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Precipitation Scenarios

Chris Kilsby

University of Newcastle

**School of
Civil Engineering and Geosciences**

water@newcastle

Time resolution

- hours and minutes, not days

Space resolution

- Specific to sites, not grid boxes

Properties

- realistic amounts, intensities, extremes
- seasonality
- long time series – multiple events

Stochastic rainfall modelling

- To achieve downscaling in time and space
- To generate long series
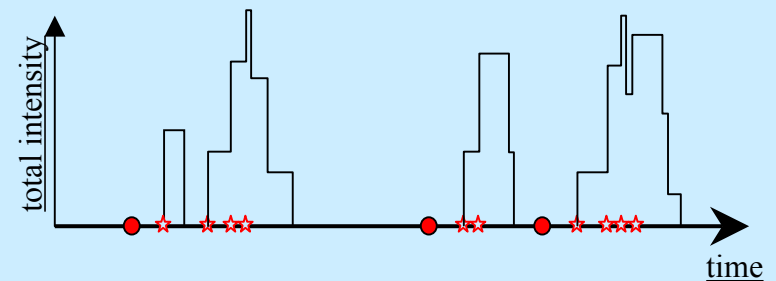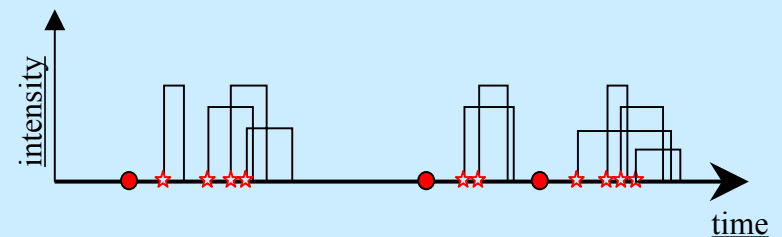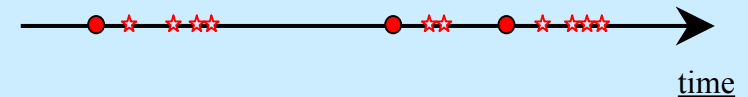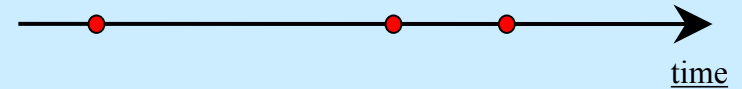- To interface with CRU weather generator

Building on:

- UKCIP02 scenarios and UKMO climatology
- Consistency with the FEH extremes
- 15 years development at Newcastle
- The StormPac approach

The GNSRP model

- A stochastic rainfall modelling system

- Generalised Neyman-Scott Rectangular Pulses

- Can generate arbitrarily long series (e.g. 1000 years) of rainfall

- Applied to historic, control and future climates

- Reproduces key statistical properties of rainfall series, e.g. mean, variance, dry hours, 2, 5, 10, 25 year annual maxima);

- Time resolution of 1-hour or 1-day

- Storm origins arrive in a Poisson process

- Each origin generates a random number of rain cells

- A rectangular pulse is associated with each rain cell

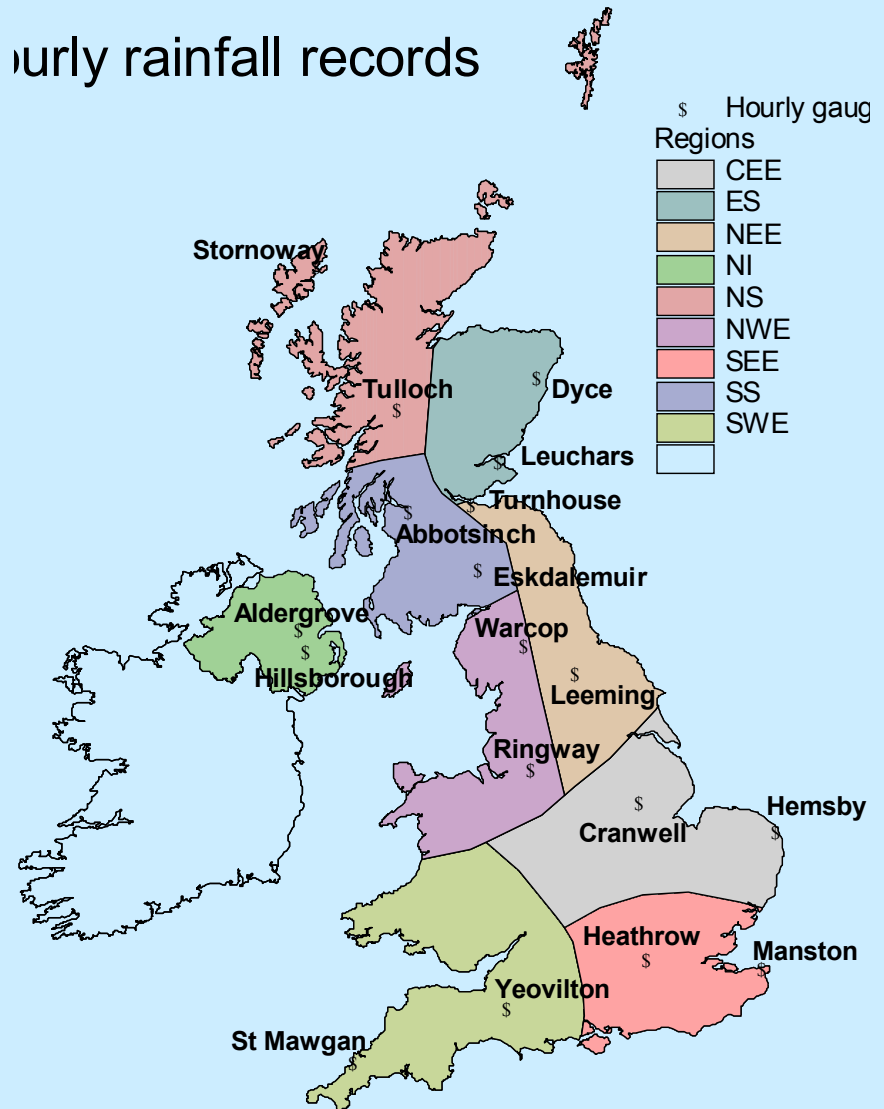- The total rainfall at any time is the sum of all active rain cells

Historic case

- Set up the GNSRP model for the whole UK using the MetOffice/UKCIP 5-km climatology.

- Parameterise to match observed 1961-1990 rainfall:

  - means, variance, proportion dry hours etc
  - return period rainfalls - 2,5,10 or 25 year events using observed data and FEH DDF model
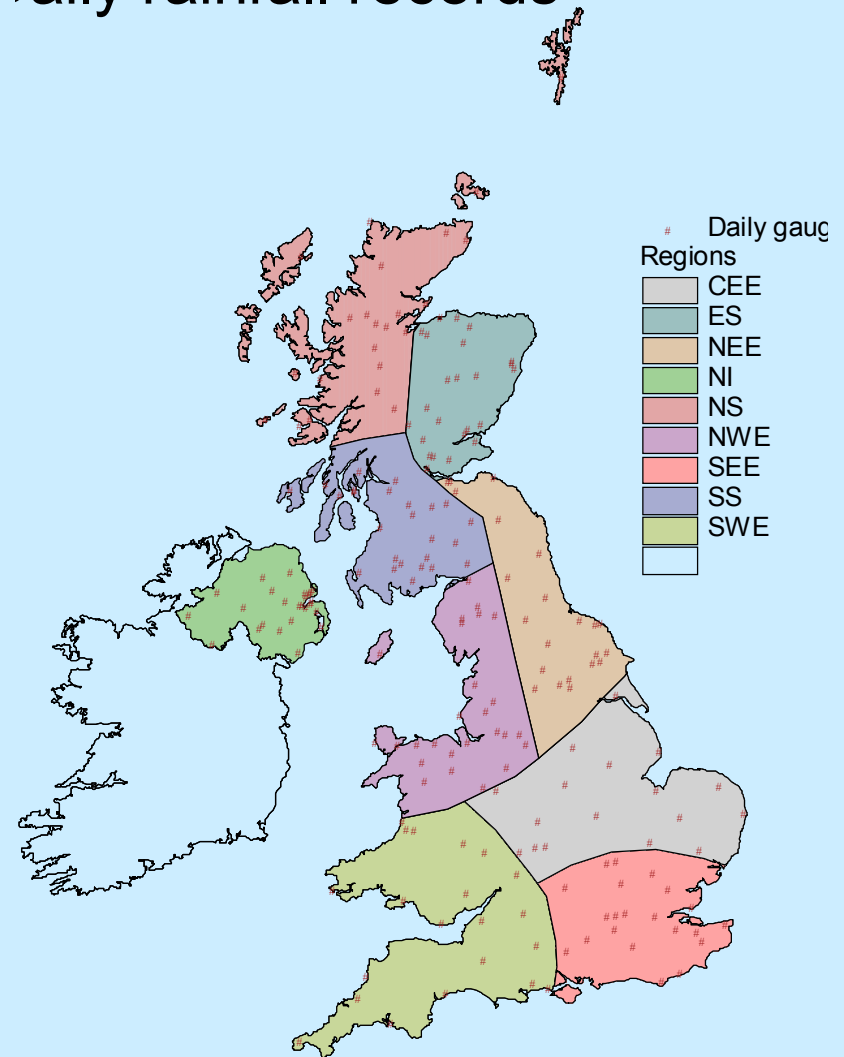
18 sites
in 9 regions
> 10 years

ourly rainfall records

$ Hourly gaug

Regions
	CEE
	ES
	NEE
	NI
	NS
	NWE
	SEE
	SS
	SWE

Stornoway

Tulloch

Dyce

Leuchars

Turnhouse

Abbotsinch

Eskdalemuir

Aldergrove

Warcop

Hillsborough

Leeming

Ringway

Hemsby

Cranwell

Heathrow

Manston

Yeovilton

St Mawgan

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Daily rainfall records

204 sites

in 9 regions

40 years

Daily gauge

Regions
- CEE
- ES
- NEE
- NI
- NS
- NWE
- SEE
- SS
- SWE

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Future climate

- Parameterise for the whole UK for future climates by using control and future output from HAdRM3
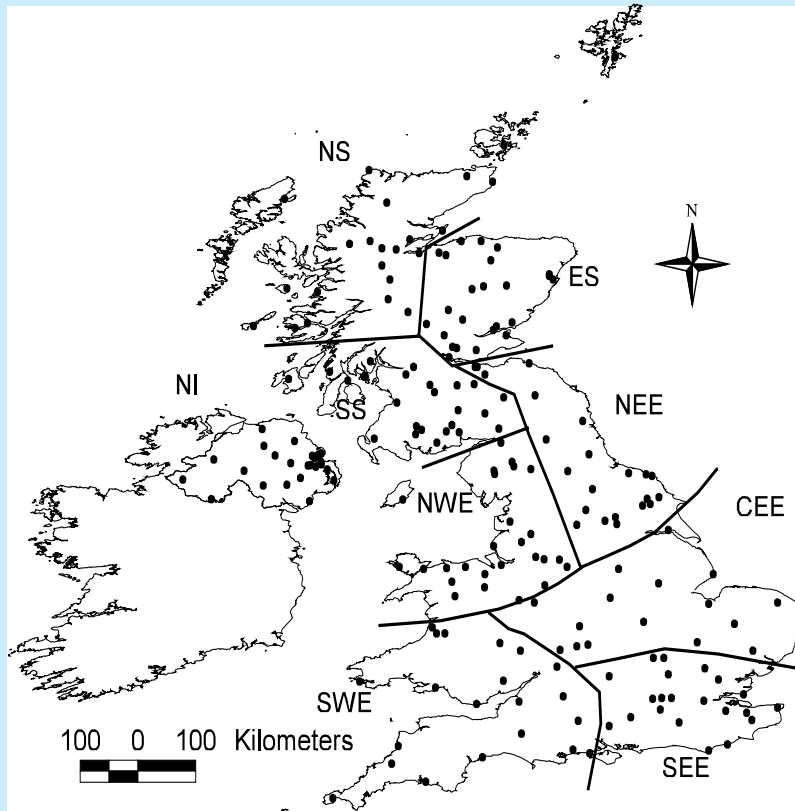
Sub-hourly resolution

- Use cascade model to disaggregate data from 60 – 30 – 15 minute level
- Reliability to be established below 15 minute – depends on validation data

- Interface from GNSRP model to CRU daily WG.

- Extend model to allow for changing proportion of convective/frontal rainfall in future climate
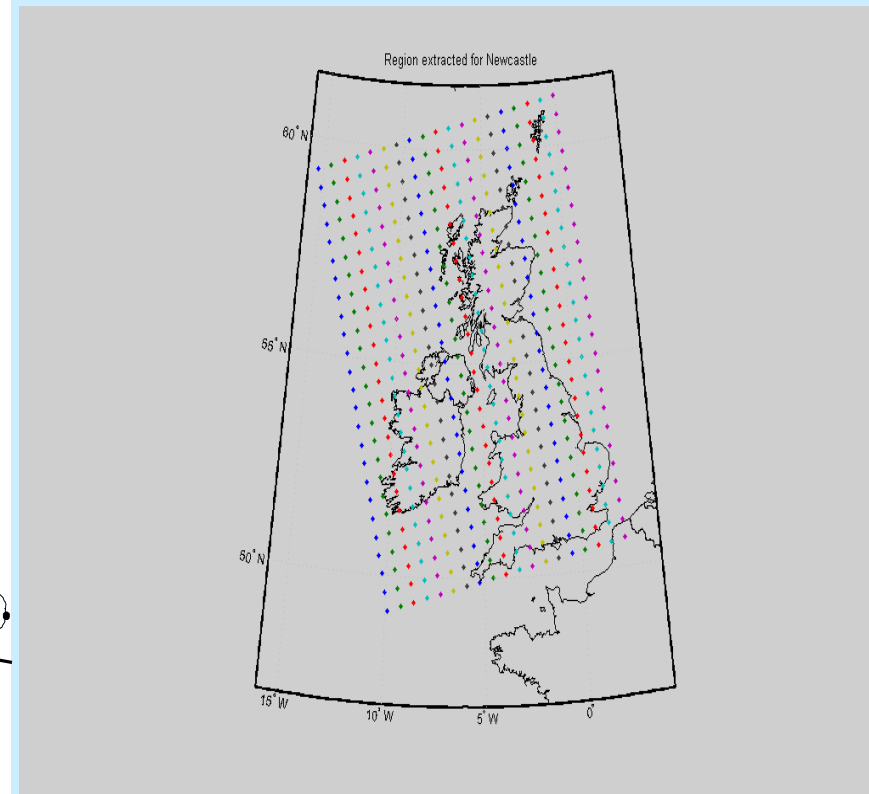
Rainfall model

- **for use by partners;**
- **within the project;**
- **to generate rainfall series;**
  - at any site in UK
  - arbitrary length
  - time resolution of 1-day, 1-hour and below
  - control and future climates
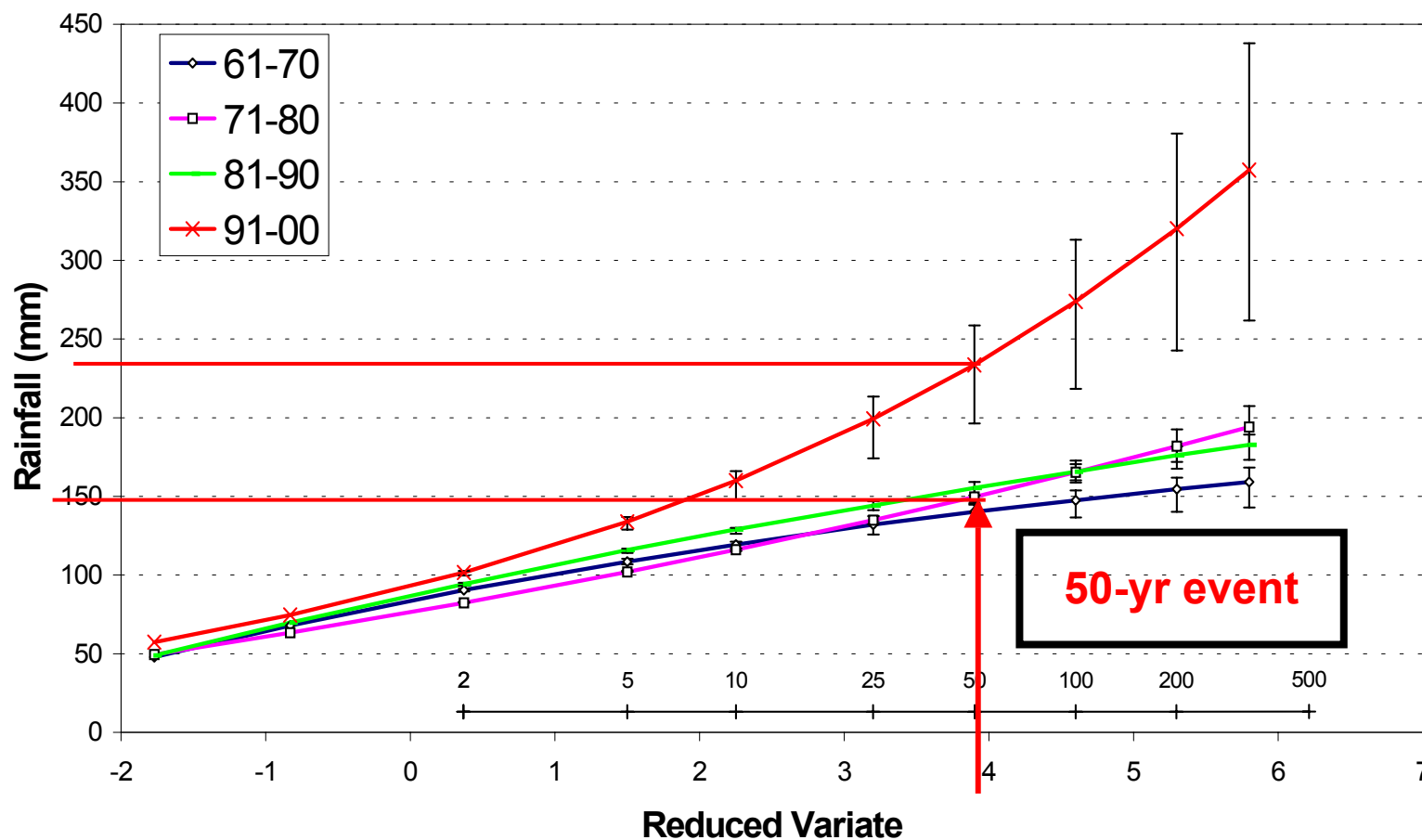 - reproduces observed extreme rainfall (up to at least 25 year return period)

Observed daily rainfall data 1961-2000

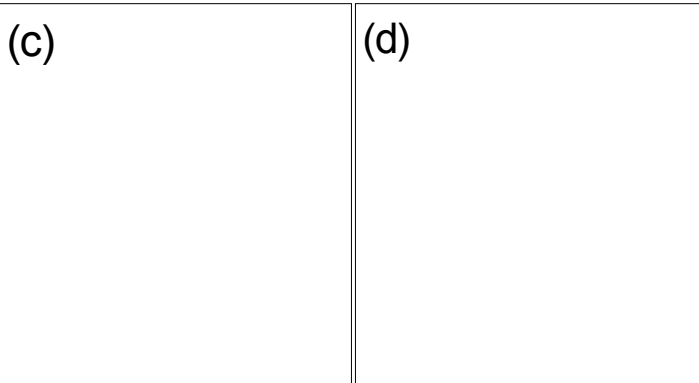Daily rainfall data from RCMs 1961-1990 and 2070-2100

Region extracted for Newcastle

East Scotland 10-day

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Change in recurrence interval for a 50-year event in 1961-1990 during 1991-2000

ES	1 in 8 year
SS	1 in 11 year
NS	1 in 25 year
NWE	1 in 25 year
NEE	1 in 25 year

(a)

(b)

(c)

(d)

- (a) and (b) show HadRM2 projected % change in magnitude of 10-yr and 50-yr 1 day event during 2080-2100

- (c) and (d) show same for HadRM3 (UKCIP02) scenarios