WRF Simulations on the Impacts and Responses of Extreme Weather Events: From the Perspectives of Climate Change and Urbanisation over UK Cities

Initial Exploration

Sichan Du[1], Lu Zhuo[2], Elizabeth J. Kendon[3,4], Dawei Han[1], Ying Liu[1], Jiao Wang[1], Qin Wang[1]
[1]Department of Civil Engineering, University of Bristol, Bristol BS8 1TR, UK
[2]School of Geographical Sciences, University of Bristol, Bristol BS8 1SS, UK
[3]Met Office, FitzRoy Road, Exeter EX1 3PB, UK
[4]Faculty of Science, University of Bristol, Bristol BS8 1UH, UK

What are the Highest Resolutions Achievable in Urban Environment by WRF Simulation on Rainfall Extremes?

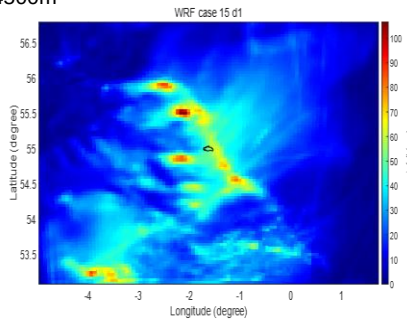
WRF Basic Settings

Variables	Settings
Central Point of Domain	Newcastle upon Tyne Latitude: 54.98 & Longitude: -1.62
Latitudinal Grid Length & Longitudinal Grid Length	Regional Convection-Permitting Resolutions (250m–4500m)
Nesting State	Single Model Domain Two-Way Nested Run, with Two Input Files
Input Data	ERA5: 31 km Spatial Resolution & Hourly Temporal Resolution
Validation Data	1 km Resolution Composite Data from the Met Office's UK Rainfall Radars
Simulation Period	Summer Event: 11/06/2019 00:00–14/06/2019 23:00 Winter Event: 18/01/2021 00:00–21/01/2021 23:00
Spin-up Period	Summer Event: 11/06/2019 00:00–11/06/2019 23:00 Winter Event: 18/01/2021 00:00–18/01/2021 23:00

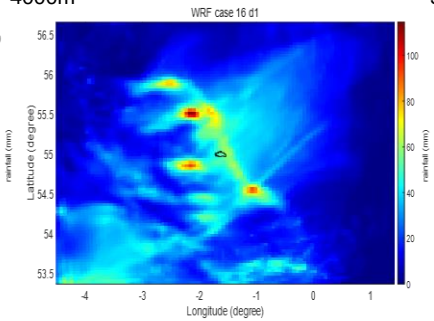
Single Model Domain: domain resolution—4500m/4000m/3500m/3000m/2500m/2000m/1500m

summer rainfall extremes

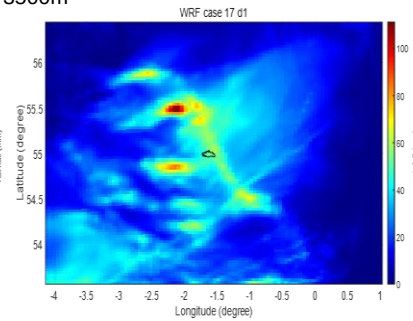
4500m



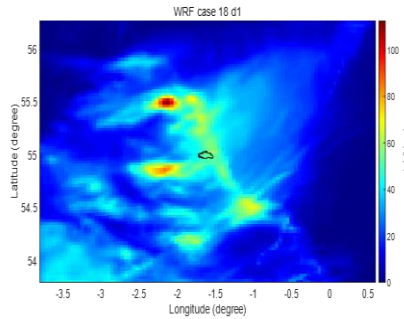
4000m



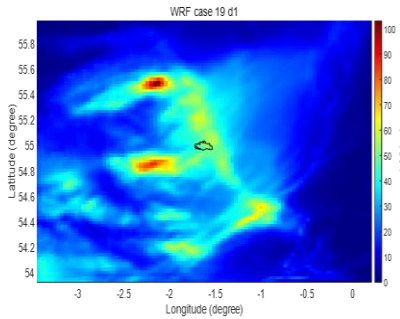
3500m



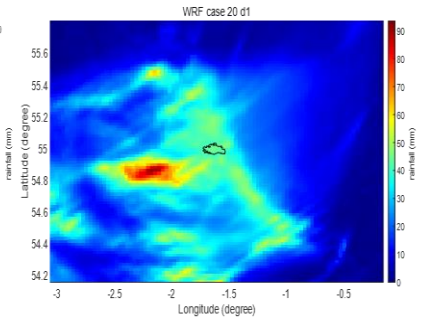
3000m



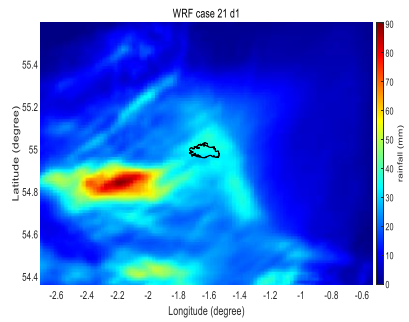
2500m

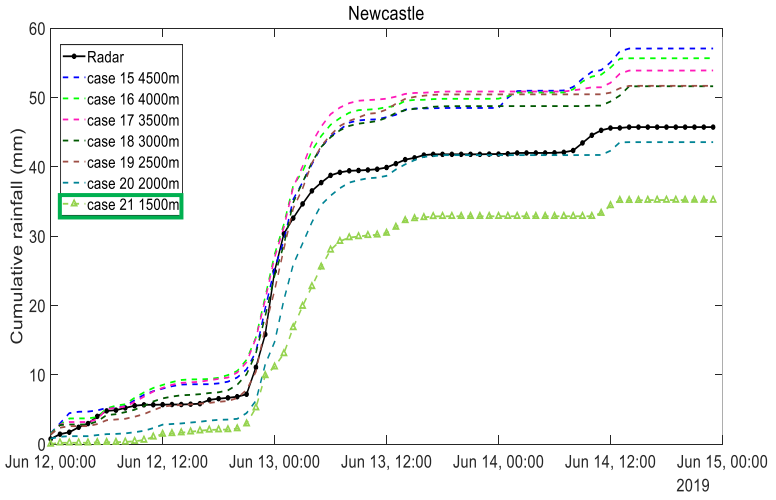


2000m



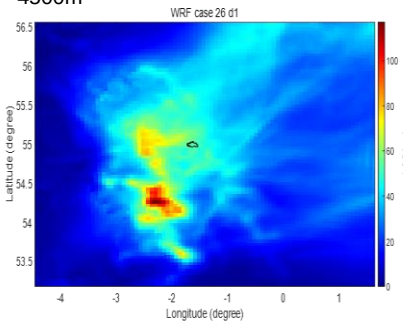
1500m



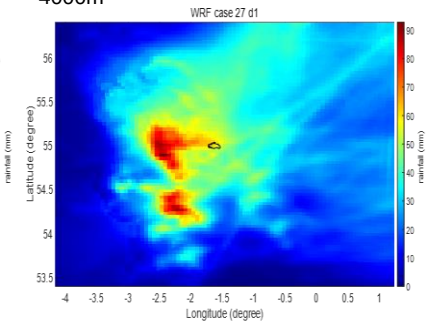


winter rainfall extremes

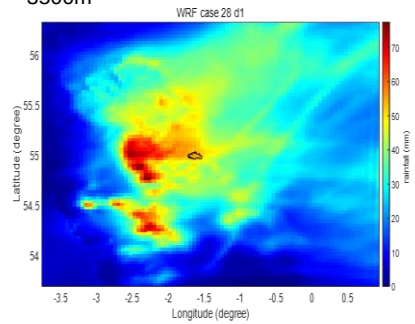
4500m



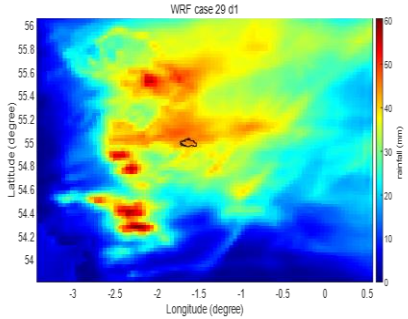
4000m



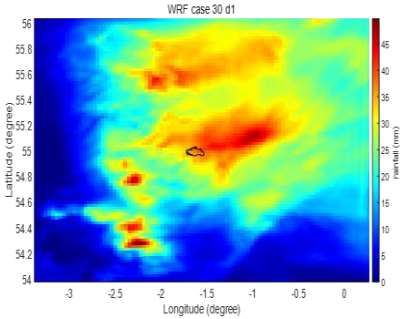
3500m



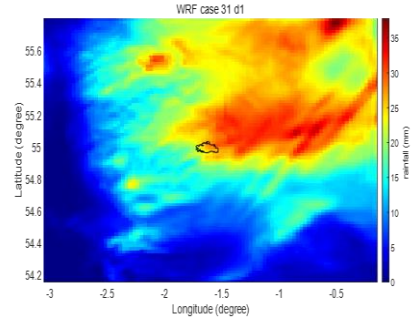
3000m



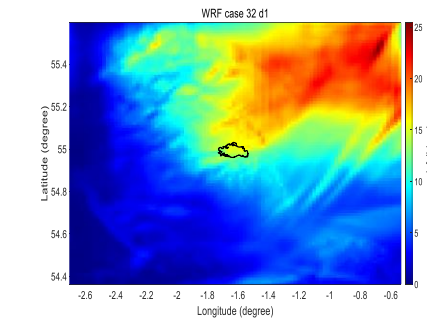
2500m

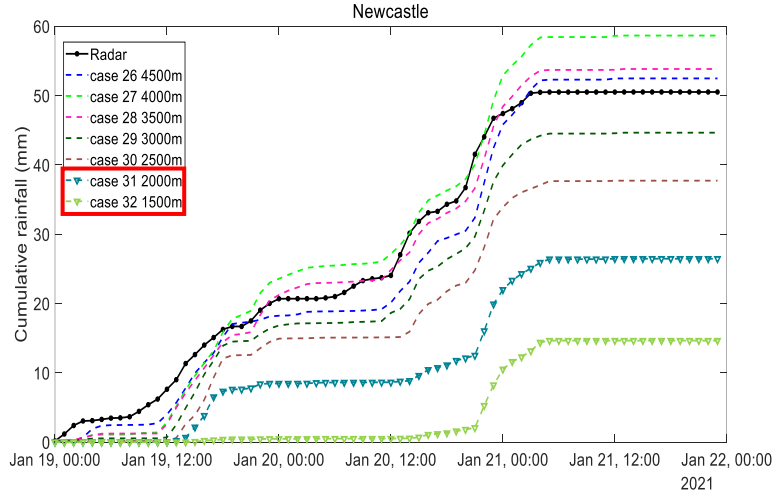


2000m



1500m

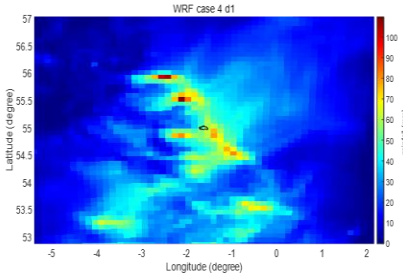


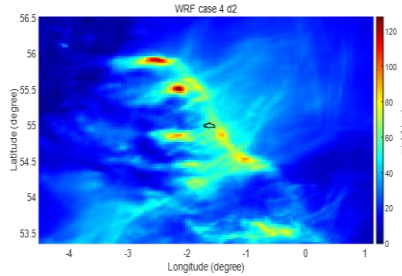


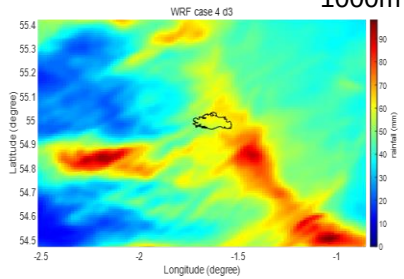
Nested Model Runs: domain three resolution—1000m/750m/500m/250m

summer rainfall extremes

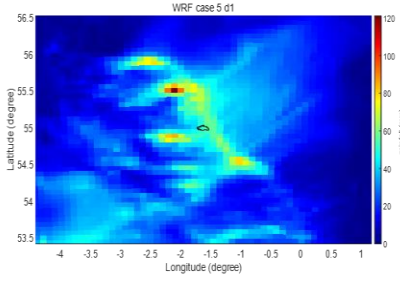
1000m

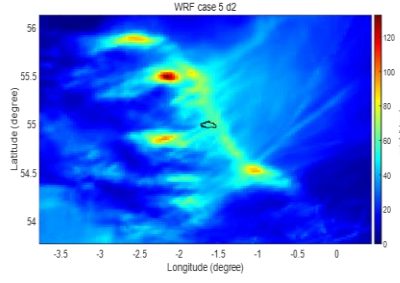


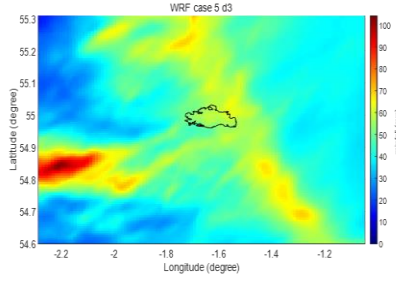




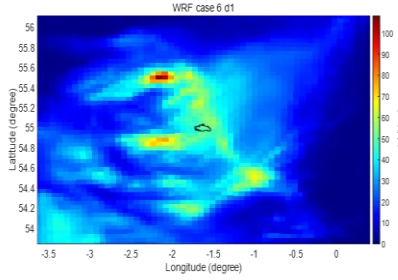
750m

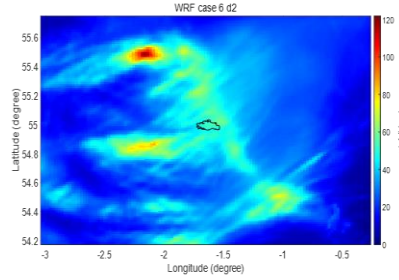


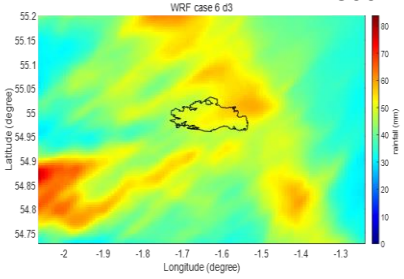




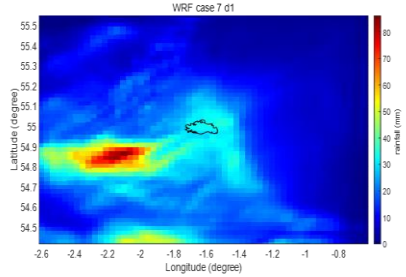
500m

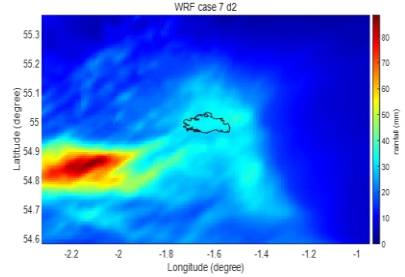


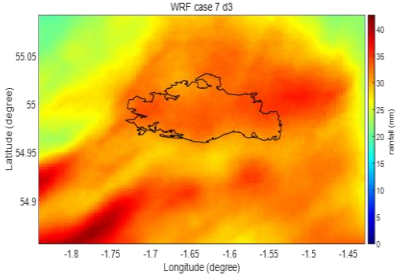




250m

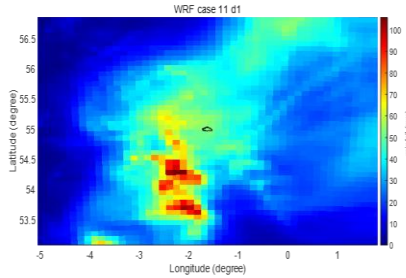


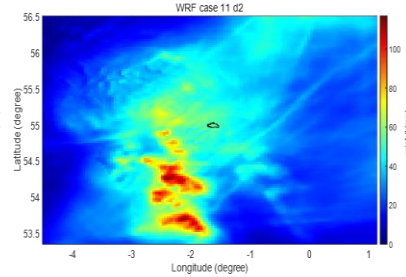


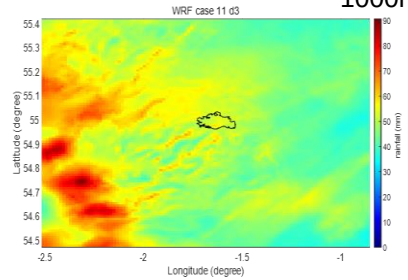


winter rainfall extremes

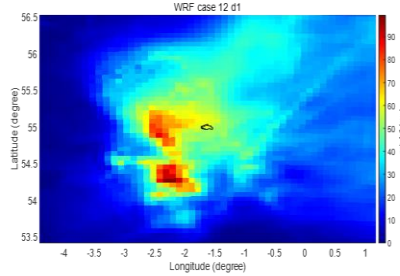
1000m

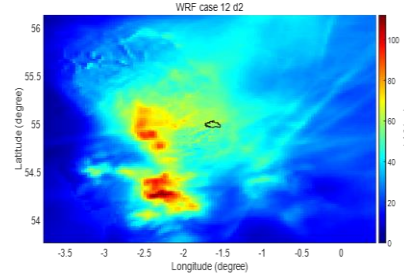


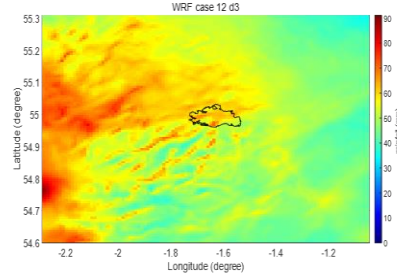




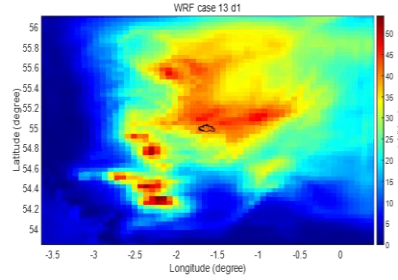
750m

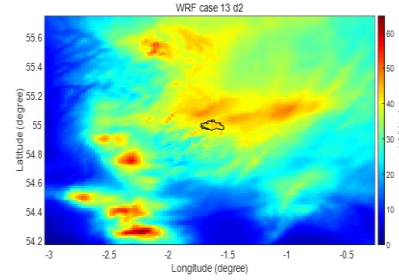


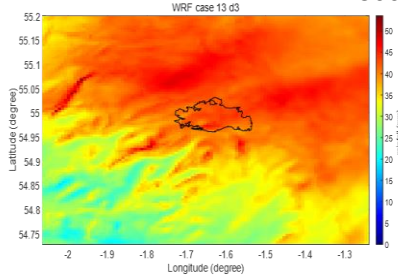




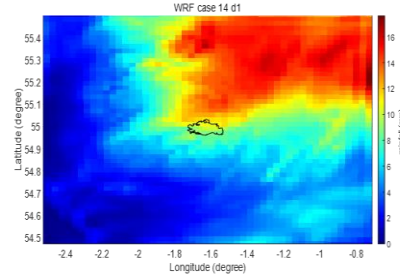
500m

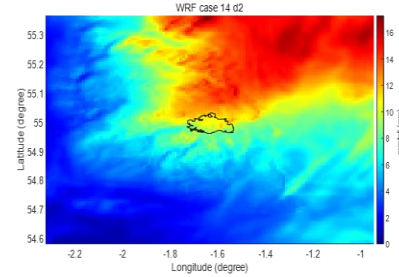


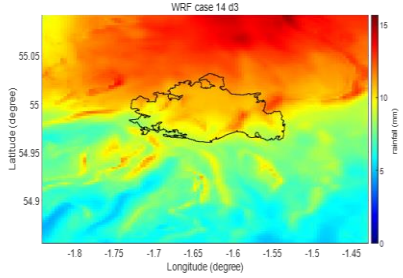




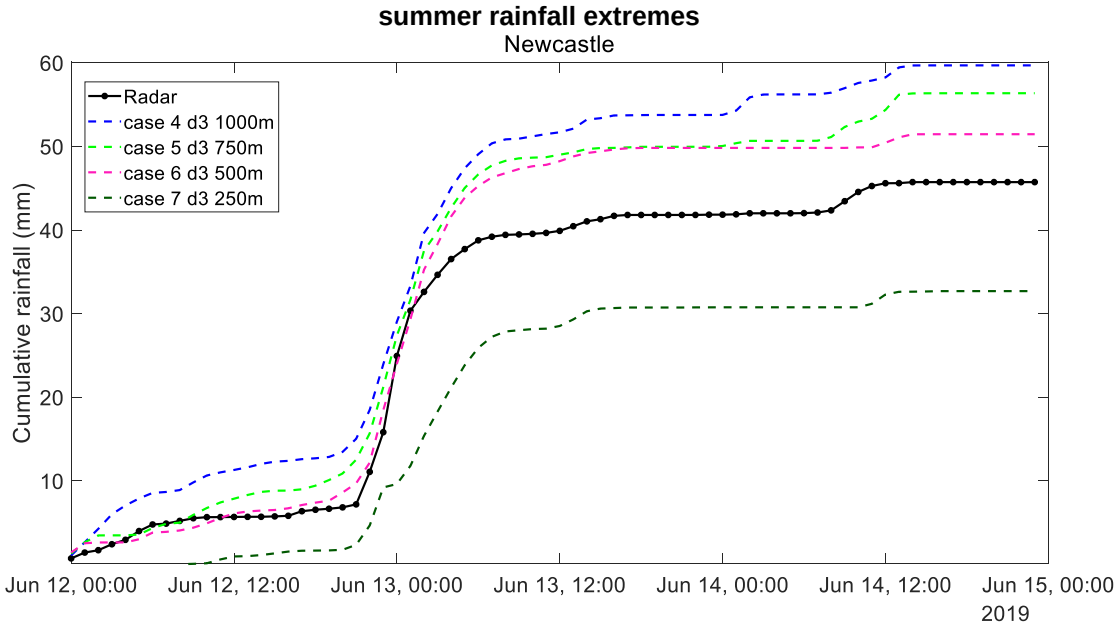
250m

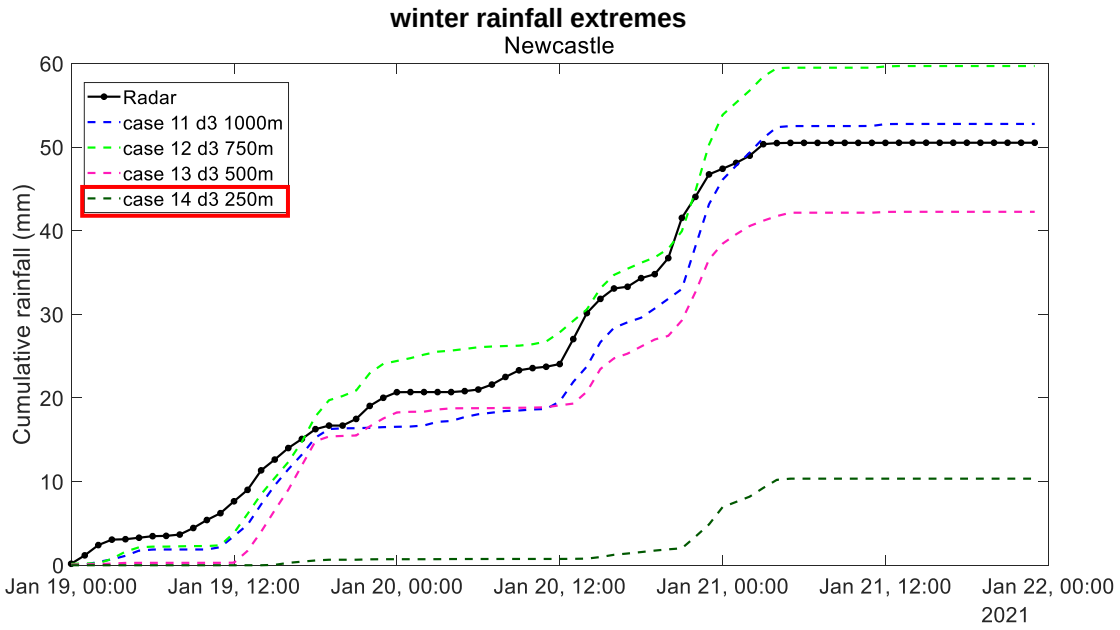






Nested Model Runs
domain three resolution—1000m/750m/500m/250m





250m High-Resolution Simulation Improvement
nesting ratio enlargement and domain number increase

winter rainfall extremes

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parent_grid_ratio=1:5:5

max_dom=4
parent_grid_ratio=1:3:3:3