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Simultaneous calibration of hydrological models in geographical space

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Figure S1 shows the range of the 10000 calibrated HBV model parameter sets for catchment 1 using NS as objective function. Figure S2 shows the corresponding model performance for both calibration and validation periods.

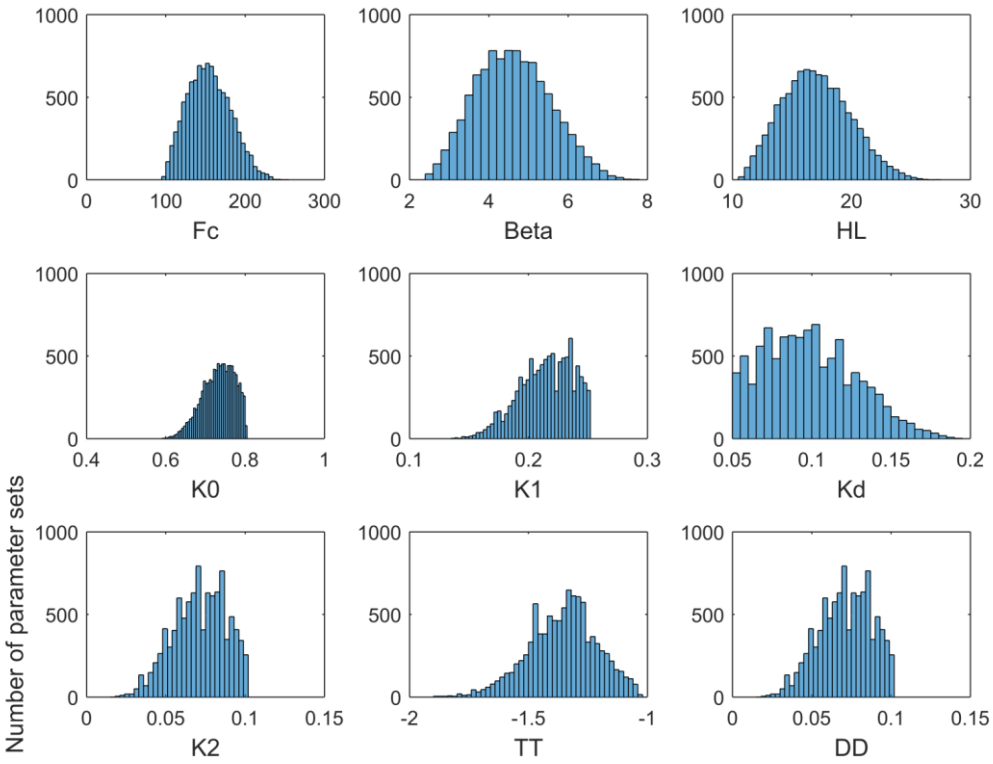

Figure S1: Range of the 10000 calibrated HBV model parameter sets for catchment 1. NS performance was taken as objective function for model calibration.

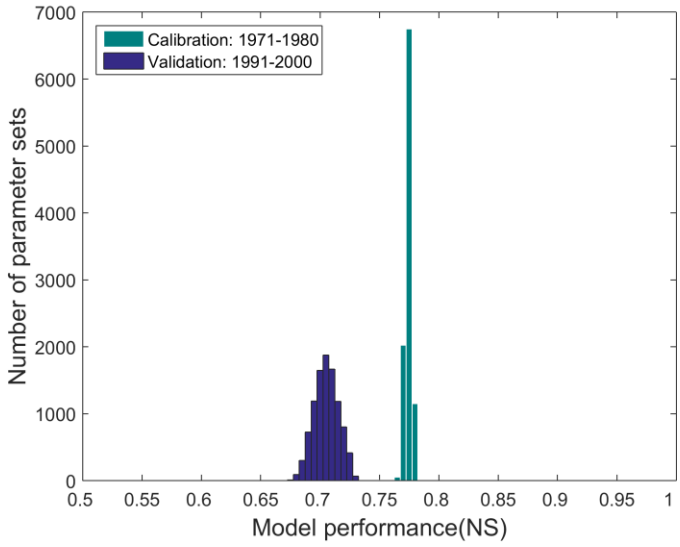

Figure S2: NS model performance for catchment 1 using HBV model.

The tables below list the model performance of the 10000 calibrated parameter sets. All the model calibration procedures were carried out using the ROPE algorithm.

Table S1: Individual calibration results of **HBV** model

Criteria	NS				GK				NS+LNS			
Catchment	Mean	Std.	Min	Max	Mean	Std.	Min	Max	Mean	Std.	Min	Max
1	0.774	0.003	0.749	0.783	0.986	0.001	0.98	0.987	0.738	0.002	0.715	0.747
2	0.712	0.002	0.703	0.719	0.978	0.001	0.974	0.98	0.728	0.002	0.718	0.737
3	0.707	0.002	0.697	0.716	0.975	0.003	0.954	0.98	0.73	0.003	0.71	0.741
4	0.664	0.002	0.655	0.671	0.964	0.001	0.958	0.967	0.694	0.002	0.688	0.7
5	0.817	0.001	0.812	0.821	0.99	0	0.986	0.991	0.798	0.001	0.793	0.803
6	0.769	0.003	0.753	0.778	0.985	0	0.979	0.986	0.802	0.002	0.791	0.809
7	0.805	0.003	0.782	0.814	0.992	0	0.991	0.993	0.784	0.003	0.763	0.795
8	0.736	0.002	0.73	0.742	0.983	0	0.982	0.984	0.71	0.002	0.7	0.718
9	0.707	0.005	0.691	0.723	0.978	0.001	0.97	0.982	0.747	0.004	0.734	0.76
10	0.709	0.003	0.698	0.722	0.98	0.001	0.975	0.982	0.666	0.007	0.644	0.689
11	0.704	0.003	0.69	0.714	0.979	0	0.977	0.981	0.651	0.008	0.622	0.675
12	0.87	0.001	0.856	0.873	0.996	0	0.995	0.996	0.854	0.002	0.842	0.858
13	0.766	0.005	0.749	0.778	0.984	0.002	0.98	0.988	0.734	0.004	0.716	0.749
14	0.709	0.012	0.664	0.744	0.976	0.002	0.938	0.98	0.707	0.003	0.682	0.719
15	0.614	0.001	0.604	0.618	0.941	0.001	0.938	0.944	0.592	0.002	0.584	0.597

Table S2: Individual calibration results of **HYMOD** model

Criteria	NS				GK				NS+LNS			
Catchment	Mean	Std.	Min	Max	Mean	Std.	Min	Max	Mean	Std.	Min	Max
1	0.685	0.001	0.68	0.689	0.96	0	0.958	0.963	0.662	0.002	0.654	0.669
2	0.633	0.003	0.616	0.644	0.959	0.001	0.953	0.963	0.683	0.002	0.66	0.691
3	0.601	0.002	0.59	0.608	0.95	0.001	0.938	0.954	0.65	0.002	0.636	0.658
4	0.603	0.001	0.597	0.608	0.942	0.002	0.931	0.949	0.652	0.001	0.648	0.656
5	0.69	0.001	0.686	0.695	0.969	0.001	0.962	0.971	0.713	0.001	0.71	0.717
6	0.633	0.001	0.629	0.636	0.959	0	0.955	0.96	0.719	0.001	0.714	0.724
7	0.677	0.002	0.668	0.682	0.97	0.001	0.965	0.972	0.697	0.006	0.679	0.715
8	0.626	0.001	0.62	0.63	0.956	0.001	0.948	0.959	0.657	0.002	0.652	0.664
9	0.559	0.004	0.547	0.572	0.938	0.001	0.932	0.942	0.639	0.002	0.633	0.645
10	0.599	0.002	0.592	0.607	0.95	0.002	0.941	0.957	0.618	0.002	0.611	0.627
11	0.59	0.002	0.583	0.597	0.949	0.002	0.939	0.954	0.611	0.003	0.599	0.621
12	0.715	0.001	0.71	0.72	0.975	0	0.974	0.976	0.737	0.002	0.73	0.743
13	0.672	0.001	0.666	0.677	0.967	0.001	0.965	0.969	0.674	0.002	0.669	0.681
14	0.674	0.008	0.63	0.692	0.968	0.002	0.962	0.972	0.694	0.002	0.68	0.699
15	0.594	0.001	0.589	0.597	0.934	0	0.933	0.935	0.584	0.001	0.58	0.589

Table S3: Individual calibration results of **XAJ** model

Criteria	NS				GK				NS+LNS			
Catchment	Mean	Std.	Min	Max	Mean	Std.	Min	Max	Mean	Std.	Min	Max
1	0.655	0.007	0.606	0.668	0.968	0.001	0.963	0.97	0.545	0.03	0.395	0.6
2	0.63	0.008	0.486	0.648	0.96	0.001	0.952	0.963	0.634	0.035	0.457	0.702
3	0.581	0.009	0.451	0.603	0.95	0.002	0.93	0.954	0.554	0.062	0.262	0.649
4	0.544	0.017	0.468	0.575	0.933	0.005	0.901	0.943	0.59	0.031	0.364	0.642
5	0.635	0.004	0.617	0.649	0.96	0.001	0.955	0.963	0.639	0.038	0.43	0.697
6	0.559	0.01	0.514	0.583	0.941	0.002	0.924	0.945	0.645	0.045	0.428	0.707
7	0.649	0.008	0.544	0.676	0.967	0.001	0.958	0.97	0.654	0.046	0.41	0.722
8	0.633	0.003	0.62	0.641	0.96	0.001	0.956	0.963	0.63	0.025	0.512	0.68
9	0.522	0.006	0.466	0.536	0.931	0.009	0.541	0.941	0.507	0.066	0.256	0.652
10	0.498	0.033	0.371	0.56	0.946	0.001	0.93	0.95	0.386	0.06	0.194	0.546
11	0.521	0.02	0.424	0.562	0.945	0.004	0.863	0.949	0.398	0.059	0.227	0.552
12	0.687	0.004	0.631	0.699	0.971	0.001	0.966	0.973	0.703	0.037	0.461	0.743
13	0.658	0.004	0.638	0.671	0.967	0.001	0.962	0.97	0.64	0.028	0.502	0.686
14	0.656	0.005	0.635	0.67	0.964	0.001	0.96	0.967	0.641	0.034	0.48	0.693
15	0.527	0.02	0.409	0.556	0.933	0.002	0.916	0.937	0.465	0.024	0.343	0.503