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Catchment size is an important factor in mapping long-term flood behaviour

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Comment

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COMMENT ON Blöschl, G. et al. Changing climate both increases and decreases European river floods. *Nature*, **573**, 108-111, (2019); https://doi.org/10.1038/s41586-019-1495-6

From an analysis of 3,738 river gauging stations[1] of catchments ranging from 5 to 100,000 km^2, Blöschl et al.[2] constructed a map that depicts trends of annual maximum discharges across Europe for the 1960-2010 period. On that map Hungary, one of the most flood-prone countries in Europe[3], appears with nearly unanimously decreasing flood discharges which is in stark contrast with the reality of worsening floods on the Danube over the past 50-60 years in Hungary (Fig. 1), costing €58 million in flood defence in 2013 alone[4], a year with record-breaking flood. The contradiction arises due to differences in scale for the drainage area between the Danube (i.e., over 100,000 km^2 in Hungary) and the ones employed for the preparation of the map.

In general, the streamflow behaviour of a large river at a given location cannot be predicted from similar behaviour of the nearest sub-catchments as the relative contribution of streamflow from such watersheds diminishes in gaining streams with distance travelled down the main river. In particular, the flood behaviour of the Danube in Hungary is chiefly influenced by what is happening over its headwaters in southern Germany and western Austria where flood conditions generally worsened[2].

As the database[1] also contains gauging stations with corresponding drainage area in excess of 100,000 km^2, the authors could have produced an additional map depicting flood trends at stations along the largest rivers in Europe (similar to their Fig. 3), thus providing a more realistic picture of changing flooding conditions across the continent and that way resolving the contradiction their map generates for Hungary, as an example. Had such an additional map not been feasible due to scarcity of stations in the database, some discussion would still have been warranted about this specific limitation of their approach and the possible (and indeed real) contradictions it may evoke. In its present form the study of Blöschl et al.[2] fails to include (and explain) flood tendencies for high-risk zones along the largest rivers that already pose the strongest flood-related destruction potential for society.

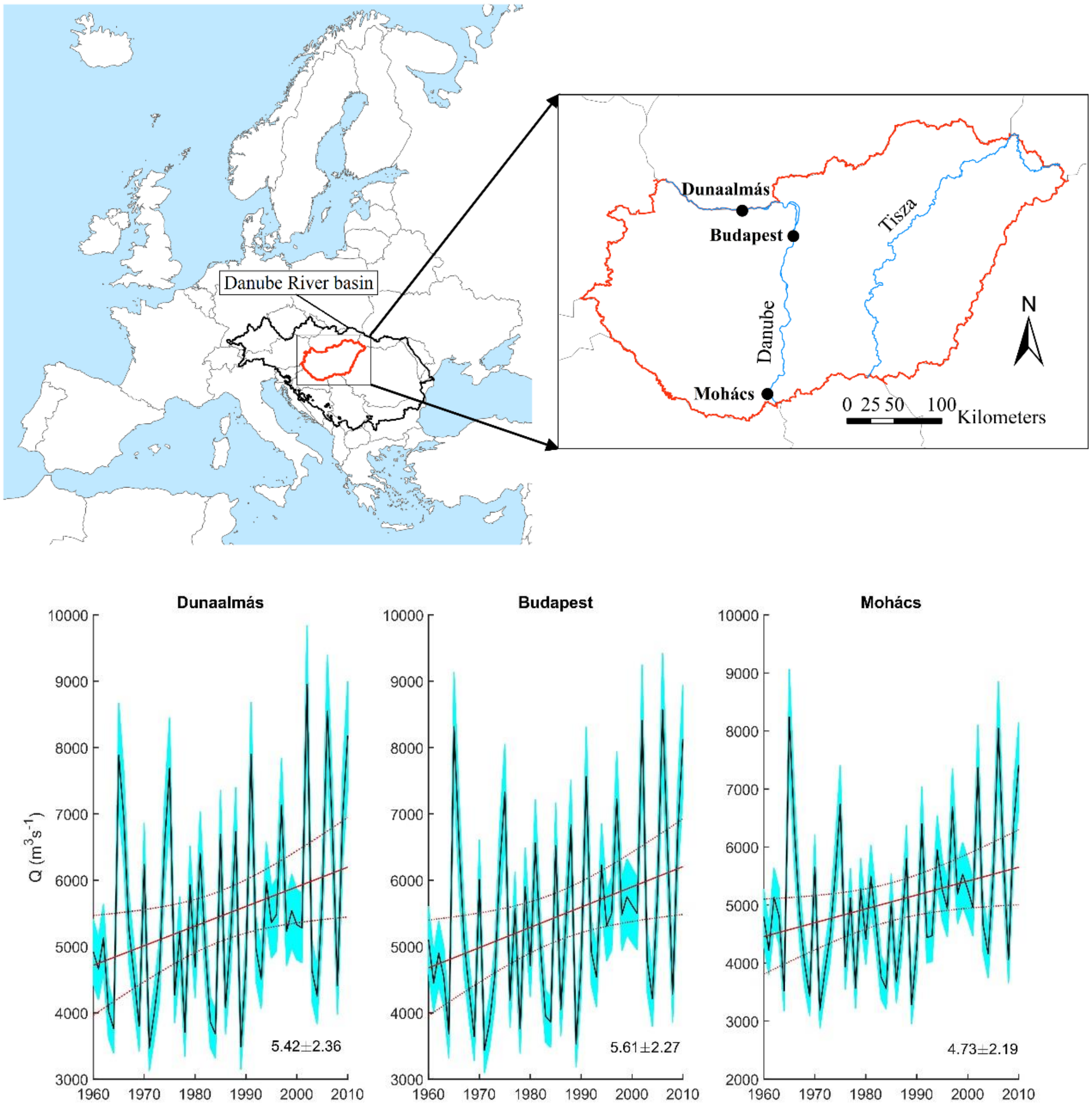

Fig. 1 | Annual maximum (1960-2010) discharge rates and their least-squares fitted linear trends at selected gauging stations along the Hungarian section of the Danube. The shaded bands represent a 10% assumed measurement error in the discharge rates. The strips around the trend lines denote the 95% confidence intervals. All positive trends are significant at the 5% level of the modified Mann-Kendall trend test[5]. The numbers denote the estimated change (with its standard error) in mean annual flood discharge per decade (%).

Data availability

The annual maximum discharge values of Fig. 1 can be obtained from the corresponding author upon request. Daily discharge data can also be requested from http://www.ovf.hu/hu/adatigenyles.

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Contributions

All authors collaborated on the design of the study, the interpretation of the results and writing the manuscript.

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Competing interests

Declared none.