



Deriving snow water equivalent using cosmic-ray neutron sensors from the COSMOS-UK network for modelling snowmelt floods

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The COSMOS-UK sensor network has the potential to provide new insights into extreme snowfall and snowmelt events in the UK and to improve the modelling of snowmelt floods. The network consist of approximately 50 measurement sites, each equipped with a Cosmic-Ray Neutron Sensor (CRNS). A number of these sites additionally include a “SnowFox” sensor for measuring snow water equivalent (SWE) and an ultrasonic snow depth sensor.

Although the CRNS is currently used to produce estimates of soil moisture, it is also sensitive to water held as a snowpack. Moreover, the large (hundreds of metres) footprint of the CRNS potentially allows representative measurements of SWE even for inhomogeneous snowpacks. However, to date, there has been little attempt to produce snow products using the COSMOS-UK network, and soil moisture estimates during snowfall events are simply removed from the record.

Here, a method is developed for using the COSMOS-UK network to derive snow products for the UK, where shallow, ephemeral snowpacks are the norm. The challenges posed by noise from the random nature of cosmic ray events, and the problem of separating the snow signal from moisture within the soil, are discussed. A comparison is made of SWE derived from the COSMOS-UK network and modelled using the snow hydrology component of the Grid-to-Grid (G2G) distributed hydrological model, and the effect on simulated river flows discussed.