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Original
Flood frequency elasticity to extreme precipitation: a practical approach for Climate Change projection of flood probabilities / Cafiero, L., Mazzoglio, P., Viglione, A., Laio, F.. - ELETTRONICO. - (2024). (EGU General Assembly 2024 Vienna (AT) 14-19 April 2024) [10.5194/egusphere-egu24-4543].

Availability:
This version is available at: 11583/2987955 since: 2024-04-21T14:46:00Z

Publisher:
Copernicus GmbH

Published
DOI:10.5194/egusphere-egu24-4543

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14 September 2026

EGU24-4543, updated on 21 Apr 2024
https://doi.org/10.5194/egusphere-egu24-4543
EGU General Assembly 2024
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Flood frequency elasticity to extreme precipitation: a practical approach for Climate Change projection of flood probabilities

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Flood risk management institutions and practitioners need innovative and easy-to-use approaches that incorporate the changing climate conditions into flood predictions in ungauged basins. The traditional approach to regional flood frequency analysis enables the estimation of hydrological variables under stationary conditions. However, it is nowadays crucial to develop innovative techniques that consider the non-stationarity of climate variables. The present work aims at implementing an operative procedure to include the expected variation in precipitation extremes into regional analysis. We compare the Flood Frequency Curves (FFC) and the Intensity-Duration-Frequency (IDF) curves defining a relation between them through the elasticity, an indication of the sensitivity of floods to precipitation extremes. Under the assumption that this relation does not change in time, we obtain modified FFC according to the projections of an ensemble mean of 25 Cordex simulations of CMIP5. This methodology was applied to 227 catchments of the Po River basin in northern Italy. Elasticity values range between 0.5 and 2: the lowest values were found in Valle d'Aosta region, and the highest in the south-western part of Piemonte. Over the Po river basin, the percentage increase of the 100-year floods ranges between 15% and 40%. The most relevant increase of flood discharge is found in the area between Liguria and Emilia-Romagna in the southern part of the Po River basin, where the projected increase of precipitation extremes is the highest.