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IMPACTS OF THE SEPTEMBER 2008 FLOODS IN NORTHEAST ENGLAND ON RIVER MORPHOLOGY & SEDIMENTOLOGY

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Between the 6th and 7th of September 2008, the northeast of England received over one month's worth of rainfall (up to 150 mm in places). The resultant floods were the largest to affect Northumberland's river systems in historic times. While calculation of the flood flow is relatively easy for gauged sections, the upper reaches of catchments are often less heavily monitored. Yet what happens in these upper sectors during high precipitation events has direct implications for downstream communities. For selected study reaches of the River Coquet in Northumberland, we had over 11 years detailed geomorphological monitoring pre the 2008 flood event and therefore the flood represented a unique opportunity to quantify these effects within in a longer term context.
Funding was obtained under the UK's Natural Environment Research Council's Urgency scheme as the event formed an unexpected and transient scientific opportunity. Due to the pre-existing monitoring baseline, data collection pertaining to the geomorphological effects of the flood event focused on an extended reach in the piedmont region of the catchment where the river is notably dynamic and channel avulsions and patterns of sediment erosion and deposition from the flood were observed and mapped. Slope-Area techniques were used to quantify peak flood discharge within a narrower, bedrock-controlled reach 12 km further downstream at Rothbury. Flood wash limits and channel cross-sections were surveyed using a theodolite, allowing accurate quantification of calculation of water surface slope and cross-sectional areas for peak flows.
22 pre-existing monumented channel cross-sections were re-surveyed 12 km upstream at Holystone and 24 new cross sections were surveyed a further 1 km upstream at Sharperton using theodolite survey. This allowed detailed comparison with previously-surveyed cross-sections as well as a 2006 LiDAR dataset, and allows change over time to be determined from ongoing flood events (a further significant flood event occurred on the River Coquet in mid-July 2009 for example, and post the NERC project described here we are continuing to maintain the detailed monitoring programme). Observation trenches were dug to quantify the sedimentology of the event. Modelling approaches using the cross-section data and a pre-existing LiDAR dataset demonstrated the time-line of the event and, importantly, where stream powers were greatest. This modelling correlated extremely well with field observations (e.g. expansion bars, sediment ingress to riparian woodland) and thus provides a very useful toolkit for reconstruction of stream power variation and geomorphological response.
The key findings of this Urgency project as to the river's inherent robustness in the face of flood events of significant magnitude will provide valuable data to wider management initiatives as the river is a Site of Special Scientific Interest from source to sea. The research highlighted the importance of 'geomorphological priming', whereby subsequent significant but localised morphological change owes its origin to preceding dynamics and alteration. We have identified zones which show these effects from the 2008 event, and these are the focus of ongoing research.