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The development of a sub-daily gridded rainfall product to improve hydrological predictions in Great Britain

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In Great Britain and many other regions of the world, flooding resulting from short duration, high intensity rainfall events can lead to significant economic losses and fatalities. At present, such extreme events are often poorly evaluated using hydrological models due, in part, to their rarity and relatively short duration and a lack of appropriate data. Such storm characteristics are not well represented by daily rainfall records currently available using volumetric gauges and/or derived gridded products. This research aims to address this important data gap by developing a sub-daily gridded precipitation product for Great Britain. Our focus is to better understand these storm events and some of the challenges and uncertainties in quantifying such data across catchment scales. Our goal is to both improve such rainfall characterisation and derive an input to drive hydrological model simulations.

Our methodology involves the collation, error checking, and spatial interpolation of approximately 2000 rain gauges located across Great Britain, provided by the Scottish Environment Protection Agency (SEPA) and the Environment Agency (EA). Error checking was conducted over the entirety of the TBR data available, utilising a two stage approach. First, rain gauge data at each site were examined independently, with data exceeding reasonable thresholds marked as suspect. Second, potentially erroneous data were marked using a neighbourhood analysis approach whereby measurements at a given gauge were deemed suspect if they did not fall within defined bounds of measurements at neighbouring gauges. A total of eight error checks were conducted. To provide the user with the greatest flexibility possible, the error markers associated with each check have been recorded at every site. This approach aims to enable the user to choose which checks they deem most suitable for a particular application. The quality assured TBR dataset was then spatially interpolated to produce a national scale gridded rainfall product. Finally, radar rainfall data provided by the UK Met Office was assimilated, where available, to provide an optimal hourly estimate of rainfall, given the error variance associated with both datasets.

This research introduces a sub-daily rainfall product that will be of particular value to hydrological modellers requiring rainfall inputs at higher temporal resolutions than those currently available nationally. Further research will aim to quantify the uncertainties in the rainfall product in order to improve our ability to diagnose and identify structural errors in hydrological modelling of extreme events. Here we present our initial findings.