 1973 to 2012. Flood exposure is estimated from the freely available JRC Global Human Settlement Layer, which provides multitemporal information data on built-up presence as derived from Landsat image collections (GLS1975, GLS1990, GLS2000, and ad-hoc Landsat 8 collection 2013/2014) of the last 40 years.
Results shed some light on the spatio-temporal evolution of flood hazard and exposure in the study area, pointing out the significant role of human settlements dynamics on the overall evolution of flood risk.