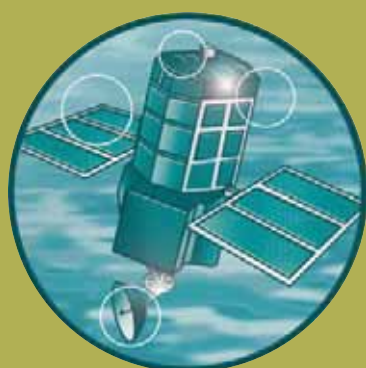


National river catchment flood frequency method using continuous simulation:

Appendices

R&D Project Record FD2106/PR



**ENVIRONMENT
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Joint Defra/EA Flood and Coastal Erosion Risk
Management R&D Programme

National river catchment flood frequency
method using continuous simulation:

Appendices

R&D Project Record FD2106/PR

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SUMMARY

This is the Technical Report for project FD2106 *National river catchment flood frequency method using continuous simulation*. It also serves a reporting role to the Scottish Executive who funded inclusion of Scotland in the work, the Defra – Environment Agency remit covering England and Wales. The term ‘national’ therefore refers to Britain.

The Technical Report contains the main text which describes the development of research approaches, analyses of results and recommendations. The figures and tables in the Appendices (Project Record) comprehensively detail the results.

The first chapter of the main text introduces the aims of the project, the potential advantages of a continuous simulation approach to river flood frequency quantification, and the specific project objectives. These are set in the context of other recent and current research projects of the Flood Management R&D programme.

Data, modelling and extrapolation issues are plainly all interlinked: for convenience they are handled in separate chapters of the report. Chapter 2 covers selection of the data-rich catchments (119 in total) which serve as the basis for extension of the method to full spatial coverage across Britain. The sources and nature of precipitation, evaporation and river flow data are detailed, together with the methods established for quality control and infilling. Both hourly and daily data were used, in order to define detail but also widen availability. Data required for the whole domain of potential application of the method, the more widely-available catchment properties, are also defined and their derivation discussed.

Chapter 3 describes the runoff models used in representing catchment processes defining the translation of rainfall to continuous river discharge series. Because of the need to ultimately apply these models to ungauged sites, with model parameters derived from catchment properties, it is currently pragmatic to use parameter-sparse runoff model formulations, and two such models (the ‘Probability Distributed Model’ and the ‘Time-Area Topographic Extension’ model) with a track record of suitable performance are described. Chapter 4 on runoff model calibration details an automated procedure developed to establish suitable parameter sets, as the large number of catchments involved precludes manual calibration. Attention was paid to the performance of earlier-established calibrations in the light of more recent data from the winter 2000-2001 floods. Methods for establishing flood statistics from time series are briefly noted. Calibration objective functions included measures relating to frequency curves as well as to discharge time series.

Spatial generalisation of the method, namely the extrapolation from calibrated catchments to data-poor or ungauged sites, is discussed in detail in Chapter 5. Three methods, together with their variants, are developed in detail: these are, in brief, a univariate regression, a sequential regression and a site-similarity approach. Tests of these methods were undertaken on the sample catchments, withholding observations and treating them as if ungauged. Results are reported and serve as a basis for recommendations of the final chapter.

Chapter 6 develops theory and methods to derive uncertainty bands around spatially-generalised flood frequency curves arising from runoff model parameter uncertainty. Results are presented for the univariate regression and site-similarity generalisation methods. In Chapter 7 an overview comparison is made of issues in flood frequency estimation using continuous simulation and using the 1999 Flood Estimation Handbook. Chapter 8 indicates research directions of likely benefit to the continuous simulation method.

The final chapter brings together the experience of the research and its testing to suggest the best recommendations at the current state of knowledge. The procedures for gauged and ungauged sites are described, the latter using site similarity generalisation with the PDM and/or univariate regression with the TATE. Use to long recurrence intervals is demonstrated, and inclusion of climate variability commented upon. The chapter ends with a recommended dissemination strategy.

Appendix A Calibration results

This appendix (pages 1-21) contains figures showing flood frequency curves and time series using calibrated parameter values, for each catchment, using each runoff model.

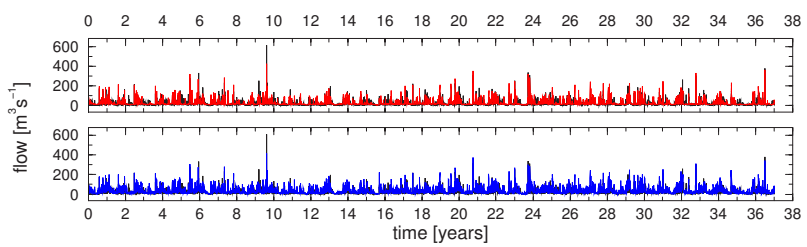
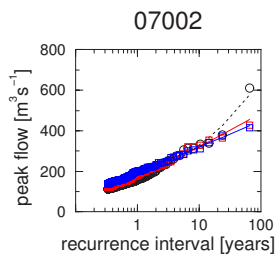
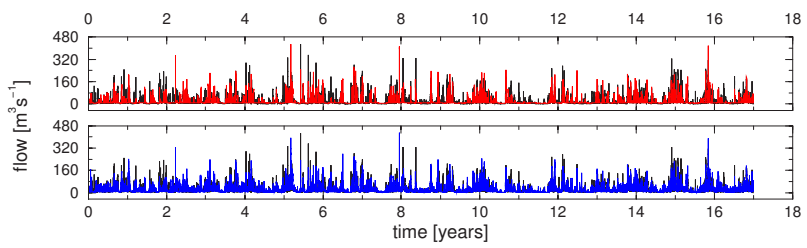
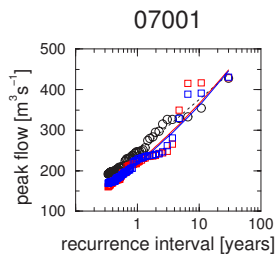
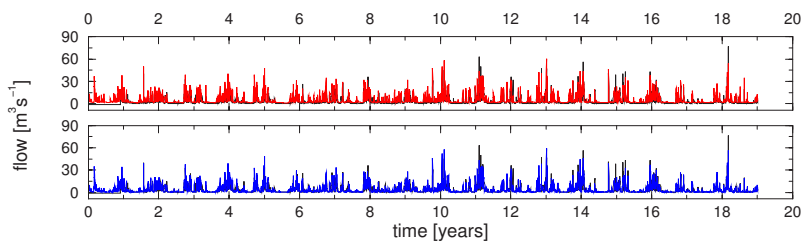
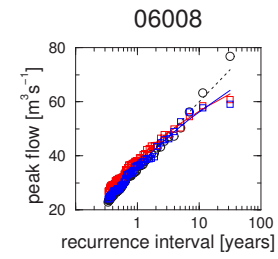
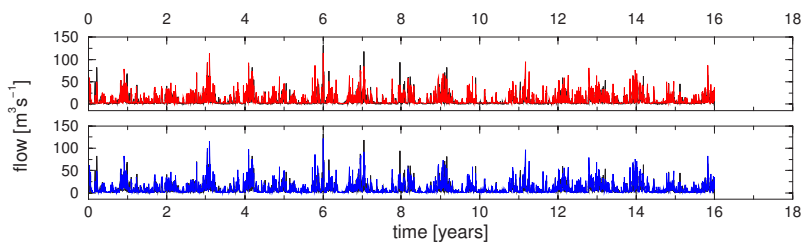
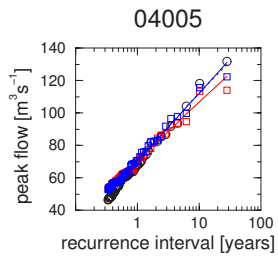
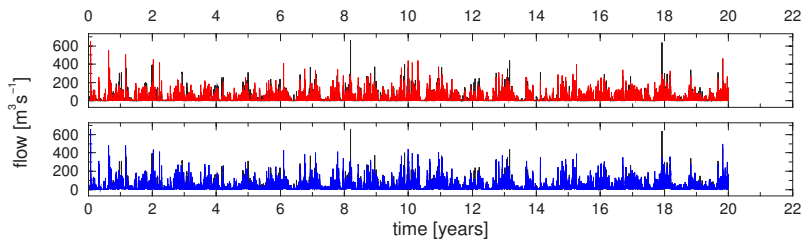
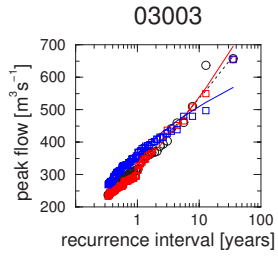
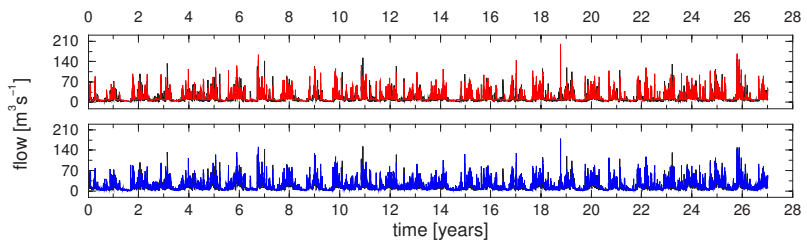
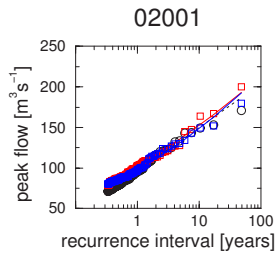
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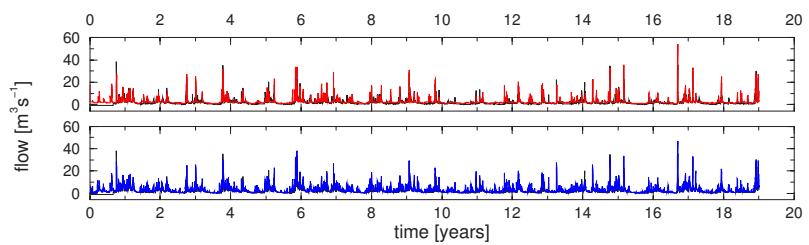
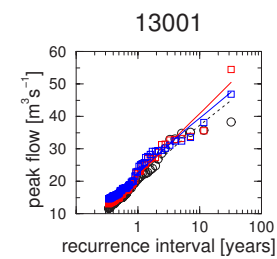
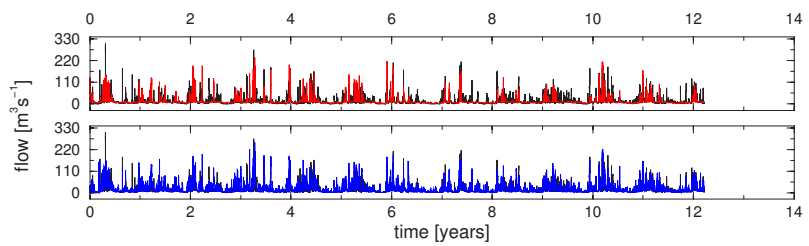
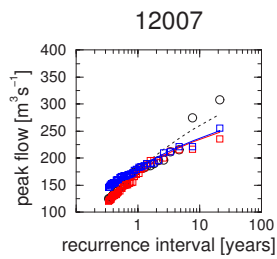
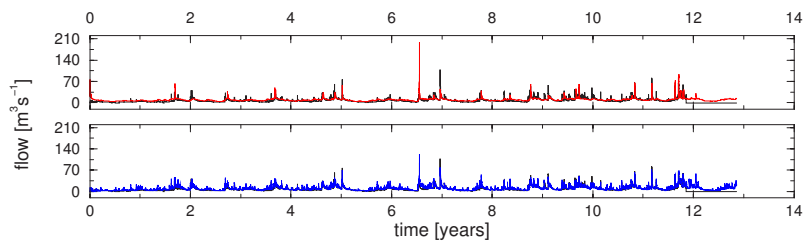
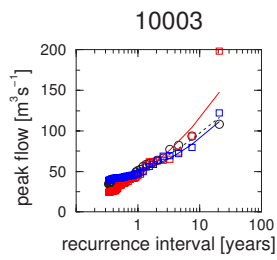
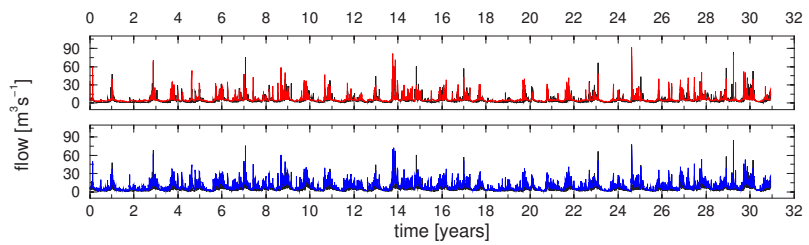
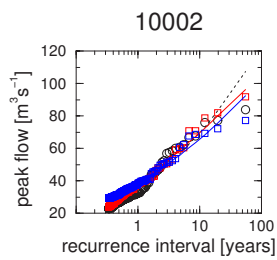
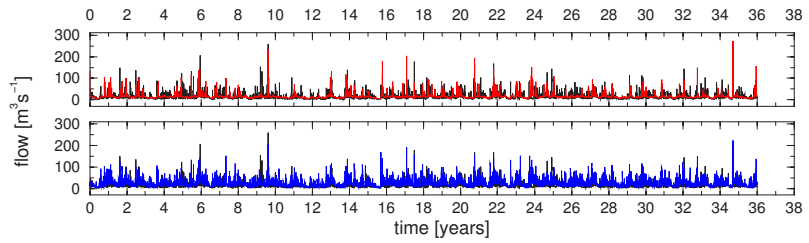
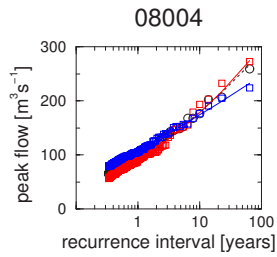
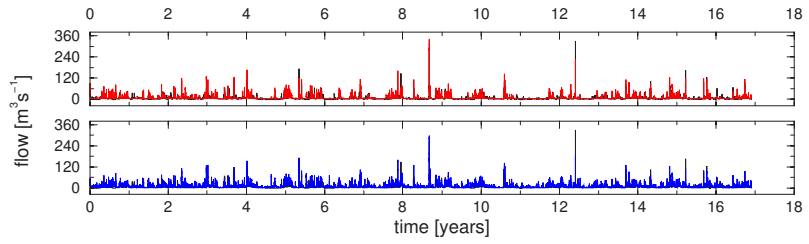
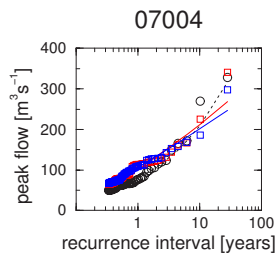
Black lines and open circles: observed flows (solid line in right-hand figures) and flood frequency curve (dotted lines in left-hand figures);

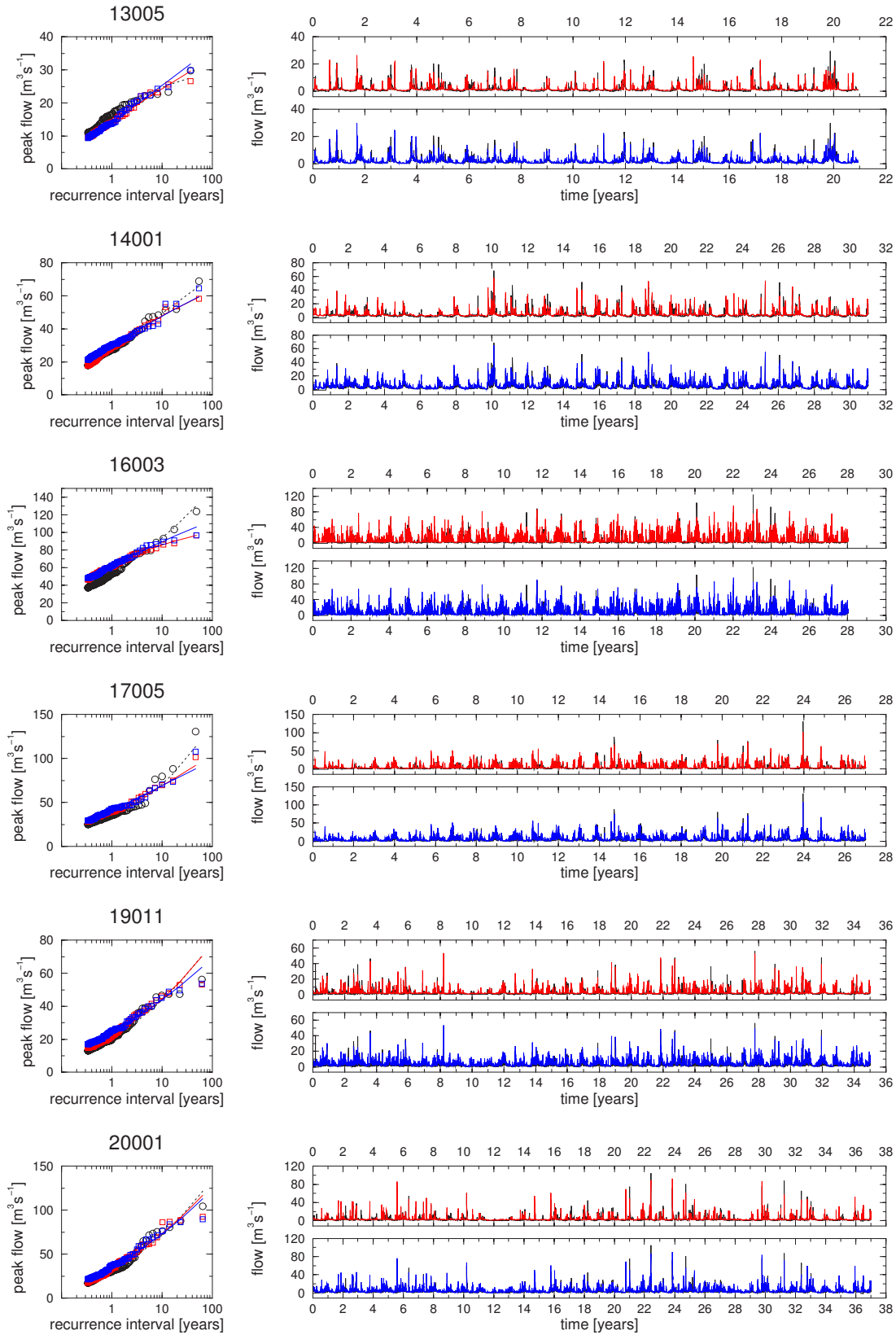
Red lines and open squares: simulated with TATE calibrated parameter values;

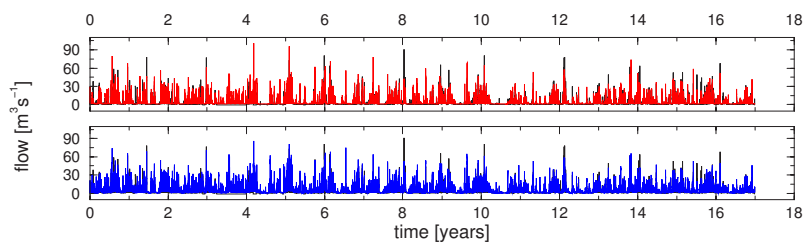
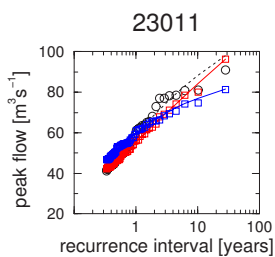
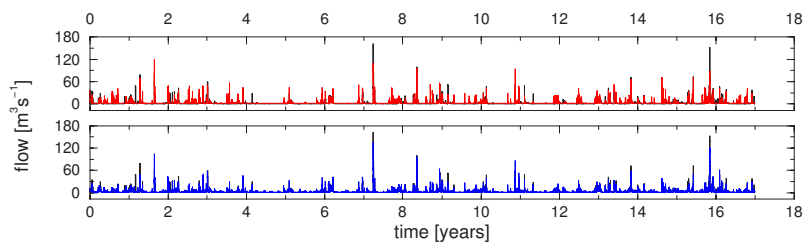
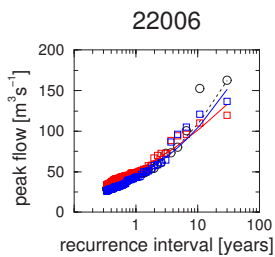
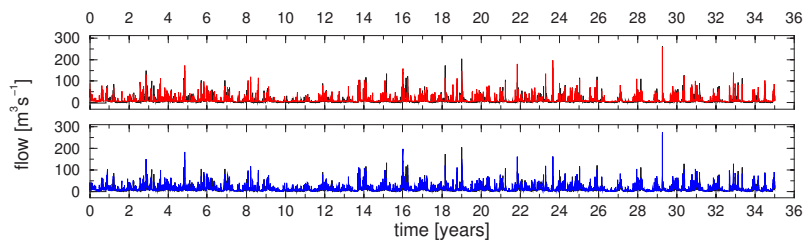
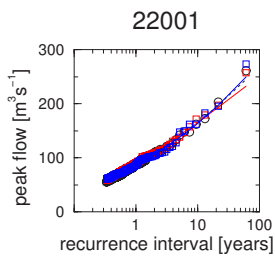
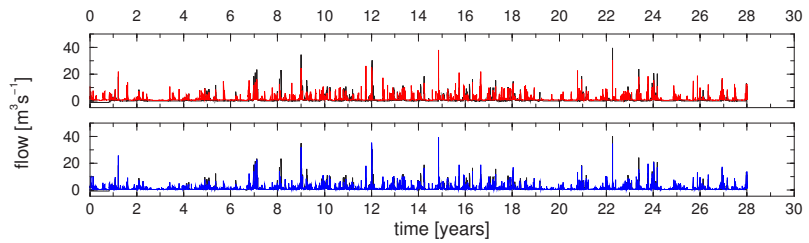
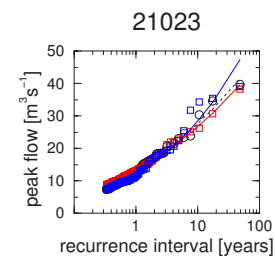
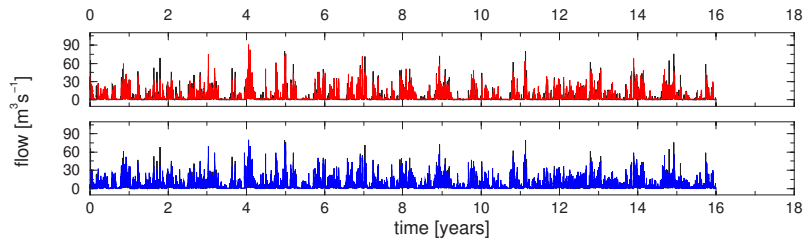
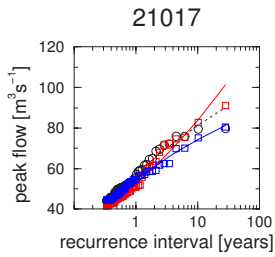
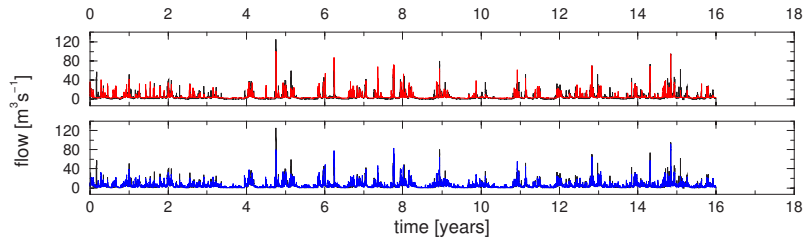
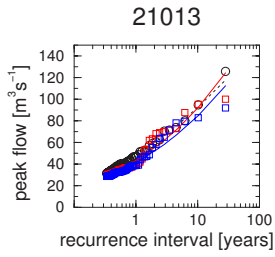
Blue lines and open squares: simulated with PDM calibrated parameter values.

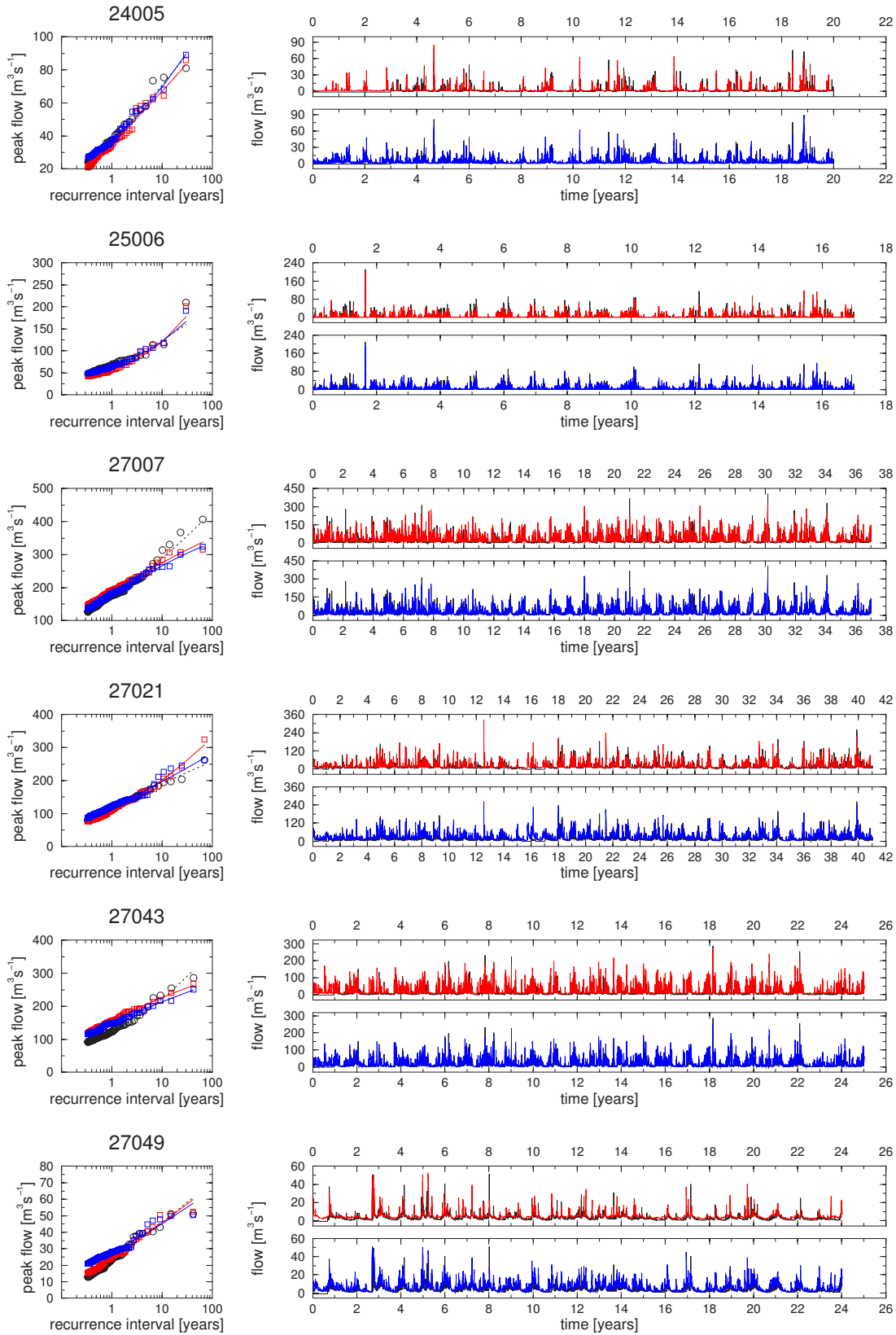
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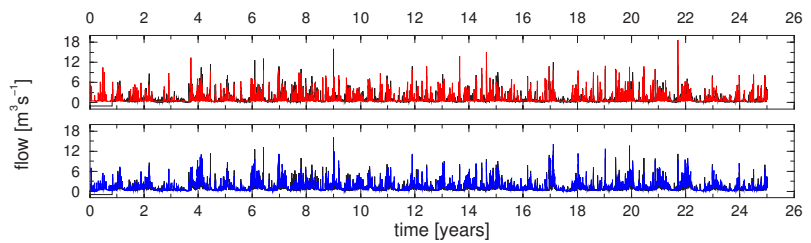
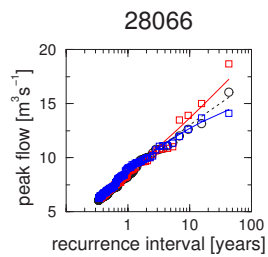
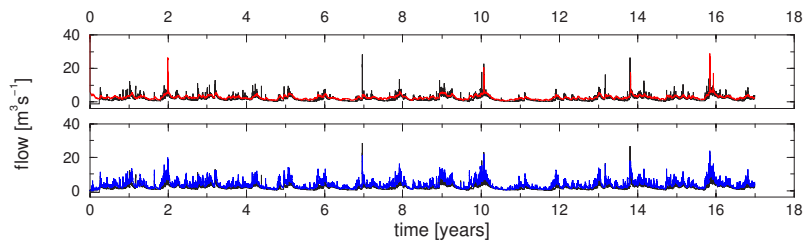
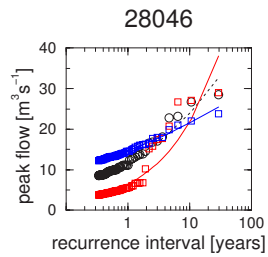
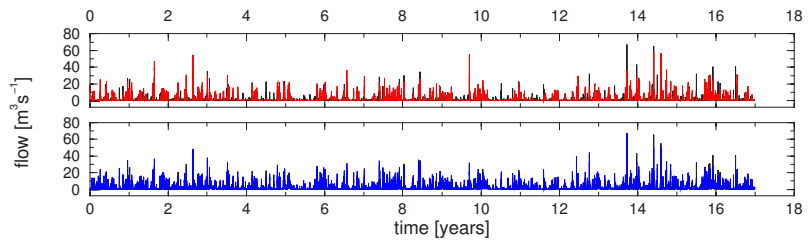
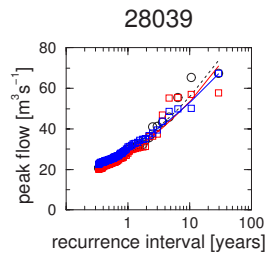
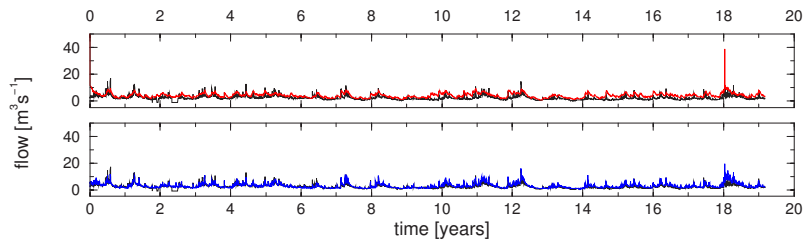
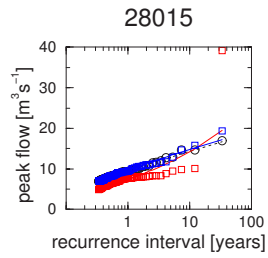
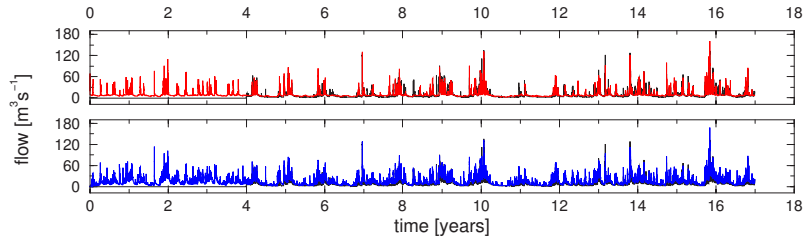
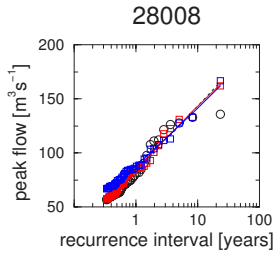
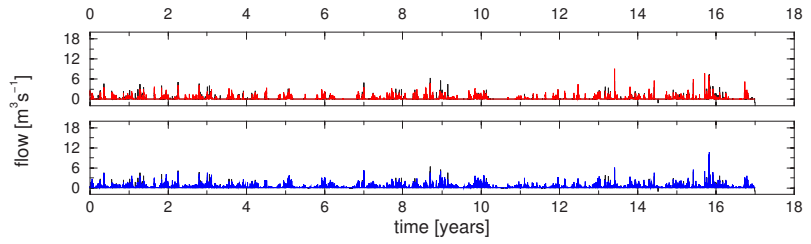
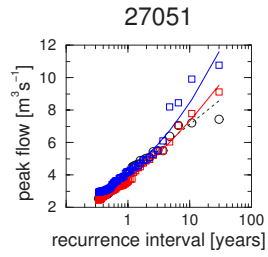


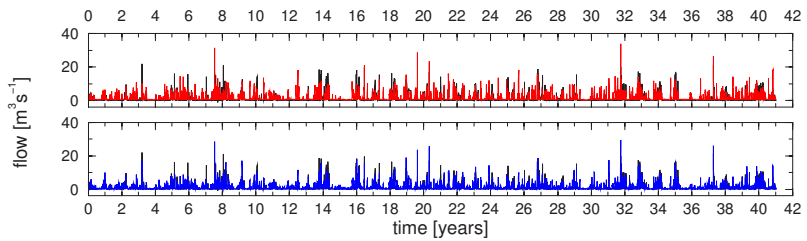
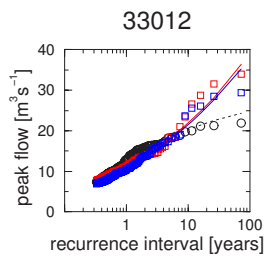
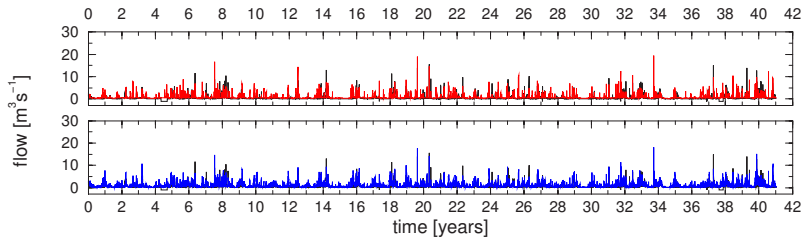
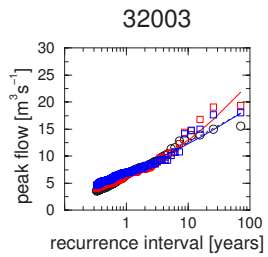
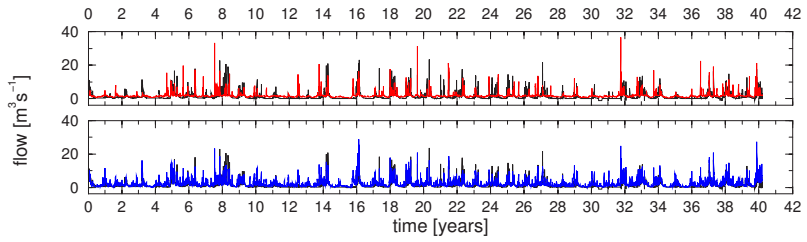
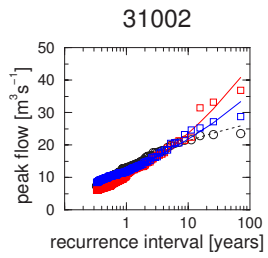
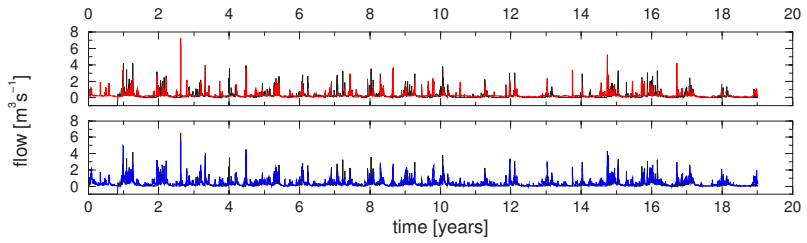
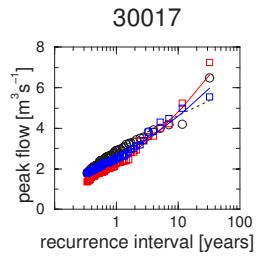
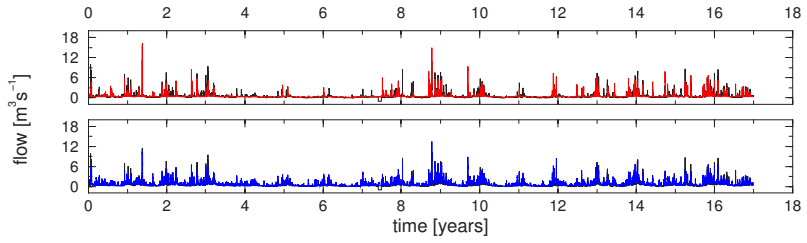
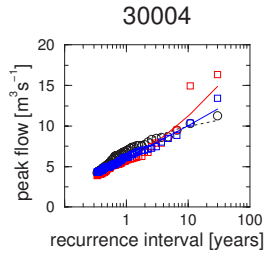
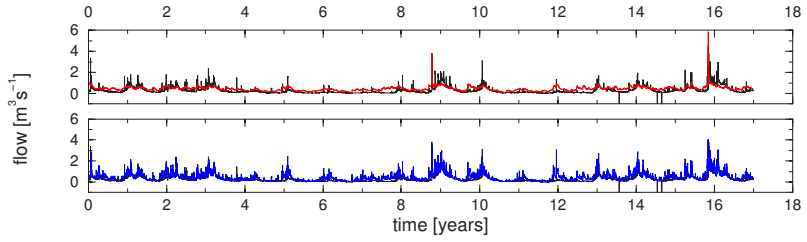
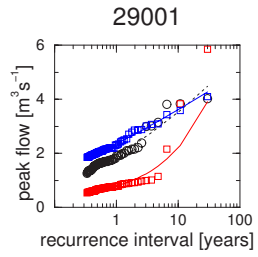


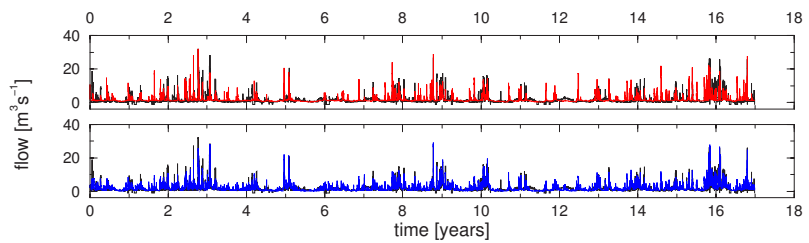
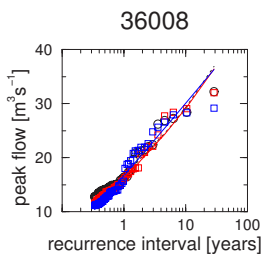
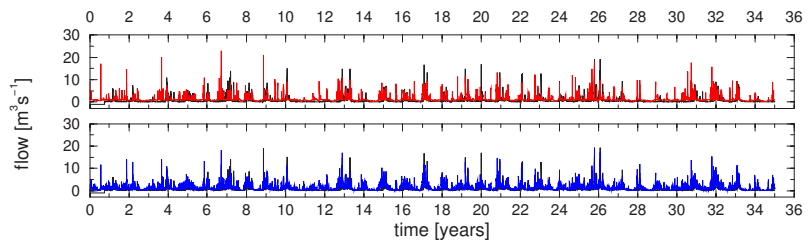
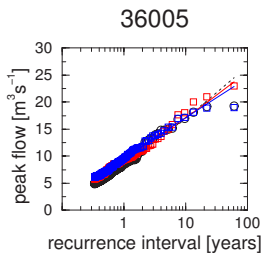
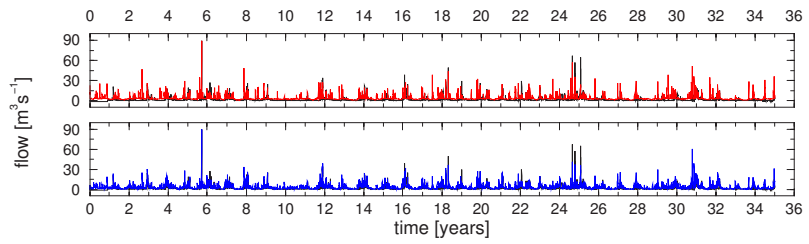
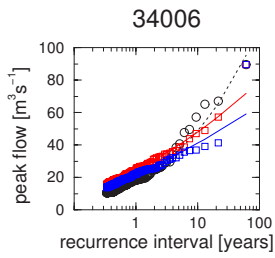
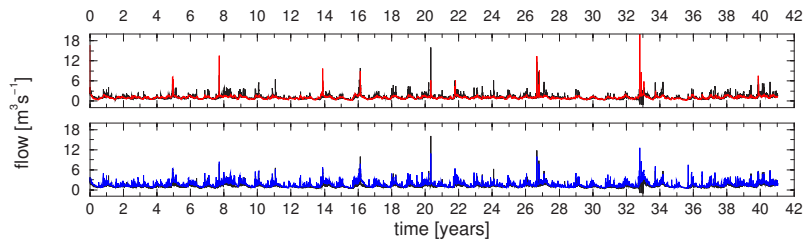
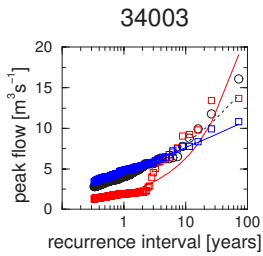
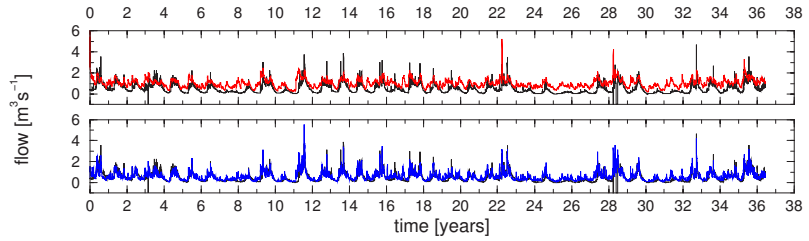
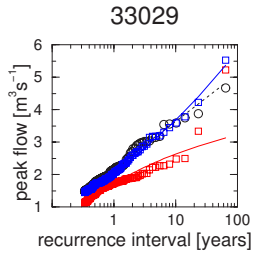
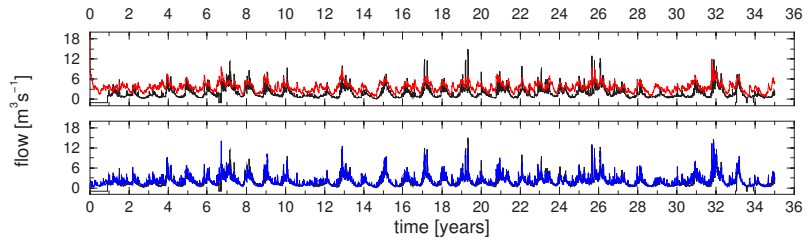
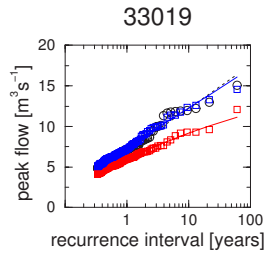


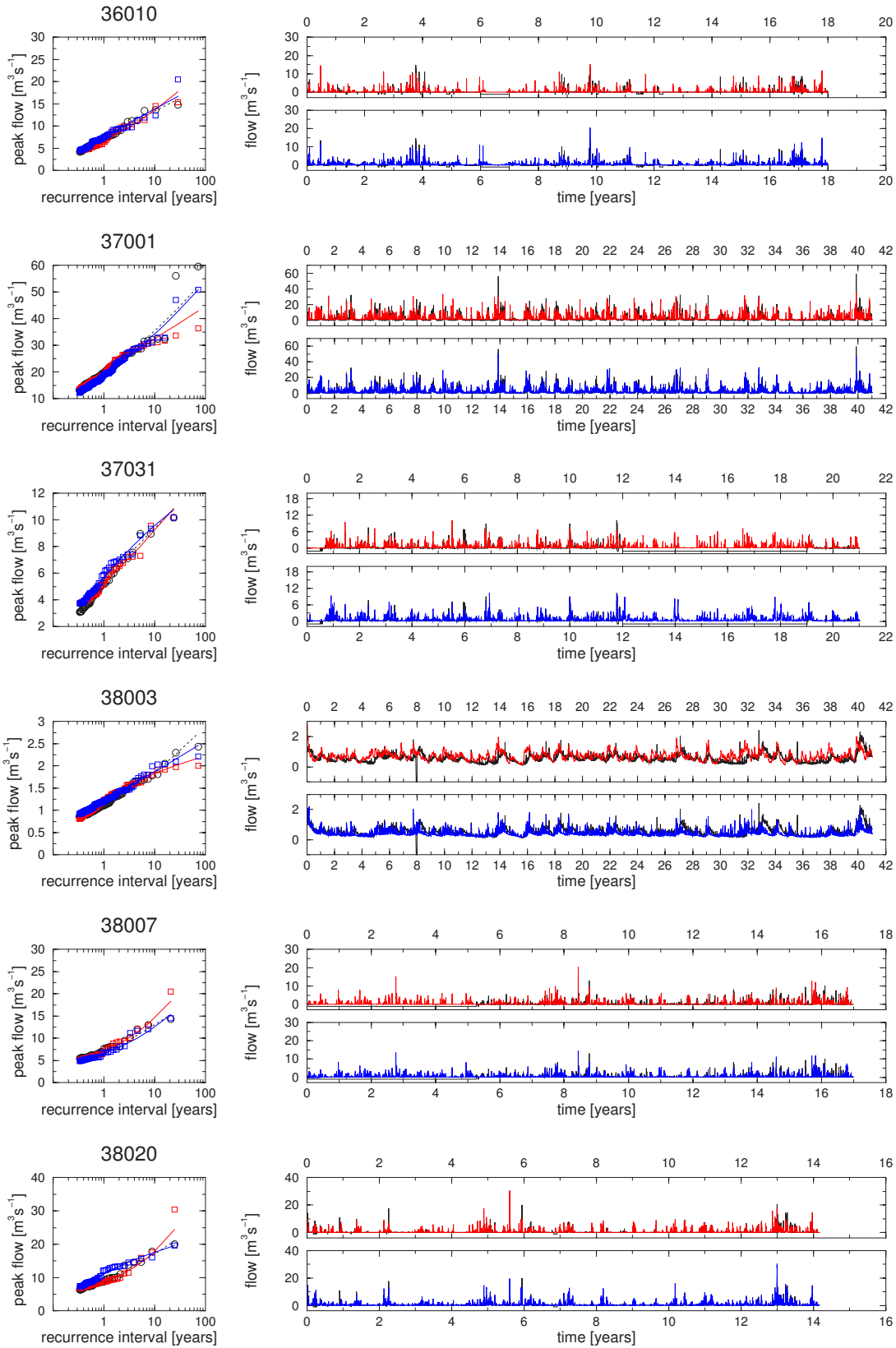


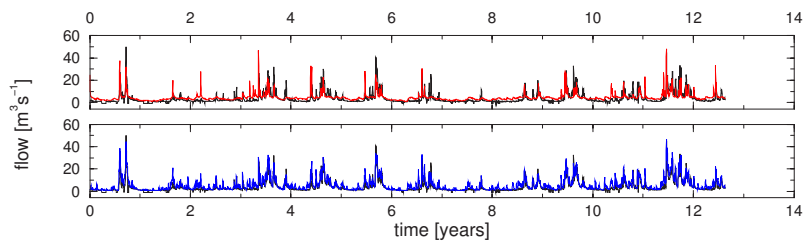
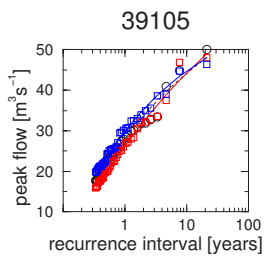
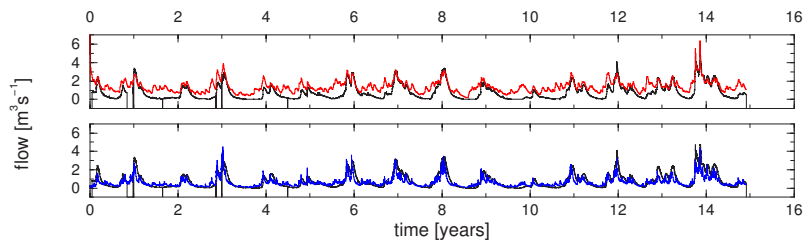
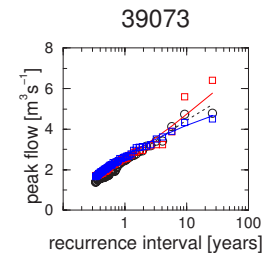
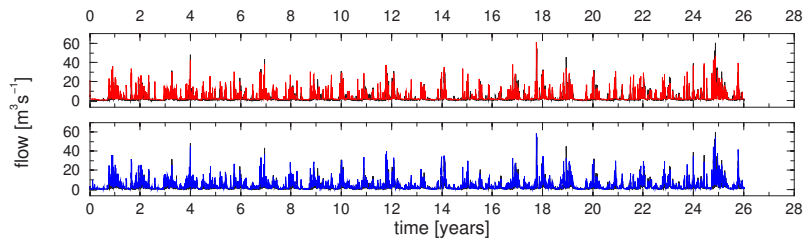
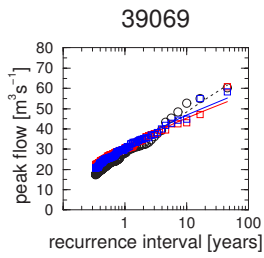
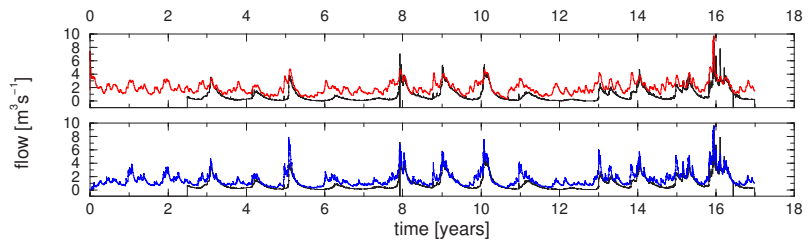
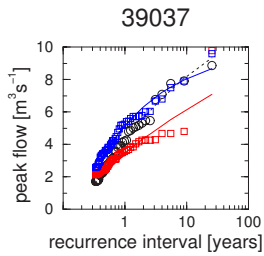
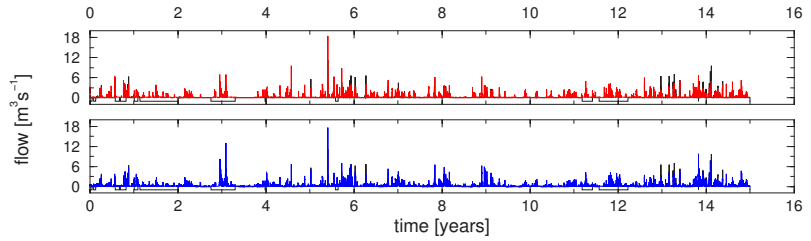
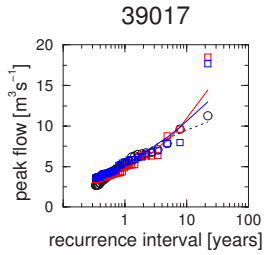
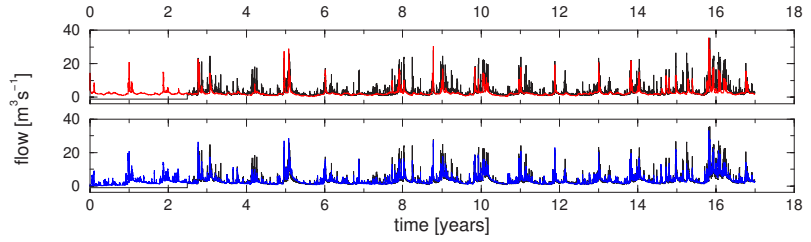
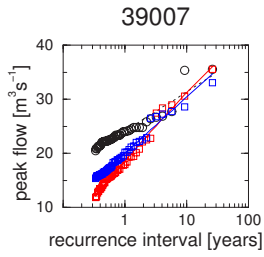


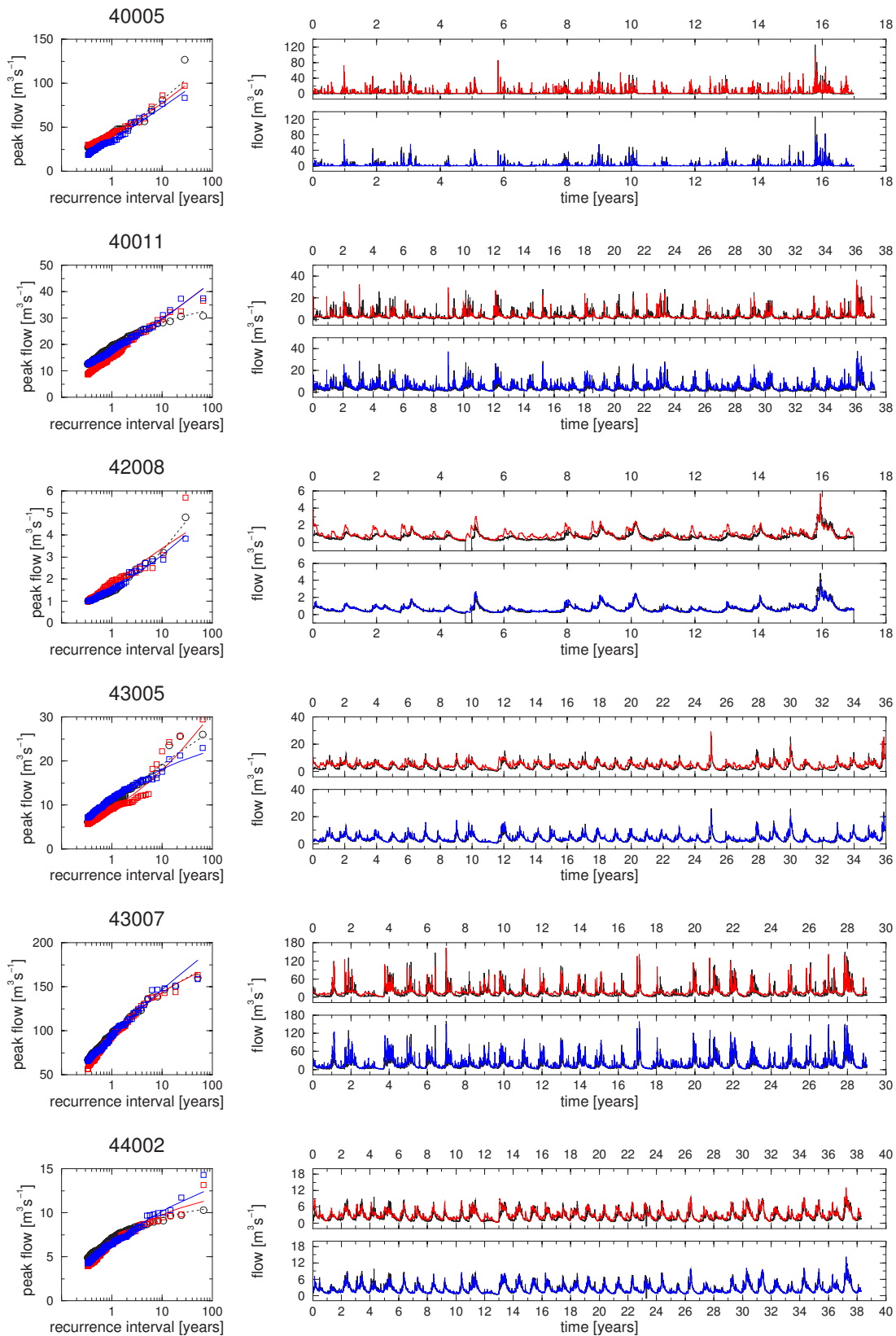


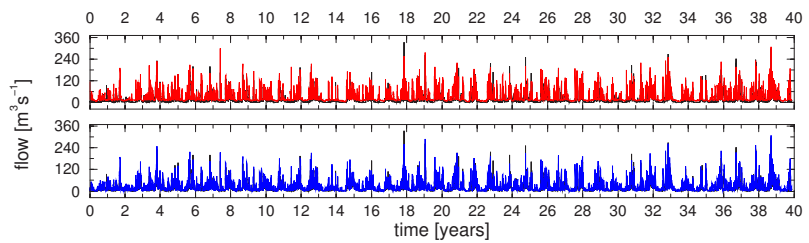
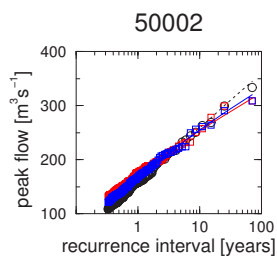
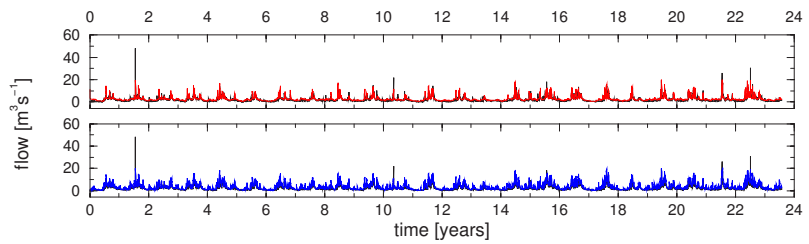
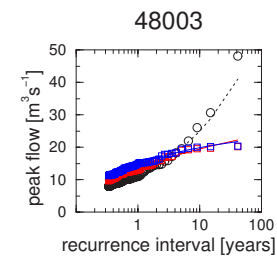
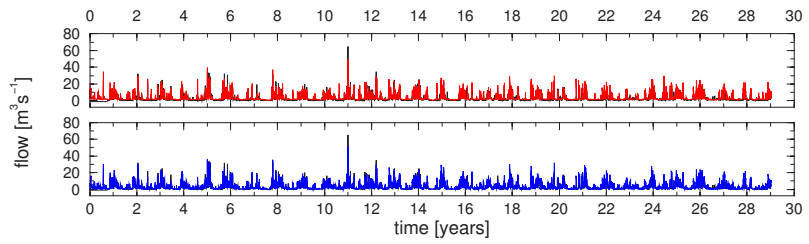
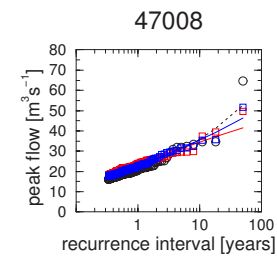
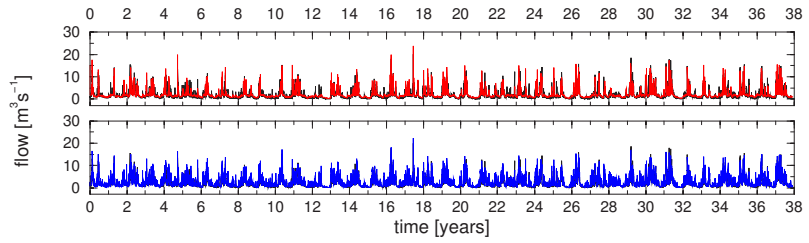
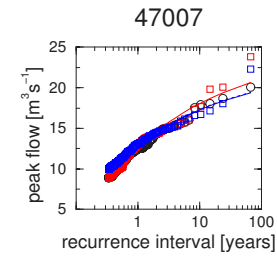
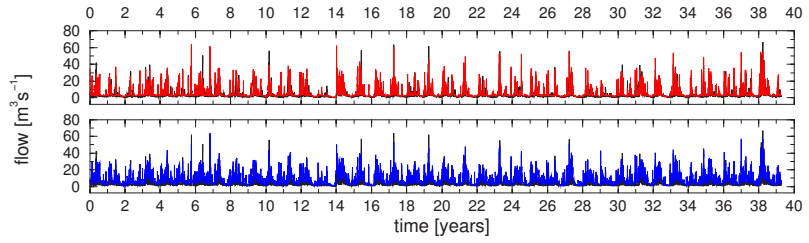
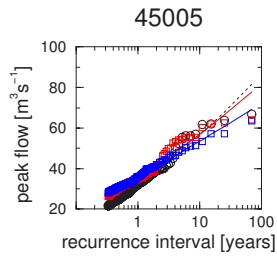
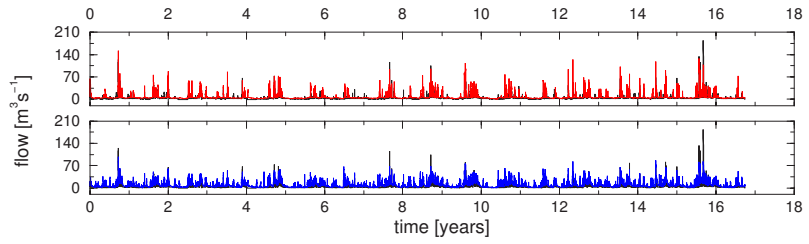
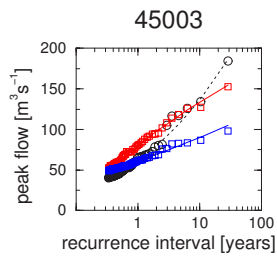


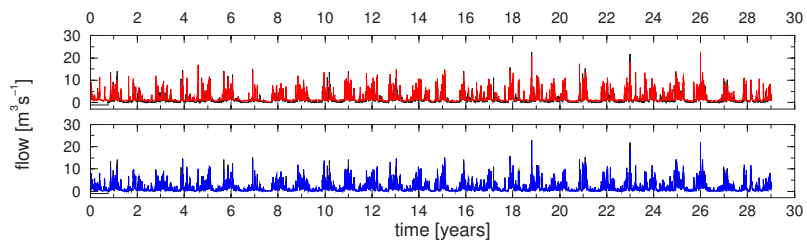
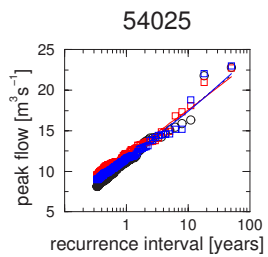
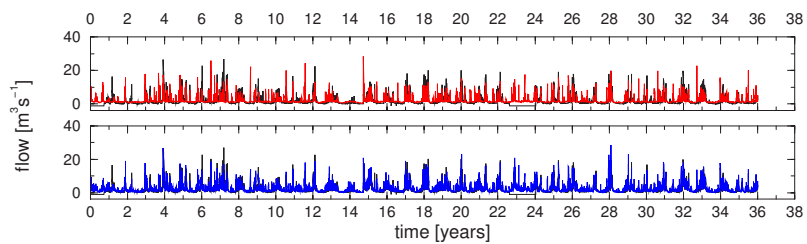
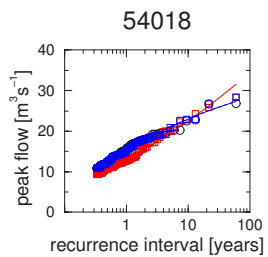
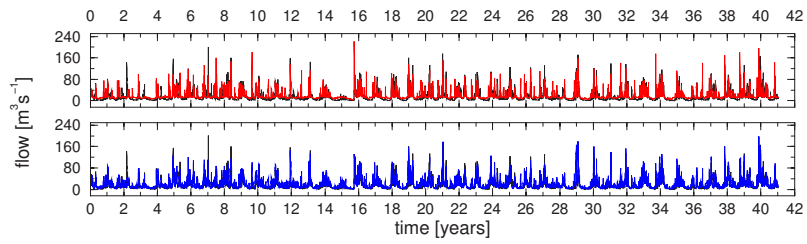
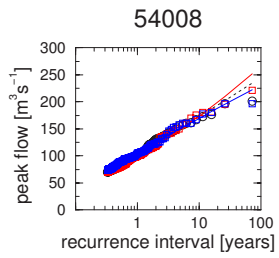
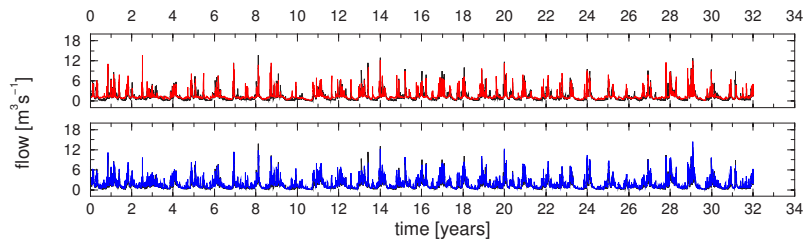
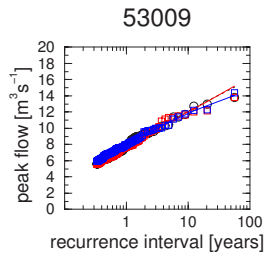
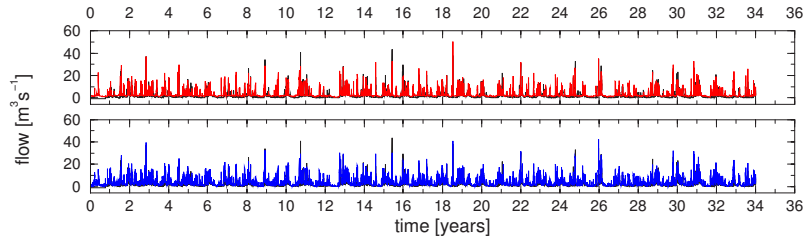
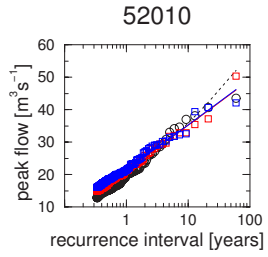
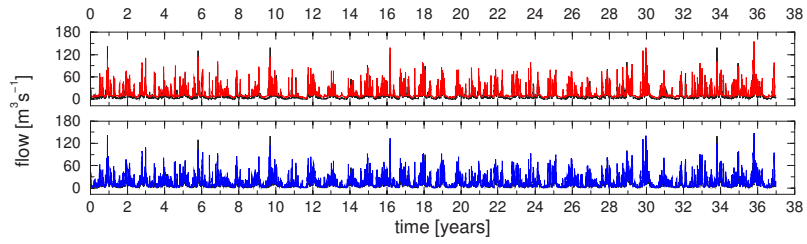
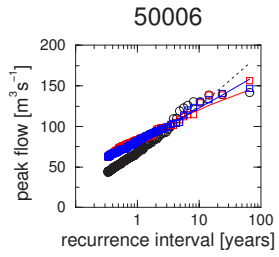


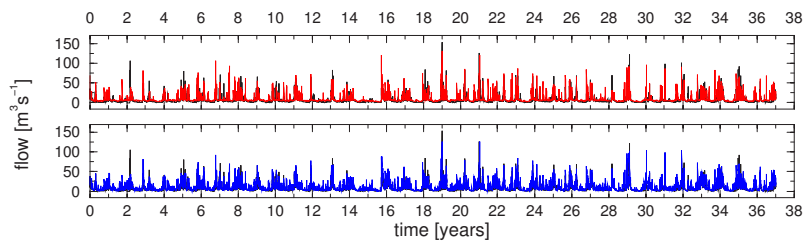
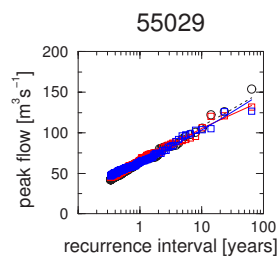
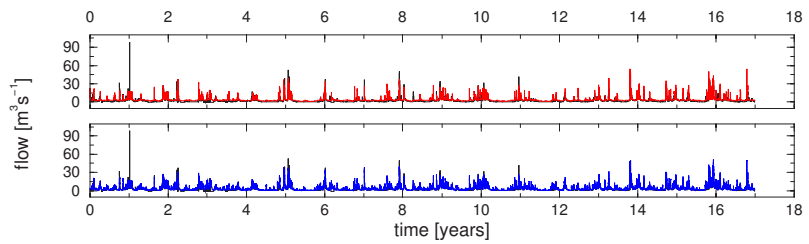
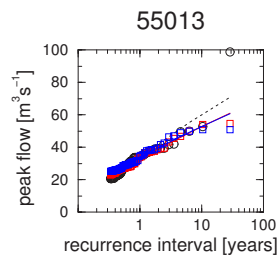
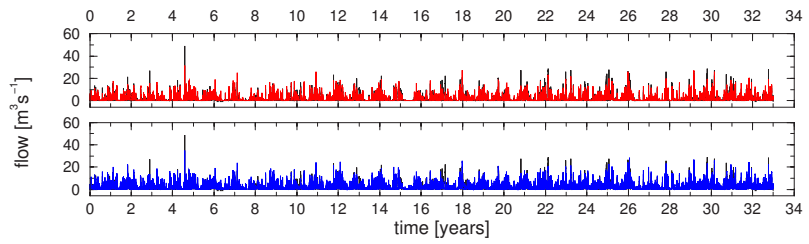
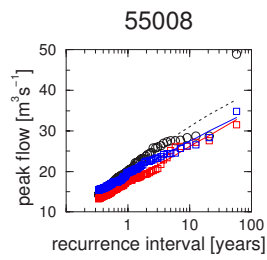
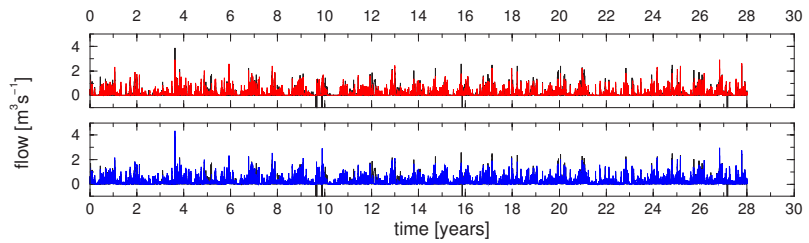
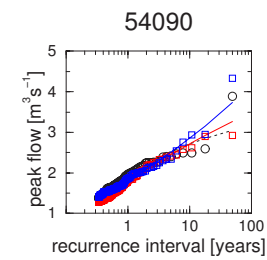
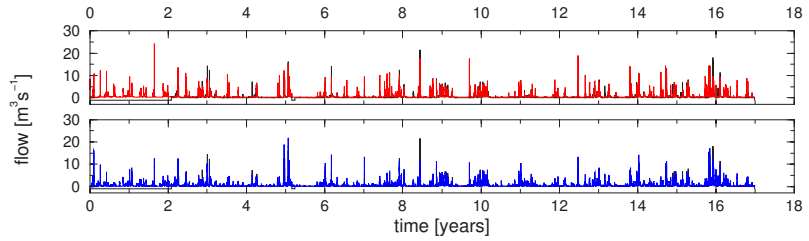
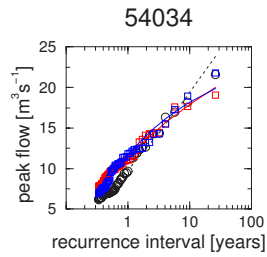
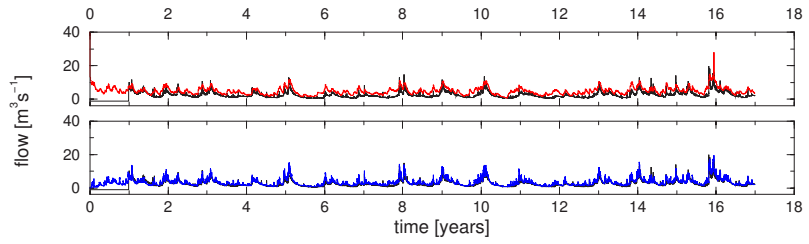
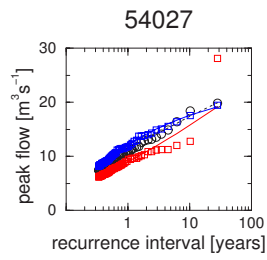


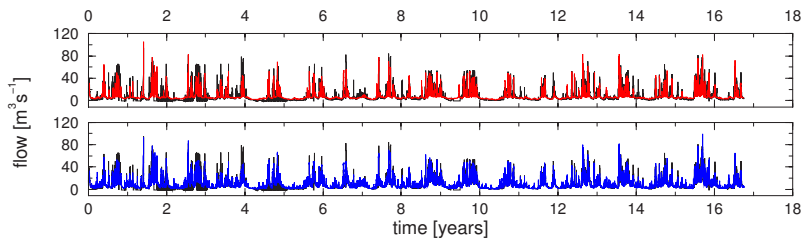
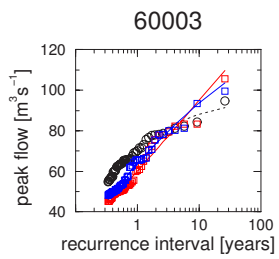
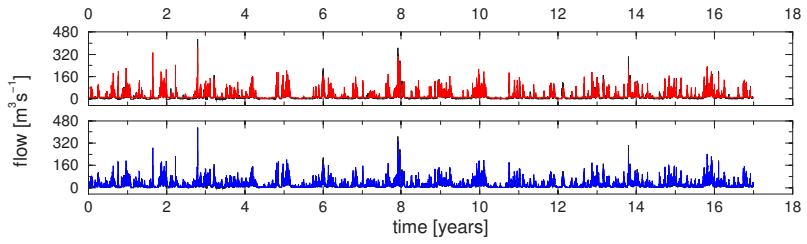
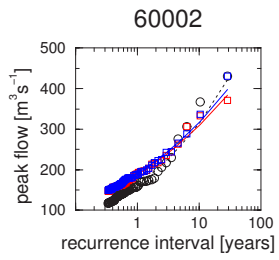
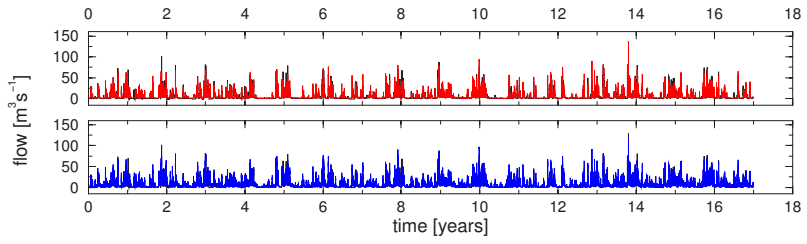
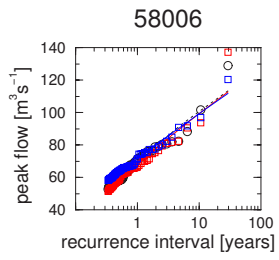
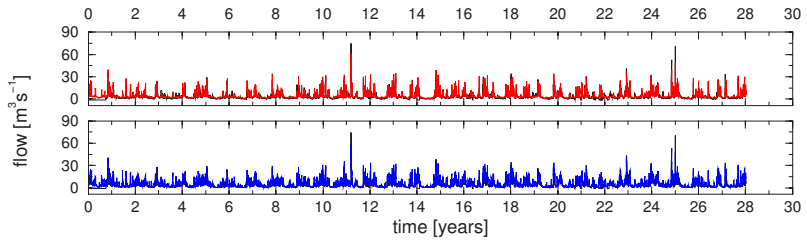
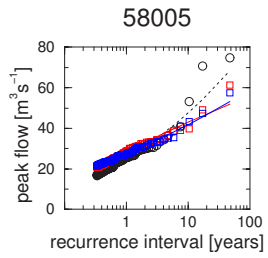
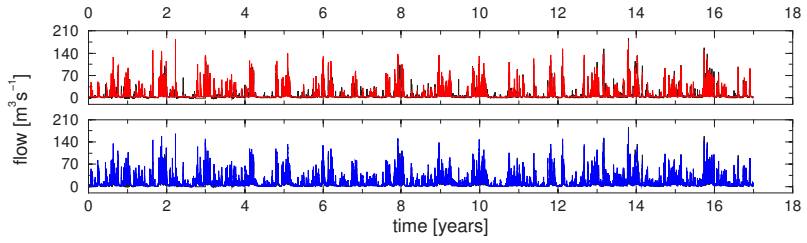
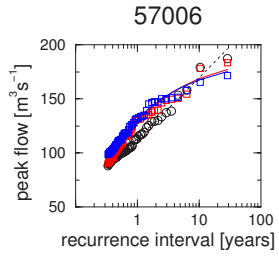
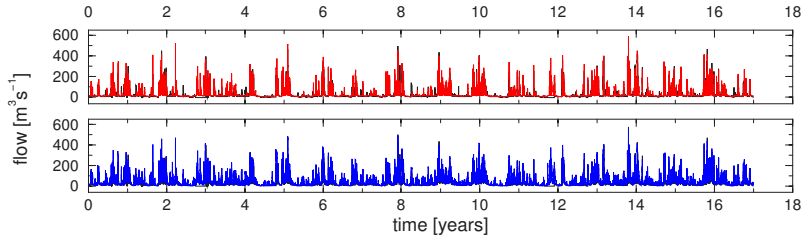
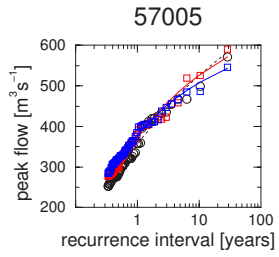


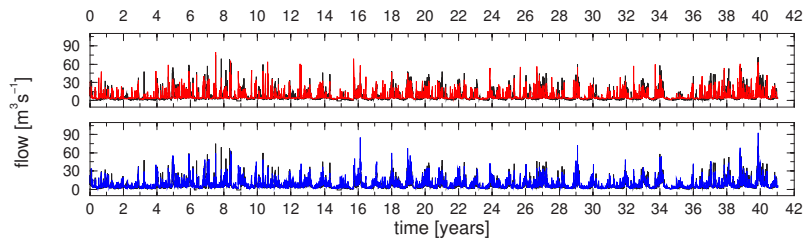
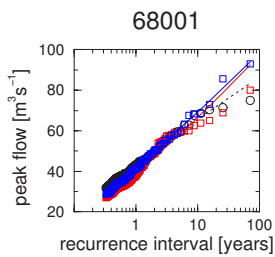
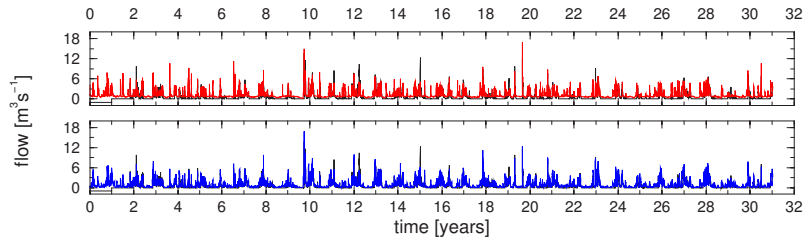
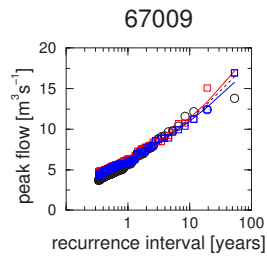
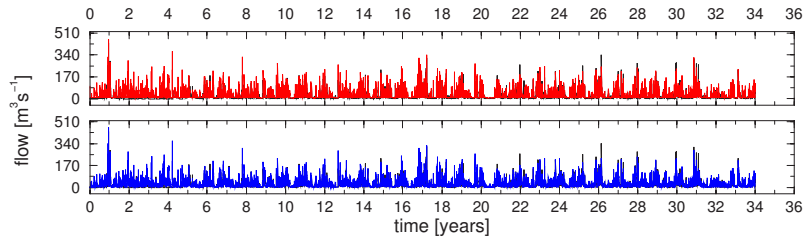
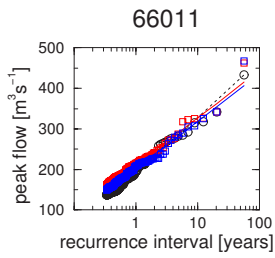
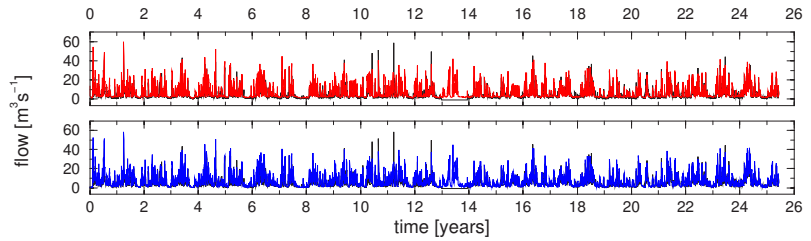
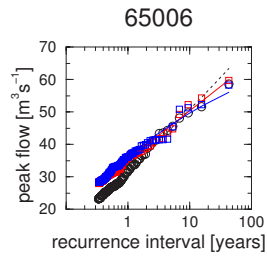
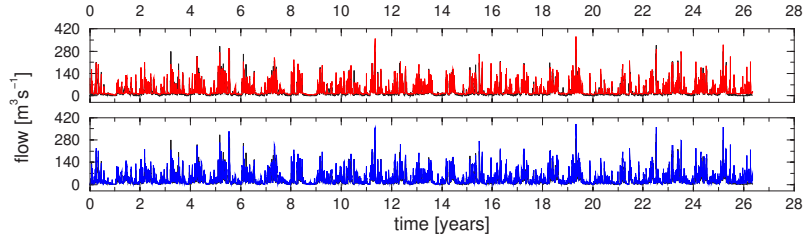
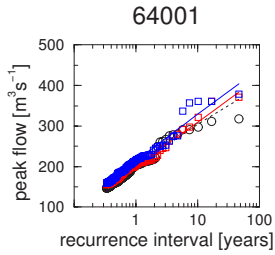
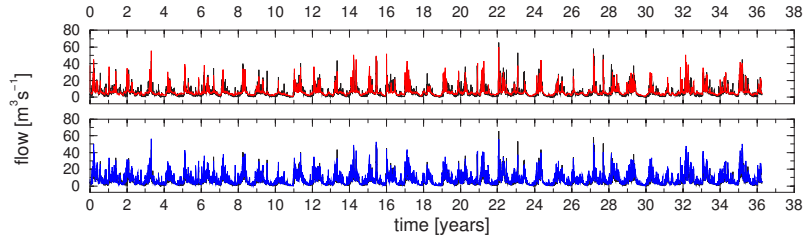
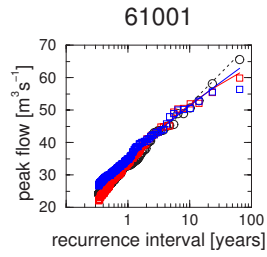


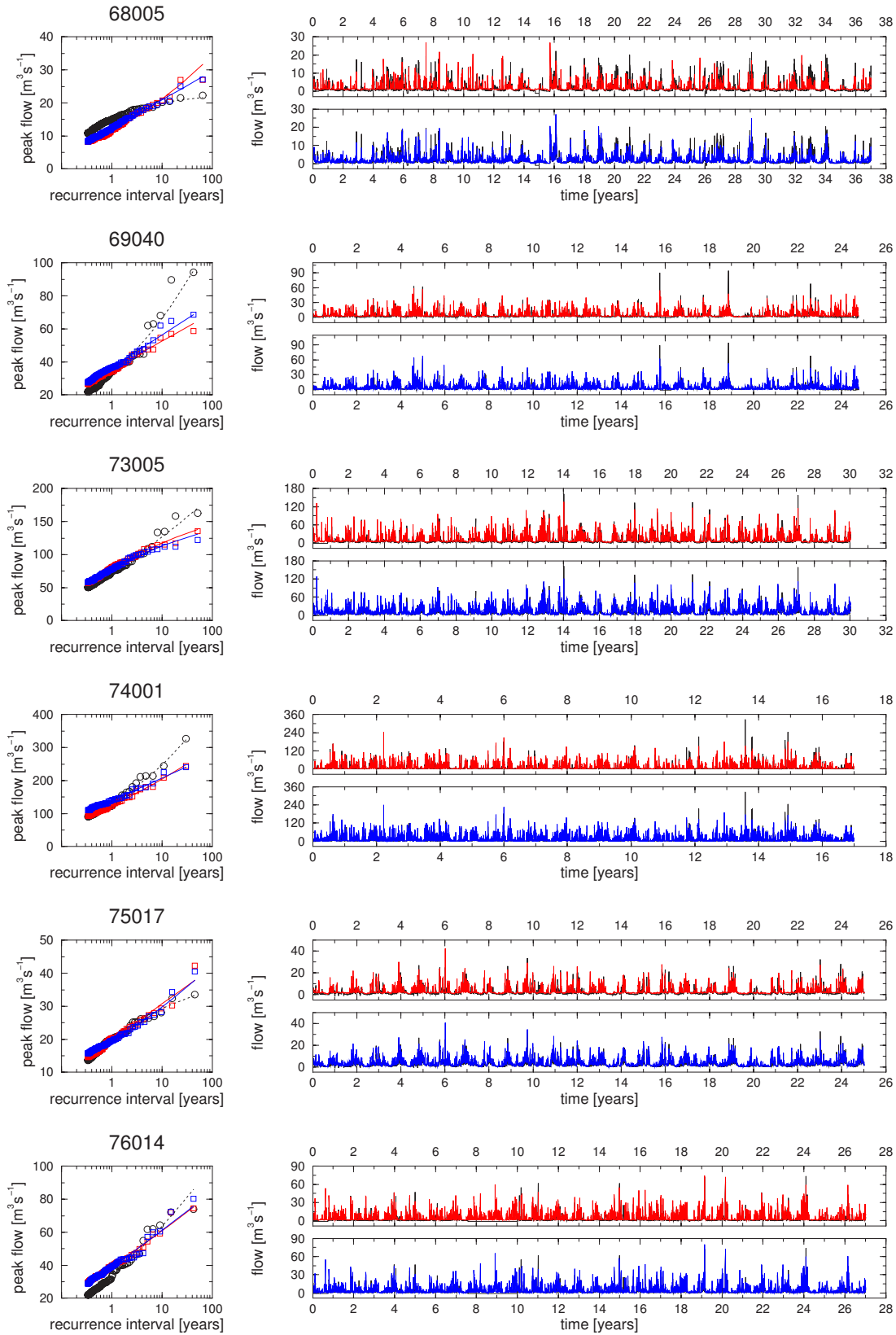


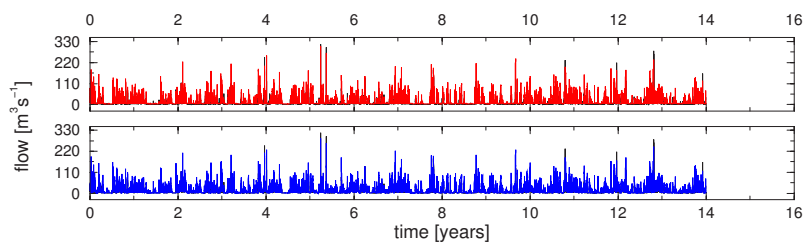
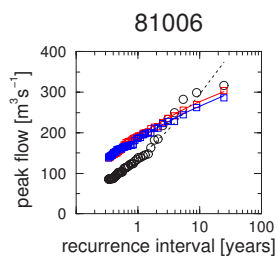
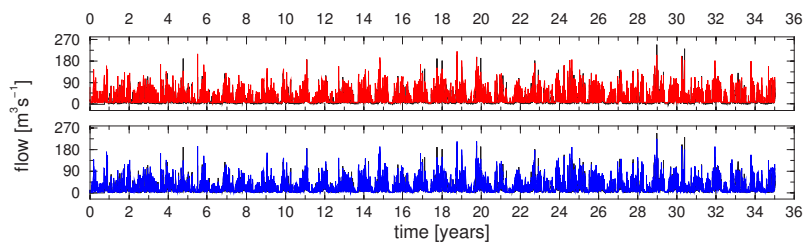
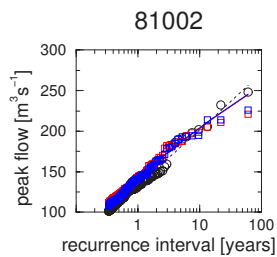
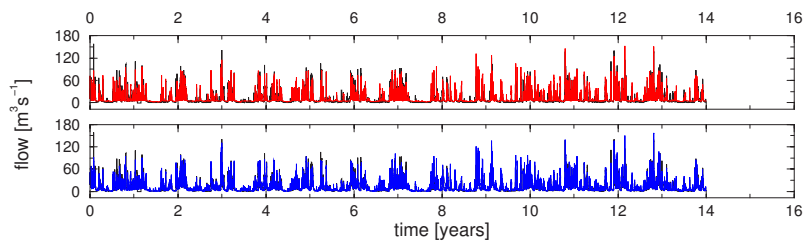
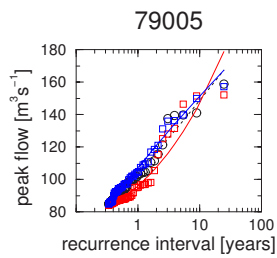
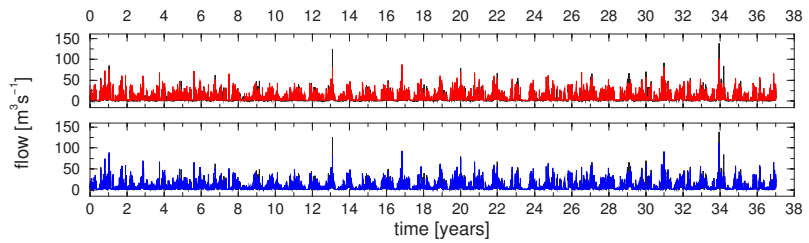
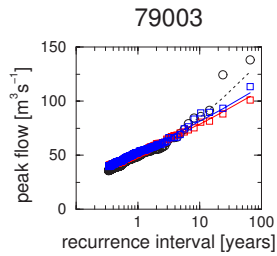
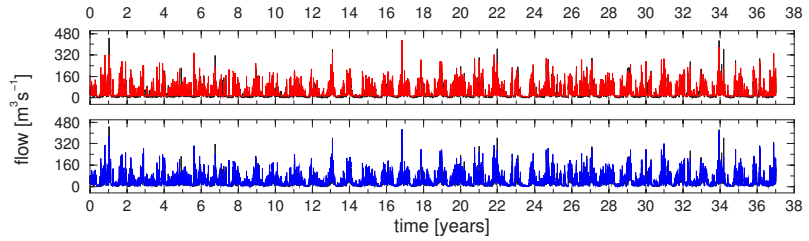
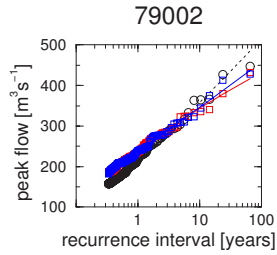
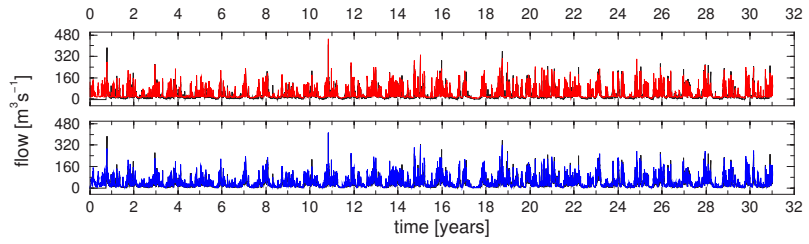
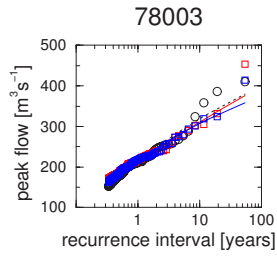


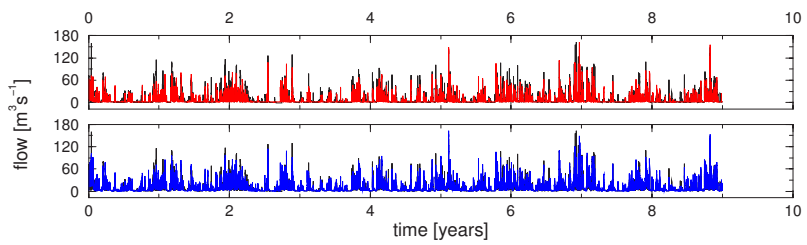
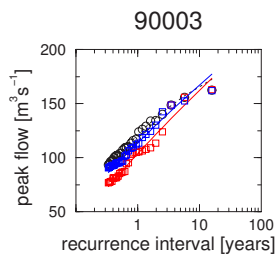
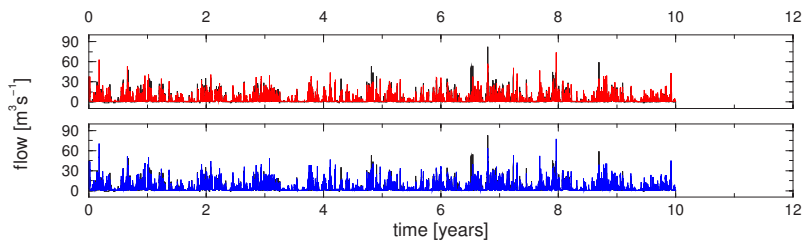
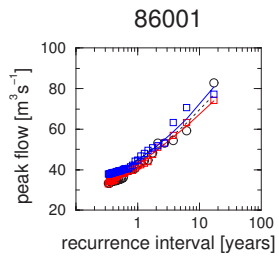
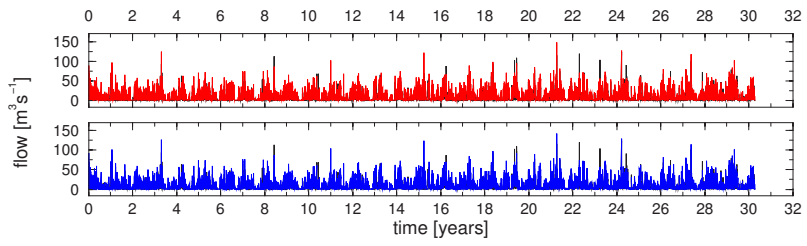
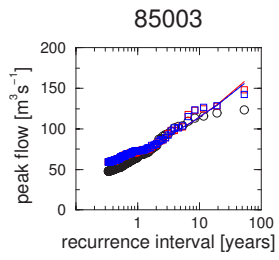
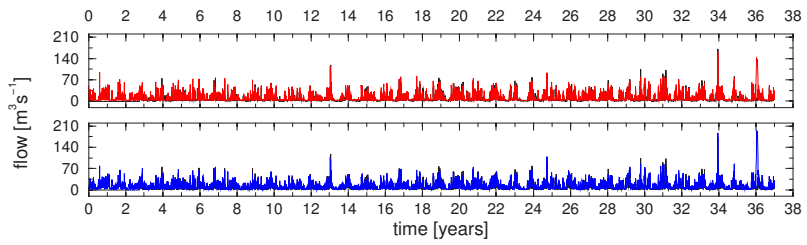
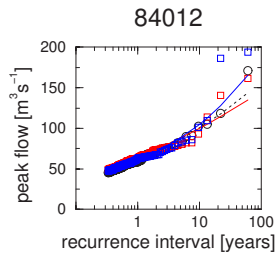
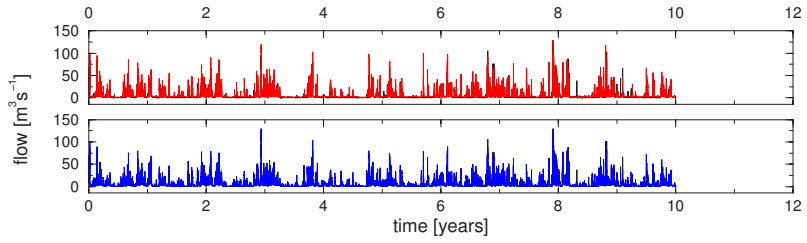
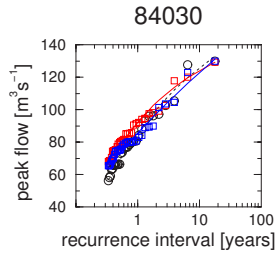
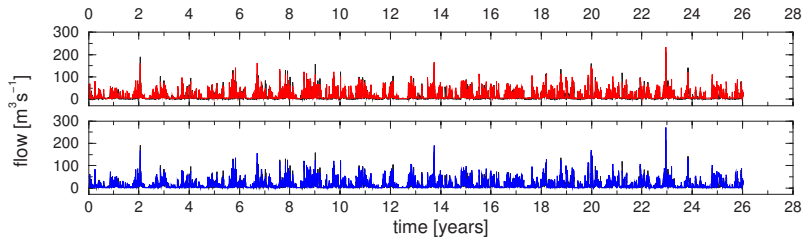
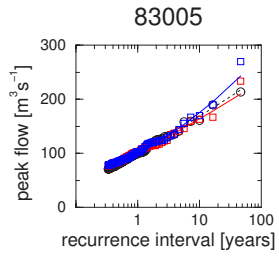


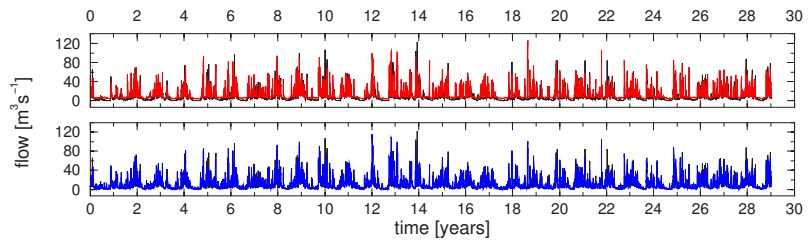
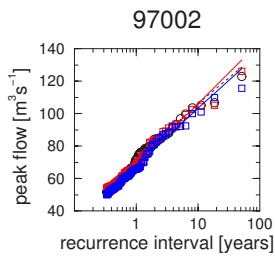
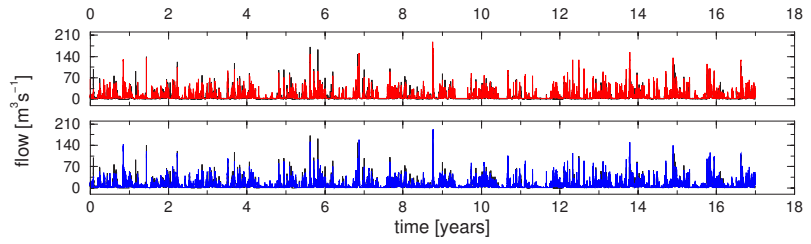
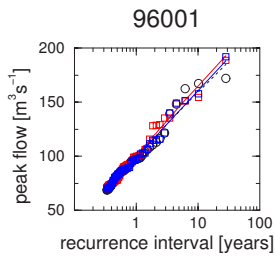
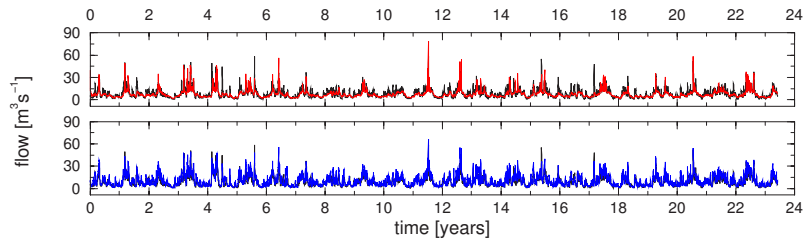
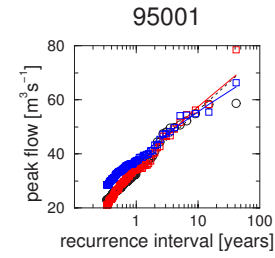
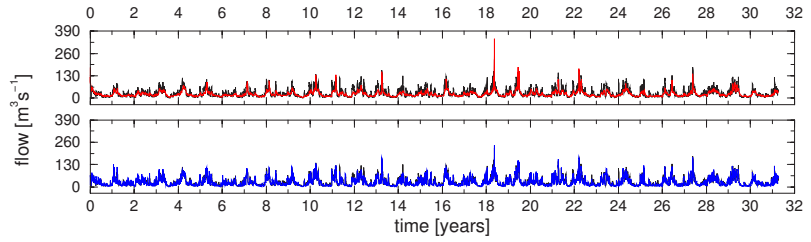
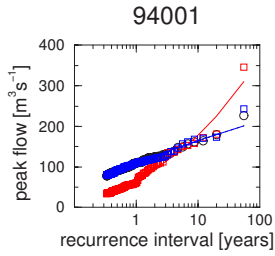
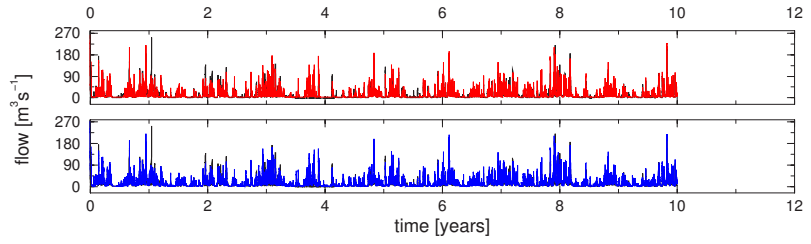
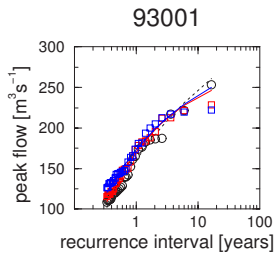












Appendix B Generalisation results

This appendix (pages 23-91) contains

- B.1 lists of the top ten best combinations of three up to six catchment properties, for each model and for univariate regression and site-similarity,
- B.2 figures showing each of the generalised flood frequency curves (univariate and sequential regression and site-similarity) compared to observed and calibrated flood frequency curves, for each catchment, using each runoff model, and
- B.3 plots of calibration and generalisation errors (at return periods of 10 and 50 years) versus catchment properties.

B.1 Catchment property combinations (pages 24-37)

In the catchment property lists, the combinations highlighted in red are those that were selected for final generalisations. Note that properties are transformed according to the transformations given in Table 2.4 (Volume 1), but that this is not specifically indicated in the lists.

PDM f_c univariate regression

σ_{η}	σ_{TA}	Catchment properties					
0.15071	0.15421	+SPRHOST	+LANDA	+LANDB			
0.15215	0.15567	-HOSTP	+LANDA	+LANDB			
0.15282	0.15635	+HOSTNG	+LANDA	+LANDB			
0.15291	0.15644	+HOSTGMIN	+HOSTPEAT	+HOSTNG			
0.15354	0.15708	-BFIHOST	+LANDA	+LANDB			
0.15546	0.15903	+DPSBAR	-HOSTP	+LANDA			
0.15582	0.15939	+DPSBAR	+SPRHOST	+LANDA			
0.15776	0.16137	+HOSTPEAT	+HOSTNG	+LANDA			
0.15807	0.16168	-HOSTGMIN	+LANDA	+LANDB			
0.15942	0.16305	+LANDA	+LANDB	+DRAIN2			
0.14406	0.14830	+DPSBAR	+HOSTGMIN	+HOSTPEAT	+HOSTNG		
0.14467	0.14893	+SAAR	+HOSTGMIN	+HOSTPEAT	+HOSTNG		
0.14782	0.15213	+HOSTGMIN	+HOSTPEAT	+HOSTNG	+LANDA		
0.14794	0.15225	+HOSTGMIN	+HOSTPEAT	+HOSTNG	-LANDD		
0.14798	0.15229	-FARL	+SPRHOST	+LANDA	+LANDB		
0.14839	0.15271	+HOSTGMIN	+HOSTPEAT	+HOSTNG	+DRAIN2		
0.14858	0.15291	+DPSBAR	+SPRHOST	+LANDA	+LANDB		
0.14876	0.15309	+SPRHOST	+LANDA	+LANDB	+LANDD		
0.14921	0.15354	-DPLCV	+SPRHOST	+LANDA	+LANDB		
0.14949	0.15383	+DPSBAR	-HOSTP	+LANDA	+LANDB		
0.14116	0.14617	+DPSBAR	+HOSTGMIN	+HOSTPEAT	+HOSTNG	+LANDA	
0.14184	0.14686	-FARL	+SAAR	+HOSTGMIN	+HOSTPEAT	+HOSTNG	
0.14233	0.14737	+SAAR	+HOSTGMIN	+HOSTPEAT	+HOSTNG	+LANDA	
0.14253	0.14757	-BFIHOST	+DPSBAR	+HOSTGMIN	+HOSTPEAT	+HOSTNG	
0.14276	0.14780	+DPSBAR	-FARL	+HOSTGMIN	+HOSTPEAT	+HOSTNG	
0.14289	0.14794	+DPLBAR	+SAAR	+HOSTGMIN	+HOSTPEAT	+HOSTNG	
0.14326	0.14832	-DPLCV	+DPSBAR	+HOSTGMIN	+HOSTPEAT	+HOSTNG	
0.14332	0.14838	+DPLBAR	+DPSBAR	+HOSTGMIN	+HOSTPEAT	+HOSTNG	
0.14340	0.14846	+DPSBAR	+SPRHOST	+HOSTGMIN	+HOSTPEAT	+HOSTNG	
0.14362	0.14869	+DPSBAR	+SAAR	+HOSTGMIN	+HOSTPEAT	+HOSTNG	
0.13832	0.14408	+DPSBAR	+SPRHOST	+HOSTGMIN	+HOSTPEAT	+HOSTNG	+LANDA
0.13879	0.14456	+DPLBAR	-FARL	+SAAR	+HOSTGMIN	+HOSTPEAT	+HOSTNG
0.13956	0.14535	+AREA	-FARL	+SAAR	+HOSTGMIN	+HOSTPEAT	+HOSTNG
0.13981	0.14561	-FARL	+SAAR	+SPRHOST	+HOSTGMIN	+HOSTPEAT	+HOSTNG
0.13983	0.14563	-BFIHOST	+DPSBAR	+HOSTGMIN	+HOSTPEAT	+HOSTNG	+LANDA
0.13993	0.14573	-BFIHOST	-FARL	+SAAR	+HOSTGMIN	+HOSTPEAT	+HOSTNG
0.14032	0.14613	-BFIHOST	+DPSBAR	-FARL	+HOSTGMIN	+HOSTPEAT	+HOSTNG
0.14040	0.14622	+SAAR	+SPRHOST	+HOSTGMIN	+HOSTPEAT	+HOSTNG	+LANDA
0.14051	0.14633	-DPLCV	+DPSBAR	+HOSTGMIN	+HOSTPEAT	+HOSTNG	+LANDA
0.14055	0.14637	+DPLBAR	+DPSBAR	+HOSTGMIN	+HOSTPEAT	+HOSTNG	+LANDA

PDM f_c site-similarity

σ_η	σ_{TA}	Catchment properties					
0.13619	0.14914	HOSTP	LANDA	LANDB			
0.14141	0.15470	SAAR	LANDB	DRAIN2			
0.14202	0.15551	FARL	SAAR	DRAIN2			
0.14247	0.15595	FARL	LANDB	DRAIN2			
0.14248	0.15610	FARL	PROPWET	DRAIN2			
0.14307	0.15673	PROPWET	HOSTGMIN	LANDC			
0.14350	0.15701	BFIHOST	DPSBAR	PROPWET			
0.14395	0.15734	BFIHOST	SAAR	LANDA			
0.14405	0.15745	BFIHOST	LANDA	LANDB			
0.14461	0.15790	SAAR	HOSTP	LANDA			
0.13283	0.14550	SAAR	HOSTP	LANDA	LANDB		
0.13486	0.14783	URBEXT	HOSTP	LANDA	LANDB		
0.13561	0.14914	FARL	SAAR	LANDB	DRAIN2		
0.13623	0.14953	BFIHOST	LANDA	LANDB	LANDC		
0.13641	0.14960	BFIHOST	DPSBAR	LANDA	LANDB		
0.13635	0.15003	FARL	HOSTP	LANDA	LANDB		
0.13677	0.15028	FARL	HOSTP	LANDB	DRAIN2		
0.13677	0.15053	BFIHOST	FARL	PROPWET	DRAIN2		
0.13706	0.15072	FARL	SAAR	HOSTP	LANDA		
0.13767	0.15128	BFIHOST	FARL	LANDA	LANDB		
0.12964	0.14307	FARL	HOSTP	LANDA	LANDB	DRAIN2	
0.13035	0.14359	FARL	SAAR	HOSTP	LANDA	LANDB	
0.13044	0.14372	SAAR	HOSTP	LANDA	LANDB	LANDC	
0.13057	0.14389	BFIHOST	FARL	LANDA	LANDB	DRAIN2	
0.13077	0.14408	BFIHOST	SAAR	LANDA	LANDB	LANDC	
0.13132	0.14457	BFIHOST	DPSBAR	LANDA	LANDB	LANDC	
0.13134	0.14471	SAAR	HOSTGMIN	LANDA	LANDB	LANDC	
0.13250	0.14553	SAAR	HOSTP	LANDA	LANDB	LANDD	
0.13269	0.14566	SAAR	URBEXT	HOSTP	LANDA	LANDB	
0.13203	0.14595	BFIHOST	DPSBAR	HOSTPEAT	LANDA	LANDC	
0.12572	0.13902	FARL	SAAR	HOSTP	LANDA	LANDB	DRAIN2
0.12832	0.14173	BFIHOST	FARL	SAAR	LANDA	LANDB	DRAIN2
0.12867	0.14223	DPSBAR	HOSTGMIN	LANDA	LANDB	LANDC	DRAIN2
0.12907	0.14241	BFIHOST	PROPWET	SAAR	LANDA	LANDB	LANDC
0.12885	0.14264	BFIHOST	DPSBAR	FARL	LANDA	LANDB	LANDC
0.12940	0.14276	BFIHOST	DPSBAR	PROPWET	LANDA	LANDB	LANDC
0.12898	0.14284	AREA	BFIHOST	DPSBAR	SAAR	LANDB	LANDC
0.12946	0.14286	BFIHOST	FARL	SAAR	HOSTP	LANDA	LANDB
0.12947	0.14287	BFIHOST	DPSBAR	SAAR	LANDA	LANDB	LANDC
0.12926	0.14290	BFIHOST	FARL	LANDA	LANDB	LANDC	DRAIN2

PDM c_{max} univariate regression

σ_η	σ_{TA}	Catchment properties					
53.254	54.559	-PROPWET	-URBEXT	+FIELD			
54.293	55.615	-SPRHOST	-URBEXT	+RESIDM			
54.560	55.887	-PROPWET	-URBEXT	+RESIDM			
54.731	56.060	+BFIHOST	-URBEXT	+RESIDM			
54.734	56.064	-PROPWET	-URBEXT	+LANDA			
54.895	56.228	-PROPWET	-URBEXT	-HOSTPEAT			
54.967	56.300	-PROPWET	-URBEXT	-HYDC			
54.979	56.313	-URBEXT	+FIELD	-LANDB			
55.226	56.564	-PROPWET	-URBEXT	-LANDB			
55.399	56.741	-PROPWET	-URBEXT	-DRAIN2			
51.192	52.775	-PROPWET	-SPRHOST	-URBEXT	+FIELD		
51.564	53.155	+BFIHOST	-PROPWET	-URBEXT	+FIELD		
51.693	53.286	-PROPWET	-URBEXT	+HOSTP	+FIELD		
51.952	53.551	-PROPWET	-URBEXT	+FIELD	+LANDA		
52.229	53.833	-PROPWET	-URBEXT	+PORO	-HYDC		
52.247	53.851	-PROPWET	-URBEXT	+FIELD	-LANDB		
52.309	53.916	-PROPWET	-SPRHOST	-URBEXT	+RESIDM		
52.347	53.954	-PROPWET	-URBEXT	+HOSTNG	+HOSTP		
52.520	54.131	+BFIHOST	-PROPWET	-URBEXT	+RESIDM		
52.586	54.198	-PROPWET	-URBEXT	+HOSTP	+RESIDM		
50.786	52.670	+BFIHOST	-PROPWET	-URBEXT	+FIELD	+LANDA	
50.844	52.729	-PROPWET	-URBEXT	+HOSTP	+FIELD	+LANDA	
50.962	52.850	-PROPWET	-SPRHOST	-URBEXT	+FIELD	+LANDA	
51.015	52.905	-PROPWET	-SPRHOST	-URBEXT	+FIELD	-LANDB	
51.026	52.916	+BFIHOST	-PROPWET	-URBEXT	+FIELD	-LANDB	
51.027	52.917	-PROPWET	-URBEXT	+PORO	-HYDC	-LANDB	
51.110	53.002	-PROPWET	-SPRHOST	-URBEXT	+HOSTNG	+FIELD	
51.133	53.026	-PROPWET	-SPRHOST	-URBEXT	-HOSTGMIN	+FIELD	
51.248	53.143	-PROPWET	-URBEXT	+PORO	-HYDC	+LANDA	
51.267	53.163	-PROPWET	-SPRHOST	-URBEXT	+FIELD	-DRAIN2	
50.260	52.436	+BFIHOST	-PROPWET	-URBEXT	-HOSTGMIN	+FIELD	+LANDA
50.418	52.598	-PROPWET	-URBEXT	-HOSTGMIN	+HOSTP	+FIELD	+LANDA
50.589	52.775	+ALTBAR	+BFIHOST	-PROPWET	-URBEXT	+FIELD	-LANDB
50.603	52.789	+ALTBAR	-PROPWET	-SPRHOST	-URBEXT	+FIELD	-LANDB
50.718	52.907	+ALTBAR	-PROPWET	-URBEXT	+PORO	-HYDC	-LANDB
50.733	52.922	+ALTBAR	-PROPWET	-URBEXT	+FIELD	-LANDB	-DRAIN2
50.857	53.050	+BFIHOST	-PROPWET	-URBEXT	+FIELD	+LANDA	-LANDB
50.863	53.057	-PROPWET	-SPRHOST	-URBEXT	-HOSTGMIN	+FIELD	+LANDA
50.867	53.060	+ALTBAR	-PROPWET	-URBEXT	+HOSTP	+FIELD	-LANDB
50.882	53.076	+ALTBAR	-PROPWET	-URBEXT	+HOSTP	+FIELD	+LANDA

PDM c_{max} site-similarity

σ_n	σ_{TA}	Catchment properties					
58.873	63.837	SAAR	HOSTP	LANDA			
59.769	65.051	PROPWET	SAAR	DRAIN2			
59.980	65.215	BFIHOST	SAAR	FIELD			
60.197	65.412	HOSTNG	HOSTP	LANDA			
60.212	65.427	ALTBAR	HOSTP	LANDA			
60.300	65.521	BFIHOST	PROPWET	FIELD			
60.704	65.896	PROPWET	HOSTP	FIELD			
60.767	66.066	FARL	URBEXT	DRAIN2			
60.927	66.152	ALTBAR	PROPWET	LANDA			
61.105	66.388	SAAR	URBEXT	PORO			
56.944	61.934	URBEXT	HOSTNG	HOSTP	LANDB		
57.100	62.185	SAAR	URBEXT	HOSTNG	HOSTP		
57.083	62.307	SAAR	URBEXT	HOSTPEAT	PORO		
57.764	62.961	DPSBAR	PROPWET	SAAR	DRAIN2		
57.847	62.980	PROPWET	HOSTNG	HOSTP	LANDA		
57.910	63.053	URBEXT	HOSTNG	HOSTP	LANDD		
58.084	63.146	SAAR	URBEXT	HOSTP	LANDB		
58.373	63.472	URBEXT	HOSTNG	HOSTP	LANDA		
58.334	63.523	ALTBAR	URBEXT	HOSTNG	HOSTP		
58.530	63.582	PROPWET	SAAR	HOSTP	LANDA		
55.098	60.085	BFIHOST	SAAR	URBEXT	HOSTNG	HOSTP	
55.391	60.314	PROPWET	URBEXT	HOSTNG	HOSTP	LANDA	
55.590	60.541	URBEXT	HOSTNG	HOSTP	LANDA	LANDB	
55.744	60.862	SAAR	URBEXT	HOSTNG	HOSTP	PORO	
56.123	61.134	URBEXT	HOSTNG	HOSTP	LANDB	LANDD	
56.165	61.207	SAAR	URBEXT	HOSTNG	HOSTP	LANDA	
56.335	61.395	SAAR	URBEXT	HOSTNG	HOSTP	LANDB	
56.446	61.506	PROPWET	SAAR	HOSTGMIN	HOSTP	LANDA	
56.455	61.599	ALTBAR	URBEXT	HOSTNG	HOSTP	FIELD	
56.389	61.654	FARL	PROPWET	HOSTP	LANDA	DRAIN2	
54.646	59.680	BFIHOST	SAAR	URBEXT	HOSTNG	HOSTP	PORO
55.010	60.044	SAAR	URBEXT	HOSTNG	HOSTP	PORO	LANDA
54.991	60.082	SAAR	URBEXT	HOSTNG	HOSTP	PORO	LANDD
55.055	60.218	BFIHOST	SAAR	URBEXT	HOSTNG	HOSTP	FIELD
55.283	60.352	BFIHOST	SAAR	URBEXT	HOSTNG	HOSTP	LANDD
55.393	60.389	BFIHOST	PROPWET	URBEXT	HOSTNG	HOSTP	LANDA
55.491	60.555	BFIHOST	PROPWET	SAAR	URBEXT	HOSTNG	HOSTP
55.373	60.569	DPSBAR	SAAR	URBEXT	HOSTNG	HOSTP	PORO
55.623	60.647	BFIHOST	URBEXT	HOSTNG	HOSTP	FIELD	LANDD
55.587	60.684	PROPWET	SAAR	URBEXT	HOSTNG	HOSTP	LANDD

PDM k_1 univariate regression

σ_j	σ_{TA}	Catchment properties					
0.42188	0.43061	-ALTBAR	+BFIHOST	+DPLBAR			
0.42618	0.43499	+AREA	-ALTBAR	+BFIHOST			
0.42748	0.43631	+AREA	-PROPWET	-URBEXT			
0.42898	0.43784	-ALTBAR	+DPLBAR	+HOSTGMIN			
0.42928	0.43815	+AREA	-ALTBAR	+HOSTGMIN			
0.43080	0.43970	-ALTBAR	+DPLBAR	-SPRHOST			
0.43214	0.44106	-ALTBAR	+DPLBAR	-URBEXT			
0.43224	0.44116	+AREA	-ALTBAR	+HOSTP			
0.43291	0.44184	-ALTBAR	+DPLBAR	+HOSTP			
0.43445	0.44341	+AREA	-ALTBAR	-SPRHOST			
0.39088	0.40107	+AREA	-ALTBAR	-URBEXT	+HOSTGMIN		
0.39109	0.40128	-ALTBAR	+DPLBAR	-URBEXT	+HOSTGMIN		
0.39668	0.40699	-ALTBAR	+BFIHOST	+DPLBAR	-URBEXT		
0.39812	0.40847	-ALTBAR	+DPLBAR	-SPRHOST	-URBEXT		
0.40105	0.41146	+AREA	-ALTBAR	+BFIHOST	-URBEXT		
0.40146	0.41188	+AREA	-ALTBAR	-PROPWET	-URBEXT		
0.40175	0.41218	+AREA	-ALTBAR	-SPRHOST	-URBEXT		
0.40273	0.41318	+AREA	-ALTBAR	-URBEXT	+HOSTP		
0.40294	0.41340	-ALTBAR	+DPLBAR	-URBEXT	-DRAIN2		
0.40351	0.41398	-ALTBAR	+DPLBAR	-URBEXT	+HOSTP		
0.37885	0.39072	+AREA	-ALTBAR	-PROPWET	-URBEXT	+HOSTGMIN	
0.38134	0.39328	+AREA	-ALTBAR	+BFIHOST	-PROPWET	-URBEXT	
0.38270	0.39467	-ALTBAR	+DPLBAR	-URBEXT	+HOSTGMIN	-DRAIN2	
0.38337	0.39537	-ALTBAR	+BFIHOST	+DPLBAR	-URBEXT	-DRAIN2	
0.38392	0.39592	-ALTBAR	+DPLBAR	-SPRHOST	-URBEXT	-DRAIN2	
0.38420	0.39622	+AREA	-ALTBAR	-PROPWET	-URBEXT	+HYDC	
0.38429	0.39630	+AREA	+FARL	-PROPWET	-SPRHOST	-URBEXT	
0.38448	0.39650	+AREA	-ALTBAR	-URBEXT	+HOSTGMIN	-DRAIN2	
0.38477	0.39680	+AREA	-ALTBAR	-PROPWET	-URBEXT	+PORO	
0.38530	0.39734	+AREA	-ALTBAR	-PROPWET	-SPRHOST	-URBEXT	
0.36757	0.38103	+AREA	-ALTBAR	+FARL	-PROPWET	-SPRHOST	-URBEXT
0.37025	0.38380	+AREA	-ALTBAR	+FARL	-PROPWET	-URBEXT	+HOSTGMIN
0.37026	0.38380	+AREA	-ALTBAR	+BFIHOST	+FARL	-PROPWET	-URBEXT
0.37138	0.38496	-ALTBAR	+DPLBAR	+FARL	-PROPWET	-SPRHOST	-URBEXT
0.37188	0.38548	+AREA	-ALTBAR	-PROPWET	-URBEXT	+HOSTGMIN	+PORO
0.37206	0.38566	+AREA	-ALTBAR	+FARL	-PROPWET	-URBEXT	+PORO
0.37363	0.38728	+AREA	+FARL	-PROPWET	-URBEXT	+PORO	-LANDB
0.37458	0.38826	-ALTBAR	+BFIHOST	+DPLBAR	+FARL	-PROPWET	-URBEXT
0.37478	0.38846	+AREA	-ALTBAR	+FARL	-PROPWET	-URBEXT	+HOSTP
0.37488	0.38857	+AREA	-ALTBAR	-PROPWET	-URBEXT	+HOSTGMIN	+HOSTPEAT

PDM k_1 site-similarity

σ_η	σ_{TA}	Catchment properties					
0.49879	0.53847	ALTBAR	DPLBAR	HOSTP			
0.50362	0.54349	ALTBAR	BFIHOST	DPLBAR			
0.51656	0.55763	ALTBAR	DPLBAR	SPRHOST			
0.52736	0.56868	AREA	ALTBAR	HOSTP			
0.52946	0.57072	AREA	ALTBAR	BFIHOST			
0.53162	0.57331	AREA	ALTBAR	SPRHOST			
0.54400	0.58629	FARL	SPRHOST	URBEXT			
0.54603	0.58878	FARL	SPRHOST	LANDD			
0.54560	0.58881	BFIHOST	DPLBAR	RESIDM			
0.54708	0.58997	DPLBAR	LANDD	DRAIN2			
0.46976	0.50873	ALTBAR	BFIHOST	DPLBAR	FARL		
0.47510	0.51428	AREA	ALTBAR	BFIHOST	FARL		
0.47590	0.51534	ALTBAR	DPLBAR	FARL	HOSTP		
0.47987	0.51979	AREA	ALTBAR	FARL	HOSTP		
0.48571	0.52585	AREA	ALTBAR	FARL	SPRHOST		
0.48721	0.52670	AREA	BFIHOST	FARL	LANDB		
0.48738	0.52721	BFIHOST	DPLBAR	FARL	LANDB		
0.48762	0.52779	ALTBAR	DPLBAR	FARL	SPRHOST		
0.48878	0.52834	BFIHOST	DPLBAR	FARL	PROPWET		
0.49081	0.53029	DPLBAR	FARL	PROPWET	HOSTP		
0.46586	0.50493	ALTBAR	BFIHOST	DPLBAR	FARL	LANDB	
0.46693	0.50596	ALTBAR	BFIHOST	DPLBAR	FARL	SPRHOST	
0.46881	0.50825	ALTBAR	BFIHOST	DPLBAR	FARL	HOSTP	
0.46915	0.50833	AREA	ALTBAR	BFIHOST	FARL	SPRHOST	
0.47008	0.50977	ALTBAR	DPLBAR	FARL	SPRHOST	HOSTP	
0.47115	0.51010	BFIHOST	DPLBAR	FARL	URBEXT	LANDB	
0.47137	0.51042	AREA	BFIHOST	FARL	URBEXT	LANDB	
0.47244	0.51137	BFIHOST	DPLBAR	FARL	PROPWET	URBEXT	
0.47223	0.51190	AREA	ALTBAR	BFIHOST	FARL	LANDB	
0.47439	0.51400	ALTBAR	BFIHOST	DPLBAR	FARL	URBEXT	
0.45754	0.49706	AREA	ALTBAR	BFIHOST	FARL	URBEXT	LANDB
0.45916	0.49813	ALTBAR	BFIHOST	DPLBAR	FARL	URBEXT	LANDB
0.46002	0.49940	ALTBAR	BFIHOST	DPLBAR	FARL	SPRHOST	LANDB
0.46231	0.50110	BFIHOST	DPLBAR	FARL	PROPWET	URBEXT	LANDB
0.46225	0.50149	AREA	ALTBAR	BFIHOST	DPLBAR	FARL	LANDB
0.46309	0.50262	AREA	ALTBAR	BFIHOST	FARL	SPRHOST	LANDB
0.46348	0.50312	AREA	ALTBAR	FARL	SPRHOST	URBEXT	LANDB
0.46404	0.50335	ALTBAR	DPLBAR	FARL	URBEXT	HOSTP	LANDB
0.46393	0.50382	AREA	ALTBAR	FARL	URBEXT	HOSTP	LANDB
0.46448	0.50389	ALTBAR	BFIHOST	DPLBAR	FARL	SPRHOST	HOSTNG

PDM k_b univariate regression

σ_{η}	σ_{TA}	Catchment properties					
0.62453	0.63627	+BFIHOST	+SPRHOST	+URBEXT			
0.62784	0.63964	+HOSTGMIN	+HYDC	-DRAIN2			
0.62800	0.63981	+BFIHOST	+HYDC	-DRAIN2			
0.62968	0.64151	+BFIHOST	-LANDD	-DRAIN2			
0.63130	0.64316	+BFIHOST	+DPSBAR	-DRAIN2			
0.63186	0.64373	+BFIHOST	+HOSTPEAT	-DRAIN2			
0.63265	0.64454	+BFIHOST	+URBEXT	+LANDB			
0.63344	0.64533	+HOSTP	+HYDC	-DRAIN2			
0.63396	0.64586	+BFIHOST	+SPRHOST	-DRAIN2			
0.63498	0.64691	+BFIHOST	+URBEXT	-LANDD			
0.61047	0.62481	+BFIHOST	+DPLBAR	+SAAR	-DRAIN2		
0.61236	0.62674	+BFIHOST	+DPLBAR	+DPSBAR	-DRAIN2		
0.61306	0.62746	+BFIHOST	+DPLBAR	-LANDD	-DRAIN2		
0.61314	0.62754	+BFIHOST	+DPLBAR	+SPRHOST	+URBEXT		
0.61325	0.62765	+AREA	+BFIHOST	+SPRHOST	+URBEXT		
0.61434	0.62876	+AREA	+BFIHOST	+DPSBAR	-DRAIN2		
0.61451	0.62894	+AREA	+BFIHOST	+SAAR	-DRAIN2		
0.61513	0.62958	+BFIHOST	+DPLBAR	+HYDC	-DRAIN2		
0.61549	0.62994	+AREA	+BFIHOST	-LANDD	-DRAIN2		
0.61716	0.63164	+BFIHOST	+DPLBAR	+URBEXT	+PORO		
0.59653	0.61333	+BFIHOST	+DPLBAR	+DPSBAR	+URBEXT	-DRAIN2	
0.59815	0.61500	+BFIHOST	+DPLBAR	+SAAR	+URBEXT	-DRAIN2	
0.59907	0.61594	+AREA	+BFIHOST	+DPSBAR	+URBEXT	-DRAIN2	
0.60036	0.61726	+BFIHOST	+DPSBAR	+SPRHOST	+URBEXT	-DRAIN2	
0.60219	0.61914	+BFIHOST	+DPLBAR	+DPSBAR	+HOSTPEAT	-DRAIN2	
0.60222	0.61917	+BFIHOST	+SPRHOST	+URBEXT	-LANDD	-DRAIN2	
0.60265	0.61961	+BFIHOST	+DPSBAR	+URBEXT	+HOSTPEAT	-DRAIN2	
0.60304	0.62001	+AREA	+BFIHOST	+SAAR	+URBEXT	-DRAIN2	
0.60341	0.62039	+BFIHOST	+DPLBAR	+URBEXT	-LANDD	-DRAIN2	
0.60342	0.62041	+BFIHOST	+DPLBAR	+SPRHOST	-LANDD	-DRAIN2	
0.57930	0.59834	+BFIHOST	+DPLBAR	+DPSBAR	+URBEXT	+HOSTPEAT	-DRAIN2
0.57987	0.59892	+BFIHOST	+DPLBAR	+DPSBAR	+SPRHOST	+URBEXT	-DRAIN2
0.58218	0.60130	+AREA	+BFIHOST	+DPSBAR	+SPRHOST	+URBEXT	-DRAIN2
0.58257	0.60170	+AREA	+BFIHOST	+DPSBAR	+URBEXT	+HOSTPEAT	-DRAIN2
0.58512	0.60433	+BFIHOST	+DPLBAR	+SAAR	+SPRHOST	+URBEXT	-DRAIN2
0.58521	0.60443	+BFIHOST	+DPLBAR	+SPRHOST	+URBEXT	-LANDD	-DRAIN2
0.58610	0.60534	+BFIHOST	+DPLBAR	+DPSBAR	+URBEXT	+HYDC	-DRAIN2
0.58656	0.60582	+BFIHOST	+DPLBAR	+DPSBAR	+URBEXT	-RESIDM	-DRAIN2
0.58771	0.60700	+AREA	+BFIHOST	+SPRHOST	+URBEXT	-LANDD	-DRAIN2
0.58867	0.60800	+DPLBAR	+DPSBAR	+URBEXT	+HOSTP	-RESIDM	-DRAIN2

PDM k_b site-similarity

σ_η	σ_{TA}	Catchment properties					
0.62547	0.67446	BFIHOST	URBEXT	HOSTNG			
0.64157	0.69147	BFIHOST	DPLBAR	URBEXT			
0.64348	0.69303	BFIHOST	HOSTNG	DRAIN2			
0.64361	0.69355	BFIHOST	LANDD	DRAIN2			
0.64624	0.69675	BFIHOST	HYDC	DRAIN2			
0.64759	0.69733	BFIHOST	LANDB	DRAIN2			
0.64818	0.69888	BFIHOST	DPSBAR	DRAIN2			
0.64913	0.69949	BFIHOST	URBEXT	HOSTPEAT			
0.65103	0.70134	BFIHOST	URBEXT	DRAIN2			
0.64986	0.70145	RESIDM	LANDC	DRAIN2			
0.60225	0.65135	BFIHOST	URBEXT	RESIDM	LANDC		
0.60955	0.65872	BFIHOST	URBEXT	HYDC	LANDC		
0.61476	0.66515	URBEXT	HOSTP	RESIDM	LANDC		
0.61818	0.66840	BFIHOST	URBEXT	HYDC	DRAIN2		
0.62078	0.67032	BFIHOST	URBEXT	HOSTNG	DRAIN2		
0.62093	0.67129	BFIHOST	URBEXT	RESIDM	DRAIN2		
0.62304	0.67225	BFIHOST	URBEXT	HOSTPEAT	DRAIN2		
0.62550	0.67416	BFIHOST	URBEXT	LANDB	DRAIN2		
0.62394	0.67554	DPSBAR	RESIDM	LANDC	DRAIN2		
0.62765	0.67753	BFIHOST	SAAR	URBEXT	HOSTNG		
0.59384	0.64303	BFIHOST	URBEXT	HYDC	LANDC	DRAIN2	
0.59840	0.64942	DPLBAR	URBEXT	HOSTP	RESIDM	LANDC	
0.60125	0.65250	BFIHOST	DPLBAR	URBEXT	RESIDM	LANDC	
0.60561	0.65584	BFIHOST	URBEXT	RESIDM	LANDC	DRAIN2	
0.60602	0.65618	BFIHOST	URBEXT	HOSTNG	RESIDM	LANDC	
0.60851	0.65838	BFIHOST	URBEXT	RESIDM	HYDC	LANDC	
0.60736	0.65867	BFIHOST	URBEXT	HOSTPEAT	LANDC	DRAIN2	
0.60821	0.65881	URBEXT	HOSTP	RESIDM	LANDC	DRAIN2	
0.60800	0.65935	BFIHOST	DPLBAR	URBEXT	HYDC	LANDC	
0.61112	0.66147	BFIHOST	URBEXT	FIELDC	RESIDM	LANDC	
0.59091	0.64191	BFIHOST	DPLBAR	URBEXT	FIELDC	PORO	LANDC
0.59251	0.64369	BFIHOST	DPLBAR	URBEXT	RESIDM	HYDC	LANDC
0.59510	0.64575	DPLBAR	URBEXT	HOSTP	FIELDC	PORO	LANDC
0.59402	0.64621	BFIHOST	DPLBAR	DPSBAR	URBEXT	RESIDM	LANDC
0.59665	0.64758	BFIHOST	DPLBAR	URBEXT	RESIDM	PORO	LANDC
0.59736	0.64937	DPLBAR	DPSBAR	URBEXT	HOSTP	RESIDM	LANDC
0.59997	0.65084	URBEXT	RESIDM	HYDC	LANDC	LANDD	DRAIN2
0.60072	0.65123	BFIHOST	URBEXT	HOSTPEAT	HYDC	LANDC	DRAIN2
0.60194	0.65299	DPLBAR	URBEXT	HOSTP	RESIDM	PORO	LANDC
0.60183	0.65329	BFIHOST	DPLBAR	URBEXT	HYDC	LANDC	DRAIN2

TATE *crm* univariate regression

σ_j	σ_{TA}	Catchment properties					
0.12484	0.12823	-SAAR	-SPRHOST	-LANDA			
0.12523	0.12863	-SAAR	+HOSTP	-LANDA			
0.12544	0.12884	+FARL	-PROPWET	-SAAR			
0.12593	0.12934	+FARL	-PROPWET	+LANDD			
0.12615	0.12957	+FARL	-SAAR	+HOSTP			
0.12706	0.13049	-SAAR	-LANDA	-LANDB			
0.12772	0.13115	+FARL	-SAAR	+LANDD			
0.12864	0.13209	+FARL	-SAAR	-LANDB			
0.12923	0.13269	+FARL	-SAAR	-SPRHOST			
0.12997	0.13344	-PROPWET	-SAAR	-LANDA			
0.11469	0.11874	-SAAR	-SPRHOST	-LANDA	-LANDB		
0.11663	0.12071	-SAAR	+HOSTGMIN	-LANDA	-LANDB		
0.11685	0.12094	-SAAR	+HOSTP	-LANDA	-LANDB		
0.11703	0.12112	+BFIHOST	-SAAR	-LANDA	-LANDB		
0.11832	0.12243	-ALTBAR	-SAAR	-SPRHOST	-LANDA		
0.11945	0.12358	+FARL	-SAAR	-LANDA	-LANDB		
0.11957	0.12370	-ALTBAR	-SAAR	+HOSTP	-LANDA		
0.11961	0.12375	+FARL	-PROPWET	-SAAR	+HOSTP		
0.11964	0.12377	-PROPWET	-SAAR	-SPRHOST	-LANDA		
0.11967	0.12380	+FARL	-SAAR	+HOSTP	+LANDD		
0.10609	0.11076	+FARL	-SAAR	-SPRHOST	-LANDA	-LANDB	
0.10889	0.11361	+BFIHOST	+FARL	-SAAR	-LANDA	-LANDB	
0.10916	0.11389	+FARL	-SAAR	+HOSTP	-LANDA	-LANDB	
0.11017	0.11492	+FARL	-SAAR	+HOSTGMIN	-LANDA	-LANDB	
0.11073	0.11549	+FARL	-SAAR	+PORO	-LANDA	-LANDB	
0.11154	0.11632	+DPLCV	-SAAR	-SPRHOST	-LANDA	-LANDB	
0.11168	0.11646	+FARL	-PROPWET	-SAAR	-SPRHOST	-LANDA	
0.11209	0.11688	-SAAR	-SPRHOST	-LANDA	-LANDB	-LANDC	
0.11254	0.11734	+FARL	-SAAR	-SPRHOST	-HOSTPEAT	-LANDA	
0.11300	0.11781	+FARL	-PROPWET	-SAAR	+HOSTP	-LANDA	
0.10158	0.10691	+DPLCV	+FARL	-SAAR	-SPRHOST	-LANDA	-LANDB
0.10457	0.10996	+FARL	-SAAR	-SPRHOST	+PORO	-LANDA	-LANDB
0.10458	0.10997	+DPSBAR	+FARL	-SAAR	-SPRHOST	-LANDA	-LANDB
0.10485	0.11025	+FARL	-SAAR	-SPRHOST	-LANDA	-LANDB	-LANDC
0.10536	0.11077	+FARL	-SAAR	+HOSTGMIN	+PORO	-LANDA	-LANDB
0.10553	0.11095	+FARL	-PROPWET	-SAAR	-SPRHOST	-LANDA	-LANDB
0.10579	0.11121	+DPLCV	+FARL	-SAAR	+HOSTP	-LANDA	-LANDB
0.10579	0.11121	+BFIHOST	+DPLCV	+FARL	-SAAR	-LANDA	-LANDB
0.10583	0.11126	+FARL	-SAAR	-SPRHOST	-HOSTPEAT	-LANDA	-LANDB
0.10606	0.11149	+FARL	-SAAR	-HOSTPEAT	+HYDC	-LANDA	-LANDB

TATE *crm* site-similarity

σ_n	σ_{TA}	Catchment properties					
0.10271	0.11425	ALTBAR	SAAR	HOSTGMIN			
0.10393	0.11590	FARL	SAAR	SPRHOST			
0.10483	0.11681	PROPWET	SAAR	DRAIN2			
0.10486	0.11682	FARL	PROPWET	SAAR			
0.10540	0.11743	FARL	SAAR	DRAIN2			
0.10689	0.11850	SAAR	HOSTGMIN	LANDB			
0.10730	0.11906	SAAR	SPRHOST	LANDB			
0.10760	0.11943	PROPWET	SAAR	HOSTNG			
0.10732	0.11950	FARL	PROPWET	DRAIN2			
0.10773	0.11951	FARL	SAAR	HOSTP			
0.10048	0.11277	FARL	PROPWET	SAAR	DRAIN2		
0.10078	0.11302	DPLCV	PROPWET	LANDD	DRAIN2		
0.10138	0.11331	DPLCV	SAAR	SPRHOST	LANDB		
0.10165	0.11391	DPLCV	SAAR	LANDB	DRAIN2		
0.10258	0.11477	FARL	SAAR	SPRHOST	DRAIN2		
0.10301	0.11525	FARL	PROPWET	SAAR	SPRHOST		
0.10353	0.11539	FARL	PROPWET	SAAR	HOSTP		
0.10331	0.11540	BFIHOST	FARL	PROPWET	SAAR		
0.10364	0.11572	FARL	SAAR	HOSTGMIN	LANDB		
0.10413	0.11595	PROPWET	SAAR	SPRHOST	LANDB		
0.09765	0.11020	DPLCV	SAAR	LANDB	LANDD	DRAIN2	
0.09979	0.11201	DPLCV	DPSBAR	SAAR	SPRHOST	LANDB	
0.09991	0.11241	DPLCV	FARL	PROPWET	SAAR	SPRHOST	
0.10004	0.11258	DPLCV	PROPWET	LANDB	LANDD	DRAIN2	
0.10056	0.11329	DPLCV	FARL	PROPWET	SAAR	LANDD	
0.10100	0.11343	DPLCV	PROPWET	HOSTPEAT	LANDD	DRAIN2	
0.10139	0.11356	DPLCV	PROPWET	SAAR	SPRHOST	LANDB	
0.10093	0.11356	DPLCV	PROPWET	SAAR	LANDC	DRAIN2	
0.10138	0.11389	DPLCV	SAAR	SPRHOST	LANDB	DRAIN2	
0.10132	0.11397	DPLCV	PROPWET	URBEXT	LANDD	DRAIN2	
0.09525	0.10776	DPLCV	PROPWET	SAAR	LANDB	LANDD	DRAIN2
0.09659	0.10933	DPLCV	DPSBAR	SAAR	LANDB	LANDD	DRAIN2
0.09688	0.10946	DPLCV	FARL	PROPWET	SAAR	SPRHOST	LANDD
0.09758	0.11007	ALTBAR	DPLCV	DPSBAR	SAAR	LANDD	DRAIN2
0.09807	0.11033	ALTBAR	DPLCV	PROPWET	SAAR	LANDD	DRAIN2
0.09830	0.11119	DPLCV	DPSBAR	FARL	SAAR	SPRHOST	LANDD
0.09854	0.11133	DPLCV	DPSBAR	FARL	PROPWET	SAAR	LANDD
0.09878	0.11150	ALTBAR	DPLCV	SAAR	LANDB	LANDD	DRAIN2
0.09880	0.11150	ALTBAR	DPLCV	FARL	SAAR	HOSTP	LANDD
0.09900	0.11174	DPLCV	PROPWET	SAAR	LANDC	LANDD	DRAIN2

TATE *csm* univariate regression

σ_j	σ_{TA}	Catchment properties					
0.15162	0.15475	+BFIHOST	+SAAR	+PORO			
0.15180	0.15493	+BFIHOST	+SAAR	-DRAIN2			
0.15187	0.15500	+BFIHOST	+FARL	+SAAR			
0.15204	0.15519	+BFIHOST	+FARL	+PORO			
0.15338	0.15654	+BFIHOST	+SAAR	+FIELD			
0.15453	0.15771	+FARL	-SPRHOST	+PORO			
0.15458	0.15776	+BFIHOST	+PROPWET	+PORO			
0.15580	0.15900	+SAAR	+HOSTP	+PORO			
0.15606	0.15927	+FARL	+HOSTP	+PORO			
0.15609	0.15929	+PROPWET	+HOSTP	+PORO			
0.14446	0.14821	+BFIHOST	+SAAR	+PORO	-DRAIN2		
0.14455	0.14831	+BFIHOST	+FARL	+SAAR	+FIELD		
0.14581	0.14960	+BFIHOST	+FARL	+SAAR	+PORO		
0.14701	0.15082	+BFIHOST	+FARL	+SAAR	-DRAIN2		
0.14722	0.15104	+FARL	-FIELD	+PORO	-HYDC		
0.14759	0.15142	+BFIHOST	+SAAR	-URBEXT	-DRAIN2		
0.14765	0.15148	+BFIHOST	+SAAR	+LANDB	-DRAIN2		
0.14768	0.15151	+BFIHOST	+SAAR	+HOSTPEAT	-DRAIN2		
0.14782	0.15165	+ALTBAR	+BFIHOST	+SAAR	-DRAIN2		
0.14841	0.15225	+BFIHOST	+PROPWET	+SAAR	-DRAIN2		
0.14039	0.14479	+BFIHOST	+FARL	+SAAR	-URBEXT	-DRAIN2	
0.14049	0.14489	+BFIHOST	+FARL	+SAAR	+PORO	-HYDC	
0.14052	0.14492	+BFIHOST	+FARL	+SAAR	+PORO	-DRAIN2	
0.14076	0.14517	+BFIHOST	+FARL	+SAAR	-URBEXT	+FIELD	
0.14148	0.14590	+BFIHOST	+SAAR	+HOSTPEAT	+FIELD	-DRAIN2	
0.14156	0.14598	+ALTBAR	+BFIHOST	+FARL	+SAAR	+FIELD	
0.14179	0.14622	+ALTBAR	+BFIHOST	+FARL	+SAAR	-DRAIN2	
0.14181	0.14624	+BFIHOST	+FARL	+SAAR	+FIELD	-RESIDM	
0.14214	0.14659	+FARL	+SAAR	-SPRHOST	-URBEXT	-DRAIN2	
0.14298	0.14744	+BFIHOST	+SAAR	-URBEXT	+PORO	-DRAIN2	
0.13384	0.13877	+ALTBAR	+FARL	+SAAR	-SPRHOST	-URBEXT	-DRAIN2
0.13610	0.14109	+FARL	+SAAR	-SPRHOST	-URBEXT	+PORO	-DRAIN2
0.13719	0.14222	+ALTBAR	+BFIHOST	+FARL	+SAAR	-URBEXT	-DRAIN2
0.13723	0.14226	+BFIHOST	+FARL	+SAAR	-URBEXT	+PORO	-DRAIN2
0.13729	0.14232	+FARL	+SAAR	+HOSTP	-FIELD	+PORO	-HYDC
0.13738	0.14241	+BFIHOST	+FARL	+SAAR	-URBEXT	+FIELD	-DRAIN2
0.13753	0.14256	+ALTBAR	+FARL	+SAAR	-SPRHOST	+PORO	-DRAIN2
0.13756	0.14259	+BFIHOST	+FARL	+SAAR	-FIELD	+PORO	-HYDC
0.13784	0.14289	+BFIHOST	+FARL	+SAAR	-URBEXT	+PORO	-HYDC
0.13824	0.14330	+ALTBAR	+BFIHOST	+FARL	+SAAR	+FIELD	-DRAIN2

TATE *csm* site-similarity

σ_n	σ_{TA}	Catchment properties					
0.13319	0.14451	DPSBAR	HOSTP	PORO			
0.13727	0.14882	BFIHOST	DPSBAR	PORO			
0.13721	0.14889	BFIHOST	DPSBAR	LANDD			
0.13890	0.15047	BFIHOST	FARL	SAAR			
0.13958	0.15112	BFIHOST	DPSBAR	SAAR			
0.13993	0.15164	DPSBAR	PORO	DRAIN2			
0.14019	0.15181	BFIHOST	SAAR	DRAIN2			
0.14194	0.15372	DPSBAR	SAAR	HOSTP			
0.14213	0.15417	BFIHOST	DPSBAR	DRAIN2			
0.14282	0.15481	BFIHOST	DPSBAR	RESIDM			
0.12606	0.13711	DPSBAR	HOSTP	PORO	DRAIN2		
0.12610	0.13729	BFIHOST	DPSBAR	PORO	DRAIN2		
0.12792	0.13919	BFIHOST	DPSBAR	SAAR	DRAIN2		
0.12922	0.14049	DPSBAR	SAAR	HOSTP	DRAIN2		
0.13010	0.14142	DPSBAR	HOSTP	RESIDM	PORO		
0.13078	0.14206	BFIHOST	DPSBAR	RESIDM	PORO		
0.13098	0.14244	ALTBAR	BFIHOST	SAAR	DRAIN2		
0.13206	0.14353	BFIHOST	DPSBAR	SAAR	LANDD		
0.13300	0.14430	BFIHOST	SAAR	LANDD	DRAIN2		
0.13279	0.14433	ALTBAR	SAAR	HOSTP	DRAIN2		
0.12413	0.13542	ALTBAR	BFIHOST	SAAR	LANDD	DRAIN2	
0.12442	0.13574	ALTBAR	BFIHOST	DPSBAR	PORO	DRAIN2	
0.12477	0.13605	BFIHOST	DPSBAR	SAAR	LANDD	DRAIN2	
0.12484	0.13614	BFIHOST	DPSBAR	PORO	LANDD	DRAIN2	
0.12570	0.13690	DPSBAR	HOSTP	PORO	LANDD	DRAIN2	
0.12749	0.13876	ALTBAR	BFIHOST	DPSBAR	SAAR	DRAIN2	
0.12726	0.13879	DPLBAR	DPSBAR	SAAR	HOSTP	DRAIN2	
0.12713	0.13889	ALTBAR	BFIHOST	FARL	SAAR	DRAIN2	
0.12768	0.13911	ALTBAR	DPSBAR	HOSTP	PORO	DRAIN2	
0.12778	0.13914	DPSBAR	SAAR	HOSTP	PORO	DRAIN2	
0.12435	0.13567	BFIHOST	DPSBAR	SAAR	HOSTP	LANDD	DRAIN2
0.12425	0.13580	ALTBAR	BFIHOST	DPSBAR	PORO	LANDD	DRAIN2
0.12550	0.13685	ALTBAR	BFIHOST	SAAR	HOSTP	LANDD	DRAIN2
0.12521	0.13700	ALTBAR	BFIHOST	FARL	SAAR	HOSTP	DRAIN2
0.12581	0.13714	ALTBAR	DPSBAR	HOSTP	RESIDM	PORO	DRAIN2
0.12571	0.13729	ALTBAR	DPSBAR	HOSTP	PORO	LANDD	DRAIN2
0.12644	0.13762	ALTBAR	BFIHOST	DPSBAR	SAAR	HOSTP	DRAIN2
0.12597	0.13781	ALTBAR	BFIHOST	FARL	SAAR	SPRHOST	DRAIN2
0.12647	0.13782	ALTBAR	BFIHOST	DPSBAR	HOSTP	PORO	DRAIN2
0.12609	0.13787	BFIHOST	DPLBAR	DPSBAR	SAAR	HOSTP	DRAIN2

TATE *cfr* univariate regression

σ_{η}	σ_{TA}	Catchment properties						
0.45517	0.46967	-DPLBAR	-FARL	+SPRHOST				
0.45972	0.47433	-AREA	-FARL	+SPRHOST				
0.46829	0.48310	-DPLBAR	+SPRHOST	-PORO				
0.47229	0.48719	-DPLBAR	+SPRHOST	-HOSTPEAT				
0.47261	0.48752	+ALTBAR	-DPLBAR	-PORO				
0.47413	0.48908	+ALTBAR	-BFIHOST	-DPLBAR				
0.47568	0.49066	-AREA	+SPRHOST	-PORO				
0.47625	0.49125	-DPLBAR	+SPRHOST	+URBEXT				
0.47644	0.49144	-DPLBAR	+SPRHOST	-HYDC				
0.47660	0.49160	-AREA	+SPRHOST	-HOSTPEAT				
0.43699	0.45451	+ALTBAR	-DPLBAR	+SPRHOST	-PORO			
0.44471	0.46245	+ALTBAR	-BFIHOST	-DPLBAR	-PORO			
0.44828	0.46613	-DPLBAR	-FARL	+SPRHOST	-FIELDC			
0.45077	0.46869	-DPLBAR	-FARL	+SPRHOST	+URBEXT			
0.45137	0.46931	+ALTBAR	-DPLBAR	+SPRHOST	-LANDB			
0.45236	0.47032	+ALTBAR	-DPLBAR	-HOSTGMIN	-PORO			
0.45237	0.47034	-DPLBAR	-FARL	+SPRHOST	-PORO			
0.45275	0.47073	+ALTBAR	-DPLBAR	+PROPWET	-PORO			
0.45280	0.47078	-DPLBAR	-FARL	+PROPWET	+SPRHOST			
0.45294	0.47092	-AREA	-FARL	+PROPWET	+SPRHOST			
0.42669	0.44727	+ALTBAR	-DPLBAR	-FARL	+SPRHOST	-PORO		
0.42800	0.44863	-DPLBAR	-FARL	+PROPWET	+SPRHOST	-PORO		
0.42873	0.44938	-AREA	-FARL	+PROPWET	+SPRHOST	-PORO		
0.43113	0.45186	+ALTBAR	-DPLBAR	+FIELDC	-PORO	+HYDC		
0.43440	0.45525	+ALTBAR	-DPLBAR	+SPRHOST	-FIELDC	+RESIDM		
0.43458	0.45543	+ALTBAR	-DPLBAR	+SPRHOST	+HOSTP	-PORO		
0.43474	0.45560	-AREA	-FARL	+PROPWET	+SPRHOST	+URBEXT		
0.43520	0.45607	+ALTBAR	-DPLBAR	+SPRHOST	-PORO	-LANDB		
0.43633	0.45725	+ALTBAR	-DPLBAR	+PROPWET	+SPRHOST	-PORO		
0.43695	0.45789	-DPLBAR	-FARL	+PROPWET	+SPRHOST	+URBEXT		
0.41066	0.43393	-DPLBAR	-FARL	+PROPWET	+FIELDC	-PORO	+HYDC	
0.41183	0.43514	-DPLBAR	-FARL	+PROPWET	+SPRHOST	+HOSTP	-PORO	
0.41309	0.43646	-AREA	-FARL	+PROPWET	+FIELDC	-PORO	+HYDC	
0.41370	0.43710	-AREA	-FARL	+PROPWET	+SPRHOST	+HOSTP	-PORO	
0.41776	0.44132	-AREA	-FARL	+PROPWET	+SPRHOST	+URBEXT	-PORO	
0.41799	0.44155	+ALTBAR	-DPLBAR	-FARL	+PROPWET	+SPRHOST	-PORO	
0.41933	0.44294	-DPLBAR	-FARL	+PROPWET	+SPRHOST	+URBEXT	-PORO	
0.41974	0.44338	+ALTBAR	-DPLBAR	-FARL	+FIELDC	-PORO	+HYDC	
0.41993	0.44357	-AREA	-FARL	+PROPWET	+SPRHOST	-HOSTPEAT	-HOSTNG	
0.42148	0.44518	+ALTBAR	-DPLBAR	+PROPWET	+FIELDC	-PORO	+HYDC	

TATE *cfr* site-similarity

σ_n	σ_{TA}	Catchment properties					
0.43526	0.47333	DPLBAR	SPRHOST	PORO			
0.44928	0.48902	AREA	SPRHOST	PORO			
0.45456	0.49482	ALTBAR	DPLBAR	SPRHOST			
0.45474	0.49510	ALTBAR	DPLBAR	HOSTP			
0.45643	0.49654	DPLBAR	SPRHOST	LANDD			
0.45766	0.49725	DPLBAR	SPRHOST	HOSTP			
0.45857	0.49846	ALTBAR	SPRHOST	HOSTP			
0.45911	0.49965	DPLBAR	SPRHOST	LANDA			
0.45969	0.50010	ALTBAR	BFIHOST	DPLBAR			
0.46330	0.50348	BFIHOST	DPLBAR	SPRHOST			
0.41779	0.45658	ALTBAR	DPLBAR	SPRHOST	PORO		
0.43133	0.47133	ALTBAR	BFIHOST	DPLBAR	PORO		
0.43812	0.47920	DPLBAR	SPRHOST	PORO	DRAIN2		
0.44255	0.48166	BFIHOST	DPLBAR	SPRHOST	PORO		
0.44196	0.48253	ALTBAR	DPLBAR	SPRHOST	HOSTP		
0.44350	0.48274	DPLBAR	SPRHOST	HOSTP	PORO		
0.44197	0.48276	AREA	ALTBAR	SPRHOST	PORO		
0.44218	0.48379	ALTBAR	DPLBAR	SPRHOST	URBEXT		
0.44375	0.48456	AREA	BFIHOST	FARL	LANDA		
0.44492	0.48516	DPLBAR	SPRHOST	PORO	LANDD		
0.42350	0.46486	ALTBAR	DPLBAR	SPRHOST	PORO	DRAIN2	
0.42787	0.46733	ALTBAR	BFIHOST	DPLBAR	SPRHOST	PORO	
0.43097	0.47093	ALTBAR	DPLBAR	SPRHOST	HOSTP	PORO	
0.43016	0.47124	ALTBAR	DPLBAR	FARL	PROPWET	PORO	
0.43137	0.47177	ALTBAR	DPLBAR	SPRHOST	PORO	LANDD	
0.43201	0.47206	ALTBAR	DPLBAR	FARL	SPRHOST	PORO	
0.43584	0.47667	AREA	ALTBAR	FARL	SPRHOST	PORO	
0.43535	0.47669	DPLBAR	FARL	PROPWET	PORO	LANDB	
0.43699	0.47784	ALTBAR	DPLBAR	FARL	PORO	LANDA	
0.43615	0.47866	ALTBAR	BFIHOST	DPLBAR	URBEXT	HOSTGMIN	
0.42387	0.46516	ALTBAR	DPLBAR	FARL	PROPWET	PORO	LANDA
0.42522	0.46556	ALTBAR	DPLBAR	FARL	PROPWET	SPRHOST	PORO
0.42726	0.46681	ALTBAR	BFIHOST	DPLBAR	FARL	SPRHOST	PORO
0.42758	0.46845	DPLBAR	FARL	PROPWET	SPRHOST	PORO	LANDB
0.42950	0.47068	ALTBAR	DPLBAR	FARL	PROPWET	PORO	LANDD
0.43073	0.47117	ALTBAR	BFIHOST	DPLBAR	SPRHOST	HOSTP	PORO
0.42992	0.47120	AREA	FARL	PROPWET	SPRHOST	PORO	LANDB
0.43091	0.47168	ALTBAR	BFIHOST	DPLBAR	FARL	HOSTGMIN	PORO
0.43077	0.47171	ALTBAR	BFIHOST	DPLBAR	FARL	PROPWET	PORO
0.43163	0.47201	ALTBAR	DPLBAR	FARL	SPRHOST	PORO	LANDB

B.2 Generalised flood frequency curves (pages 38-78)

Key to figures in this appendix:

The left-hand column is using the PDM, and the right-hand column using TATE.

Black dotted line and open circles: flood frequency from observed flows;

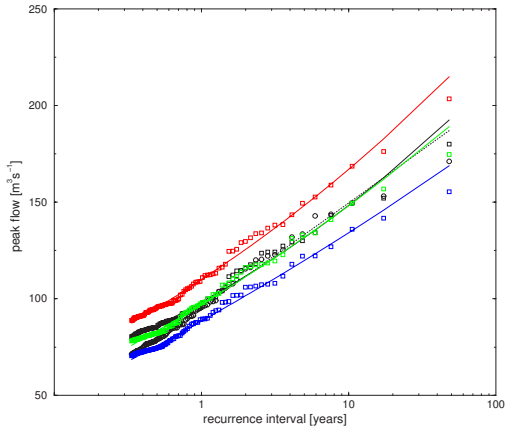
Black solid line and open squares: flood frequency from flows simulated with calibrated parameter values;

Blue solid line and open squares: flood frequency from flows simulated with parameter values generalised using multiple univariate regression;

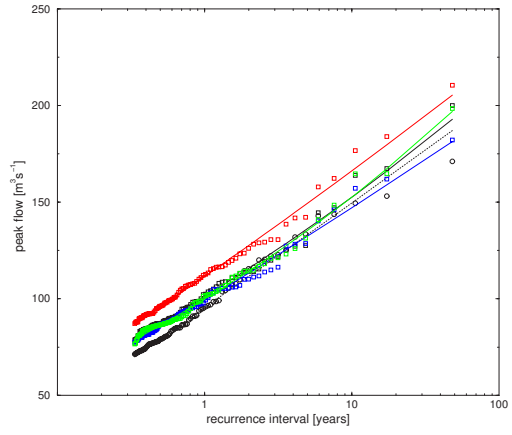
Green solid line and open squares: flood frequency from flows simulated with parameter values generalised using sequential regression;

Red solid lines and open squares: flood frequency from flows simulated with parameter values generalised using site-similarity.

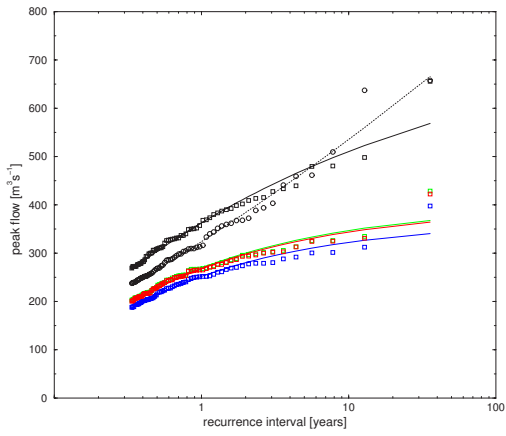
PDM
02001



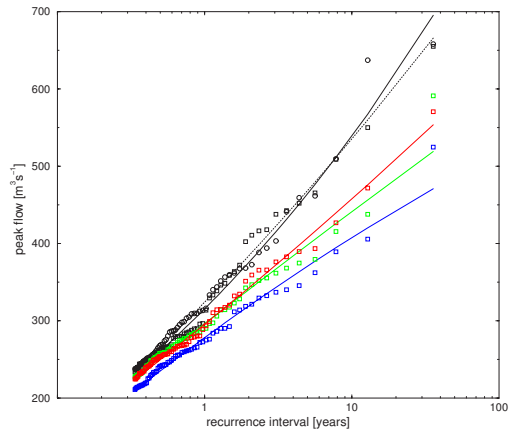
TATE
02001



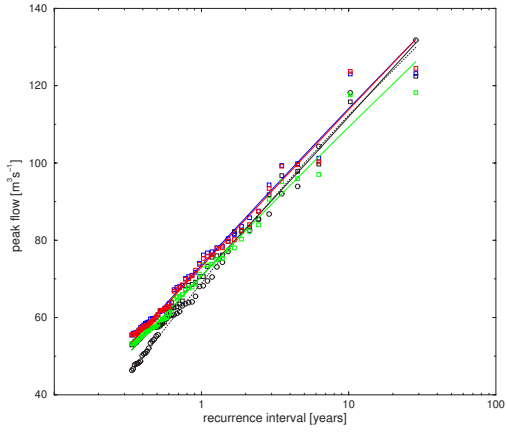
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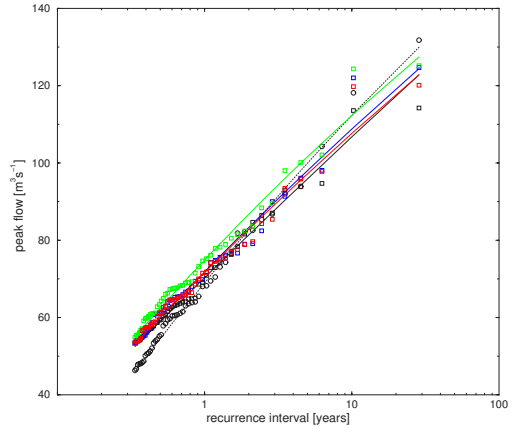
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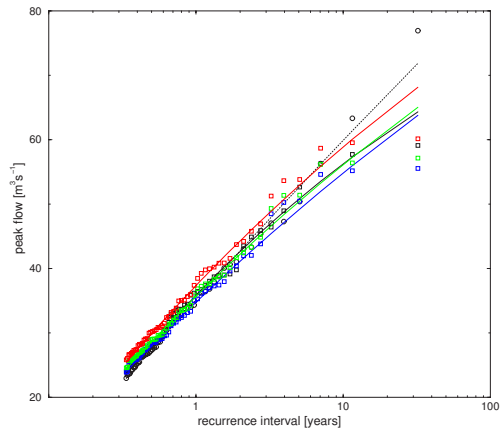
04005



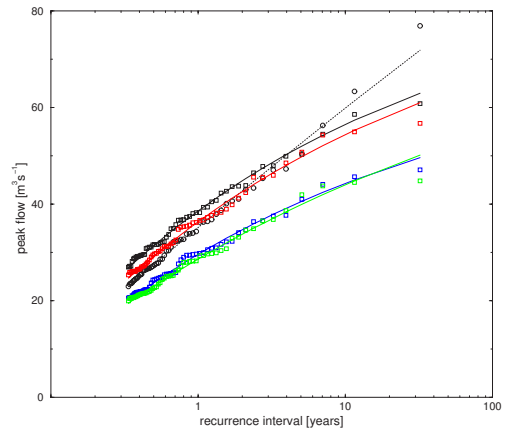
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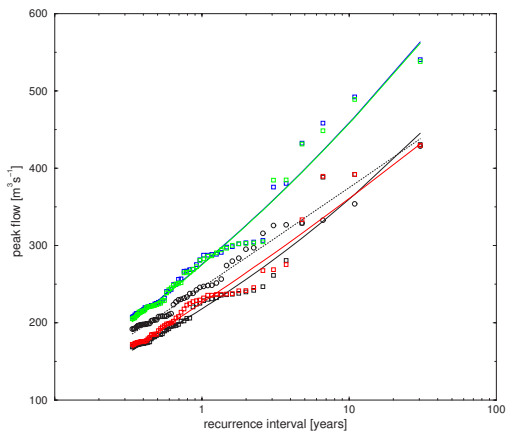
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06008



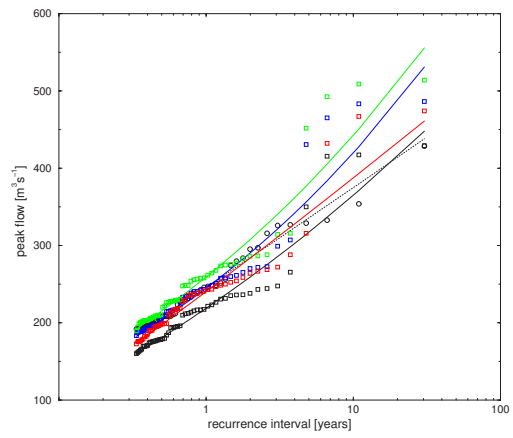
TATE
06008



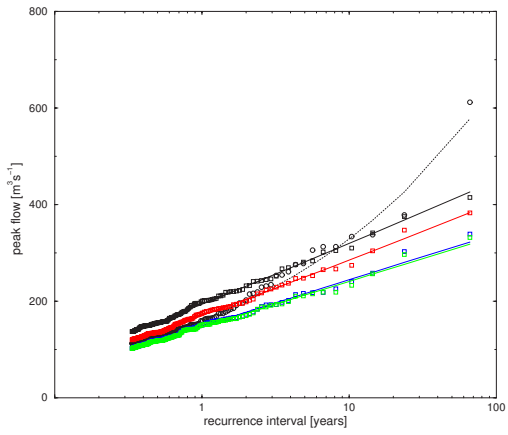
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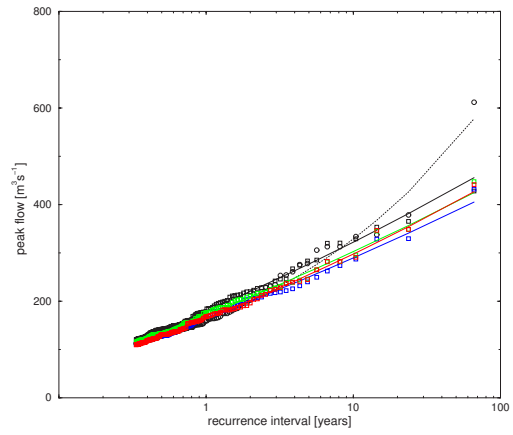
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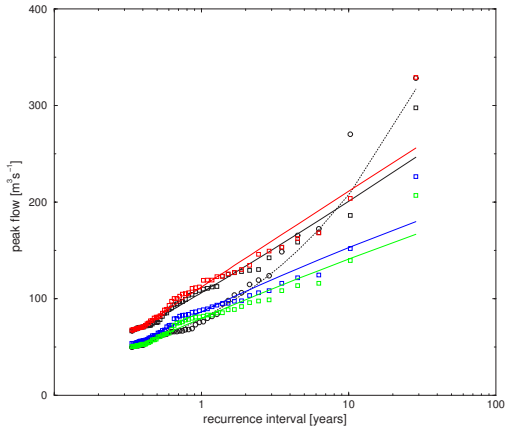
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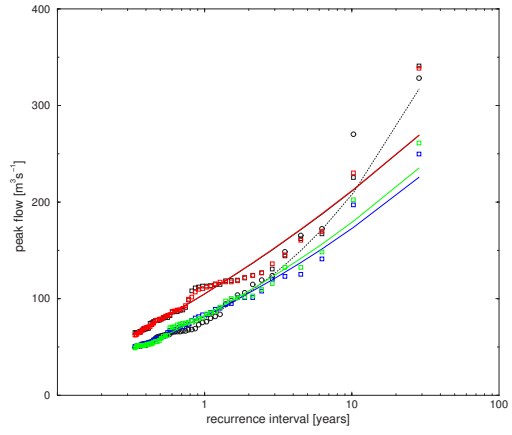
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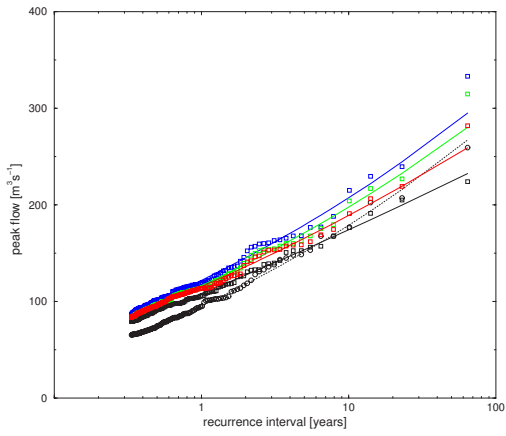
PDM
07004



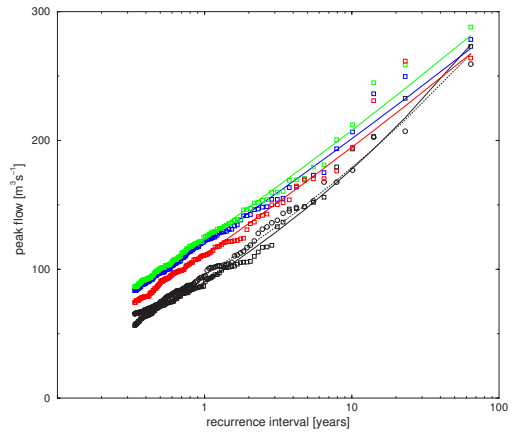
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07004



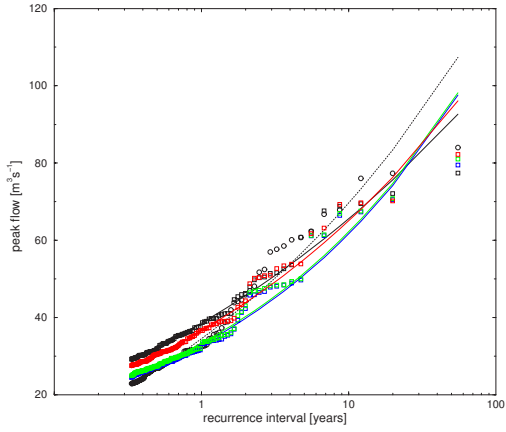
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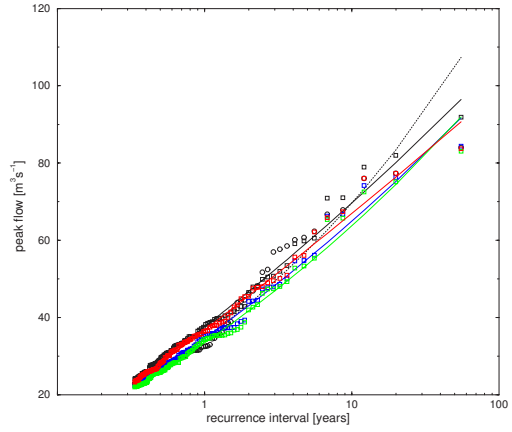
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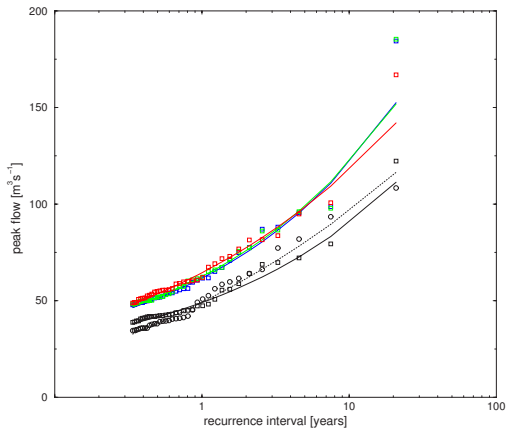
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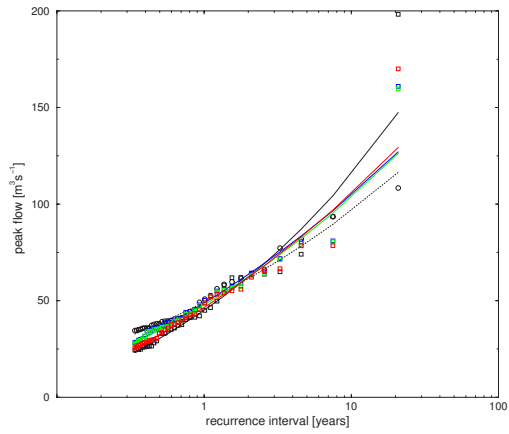
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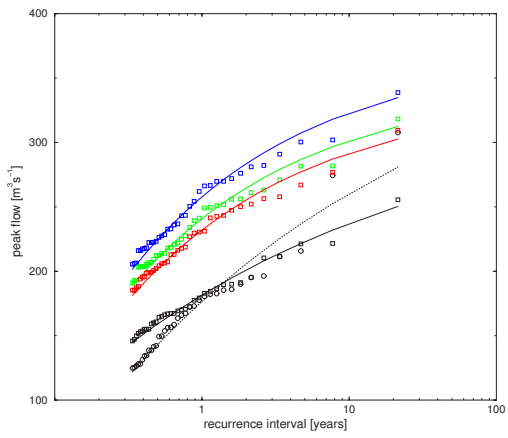
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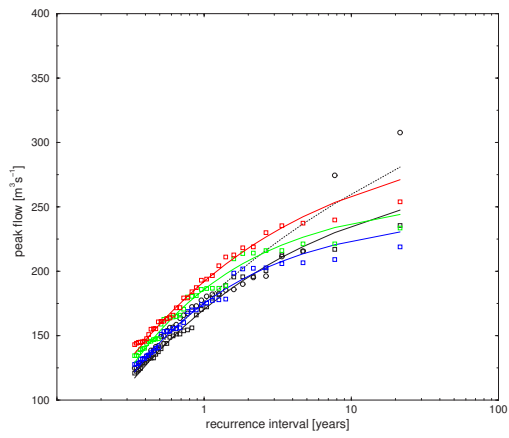
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10003



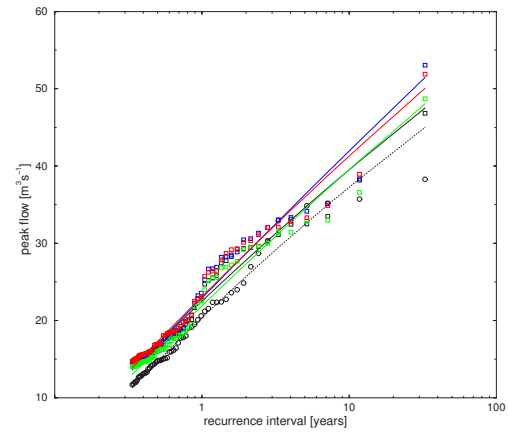
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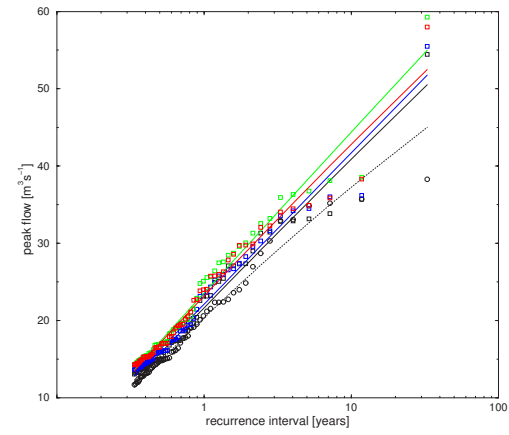
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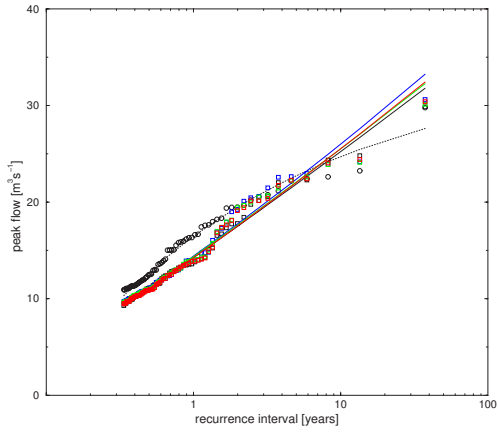
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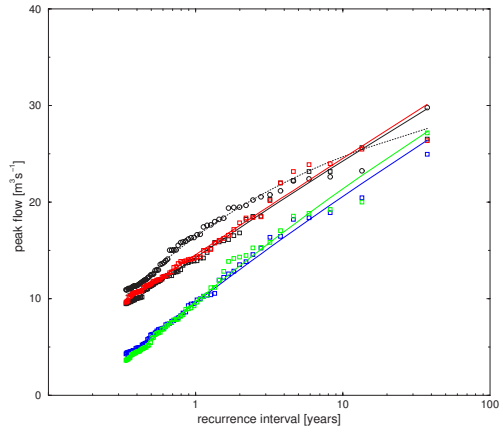
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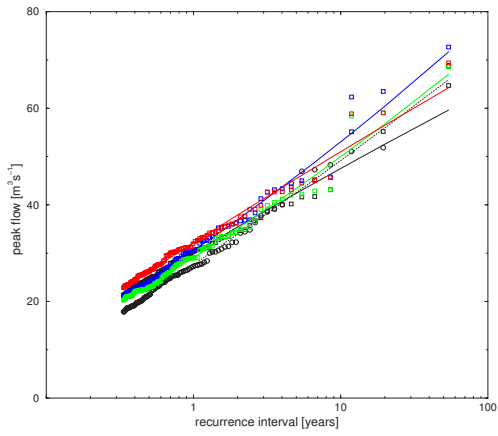
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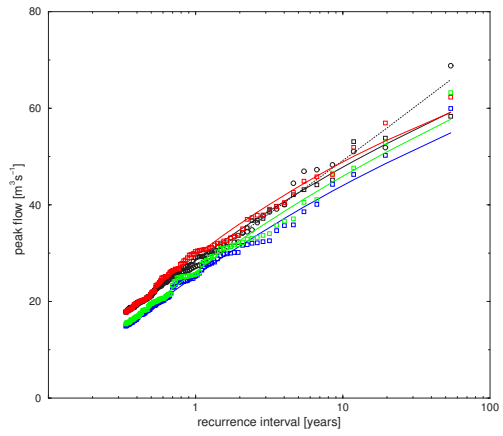
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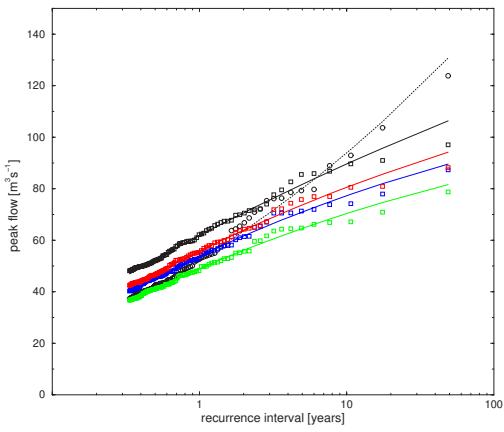
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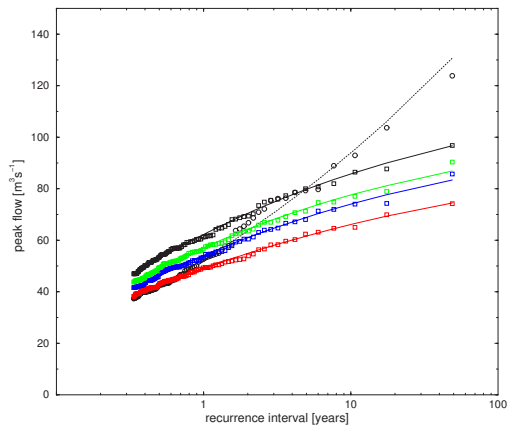
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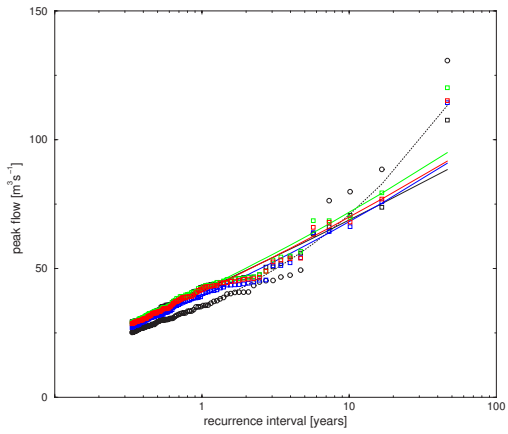
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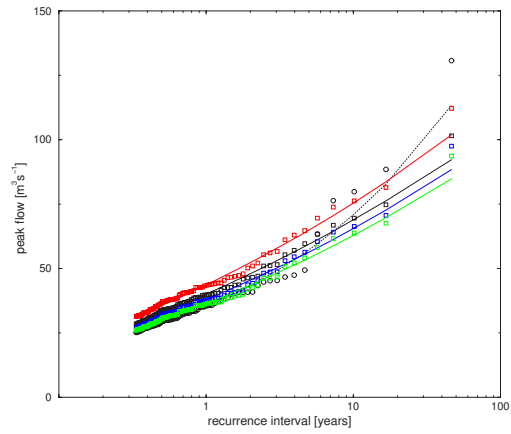
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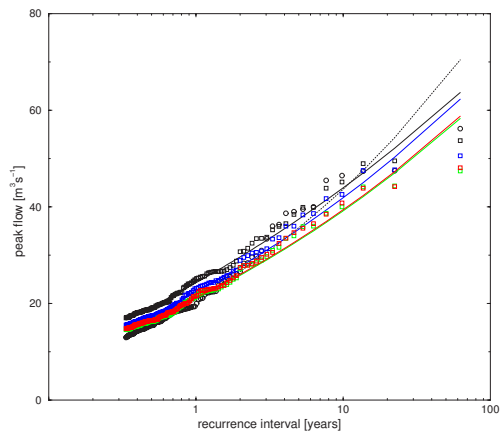
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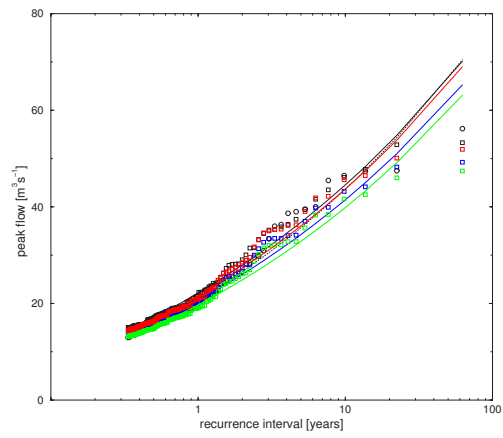
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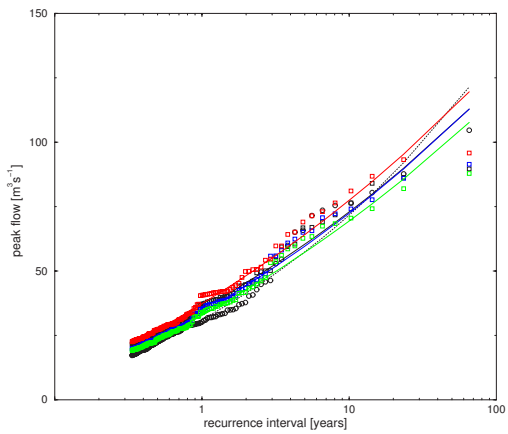
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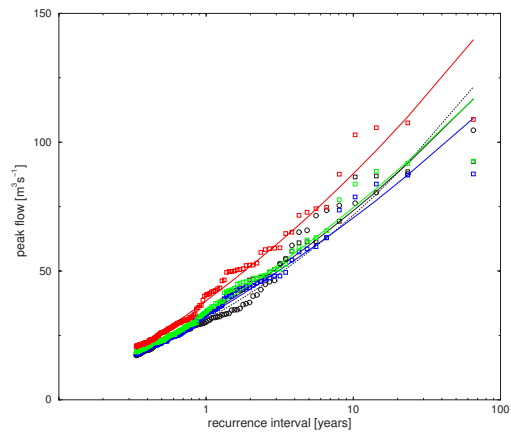
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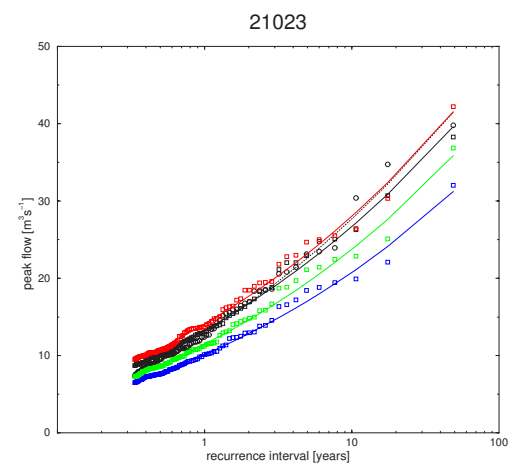
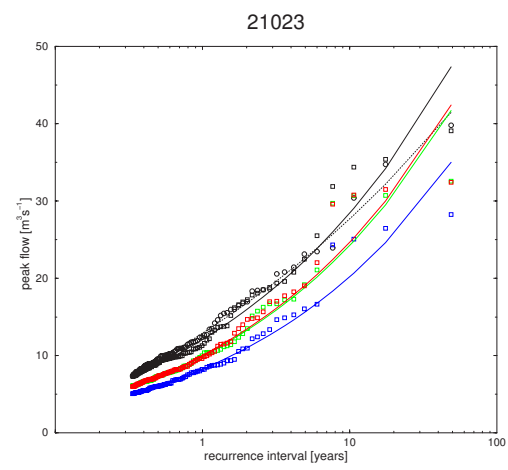
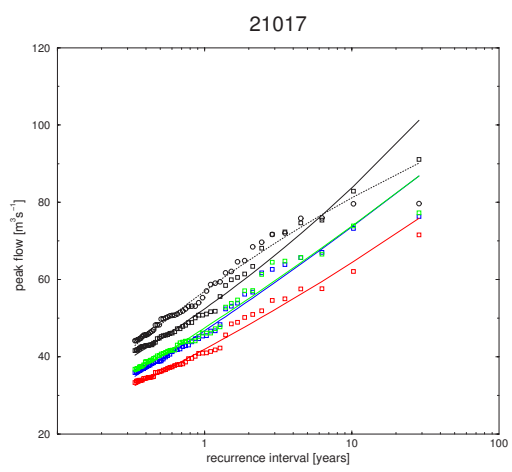
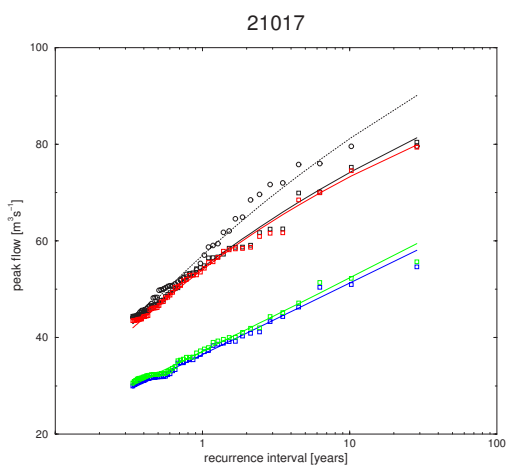
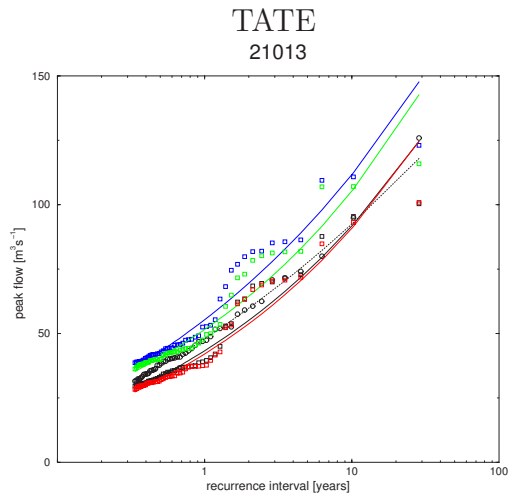
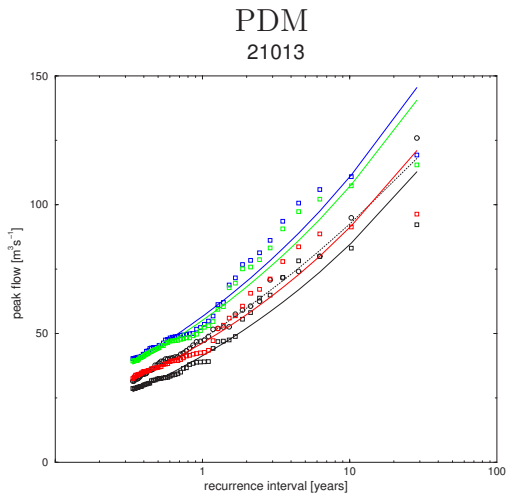


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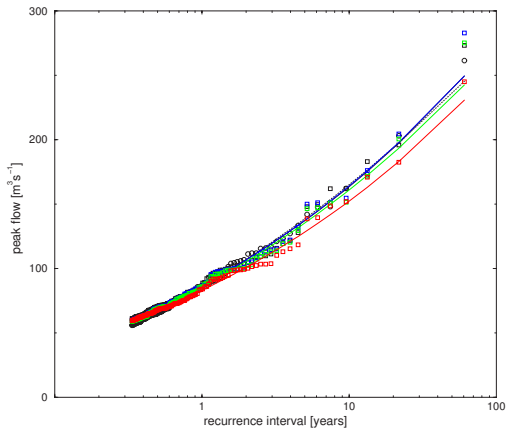


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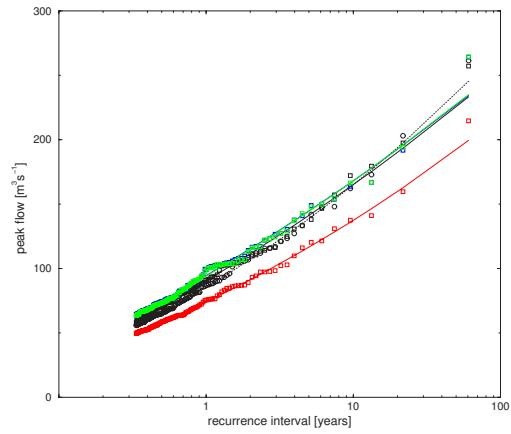




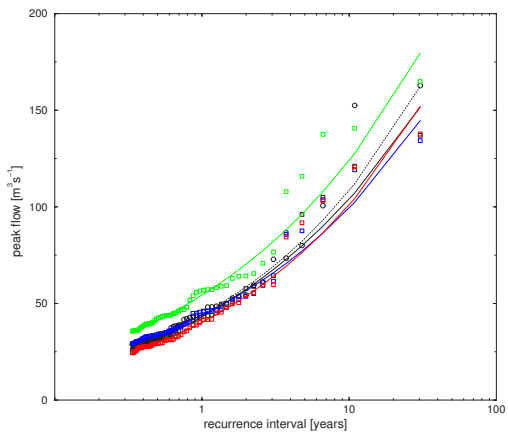
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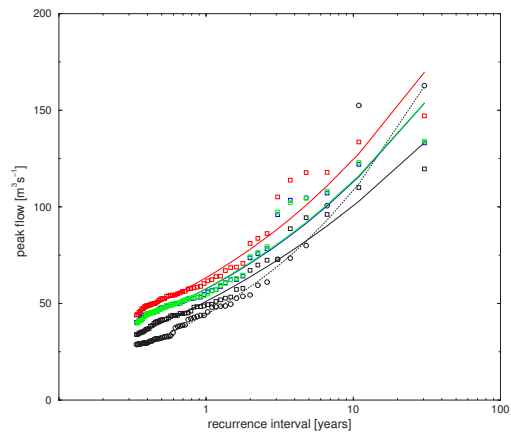
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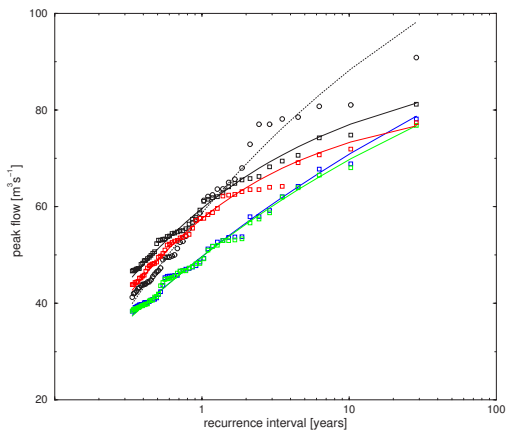
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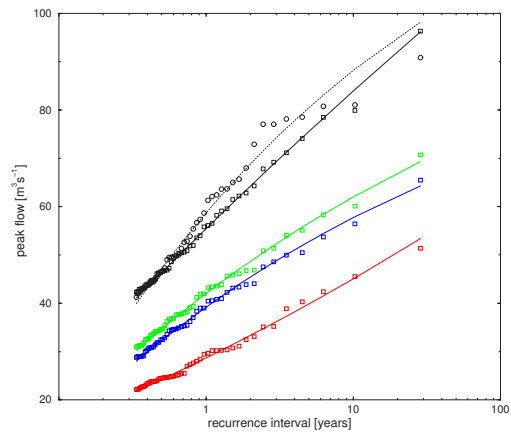
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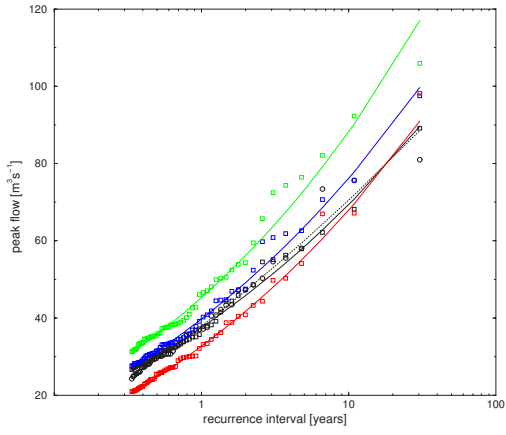
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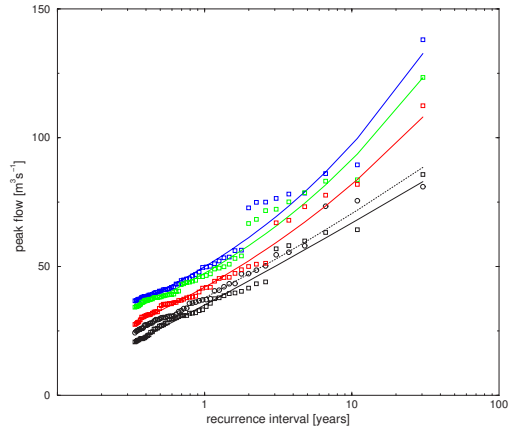
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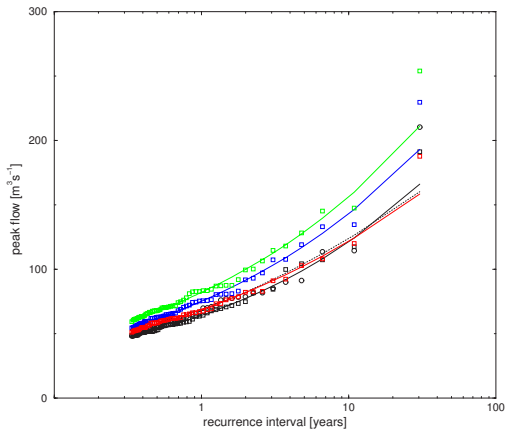
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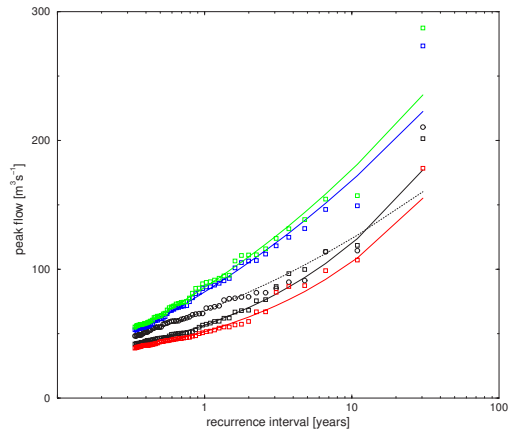
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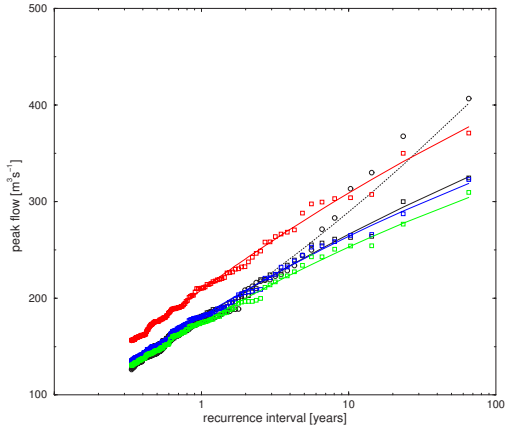
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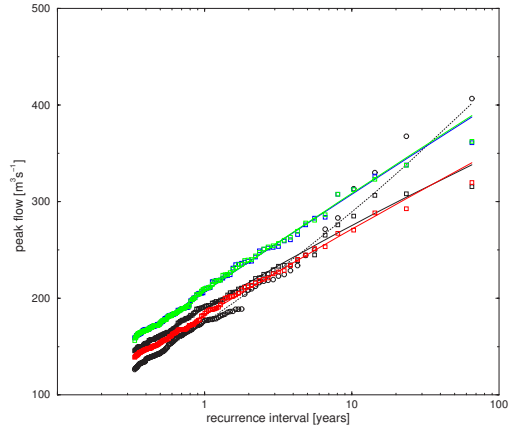
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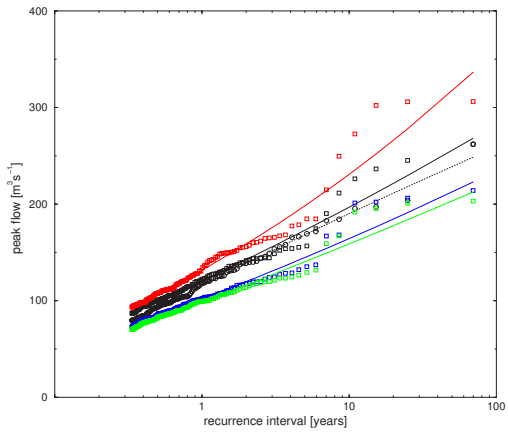
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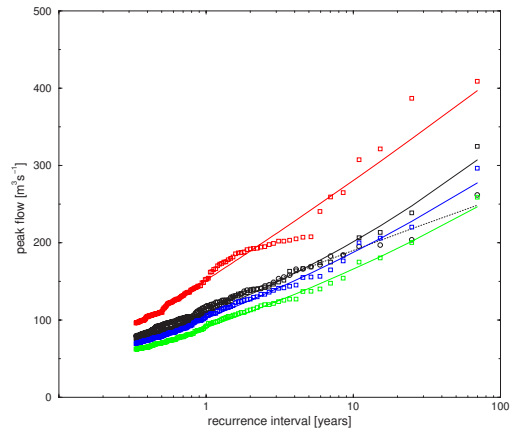
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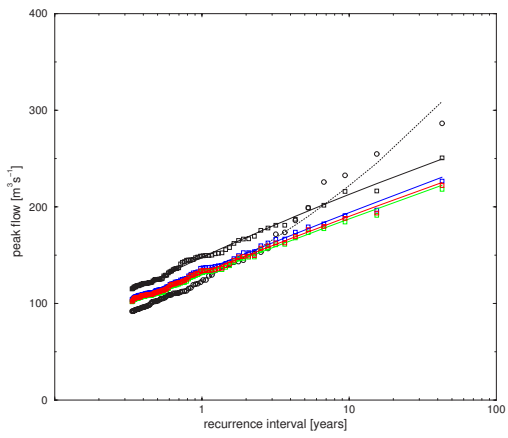
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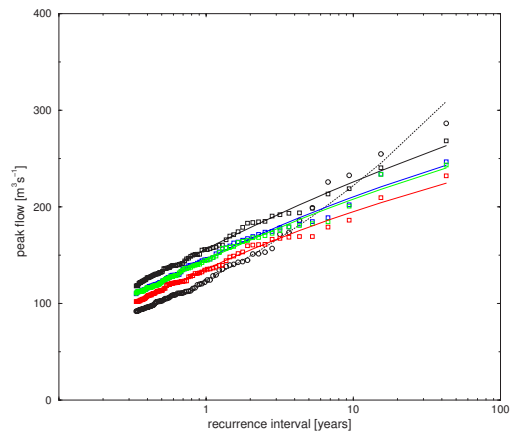
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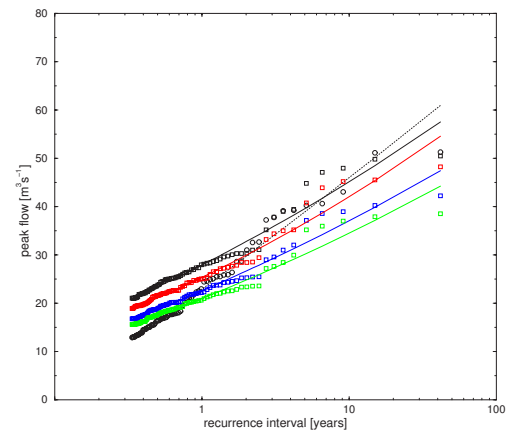
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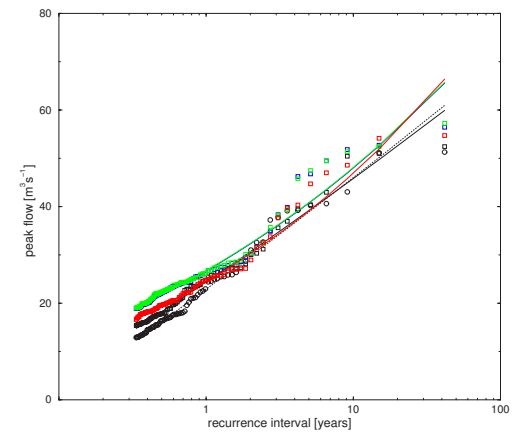
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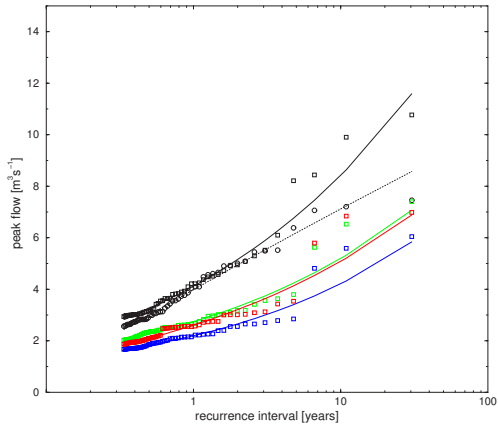
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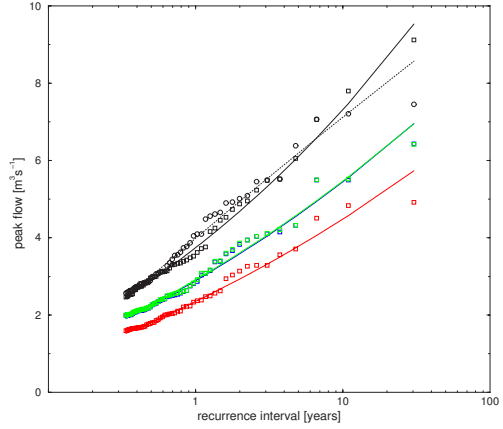
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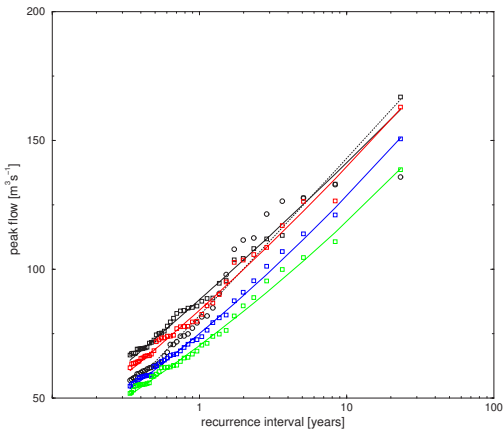
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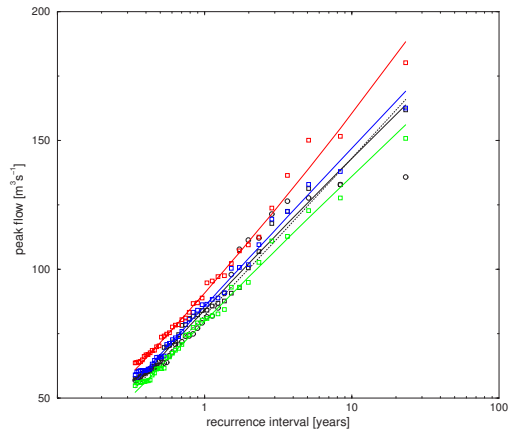
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27051



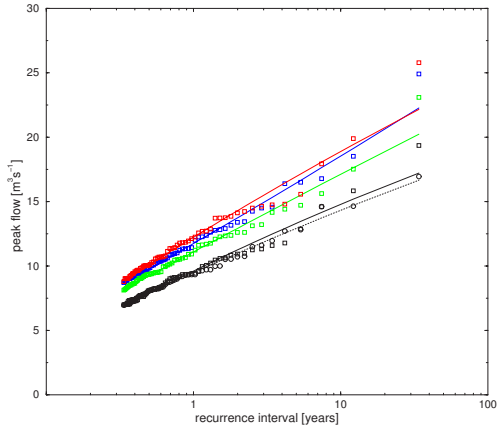
28008



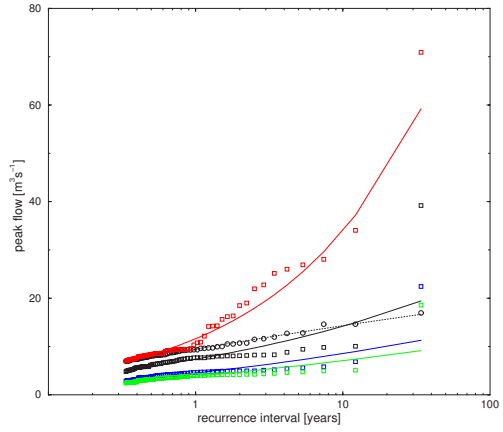
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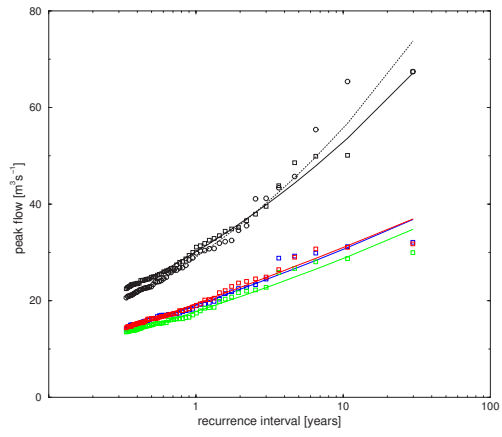
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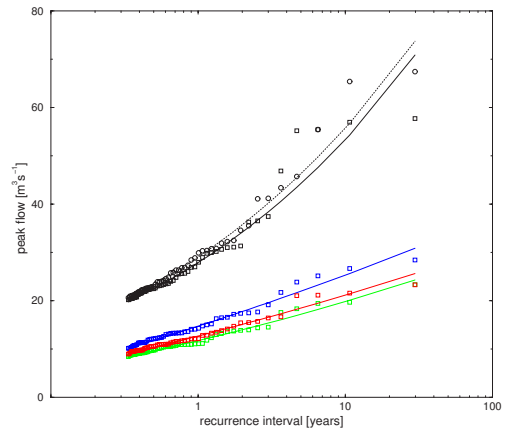
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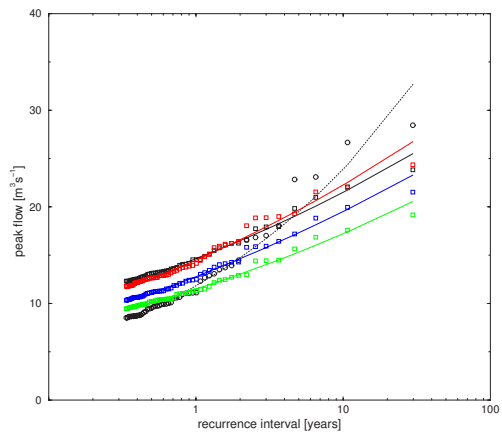
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28039



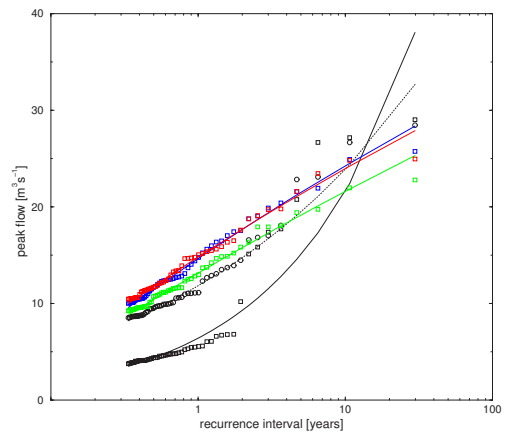
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28039



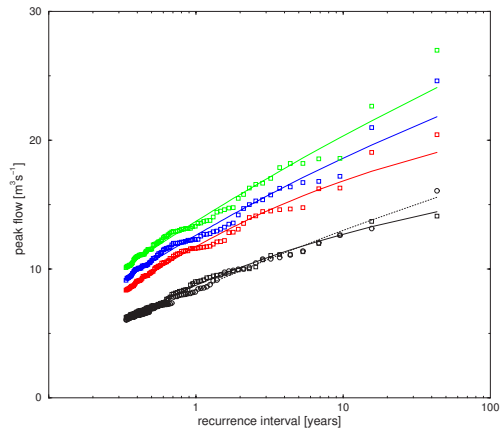
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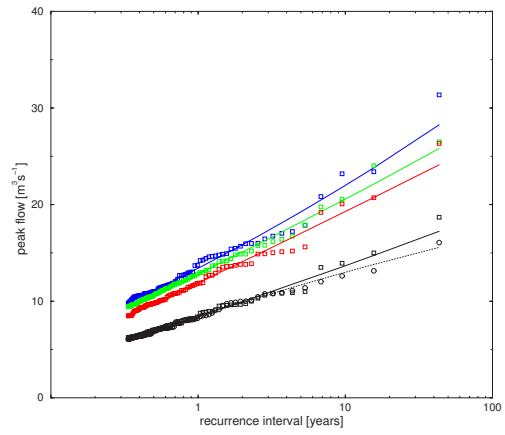
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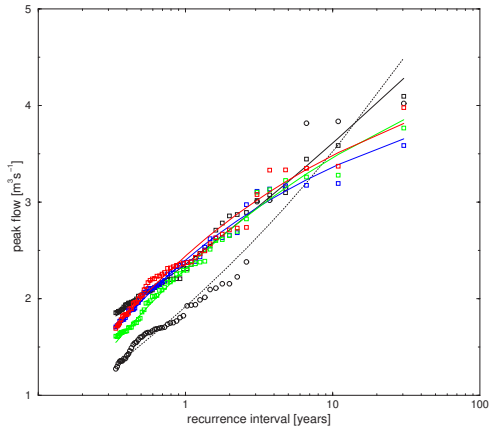
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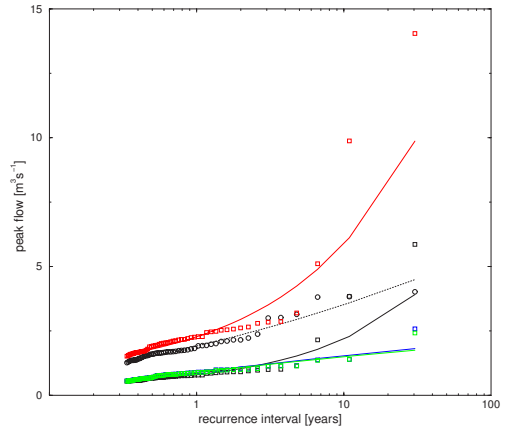
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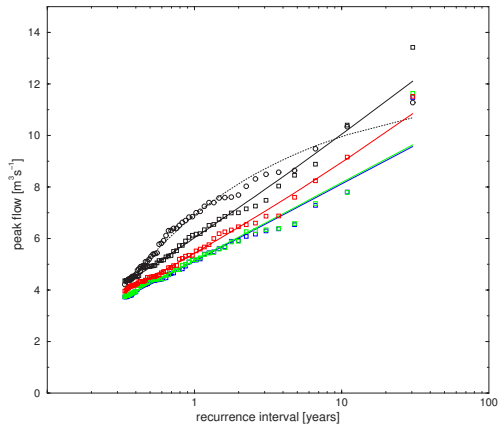
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29001



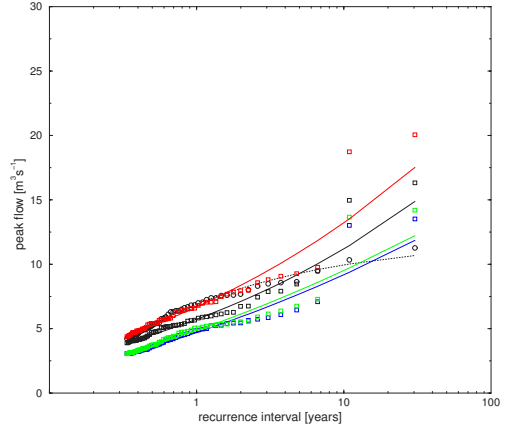
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29001



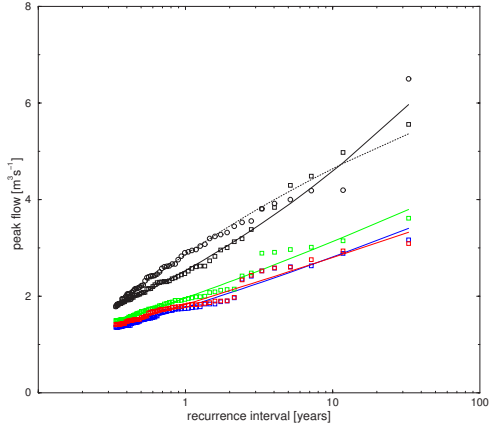
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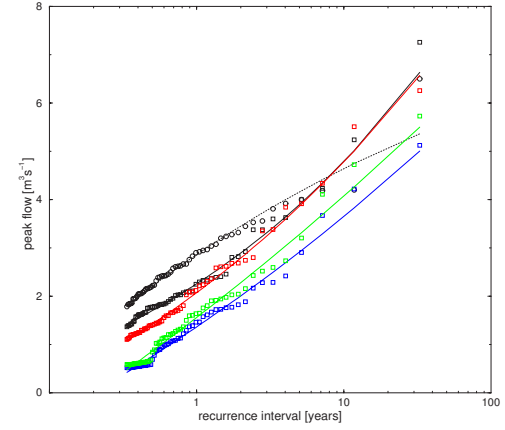
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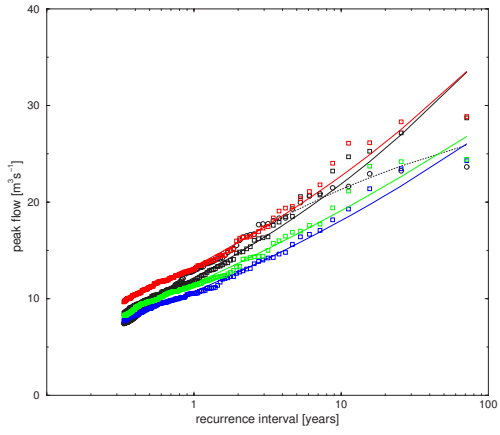
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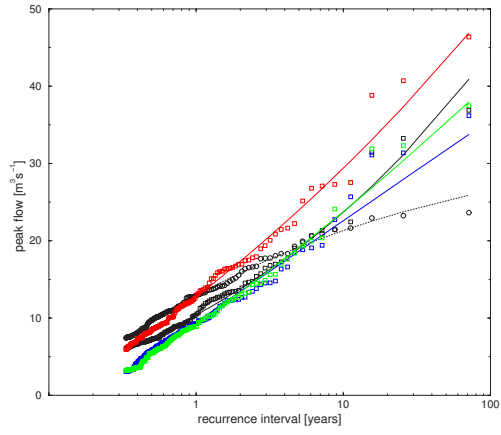
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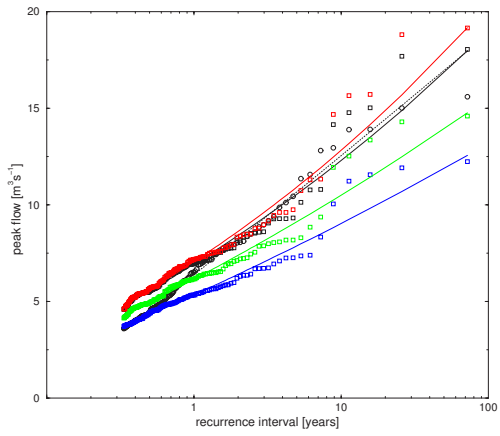
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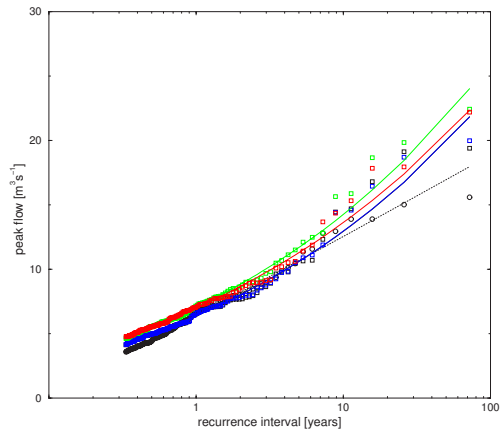
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31002



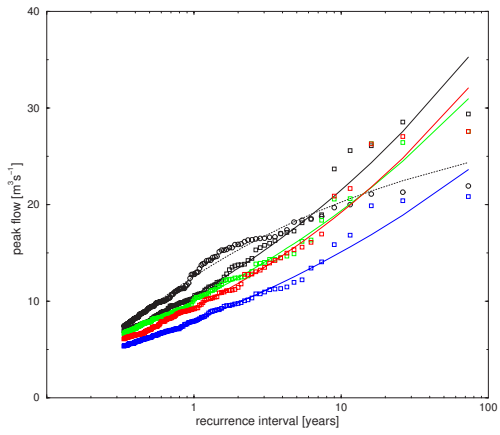
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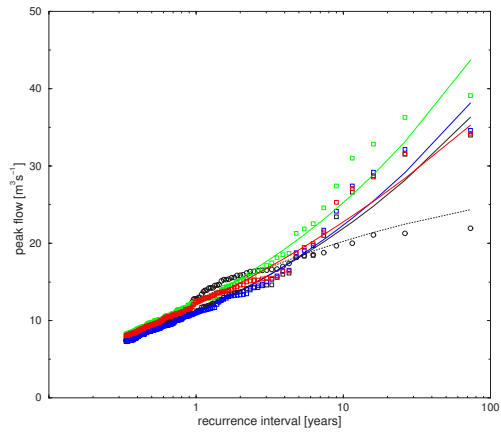
32003



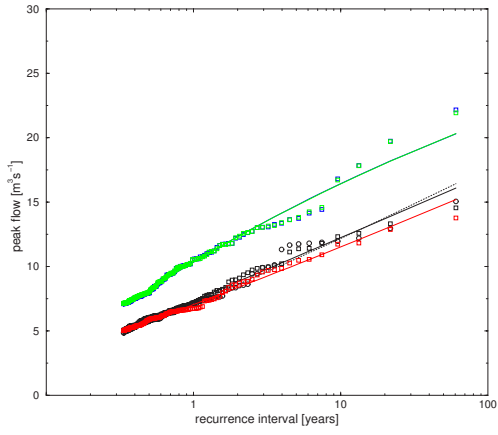
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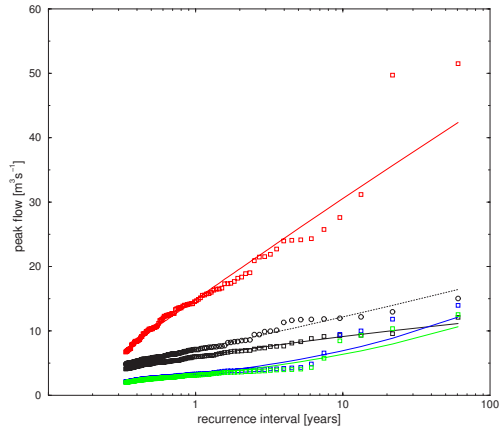
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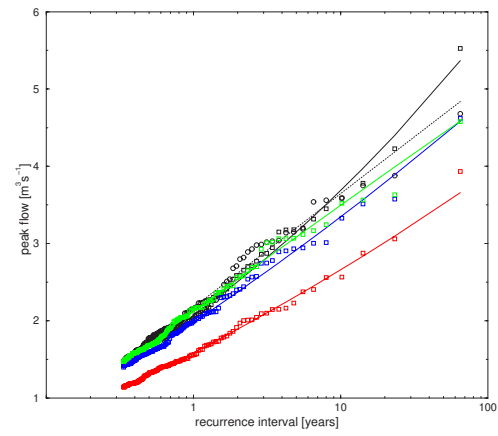
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33019



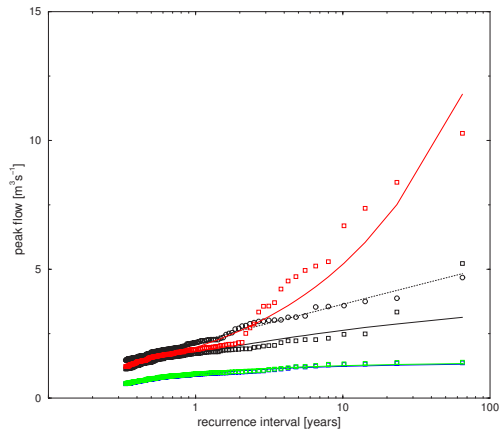
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33019



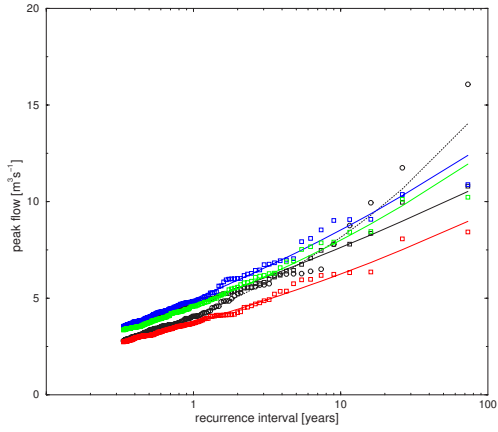
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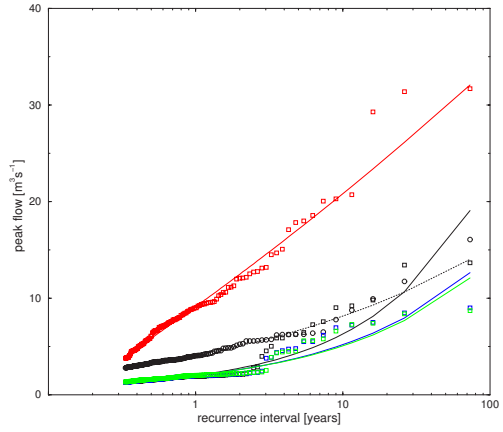
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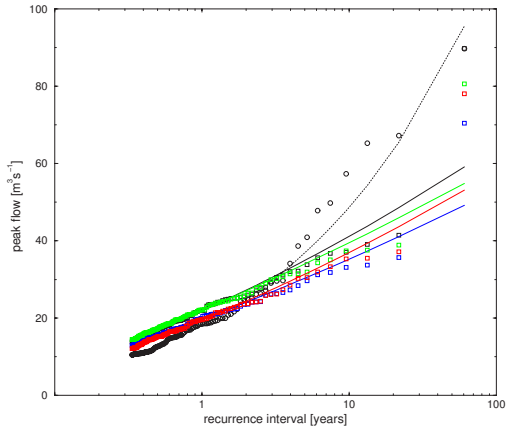
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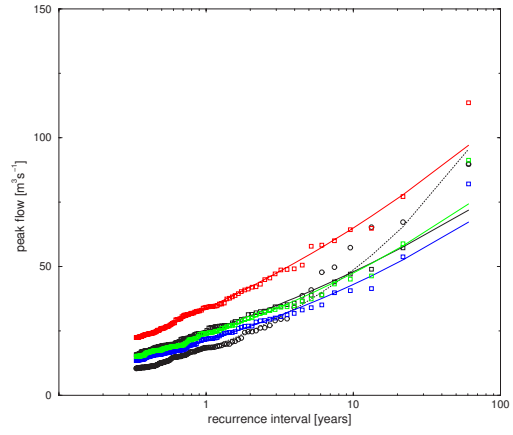
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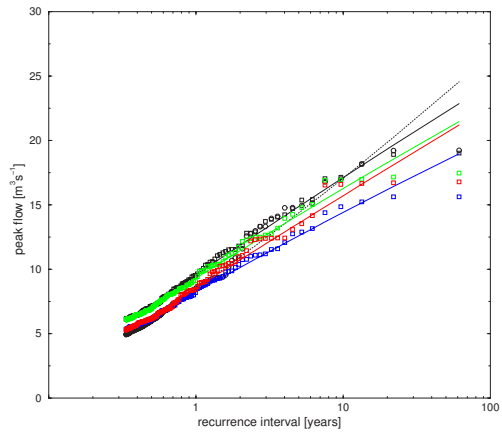
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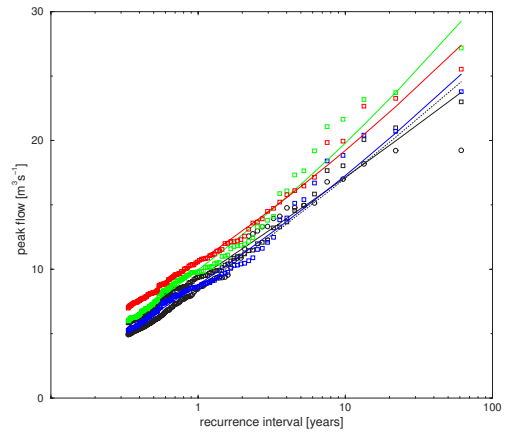
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34006



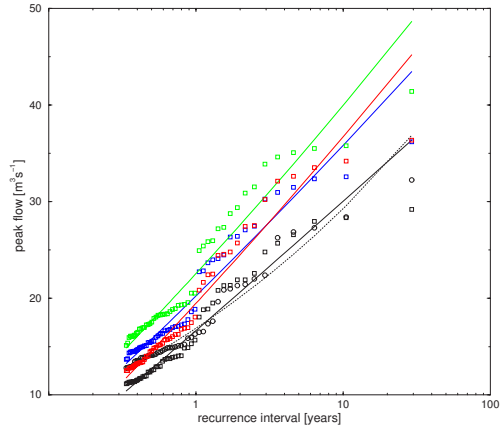
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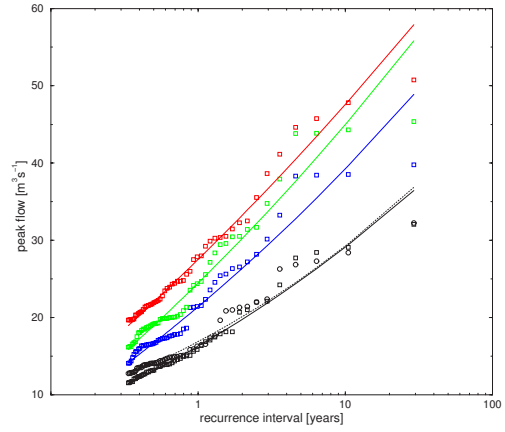
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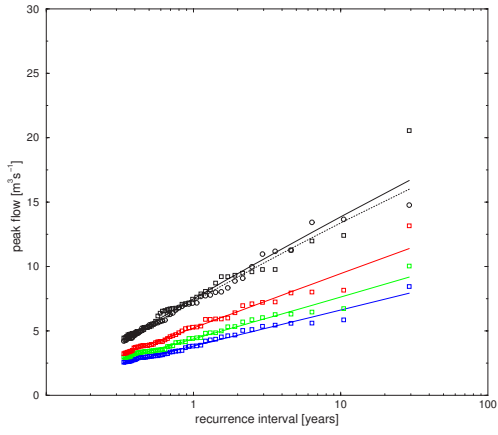
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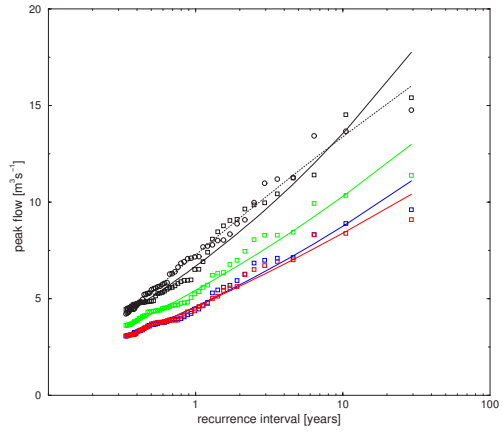
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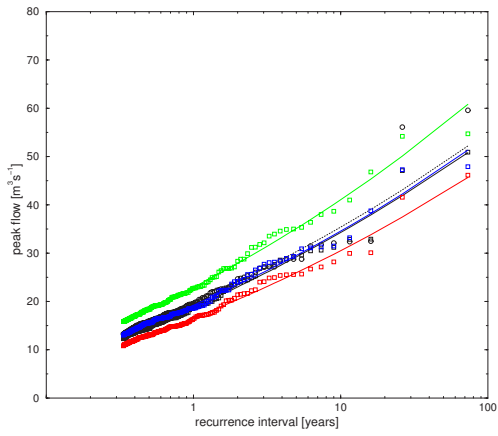
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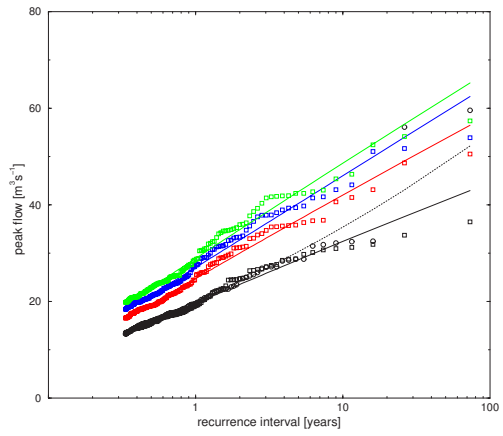
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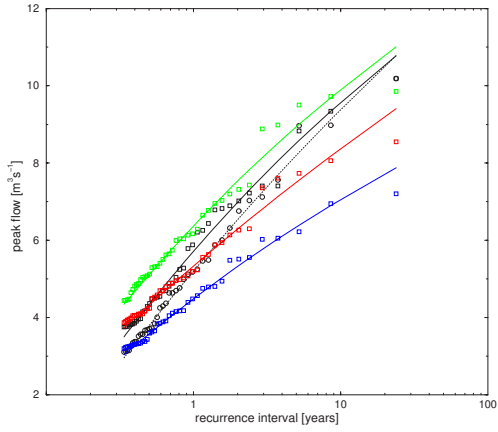
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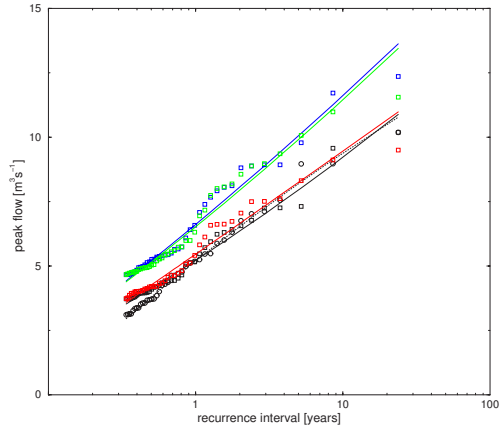
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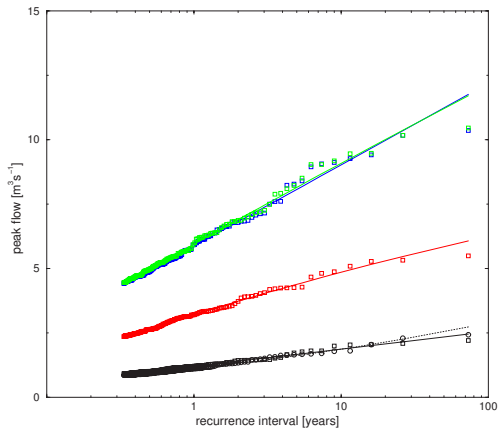
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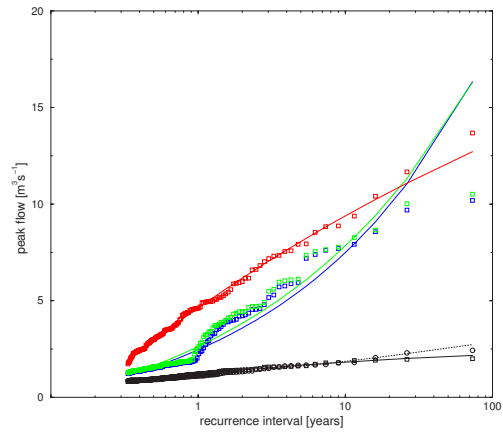
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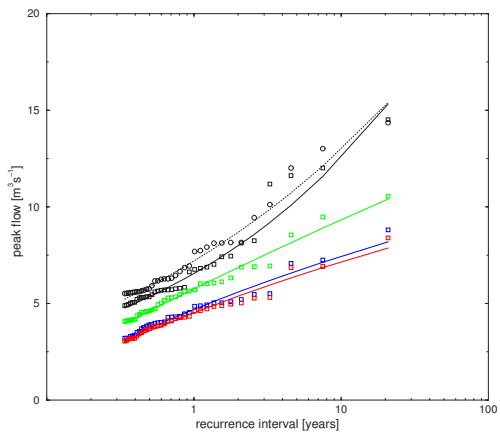
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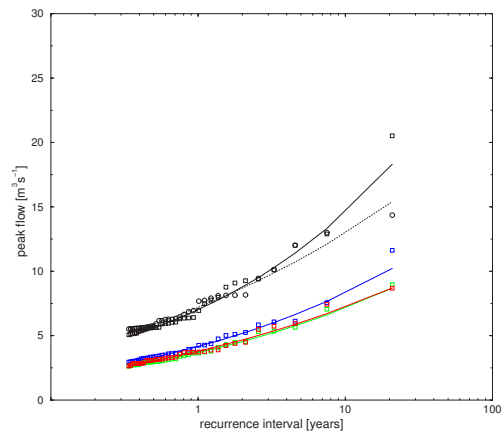
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38003



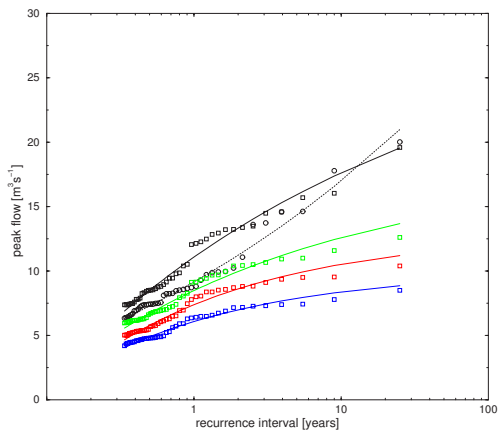
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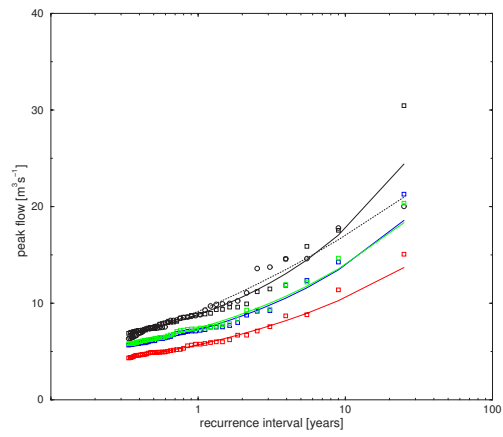
38007



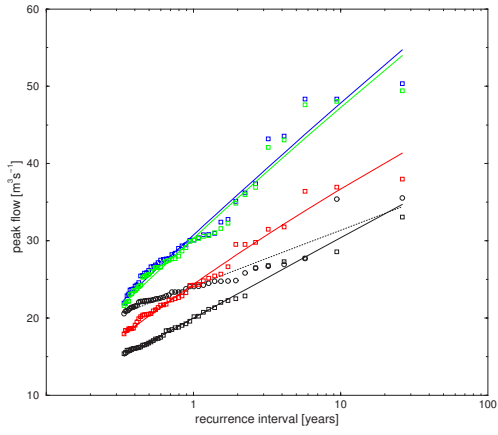
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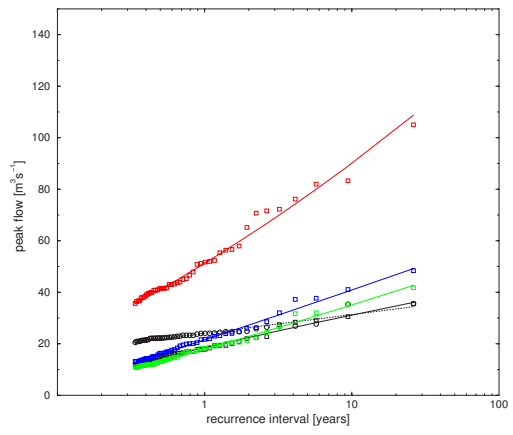
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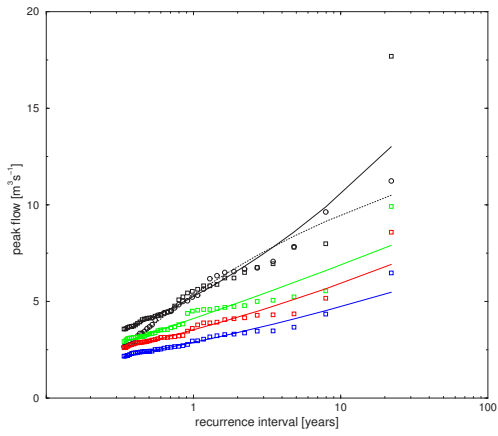
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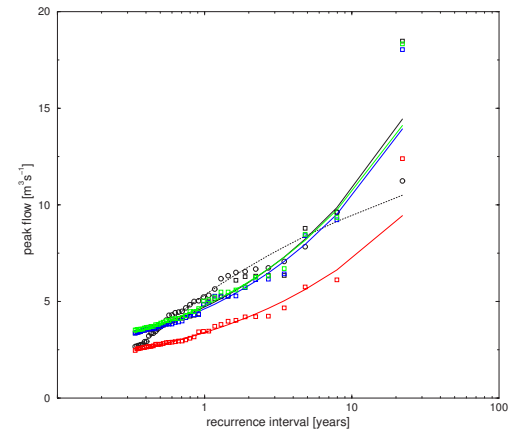
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39007



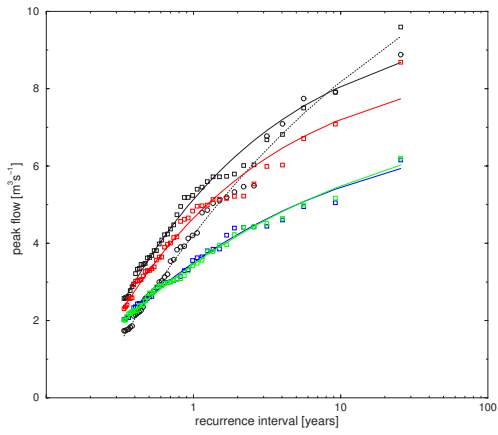
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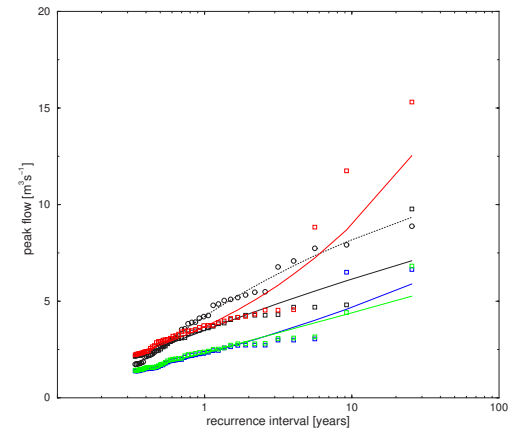
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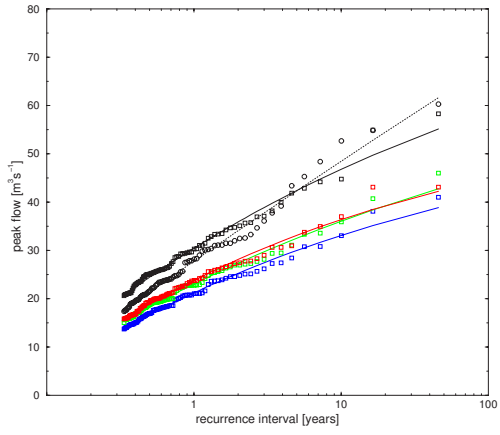
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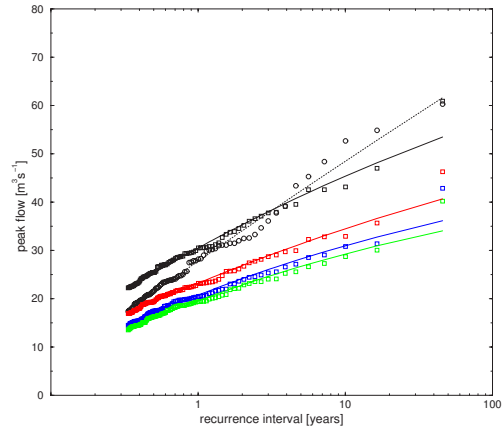
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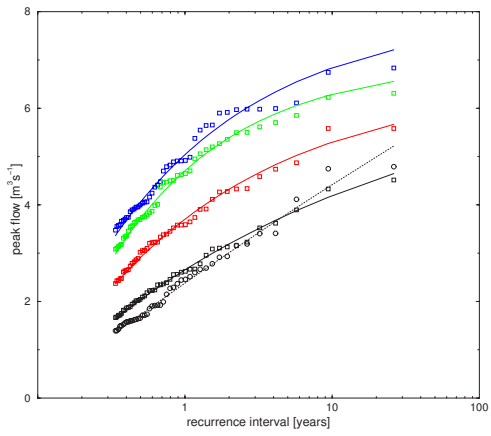
PDM
39069



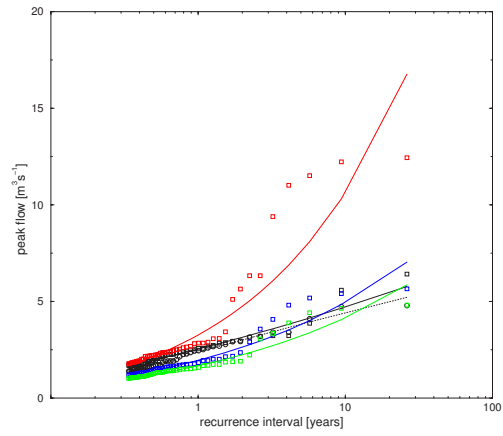
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39069



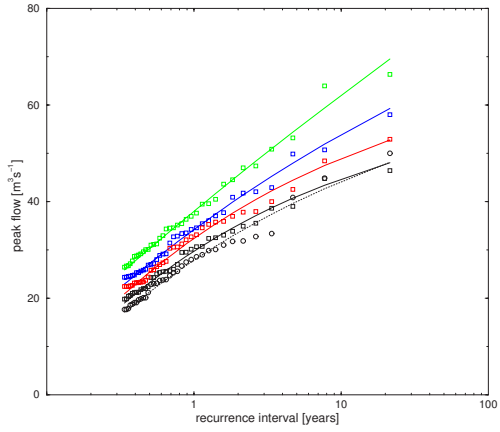
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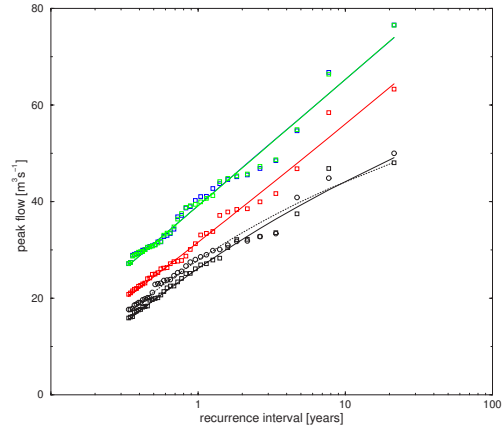
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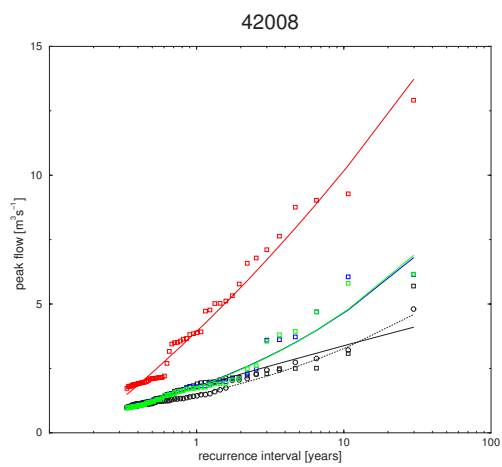
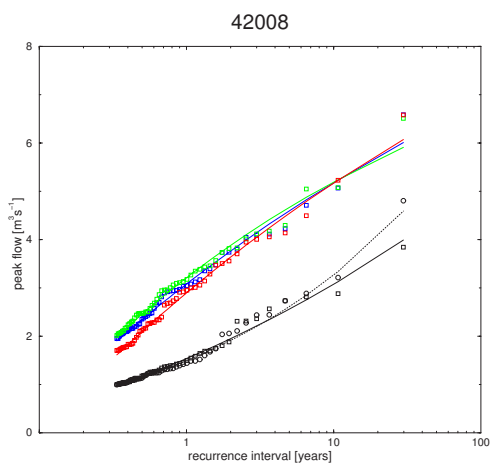
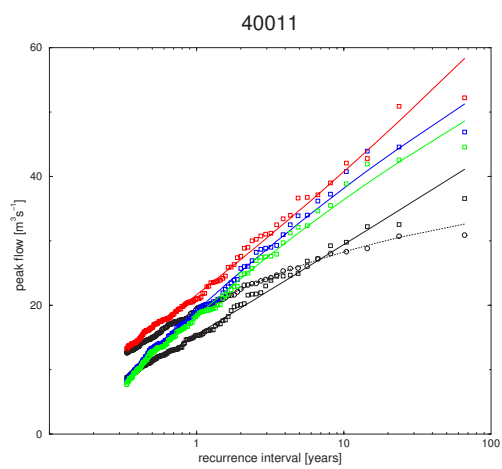
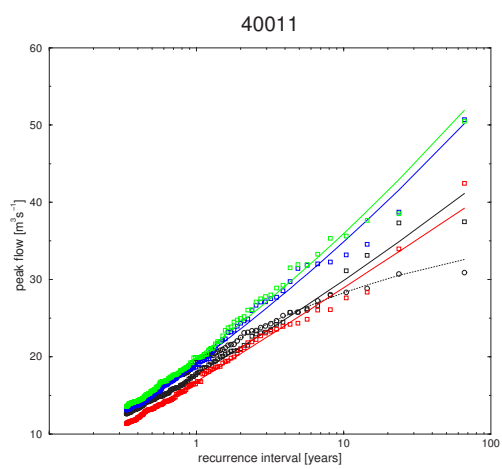
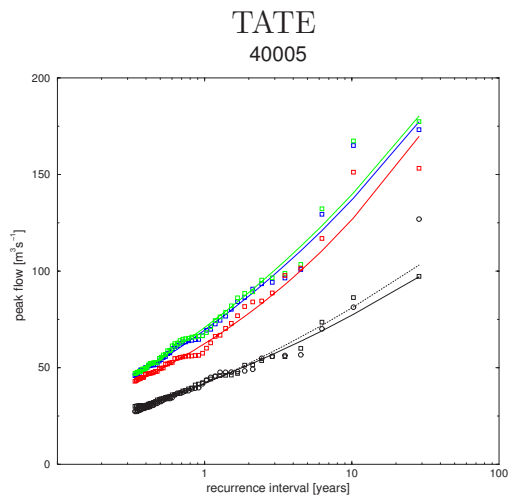
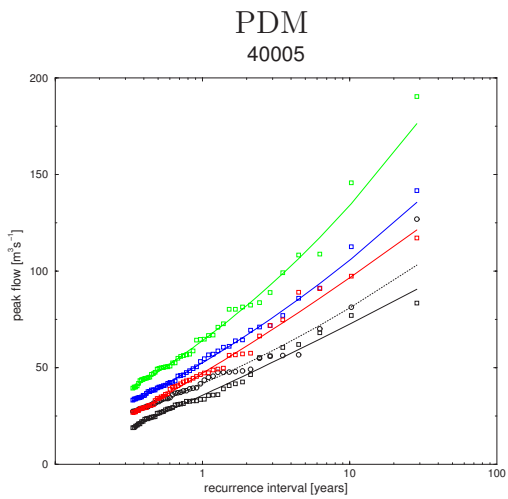


39105

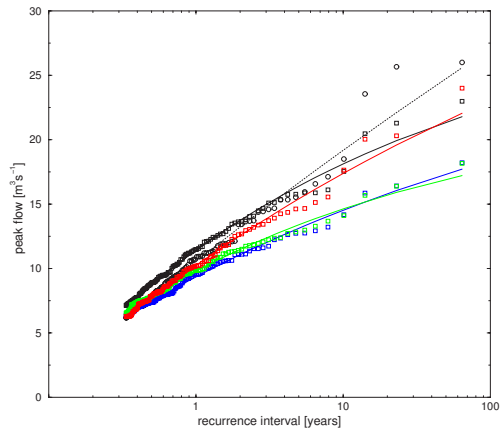


39105

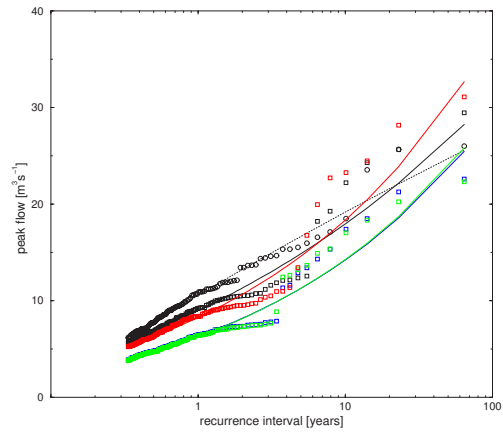




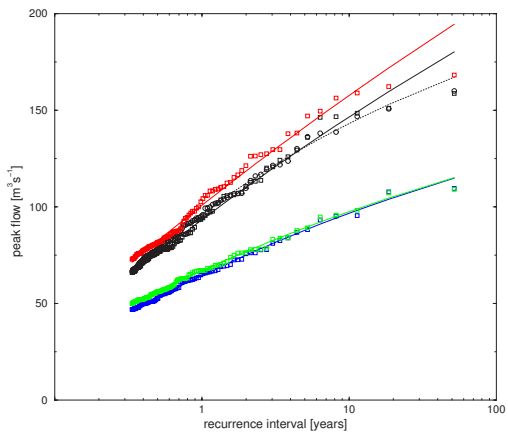
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43005



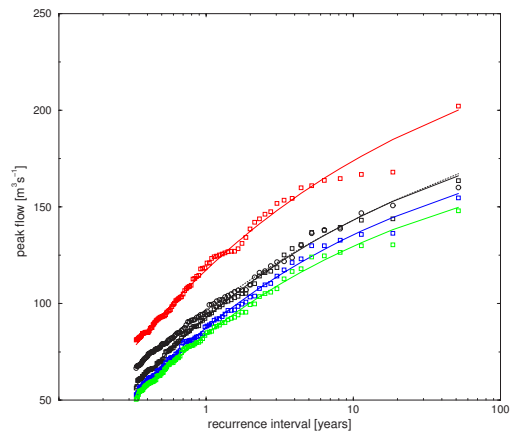
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43005



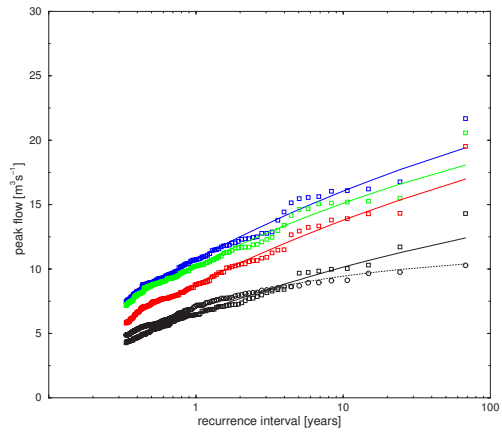
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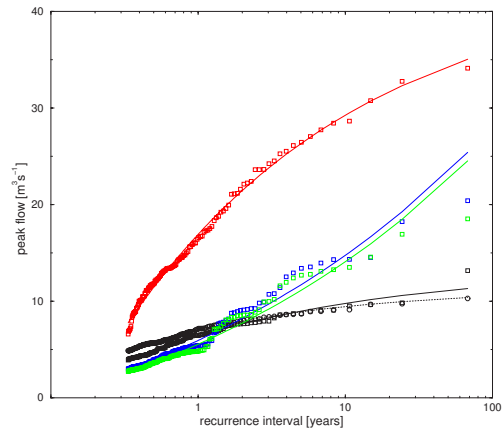
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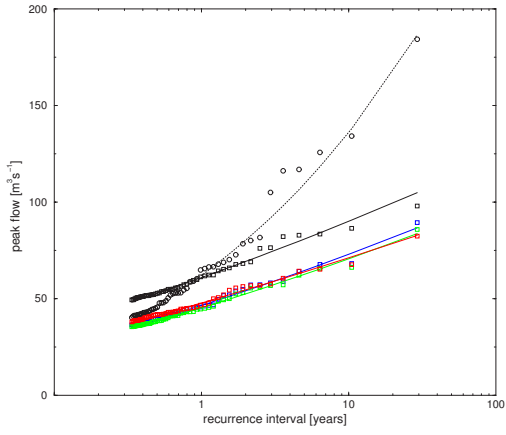
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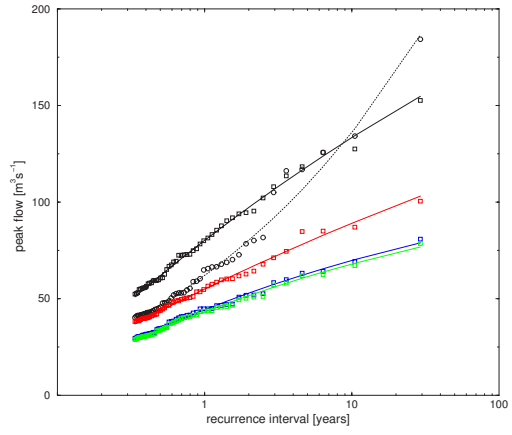
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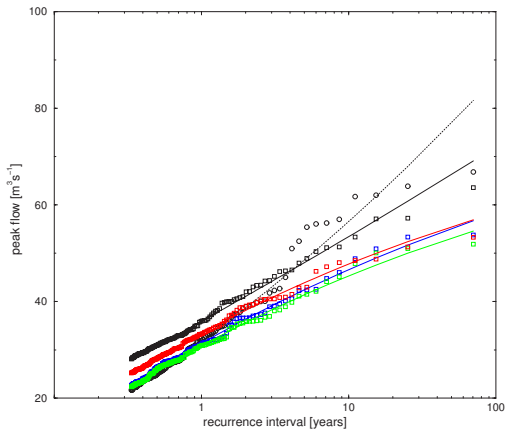
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45003



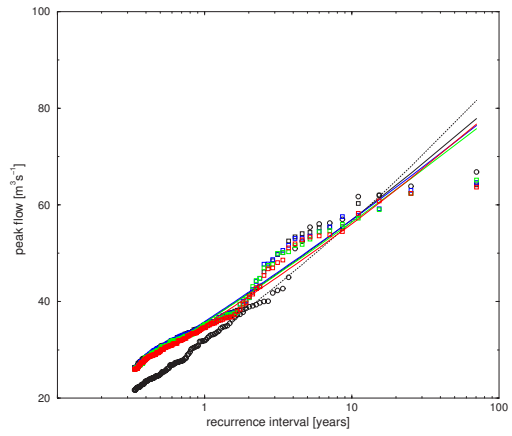
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45003



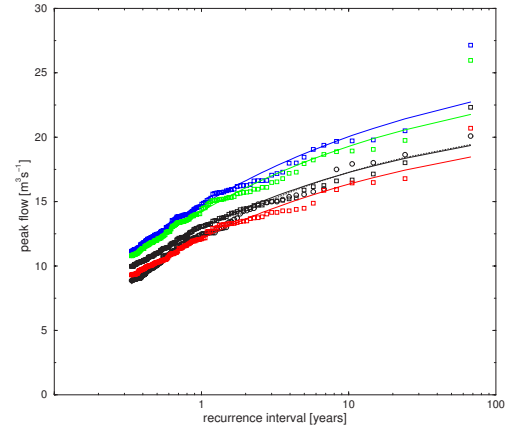
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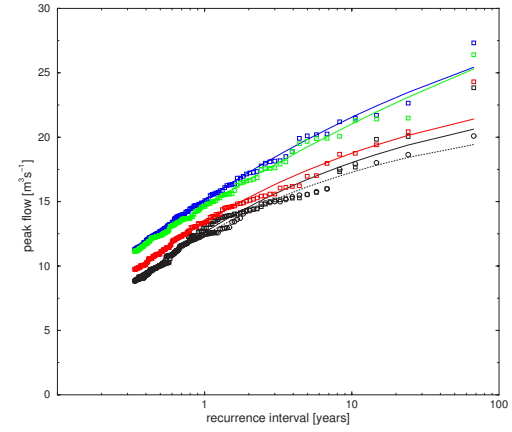
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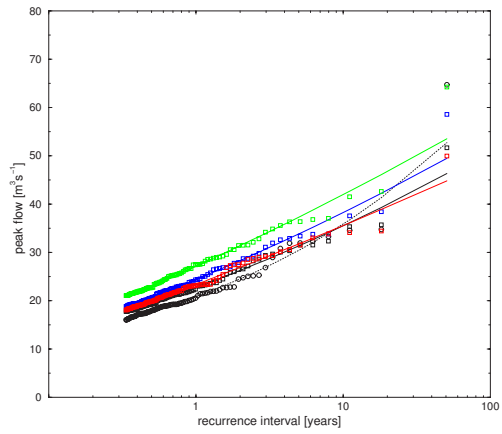
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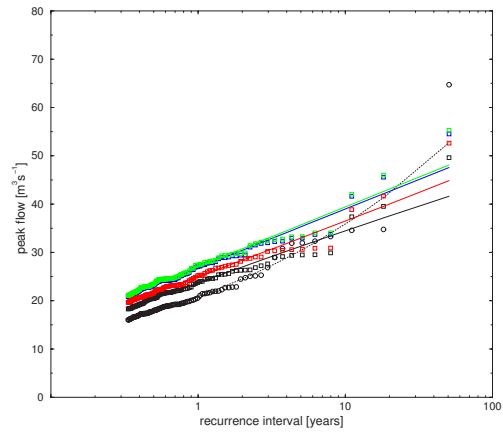
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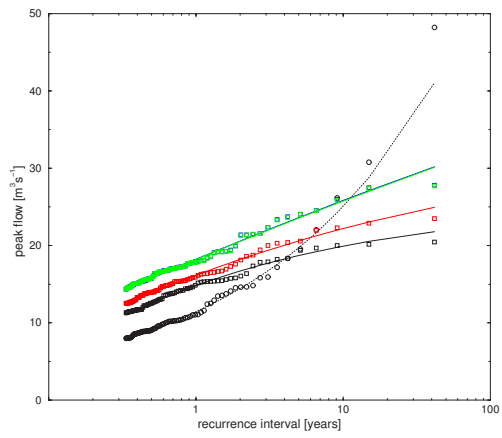
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47008



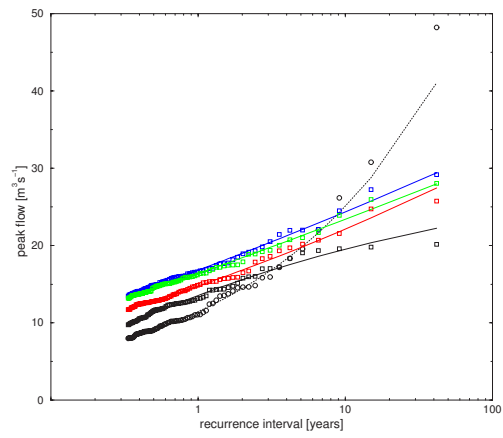
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47008



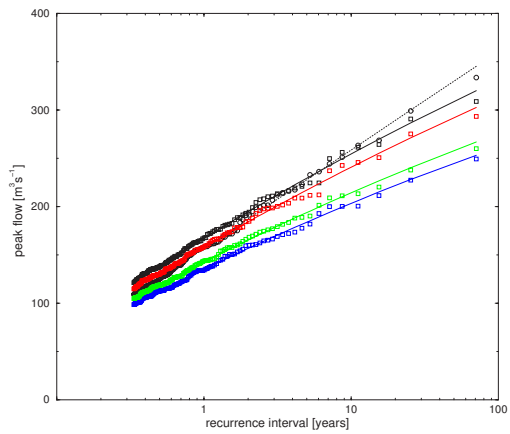
48003



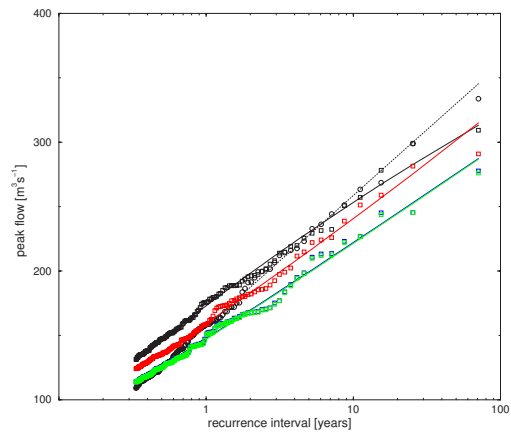
48003

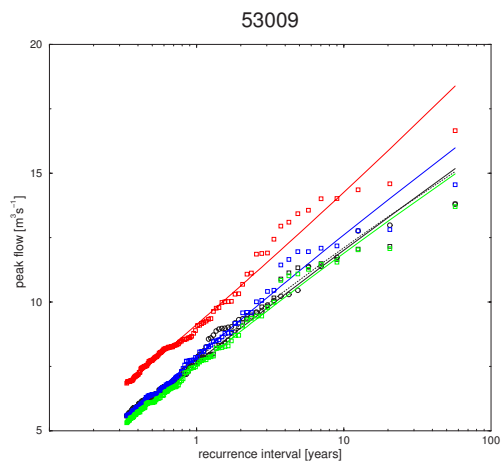
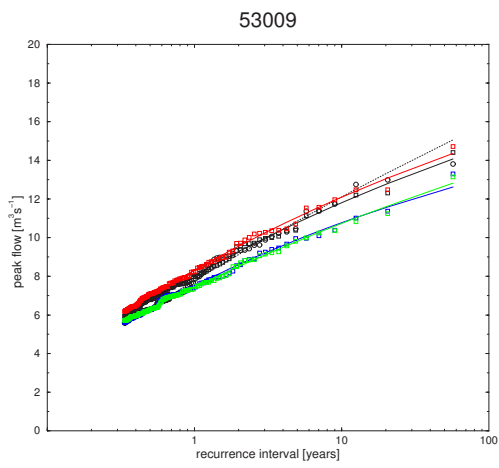
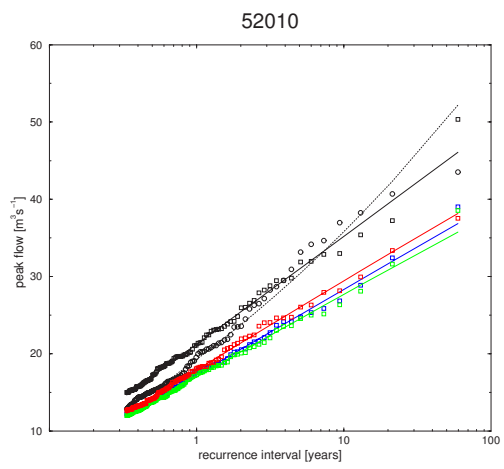
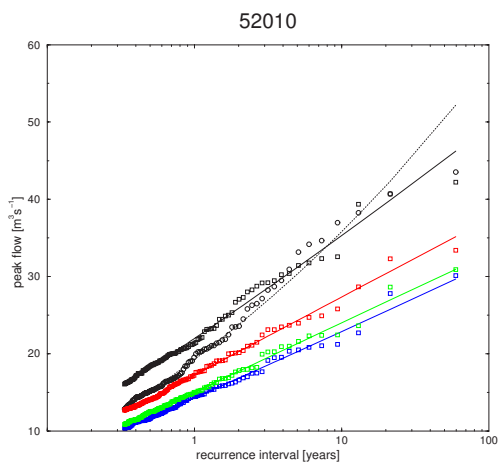
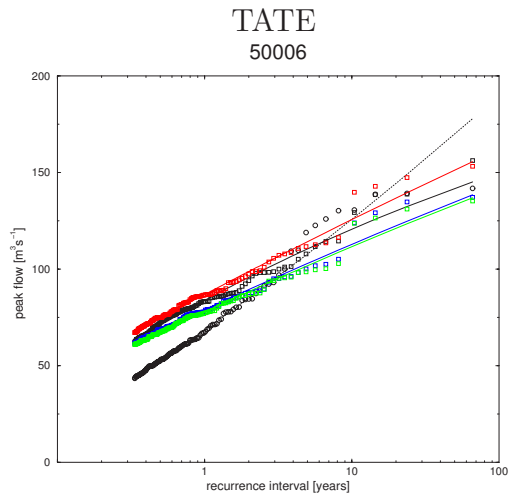
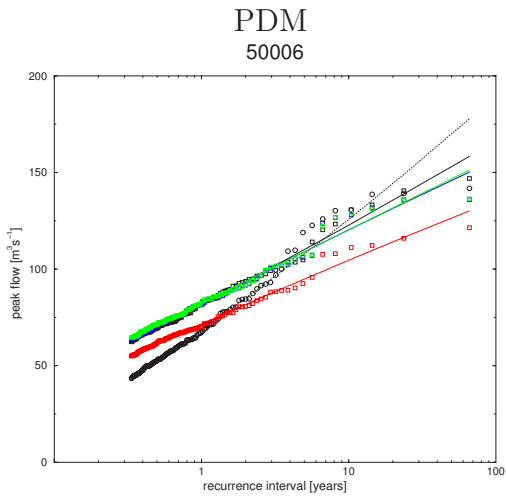


50002

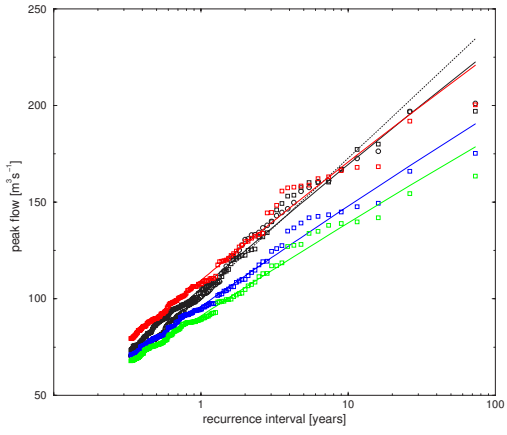


50002

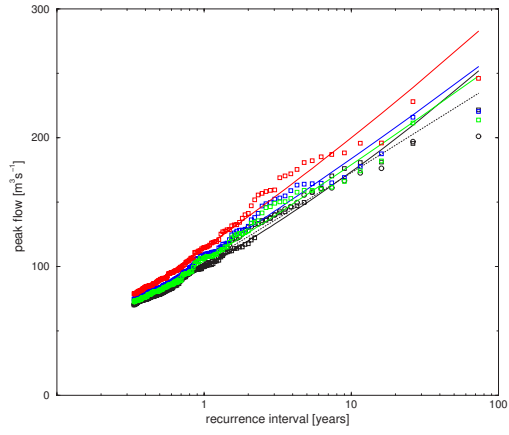




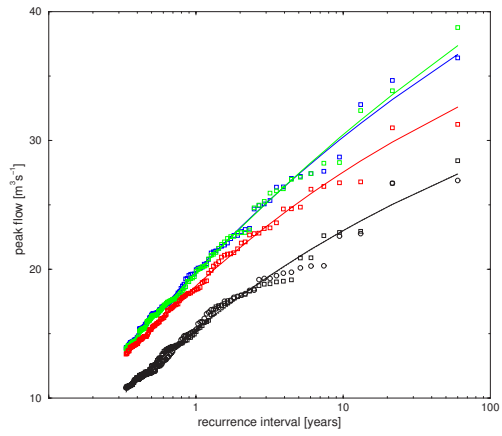
PDM
54008



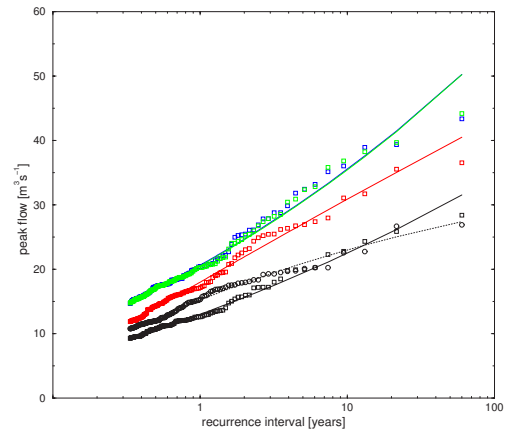
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54008



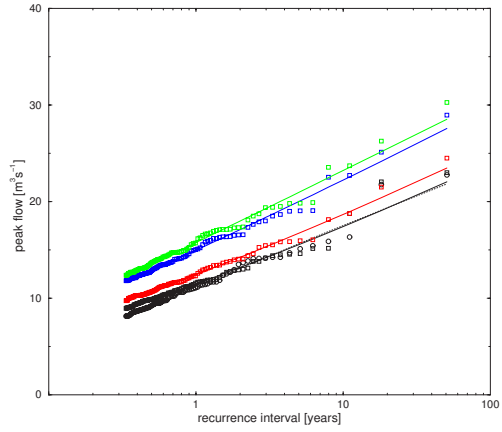
54018



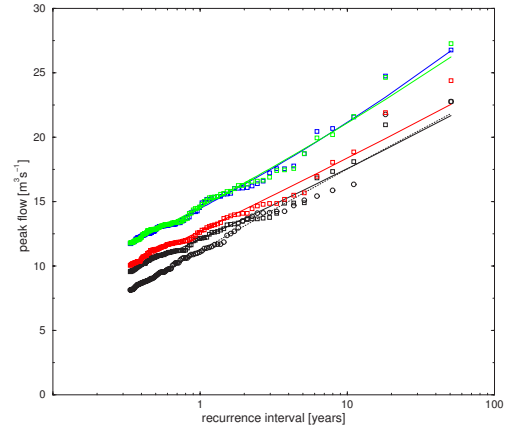
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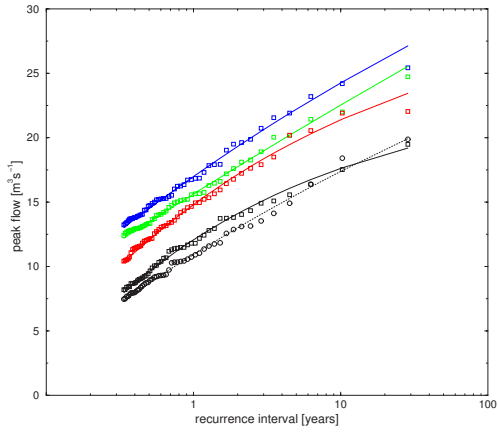
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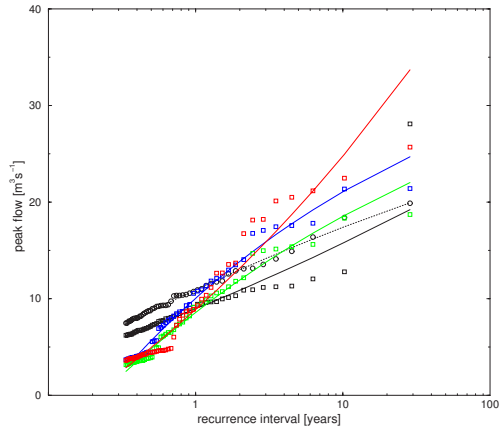
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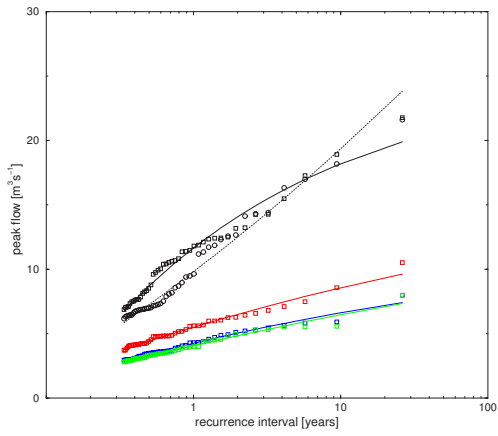
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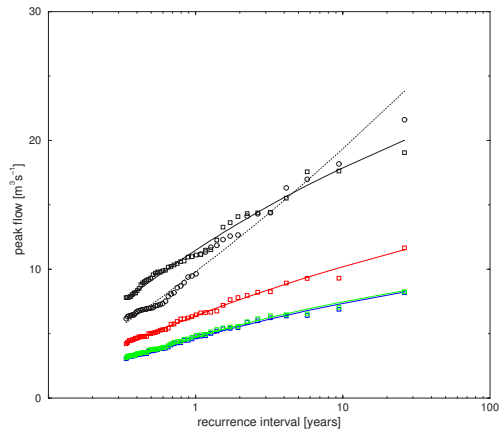
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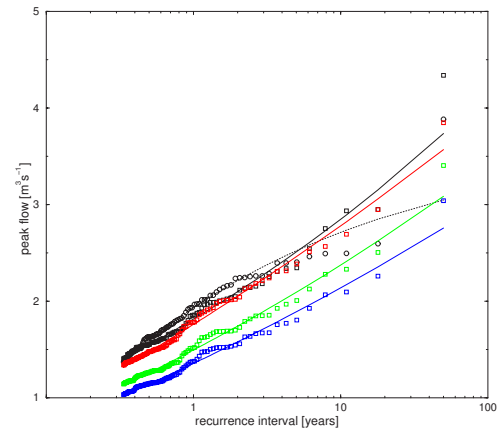
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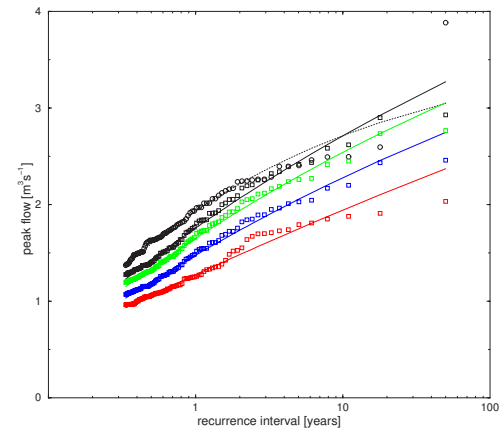
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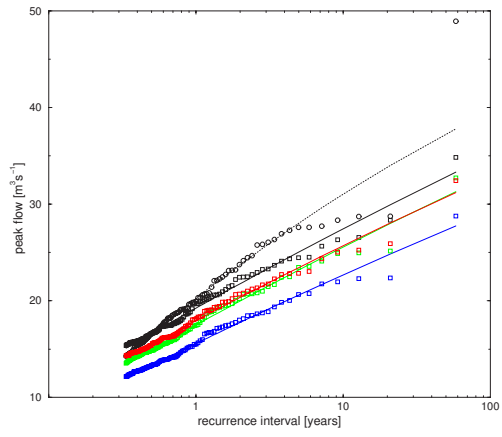
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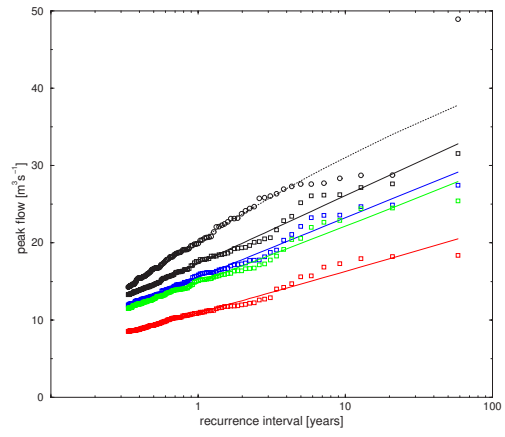
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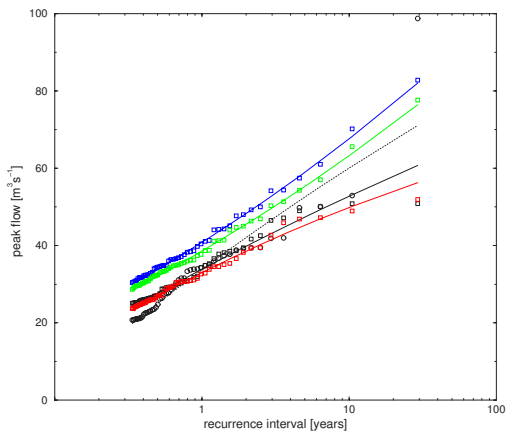
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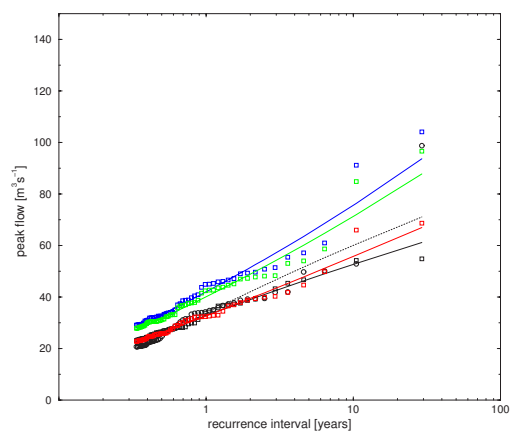
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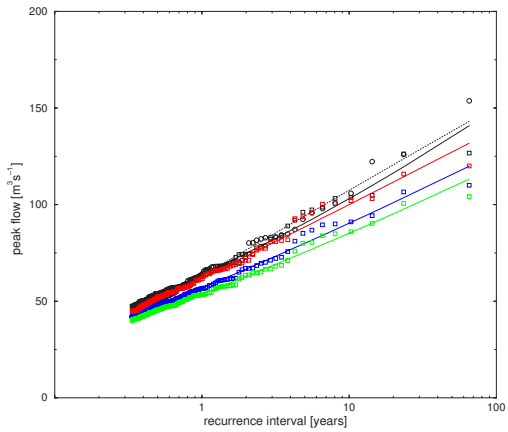
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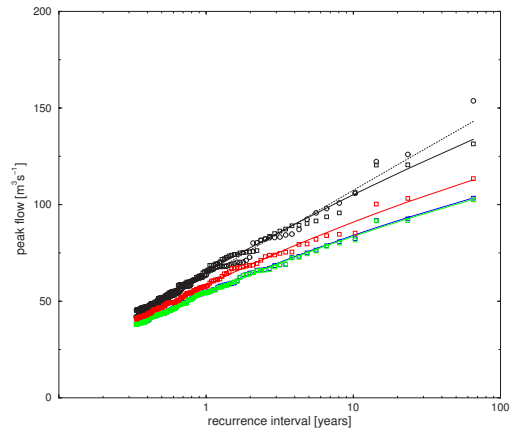
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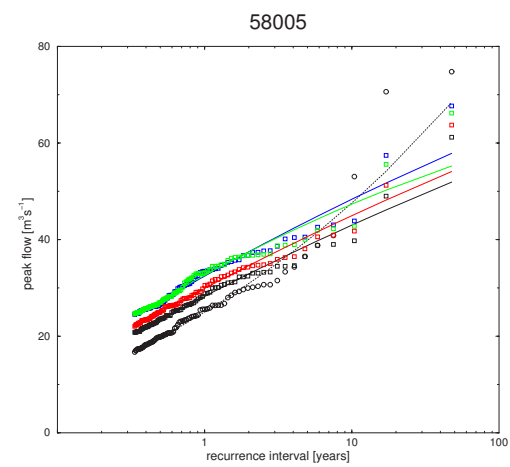
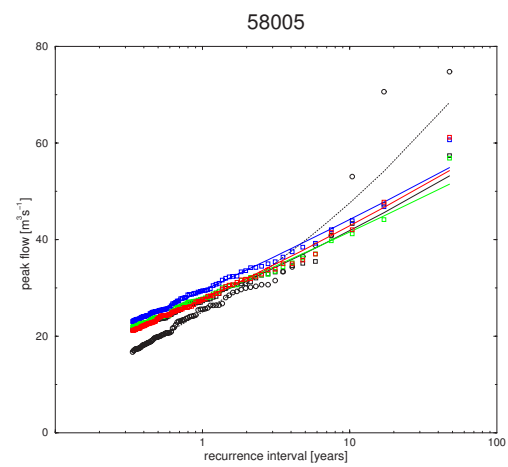
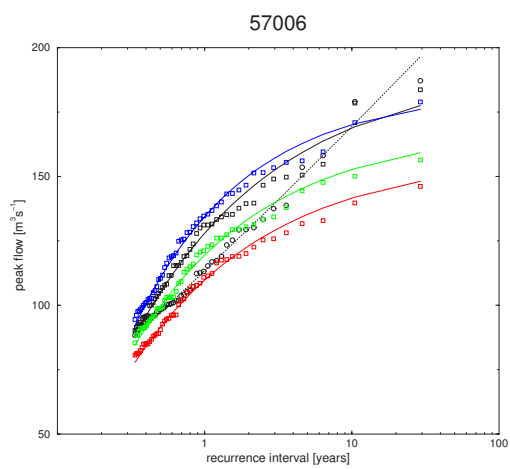
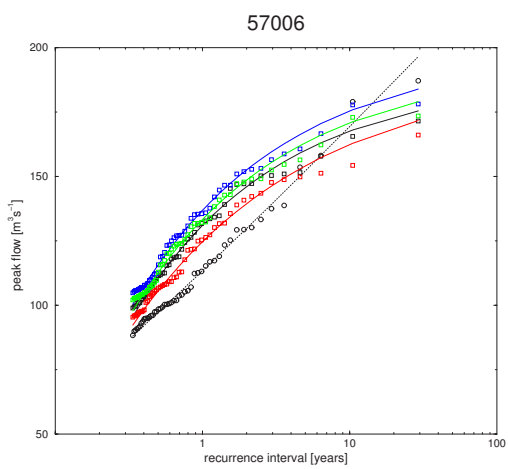
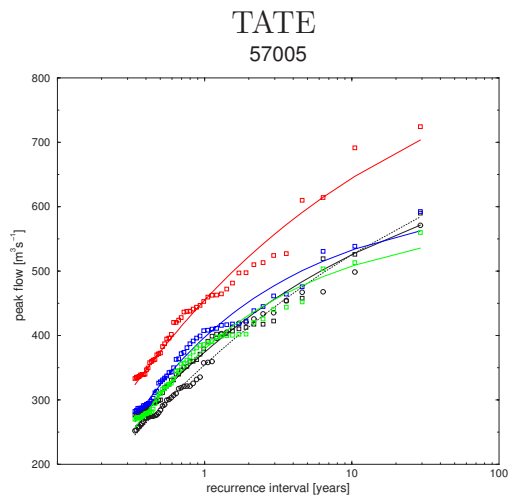
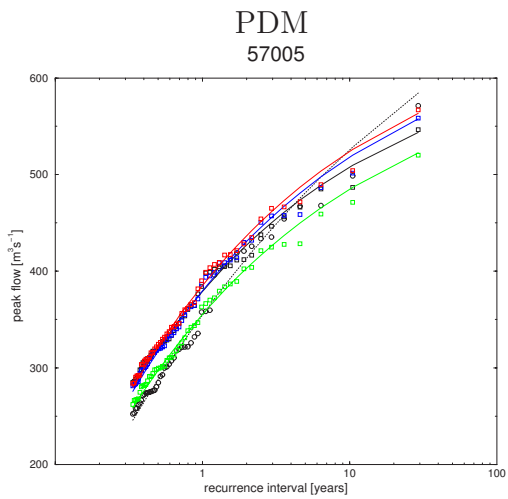


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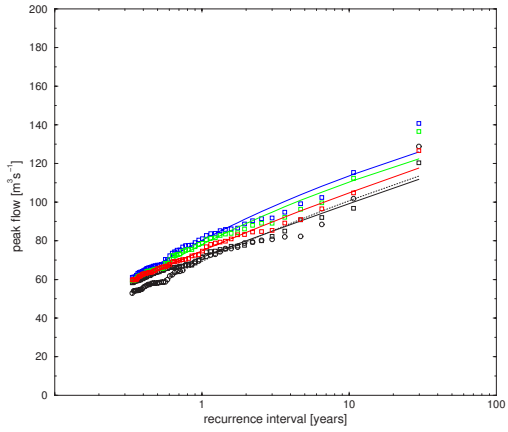


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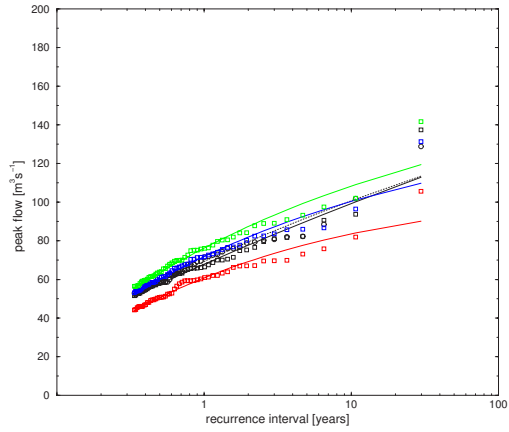




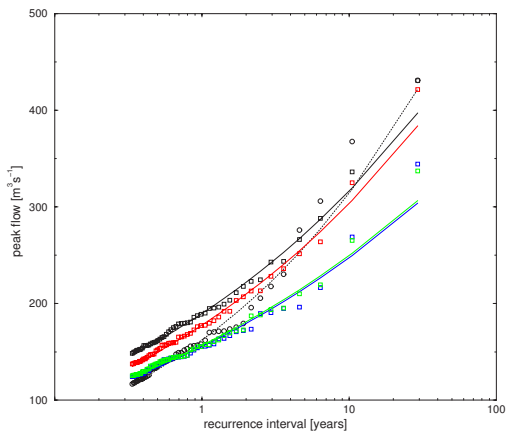
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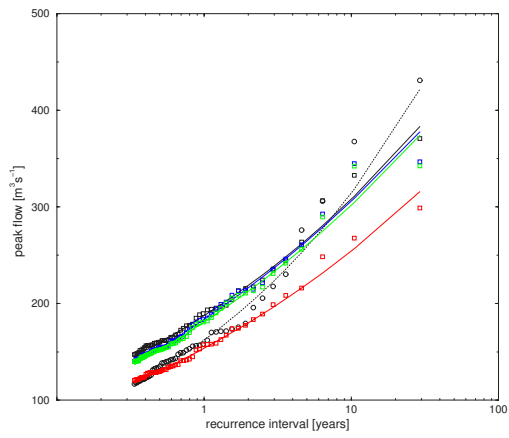
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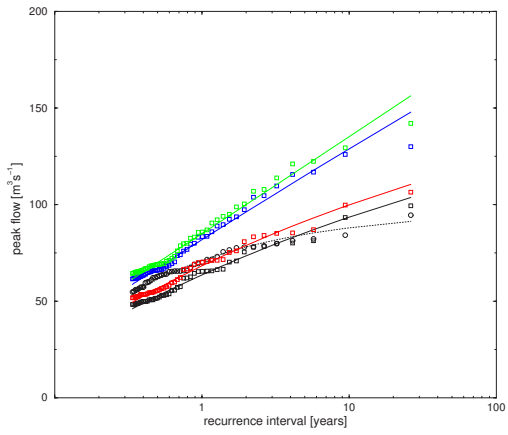
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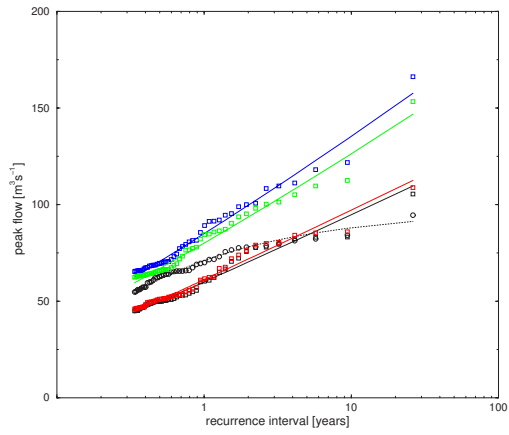
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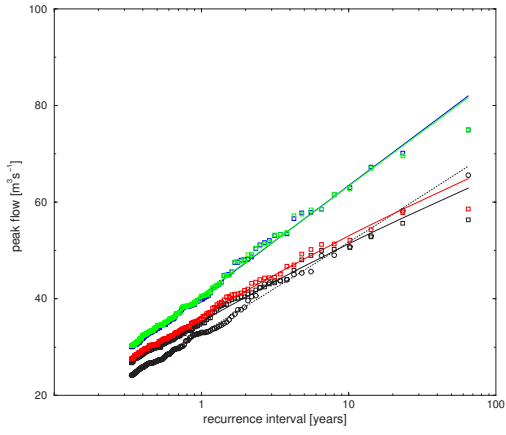
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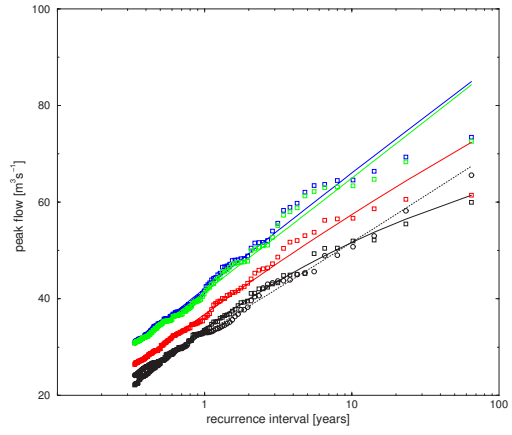
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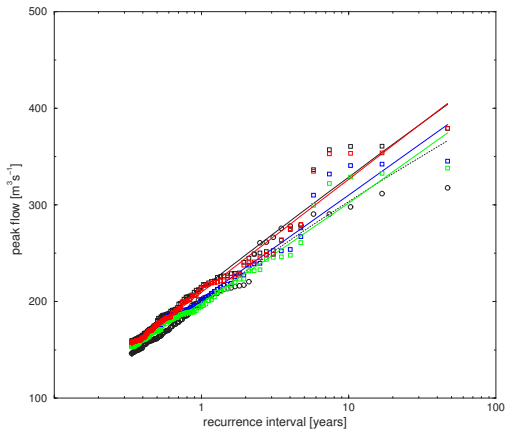
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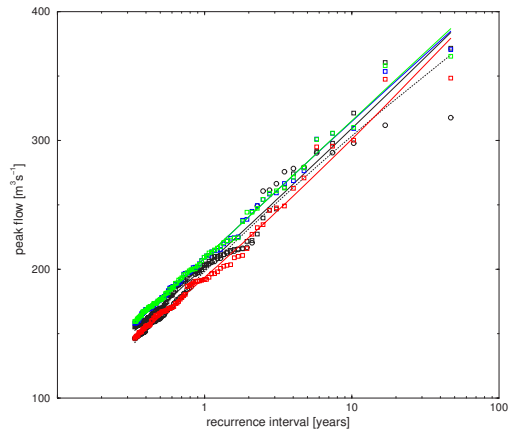
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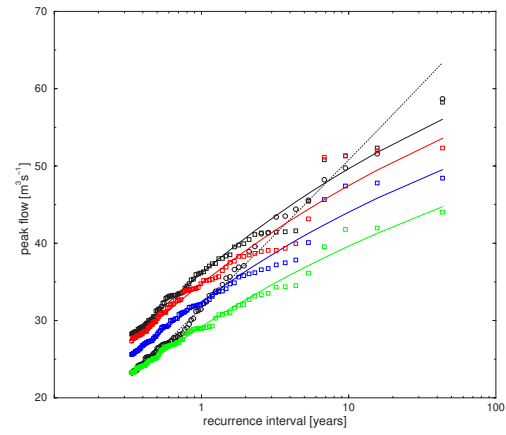
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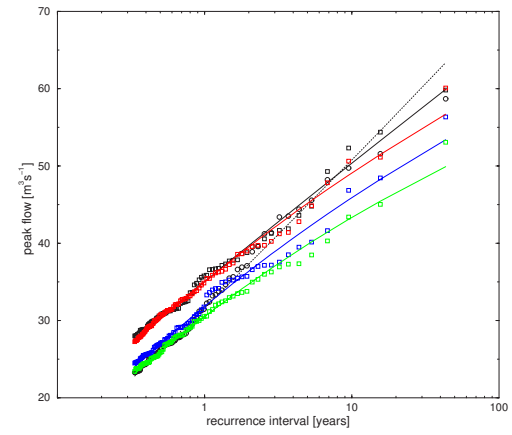
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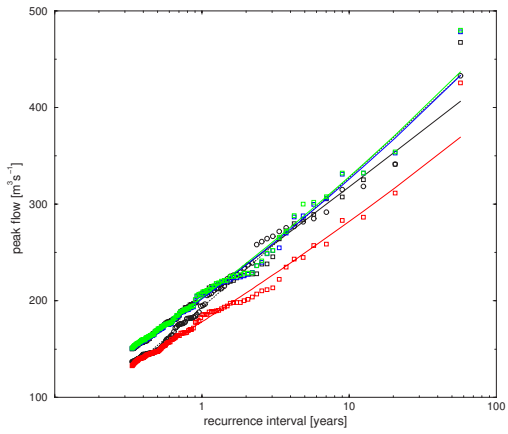
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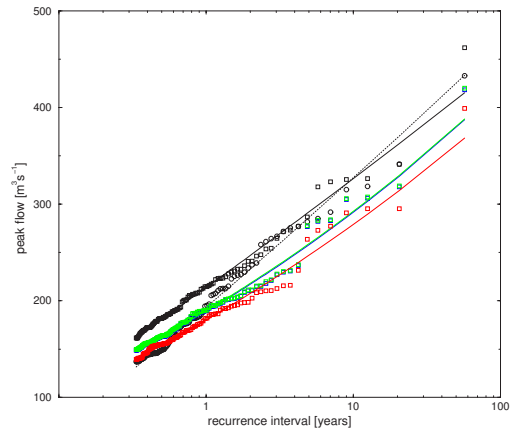
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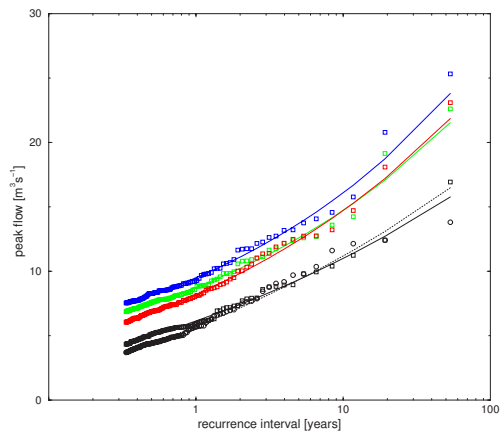
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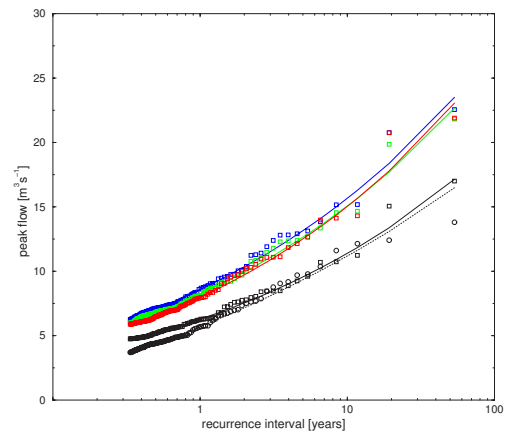
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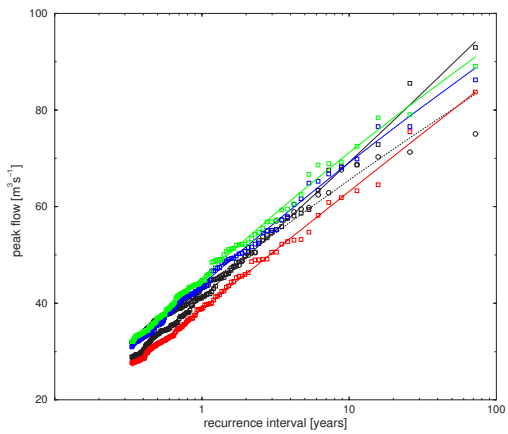
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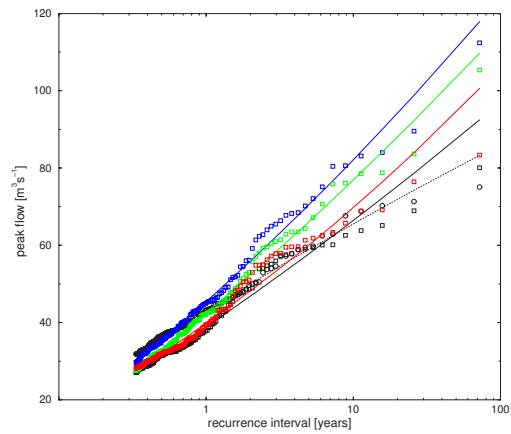
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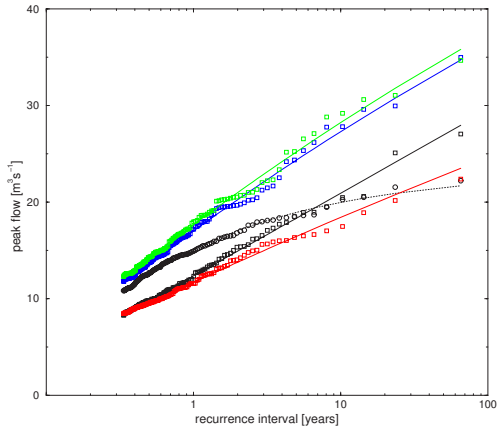
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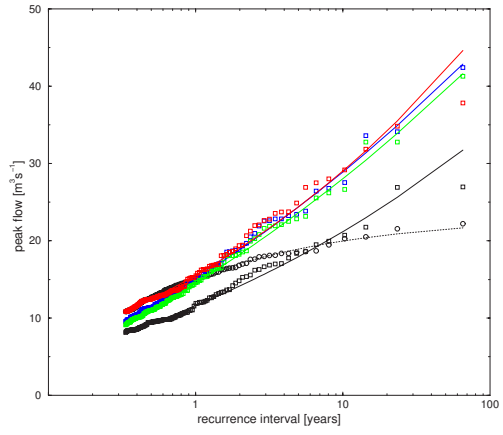
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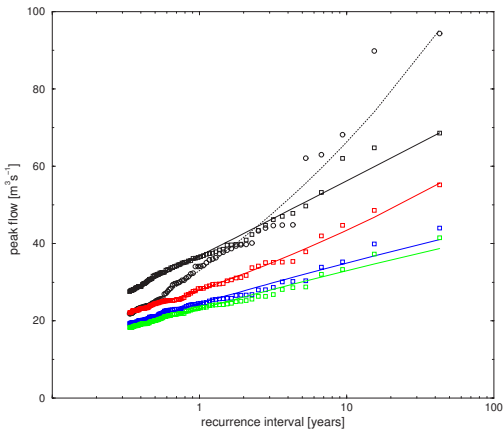
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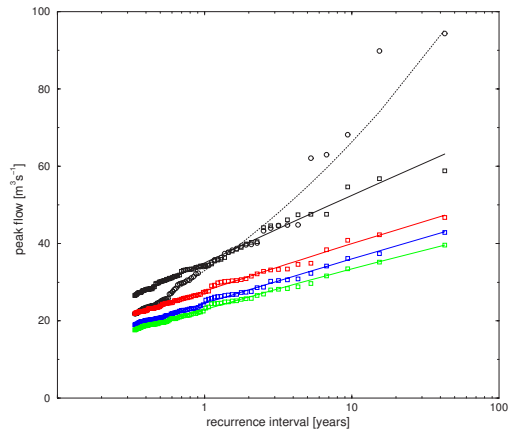
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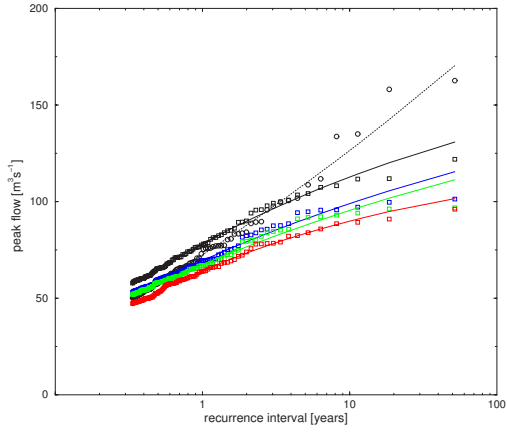
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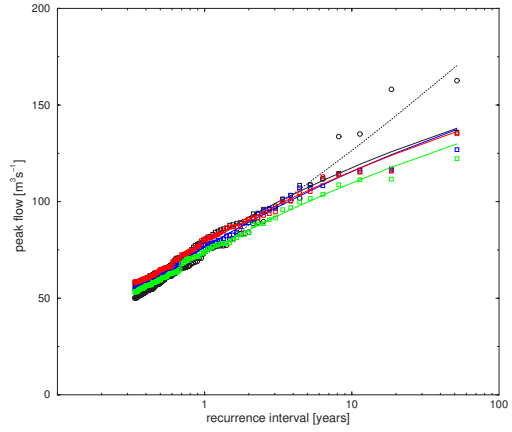
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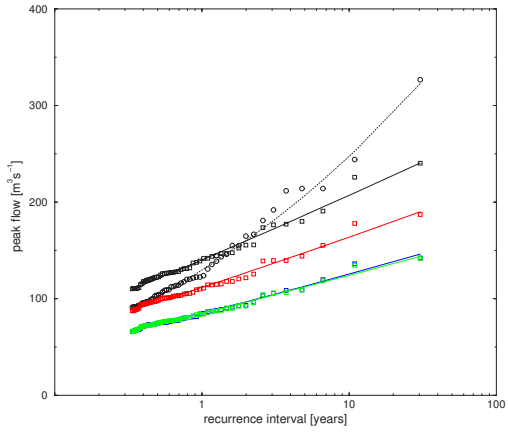
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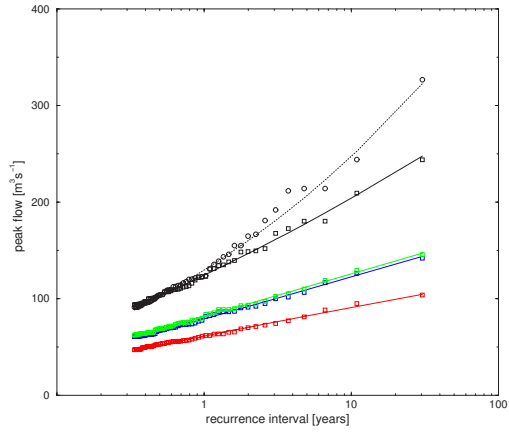
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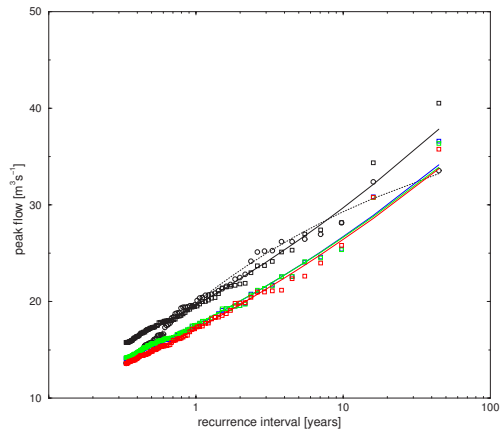
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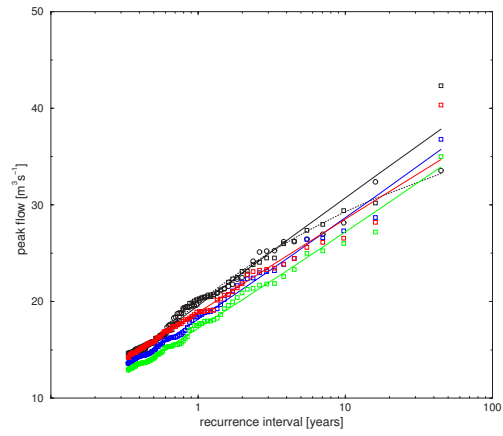
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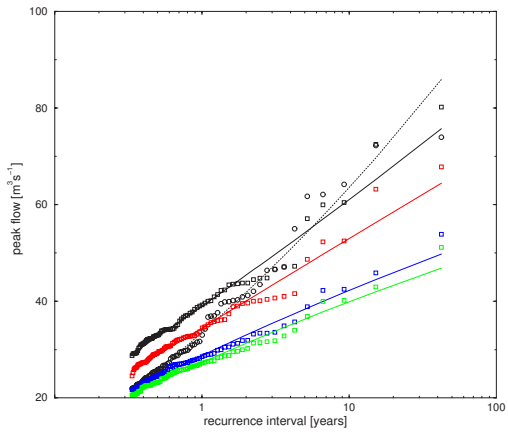
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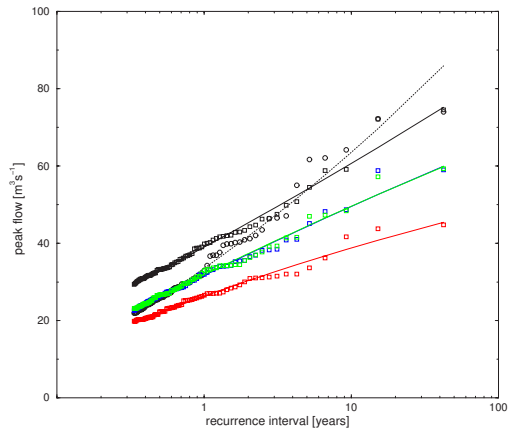
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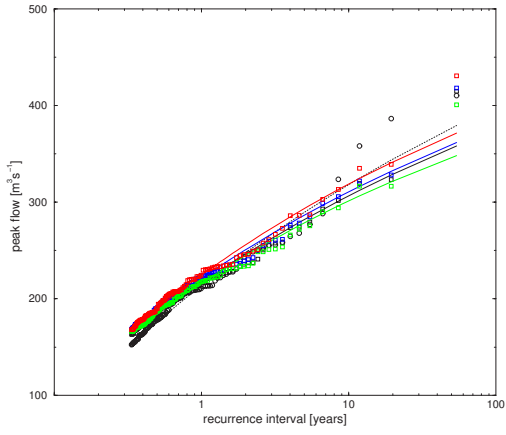
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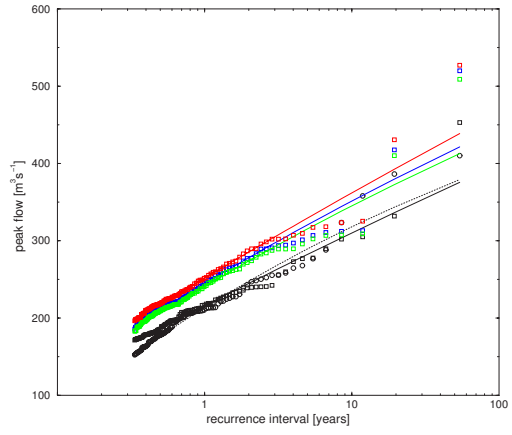
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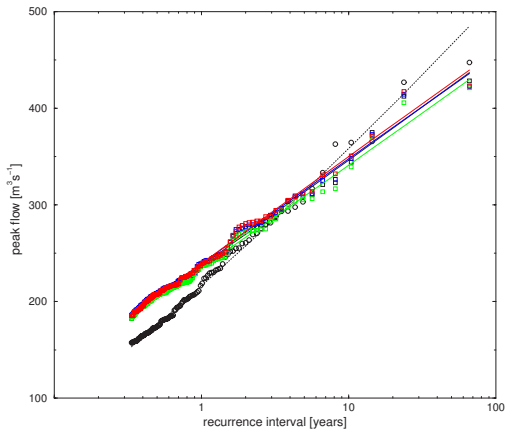
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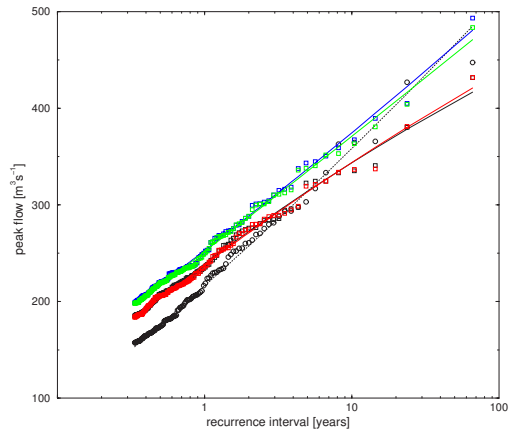
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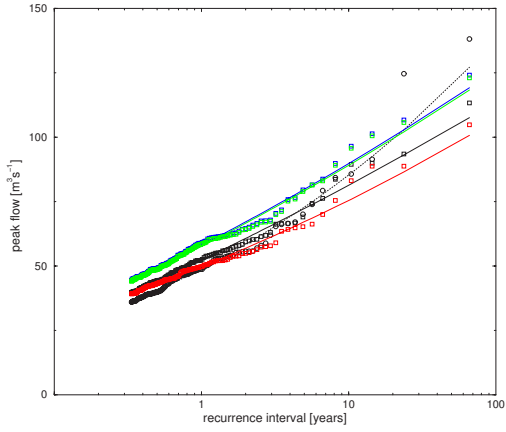
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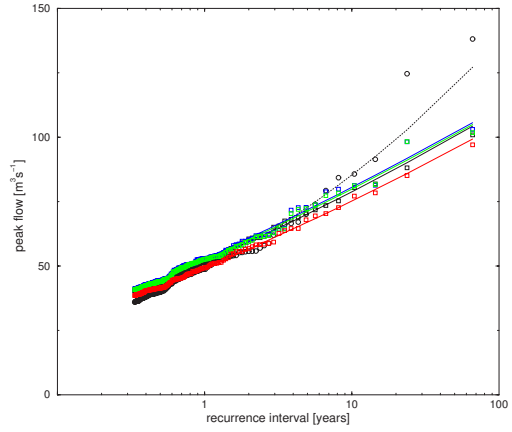
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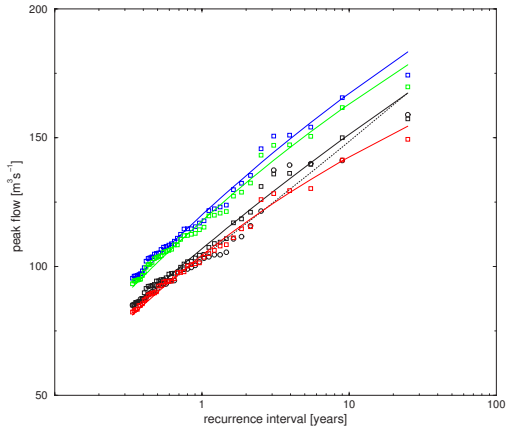
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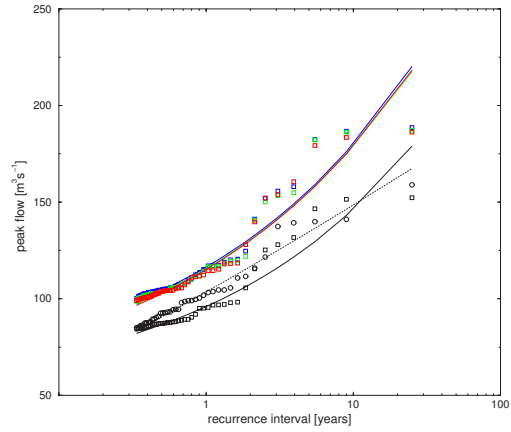
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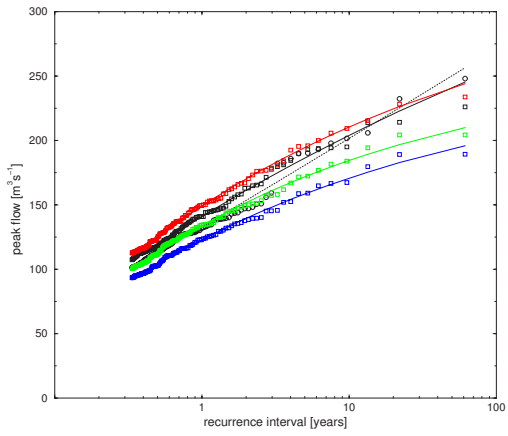
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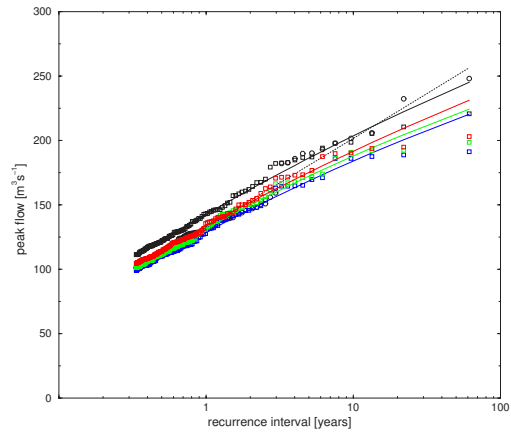
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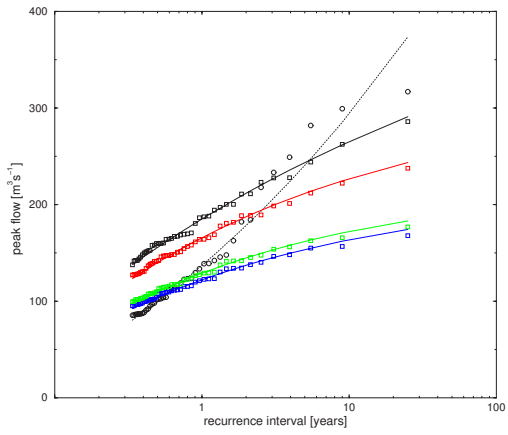
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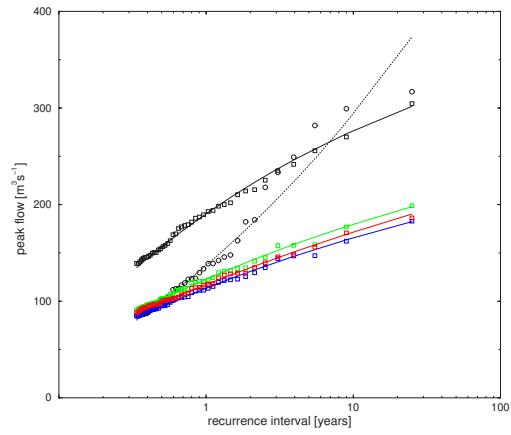
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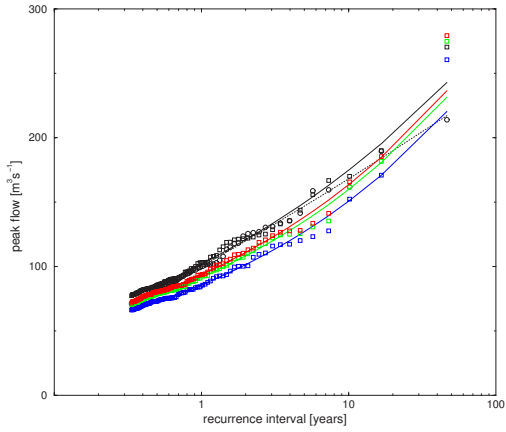
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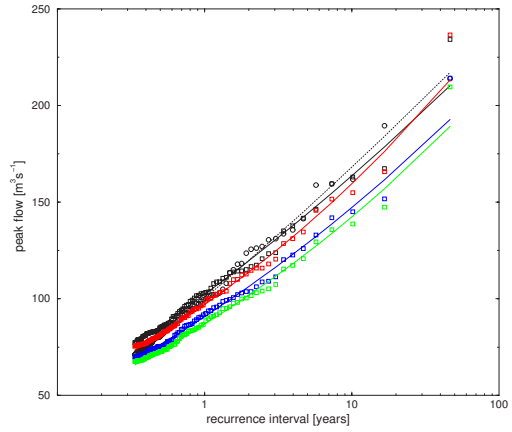
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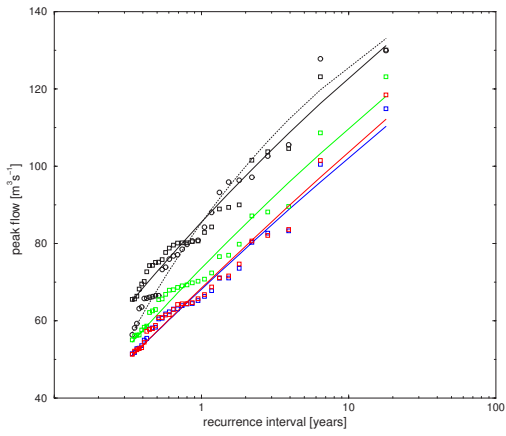
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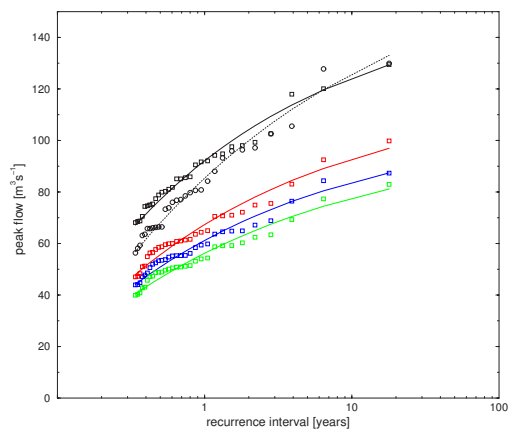
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83005



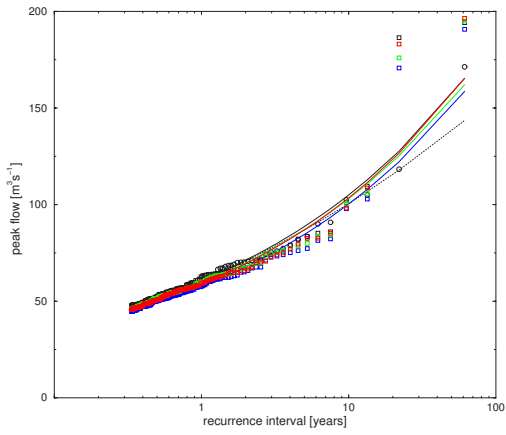
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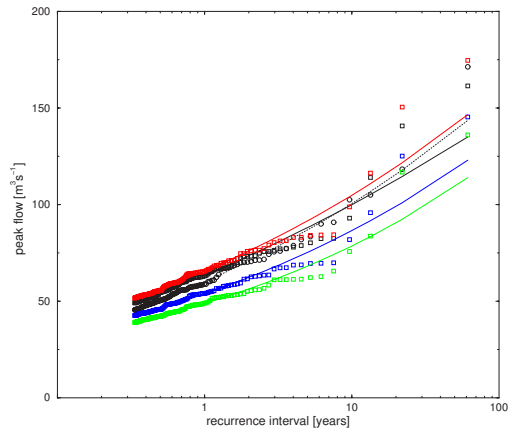
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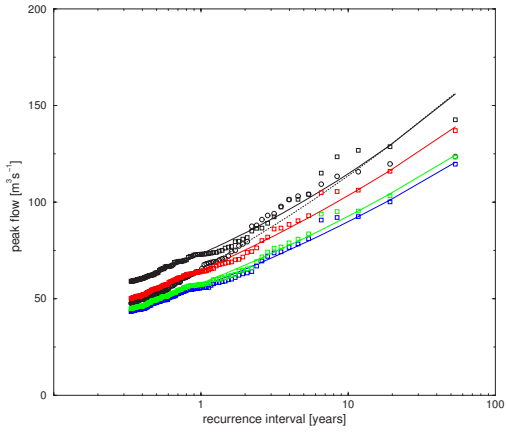
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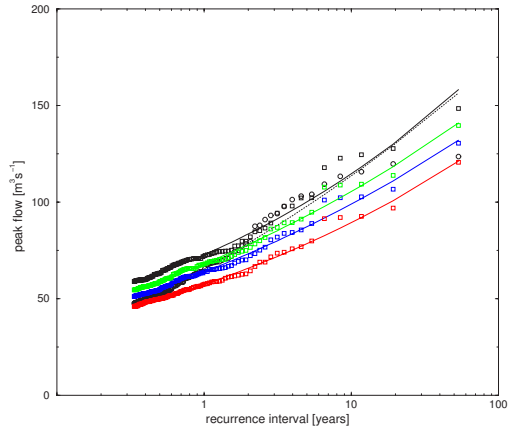
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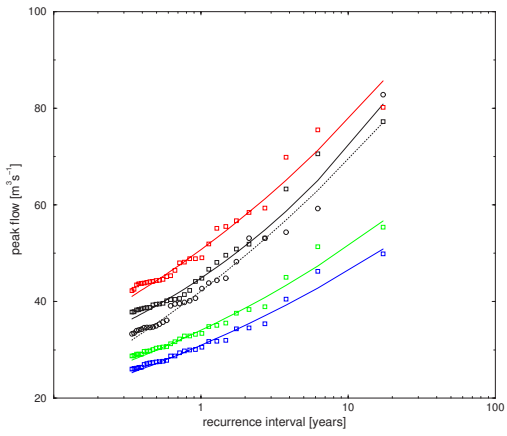
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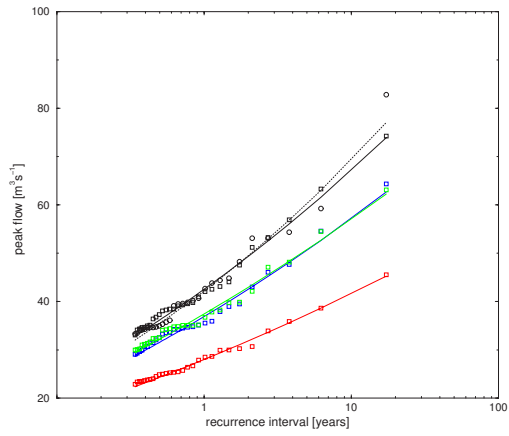
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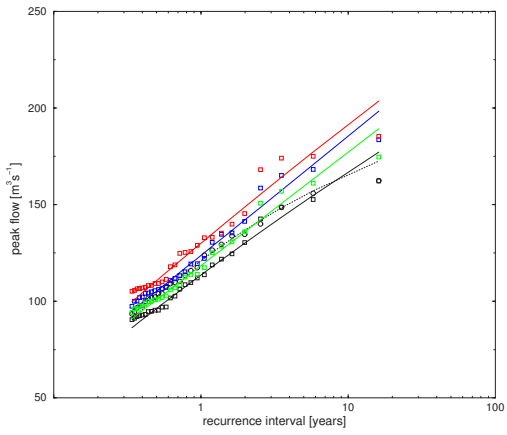
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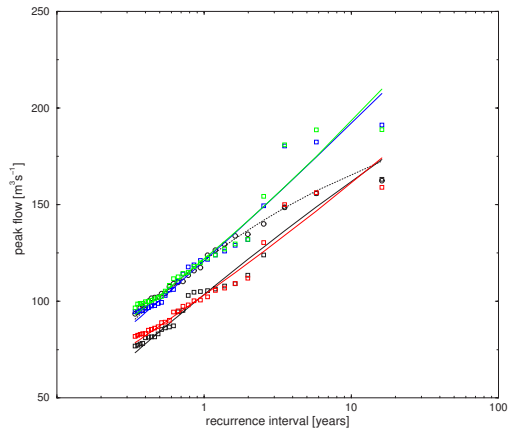
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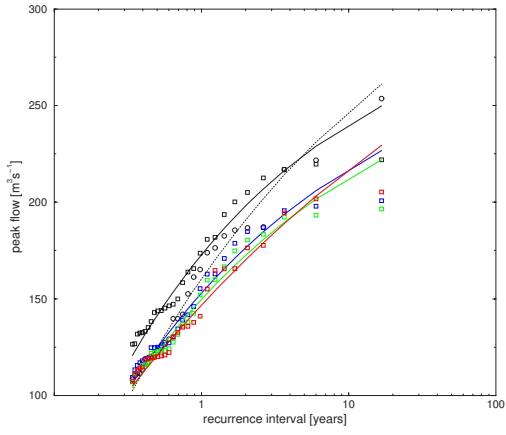
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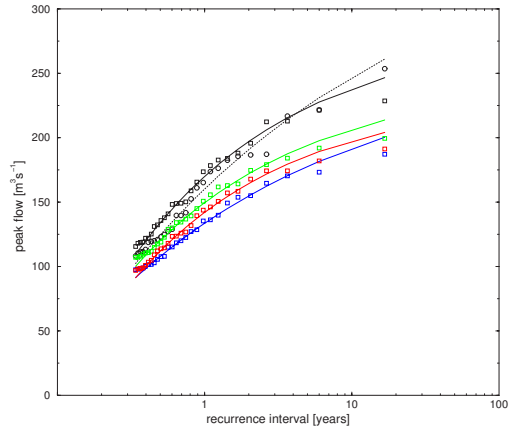
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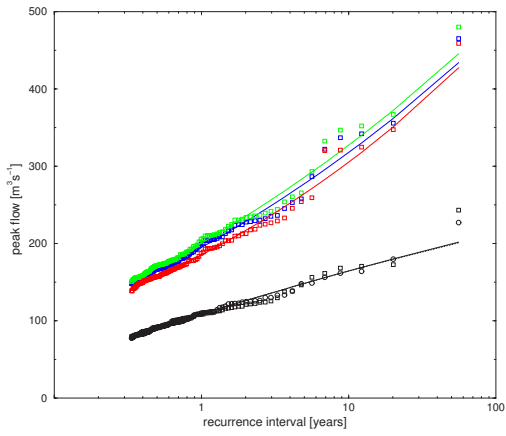
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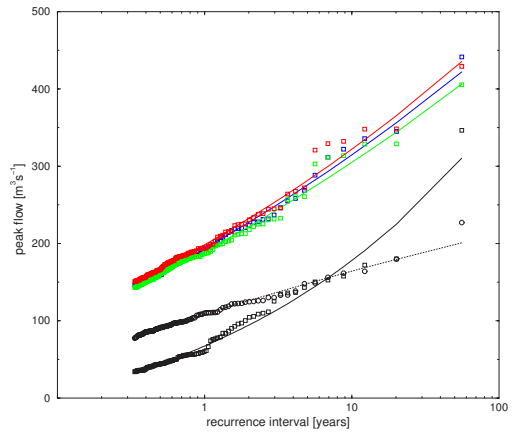
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93001



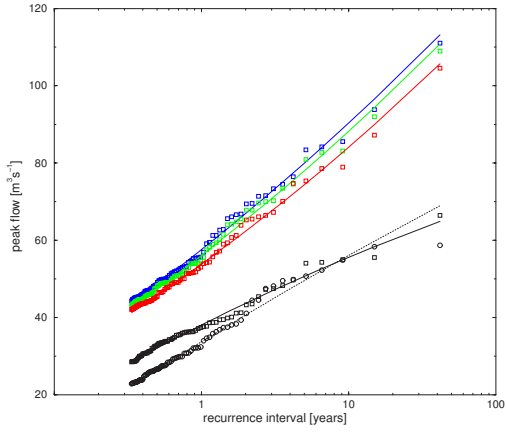
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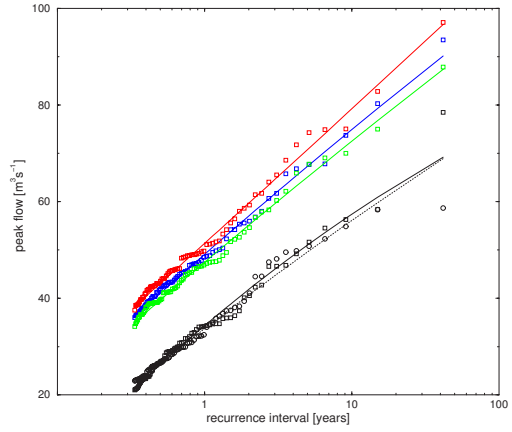
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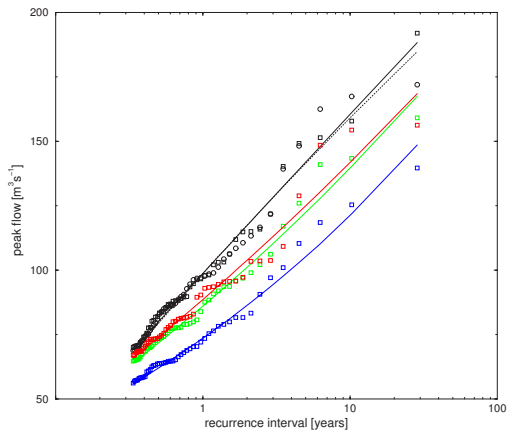
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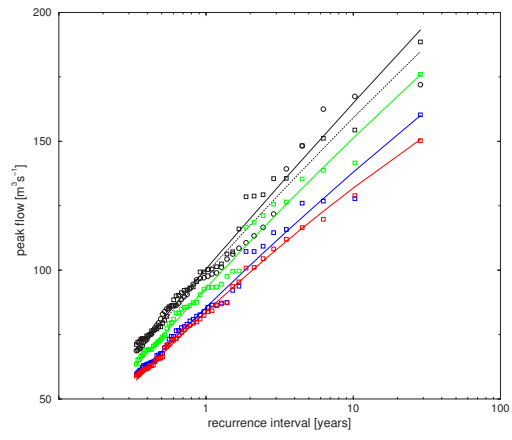
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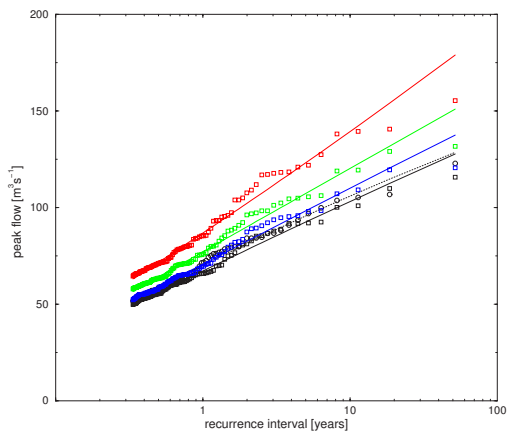
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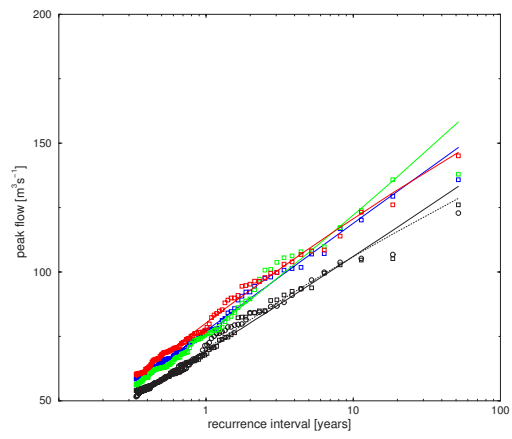
TATE
96001



97002



97002



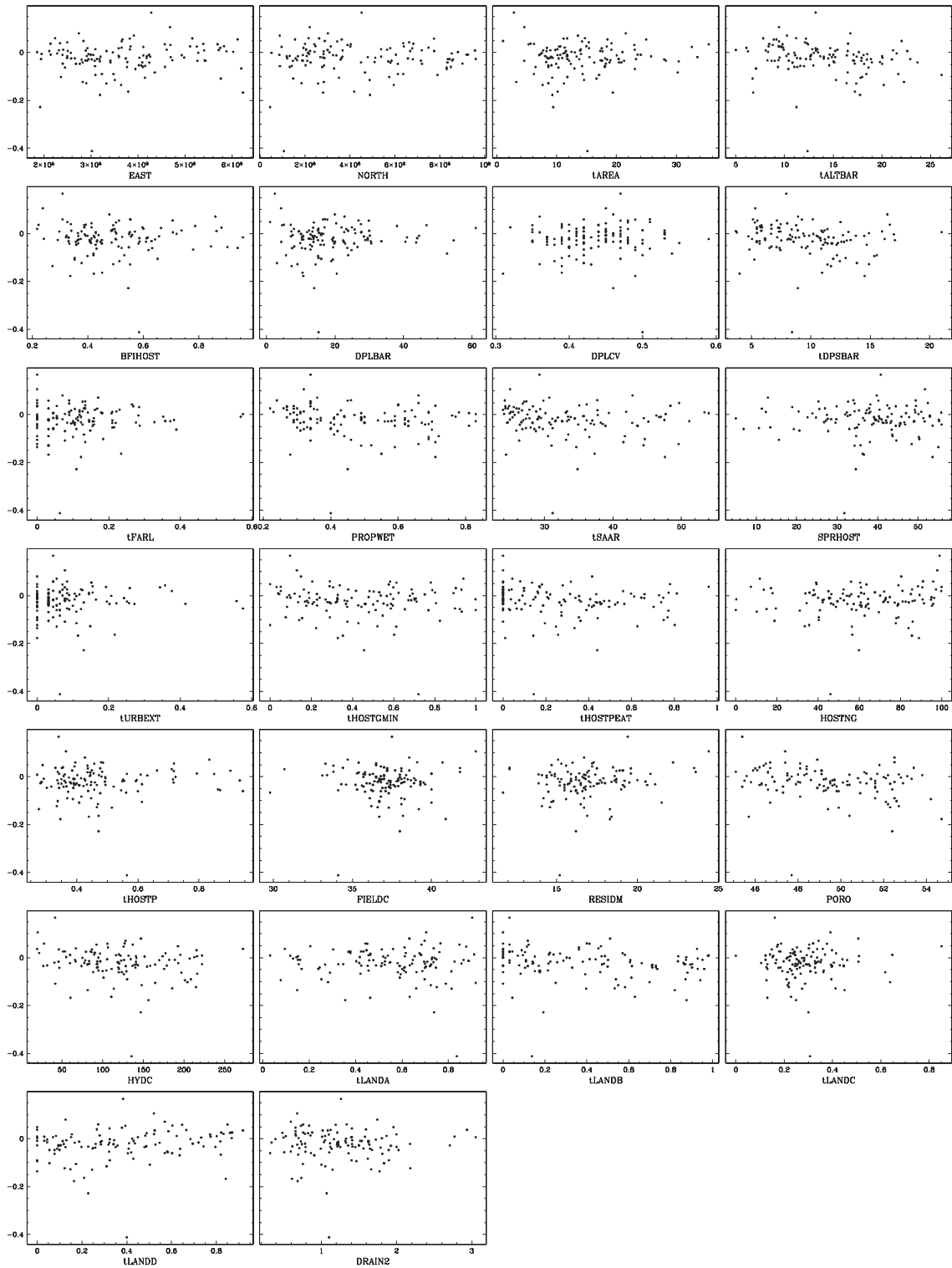
B.3 Generalisation errors versus catchment properties (pages 79-91)

The following figures present plots of generalisation errors (at return periods of 10 and 50 years) versus catchment properties, to reveal any potential dependence between the two. Plots of calibration errors versus catchment properties are also given, for comparison.

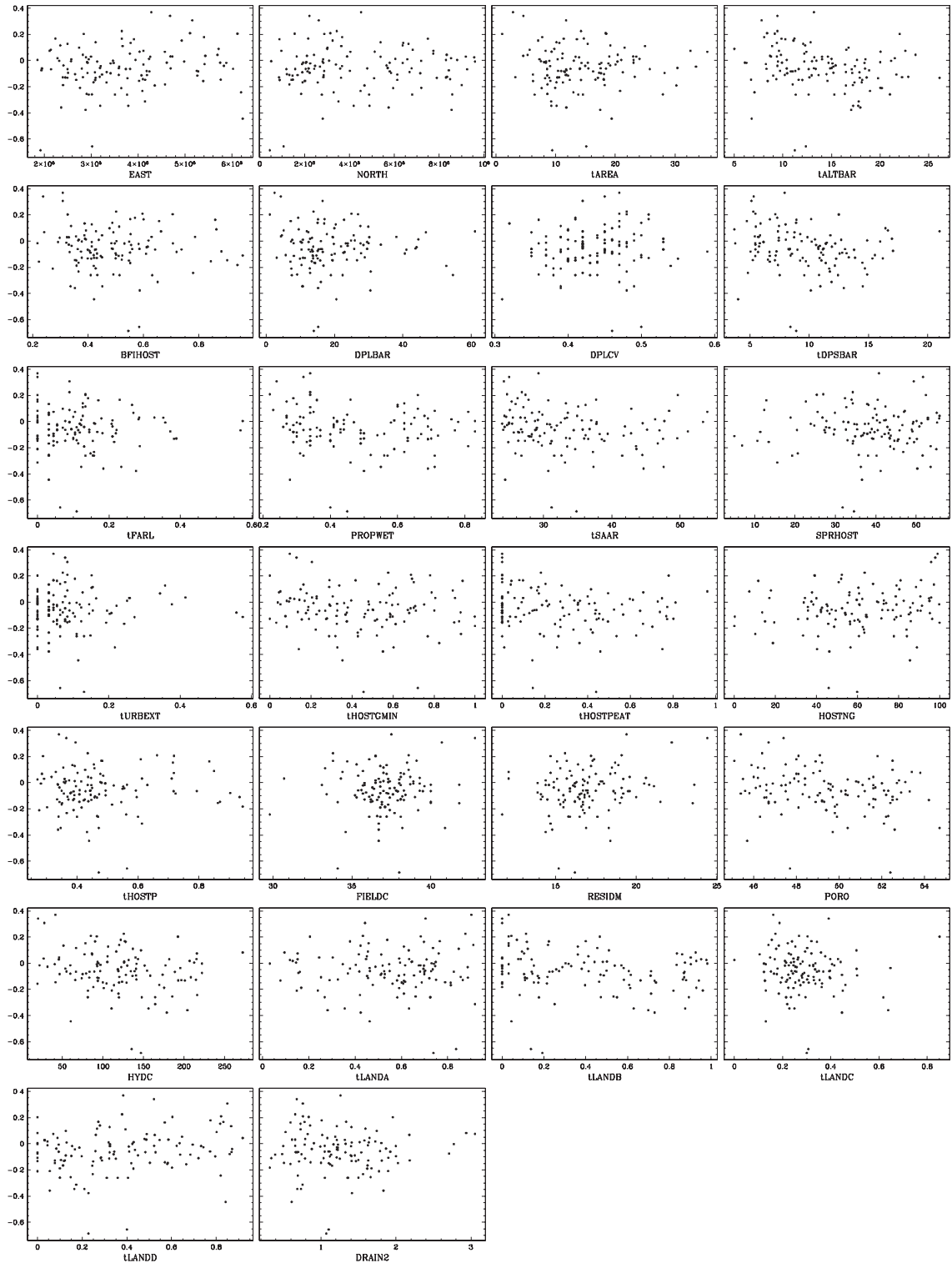
Note:

- The errors plotted are logarithmic errors in the estimated flood at the given return period (compared to the observed flood frequency curve). A logarithmic error of 1 means that the estimated peak flow at that return period is 2.7 times the observed peak flow, while -1 means that the peak flow is underestimated by a factor of 2.7.
- The catchment properties plotted are the 24 listed in Table 2.3, plus the Easting and Northing of the catchment outlet. Properties prefixed by a 't' have been transformed according to the functions given in Table 2.4 (Volume 1).

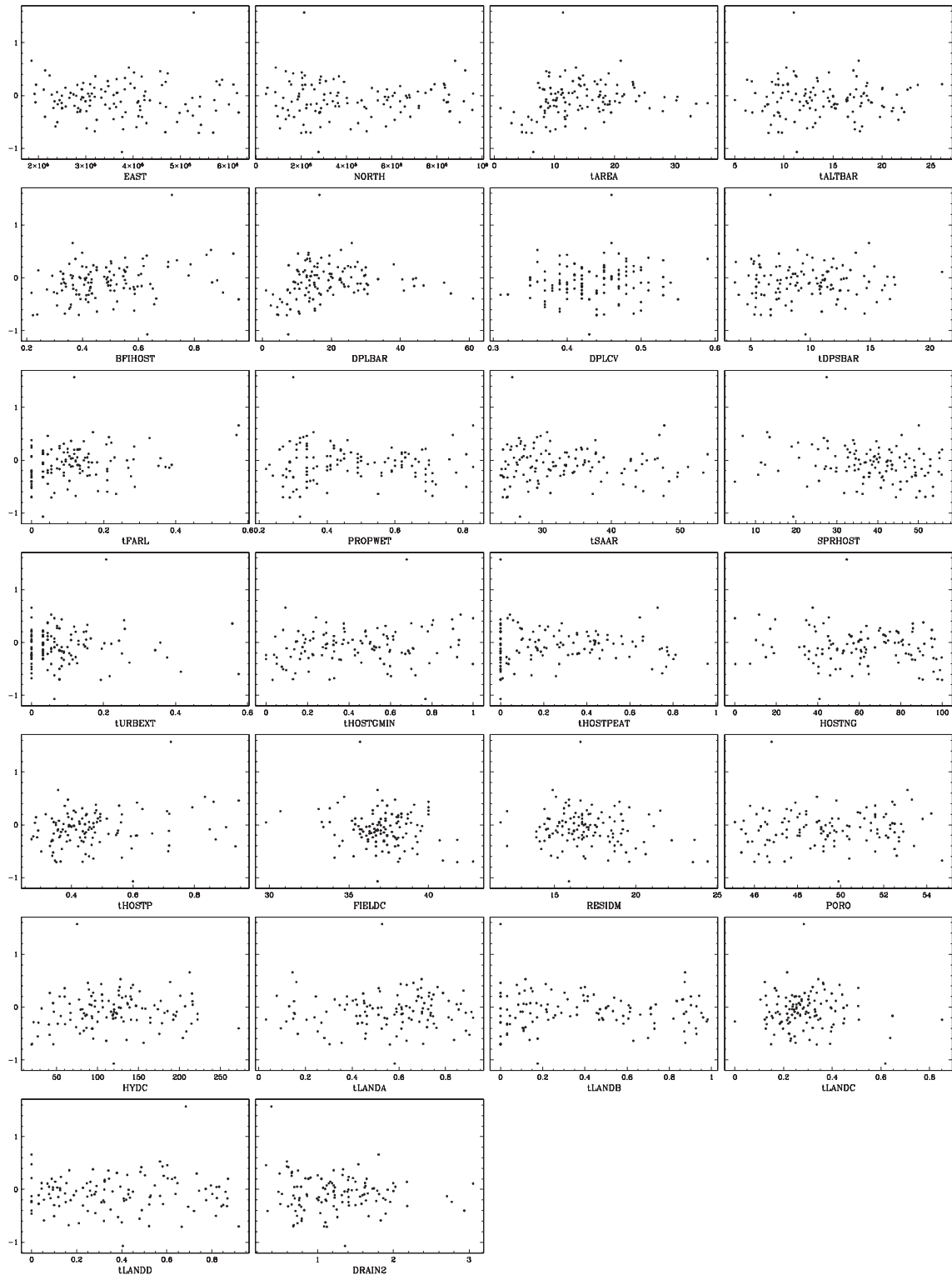
PDM, calibrated, 10 year return period



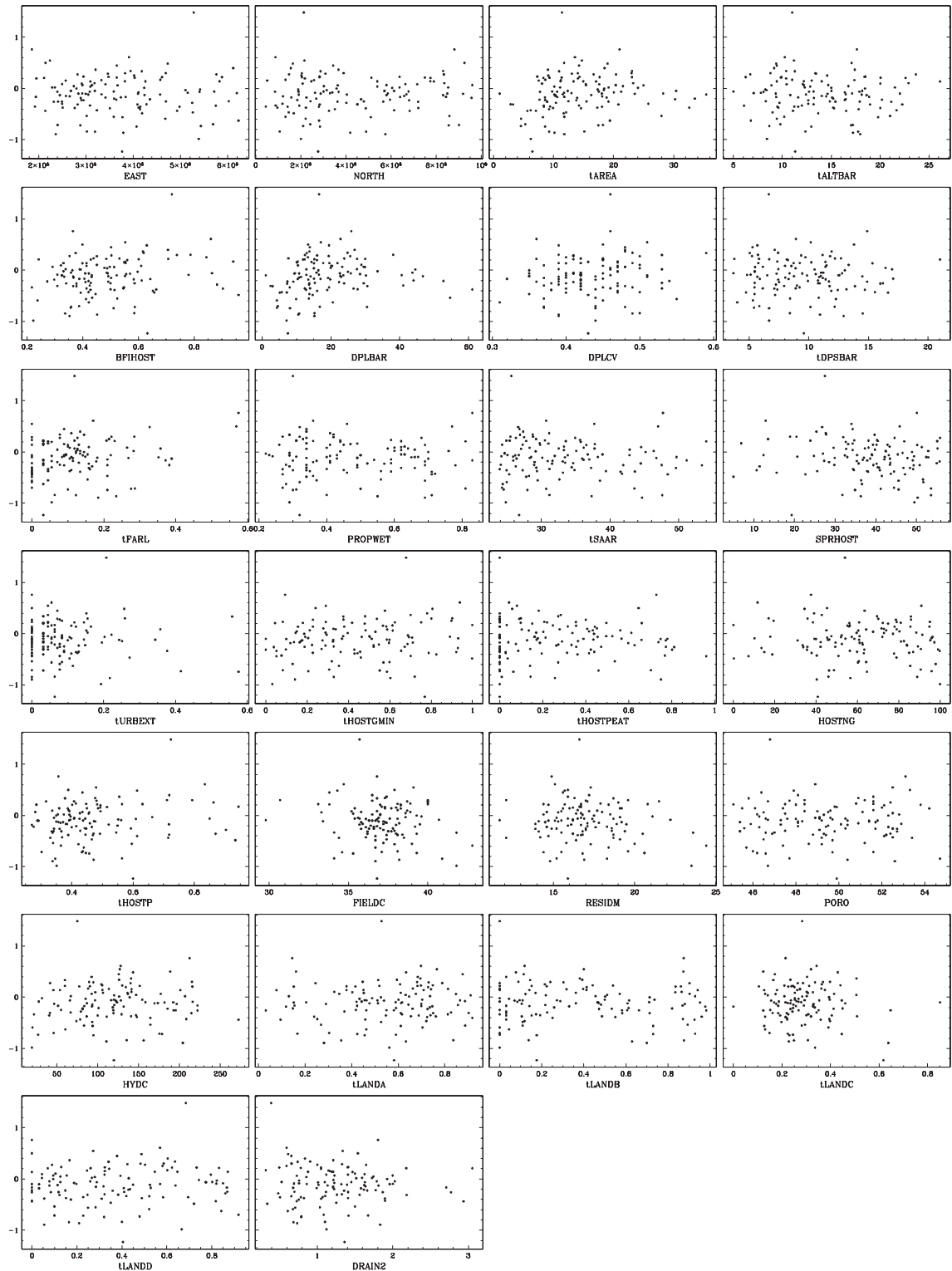
PDM, calibrated, 50 year return period



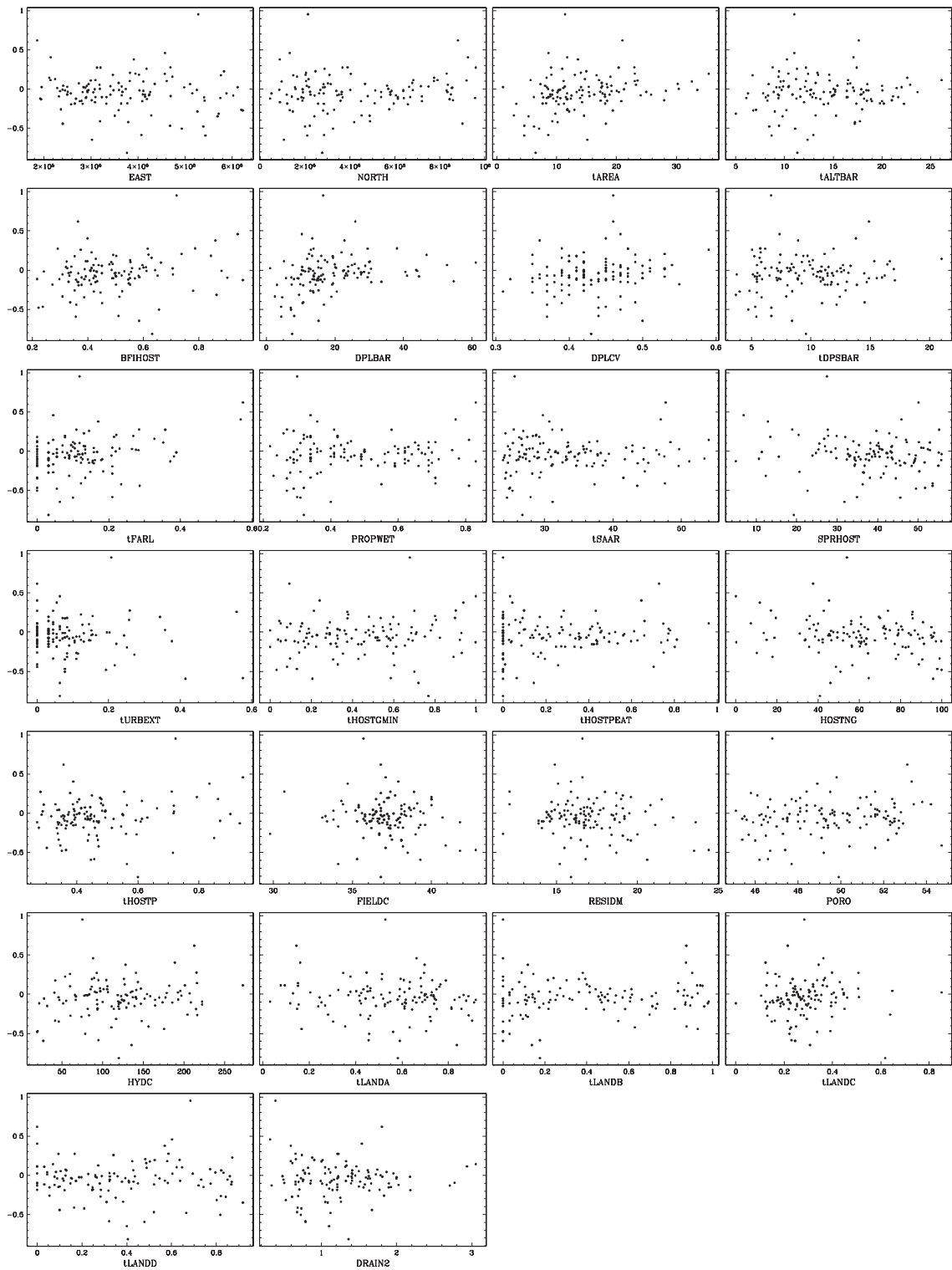
PDM, generalised, univariate regression, 10 year return period



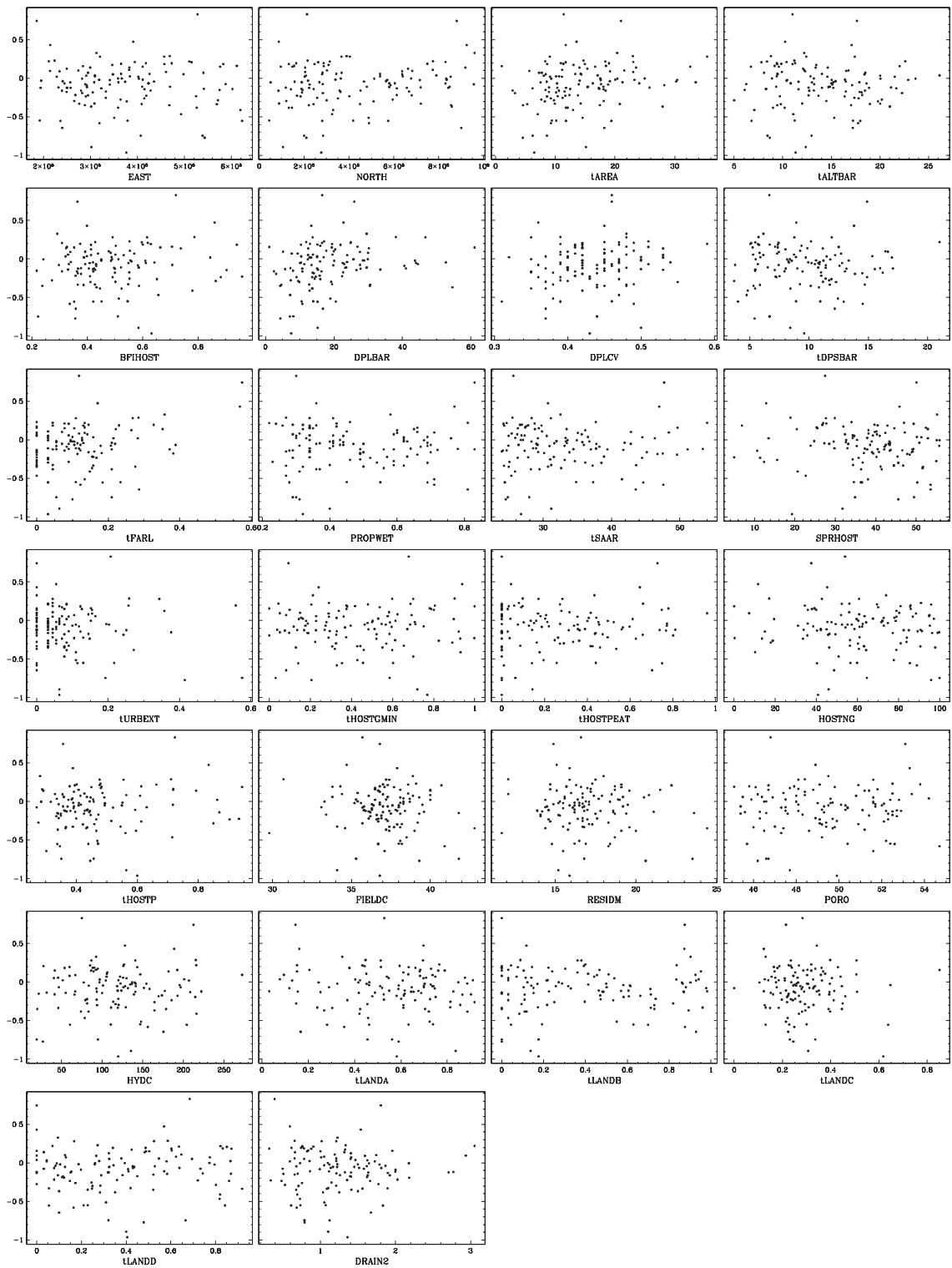
PDM, generalised, univariate regression, 50 year return period



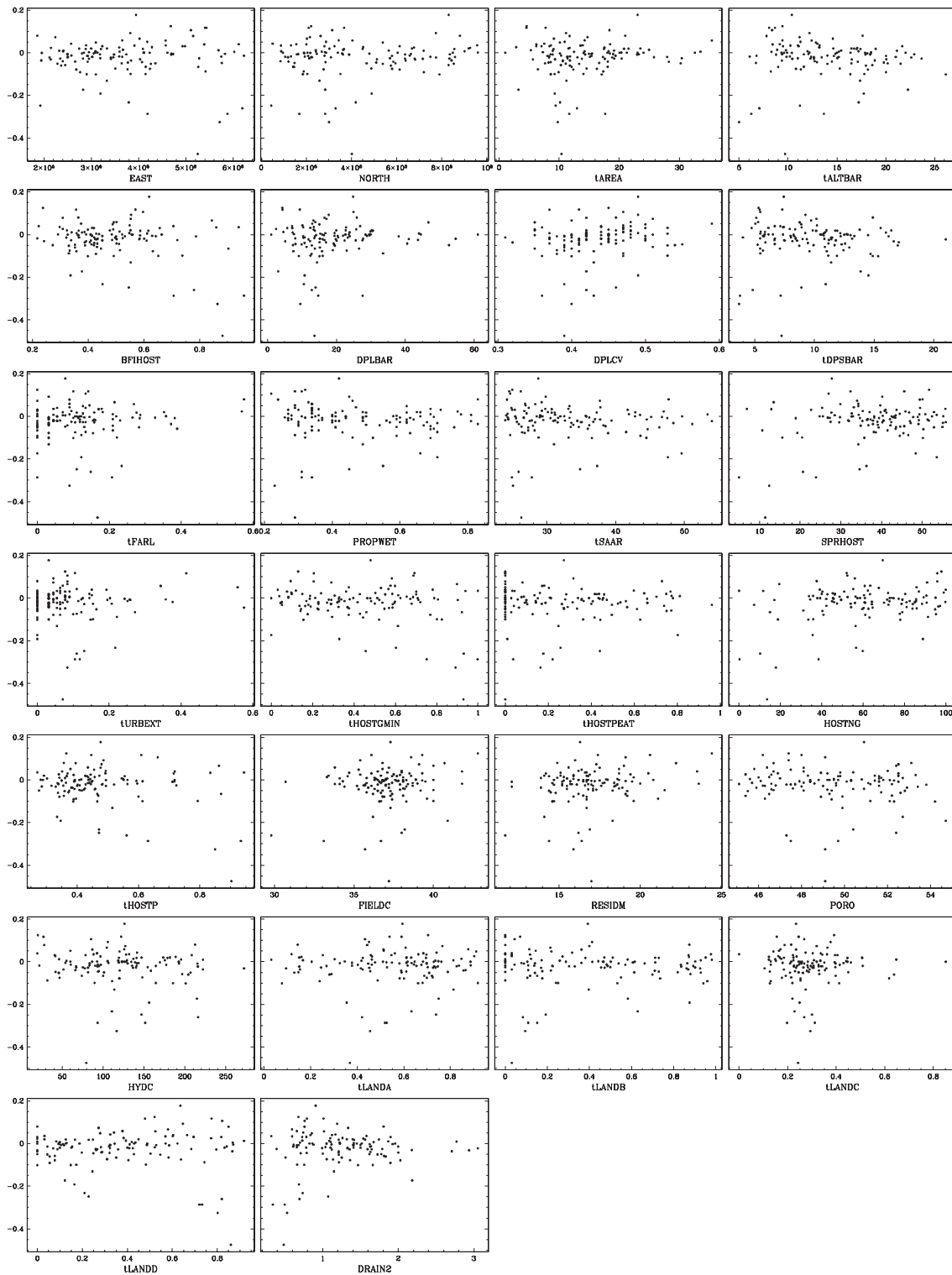
PDM, generalised, site-similarity, 10 year return period



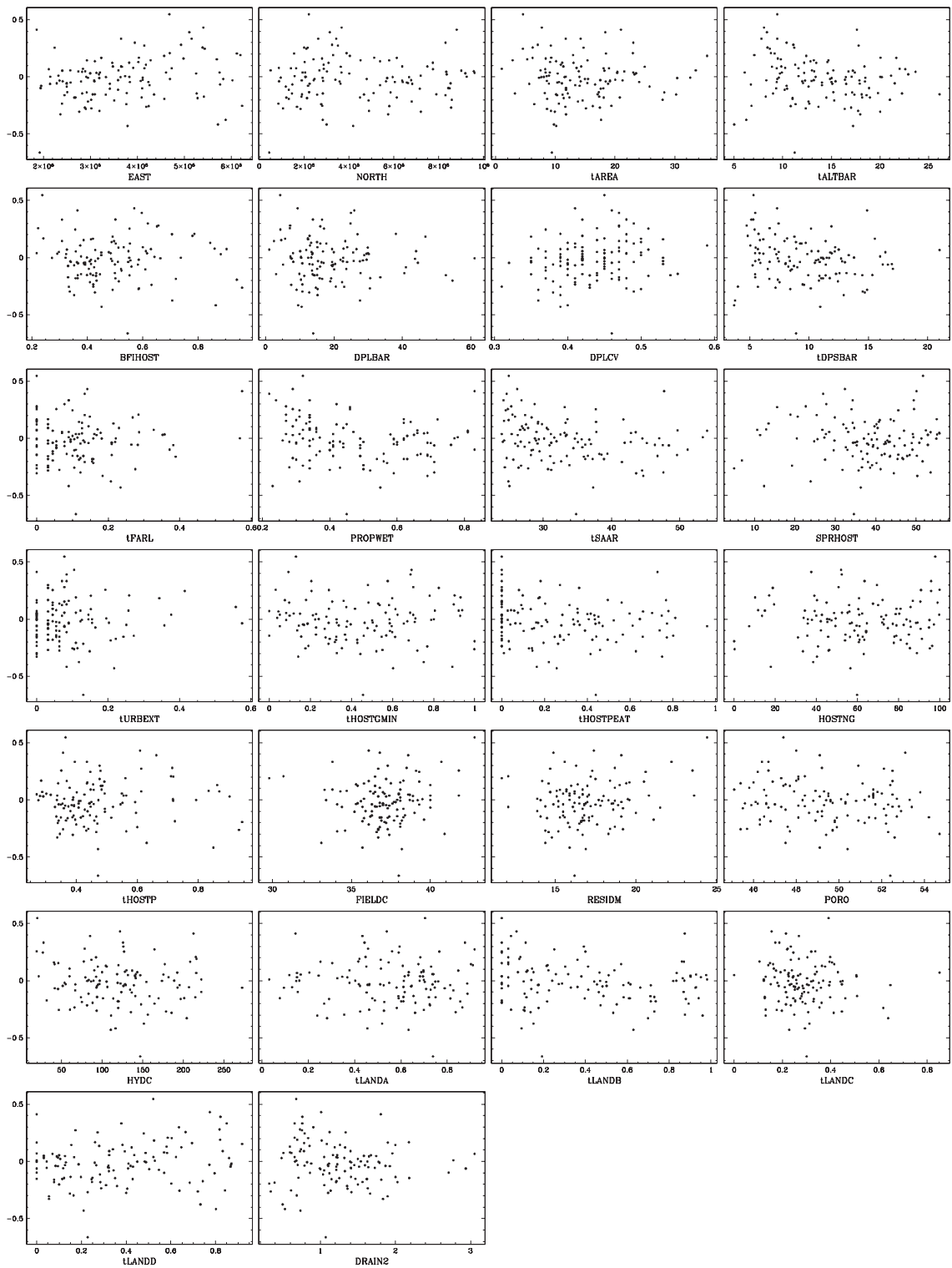
PDM, generalised, site-similarity, 50 year return period



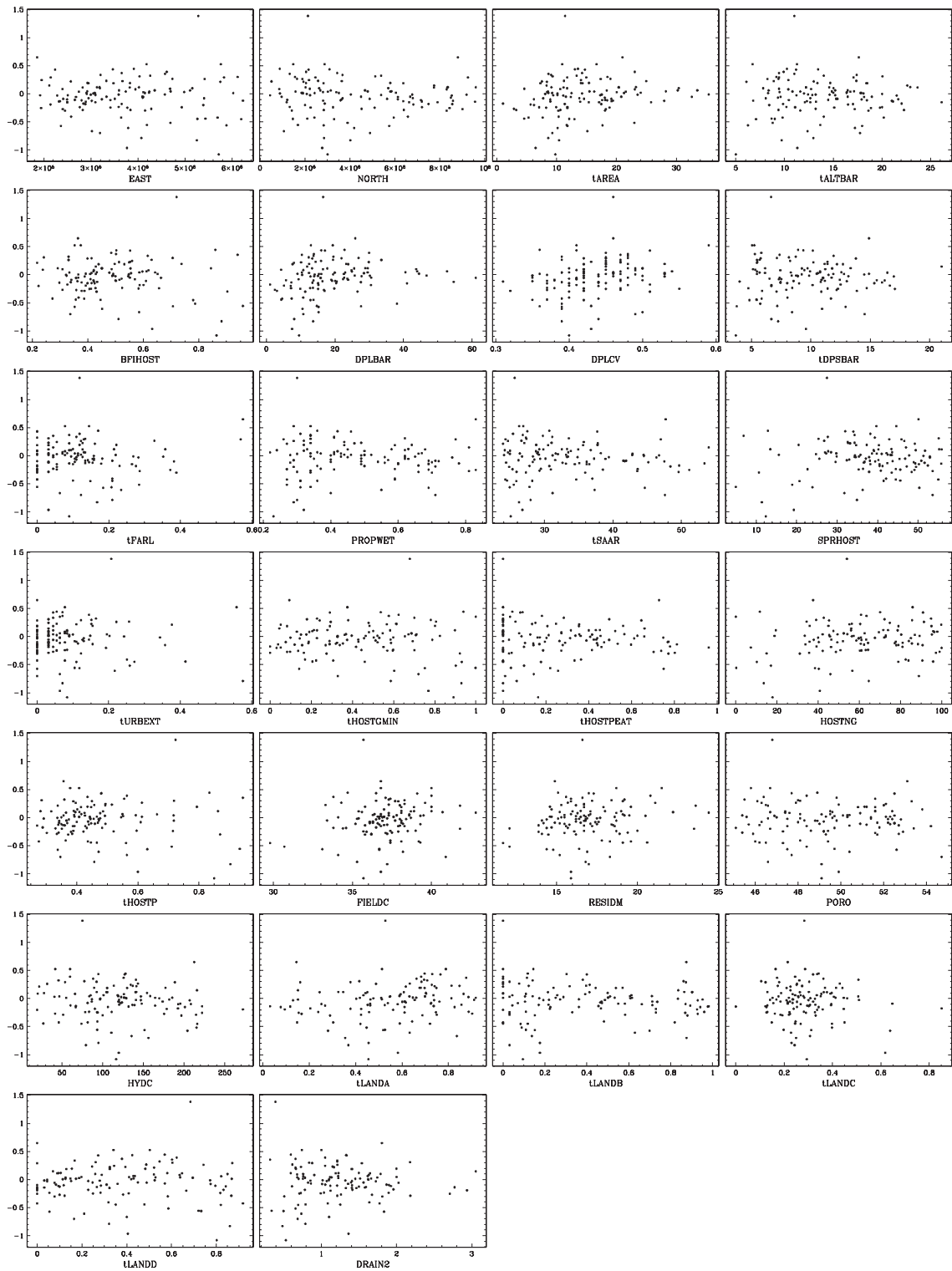
TATE, calibrated, 10 year return period



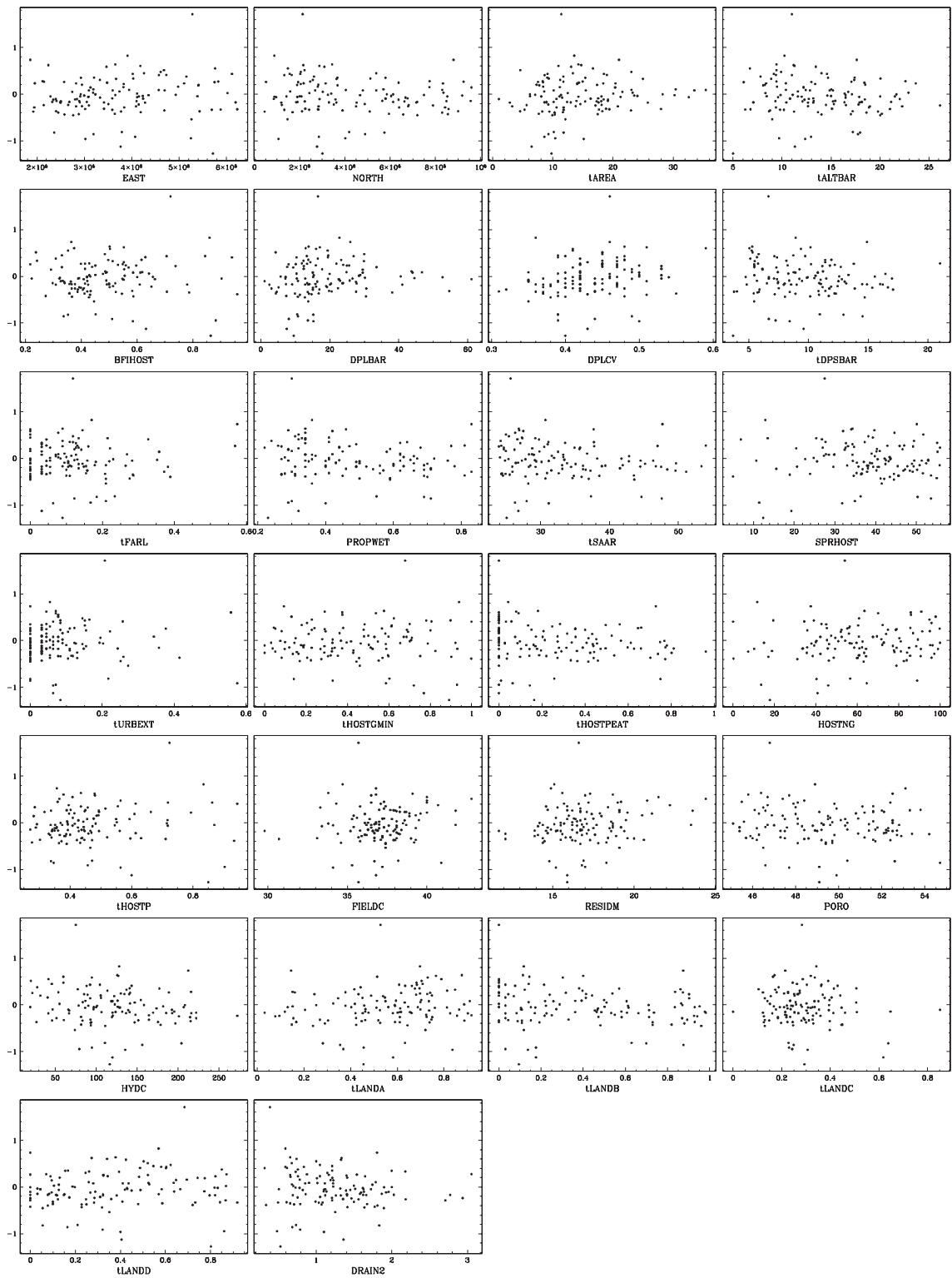
TATE, calibrated, 50 year return period



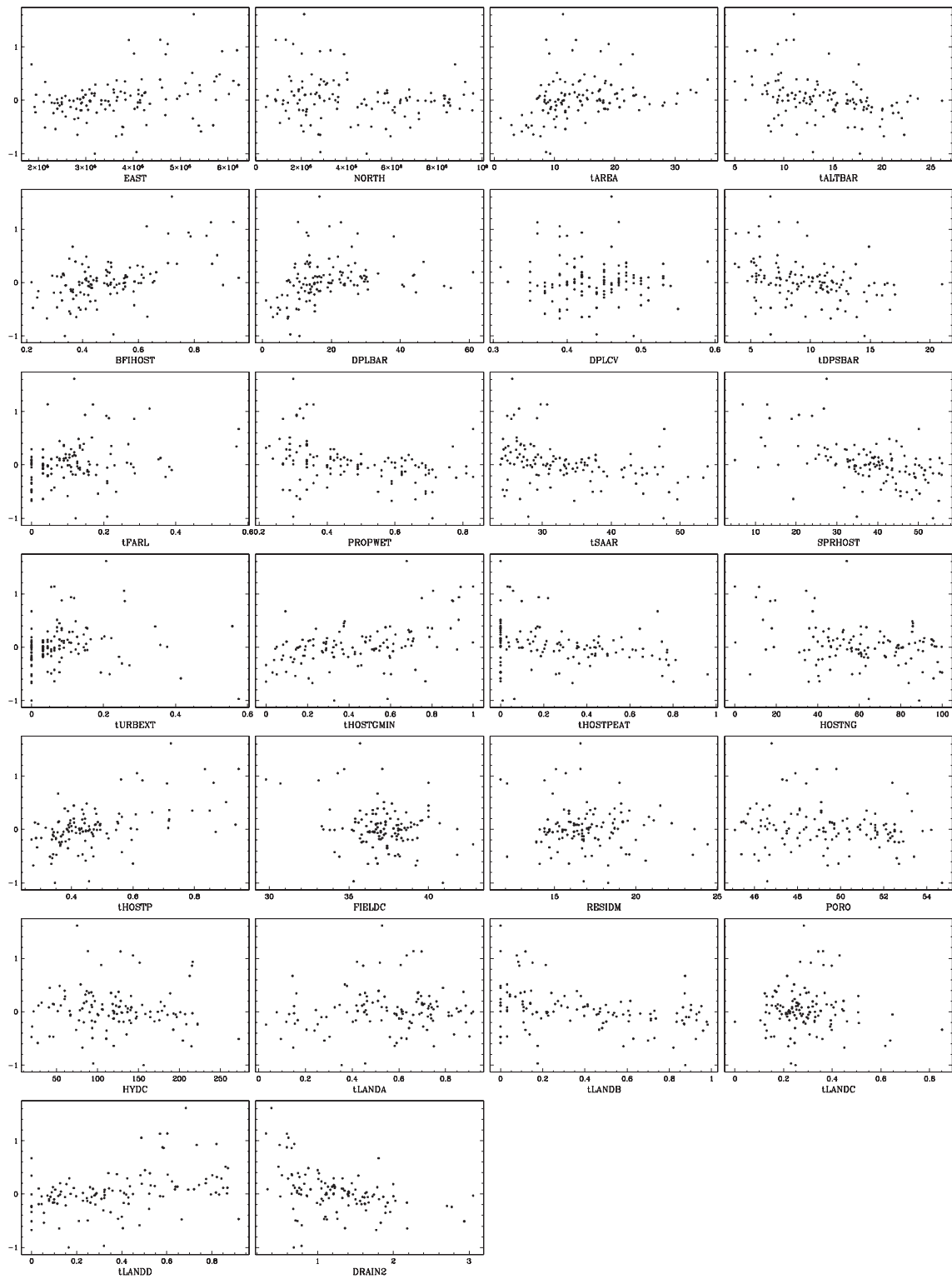
TATE, generalised, univariate regression, 10 year return period



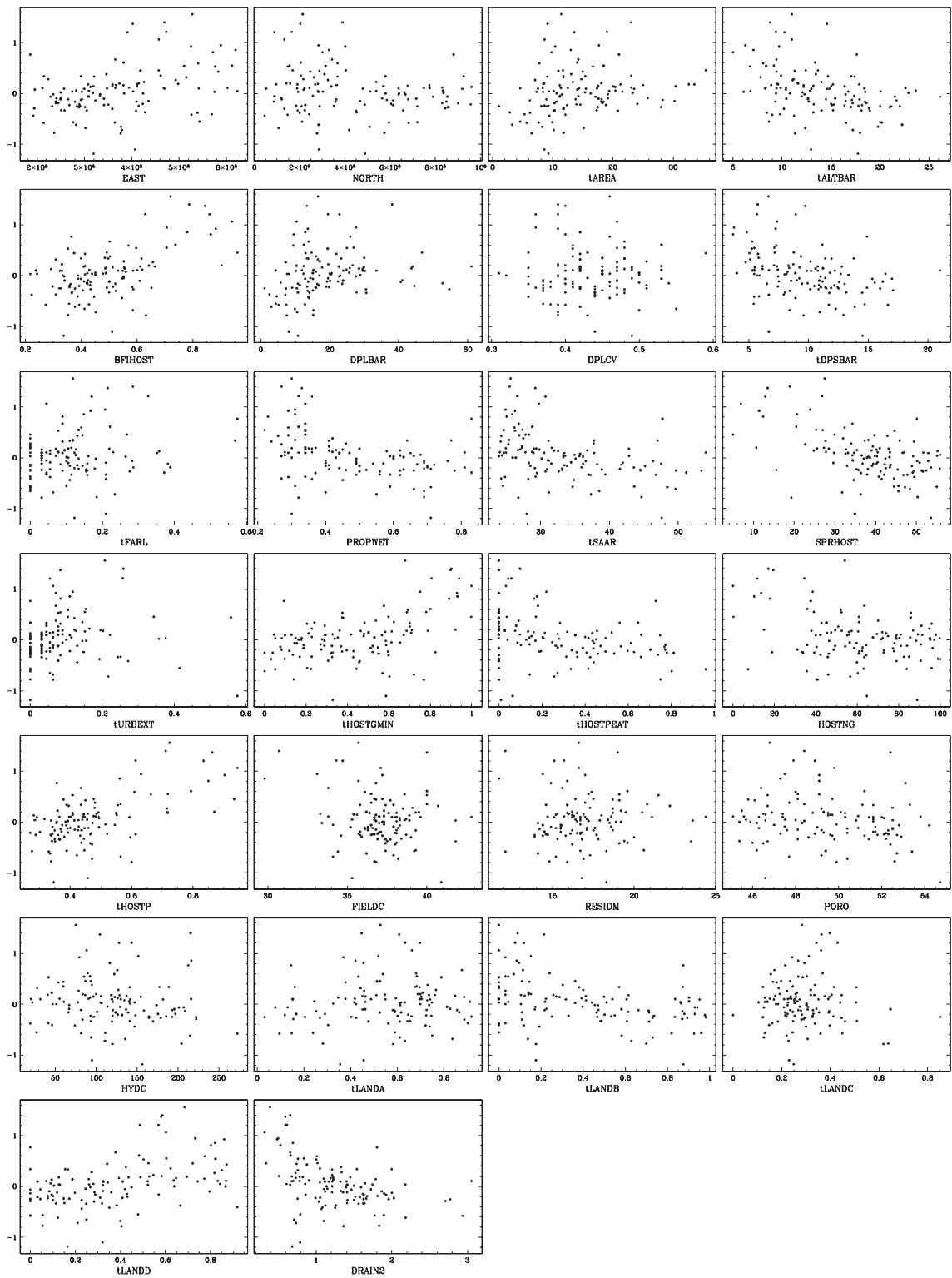
TATE, generalised, univariate regression, 50 year return period



TATE, generalised, site-similarity, 10 year return period



TATE, generalised, site-similarity, 50 year return period



Appendix C Parameter calibration and generalisation uncertainties

This appendix (pages 93-107) contains figures comparing the calibrated values of runoff model parameters with the corresponding values that would be estimated by the generalisation procedures for ungauged catchments whose properties happened to coincide with those in the calibration set. The figures also contain information about the sizes estimated for the uncertainties represented by the statistical model. These are plotted as ± 2 standard deviation bounds corresponding to the variances described in Table C.1. The left-most of each pair of plots shows error bands relevant when comparing the calibrated values with the 1:1 line, where the outer bands include the calibration uncertainty associated with calibrating the runoff model. The right-most plot shows error-bands associated with the error of the generalisation estimate considered as estimating the “true” parameter value for an ungauged catchment, which does not include the same substantial contribution from the calibration uncertainty. Further details are given in Section 6.5.2.

In the figures here, all parameters are shown on the transformed scales described in Section 5.3.

Table C.1 Composition of the error bounds shown in Figures C.1 to C.14

Colour	Position	Description	Formula
Left-most scatter plot:			
Bright red	Inner-most	Basic generalisation error	σ_{η}^2
Green	Outer-most	Generalisation variance plus the calibration error variance	$\sigma_{\eta}^2 + \sigma_{i,\varepsilon}^2$
Right-most scatter plot:			
Bright red	Inner-most	Basic generalisation error	σ_{η}^2
Pale blue*	Next	Generalisation error variance plus the transferred effect of the generalisation error for sites used in the generalisation procedure	$\sigma_{\eta}^2 + \sum_{j=1}^n w_{*j}^2 \sigma_{\eta}^2$
Purple	Outer-most	Total error – generalisation error variance plus the transferred effects of generalisation error and calibration errors for sites used in the generalisation procedure	$\sigma_{\eta}^2 + \sum_{j=1}^n w_{*j}^2 (\sigma_{\eta}^2 + \sigma_{j,\varepsilon}^2)$

* Note that this bound is often obscured in the figures by the outer-most bound

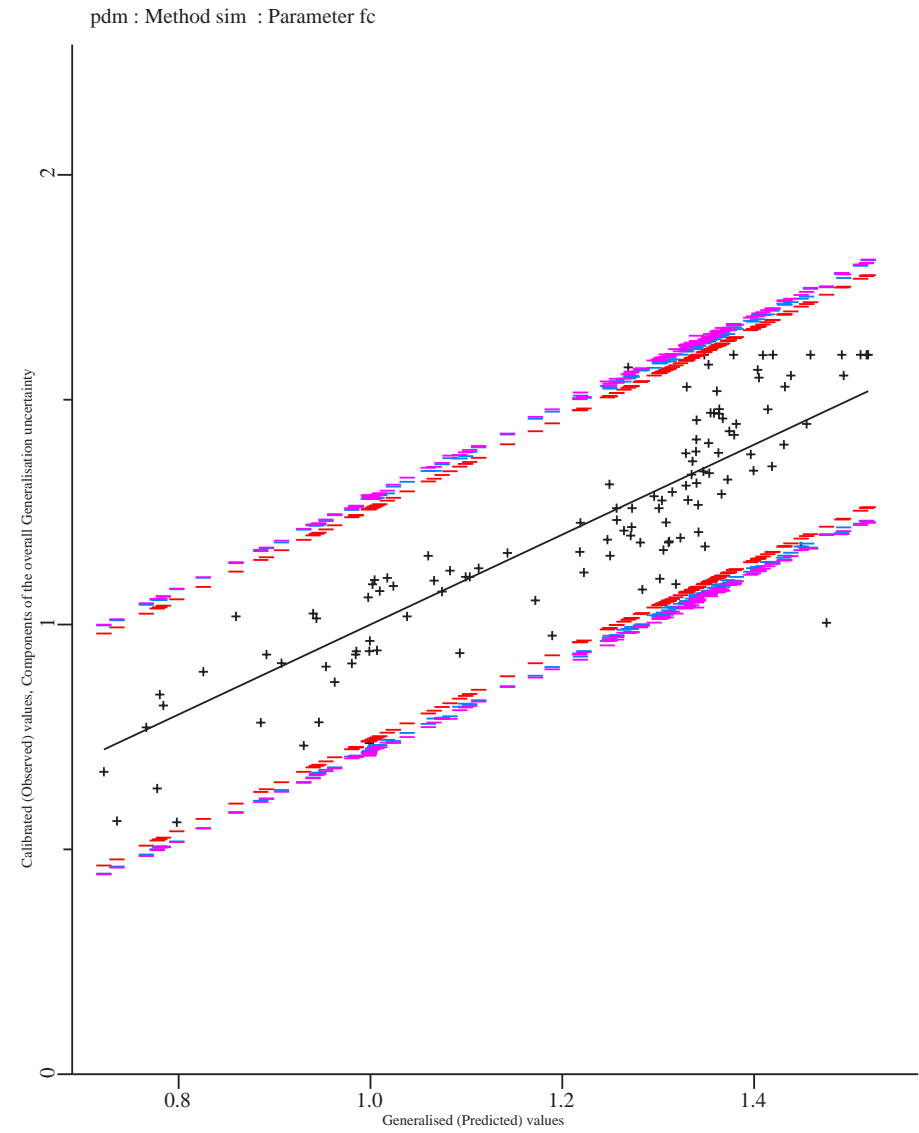
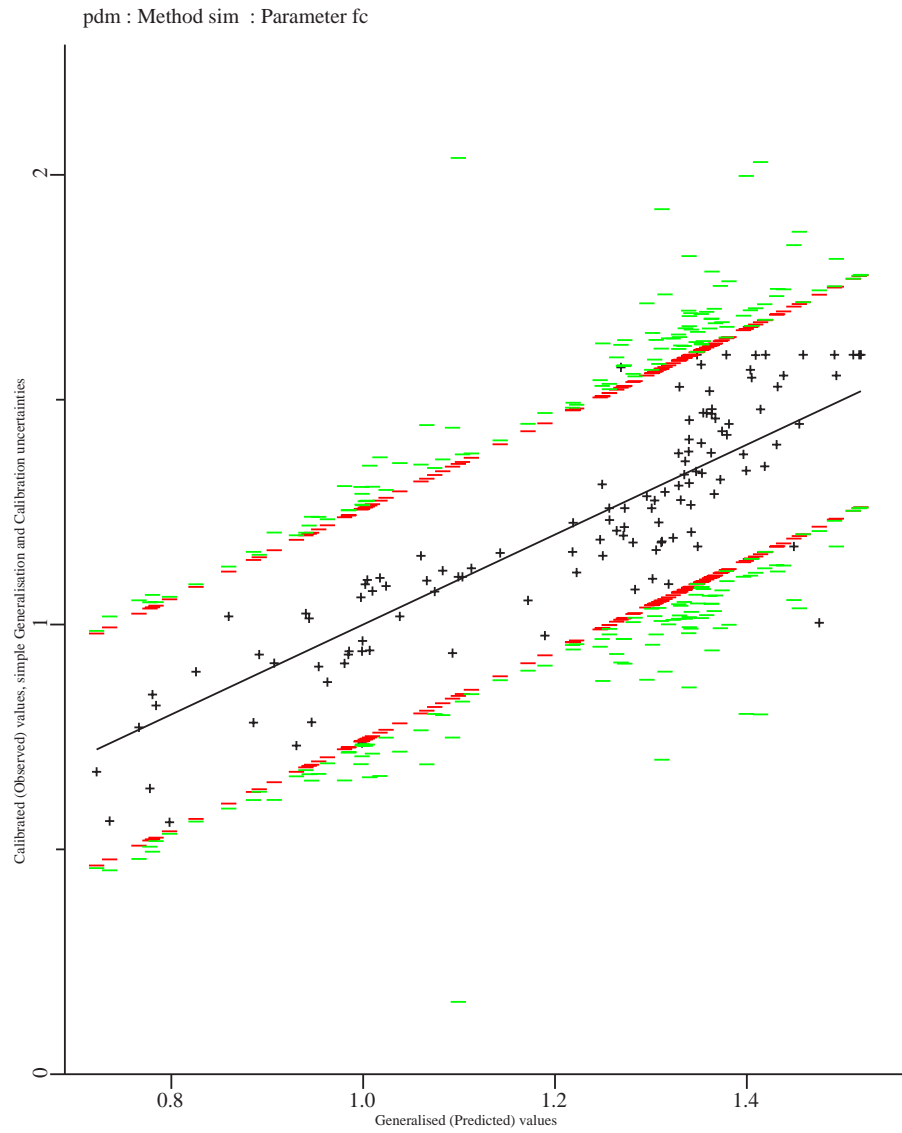


Figure C.1 Calibrated and generalised parameter values, with uncertainty bounds: parameter “fc” of the PDM model; generalisation by site-similarity. See text and Table C.1 for description.

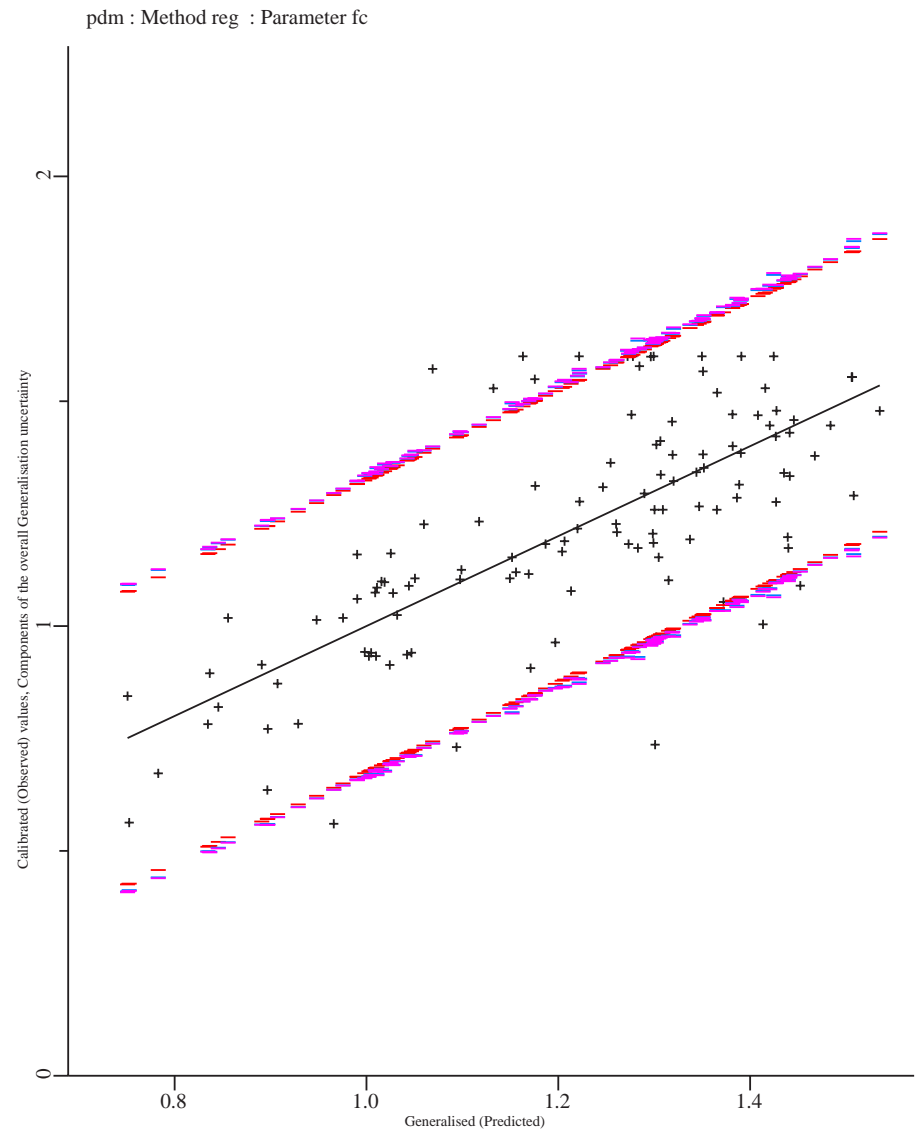
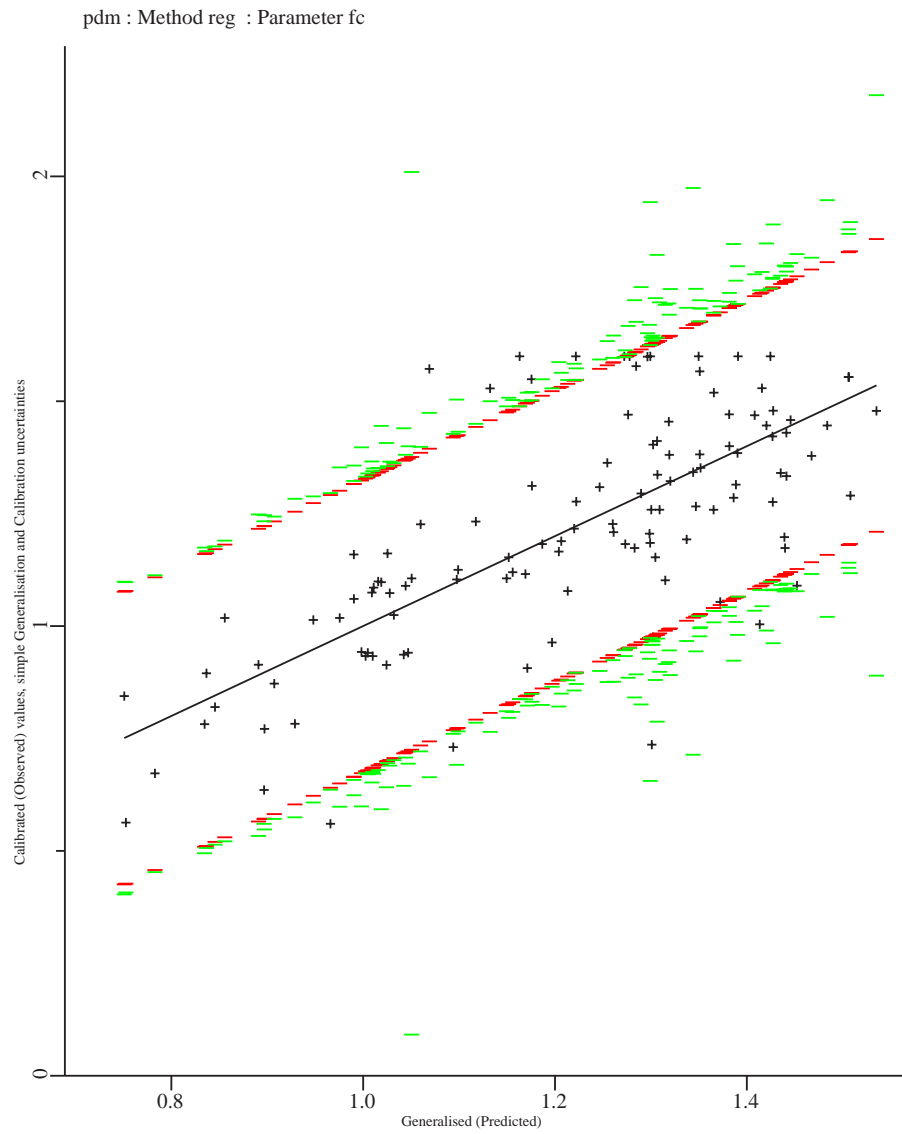


Figure C.2 Calibrated and generalised parameter values, with uncertainty bounds: parameter “fc” of the PDM model; generalisation by regression. See text and Table C.1 for description.

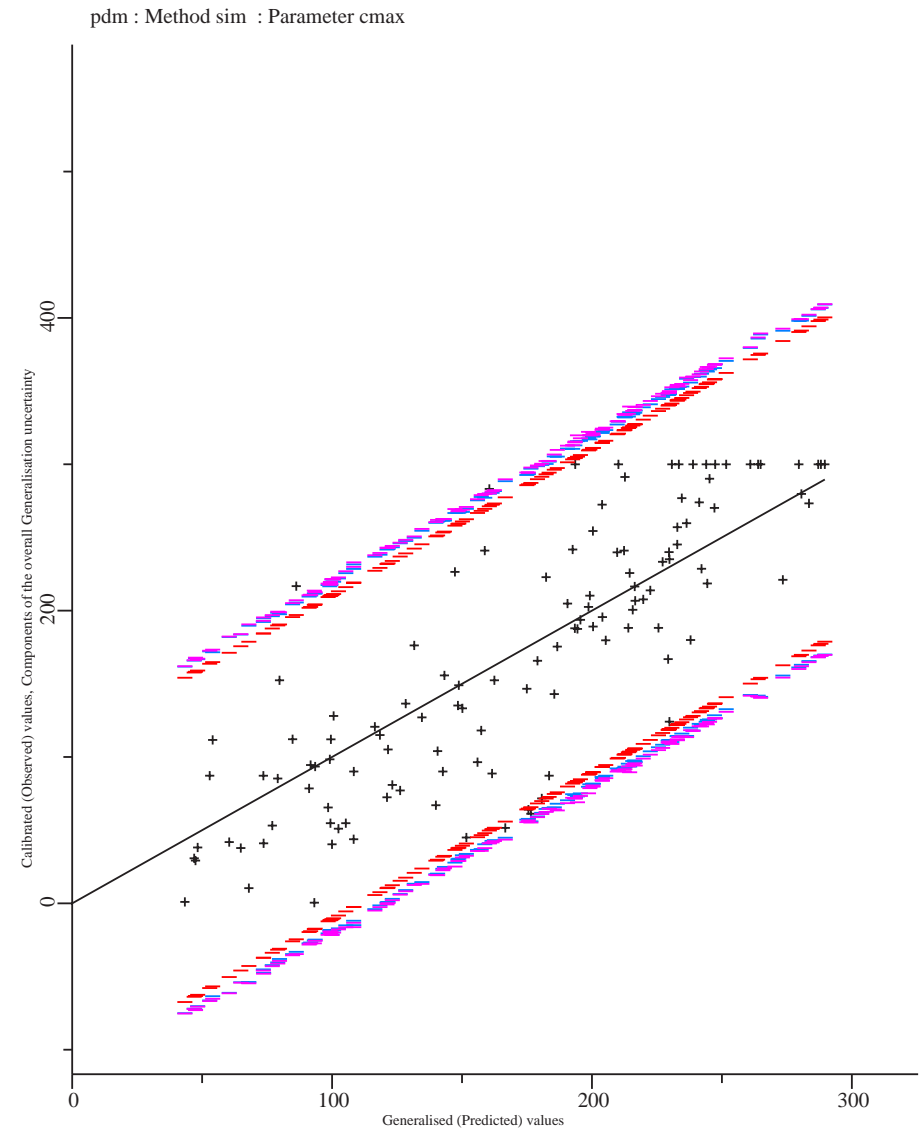
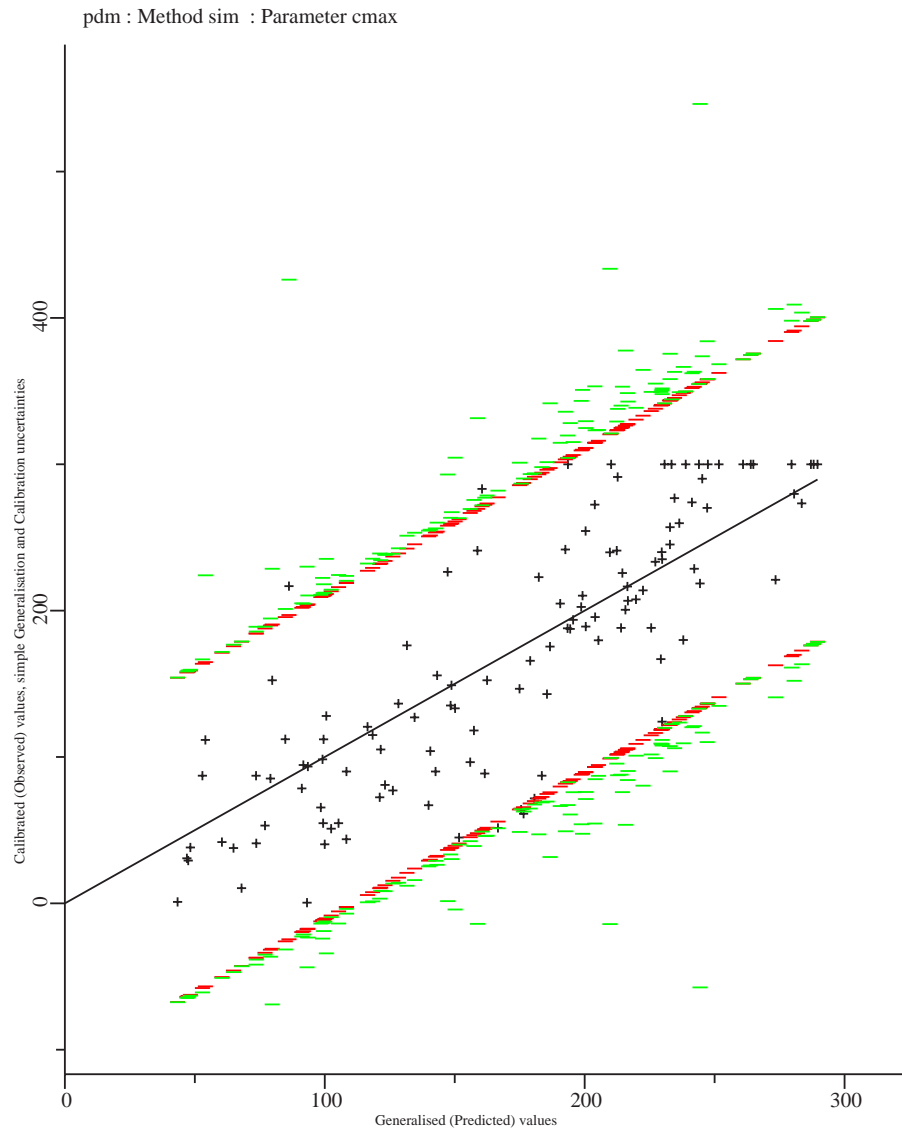


Figure C.3 Calibrated and generalised parameter values, with uncertainty bounds: parameter “cmax” of the PDM model; generalisation by site-similarity. See text and Table C.1 for description.

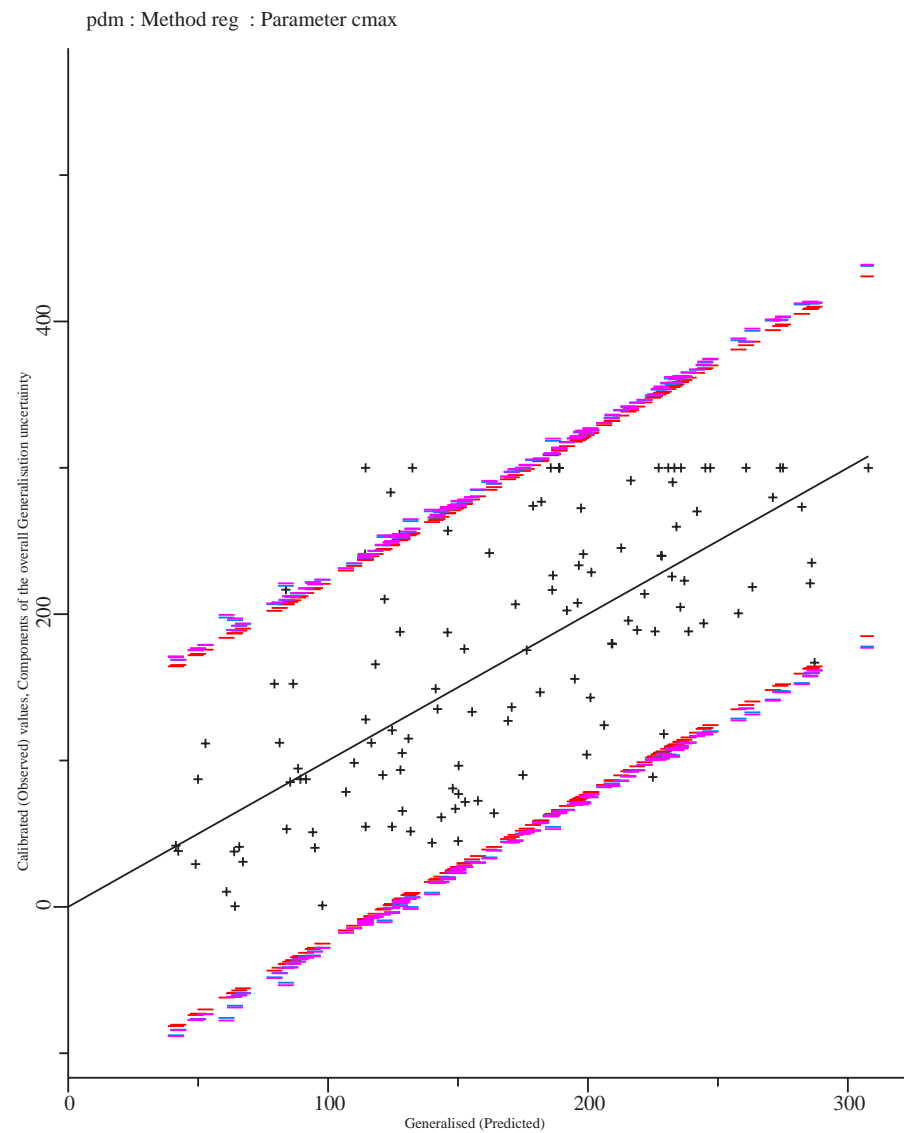
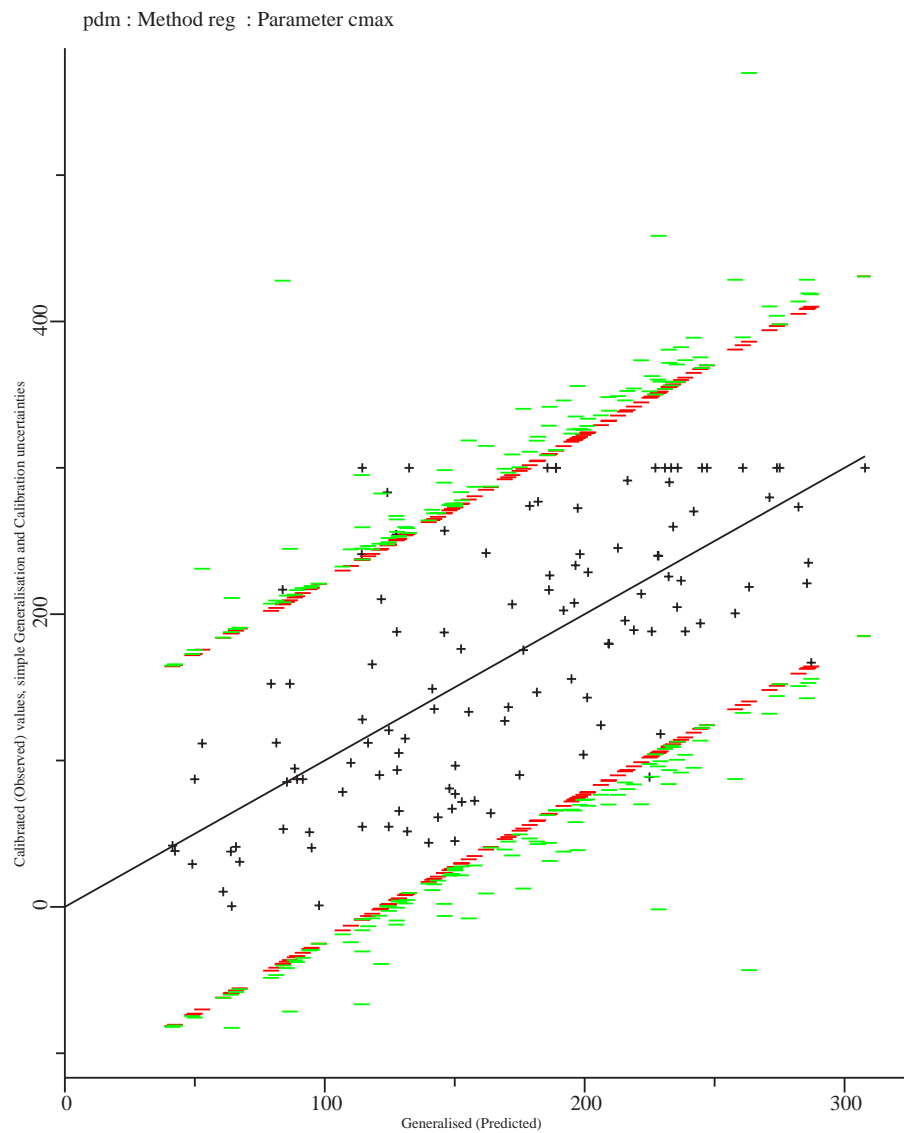


Figure C.4 Calibrated and generalised parameter values, with uncertainty bounds: parameter “cmax” of the PDM model; generalisation by regression. See text and Table C.1 for description.

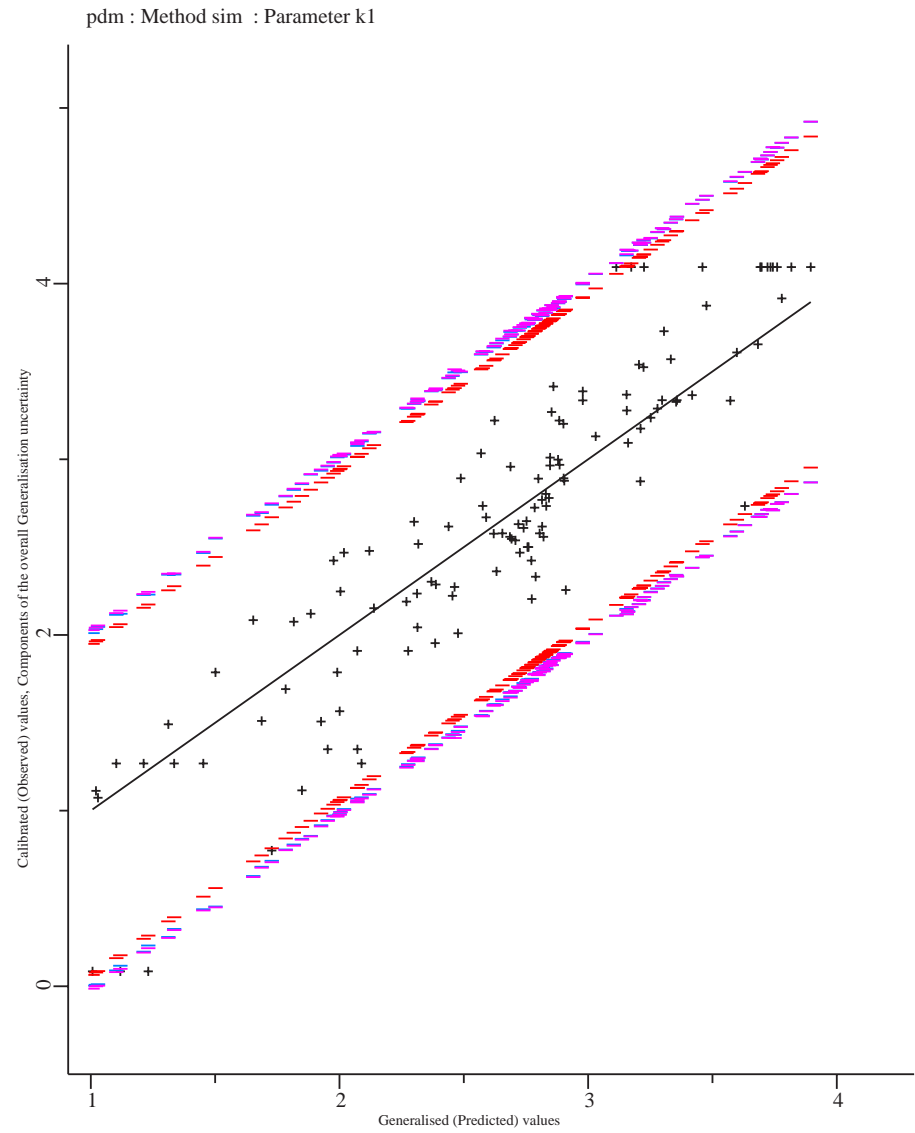
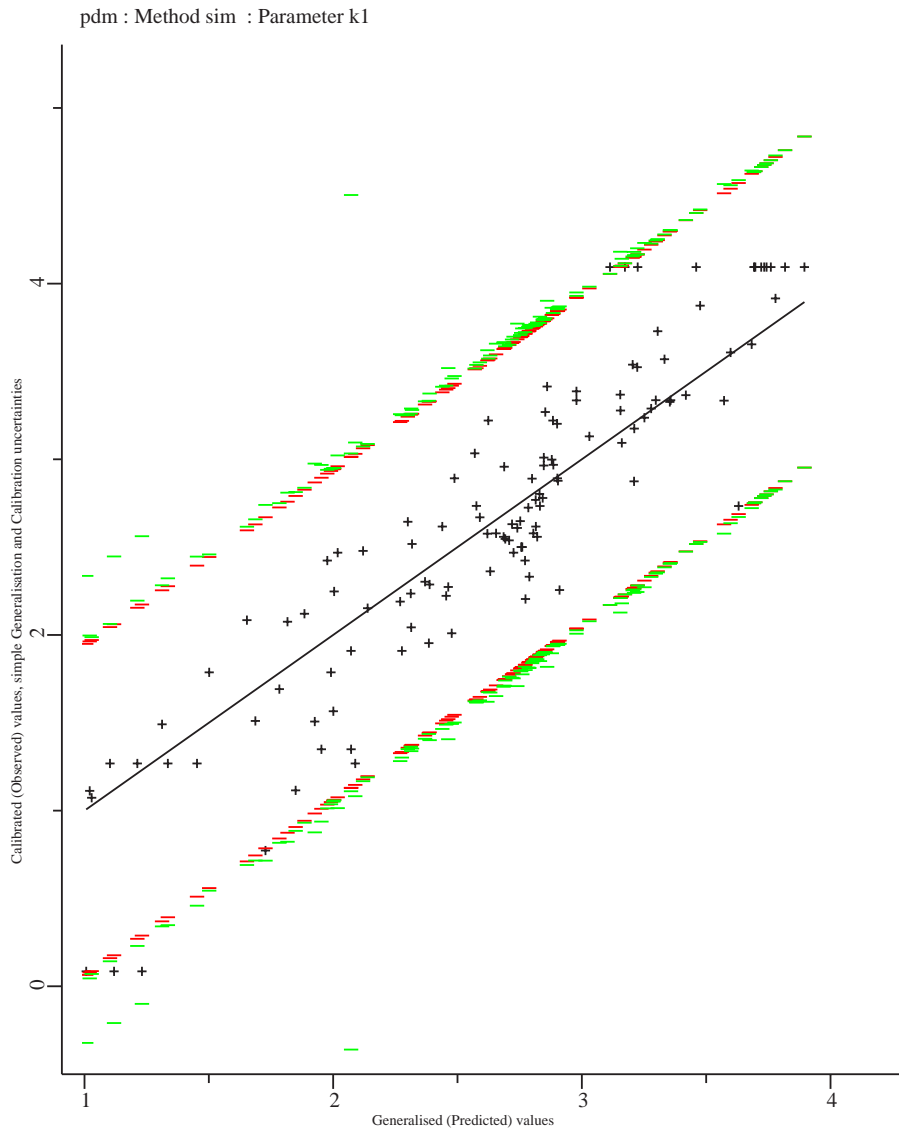


Figure C.5 Calibrated and generalised parameter values, with uncertainty bounds: parameter “k1” of the PDM model; generalisation by site-similarity. See text and Table C.1 for description.

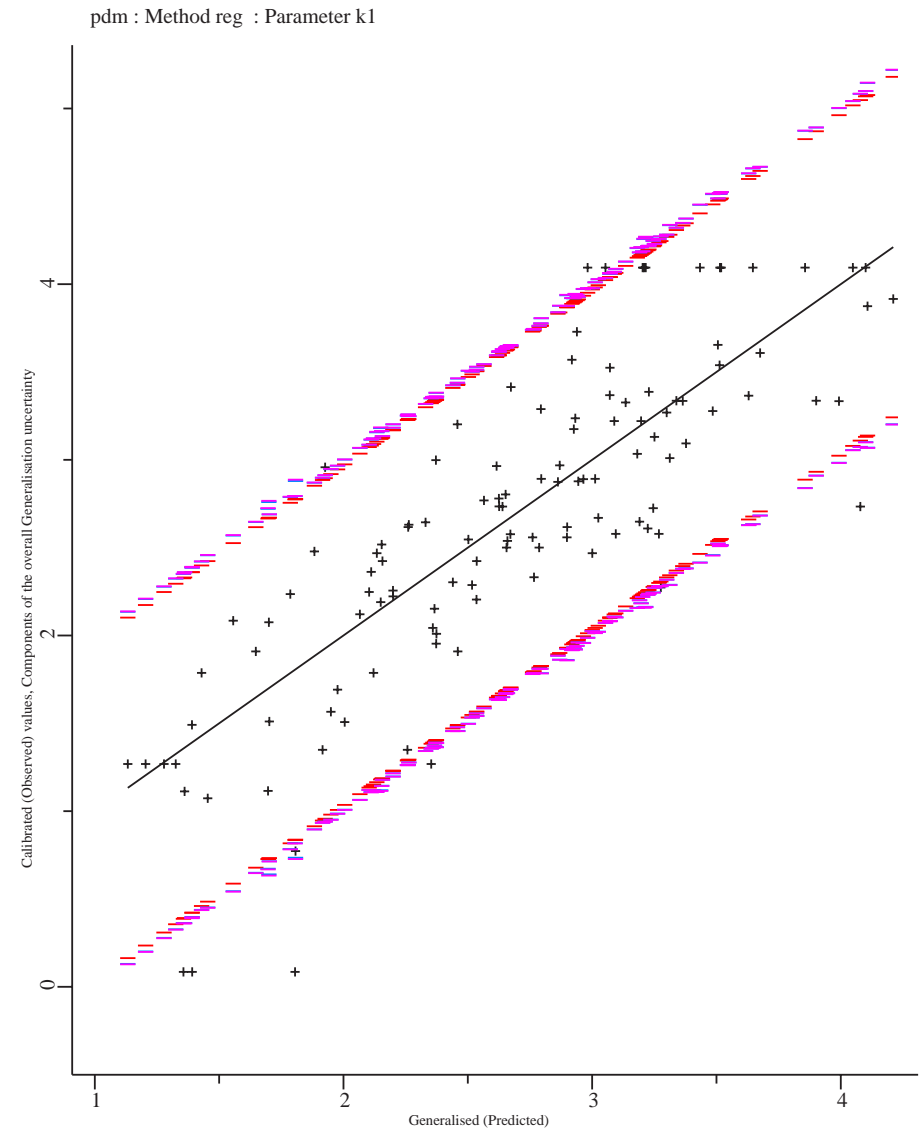
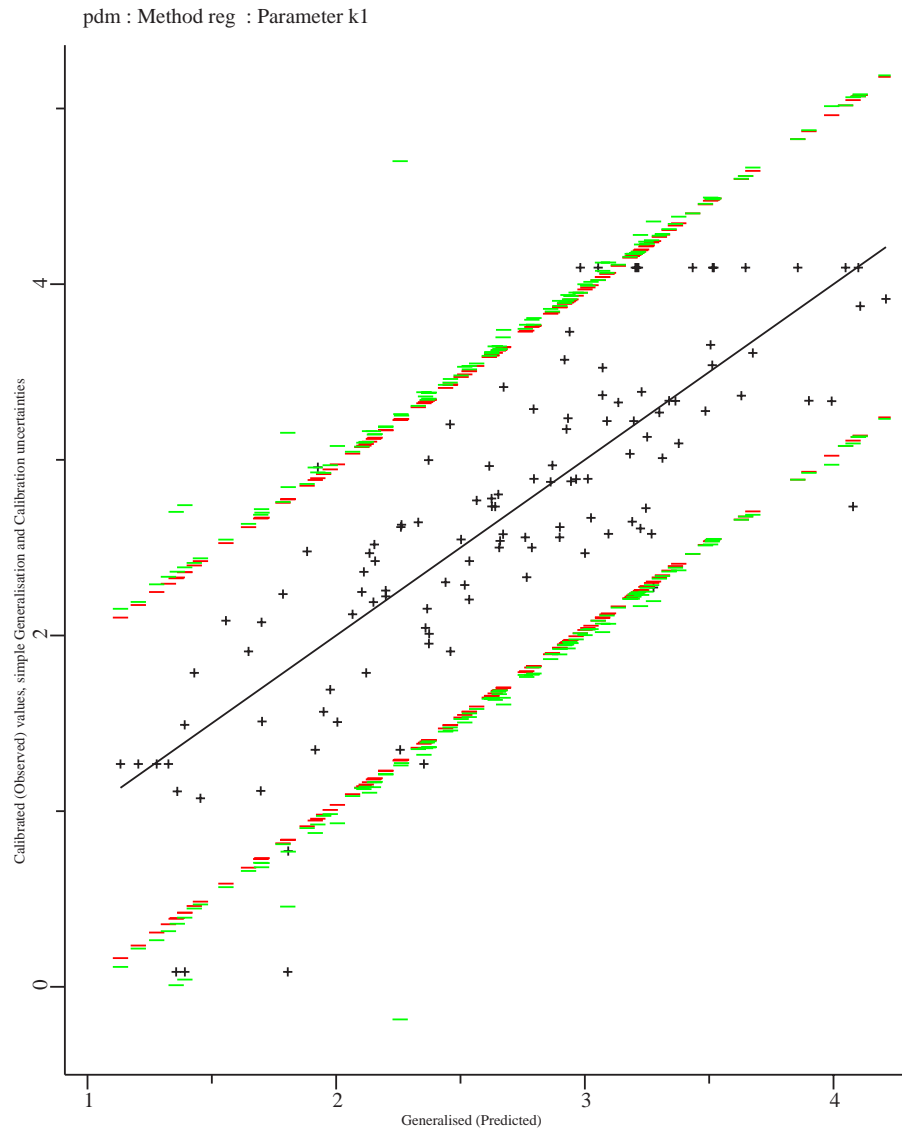


Figure C.6 Calibrated and generalised parameter values, with uncertainty bounds: parameter “k1” of the PDM model; generalisation by regression. See text and Table C.1 for description.

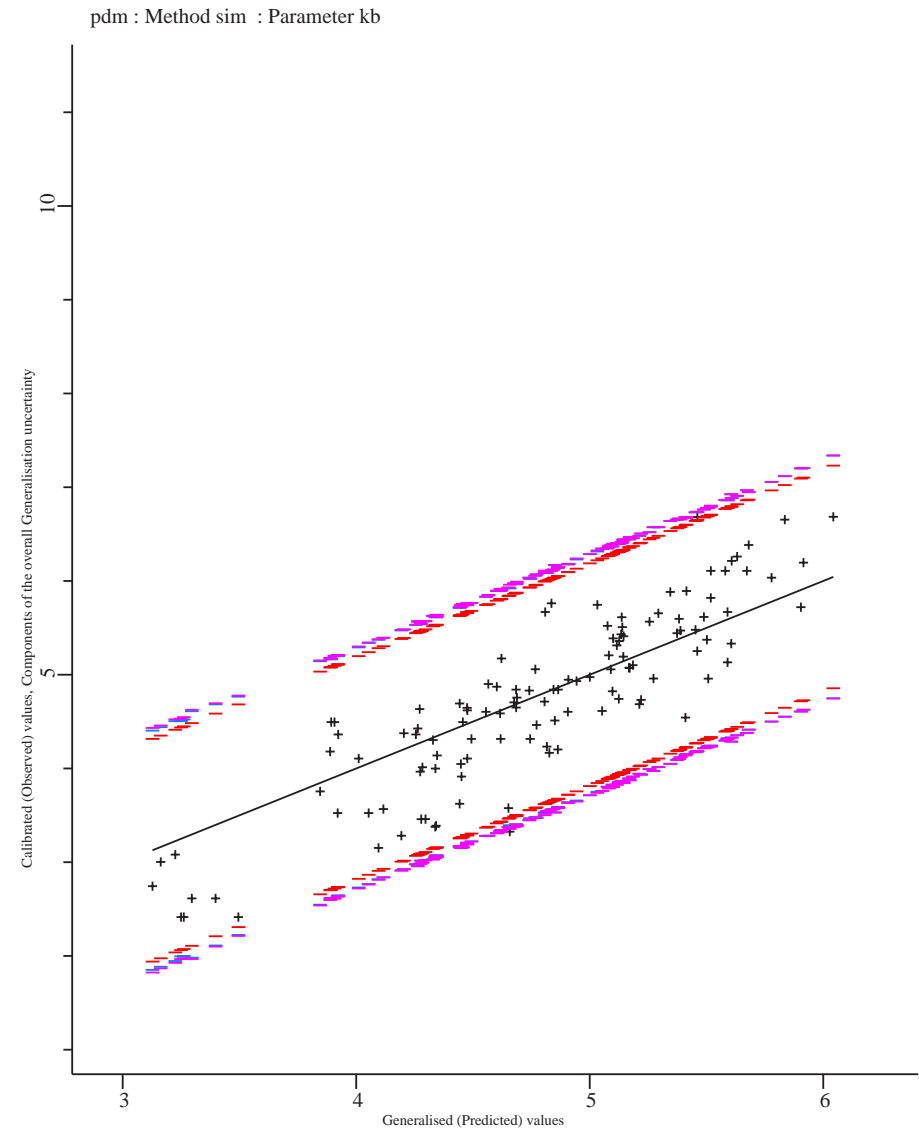
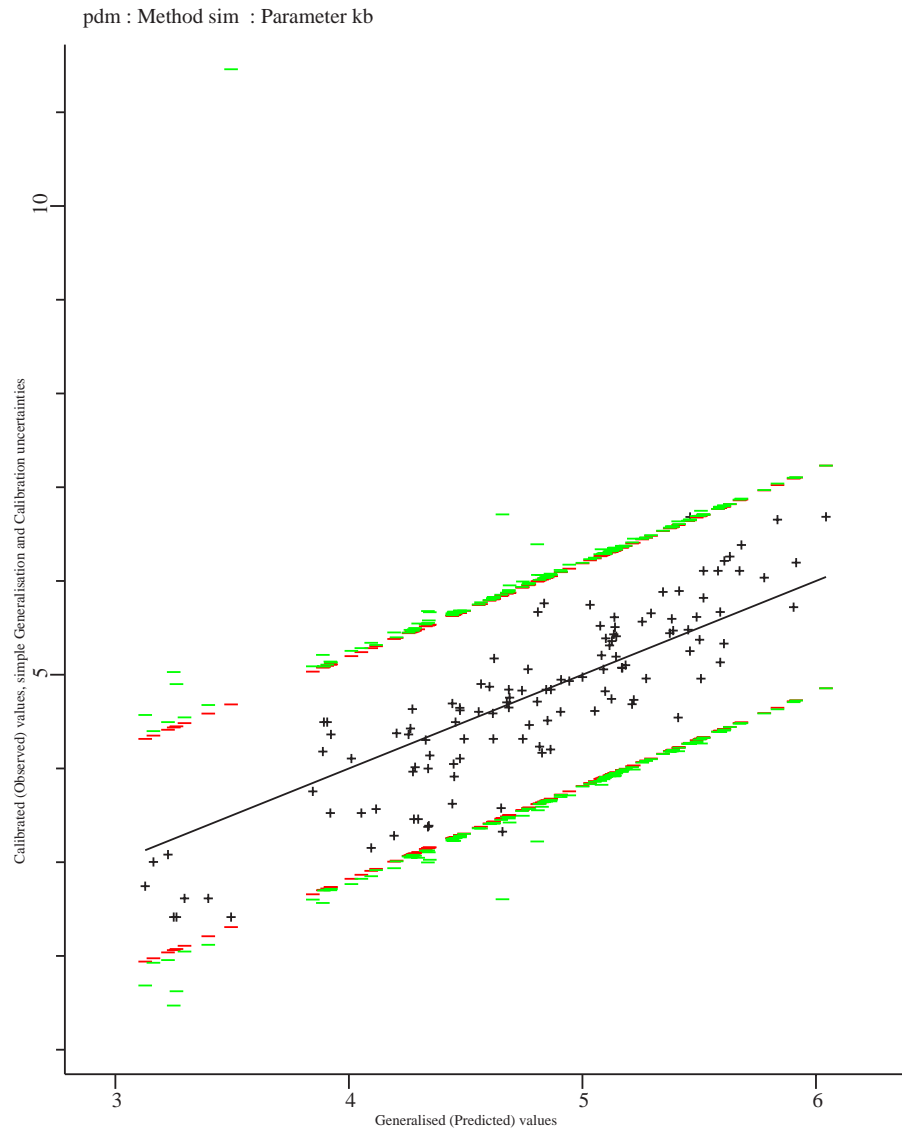


Figure C.7 Calibrated and generalised parameter values, with uncertainty bounds: parameter “kb” of the PDM model; generalisation by site-similarity. See text and Table C.1 for description.

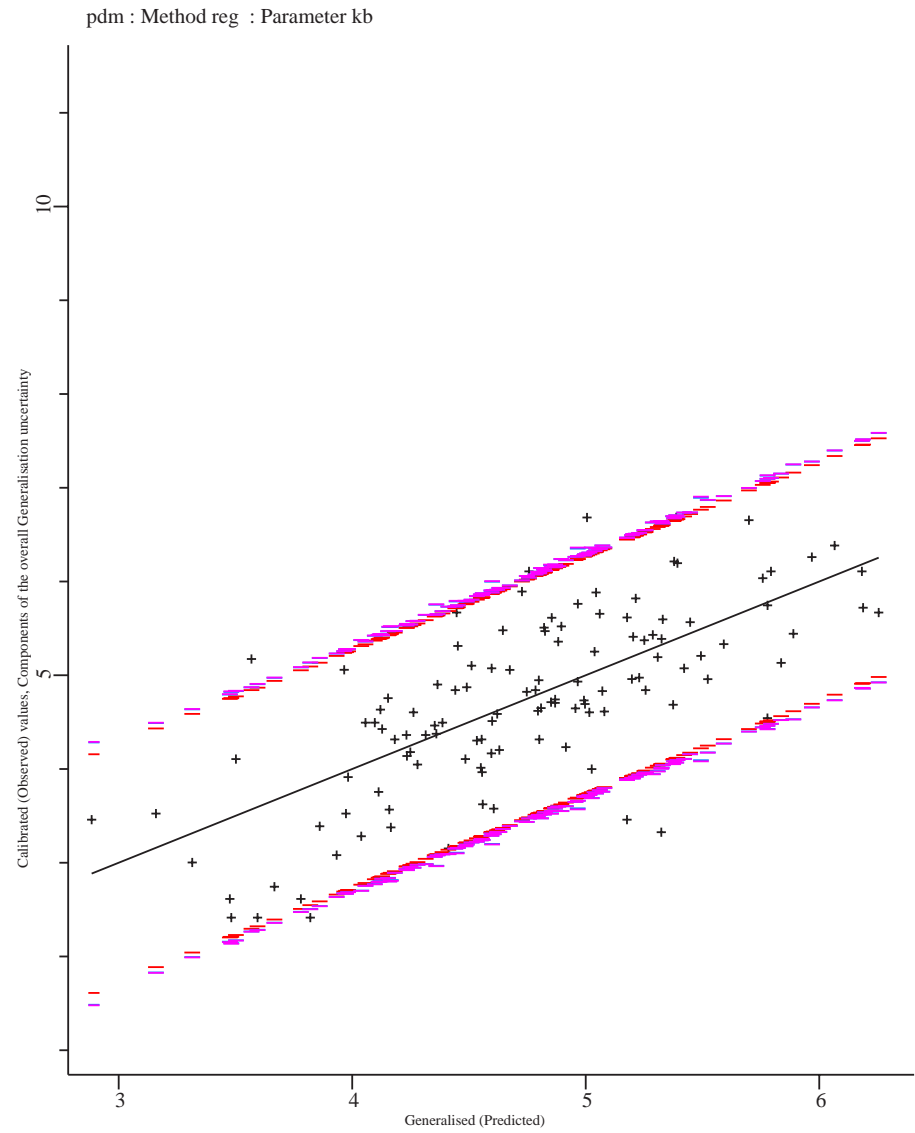
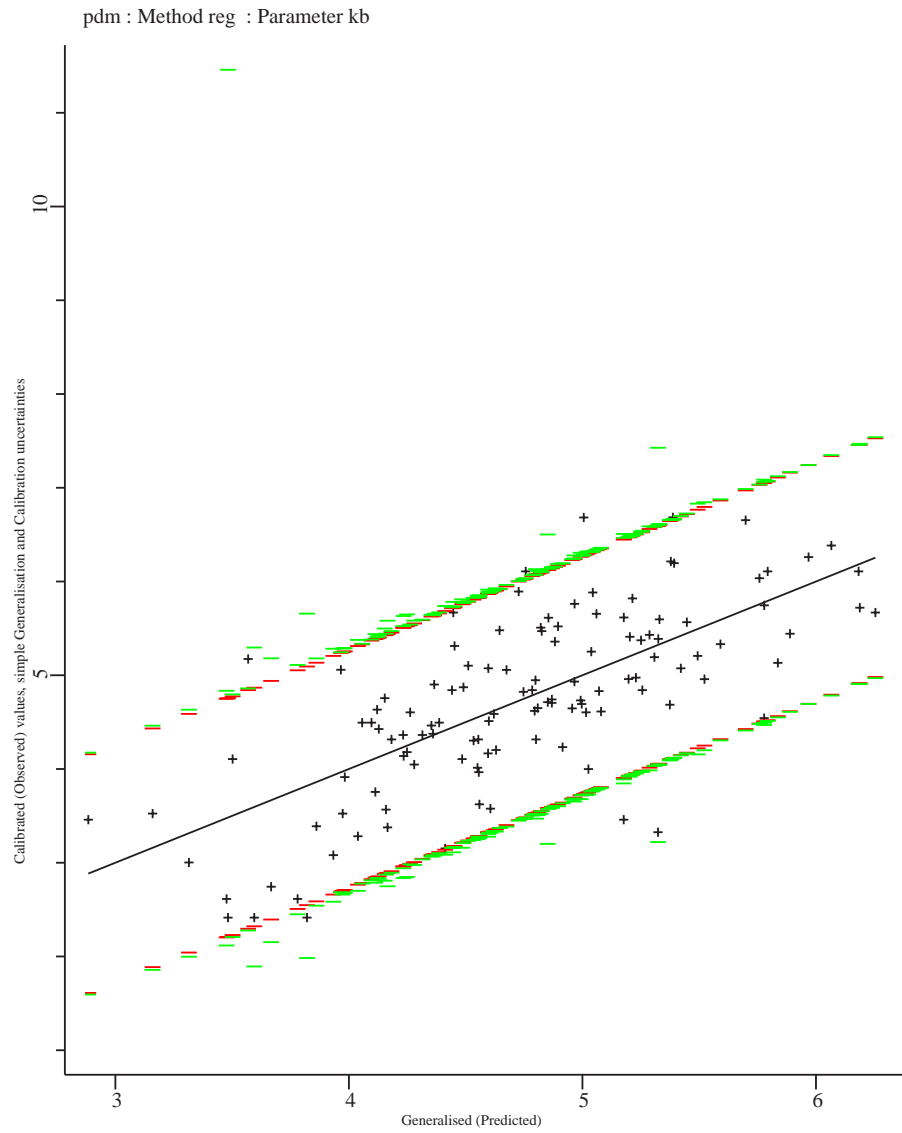


Figure C.8 Calibrated and generalised parameter values, with uncertainty bounds: parameter “kb” of the PDM model; generalisation by regression. See text and Table C.1 for description.

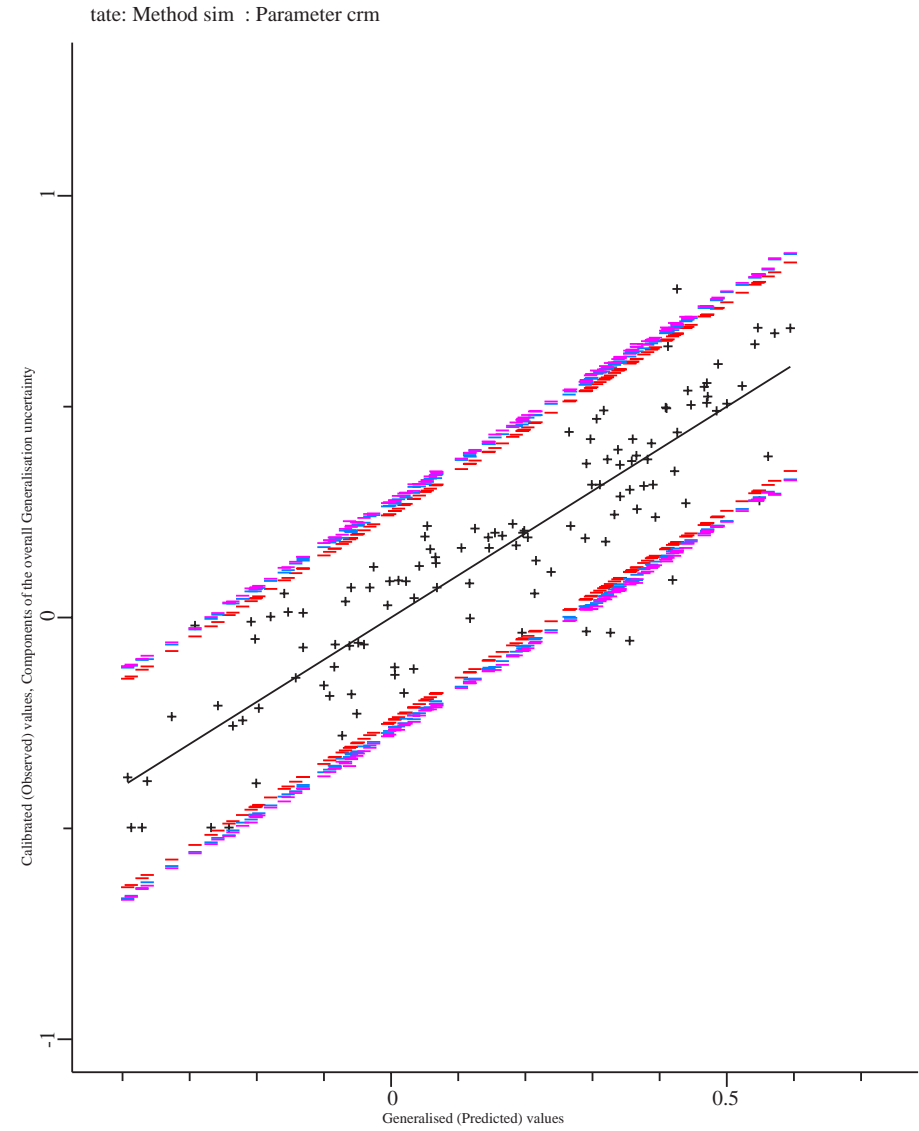
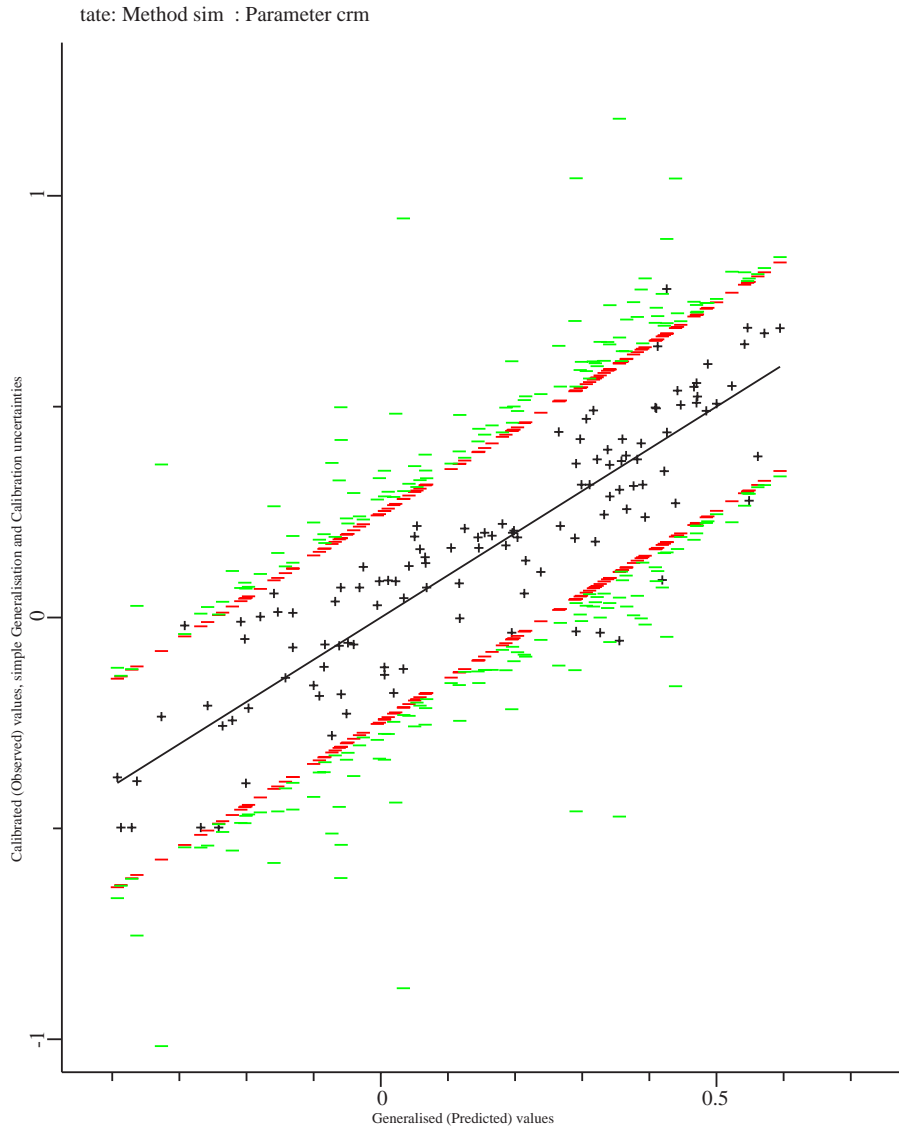


Figure C.9 Calibrated and generalised parameter values, with uncertainty bounds: parameter “crm” of the TATE model; generalisation by site-similarity. See text and Table C.1 for description.

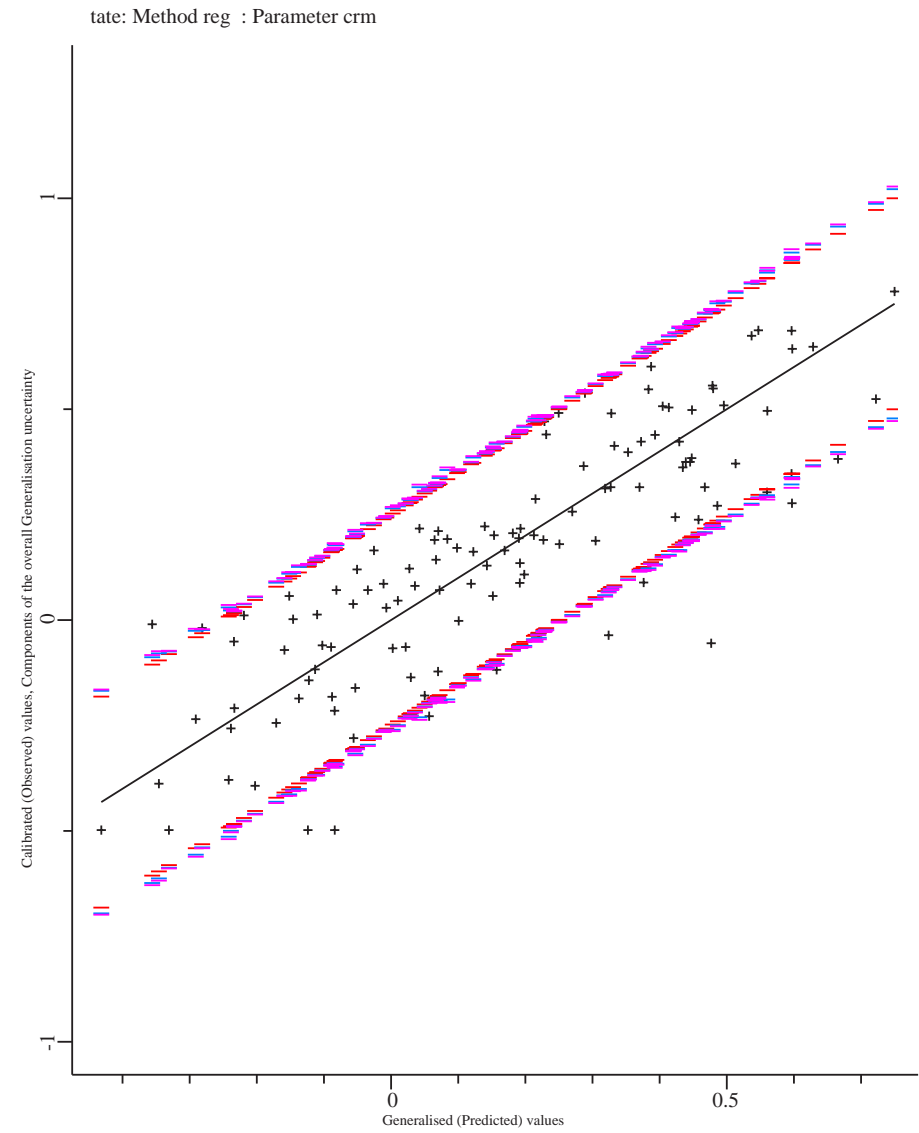
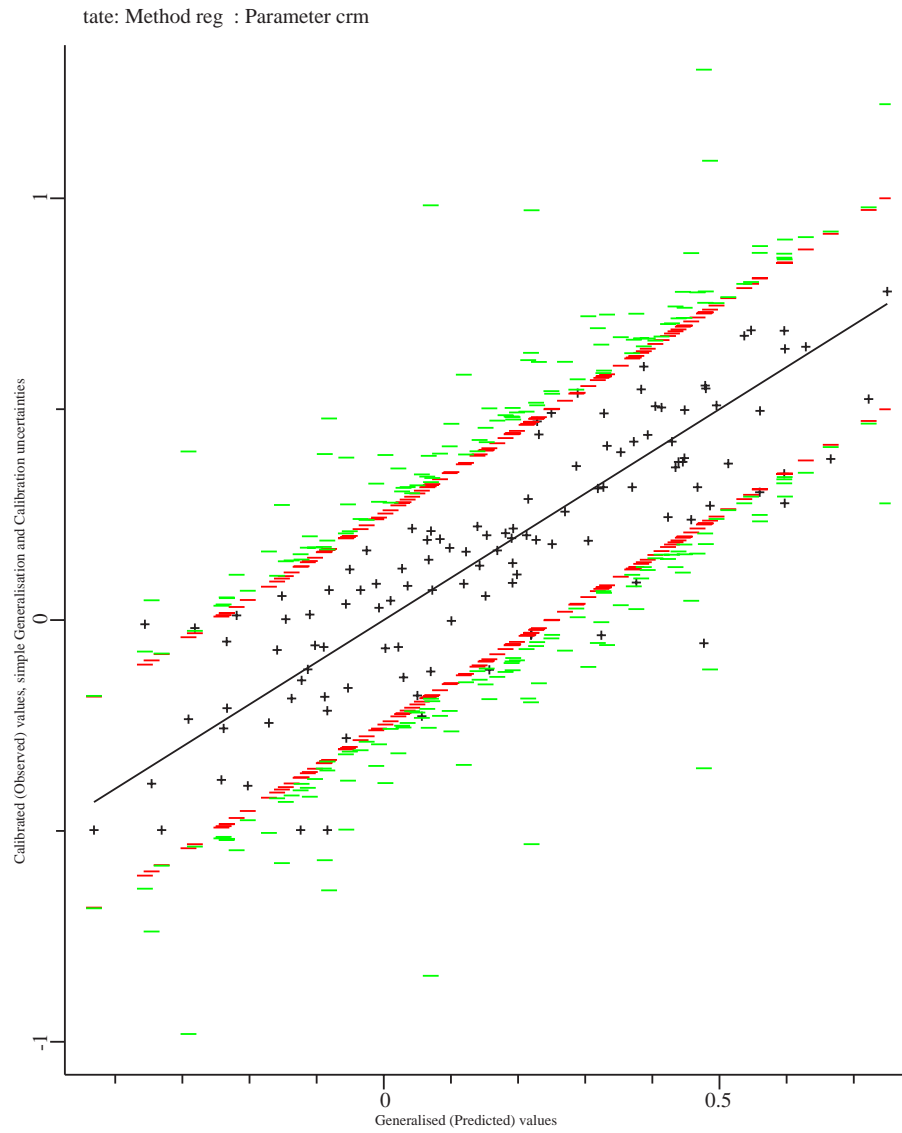


Figure C.10 Calibrated and generalised parameter values, with uncertainty bounds: parameter “crm” of the TATE model; generalisation by regression. See text and Table C.1 for description.

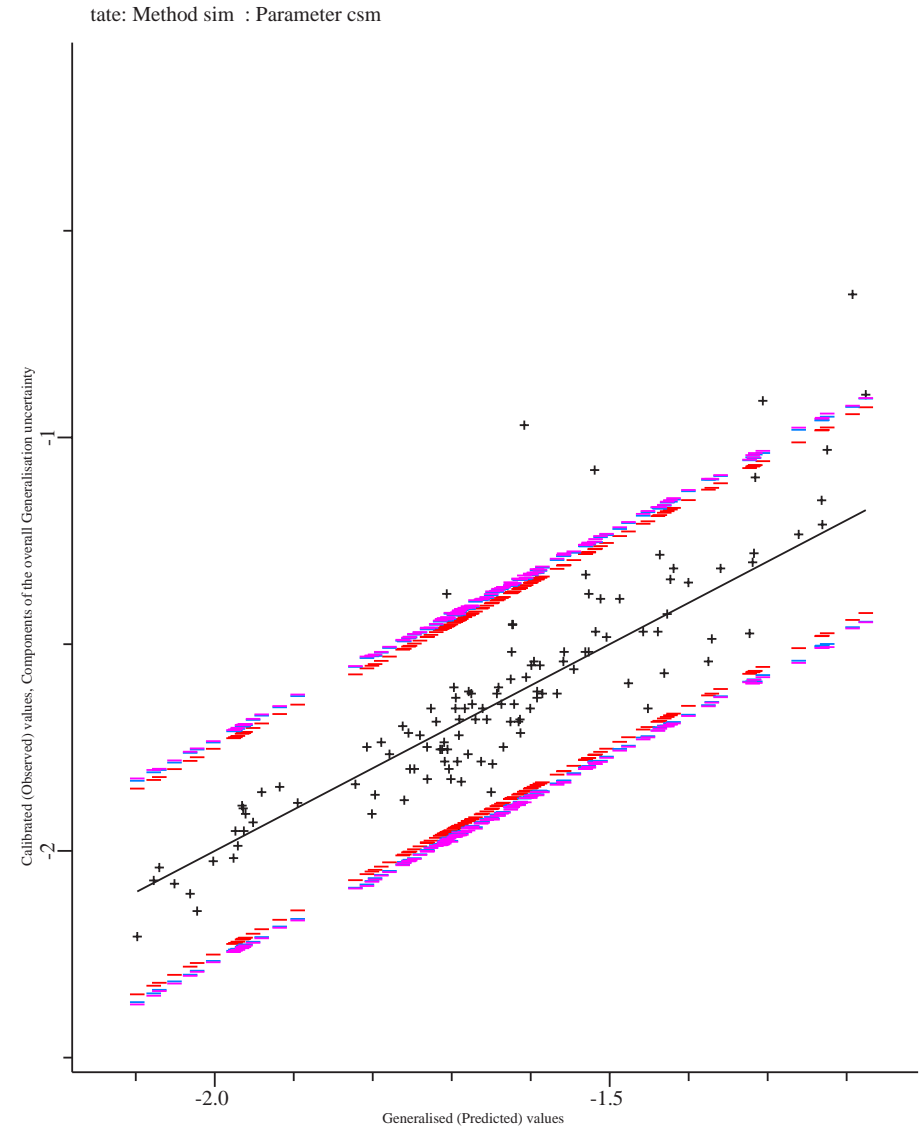
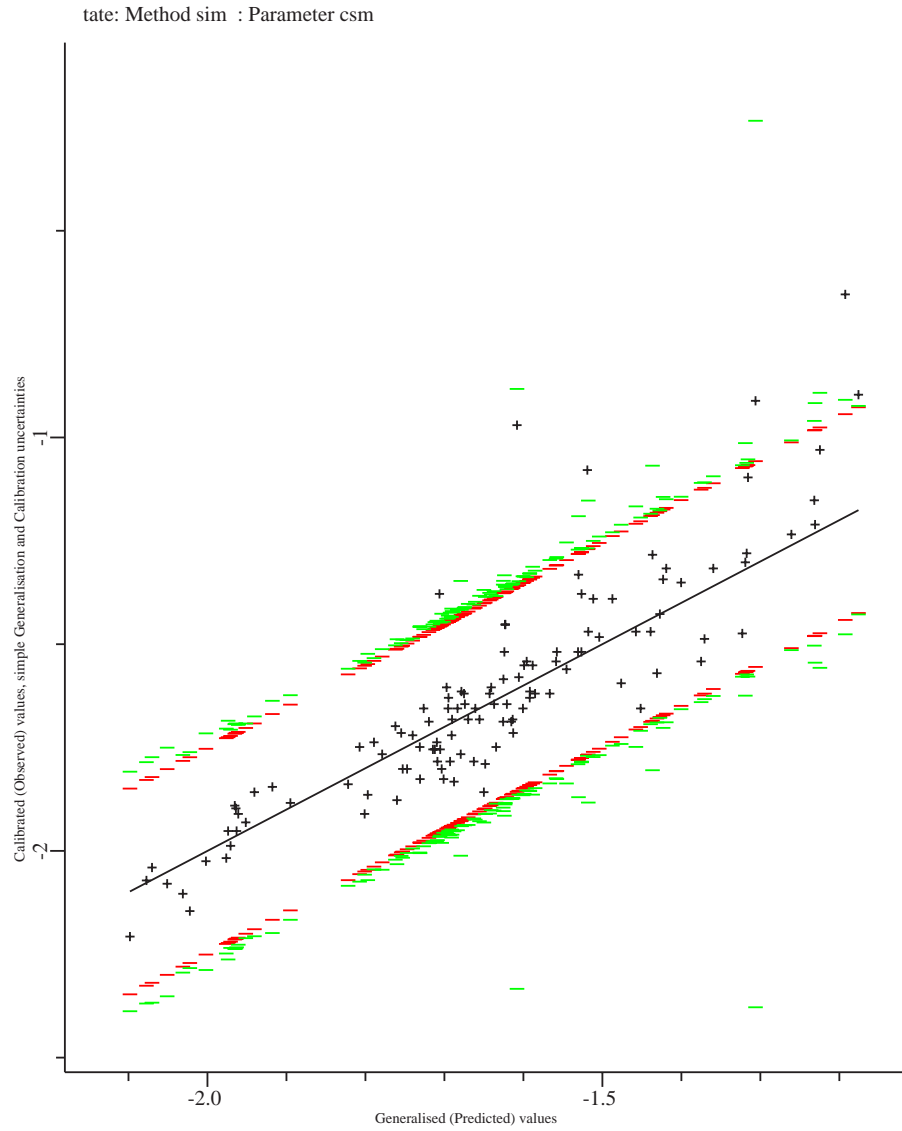


Figure C.11 Calibrated and generalised parameter values, with uncertainty bounds: parameter “csm” of the TATE model; generalisation by site-similarity. See text and Table C.2 for description.

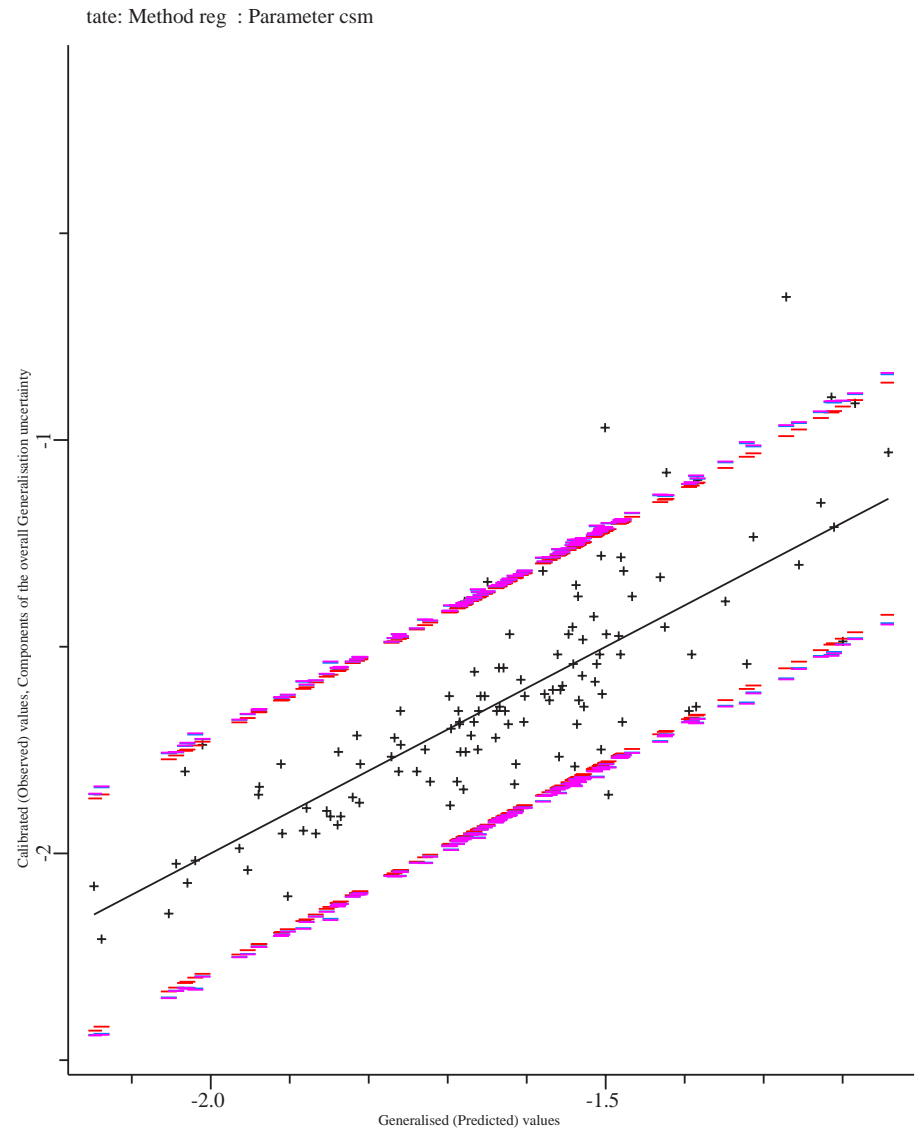
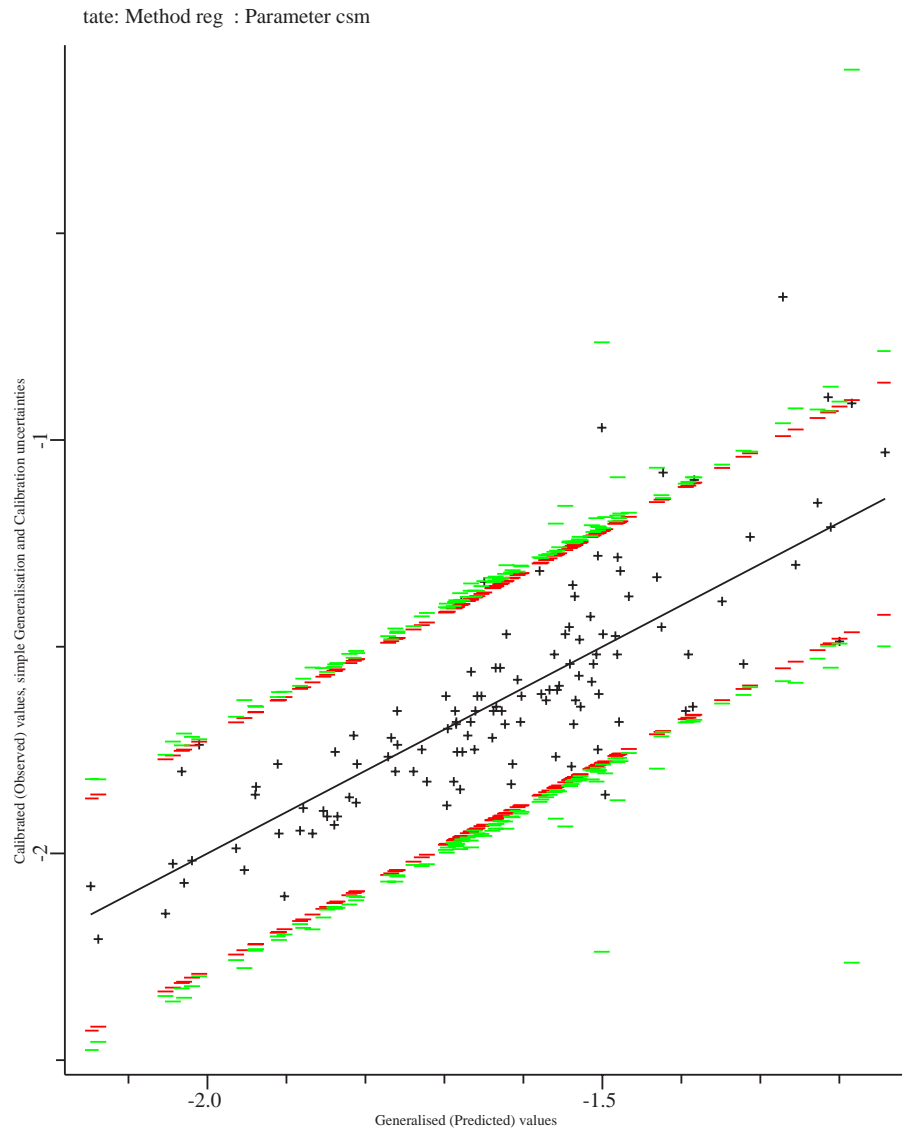


Figure C.12 Calibrated and generalised parameter values, with uncertainty bounds: parameter “csm” of the TATE model; generalisation by regression. See text and Table C.1 for description.

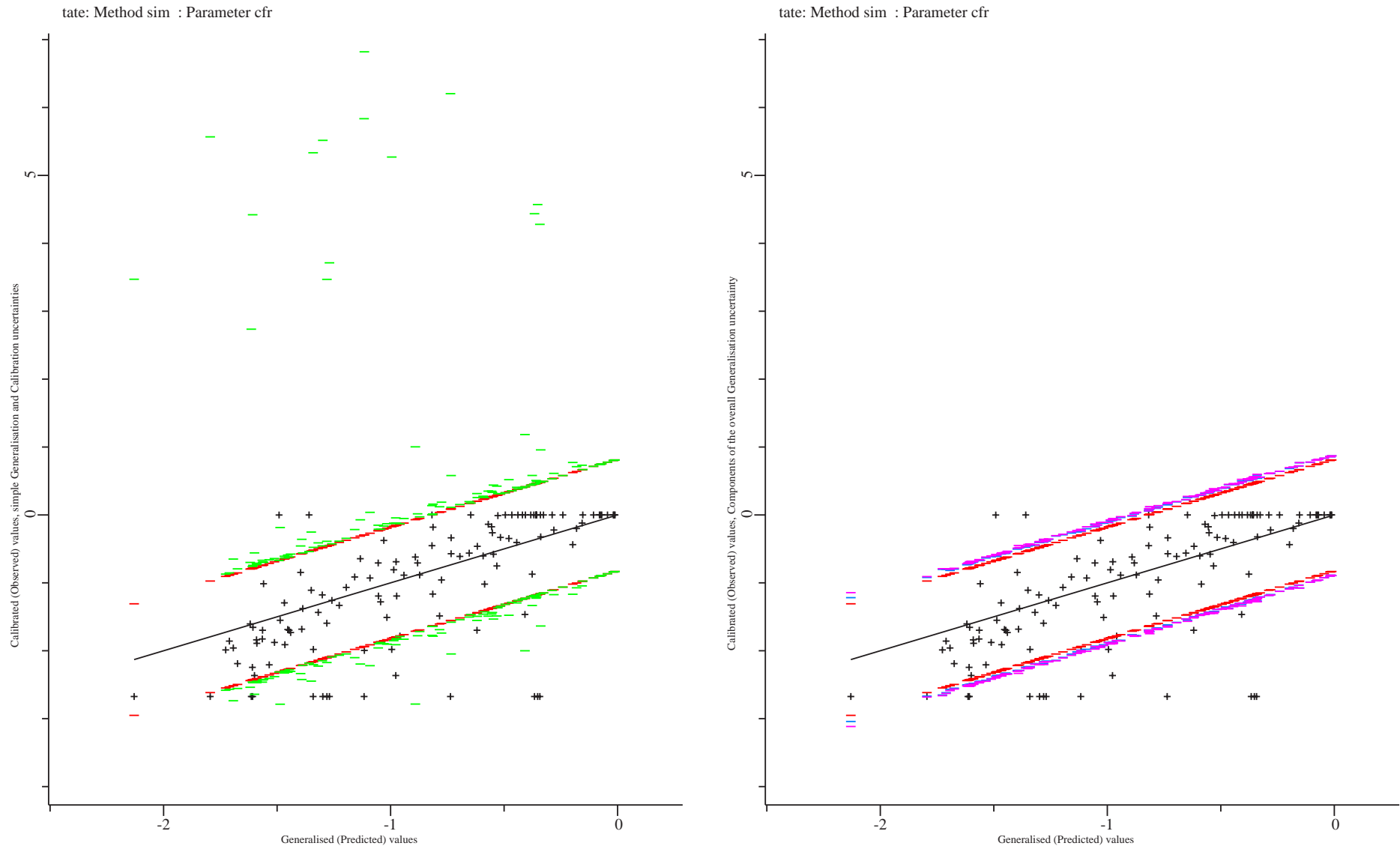


Figure C.13 Calibrated and generalised parameter values, with uncertainty bounds: parameter “cfr” of the TATE model; generalisation by site-similarity. See text and Table C.1 for description.

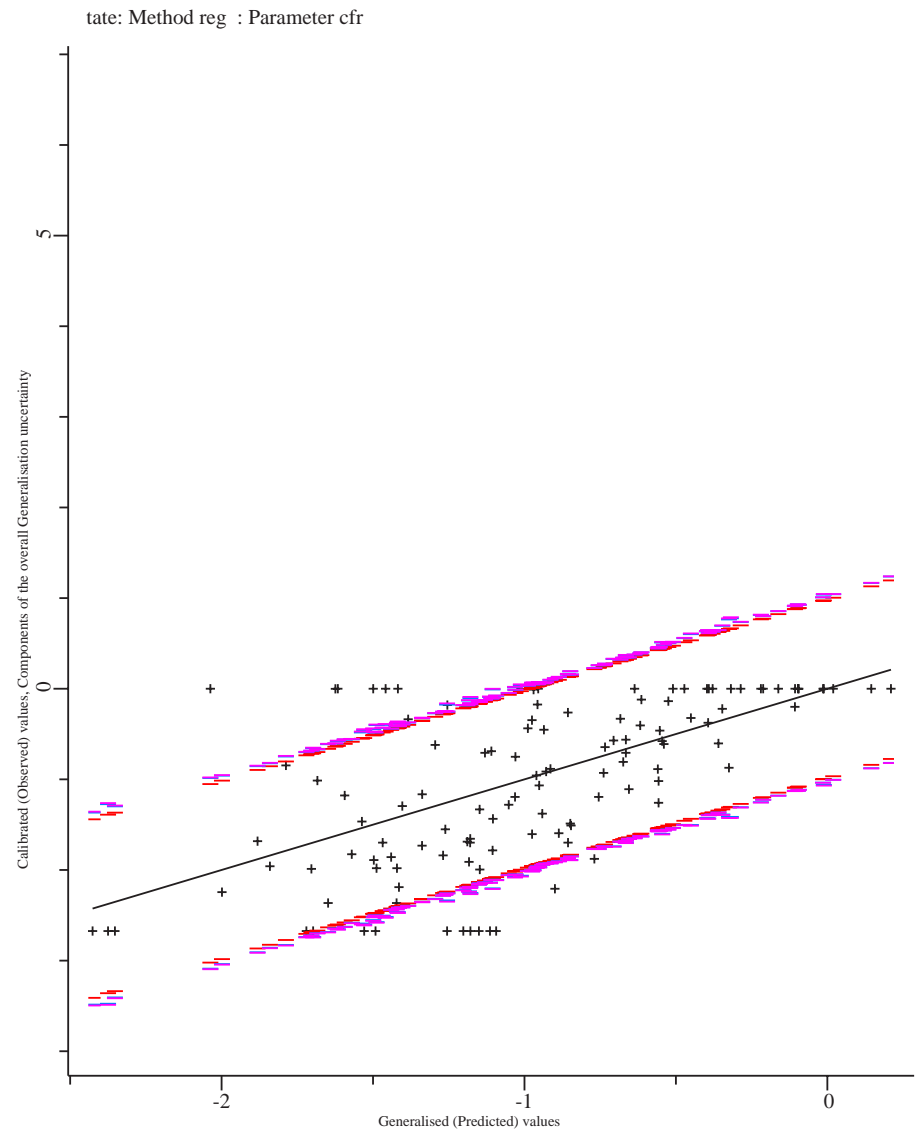
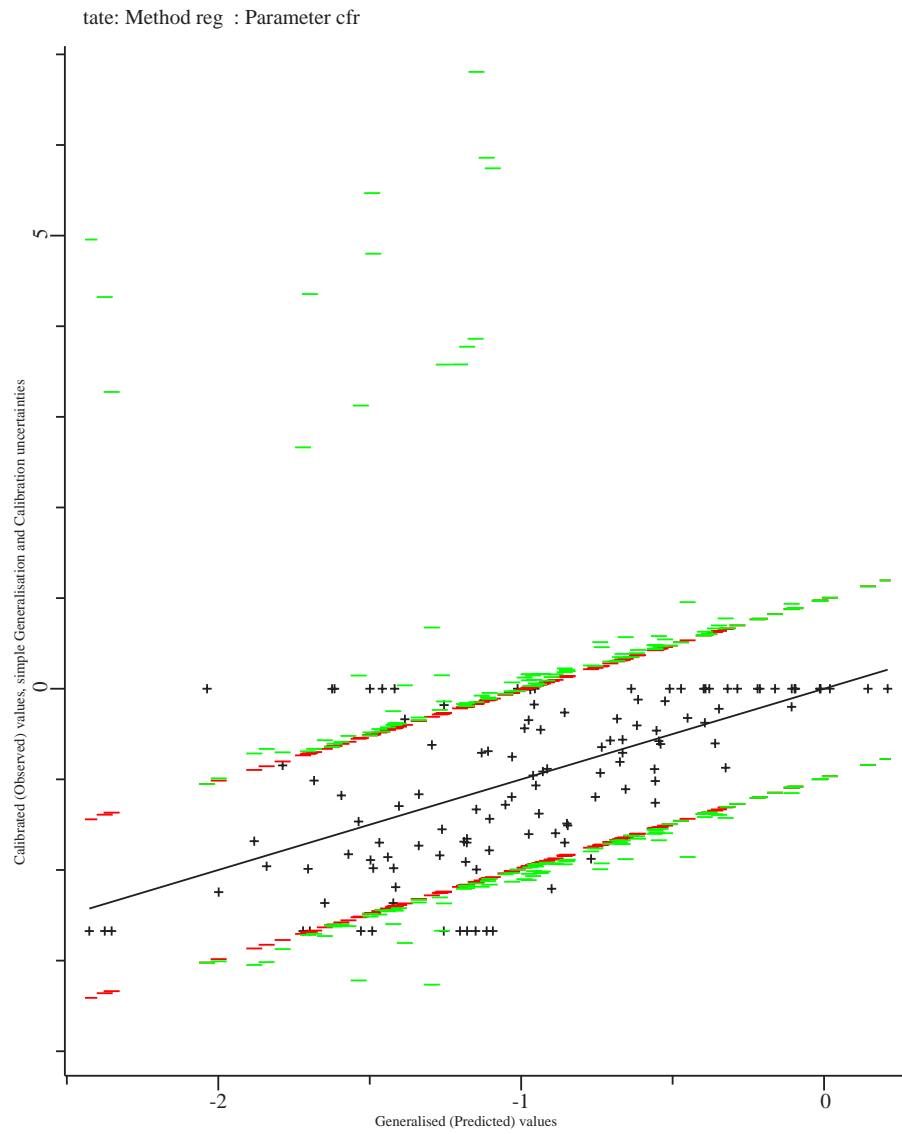


Figure C.14 Calibrated and generalised parameter values, with uncertainty bounds: parameter “cfr” of the TATE model; generalisation by regression. See text and Table C.1 for description.

Appendix D Uncertainty bounds on flood frequency curves

This appendix (pages 109-141) contains figures showing the 90, 95 and 99% uncertainty bounds on the generalised flood frequency curves for each catchment, using each runoff model and both site-similarity and univariate regression generalisation.

Key to figures in this Appendix:

Black dotted line and open circles: flood frequency from observed flows;

Black dashed line and open squares: flood frequency from flows simulated with calibrated parameter values;

Black solid line and filled squares: flood frequency from flows simulated with generalised parameter values;

Blue central dot-dash line: median flood frequency from 1000 parameter sets;

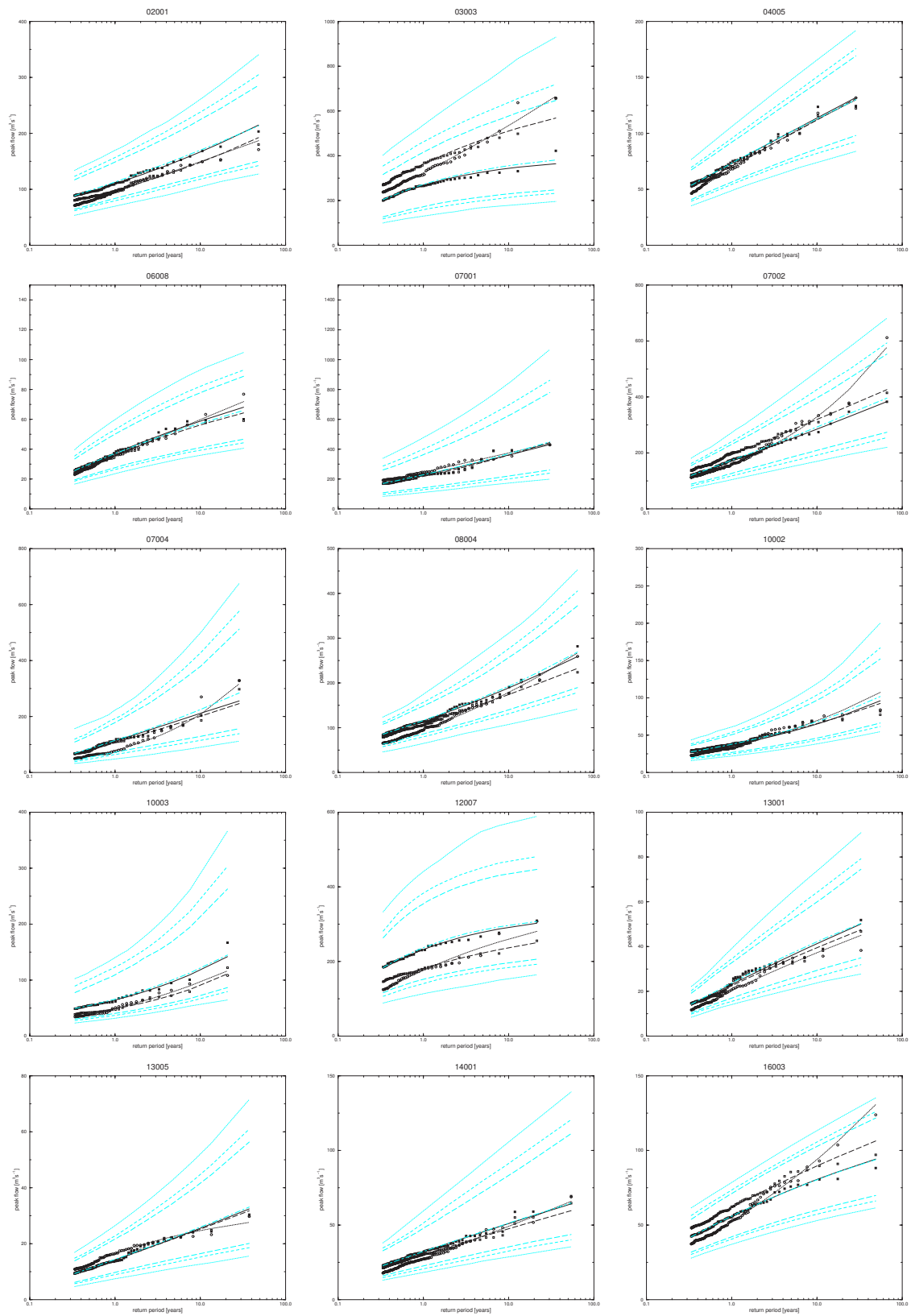
Blue long-dashed lines: upper and lower 90% uncertainty bounds from 1000 parameter sets;

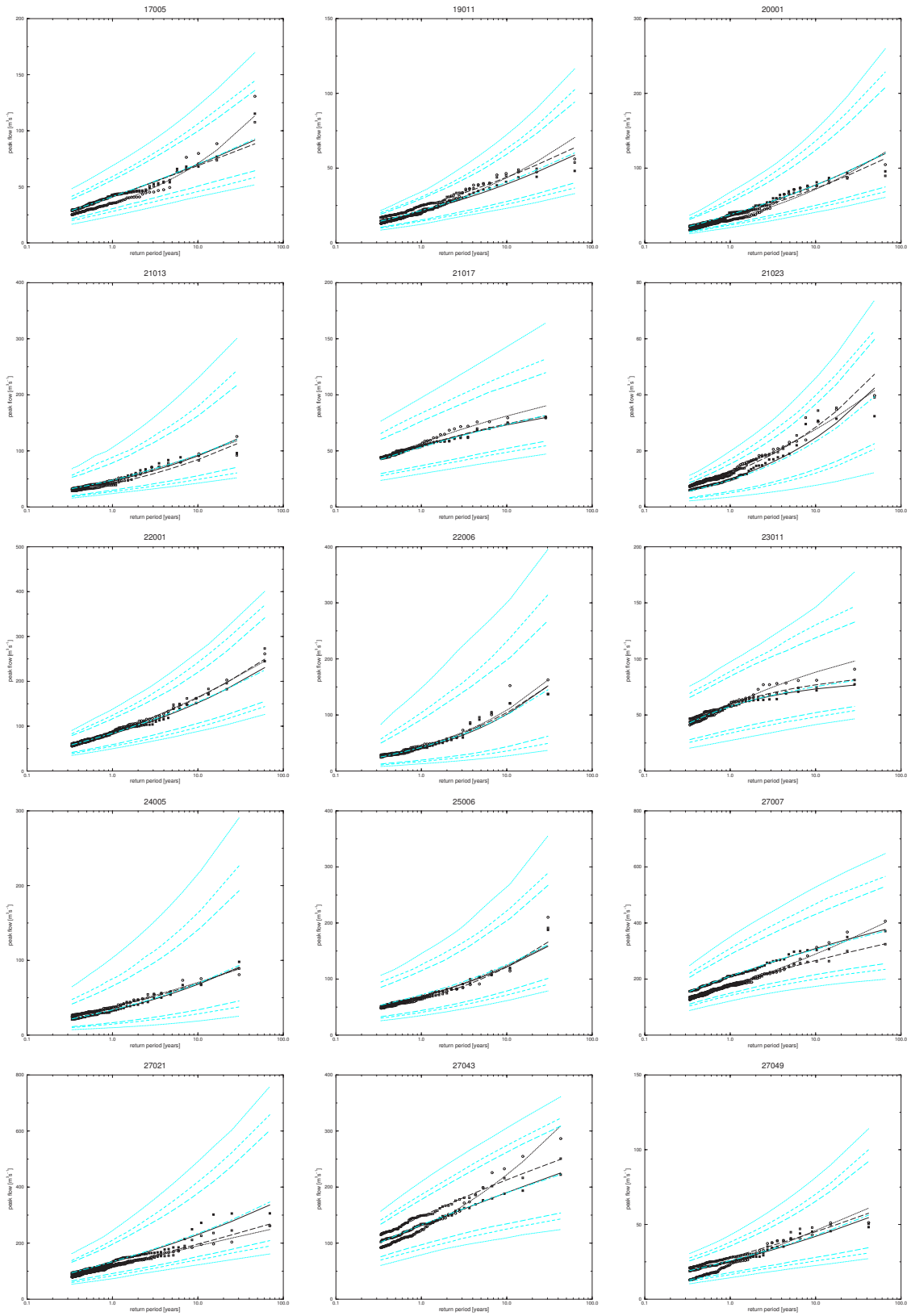
Blue short-dashed lines: upper and lower 95% uncertainty bounds from 1000 parameter sets;

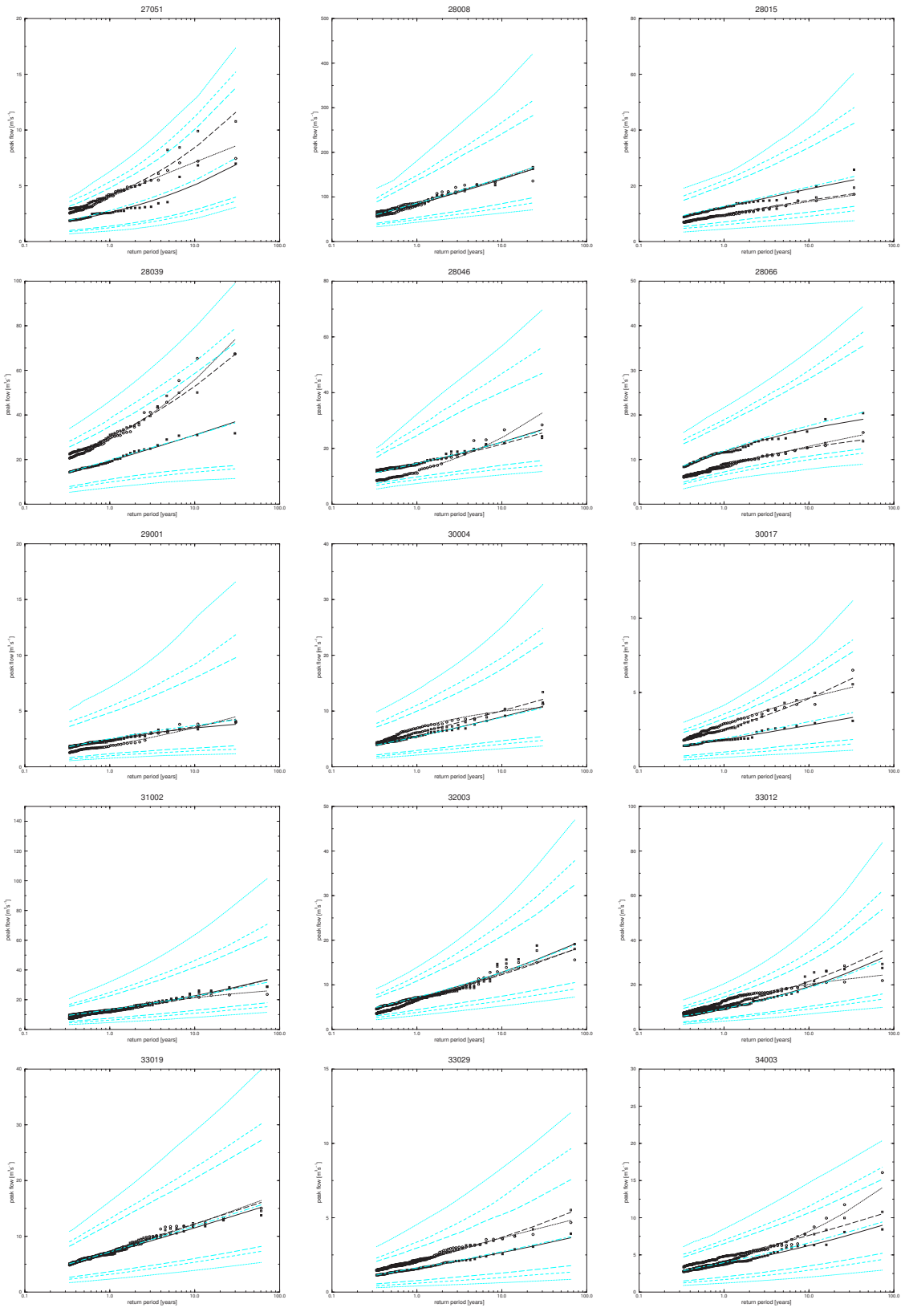
Blue dotted lines: upper and lower 99% uncertainty bounds from 1000 parameter sets.

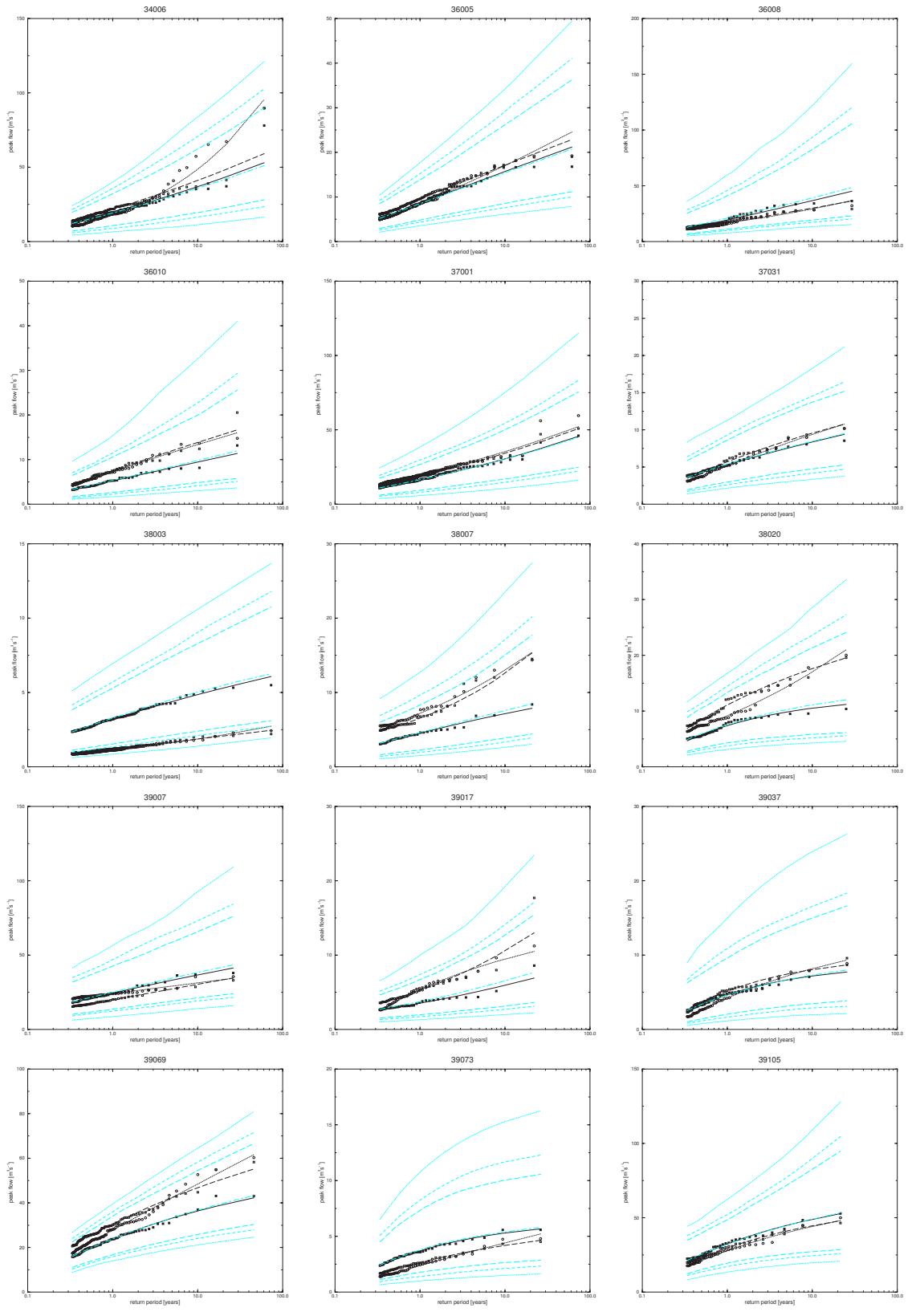
- D.1 PDM site-similarity (pages 110-117)
- D.2 PDM univariate regression (pages 118-125)
- D.3 TATE site-similarity (pages 126-133)
- D.4 TATE univariate regression (pages 134-141)

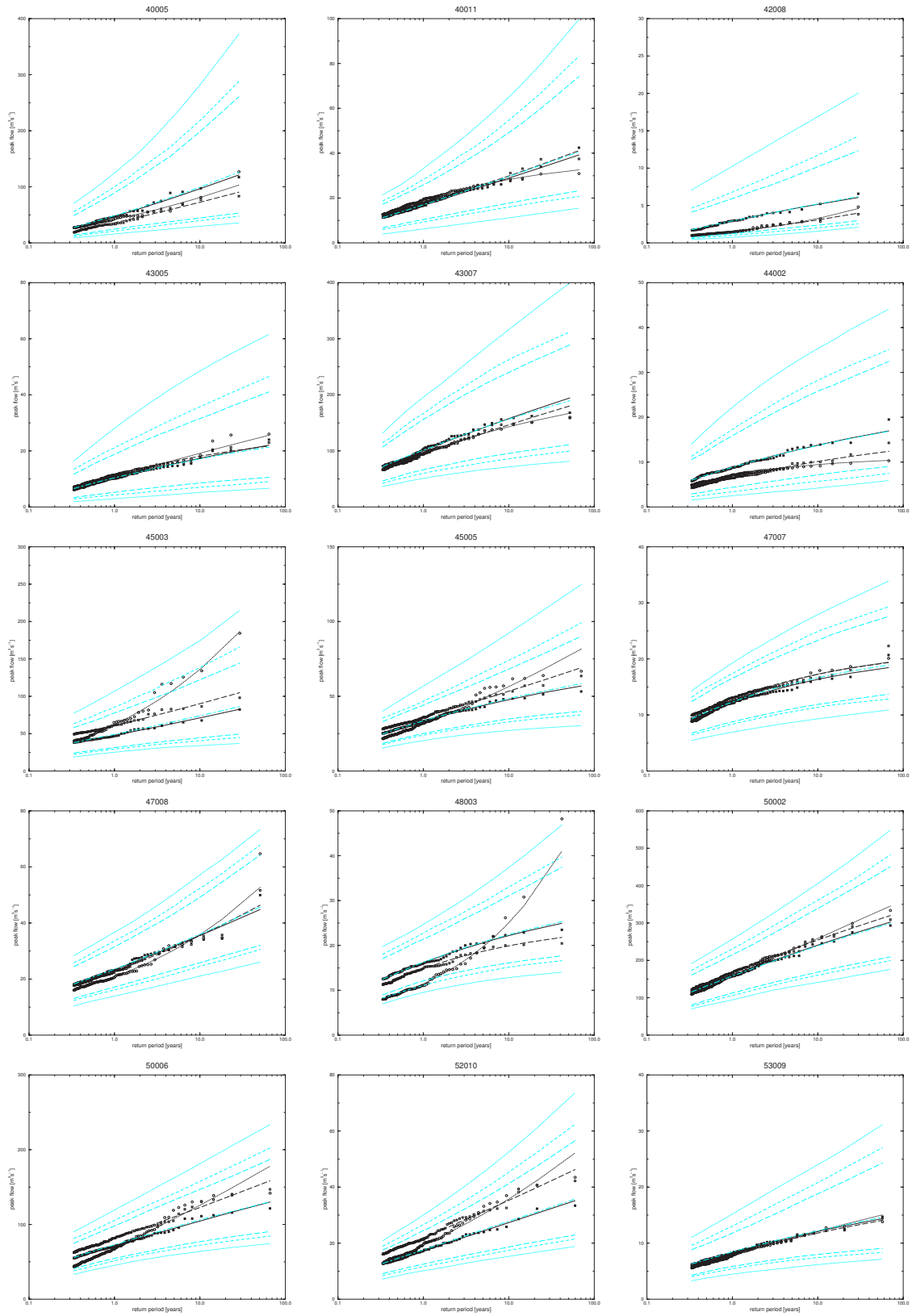
D.1 PDM site-similarity

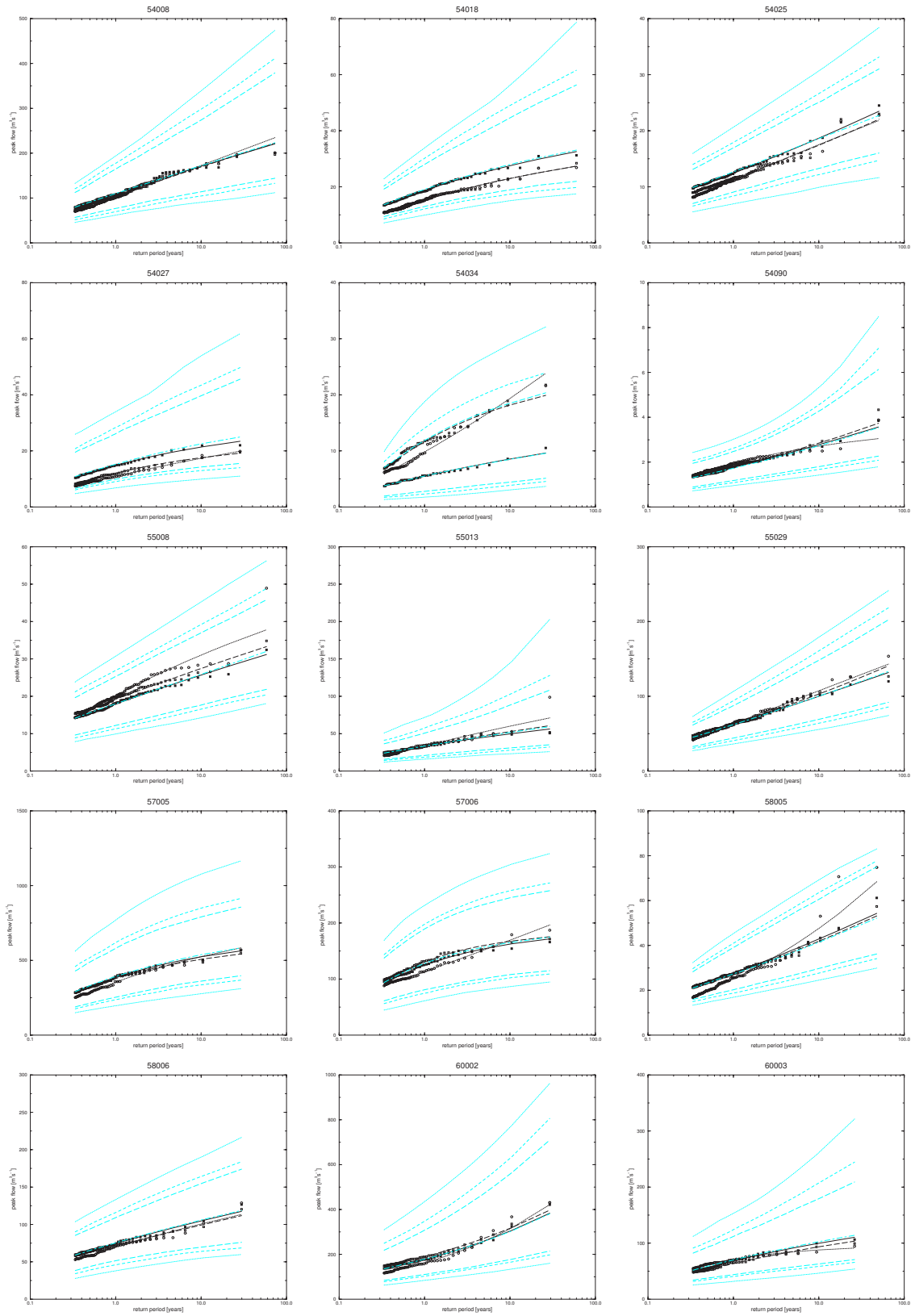


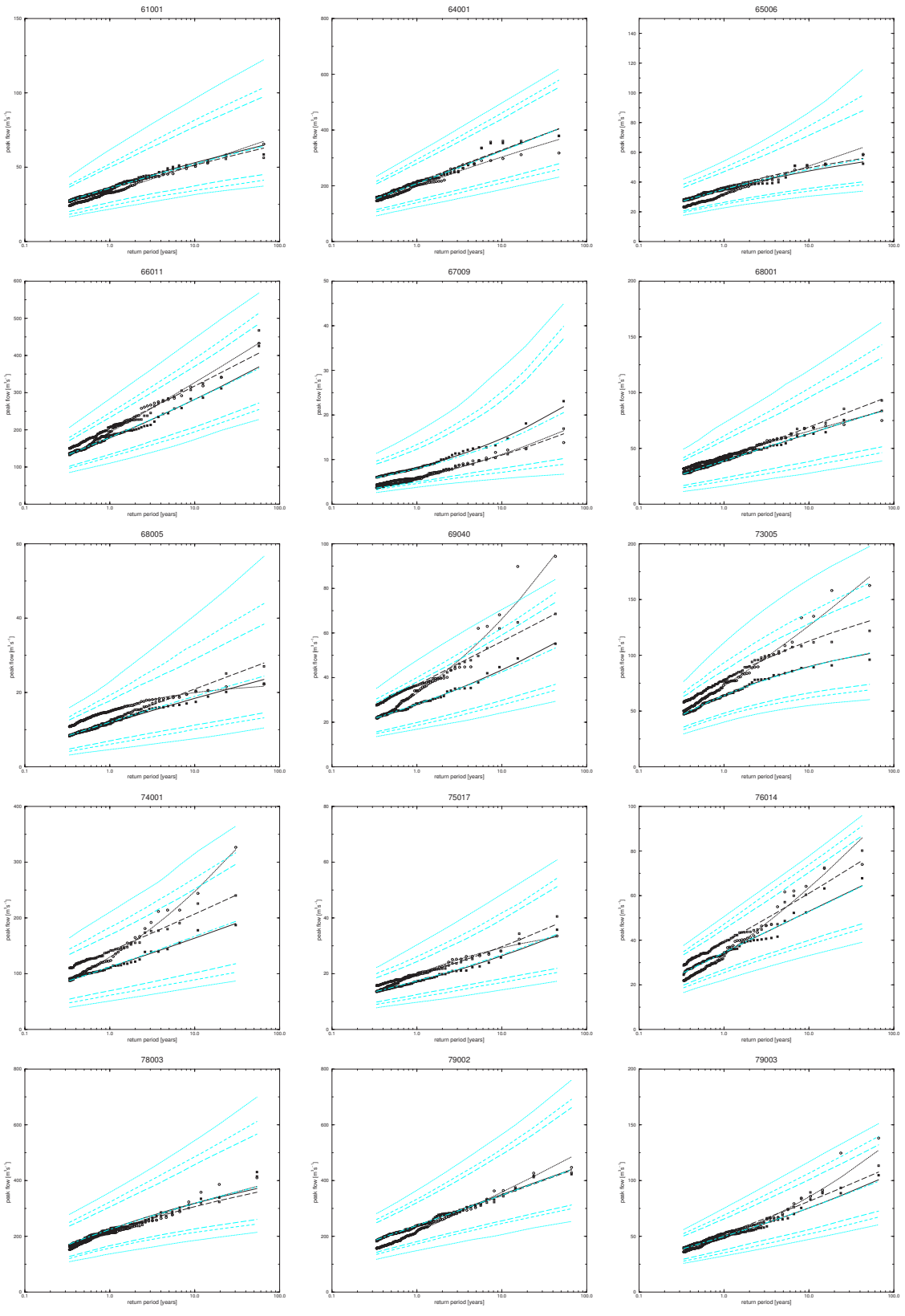


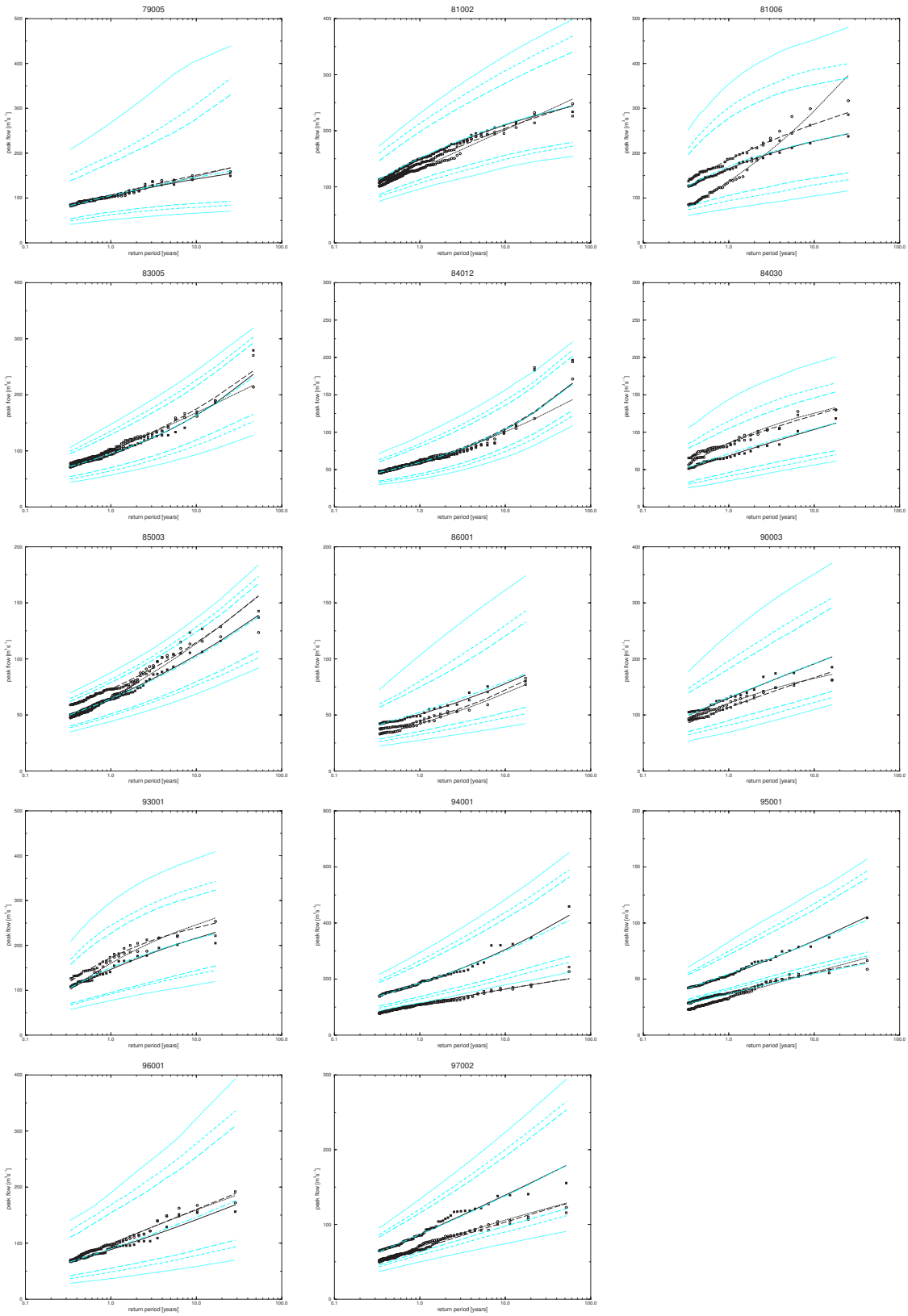




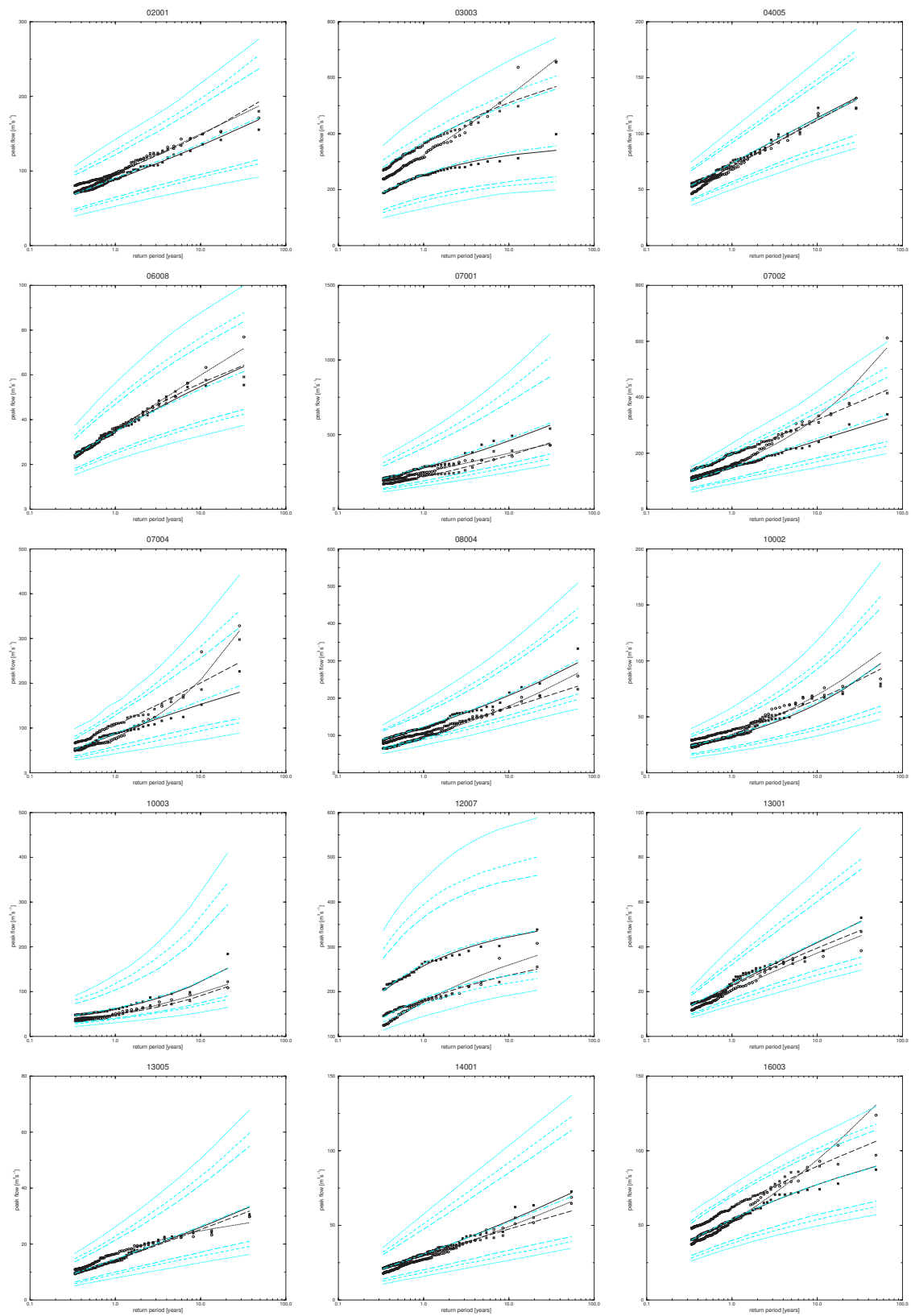


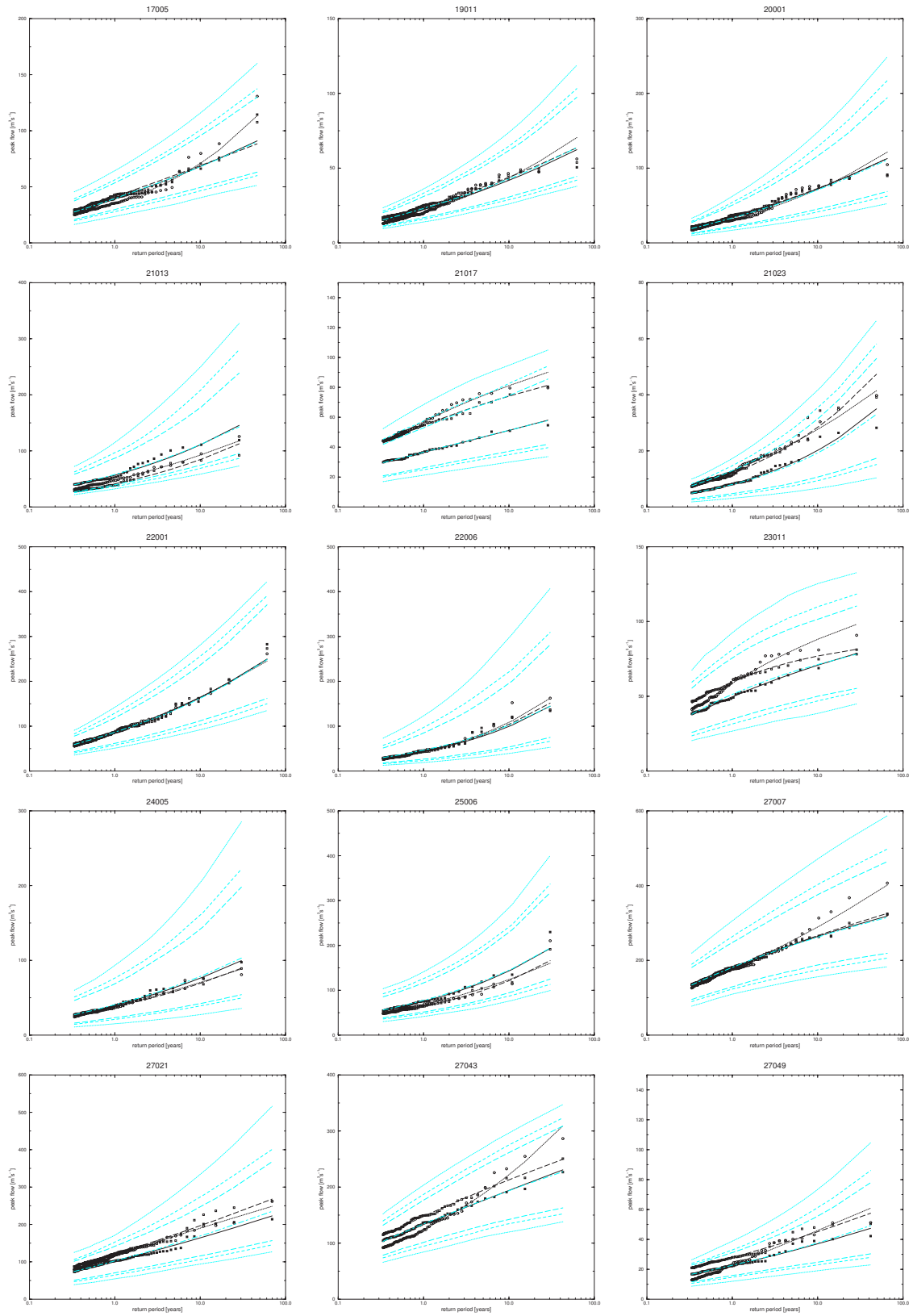


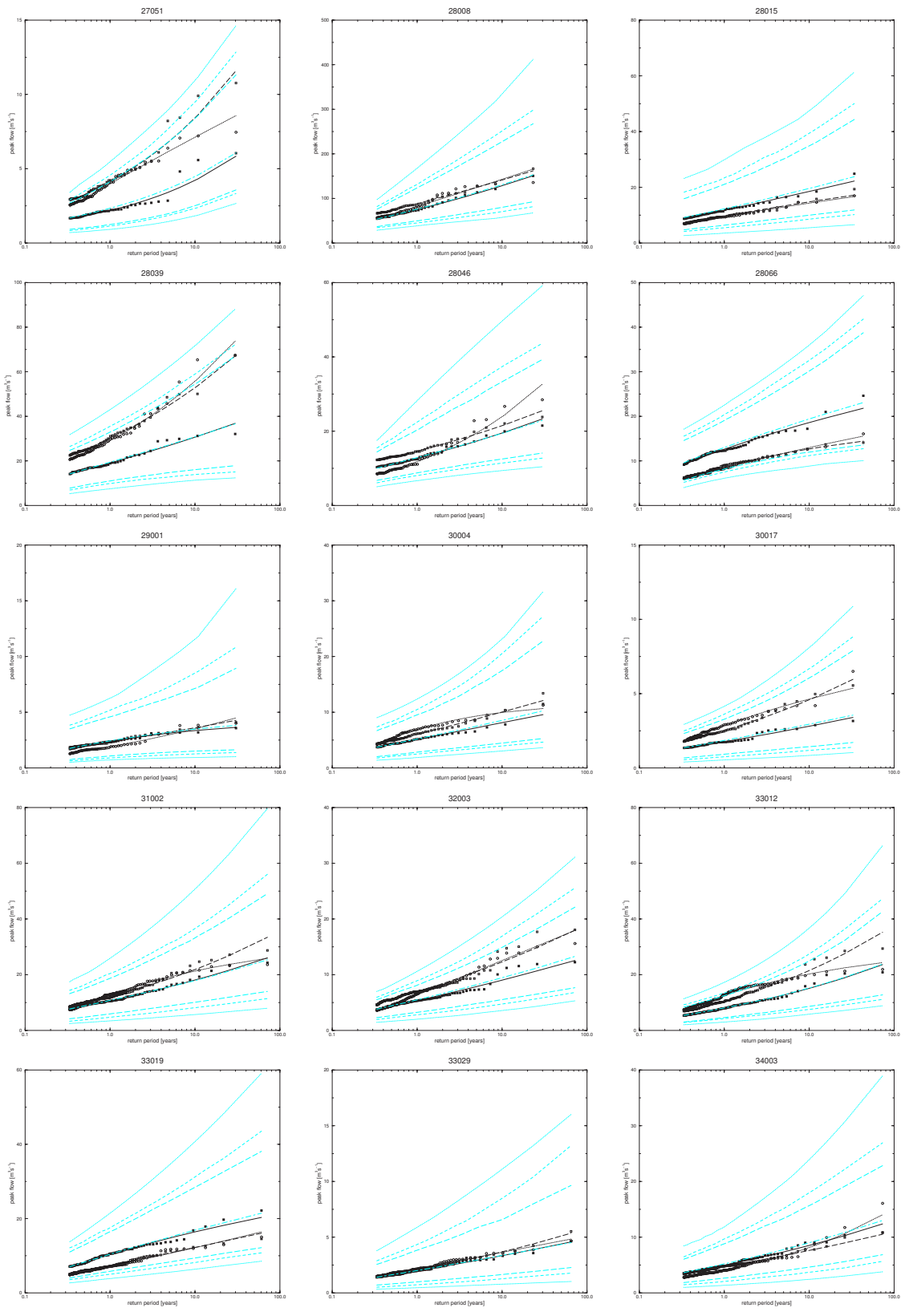


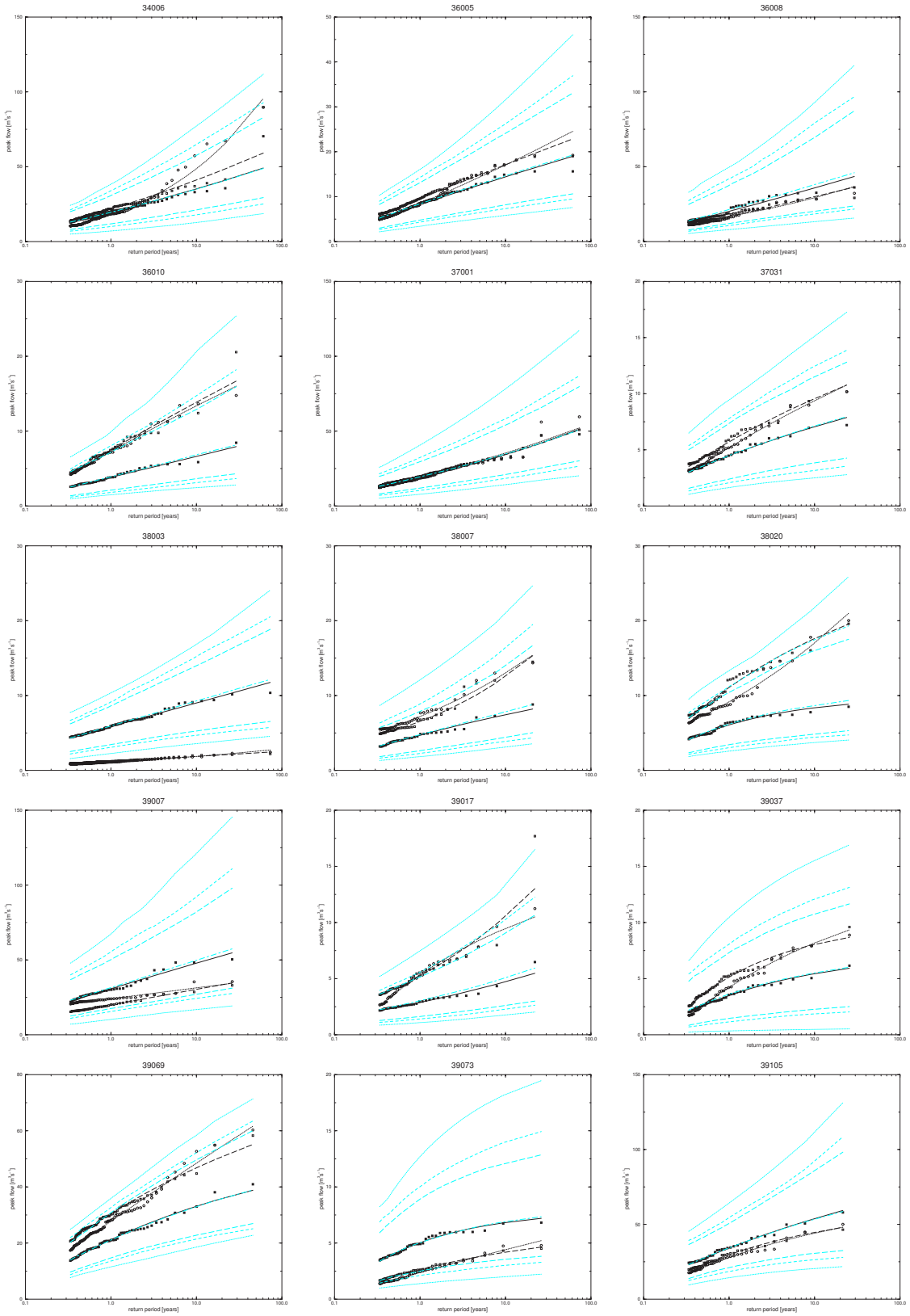


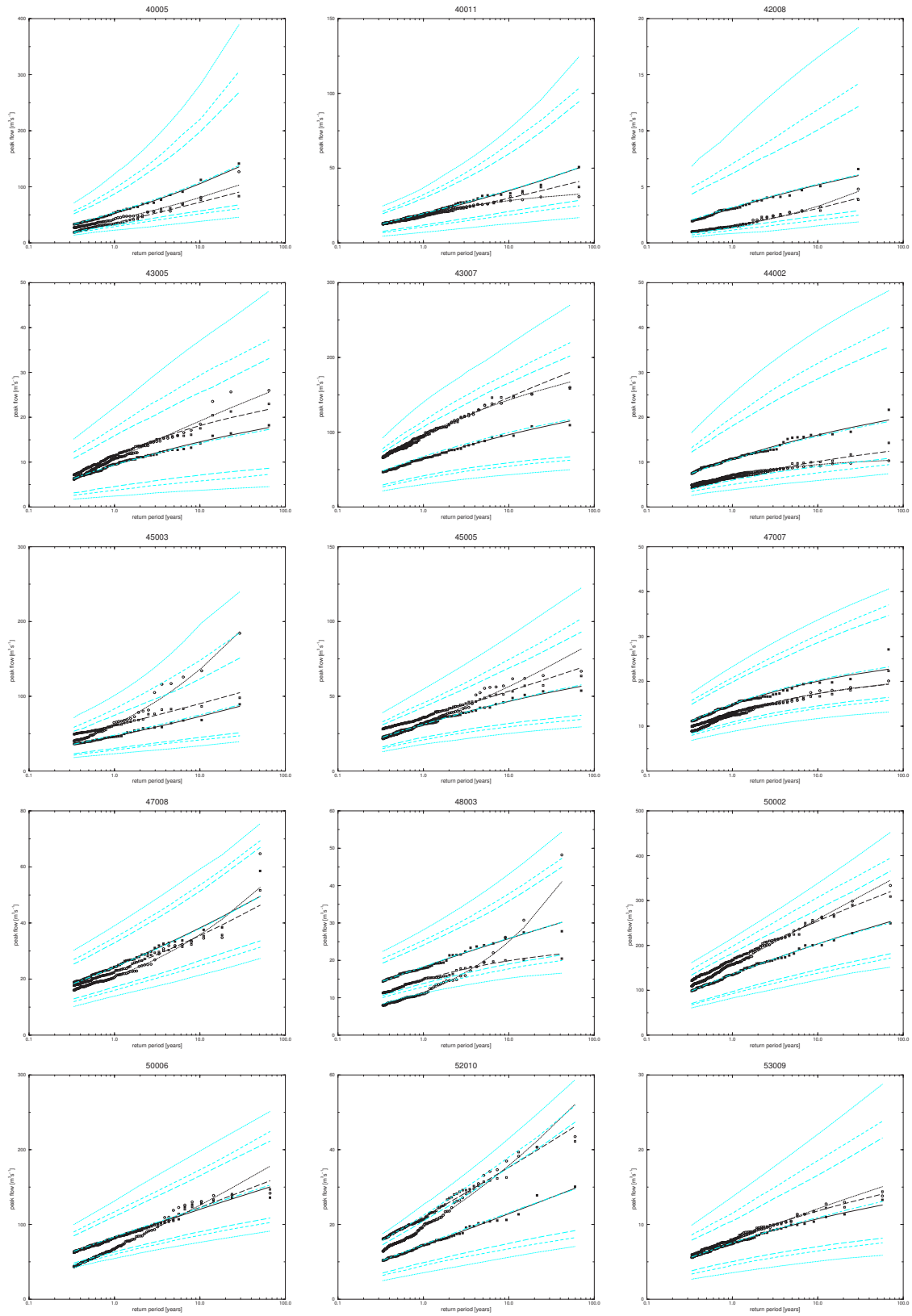
D.2 PDM univariate regression

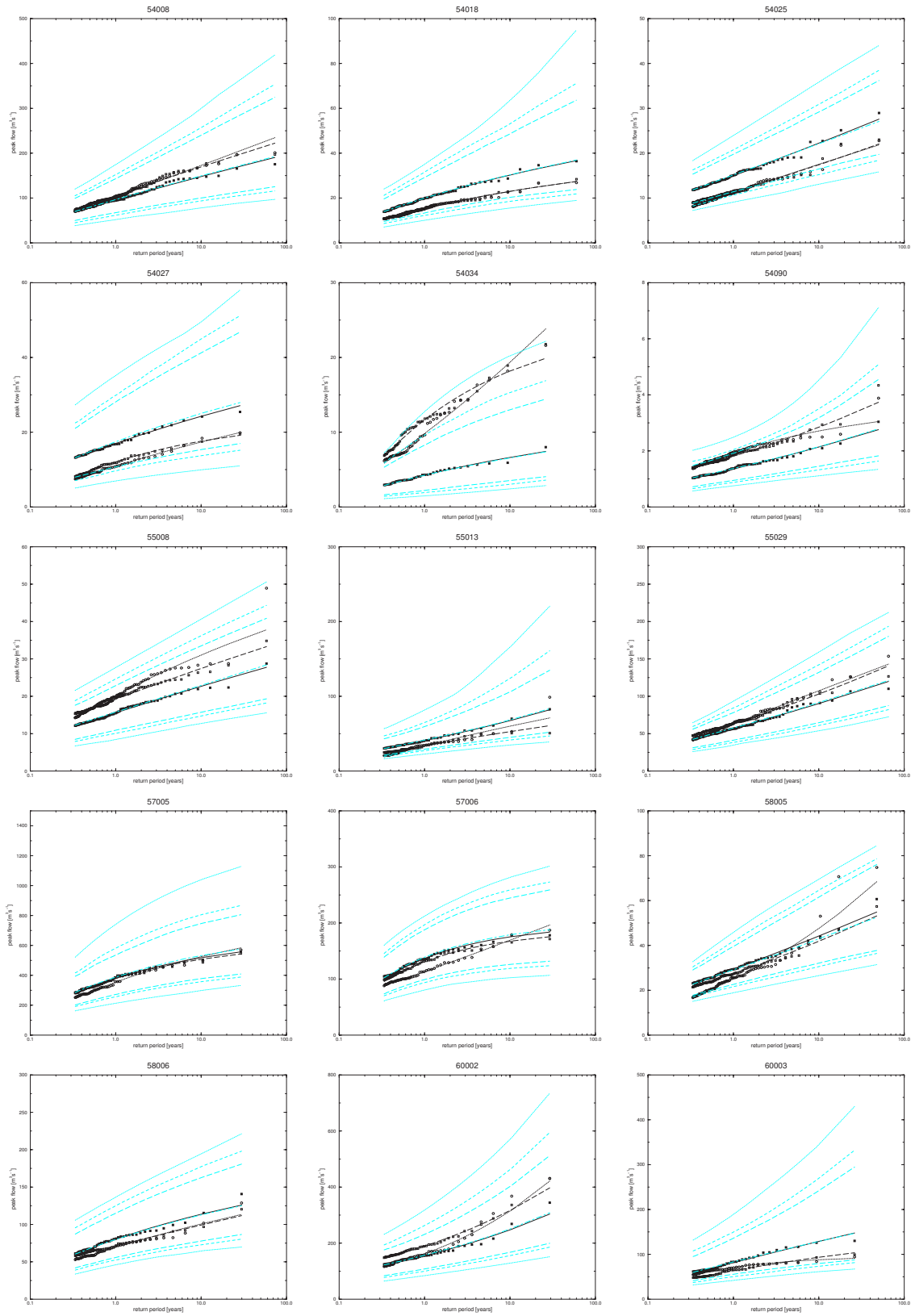


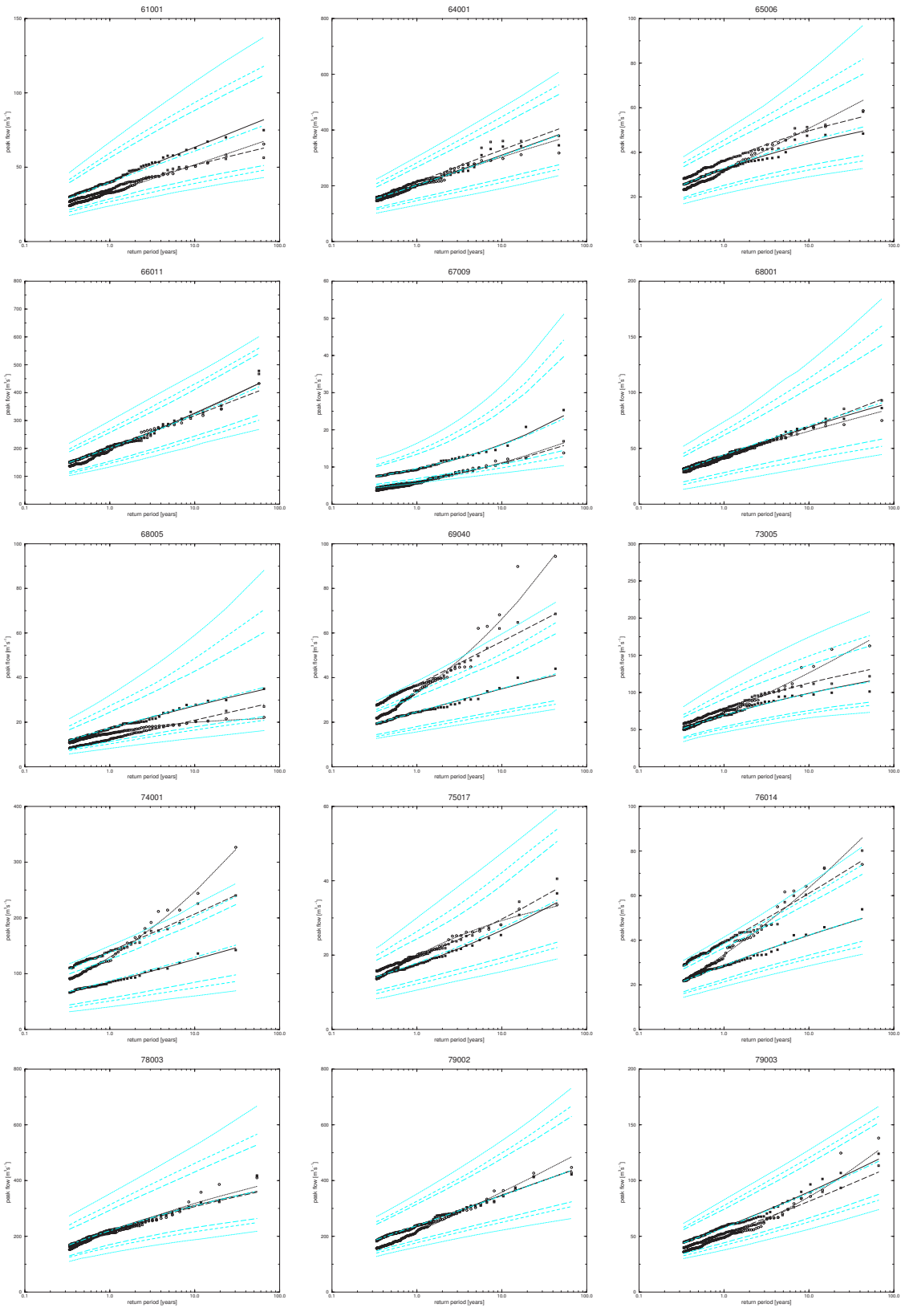


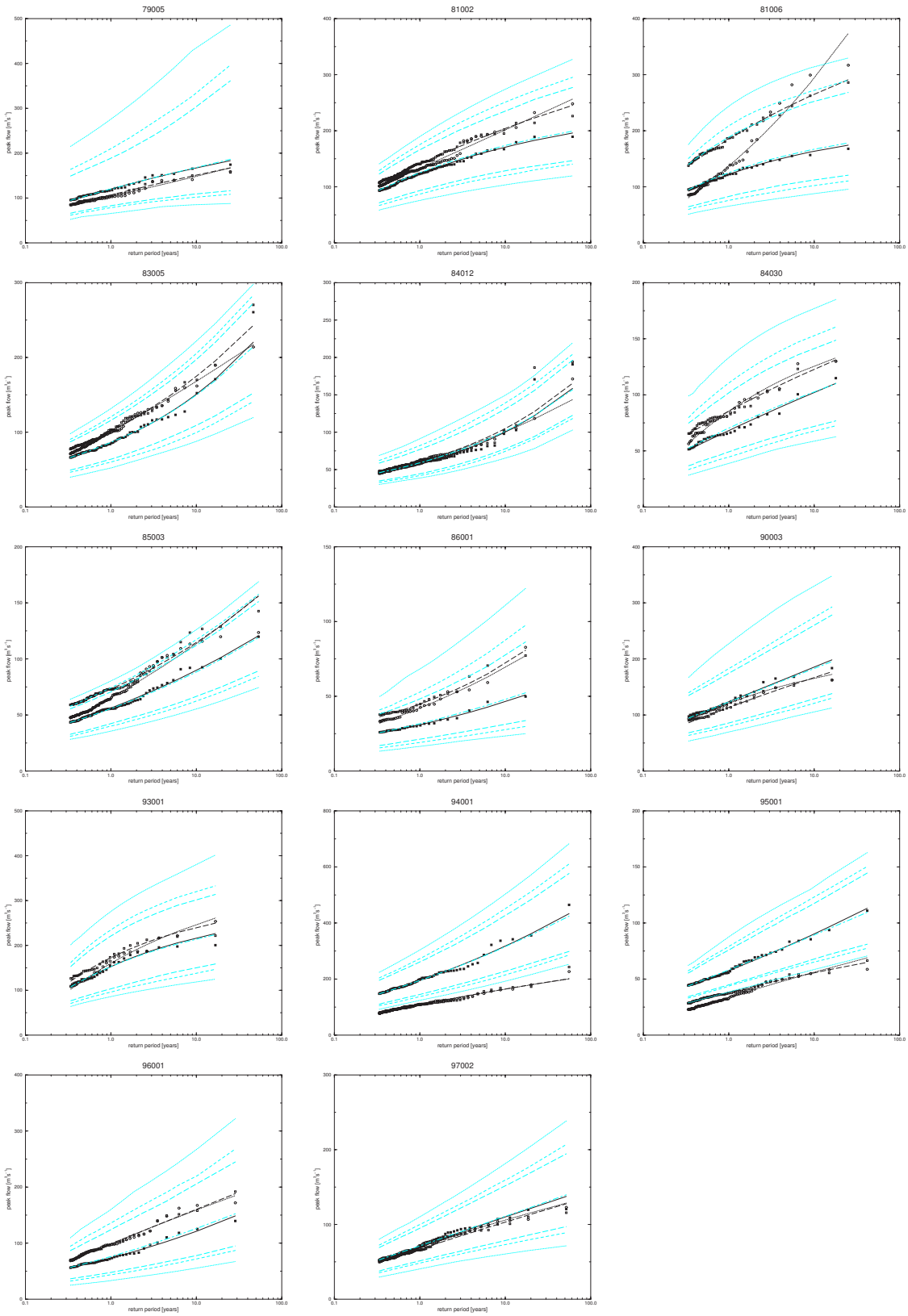




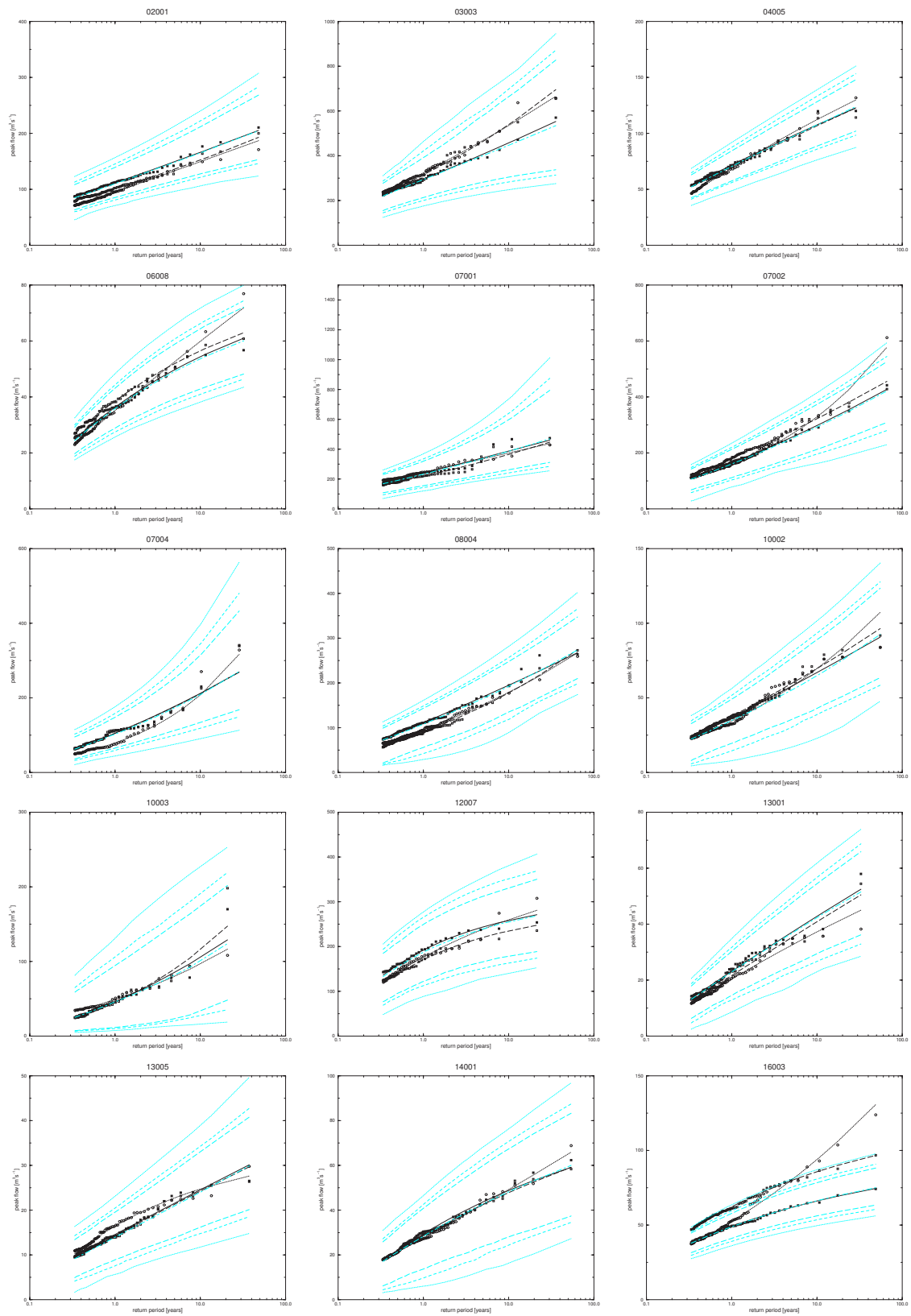


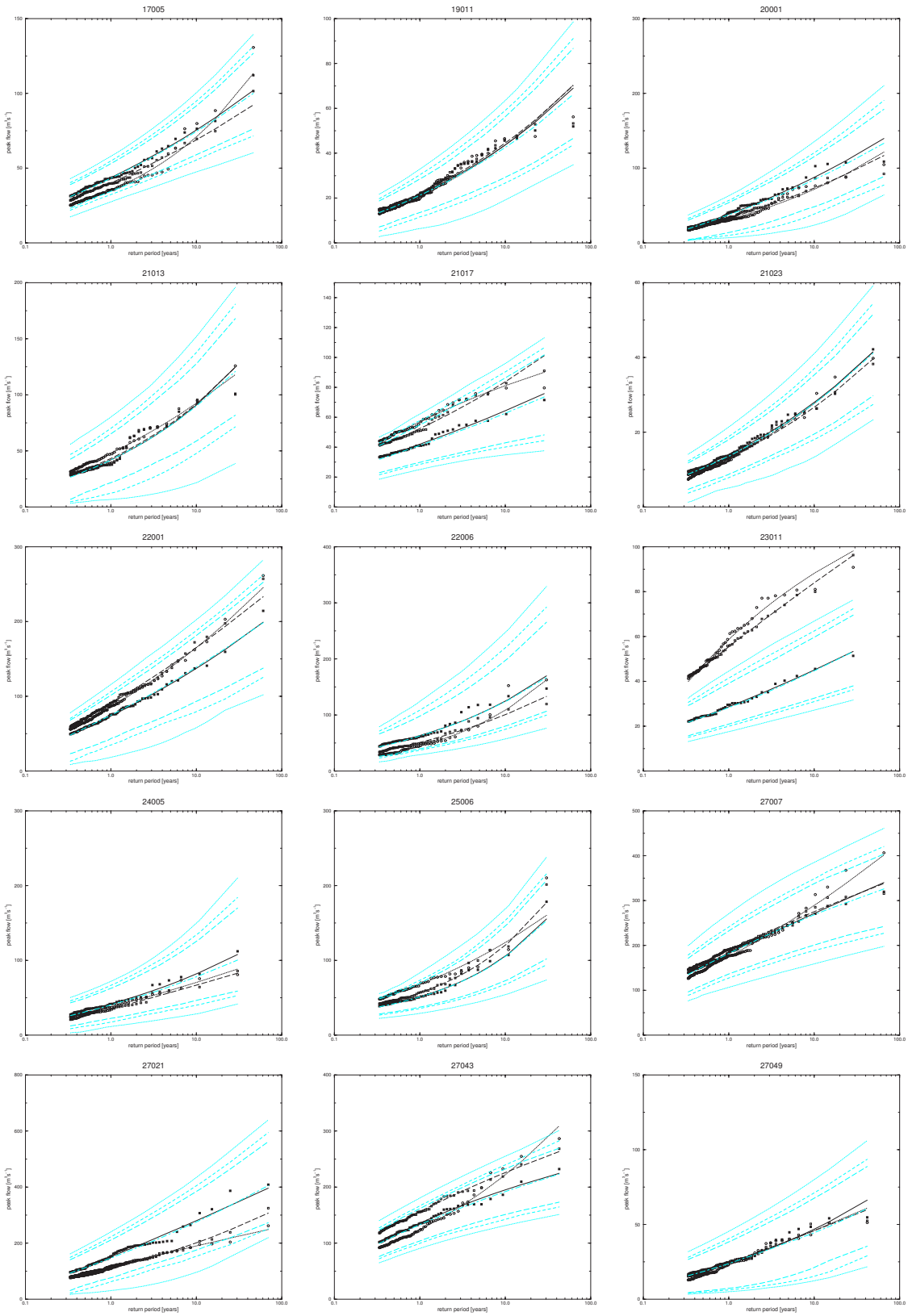


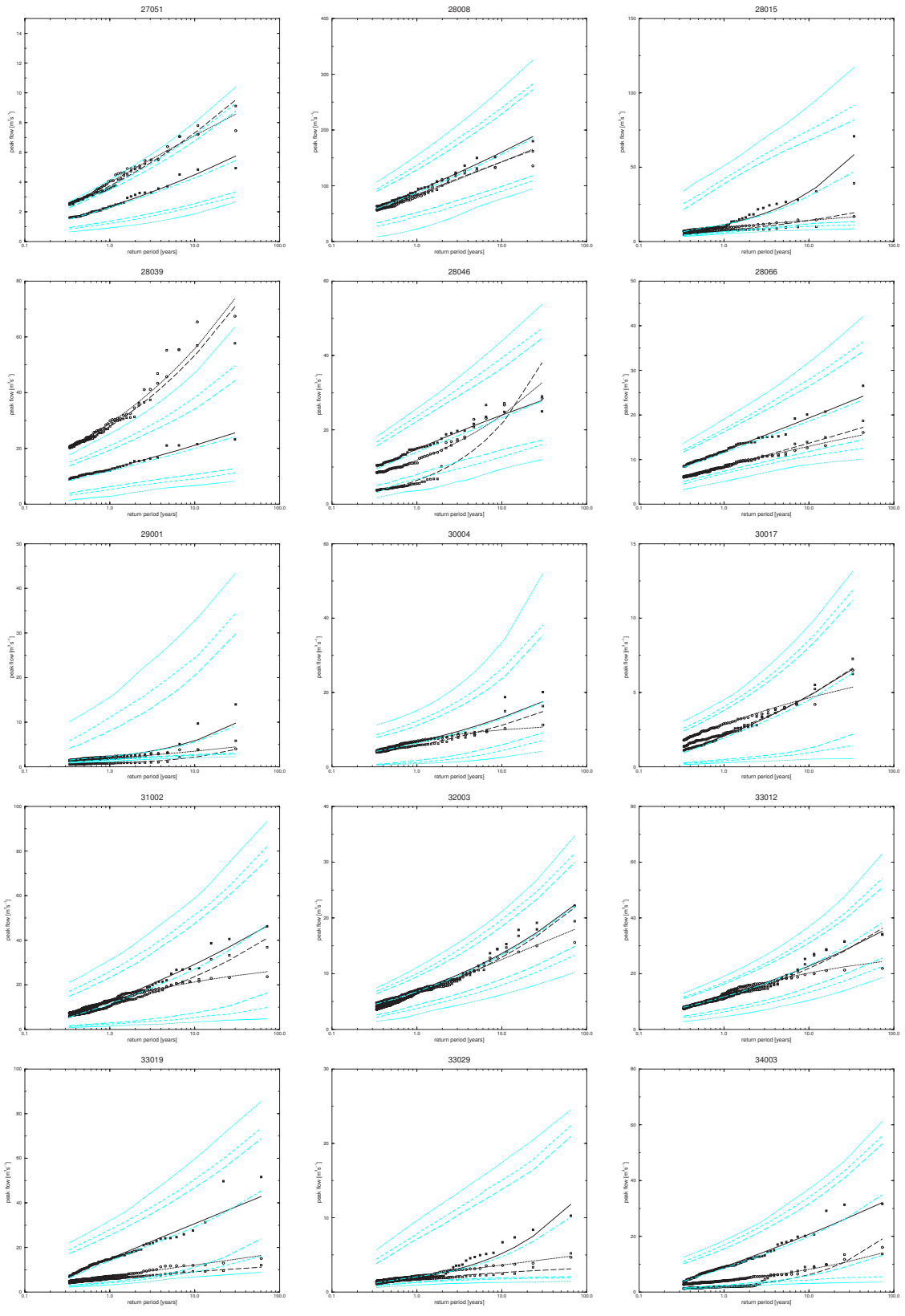


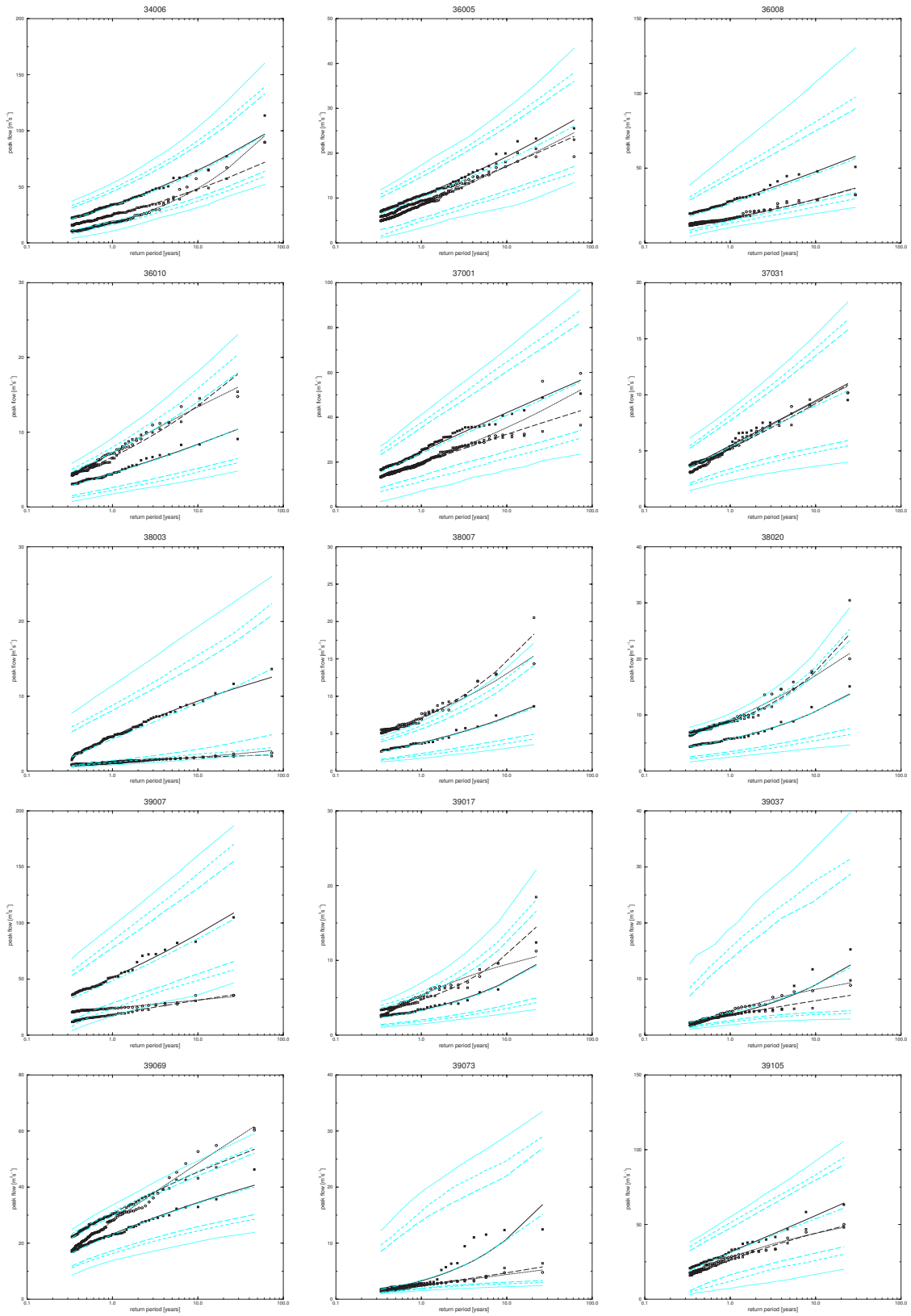


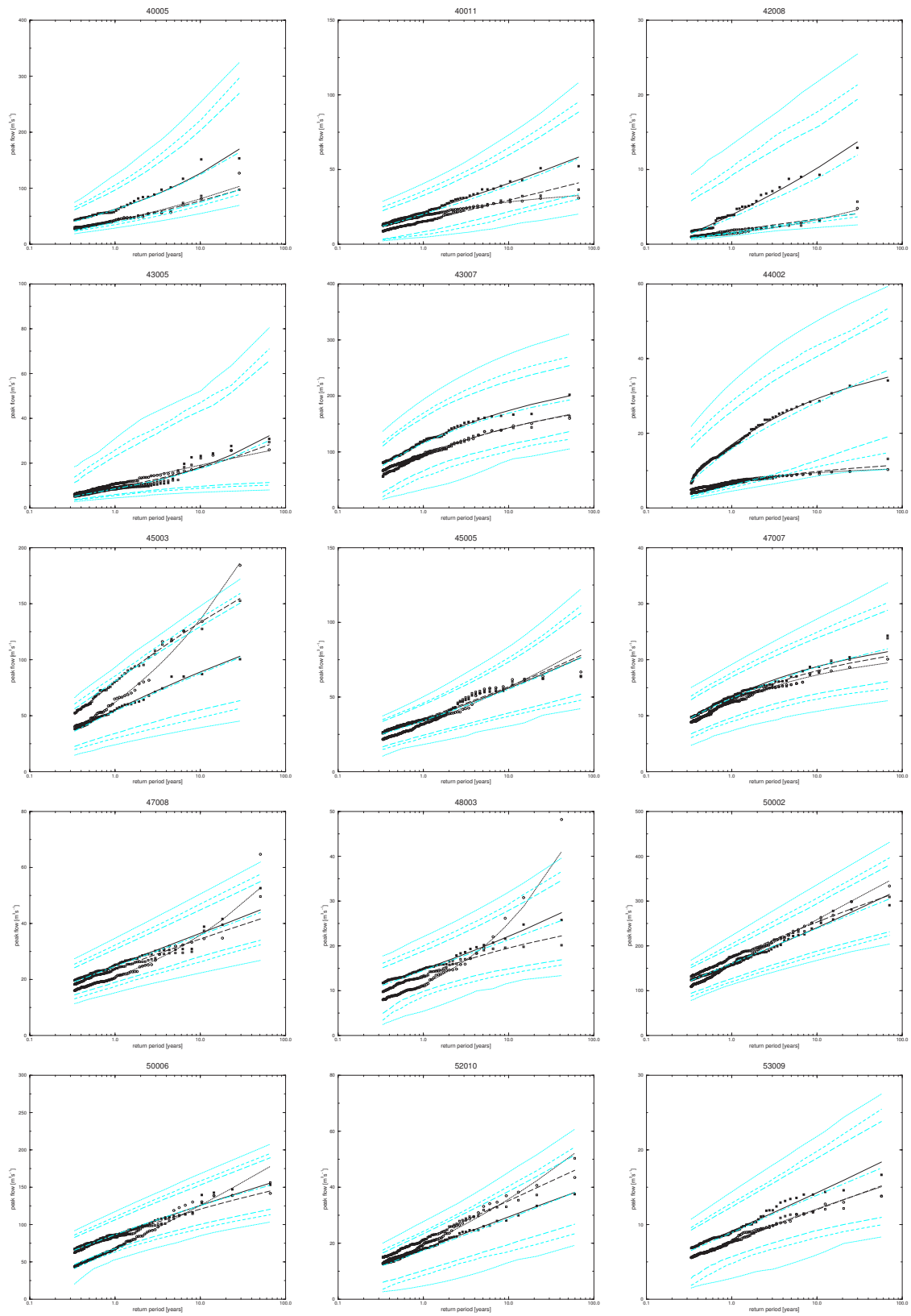
D.3 TATE site-similarity

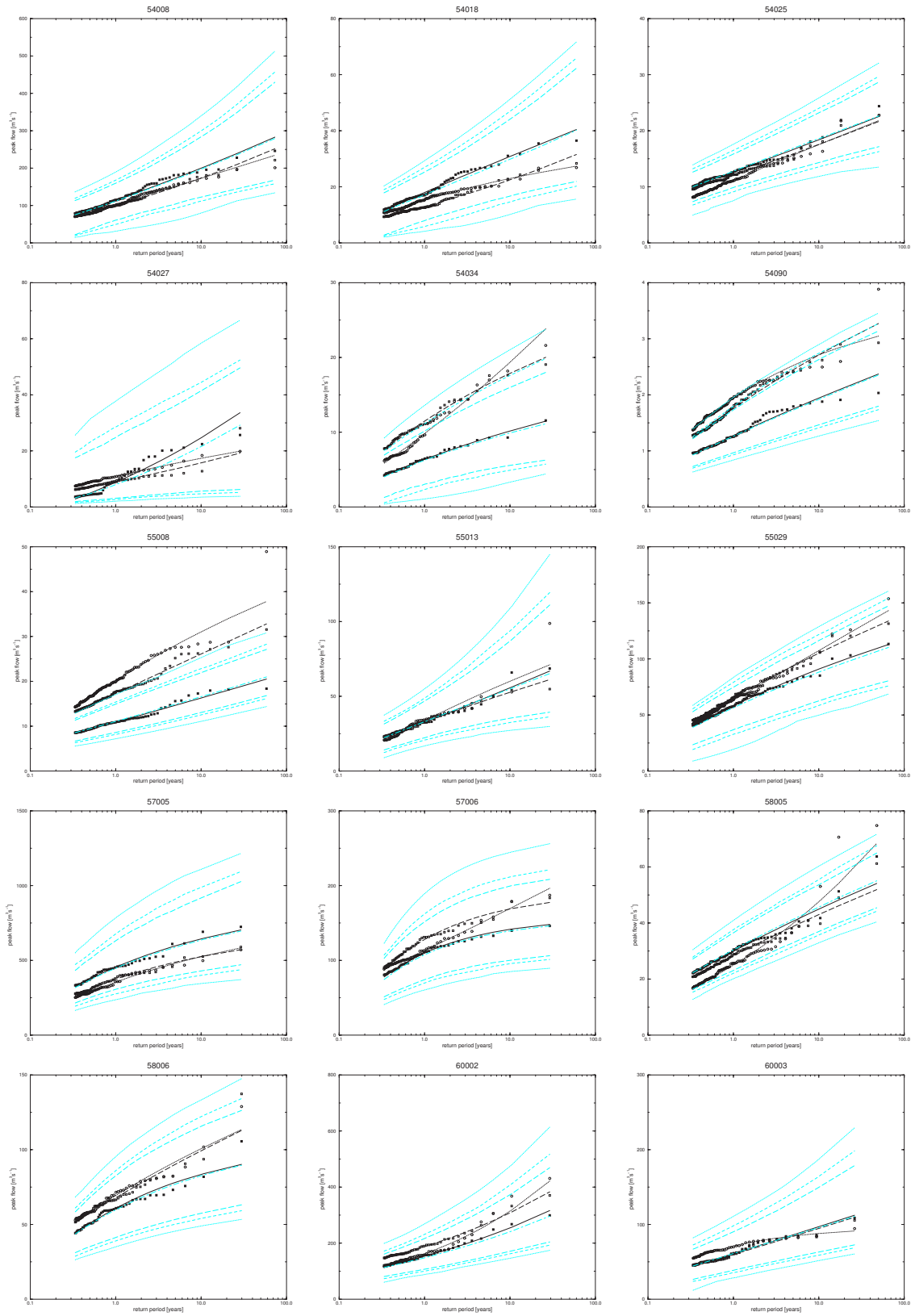


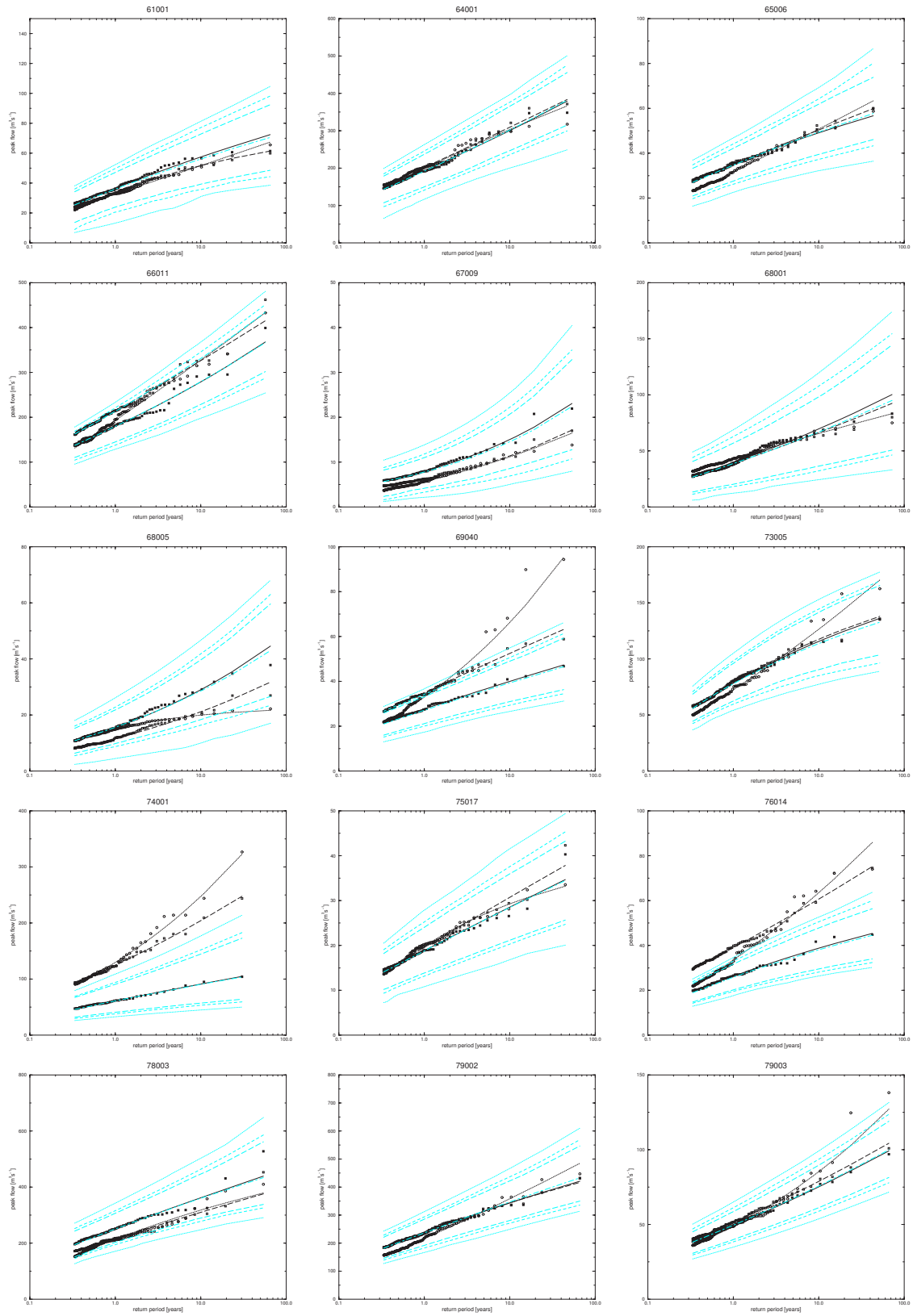


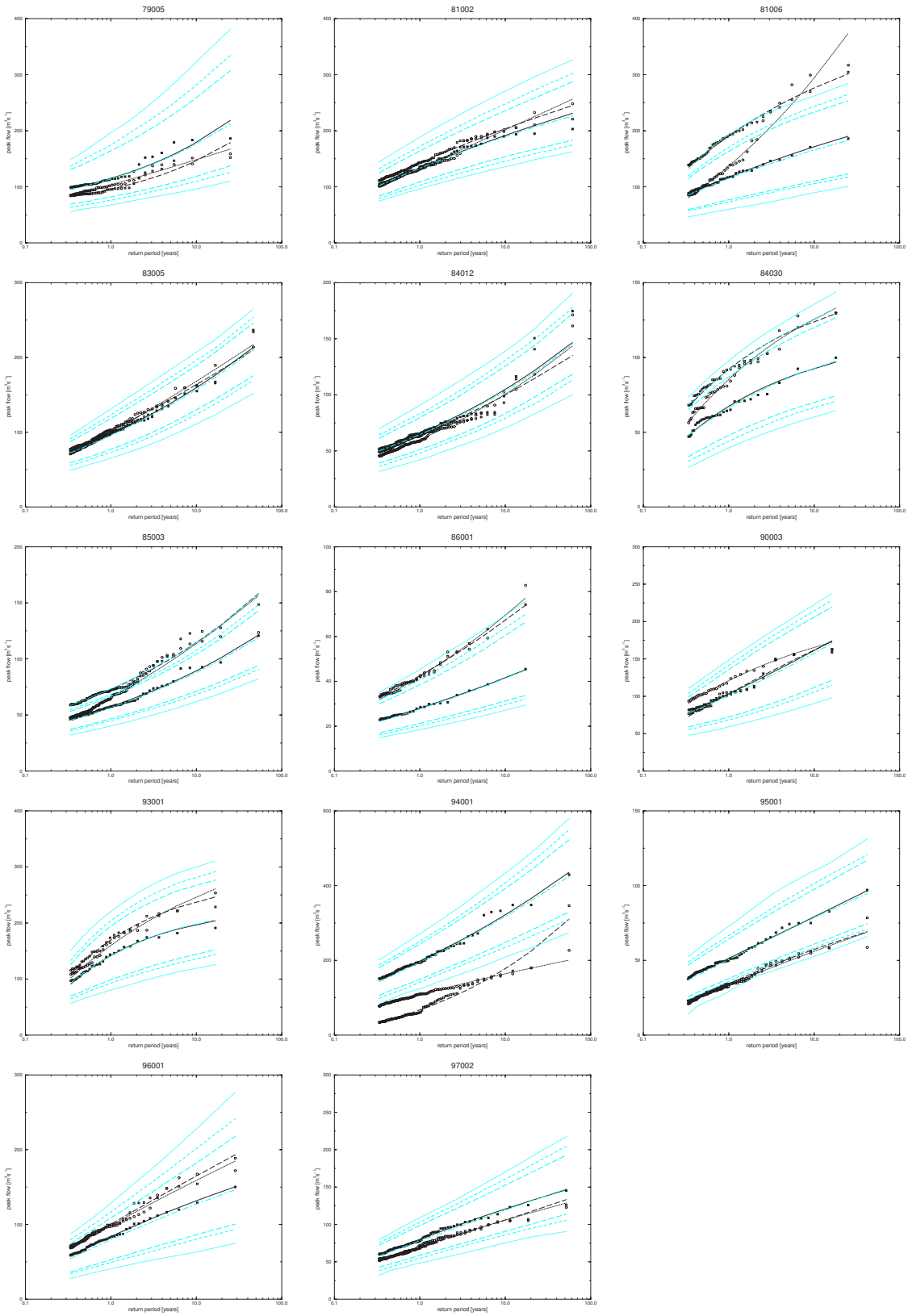




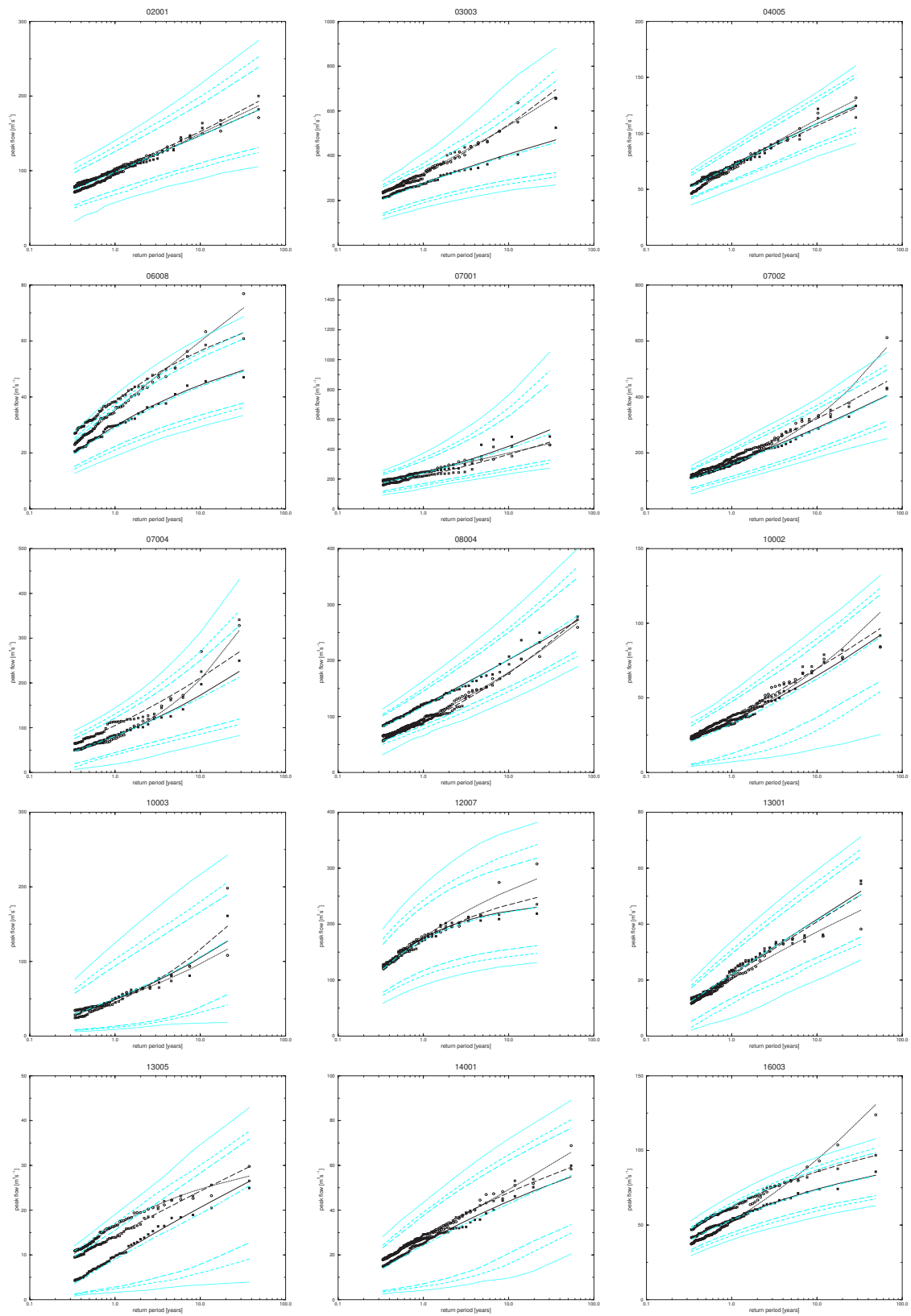


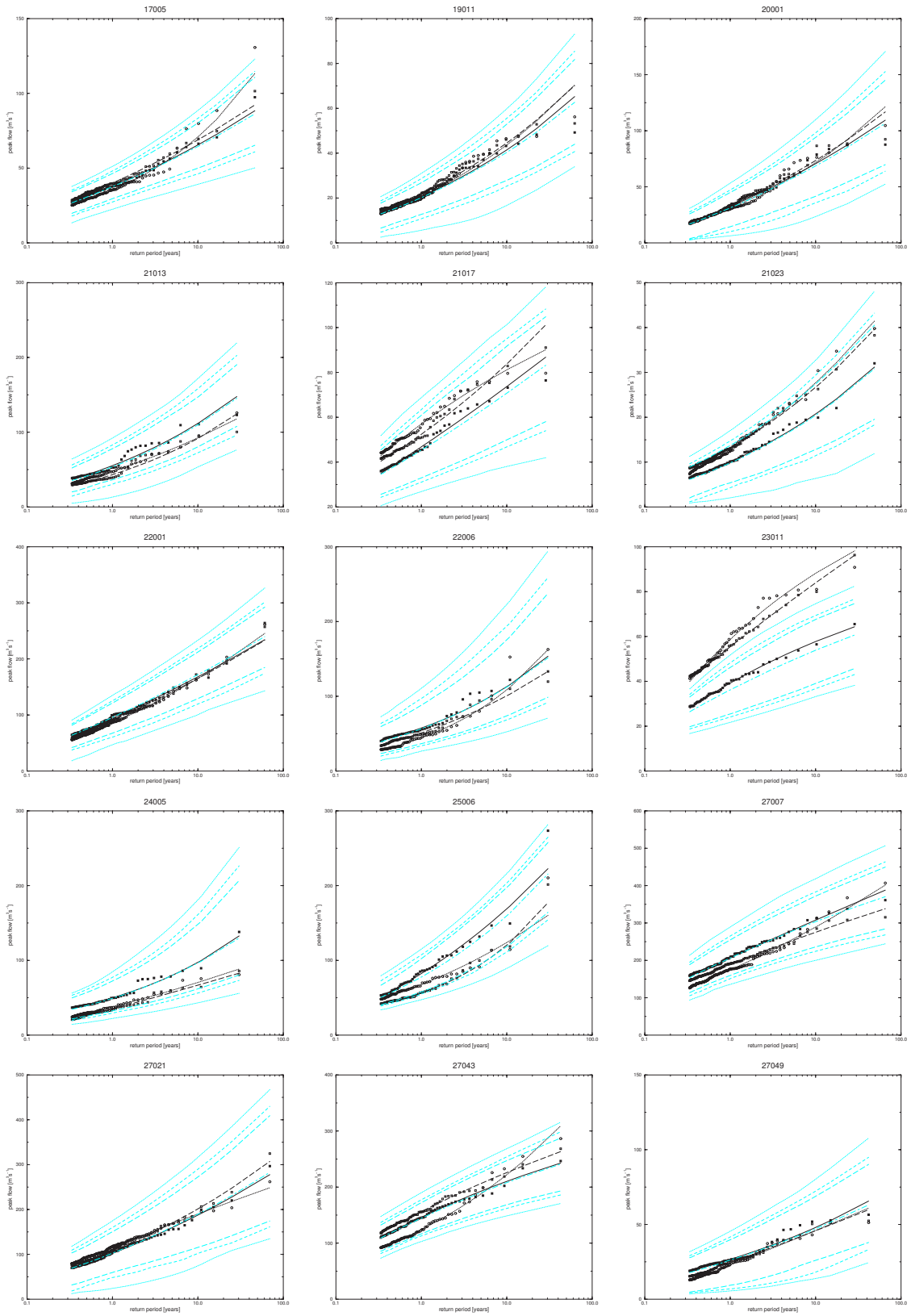


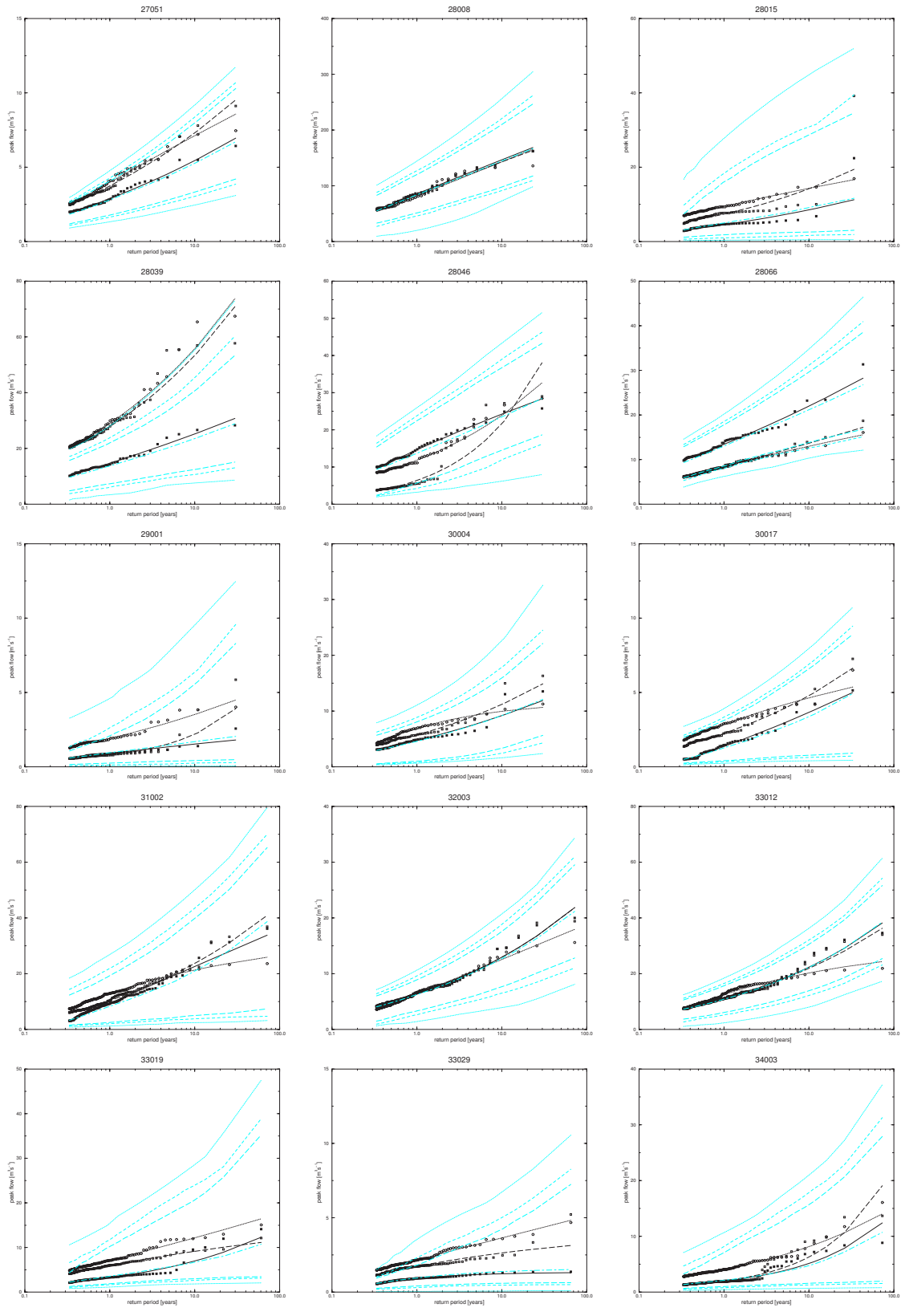


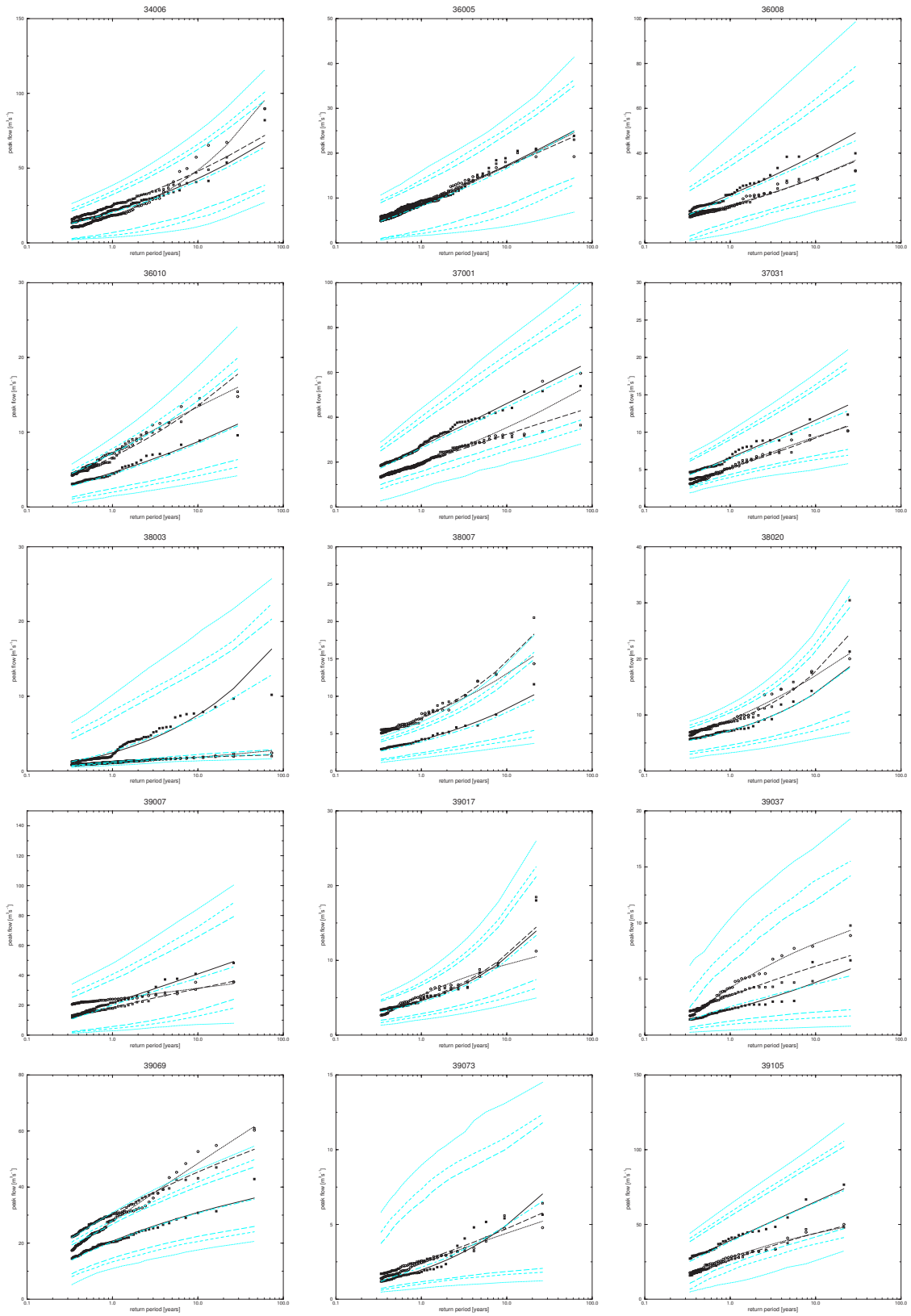


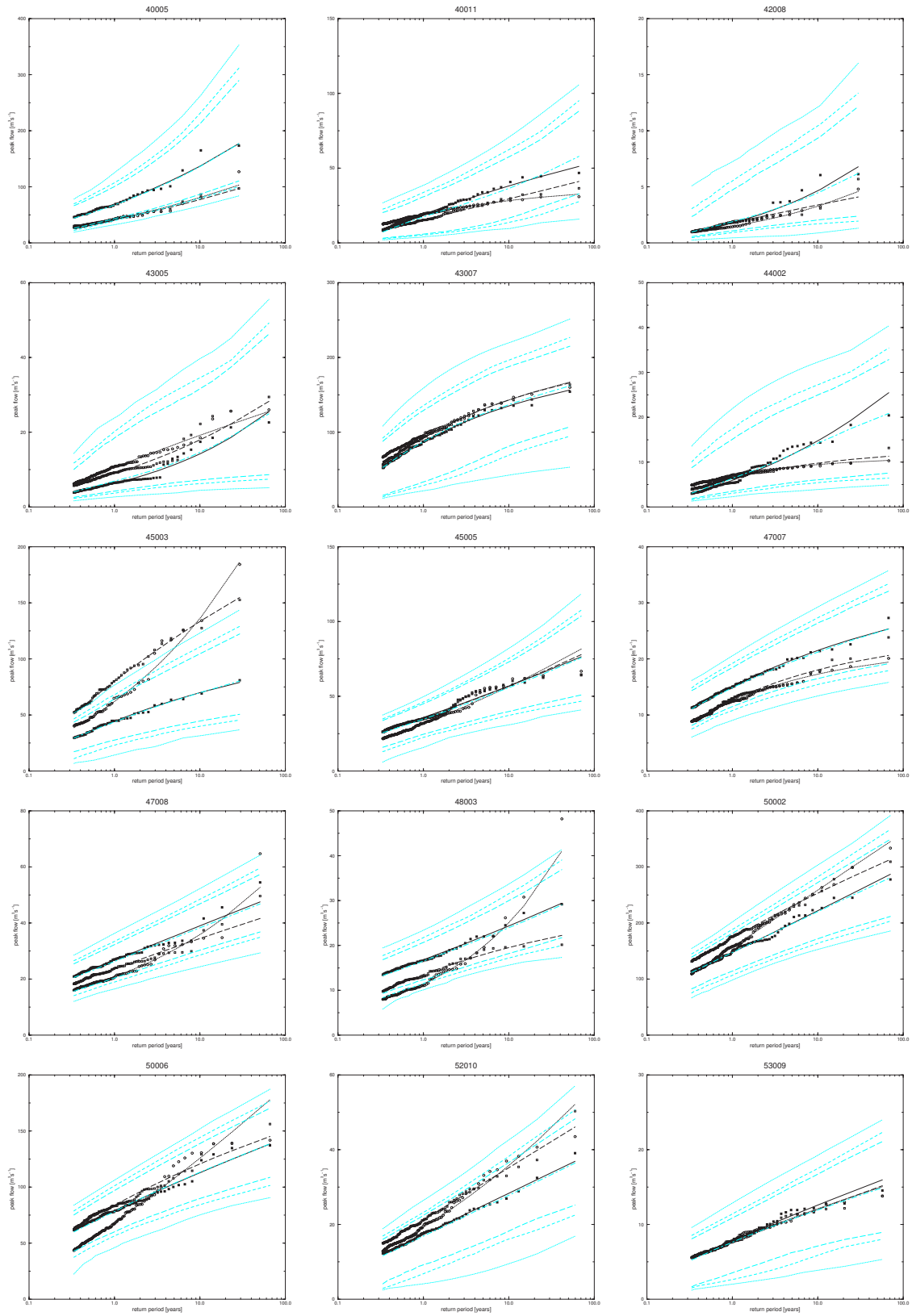
D.4 TATE univariate regression

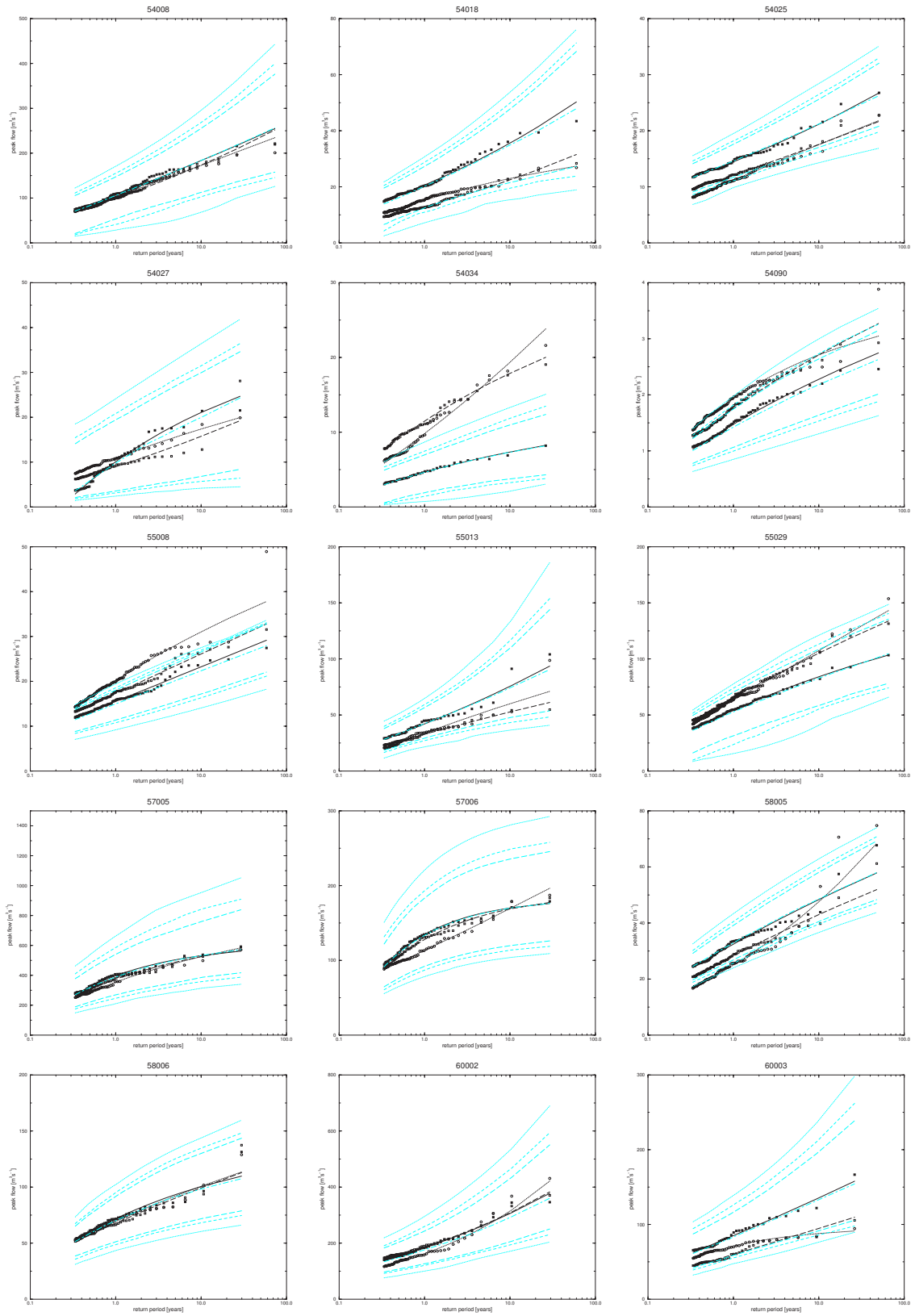


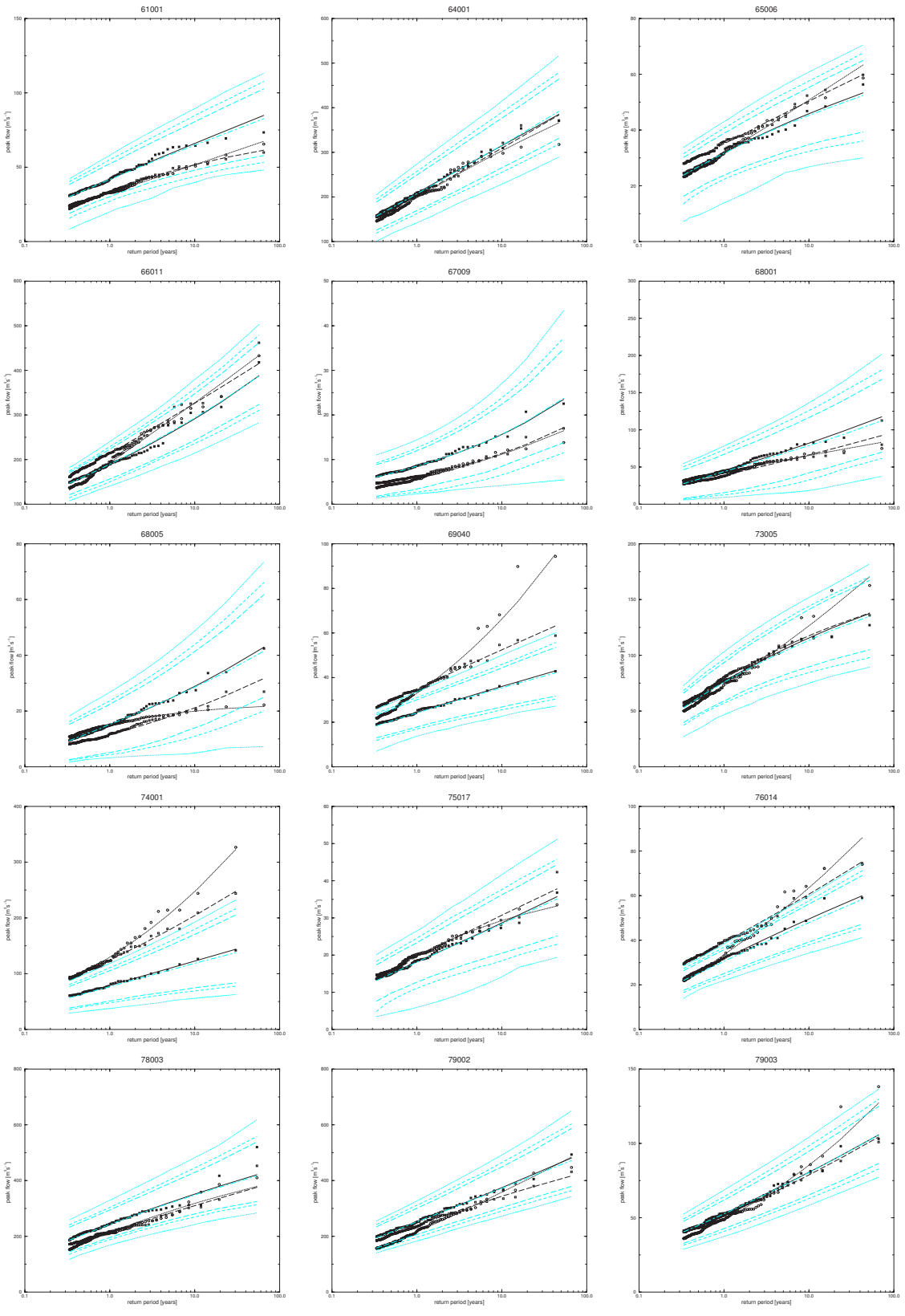


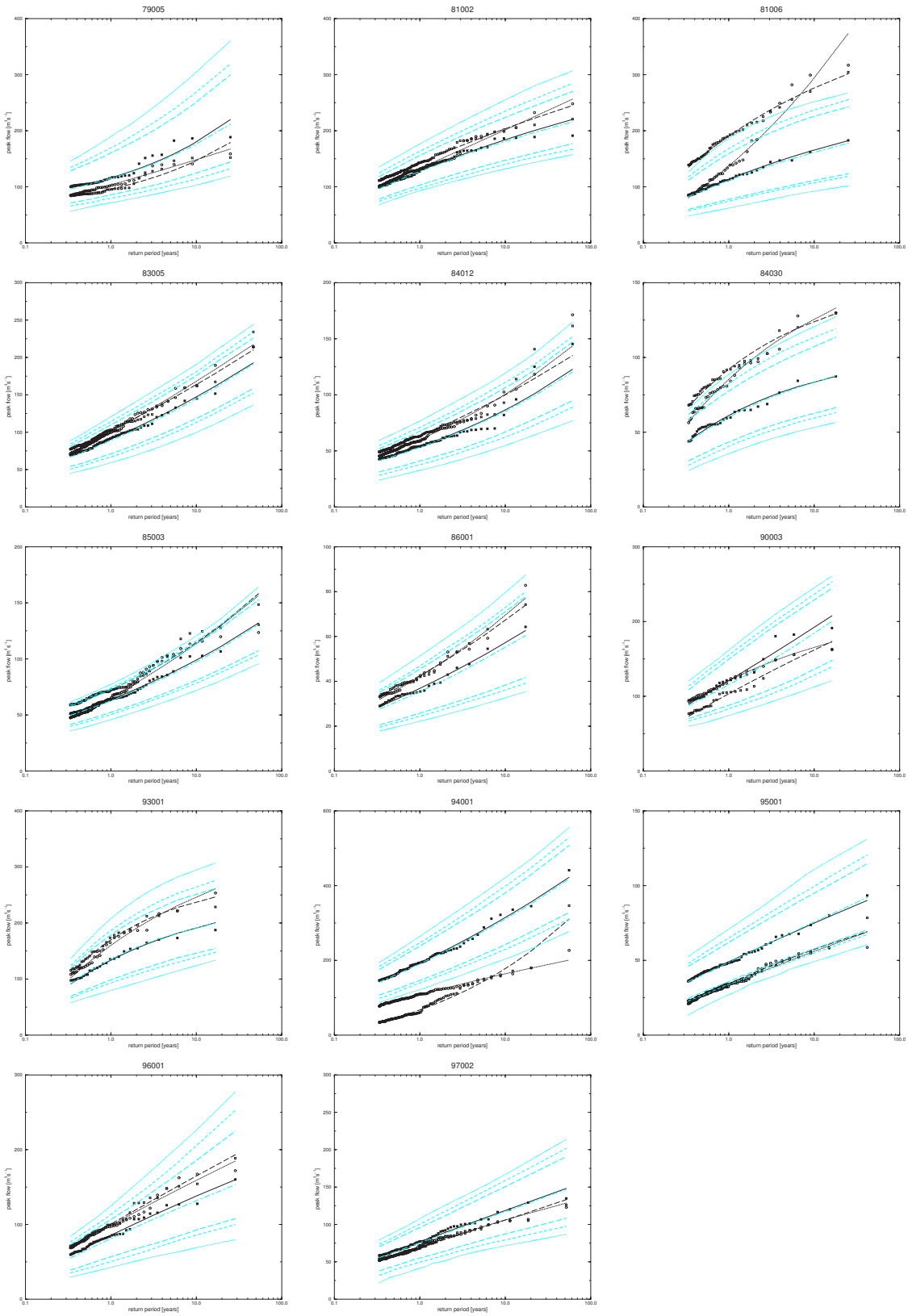












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