Trends in groundwater chemistry across Sweden during 1980−2020

SND-ID: 2022-226-1. **Version**: 1. **DOI**: https://doi.org/10.5878/ms33-dh85

Download data

Klaus_Swedish_Groundwater_chemistry_DATASET_ver1_2.tsv *(124.68 KB)*

Associated documentation

Acidity - pH Methods.pdf *(475.34 KB)*

Alkalinity Methods.pdf *(104.33 KB)*

Ammonium, NH4-N Methods.pdf *(90.7 KB)*

Calcium, Ca Methods.pdf *(84.86 KB)*

Chloride, Cl Methods.pdf *(87.79 KB)*

Dissolved oxygen, O2 Methods.pdf *(102.16 KB)*

HVM_grundvattenkvalitet.pdf *(2.24 MB)*

Klaus_DATASET_Variable description.pdf *(813.96 KB)*

Magnesium, Mg Methods.pdf *(86.73 KB)*

Potassium, K Methods.pdf *(85.98 KB)*

Silicon, Si Methods.pdf *(98.2 KB)*

Sodium, Na Methods.pdf *(85.79 KB)*

Sulphate, SO4 Methods.pdf *(95.41 KB)*

Sum of Oxidized Nitrogen, NO2-N and NO3-N_NOX Methods.pdf *(104.15 KB)*

Total organic carbon, TOC Methods.pdf *(93.36 KB)*

Download all files

2022-226-1-1.zip *(~4.72 MB)*

Citation

Klaus, M. (2023) Trends in groundwater chemistry across Sweden during 1980−2020 (Version 1) [Data set]. Swedish University of Agricultural Sciences. Available at: https://doi.org/10.5878/ms33-dh85

Creator/Principal investigator(s)

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Research principal

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Principal's reference number

SLU.seksko.2022.4.1-52

SLU.seksko.2022.lÄ-7

Description

This dataset contains medians, linear trends and change points in groundwater chemistry across Sweden during 1980-2020. Water chemical parameters include measured pH, alkalinity, concentrations of base cations and acid anions, dissolved oxygen, dissolved silica, total organic carbon, groundwater temperature, groundwater level, as well as dissolved inorganic carbon and carbon dioxide calculated using carbonate equilibrium equations based on pH, alkalinity and temperature. The statistics are calculated from a total of 5745 sampling occasions for 55 groundwater wells or springs that are part of the National Groundwater Chemistry Monitoring program run by the Geological Survey of Sweden. Included is also background information on the sampling locations. The aim with this data compilation is to evaluate effects of environmental changes on groundwater carbon cycling.

Given are medians and linear trends (Theil sen slopes, incl. p-value), change points in trends and numbers of observation of dissolved inorganic carbon, carbon dioxide, pH, alkalinity, total organic carbon, base cations (Ca, Mg, K, Na), acid anions (Cl, SO4, NO3), ammonium, dissolved silica, dissolved oxygen, groundwater temperature and groundwater level. Medians and linear trends are also given for transformations (Pivot coordinates) of the above listed water chemical variables that account for the compositional nature of the data (Templ et al. 2011). Additionally, site specific information is given, including site name / ID, geographic coordinates, bedrock type, aquifer type and well depth. Dissolved inorganic carbon and carbon dioxide is calculated using carbonate equilibrium equations based on alkalinity, pH and water temperature, using the R package "phreeqc" (Charlton and Parkhurst 2011). Trends are calculated for the periods 1980-2000, 2000-2020 and 1980-2020 using the R package "rkt" (Marchetto 2021). Break points are calculated using the R package "segmented" (Muggeo 2008). Pivot coordinates are calculated using the R package ‘robCompositions’ (Templ et al. 2011). The raw data is openly available at Swedish Geological Survey (SGU 2022a,b). The data was downloaded on 2021-10-03.

References:
Charlton, S. R. & Parkhurst, D. . Modules based on the geochemical model PHREEQC for use in scripting and programming languages: Computers & Geosciences, v. 37, p. 1653-1663. (2011)
Marchetto, A. rkt: Mann-Kendall Test, Seasonal and Regional Kendall Tests. R package version 1.6. Available at: https://CRAN.R-project.org/package=rkt. (2021).
Muggeo, V. M. R. segmented: an R Package to Fit Regression Models with Broken-Line Relationships. R News, 8/1, 20-25. Available at: https://cran.r-project.org/doc/Rnews/. (2008).
SGU. Data från miljöövervakning av grundvatten, öppna data (Groundwater environmental monitoring data, in Swedish). Available at: https://www.sgu.se/produkter/geologiska-data/oppna-data/grundvatten-oppna-data/miljoovervakning-av-grundvatten/. (2022a).
SGU. Data om grundvattennivåer (Groundwater level data, in Swedish). Available at https://www.sgu.se/grundvatten/grundvattennivaer/ladda-ned-grundvattendata/. (2022b).
Matthias Templ, Karel Hron, P. F. robCompositions: an R-package for robust statistical analysis of compositional data. v. 2.3.1. in Compositional Data Analysis. Theory and Applications (eds. Pawlowsky-Glahn, V. & Buccianti, A.) 341–355 (John Wiley & Sons, 2011).

Data contains personal data

No

Language

English

Time period(s) investigated

1980-01-01 – 2020-12-31

Variables

229

Data format / data structure

Numeric

Text

Data collection 1

- Description of the mode of collection: National monitoring of groundwater chemistry, performed by the Geological Survey in Sweden. For details, see attached document "HVM_grundvattenkvalitet" (in Swedish only)
- Time period(s) for data collection: 1980-01-01 – 2020-12-31
- Instrument: Water chemical laboratory (SLU) (Technical instrument(s)) - Analysis at the Water chemical laboratory at the Department of Aquatic Sciences and Assessment, Swedish University of Agricultural Sciences. Laboratory methods are described in the documenting files.

Geographic spread

Geographic location: Sweden

Geographic description: The sites are located all across Sweden and cover a range of latitudes from 52−68°N.

Responsible department/unit

Department of Forest Ecology and Management

Funding

- Funding agency: Geological Survey of Sweden
- Funding agency's reference number: 36–2788/2021
- Project name on the application: The role of groundwater in the carbon cycle: long-term sink or overlooked legacy?

Research area

Earth and related environmental sciences (Standard för svensk indelning av forskningsämnen 2011)

Environmental sciences (Standard för svensk indelning av forskningsämnen 2011)

Geochemistry (Standard för svensk indelning av forskningsämnen 2011)

Physical geography (Standard för svensk indelning av forskningsämnen 2011)

Oceanography, hydrology and water resources (Standard för svensk indelning av forskningsämnen 2011)

Geoscientific information (INSPIRE topic categories)

Environment (INSPIRE topic categories)

Keywords

Environmental impacts, Water quality/water chemistry, Water temperature, Ph, Ground water, Carbon cycle/carbon budget models, Groundwater quality, Environmental change, Long-term trend, Basicity, Environmental monitoring, Pollution

Publications

Klaus, M., (2023). Decadal increase in groundwater inorganic carbon concentrations across Sweden. Communications Earth & Environment 4:221. https://doi.org/10.1038/s43247-023-00885-4
DOI: https://doi.org/10.1038/s43247-023-00885-4

Polygon (Lon/Lat)

10.850066, 54.940607

25.09686, 54.940607

25.09686, 69.139619

10.850066, 69.139619

10.850066, 54.940607

Accessibility level

Access to data through SND
Data are freely accessible

Use of data

Things to consider when using data shared through SND

Versions

Version 1. 2023-05-16

Contact for questions about the data

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Download metadata

DataCite

DDI 2.5

DDI 3.3

DCAT-AP-SE 2.0

JSON-LD

PDF

Citation (CSL)

File overview (CSV)

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