

Scope

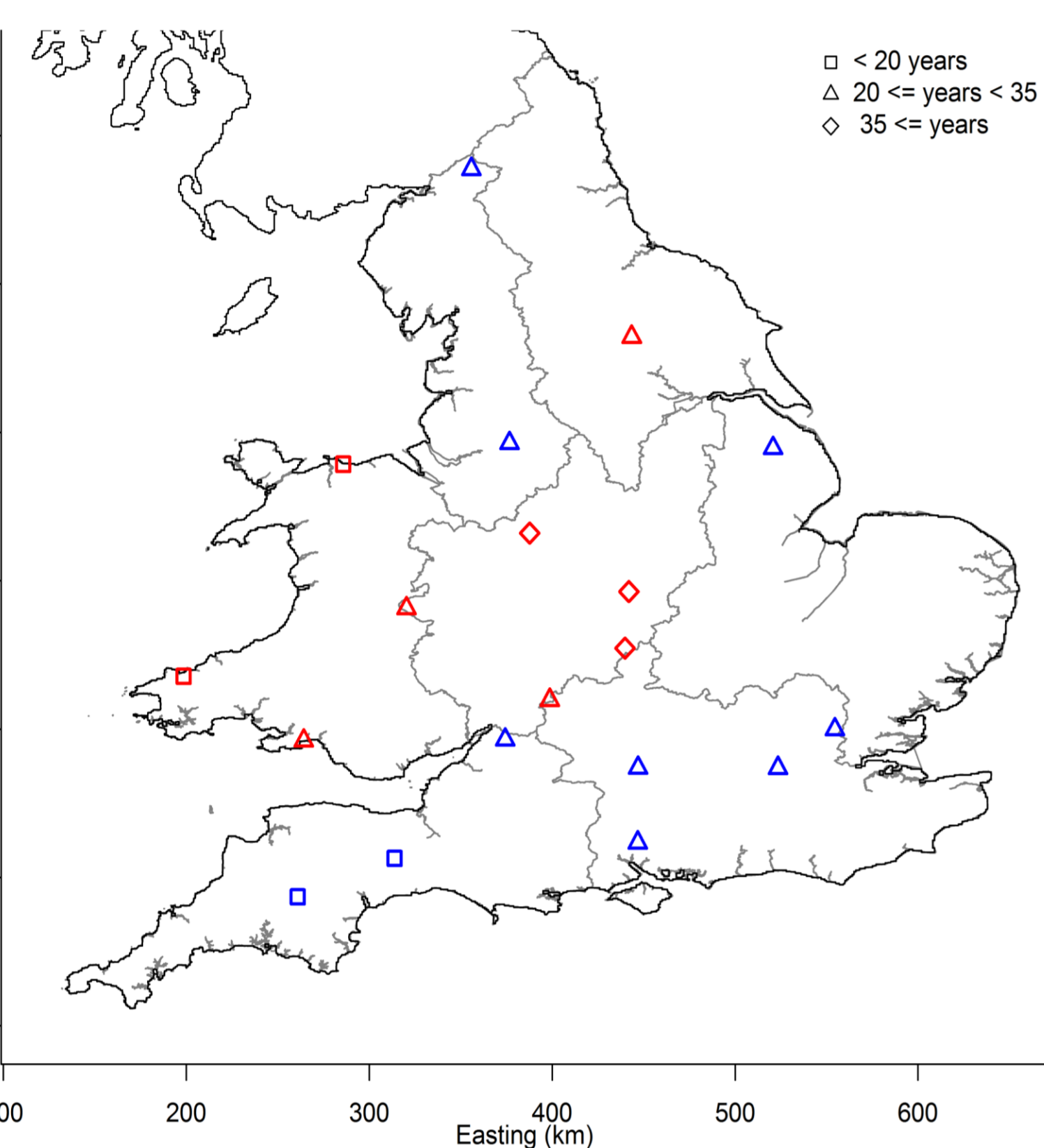
EA Project SC090031 – Estimating flood peaks and hydrographs for small catchments (Phase 2)

Small catchments and plot-scale areas often have short response times, making them potentially vulnerable to short, intense bursts of rainfall. The aims of this study were:

- To investigate the depth-duration-frequency (DDF) characteristics of short-duration rainfall data.
- To assess the reliability of current nationally applicable models in estimating rainfall frequency for durations shorter than the basic intervals that were used in their development.

Annual and seasonal DDF relationships were studied for a set of 19 sub-hourly raingauges with relatively long records in England and Wales. The resulting rainfall frequency curves have been compared with those from existing UK DDF models, the Flood Studies Report (NERC, 1975), the Flood Estimation Handbook (Faulkner, 1999) and the FEH13 model (Stewart *et al.*, 2013).

Data



Raingauges were selected to provide:

- sub-hourly rainfall events (time of tip and 15-minute data)
- good geographical coverage of England and Wales
- long records (at least 10 years)

Annual and seasonal maxima were abstracted for the following durations:

- 1-, 2-, 5- and 10-minute for the TBR stations only
- 15-, 30-, 45-, 60-, 90- and 120-minute for all stations

	East (hm)	North (hm)	AMAX length (years)	SAAR (mm)		East (hm)	North (hm)	AMAX length (years)	SAAR (mm)
Bettws-y-Crwyn	3204	2814	28	1000	Chieveley	4470	1739	22	699
Colwyn Bay	2858	3785	19	777	Crew Fell	3559	5774	20	1188
Dowdeswell	3988	2196	30	772	Hemyock	3138	1129	18	995
Hinckley	4420	2927	46	643	Kingswood	3743	1928	33	777
Knightcote	4398	2545	35	631	Ludford	5208	3893	23	700
Llanychaer	1986	2356	19	1263	Otterbourne	4467	1235	26	786
Lower Dunsforth	4435	4643	26	632	Putney Heath	5235	1738	25	614
Stone	3878	3321	46	740	Sale Carrington	3766	3927	23	836
Victoria Park	2642	1922	21	1150	Stanford Rivers	5546	1999	22	606
					Taw Head	2609	869	15	2186

Methods

A new modelling strategy has been used to estimate rainfall event frequencies. The method has the following characteristics:

- It ensures consistency (non-crossing) between frequency curves
- It allows frequency to be estimated even with relatively few data points (i.e. few parameters in the model)
- Frequency curves are fitted on a site by site basis
- Frequency relationships are informed by the observed features in measured data
- It is built on the standard Generalised Extreme Value (GEV) distribution called here the **Unified GEV**

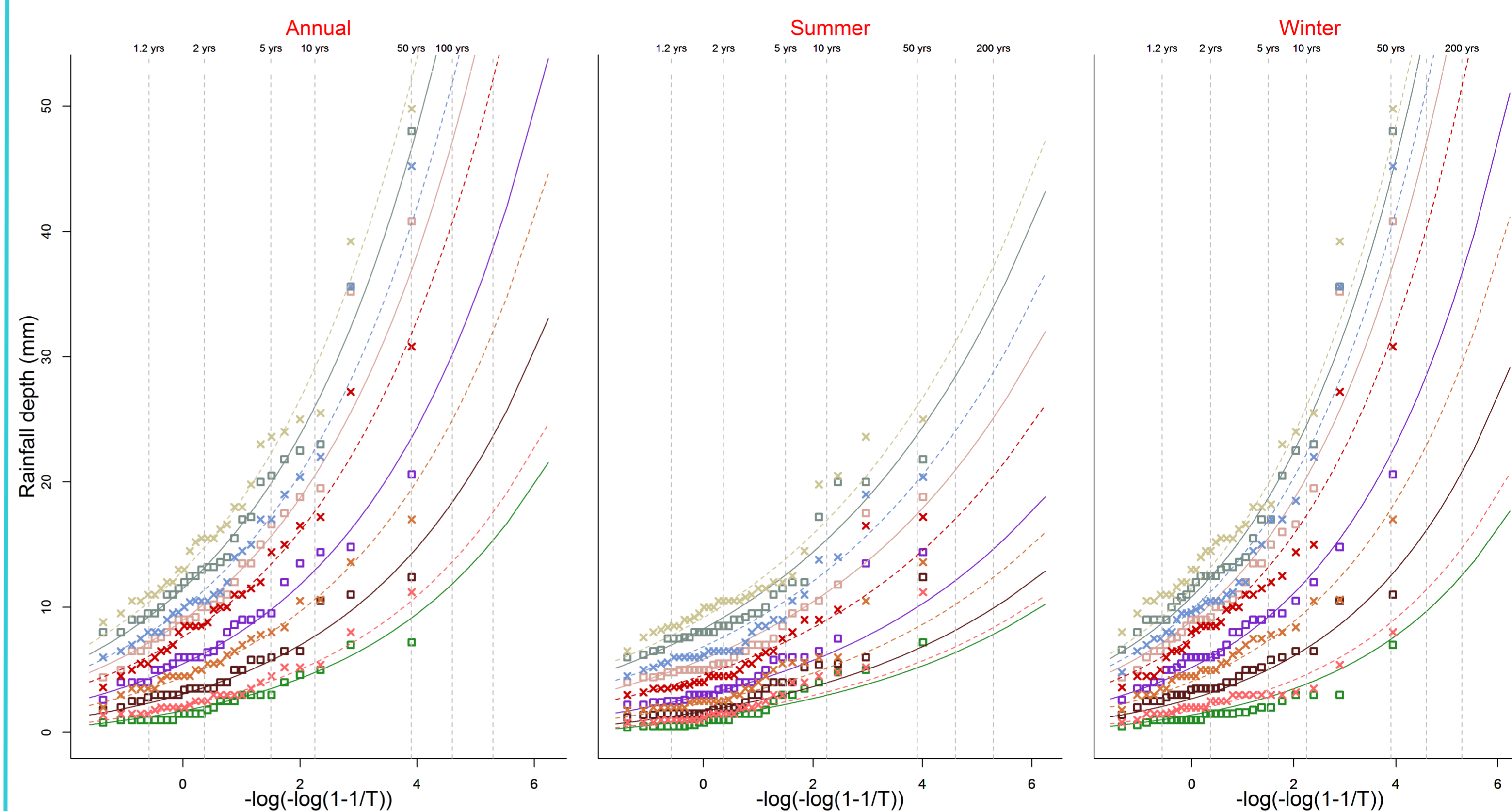
References

Faulkner, D., 1999. Flood Estimation Handbook, Vol. 2: Rainfall frequency estimation. Institute of Hydrology, Wallingford.
NERC, 1975. Flood Studies Report (five volumes). London: Natural Environment Research Council.

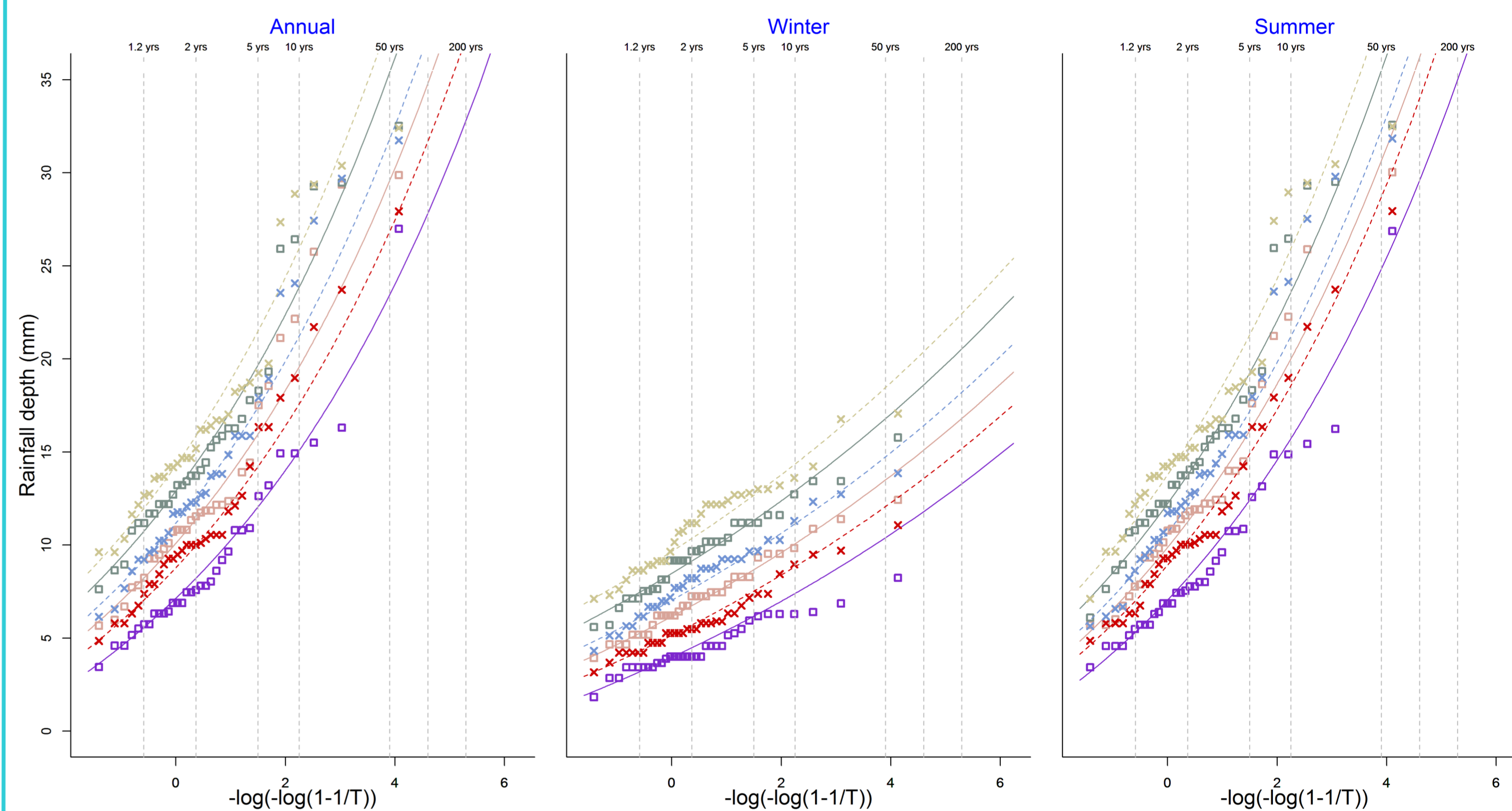
Stewart, E.J. *et al* 2013. Reservoir Safety – Long Return Period Rainfall. Final report. London: Defra. Joint EA/Defra FCERM R&D Programme

Results

The unified GEV model is fitted to the annual and seasonal maxima series for all the tipping bucket stations. Below the results for the TBR station of Bettws-y-Crwyn are shown.

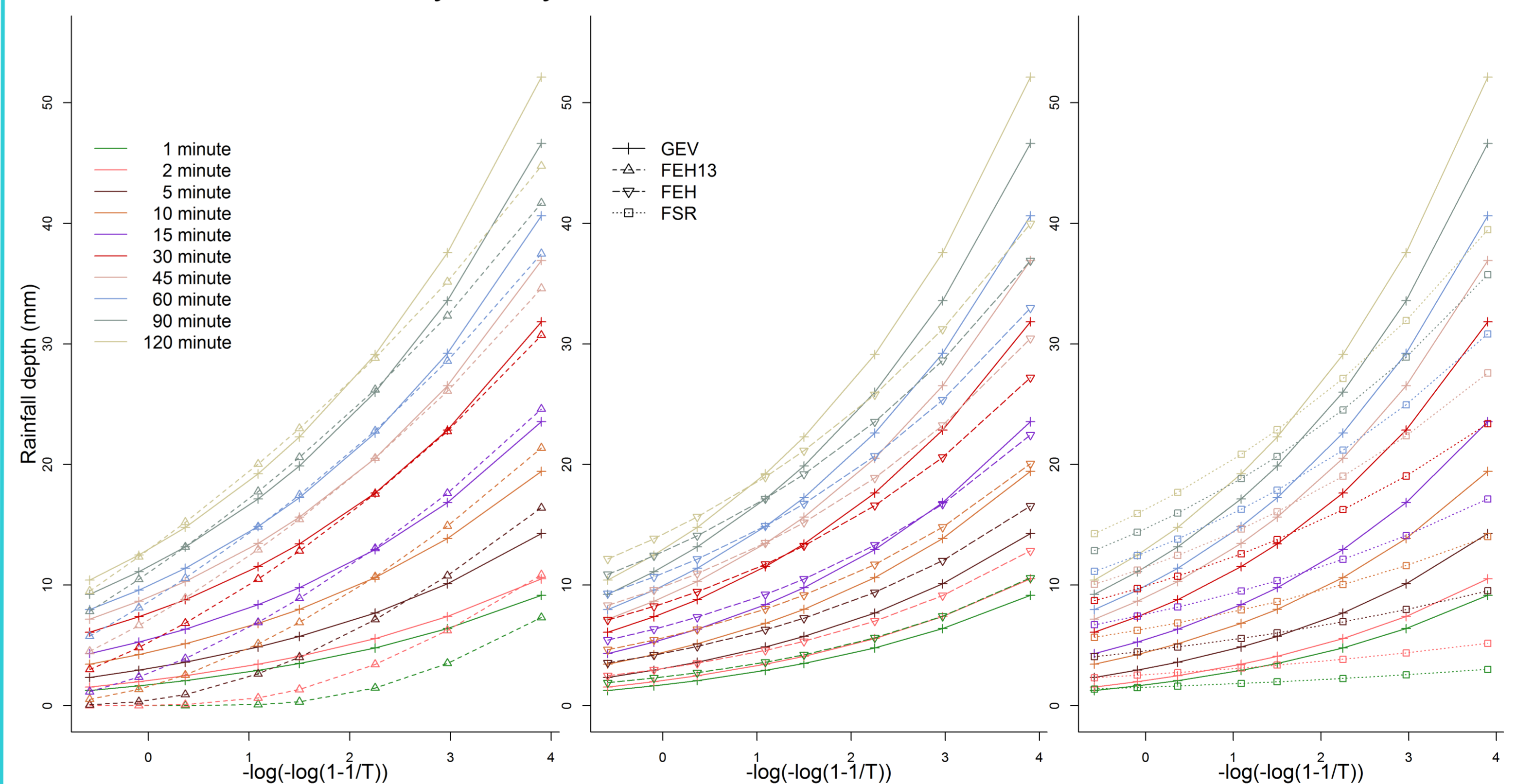


The unified GEV model is fitted to the annual and seasonal maxima series for durations of at least 15 minutes for all stations TBR and 15-minute). Below the results for the 15-minute station of Kingswood are shown.



Comparisons

For each stations comparisons were made with estimated frequencies for annual series obtained using the FSR, FEH and FEH13 DDF models. Below the results for Bettws-y-Crwyn are shown.



- The estimated values across stations and durations are fairly comparable for the different estimation procedures.
- No consistent patterns in the differences between the unified GEV estimates and the other methods are apparent.
- Some larger differences seen between the unified GEV estimates and the other methods are due to data properties which influence the at-site estimation.

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