Sub- & multi-day precipitation extremes in high-resolution Met Office regional climate model simulations

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Outline

•The CONVEX (**CONV**ective **Ex**tremes) project (website: http://research.ncl.ac.uk/convex/)

•The Met Office (UKMO) has completed 1.5-km and 12-km RCM simulations. The 1.5-km model has no convective parameterisation (CP).

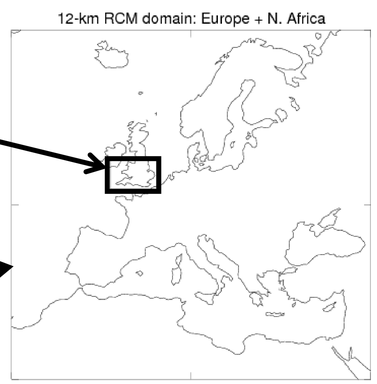
•Goal: To test if convective-permitting resolution improves the representation of convective storms.

•Key Result: The 1.5-km RCM has greater realism in representing JJA convective extremes than the 12-km RCM especially for long return extremes ("extreme extremes").

RCM Simulation Domain

1.5-km no-CP RCM domain [inner box]

12-km RCM domain [outer box]



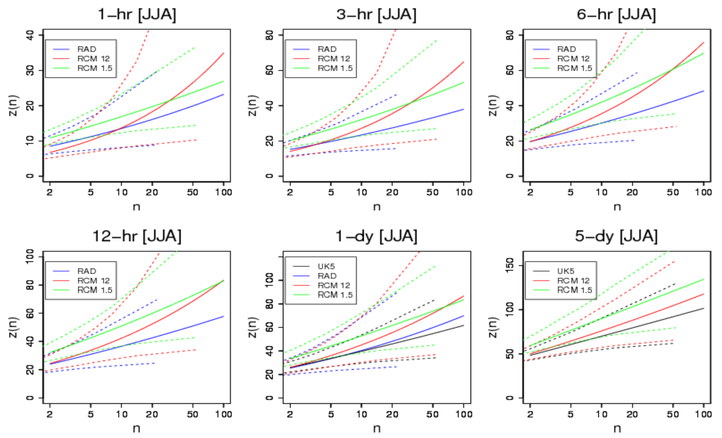
Observations

•UKMO 5-km gridded daily gauges & hourly radar

•UKMO hourly station precipitation (MIDAS database; available for download at http://badc.nerc.ac.uk)

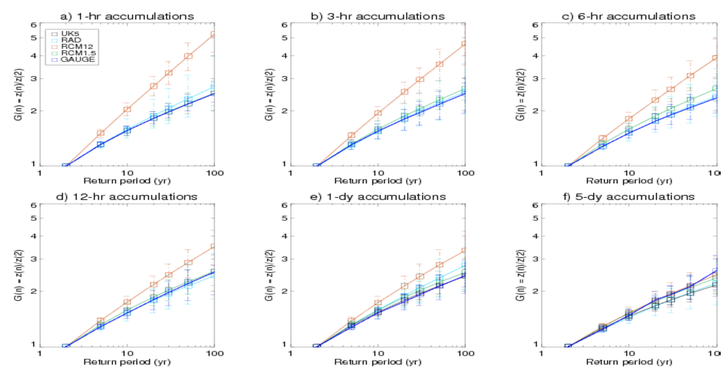
Returns & Growth Curves

Using Peaks-over-Threshold (POT) to estimate return values at each grid point



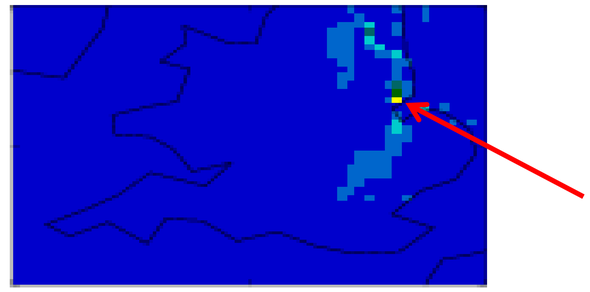
Returns levels [z(n); n = return period in years]:
Relative to radar (RAD) & gridded gauges (UK5):

- 12-km RCM long returns ("extreme extremes", z(100 yr)) are too high
- 1.5-km RCM short returns ("typical extremes", z(2-10 yr)) are too high

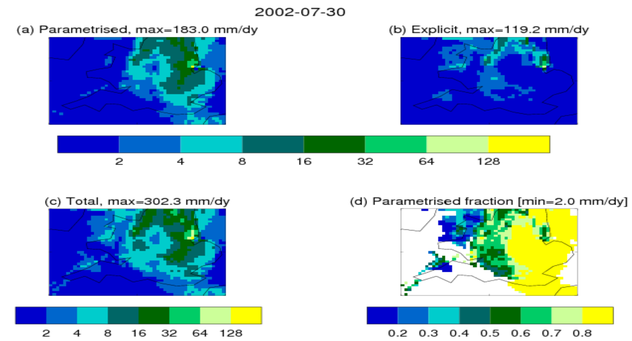


Growth curves [G(n) = z(n) / z(2)]:
12-km RCM 100-year growth rates for short accumulations (1-3 hour totals) are too high

Extremes in 12-km RCM



An extreme event simulated by 12-km RCM:
Stationary grid-point storm with unrealistic high hourly intensities; such high intensities are only observed for small areas



CP & large-scale precipitation divisions:
Grid-point storm has low CP fraction – indicating full grid point saturation; CP is not designed for such large storms nor for such high resolutions

Related Publications

Kendon, E. J., N. M. Roberts, C. A. Senior, and M. J. Roberts (2012), Realism of Rainfall in a Very High-Resolution Regional Climate Model, J. Climate, 25(17), 5791–5806, doi:10.1175/JCLI-D-11-00562.1.

Chan, S., E. Kendon, H. Fowler, S. Blenkinsop, C. A. Ferro, and D. Stephenson (2012), Does increasing the spatial resolution of a regional climate model improve the simulated daily precipitation?, Climate Dynamics, 1–21, doi:10.1007/s00382-012-1568-9.

Chan, S., E. Kendon, H. Fowler, S. Blenkinsop, C. A. Ferro, and N. Roberts (2013), United Kingdom multi-hourly rainfall extremes in the high resolution regional climate model simulations, J. Climate, submitted.