



Extreme multi-basin fluvial flows and their relationship to extra-tropical cyclones

Paolo De Luca (1), John K. Hillier (1), Robert L. Wilby (1), Nevil W. Quinn (2), and Shaun Harrigan (3)

(1) Department of Geography, Loughborough University, Loughborough, United Kingdom, (2) Department of Geography and Environmental Management, University of the West of England, Bristol, United Kingdom, (3) Centre for Ecology and Hydrology (CEH), Wallingford, United Kingdom

Fluvial floods are typically investigated as ‘events’ at the single basin scale, thereby implicitly assuming that severe flooding impacts each catchment independently from those nearby. A statistical analysis of the spatio-temporal characteristics of extreme flows in Great Britain (GB), during 1975-2014, is presented. These observations deepen understanding of the processes leading to multi-basin floods and present helpful insights for contingency planning and emergency responders. The largest multi-basin peak flow events within different time windows were identified by counting the number of coincident annual maximum river peak flows (AMAX) across 261 non-nested catchments, using search windows of 1 to 19 days. This showed that up to 107 basins reached their AMAX within the same plateauing 13-day window, draining a total area equivalent to $\sim 46\%$ of the overall basins considered, which is an equivalent fraction of $\sim 27\%$ of Great Britain. Such episodes are typically associated with persistent cyclonic atmospheric circulation and saturated ground, combined with short hydrological response times (< 48 h) from large contributing basins. The most spatially extensive episodes also tend to coincide with the most severe gales (i.e. extra-tropical cyclones) on a $\pm 0-13$ day time-scale. The analysis suggests that multi-basin peak flow events can be characterised by concurrent peak flow AMAX and that the most extreme are driven by very severe gales (VSG). This has implications for emergency response including planning for combined flood-wind impacts (on for example power and communication systems), meaning that the emergency preparedness need to be reorganised in order to face this peril.