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The use of electrical resistance sensors to monitor hydrological connectivity at high resolutions

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This poster presents the designs for a series of innovative sensors which exploit electrical resistance (ER) technology to detect water travelling via various flow pathways. The data collected by the sensors can be used to tell us about the connectivity of different flow pathways over time and space.

Inexpensive, commercially available temperature sensors have been converted into ER sensors by removing the thermistor and stripping the insulation enclosing the electrodes. When the sensor electrodes are in contact with water a continuous electrical circuit is supported between the electrodes and resistance is low. During dry conditions the circuit is broken and the measured resistivity increases sharply. The electrodes can then be housed in various 'sensor heads' with different design features depending on the type of flow being monitored.

Designs are presented for ephemeral streamflow, overland flow and pipeflow sensors. The data collected by the ephemeral streamflow and overland flow sensors allows a binary distinction to be made between times when water is present (a 'flow' or 'wet' reading) and absent (a 'dry' or 'no flow' reading). The pipeflow sensors provide more continuous ER data and field and lab experiments confirm that there is a strong relationship between ER and pipe discharge.

The sensors are inexpensive allowing high-density networks to be deployed. In addition the data loggers used have user-defined sampling intervals and large memories, affording frequent monitoring. The designs presented here represent improvements on previous techniques not only in terms of the spatial and temporal resolution of measurements but also in terms of the accuracy of the data collected. Schematics, photographs of the sensors in the field and examples of the data that can be collected by each type of sensor are presented.