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Characterising local rainfall cell patterns over Birmingham (UK) using 10+ years of high-resolution radar images

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This work is part of the EU-funded FloodCitiSense project, the aim of which is to develop an urban pluvial flood forecasting and warning service for and by the citizens. The specific focus of this work is to characterise convective storm features over one of the project pilot cities – Birmingham (UK) – and in turn to provide useful 'local' knowledge that can contribute to the development of the pluvial flood forecasting service. The proposed work comprises two stages: 1) development of a regional convective rain cell database, and 2) characterisation of storm cells' features in relation to the pilot.

In the initial development of the database, individual convective rain cells and the traces between any two successive cells were extracted from the high-resolution UK Met Office (Nimrod) radar rainfall archive for the period of 2005-2017 over a 500 $\times$ 500 km2 area centred at Birmingham city. These cells and traces were identified using a new object-based convective storm cell tracking algorithm developed by Muñoz et al. (2018). Incorporating an optical flow-based rain-field tracking and a multi-threshold object identification techniques, this new algorithm enables the accurate isolation and tracking of convective rain cells from high-resolution radar reflectivity data. The extracted rain cells and traces were then stored in an open-source database, called TimescaleDB (http://www.timescale.com/).

In the second stage, the specific properties of the identified cells and traces and their relationship to the pilot city were extracted from the database for further analyses. These include characterising statistical features of rain cells' intensities, extents, lifespans and their inter-relationships, and mapping the locations of rain cells, traces and given properties over the pilot city. Preliminary results of rain cell and trace mapping enable us to locate the 'hotspots' that are prone to the initiation and maturing of convective cells. In addition, the mapping of the traces suggests the existence of certain storm 'corridors' in the southern part of Birmingham city. This provides valuable 'local' knowledge to the development of urban pluvial flood forecasting and warning services.