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DATA ARTICLE

CAMELS-SE: Long-term hydroclimatic observations (1961–2020) across 50 catchments in Sweden as a resource for modelling, education, and collaboration

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Abstract

This paper introduces a community-accessible dataset comprising daily hydroclimatic variables (precipitation, temperature, and streamflow) observed in 50 catchments in Sweden (median size of 1019 km^2). The dataset covers a 60-year period (1961–2020) and includes information on geographical location, landcover, soil classes, hydrologic signatures, and regulation for each catchment. Data were collected from various sources, such as the Swedish Meteorological and Hydrological Institute, the Swedish Geological Survey, and several Copernicus products provided by the European Environment Agency. The compiled, spatially-matched, and processed data are publicly available online through the Swedish National Data Service (https://snd.se/en), contributing a new region to the collection of existing CAMELS (Catchment Attributes and Meteorology for Large-sample Studies) datasets. The CAMELS-SE dataset spans a wide range of hydroclimatic, topographic, and environmental catchment properties, making it a valuable resource for researchers and practitioners to study hydrological processes, climate dynamics, environmental impacts, and sustainable water management strategies in Nordic regions.

KEYWORDS
hydrology, precipitation, streamflow, Sweden, temperature

Dataset details Identifier: https://doi.org/10.57804/t3rm-v029.

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Title: Swedish Hydroclimatic Data 1961–2020 – Precipitation, Temperature and Streamflow Observations across 50 Catchments (CAMELS-SE). In Swedish referred to as: 'Hydroklimatiska förhållanden i Sverige 1961–2020 – Nederbörd, temperatur och avrinningsobservationer i 50 avrinningsområden (CAMELS-SE)'.

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Resource type: compressed zip-file, including shapefiles (.shp) and comma-delimited text (.csv) files.

Version: V1.

1 | INTRODUCTION

The field of hydroclimatology is witnessing a transformative era with the convergence of various technologies and methodologies aimed at enhancing research reproducibility, collaboration, and insightful analyses (Gan et al., 2020). Within this context, hydroclimatic datasets have emerged as fundamental tools for unravelling the interplay between climate and hydrology, resonating across geographical boundaries.

The applications of these datasets span a broad spectrum, encompassing model calibration and development (Newman et al., 2015), water resources management (Stewart, 2015), land management (Ochoa-Tocachi et al., 2018), agricultural decision-making (Niyogi et al., 2017), ecological investigations (Novakovskiy & Elsakov, 2014), wetland and ecosystem services (Ghajarnia et al., 2020), and assessments of climate change impacts (Wawrzyniak & Osuch, 2020). In a world marked by increasing environmental uncertainty and the pursuit of sustainable development, the availability of comprehensive and accurate datasets becomes paramount (Gibert et al., 2018).

Beyond their scientific applications, hydroclimatic datasets also serve as vital pedagogical tools (Lane et al., 2021), providing raw material for hands-on learning and enabling students to engage in data-driven investigations, modelling, and analysis. By aligning education with real-world datasets, the research community nurtures the next generation of hydrologists and environmental scientists (Sanchez et al., 2016).

The significance of hydroclimatic datasets becomes even more evident in the face of the unresolved challenges in hydrology. The list of 'Twenty Three Unsolved Problems in Hydrology' (Blöschl et al., 2019) raises essential questions about climate change effects, extreme events, and hydrological modelling, all of which rely on the availability of robust datasets for accurate analysis. Tackling these challenges often requires the exploration of large-scale datasets, particularly when examining hydrological differences and similarities across diverse catchment areas worldwide, which could facilitate the exchange of information across regions (Addor et al., 2020).

The hydrological community is currently dedicating considerable efforts to enhance the availability of such large-scale datasets that provide **c**atchment **a**ttributes and **me**teorology for **l**arge-sample **s**tudies (CAMELS). These CAMELS datasets are currently available for various world regions (Kratzert et al., 2023), including, for instance, the United States (Addor et al., 2017), Chile (Alvarez-Garreton et al., 2018), Brazil (Chagas et al., 2020), Great Britain (Coxon et al., 2020), China (Hao et al., 2021), Australia (Fowler et al., 2021), Austria (Klingler et al., 2021), France (Delaigue et al., 2022), or Switzerland (Höge et al., 2023).

However, despite the collective global effort to unravel hydroclimatic complexities and the abundance of online databases and datasets, a significant amount of information remains fragmented and scattered across different platforms (Arheimer et al., 2011). Moreover, much local data are presented and documented in languages other than English, impeding the transfer of knowledge between local and international communities (Amano et al., 2016). For instance, a considerable portion of open hydrologic data provided by Swedish governmental authorities is solely accessible in Swedish, substantially inhibiting its integration into pan-European or global research initiatives.

To bridge this gap between inaccessible local data and expansive hydrological studies, this paper introduces a novel hydroclimatic dataset for Sweden – a region notably susceptible to the impacts of climate change (European Environment Agency, 2017). This dataset spans six decades and encompasses daily observations of hydroclimatic variables across 50 catchments in Sweden, including precipitation, temperature, and streamflow, enriched with valuable information about the geographical characteristics, land cover, soil classes, and regulation statuses for each catchment. Additionally, this dataset includes a comprehensive array of hydrological signatures that effectively capture the behavioural functions exhibited by each catchment. Importantly, this dataset is made accessible to an international audience, facilitating transdisciplinary research with the potential use cases outlined further below. The paper provides an overview of the physiographic and hydroclimatic attributes of the included catchments, coupled with a comprehensive depiction of the dataset's development process, detailing the synthesis of information derived from various sources.

2 | DATA DESCRIPTION AND DEVELOPMENT

2.1 | Catchment description

The data set comprises 50 Swedish catchments with distinct physiographic and hydroclimatic features (Table 1), varying in their upstream areas (2–8425 km^2) and covering a latitudinal gradient from 56° N to 68° N. Among these, 10 catchments fall under the category of transboundary, with more than 5% of their total area extending into Norway.

Encompassing all three major climate zones in Sweden (Figure 1a), the 50 catchments include the polar tundra climate zone in the Scandinavian Mountains, the subarctic boreal climate in central and northern Sweden, and

TABLE 1 Summary of hydroclimatic and catchment properties of the 50 catchments.

Catchment properties		Mean	Median	Min–Max
Geographic properties	Latitude [°N, WGS84]	61.2	60.5	55.9–68.4
	Catchment area [km^2]	1404	1012	2–8425
	Mean elevation [m a.s.l.]	360	255	12–942
Land cover	Agriculture [%]	10	2	0–100
	Forest [%]	55	62	0–86
	Glaciers [%]	0	0	0–2
	Open land [%]	3	0	0–38
	Shrubs and grassland [%]	16	11	0–77
	Urban [%]	1	0	0–3
	Water, i.e., streams and lakes [%]	6	5	0–16
	Wetlands [%]	8	4	0–33
Soil types	Bedrock and glaciers [%]	17	10	0–70
	Clayey till and clay till [%]	0	0	0–7
	Glaciofluvial sediments [%]	7	6	0–29
	Peat [%]	8	6	0–35
	Postglacial sand-gravel [%]	2	0	0–18
	Silt [%]	3	0	0–25
	Till [%]	47	50	0–98
	Till and weathered deposit [%]	6	0	0–57
Hydroclimatic properties	Mean annual temperature [°C]	3.3	2.8	−2.8–+7.9
	Mean annual precipitation [mm/year]	803	767	544–1196
	Mean annual streamflow [mm/year]	481	378	168–1312

the warm-summer hemiboreal climate zone in the south. Most of the catchments have a predominantly humid climate, with an average annual precipitation of 803 mm during the period 1961–2020. Notably, the western parts of Sweden experience the highest precipitation rates (Figure 1b).

In this collection of catchments, those dominated by snowmelt and those in transitional states outnumber rain-dominated ones. Moreover, nearly half of the catchments receive over a third of their total annual precipitation as snowfall. During the period 1961 to 2020, annual mean temperature stood at 3.3°C, with a clear north–south temperature gradient emerging across the catchments (Figure 1c), highlighting the variation in temperature distribution within the dataset. These climatic features collectively influence streamflow generation (Figure 1d), together with spatial variations in topography (Figure 1e), land use (Figure 1f), and soil classes (Figure 1g).

A pronounced spatial divergence in annual streamflow is also apparent (Figure 1d), with the highest runoff rates (810–1312 mm/year) occurring in the Scandinavian Mountains in northwestern Sweden and the lowest (168–300 mm/year) in Southeastern Sweden. The elevation variability within these catchments is generally relatively low, ranging from 12 to 942 metres above sea level, with mild slopes (Figure 1e). Most of the catchments are covered by forests with limited cultivation, and a limited presence of lakes and wetlands (Figure 1f). At the same time, till soils constitute the dominant soil class in 76% of the catchments, followed by bedrock, peat, and glaciofluvial sediment (Figure 1g). Roughly one-third of the catchments are regulated, but the impact of reservoirs is generally minimal. Glaciers and urban areas are also scarce in these catchments, which is essential for accurate hydrological

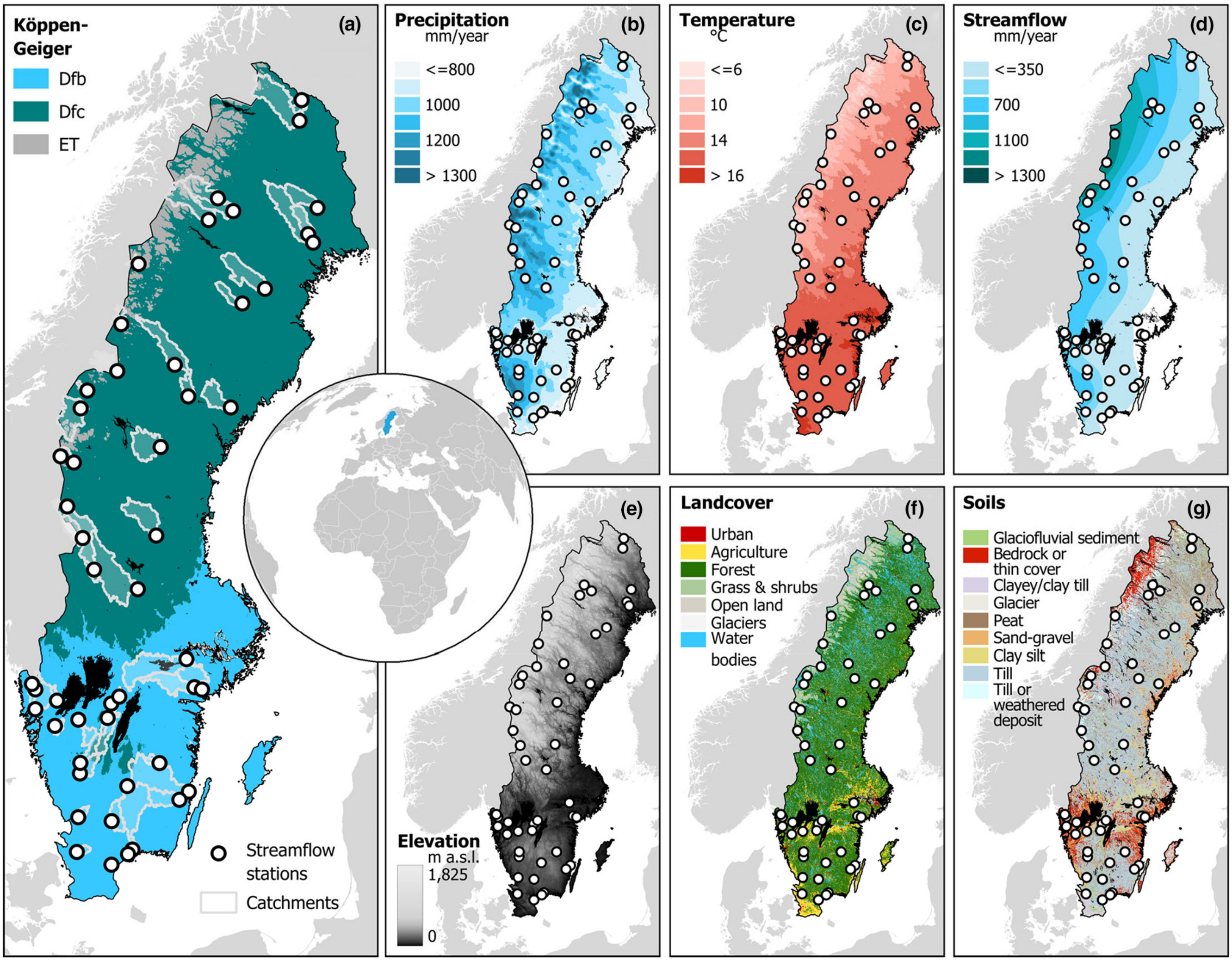


FIGURE 1 Overview of the 50 streamflow stations and their catchments in relation to Sweden's (a) climate zones according to the Köppen-Geiger classification (Beck et al., 2018), including polar tundra climate zone (ET), subarctic boreal climate (Dfc) and warm summer hemiboreal climate (Dfb), (b) mean annual precipitation, (c) mean annual temperature, (d) mean annual streamflow during the period 1961–2020, (e) elevation, (f) land cover classes, and (g) soil classes.

modelling as simulating runoff from such features poses challenges for many models.

2.2 | Data collection

2.2.1 | Streamflow data

Daily streamflow measurements were sourced from the Swedish Meteorological and Hydrological Institute (SMHI) by accessing their publicly accessible water-related database 'Vattenwebb' (SMHI, 2023a). This platform offered an array of resources, including streamflow maps, observed streamflow data, details about water samples, streamflow regimes, simulated flows for ungauged basins, snow cover information, and various other datasets. Notably, the database was exclusively accessible in the Swedish language.

Within this repository, a particular tool called 'Hydrological Observations' hosted data from more than 300 gauging stations, licenced under the Creative Commons Attribution 4.0 International licence (CC-BY 4.0). The available data has undergone regular quality checks and has been widely used for hydrological studies in Sweden, hydrological model calibration, national predictions, warnings, and statistical assessments.

From all available stations, only those that had continuous streamflow measurements during the period January 1961 to December 2020 were selected, or those with gaps of up to 14 days, which were then filled through linear interpolation. The streamflow data files provided by SMHI also included information on the gauging station's number (id), name and geographic location (i.e., latitude and longitude in WGS84 projection), catchment area (in km^2), and stream name.

2.2.2 | Geospatial data

To acquire the geospatial data for the streamflow stations and their catchments, the following steps were taken:

Visualization of a national set of catchments and streams

A polygon shapefile containing more than 55,000 catchment boundaries (with a median area of 3 km^2) and a line shapefile containing more than 135,000 stream segments across Sweden were obtained from SMHI's SVAR database (SMHI, 2023b). The database, available only in Swedish, provided comprehensive information on Swedish lakes, streams, and catchments (Eklund, 2011; Henestål et al., 2015). The shapefiles were processed using QGIS, an open-source, cross-platform GIS application (https://qgis.org/).

Localization of streamflow stations

In QGIS, a new point shapefile was created to visualize the locations of the streamflow stations based on the latitude and longitude information available in the original streamflow data files. A rigorous quality check was performed on this point shapefile, following the criteria that each streamflow station should be situated within the water of a stream and at the outlet of a catchment. Specifically, points were assessed for their intersection with stream segments in the line layer and catchment boundaries in the polygon layer. If a point did not meet this condition, it was manually relocated to the nearest stream and catchment boundary. To ensure accuracy, the final locations of all gauging stations were cross-validated against the stream names and locations on digital maps to confirm that the stream and catchment names matched the station information.

Identification of the upstream catchment area

For each station in the point shapefile, the corresponding catchment boundary was extracted from the polygon file. However, as these relatively small polygons only represented subcatchments that encompassed the respective gauging station, an automated procedure was necessary to obtain the entire upstream area, which typically comprised multiple subcatchments. Since each catchment boundary in the polygon shapefile contained information on the downstream catchment it was draining into, a recursive approach was employed. Beginning from the outlet, all upstream catchments that contributed to this particular subcatchment were systematically traced (Figure 2). This process was then repeated for the identified upstream catchments, progressively reaching further away from the catchment outlet until no further upstream catchments could be detected. Through this procedure, the complete upstream catchment area for each streamflow station could be successfully obtained by merging all the identified subcatchments into one

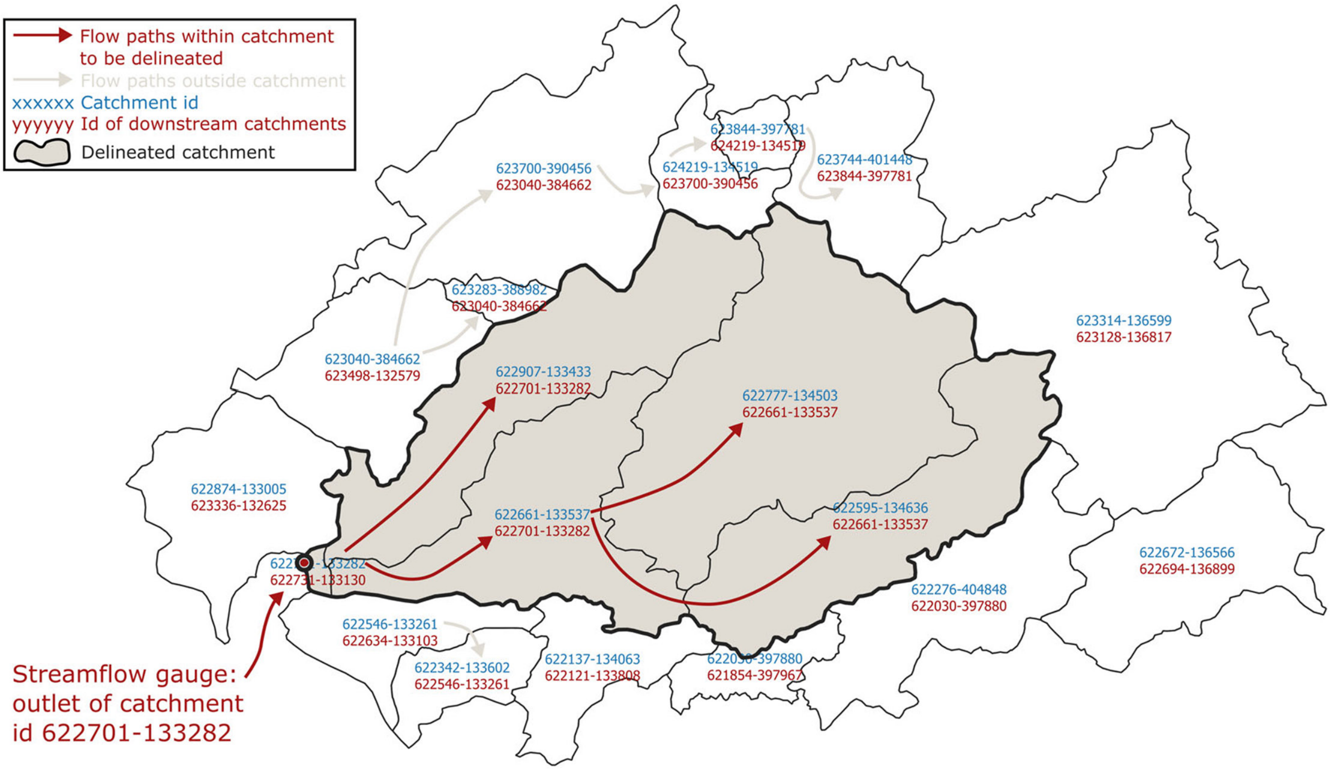


FIGURE 2 Exemplified procedure of tracing the upstream contributing catchment areas.

polygon feature. The resulting shapefiles are included in the provided dataset.

2.2.3 | Catchment properties

Computations of catchment properties, including area, mean elevation, slope, landcover, climate zones, soil classes, and human activities (i.e., river regulation), were carried out using QGIS with the aid of shape and raster files. Mean elevation and slope metrics for each catchment were calculated based on the European Digital Elevation Model (EU-DEM) version 1.1, a raster layer with a resolution of 25 × 25 m provided by the European Environment Agency (EEA, 2023a).

The distribution of landcover categories for each catchment was deduced from the raster-based Corine Land Cover (CLC) 2018 dataset, Version 2020-20u1 (Büttner, 2014; EEA, 2023b). The 28 distinct landcover classes within the Swedish catchments were aggregated into eight broader parent classes: urban, agriculture, forest, grassland and shrubs, open land, glaciers, wetlands, as well as water bodies (i.e., lakes and streams). To compute the percentage of each class within a given catchment, the number of grid cells corresponding to each class present within the catchment boundaries was analysed.

The dataset also incorporates catchment-wise information concerning the Köppen-Geiger climate zone, derived from a raster layer developed by Beck et al. (2018), available under a CC BY 4.0 licence (GloH2O, 2021). Insights into soil classes were sourced from the Swedish Geological Survey (SGU) through their publicly available Swedish national soil type database (SGU, 2023), exclusively accessible in the Swedish language. It is important to note that this soil database was geographically confined to the Swedish border, thus constraining its applicability to the small number of transboundary catchments included in the dataset (Figure 3a). This is particularly relevant for two catchments where the outlet is situated in Sweden, but 98% (Figure 3b) respective 55% (Figure 3c) of their catchment area stretches into Norway (i.e., not covered by the Swedish national soil type database).

Degree of regulation (DOR), representing reservoir volume relative to the mean annual flow volume from its draining area, alongside regulated volume were also extracted from SMHI's 'Vattenwebb' database (SMHI, 2023a). However, it is important to note that this information was not directly linked to the hydrological observations (see Section 2.2.1: Streamflow data). Instead, this information was concealed in a separate tool called 'Modelled Data by Catchment Area', which supplied modelled streamflow data for each of the nearly 55,000 catchments in Sweden, which have been simulated with the national S-HYPE model (Bergstrand, 2014; Girons Lopez et al., 2021; Strömqvist et al., 2012). To ensure a comprehensive and integrated dataset, this information had to be manually linked to the streamflow observations presented in this study.

2.2.4 | Catchment selection criteria

Drawing upon the streamflow data and extracted catchment properties, a careful selection of catchments was made, adhering to specific criteria to guarantee data quality and suitability for diverse analyses:

- Only catchments unaffected by bifurcations or backwater effects were included.
- Consideration was limited to catchments with low percentages (<5%) of glaciers and urbanized areas.
- Catchments with a low DOR (<20%) were exclusively chosen.

In total, 50 catchments fulfilled all the specified criteria (Figure 1a). Notably, six of these catchments were nested within larger catchments.

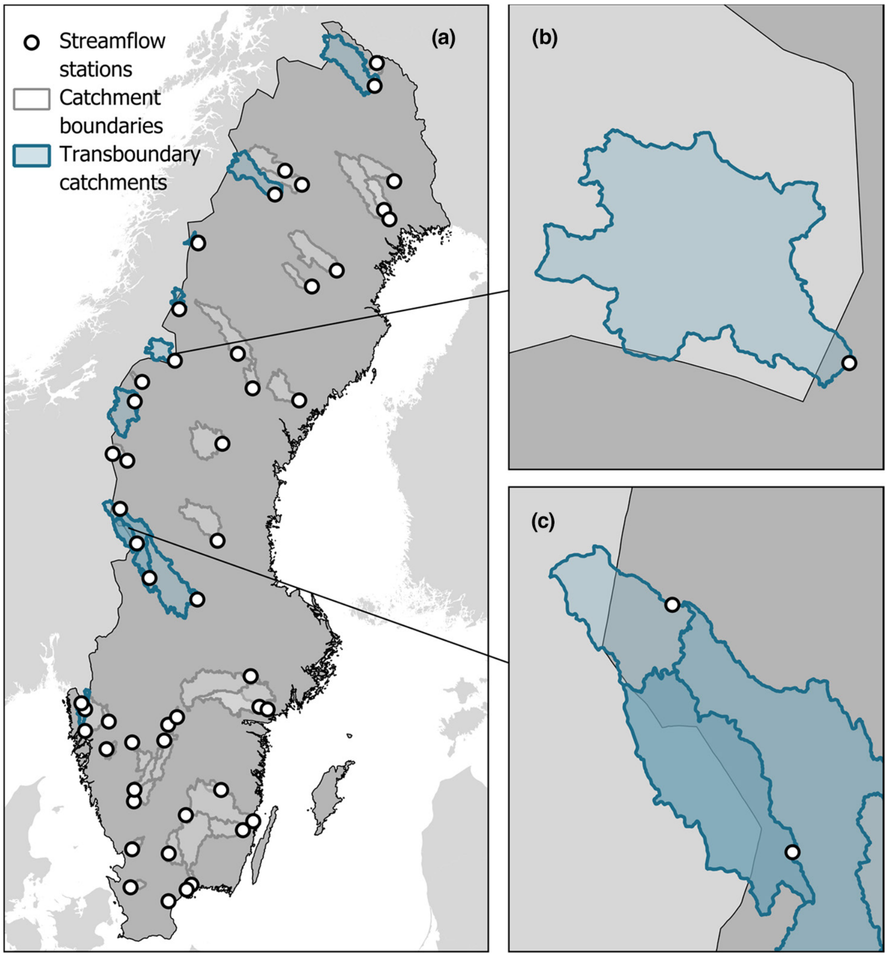
2.2.5 | Meteorological data

Gridded daily mean temperature and precipitation data for each of these 50 catchments were obtained from SMHI's openly available PTHBV database (SMHI, 2023c). This platform with a Swedish interface provided spatially interpolated 4 × 4 km national grids for the period 1961–2020, which are commonly used by SMHI for computations with the national hydrological models S-HYPE (Bergstrand, 2014; Girons Lopez et al., 2021; Strömqvist et al., 2012) and HBV (Bergström, 1992; Seibert & Vis, 2012). The data were available on the nedcdf file format, which was processed in the scientific programming and numeric computing platform MATLAB (www.mathworks.com). Catchment-specific temperature and precipitation values were calculated through an area-weighted average of all grid cells partly or fully lying within the catchment boundaries.

2.2.6 | Hydrological signatures

Hydrological signatures are a powerful tool to characterize catchment-specific dynamic functioning and hydrological responses (Gupta et al., 2008; Toth, 2013; Wagener et al., 2007; Yadav et al., 2007). A broad spectrum of potential streamflow signatures have been employed in the scientific literature (Clausen & Biggs, 2000; Ley et al., 2011;

FIGURE 3 Practical issues when extracting soil data for transboundary catchments from a national source.



Shamir et al., 2005; Yadav et al., 2007), for example, for testing and improving hydrological models (Yilmaz et al., 2008), in ecological studies (Pool et al., 2017), and for evaluating model performance under non-stationary conditions (Mendoza et al., 2015; Stahl et al., 2011). To depict (1) comprehensive water balance and runoff dynamics, (2) seasonal dynamics, (3) low flow, and (4) high flow conditions, a collection of 16 distinct hydrological signatures (Table 2) was computed following the selection by Tootoonchi et al. (2022, 2023). These signatures could be easily derived from the available observed precipitation and streamflow data. Most of these signatures were computed on an annual basis and thereafter averaged over the entire record period. The dataset includes three values for each signature: (1) an average value for CNP 1 (1961–1990), (2) an average value for CNP 2 (1991–2020), and (3) an average value over the entire record period (1961–2020).

3 | DATASET ACCESS

The dataset is available on the server of the Swedish National Data Service (www.snd.se), where it is enlisted as 'Swedish Hydroclimatic Data 1961-2020 – Precipitation, Temperature and Streamflow Observations across 50 Catchments (CAMELS-SE)'. In Swedish it is referred to as: 'Hydroklimatiska förhållanden i Sverige 1961–2020 – Nederbörd, temperatur och avrinningsobservationer i 50 avrinningsområden (CAMELS-SE)'.

It can be accessed at https://doi.org/10.57804/t3rm-v029.

This dataset exclusively consists of shape (.shp) and comma-delimited text (.csv) files that were compressed into .zip files. All file formats are easily viewable and modifiable using freely available software such as 7zip, QGIS, or R. The dataset has been structured into three main directories to ensure systematic organization:

3.1 | Catchment GIS shapefiles

This directory contains two distinct shapefiles in EPSG:4326 – WGS 84 projection. One outlines the boundaries of each catchment in polygon format; the other marks the corresponding outlets, representing streamflow stations.

TABLE 2 Overview and description of hydrological signatures provided in the dataset.

Category	No	Hydrological signatures (abbreviation)	Description	Reference
Water balance and flow dynamics	S01	Mean annual flow, (*Qmean*)	Average flow in a year (mm/year).	Yilmaz et al. (2008)
	S02	Runoff coefficient, (Qcoeff)	Fraction of the total yearly precipitation that generates flow: $Q_{coeff} = \frac{\sum_i Q_i}{\sum_i P_i}$, Where Q_i represents the daily flow (in mm/day) and P_i, daily precipitation, both of which were summed over a year.	Yadav et al. (2007)
	S03	Timing of the centre of mass of annual flow, (*COM*)	Timing is computed from daily flows Q_i and for each year: $COM = \frac{\sum_i Q_i t_i}{\sum_i Q_i}$ where t_i represents ordinal day of a year.	Mendoza et al. (2015)
	S04	Spring onset (spring "pulse day"), (*SPD*)	Spring onset is the ordinal number of the day in which the negative difference between the streamflow mass curve and the mean streamflow mass curve is the greatest. Spring onset series is obtained from values in each year.	Cunderlik and Ouarda (2009)
Seasonal flow dynamics	S05	Mean spring flow, (*Qmean_spring*)	Flows in the spring (1st March through 31st May) in each year.	Teutschbein et al. (2015, 2018)
	S06	Mean summer flow, (*Qmean_summer*)	Flows in the summer (1st June through 31st August) in each year.	
	S07	Mean autumn flow, (*Qmean_autumn*)	Flows in the autumn (1st September through 30st November) in each year.	
	S08	Mean winter flow, (Qmean_winter)	Flows in the winter (1st December through 28th February) in each year.	
Low flow characteristics	S09	Low-flow frequency, (*LFfreq*)	Number of days in a year with flows lower than the 20th percentile of all flow values in the full record period.	Krysanova et al. (2017)
	S010	Timing of 30-day low flow, (T_minQ_d30)	Ordinal day in which 15th day of the 30-day minimum annual flow occurred, obtained in each year. If there were several consecutive days with the same minimum flows, the mean timing of these days in a year is adopted.	Richter et al. (1998), Sadri et al. (2016)
	S011	7-day low flow, (minQ_d7)	Minimum flows averaged over a given number of consecutive days (here, 7 and 30) obtained in each year.	Comer and Zimmermann (1968), Khaliq et al. (2008), Richter et al. (1998)
	S012	30-day low flow, (minQ_d30)		
High flow characteristics	S013	High flow frequency, (*HFfreq*)	Number of days in a year with flows higher than the 80th percentile of all flow values in the full record period.	Krysanova et al. (2017)
	S014	Timing of the 1-day high flow, (T_maxQ_d1)	Ordinal day in which the maximum annual flow occurred, obtained in each year of the observed period.	Richter et al. (1998)
	S015	30-day high flow, (maxQ_d30)	Maximum flows averaged over a given number of days (here, 30 and 1) obtained in each year.	Richter et al. (1998)
	S016	1-day high flow, (maxQ_d1)		

3.2 | Catchment time series

Within this directory, individual files for each of the 50 catchments can be found. These files contain the measured daily hydroclimatic variables. Further details about the abbreviations and variables used in these files can be found in Table 3.

3.3 | Catchment properties

This directory includes separate files for the physical catchment properties, land cover data, soil classifications, and hydrological signatures. Each of these files consolidates information related to all 50 catchments.

3.3.1 | Physical catchment properties

Offers insights into the geographical location and physical attributes of each catchment. Abbreviations and variables are elaborated upon in Table 3.

3.3.2 | Landcover

Encompasses data on eight distinct land cover classes, along with their proportional distribution within each catchment. Table 4 provides further details about the relevant abbreviations and variables.

3.3.3 | Soil classes

Provides information about ten discrete soil categories and their respective distribution within each catchment. Refer to Table 4 for clarification on abbreviations and variables.

3.3.4 | Hydrological signatures

These are divided into three separate files, one covering the entire record period (1961–2020), another for the CNP1 (1961–1990), and a third for the CNP2 (1991–2020).

TABLE 3 Content of the observed time series files and physical catchment properties.

Category	Variable name	Description	Unit name	Unit abbr.
Catchment time series	Year	Date identifiers (year, month, and day) according to the modern-day Gregorian calendar	–	[–]
	Month		–	[–]
	Day		–	[–]
	Qobs_m3s	Observed daily streamflow values	Cubic metre per second	[m^3/s]
	Qobs_mm	Observed daily streamflow values	Millimetre per day	[mm/day]
	Pobs_mm	Observed daily precipitation values	Millimetre per day	[mm/day]
	Tobs_C	Observed daily temperature values	Degrees Celsius	[°C]
Catchment physical properties	ID	Unique catchment identifier specific for each catchment	–	[–]
	Name	Unique catchment name	–	[–]
	Latitude_WGS84	Latitudinal coordinate of the streamflow station in WGS84 projection	Degrees North	[°N]
	Longitude_WGS84	Longitudinal coordinate of the streamflow station in WGS84 projection	Degrees East	[°E]
	Area_km2	Size of the catchment area contributing to the associated streamflow station	Square kilometre	[km^2]
	Elevation_mabsl	Average catchment elevation	Metres above sea level	[m a.s.l.]
	Slope_mean_degree	Average slope across the catchment	Degrees	[°]
	DOR	Degree of regulation, i.e., reservoir volume relative to the mean annual flow volume from its draining area	Percentage	[%]
	RegVol_m3	Regulated volume	Cubic metre	[m^3]
	Pmean_mm_year	Average annual precipitation over the full record period 1961–2020	Millimetre per year	[mm/year]
	Tmean_C	Average annual temperature over the full record period 1961–2020	Degrees celsius	[°C]

TABLE 4 Overview and explanation of variables in the landcover and soil class files.

Category	Variable name	Description	Unit name	Unit abbr.
Landcover	Urban_percentage	Fraction of urban area, including industrial and commercial units, roas networks, airports, dump sites, and construction sites, etc.	Percentage	[%]
	Water_percentage	Fraction of water bodies, including streams and lakes	Percentage	[%]
	Forest_percentage	Fraction of forest cover, comprising broad-leaved, coniferous and mixed forests	Percentage	[%]
	Open_land_percentage	Fraction of open land, inclusive of beaches, bare rocks, sparsely vegetated and burnt areas	Percentage	[%]
	Agriculture_percentage	Fraction of agricultural land, including all types of arable and irrigated land, pastures, agro-forestry areas, and all types of fruit plantations	Percentage	[%]
	Glaciers_percentage	Fraction of glaciers and perpetual snow	Percentage	[%]
	Shrubs_and_grassland_percentage	Fraction of shrubs and grasslands, encompassing natural grasslands, moors and heathland, as well as transitional woodland-shrubland, etc.	Percentage	[%]
	Wetlands_percentage	Fraction of wetlands, including inland marshes, peat bogs, and salt marshes	Percentage	[%]
Soil class	Glaciofluvial_sediment_percentage	Proportion of glaciofluvial sediments	Percentage	[%]
	Bedrock_percentage	Proportion of bedrock	Percentage	[%]
	Postglacial_sand_and_gravel_percentage	Proportion of postglacial sand and gravel	Percentage	[%]
	Till_percentage	Proportion of till	Percentage	[%]
	Water_percentage	Proportion of water bodies (i.e., streams and lakes)	Percentage	[%]
	Peat_percentage	Proportion of peat soils	Percentage	[%]
	Silt_percentage	Proportion of silt	Percentage	[%]
	Clayey_till_and_clay_till_percentage	Proportion of clayey till and clay till	Percentage	[%]
	Till_and_weathered_deposit_percentage	Proportion of till and weathered deposits	Percentage	[%]
	Glacier_percentage	Proportion of glaciers	Percentage	[%]

It's important to note that the mean streamflow used as a reference for computing low- and high-flow frequencies across all three instances was computed from the entire record period (see explanations in Table 2).

4 | POTENTIAL DATA SET USE AND REUSE

The dataset comprises hydroclimatic observations that offer valuable insights into spatiotemporal patterns of hydrological dynamics and catchment behaviour. These observations can be leveraged to analyse various aspects, such as climate change impacts on water resources, catchment responses to anthropogenic factors, or the development of effective water management strategies.

The dataset spans two designated 'climate normal periods' (CNPs): 1961–1990 and 1991–2020. CNPs are widely used for calculating 'climate normals', which represent the 30-year averages of the Earth's climate (WMO, 2020). Consequently, this dataset proves to be instrumental in assessing long-term trends in hydrological variables and extreme climatic or hydrological events (cf., Teutschbein et al., 2022). It also serves as an important reference for understanding potential future climate change impacts (cf., Teutschbein et al., 2023).

With its extensive record length, the dataset provides an excellent opportunity for hydrological model calibration and testing (cf., Todorović et al., 2022), as it allows for robust split- or differential split-sample tests (Klemeš, 1986), enabling the evaluation of model transferability across a large hydroclimatic gradient. The dataset can also be utilized to build and evaluate methods across an array of catchment properties (Tootoonchi et al., 2022, 2023).

Furthermore, this dataset opens avenues for transdisciplinary research, enabling the integration of hydrology, meteorology, climate science, environmental studies, ecology, and/or public health. Such collaboration can lead to a deeper understanding of complex interactions within these fields and foster innovative solutions to address water-related challenges. Additionally, the dataset holds the potential to function as a resource in education (Lane et al., 2021), offering material for diverse learning opportunities such as data-driven investigations, modelling endeavours, and problem-based analysis.

5 | CONCLUSIONS

The developed dataset, integrating daily precipitation, temperature, and streamflow observations from 50 catchments in Sweden alongside essential geographical and catchment property information, represents a significant asset for the scientific community. Despite the diverse underlying data sources that may introduce bias and errors into subsequent analyses (McMillan et al., 2018), the dataset empowers researchers and practitioners to gain deeper insights into hydrological processes, explore climate change impacts, and devise sustainable water management strategies. With its long record period and versatility, the dataset proves to be a great resource for model calibration, education, method development, and fostering transdisciplinary research across various disciplines. Embracing this dataset opens doors to address pressing water-related challenges and advance our understanding of hydrology and climate dynamics beyond national and disciplinary boundaries.

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OPEN RESEARCH BADGES

This article has been awarded Open Data Badge for making publicly available the digitally-shareable data necessary to reproduce the reported results. Data is available at https://doi.org/10.57804/t3rm-v029.

DATA AVAILABILITY

The CAMELS-SE dataset is available through the Swedish National Data Service (www.snd.se): https://doi.org/10.57804/t3rm-v029.

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