Supplementary Information for “CAMELS-GB v2: hydrometeorological time series and landscape attributes for 671 catchments in Great Britain”

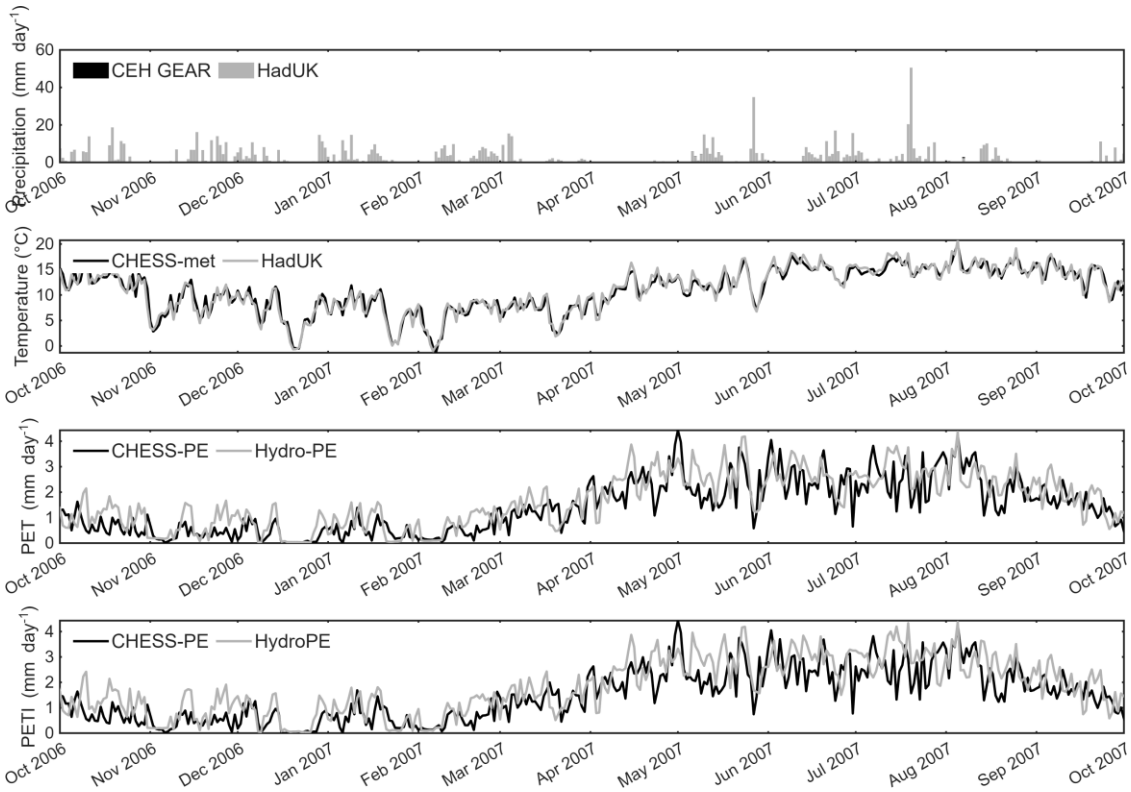

Figure S1. Precipitation, temperature, potential evapotranspiration (PET) and potential evapotranspiration with interception (PETI) for Thames at Kingston (National River Flow Archive Gauge ID 39001) for different meteorological datasets available in CAMELS-GB.

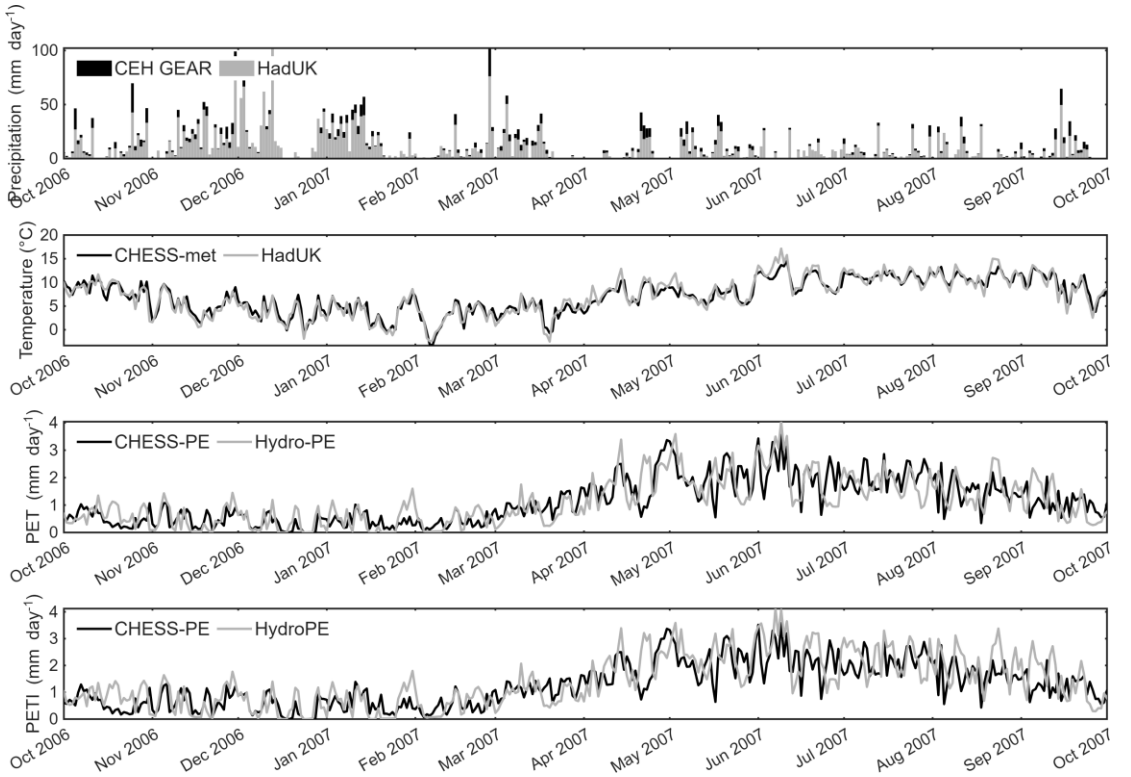

Figure S2. Precipitation, temperature, potential evapotranspiration (PET) and potential evapotranspiration with interception (PETI) for Linne nam Beathach at Victoria Bridge (National River Flow Archive Gauge ID 89002) for different meteorological datasets available in CAMELS-GB.

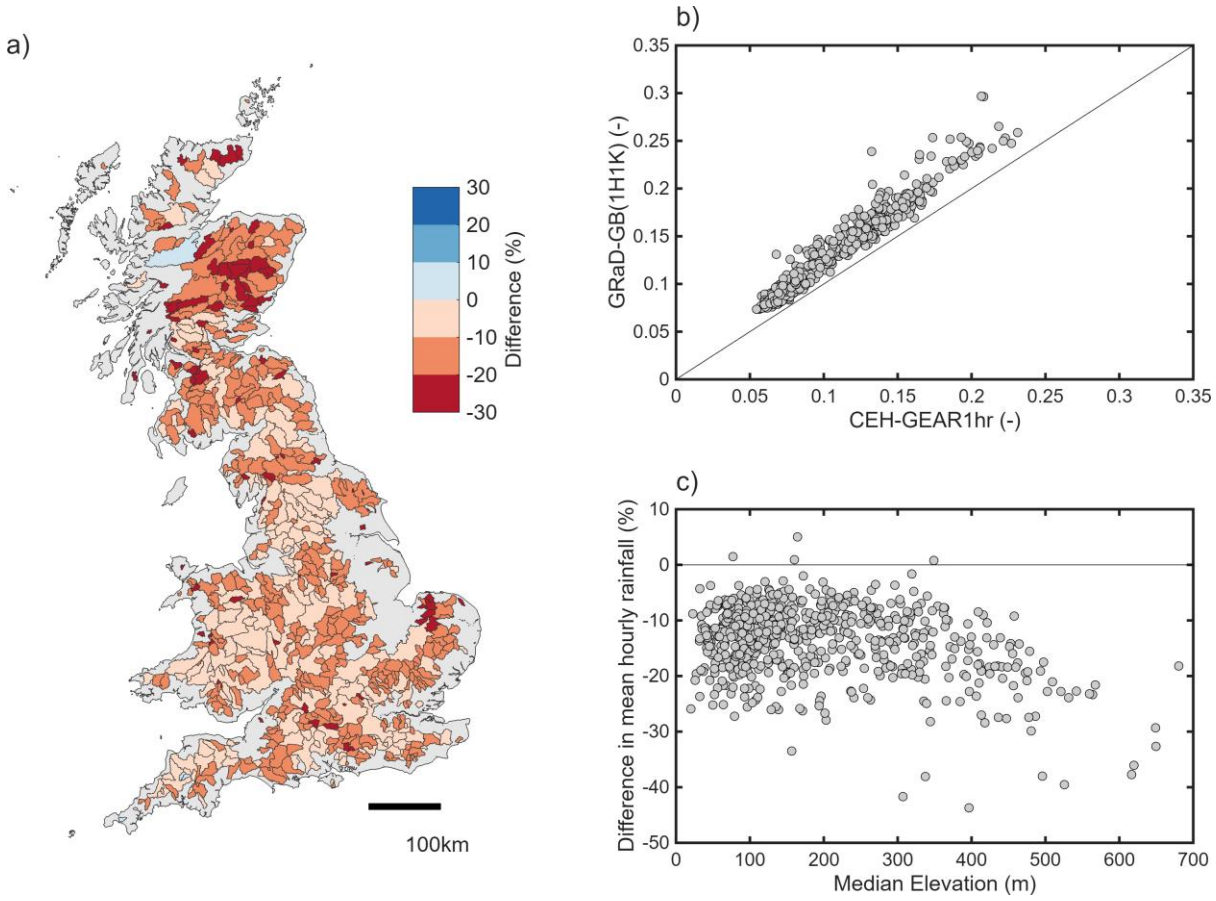

Figure S3. National comparison of average hourly rainfall (mm hour^{-1}) from 1st January 2006 to 31st December 2016 between CEH-GEAR1hr and the GraD-GB(1H1K) datasets for the 671 CAMELS-GB catchments, a) Difference in average hourly rainfall (average hourly rainfall calculated on timesteps where rainfall is >0.1mm hr^{-1}) (%), b) Fraction of wet hours (wet hours are defined as any hour that recorded rainfall >0.1mm) , c) Relationship between median elevation and difference in average hourly rainfall calculated above threshold of 0.1mm hr^{-1} (%). The blue colours indicate that the GRaD-GB(1H1K) hourly rainfall averages are higher than the CEH-GEAR1hr hourly rainfall averages, while the red colours indicate that the GRaD-GB(1H1K) hourly rainfall averages are lower than the CEH-GEAR1hr hourly rainfall averages, as a percentage of the CEH-GEAR1hr dataset. Contains OS data © Crown Copyright and database right 2025.

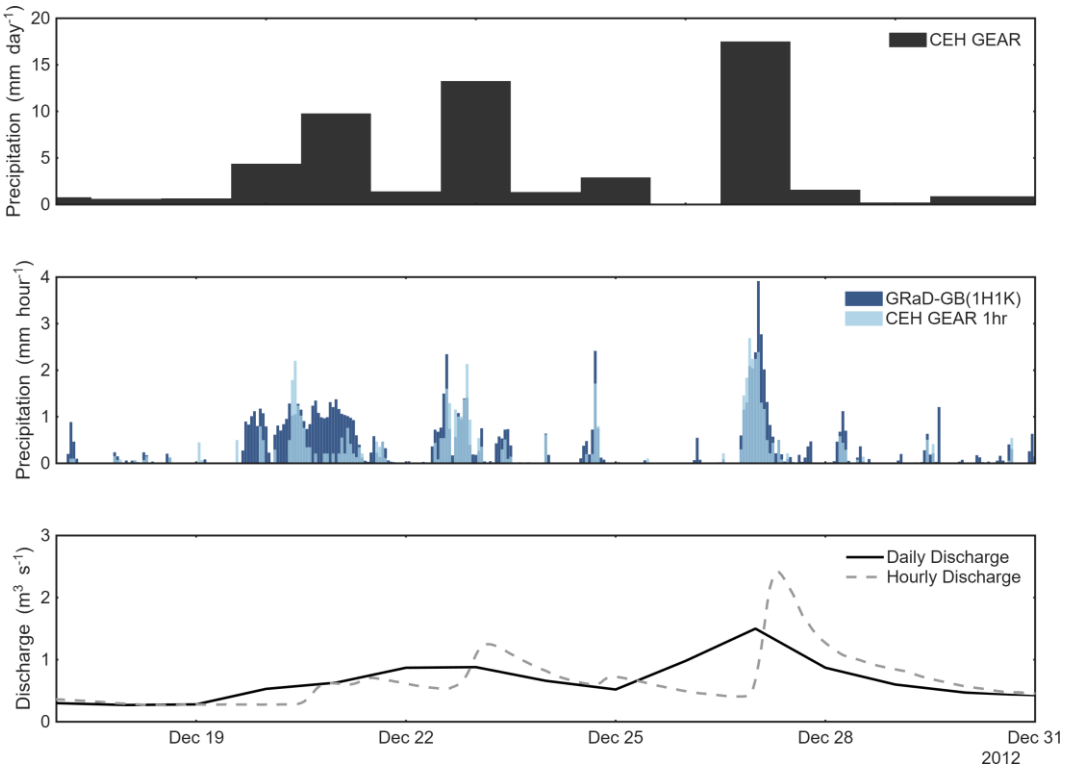

Figure S4. a) Daily CEH GEAR precipitation, b) Hourly precipitation from CEH GEAR 1hr and the GraD-GB(1H1K) dataset, and c) Daily and hourly discharge for West Peffer Burn at Luffness (National River Flow Archive Gauge ID 20002) from 17th December 2012 to 31st December 2012.

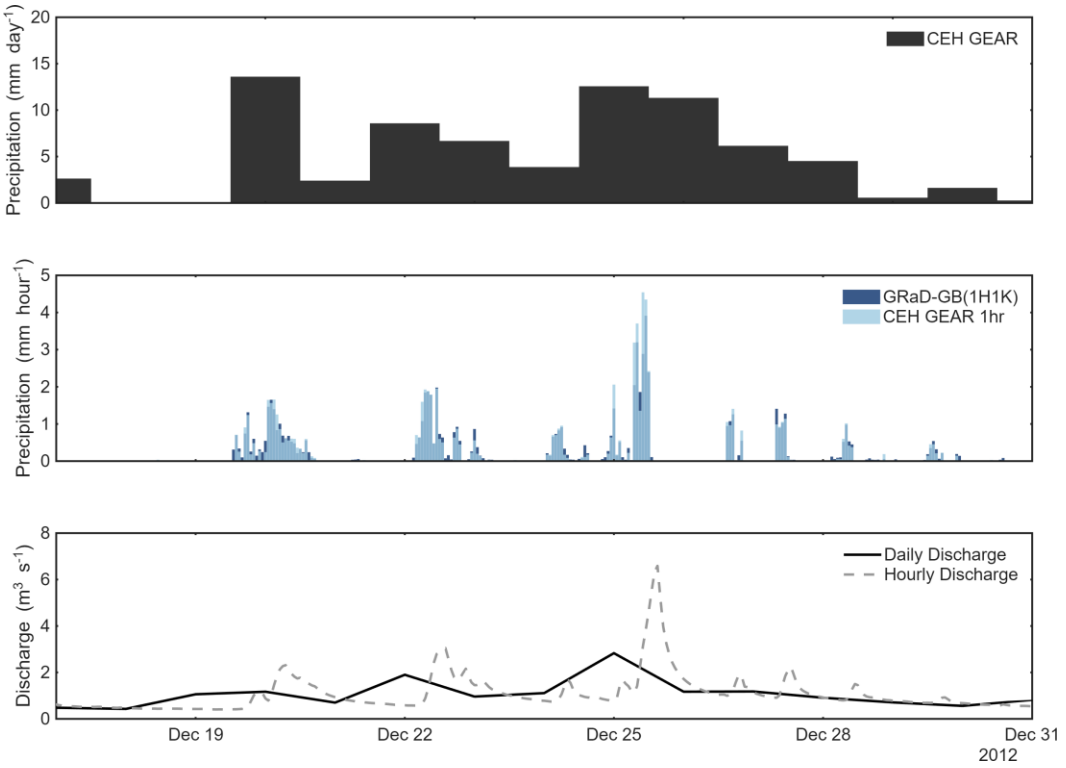

Figure S5. a) Daily CEH GEAR precipitation, b) Hourly precipitation from CEH GEAR 1hr and the GraD-GB(1H1K) dataset, and c) Daily and hourly discharge for Beverley Brook at Wimbledon Common (National River Flow Archive Gauge ID 39005) from 17th December 2012 to 31st December 2012.

Text S1. Hourly flow and level quality control flags

This section provides more detail on the hourly flow and level quality control flags. It wasn't possible to query these QC checks and data anomalies with the Environment Agency, Scottish Environmental Protection Agency or Natural Resources Wales within the timescales required. An example of how the flags are recorded for the flow/level timeseries are shown in Figure S6 and metadata on the codes are provided in TablesTable S1Table S3.

Flag resampling

During hourly resampling, flags from the original 15-minute data were retained to preserve information about potential artifacts. This decision ensures that issues identifiable at higher resolution, such as spikes, drops, or negative values, remain detectable even when they are visually obscured by averaging (see Figure S7). Retaining these flags gives users the opportunity to trace and interpret subtle data quality issues that might have not been identifiable if the code was applied to the aggregated data.

During resampling, multiple flags could co-occur within the same hourly interval. These co-occurrences were very rare, occurring in only 14608 instances (0.01% of the data). Drops and negatives, as portrayed in Figure S7, are the most common co-occurrences of flags, happening in 11438 instances. Drops, relative spikes and fluctuations can also commonly occur together (4282 instances) representing locations where the data presents lots of oscillations, notably in stations heavily influenced by reservoirs or with a high baseflow index.

In these rare instances, we have established a flag priority to be kept. Flags representing multiple concurrent issues (flags 8 and 9) were prioritized highest, as these indicate data points highly likely to be spurious. Subsequent prioritization was based on the value each flag contributes. Fluctuations and drops were assigned the lowest priority: fluctuations because they often indicate persistent station-level issues that might require a global solution at the station, such as smoothing of the data, rather than individual adjustments; and drops because spikes represent more critical and impactful anomalies. The remaining flags were prioritized in the following order: truncations, high/low extremes, negative values, and spikes (absolute and relative). This order was designed to retain the most critical information in the resampled dataset.

Flags Not Computed on the Level Data and Level Data Availability

The level dataset underwent less extensive quality control than the flow dataset due to its comparatively lower relevance in hydrological analysis. This is also the reason why less level stations are available. Unlike the iterative request-and-verification process used to compile flow data, where data were requested from measuring authorities, reviewed, and re-requested to fill gaps, the level data were mostly obtained through a single request, without further refinement.

Certain checks were not applied to the level dataset, including anomaly checks, comparisons with other UK hydrological products, and hydrological similarity flags (comparison with rainfall and stations from the same hydrometric area). However, we consider the traditional QC and high-flow QC flags available sufficient to convey meaningful quality information for level data. Users interested in a more detailed assessment are encouraged to consult the QC flags in the flow dataset.

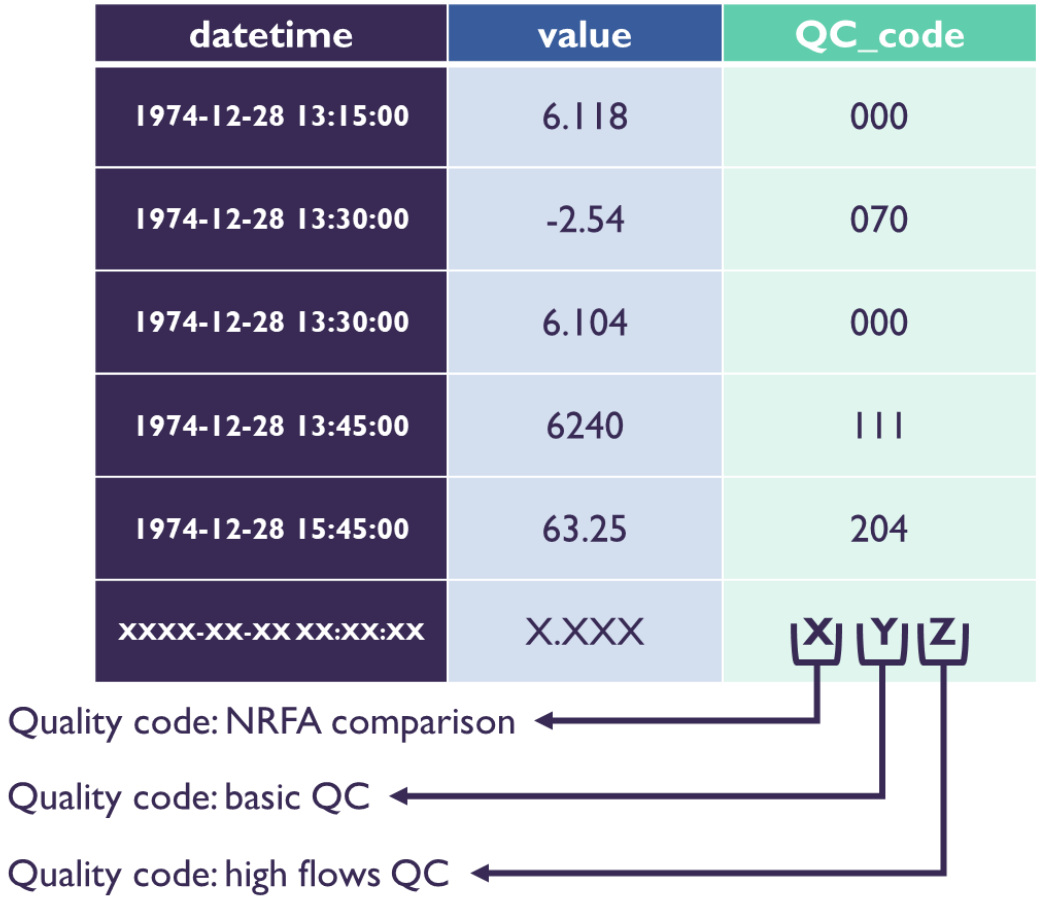

Figure S6. Example of quality control codes in a flow or level station

Table S1. Quality control flags for NRFA comparison

QC code	Meaning
0	Data is in sufficient agreement with other UK products
1	Mismatch >5% between 15-min values and National River Flow Archive daily values
2	Mismatch >20% between 15-min values and peak-over-threshold values
3	Mismatch >20% between 15-min values and annual maximum values
4	Combination of 1 and 3 — mismatch with both daily and peak-over-threshold values
5	Combination of 1 and 2 — mismatch with both daily and annual maximum values

Table S2. Quality control flags for basic QC

QC code	Meaning
0	No issues found
1	Negative value
2	Relative spike
3	Absolute spike
4	Drop
5	Fluctuation
6	Truncated low flows/levels
7	Truncated high flows/levels
8	Combination of 2 and 3 — relative and absolute spike

9	Combination of 4 with 1 or 6 — drop plus negative/truncated low flows/levels

Table S3. Quality control flags for high flow QC

QC code	Meaning
0	Not a high flow
1	Unrealistically high event
2	Exceptionally high event
3	Event with >0.1 yearly likelihood and no antecedent rainfall
4	Event with >0.1 yearly likelihood and no concurrent high flow in the hydrometric area
5	Combination of 3 and 4 - event with no antecedent rainfall or high flows in hydrometric area
6	Event with >0.1 yearly likelihood with both antecedent rainfall and concurrent regional high flow - flow is considered "validated"
7	Combination of 2 and 3 or 4 - exceptionally high event with no antecedent rainfall or high flows in hydrometric area
8	Combination of 2 and 5 - exceptionally high event with no antecedent rainfall and high flows in hydrometric area
9	Combination of 2 and 6 - flow is considered "validated"

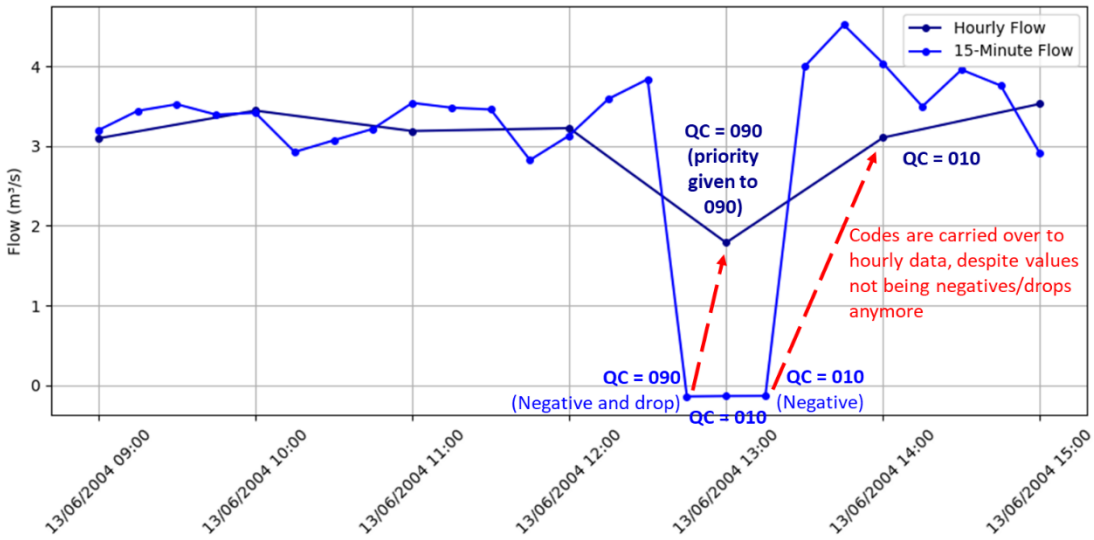

Figure S7. Example of flags being carried over from the 15-min data to the hourly dataset for gauging station 27089.

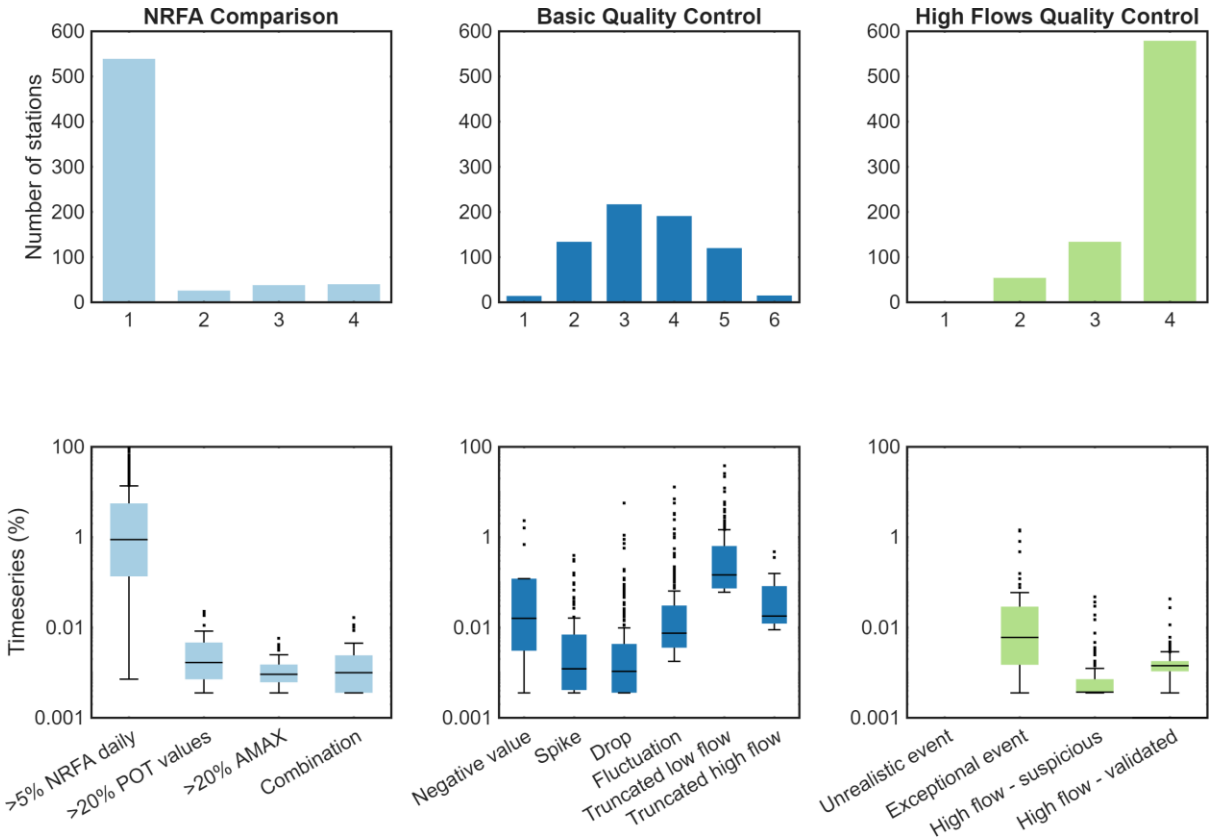

Figure S8. Analysis of quality control flags for the hourly flow timeseries in CAMELS-GB v2. The top row shows the number of stations where this flag occurs in the hourly timeseries and the bottom row show the proportion of the timeseries these flags are present. Flags have been grouped and full description of the flags can be found in Tables S1-S3.

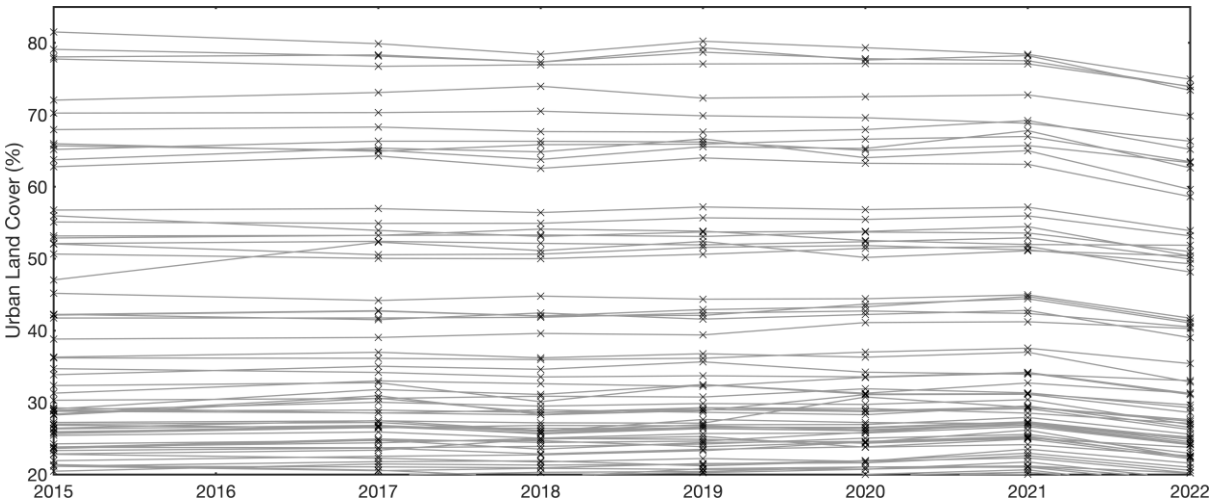

Figure S9. Changes in land cover over time between 2015 and 2022 for the 671 catchments in CAMELS-GB v2. The y-axis is truncated from 20-85% to make it easier to see changes in land cover for the most heavily urbanised catchments.

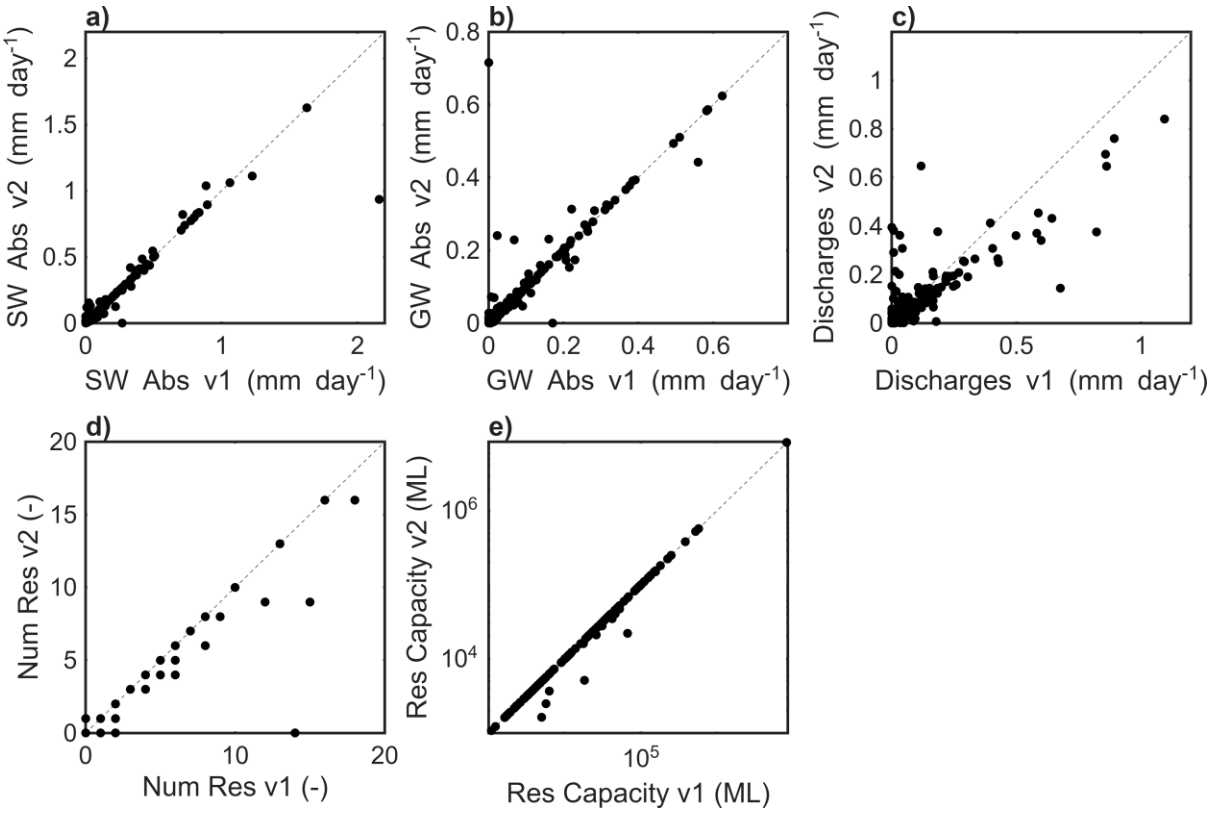

Figure S10. Comparison of human influence attributes in CAMELS-GB v1 and v2, a) surface water abstractions, b) groundwater abstractions, c) discharges, d) number of reservoirs and e) reservoir capacity

Table S4. Suspected outlier data points in CAMELS-GB-v2 monthly groundwater level timeseries

Borehole ID	Name	Suspected Readings (mAOD)	Time step in data	Suspected Datum Change
SD53_25	Red Scar Wood	12.12 – 8.82	1999-11-13 - 2002-02-10	x
SE02_46	Thrum Hall	186.71	2011-03-01	
SE23_4	Silver Blades Ice Rink	25.97 -26.87	1971-03-01 - 1981-11-01	x
SE39_20B	Scruton Village	25.81	2023-10-01	
SE93_4	Dale Plantation	20.41 - 63.41	1996-02-01 - 1996-10-01	
SJ56_45E	Ashton No.4	21.26 - 21.91	1973-03-01 – 1996-11-01	x
		25.79 - 25.00	2023-03-24 - 2023-04-02	
SJ159_147	Sandy Lane	29.30 -32.36	1971-10-01 - 1988-12-01	x
SJ87_32	Dale Brow	87.77	2021-06-22 - 2021-06-23	
SJ88_93	Bruntwood Hall	51.31 - 49.69	2009-07-03 - 2009-07-20	
SK67_17	Morris Dancers	31.6 - 30.44	2006-04-01 - 2006-05-01	x
SP90_26	Champneys	171.55	2015-08-01	
		105.91	2018-05-01	
		185.87	2021-11-01	
SP91_59	Pitstone Green Farm	104.14	2018-04-01	
ST64_33	Oakhill No 1	157.43 – 157.16	1991-01-01 – 1991-11-01	x
SU82_63	Madams Farm	112.5	2014-02-01	
		111.87	2014-03-01	

		104.16	2023-08-01	
TA07_28	Hunmanby Hall	23.58	2022-10-25	
TF73_10	Moor Farm_Bircham	56.21	2015-08-01	
TF92_5	Tower Hills Pumping Station -North Elmham	21	2012-06-29- 2012-06-30	
TG23_21	Melbourne House	14.61	2023-10-24	
		120.62	2021-09-01	
TL11_9	The Holt	89.76 - 91.6	2019-05-01 -2024-12-01	x
		42.51	2018-07-01	
		42.43	2018-08-01	
TL72_54	Rectory Road	9.12	2022-11-01	
	Billingford House- Billingford	29.05	2003-02-01	
TM17_1		28.86	2004-01-01	
TQ50_7	The Old Rectory Folkington	65.79	2022-09-01	
TQ62_99	Whiteoaks-Heathfield	133.48	1984-03-01	