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Monitoring ephemeral streamflows in a peatland headwater catchment

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Drainage network extent in a catchment is not static and can vary seasonally and over the course of a storm. During and after a rainfall event, the flowing length of channels can increase as the stream head migrates upstream into ephemeral portions of the channel network. This has implications for sediment and pollutant flux as the degree of slope channel linkage is temporally variable. Currently, information on network expansion is limited owing largely to the difficulties in monitoring this phenomenon.

The use of Electrical Resistance (ER) sensors has been shown to provide a novel way to monitor the timing of the onset and cessation of flow in ephemeral portions of the channel network as they have the ability to detect the presence or absence of flow at any given point in the landscape. The sensors have on board data-loggers and are inexpensive, enabling high resolution measurements in space and time.

This paper presents data from an extensive network of ER sensors in a headwater peatland catchment in the South Pennines. Data collected in the autumn of 2007 have been analysed to derive patterns of network expansion and contraction. Results show that different gullies need rainfall events of different magnitudes to trigger the initiation of flow. The lag times between the start of a rainfall event and flow initiation also varies between gullies. At least two modes of network expansion have been identified with some gullies expanding from the downstream to upstream and some gullies experiencing a more disjointed pattern of expansion.

Understanding the nature of ephemeral streamflows may mean that dynamic-extent

drainage networks could eventually replace the static networks currently used in runoff, erosion, sediment, and pollution transport models with potentially significant improvements to prediction accuracy.