

Where has hydrogeologic science been, and where is it going?

Research trends in hydrogeology publishing over the past 60 years

Catherine Christenson*

Corresponding author: Department of Geoscience, University of Wisconsin-Madison, 1215 W.

Dayton Street, Madison, WI 53715; cchristenso4@wisc.edu

Michael Cardiff

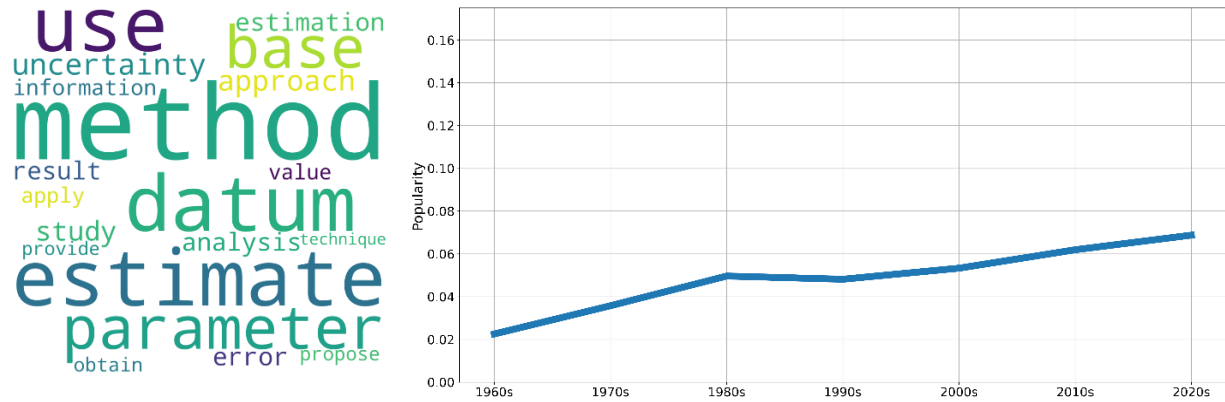
Department of Geoscience, University of Wisconsin-Madison, 1215 W. Dayton Street, Madison, WI

53715; cardiff@wisc.edu

Introduction

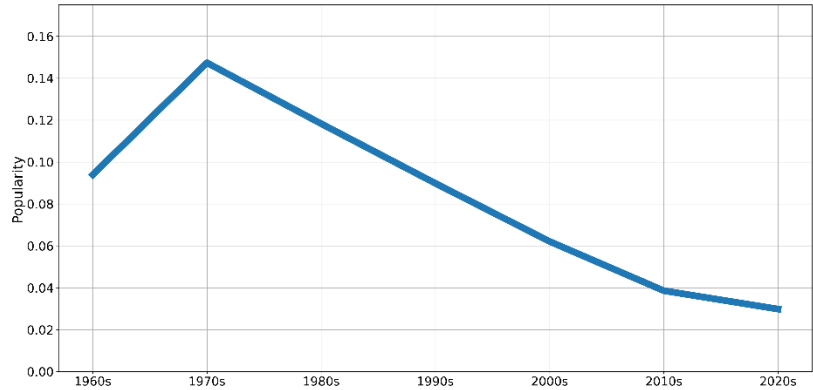
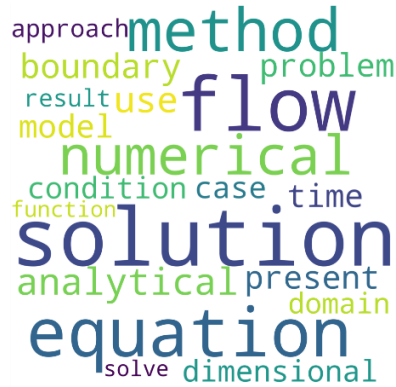
For each of the 30 resulting topics in the model presented in this study, both the initial topic name assigned by ChatGPT based on the keywords and top 10 article titles most associated with the topic are provided, along with the revised or final version of the topic name agreed upon by the authors. The trend line of the popularity of the topic relative to the other topics for each time slice (decade) is also provided.

Topic 0	
Initial ChatGPT Generated Topic Name	Final Topic Name Assignment
Groundwater Modeling and Uncertainty Estimation in Hydrogeology	Groundwater Modeling and Uncertainty Estimation in Hydrogeology



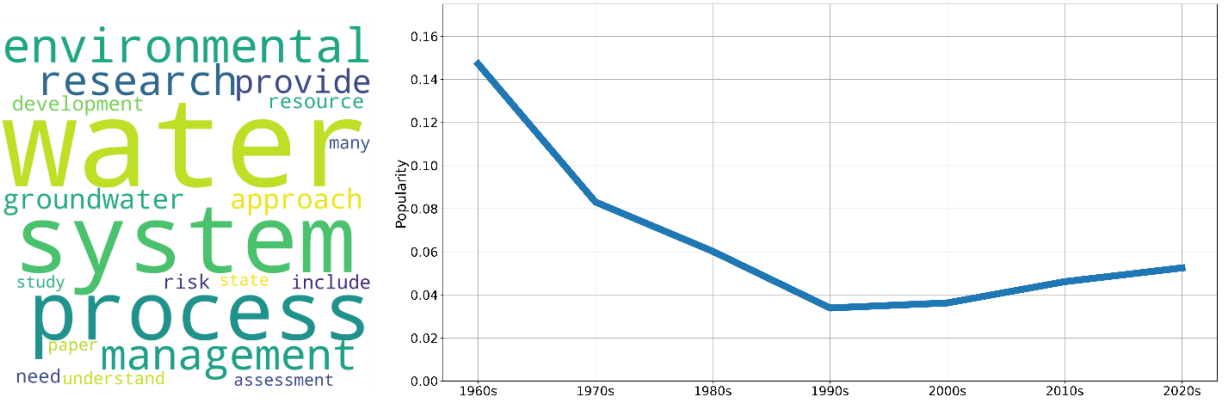
Top associated document titles for topic
A subagging regression method for estimating the qualitative and quantitative state of groundwater
Comparison of bootstrap confidence intervals for an ANN model of a karstic aquifer response
Identifying outliers of non-Gaussian groundwater state data based on ensemble estimation for long-term trends
An improved neural network approach to the determination of aquifer parameters
Geostatistical methods for detection of outliers in groundwater quality spatial fields
Alternative spatial estimators for ground-water and soil measurements
Estimating the uncertainty of hydrological predictions through data-driven resampling techniques
Aleatoric and epistemic uncertainty in groundwater flow and transport simulation
Comparison of first-order analysis and fuzzy set approach for the evaluation of imprecision in a pesticide groundwater pollution screening model
Determining the range of predictions of a groundwater model which arises from alternative calibrations

Topic 1	
Initial ChatGPT Generated Topic Name	Final Topic Name Assignment
Analytical and Numerical Methods in Groundwater Flow Modeling	Analytical and Numerical Methods in Groundwater Flow Modeling



Top associated document titles for topic
A Generalized Series Solution for the Boussinesq Equation With Constant Boundary Conditions
Series Representation of Flux for the Boussinesq Equation
A Dirac- function notation for source/sink terms in groundwater flow
A Simple Analytical Solution for the Boussinesq One Dimensional Groundwater Flow Equation
Extension of Vedernikov's graph for seepage from canals
Solution of transient groundwater flow problems by the finite element method
Dispersion calculations in nonuniform seepage
Transient flow to open drains: Comparison of linearized solutions with and without the Dupuit assumption
A numerical method for determining a coefficient in an elliptic equation
Variational Principles for Confined and Unconfined Flow of Ground Water

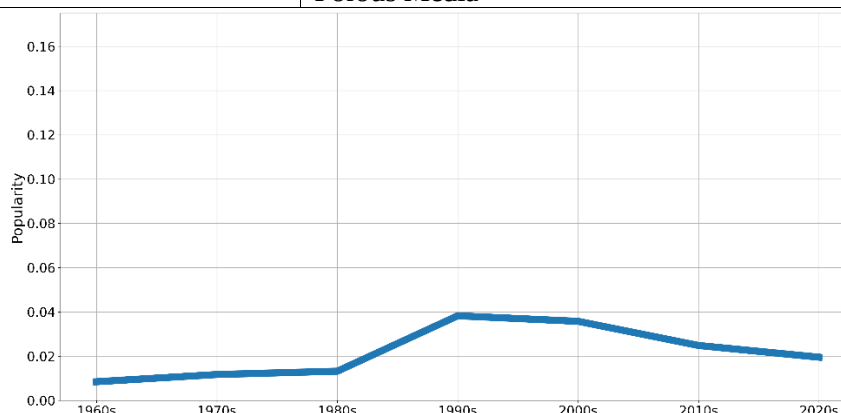
Topic 2	
Initial ChatGPT Generated Topic Name	Final Topic Name Assignment
Integrated Groundwater Management and Environmental Hydrogeology	Integrated Hydrogeological Management and Environmental Research



Top associated document titles for topic
EPA's groundwater research.
Motivation of synthesis, with an example on groundwater quality sustainability
Hydrogeological research, education, and practice: A path to future contributions
INTERSTATE AND INTERNATIONAL COMPETITION FOR WATER RESOURCES
Power and empowerment in transdisciplinary research: a negotiated approach for peri-urban groundwater problems in the Ganges Delta
Opinion I
Opinion I
Cooperative modeling: Linking science, communication, and ground water planning
Hydrogeological Training in the USSR
GROUNDWATER POLLUTION, FROM THE WASTE DISCHARGER'S VIEWPOINT

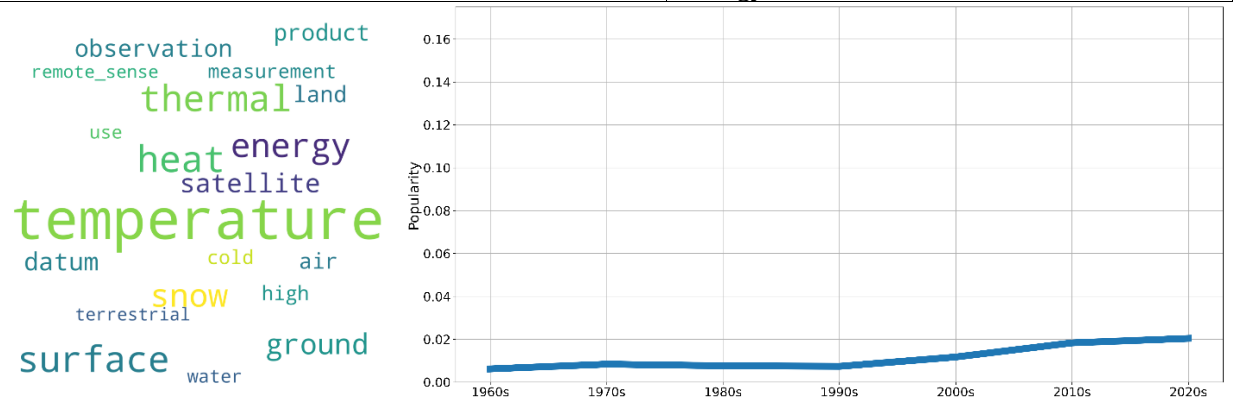
Topic 3	
Initial ChatGPT Generated Topic Name	Final Topic Name Assignment
Contaminant Remediation and Transport in Porous Media	Contaminant Remediation and Transport in Porous Media

solution
 removal
 particle
 column
 treatment
 groundwater
 low sand
 bacteria
 concentration
 high cell
 increase
 study
 experiment
 user
 result
 adsorption
 surface
 colloid



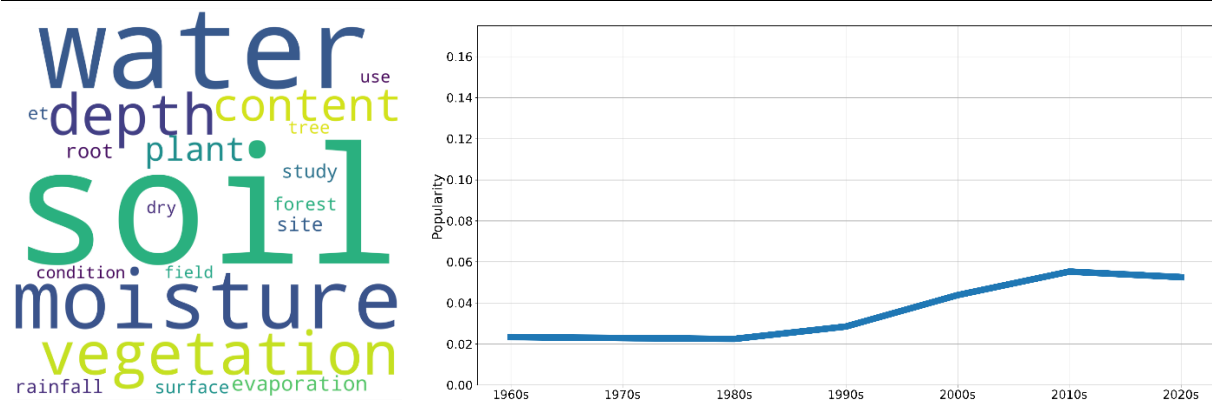
Top associated document titles for topic
Equipment news: EC-300 removes MTBE from ground water
Foam delivery of calcium polysulfide to the vadose zone for chromium(vi) immobilization: A laboratory evaluation
Effect of surface coatings, grain size, and ionic strength on the maximum attainable coverage of bacteria on sand surfaces
Effect of Anionic Biosurfactant on Hexadecane Partitioning in Multiphase Systems
Particle release and permeability reduction in a natural zeolite (clinoptilolite) and sand porous medium
Long-term chemical and biological stability of surfactant-modified zeolite
Colloidal stability and mobility of extracellular polymeric substance amended hematite nanoparticles
Use of amphiphilic polymer particles for in situ extraction of sorbed phenanthrene from a contaminated aquifer material
Polycyclic aromatic hydrocarbons remobilization from contaminated porous media by (bio)surfactants washing
The influence of mineralogy and solution chemistry on the attachment of bacteria to representative aquifer materials

Topic 4	
Initial ChatGPT Generated Topic Name	Final Topic Name Assignment
Remote Sensing and Modeling of Surface Energy Fluxes in Cold Environments	Remote Sensing and Modeling of Surface Energy Fluxes in Cold Environments



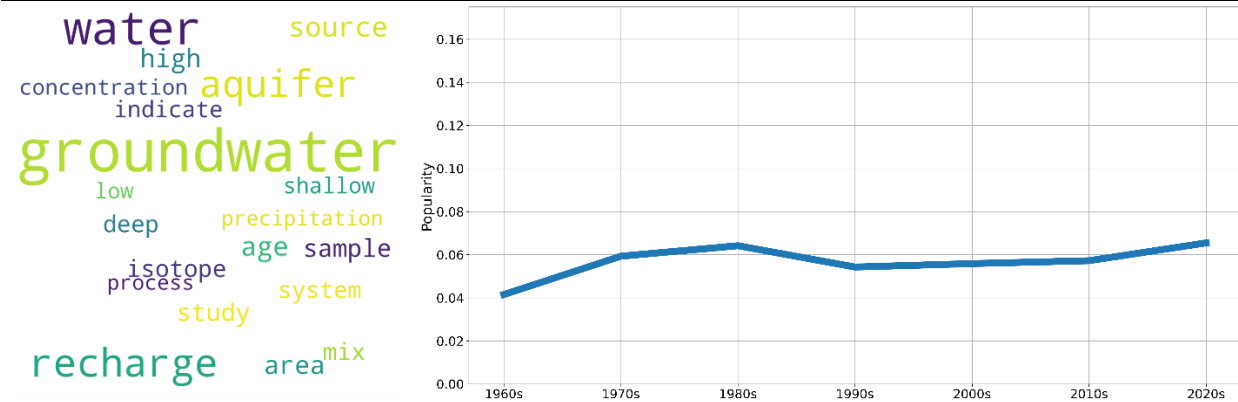
Top associated document titles for topic
Effects of surface characteristics on infiltration patterns in an arid shrub desert
Effects of rainfall characteristics on infiltration and redistribution patterns in revegetation-stabilized desert ecosystems
Comparison of interception, forest floor evaporation and transpiration in Pinus radiata and Eucalyptus globulus plantations
SPATIAL AND TEMPORAL INFLUENCE OF SOIL FROST ON INFILTRATION AND EROSION OF SAGEBRUSH RANGELANDS
Seasonal dynamics and controls of deep soil water infiltration in the seasonally-frozen region of the Qinghai-Tibet plateau
Coffee and shade trees show complementary use of soil water in a traditional agroforestry ecosystem
The effect of biological soil crusts on soil moisture dynamics under different rainfall conditions in the Tengger Desert, China
Evaporative losses from soils covered by physical and different types of biological soil crusts
Soil freezing and thawing processes affected by the different landscapes in the middle reaches of Heihe River Basin, Gansu, China
Partitioning of rainfall in a cocoa (Theobroma cacao L.) plantation

Topic 5	
Initial ChatGPT Generated Topic Name	Final Topic Name Assignment
Soil Hydrology and Vegetation Interactions	Ecohydrology



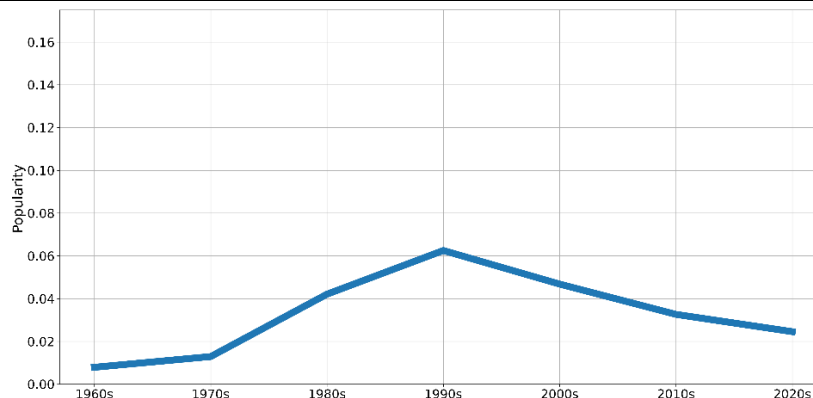
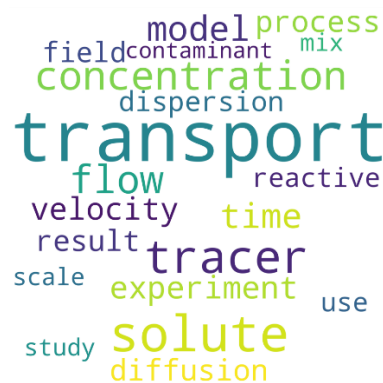
Top associated document titles for topic
Effects of surface characteristics on infiltration patterns in an arid shrub desert
Effects of rainfall characteristics on infiltration and redistribution patterns in revegetation-stabilized desert ecosystems
Comparison of interception, forest floor evaporation and transpiration in Pinus radiata and Eucalyptus globulus plantations
SPATIAL AND TEMPORAL INFLUENCE OF SOIL FROST ON INFILTRATION AND EROSION OF SAGEBRUSH RANGELANDS
Seasonal dynamics and controls of deep soil water infiltration in the seasonally-frozen region of the Qinghai-Tibet plateau
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The effect of biological soil crusts on soil moisture dynamics under different rainfall conditions in the Tengger Desert, China
Evaporative losses from soils covered by physical and different types of biological soil crusts
Soil freezing and thawing processes affected by the different landscapes in the middle reaches of Heihe River Basin, Gansu, China
Partitioning of rainfall in a cocoa (Theobroma cacao L.) plantation

Topic 6	
Initial ChatGPT Generated Topic Name	Final Topic Name Assignment
Groundwater Geochemistry and Isotopic Tracing	Groundwater Geochemistry and Isotopic Tracing



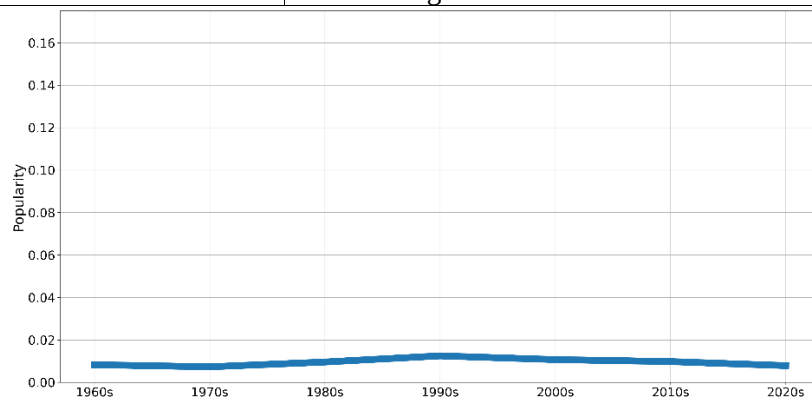
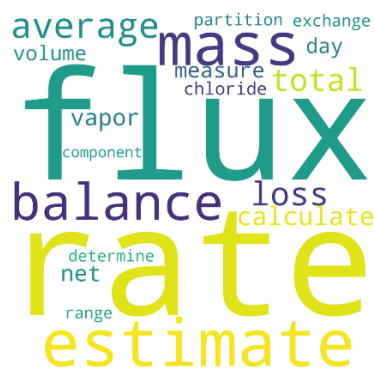
Top associated document titles for topic
Mechanism of groundwater recharge in the middle-latitude desert of eastern Hunshandake, China: diffuse or focused recharge?
Présence d'eaux anciennes dans les eaux du forage de N'Tarla, région de Koutiala (république du mali)
Use of hydrogeochemistry and environmental isotopes for evaluation of groundwater in Qingshuihe Basin, northwestern China
Strontium and carbon isotope constraints on carbonate-solution interactions and inter-aquifer mixing in groundwaters of the semi-arid Murray Basin, Australia
Geochemical and isotopic study of the multilayer aquifer system in the Moularef-Redayef basin, southern Tunisia
The chemistry and origin of groundwater in Triassic sandstone and Quaternary deposits, northwest England and some UK comparisons
Isotopic tracing for conceptual models of groundwater hydrodynamics in multilayer aquifer systems of central and southern Tunisia
Identifying the deep groundwater recharge processes in an intermountain basin using the hydrogeochemical and water isotope characteristics
Hydrochemical and isotopic characteristics of groundwater in the Continental Intercalaire aquifer system: Insights from Mزاب Ridge and surrounding regions, North of the Algerian Sahara
Recharge and mineralization of groundwater of the Upper Cretaceous aquifer in Orontes basin, Syria

Topic 7	
Initial ChatGPT Generated Topic Name	Final Topic Name Assignment
Solute Transport and Non-Equilibrium Processes in Porous Media	Solute Transport and Non-Equilibrium Processes in Porous Media



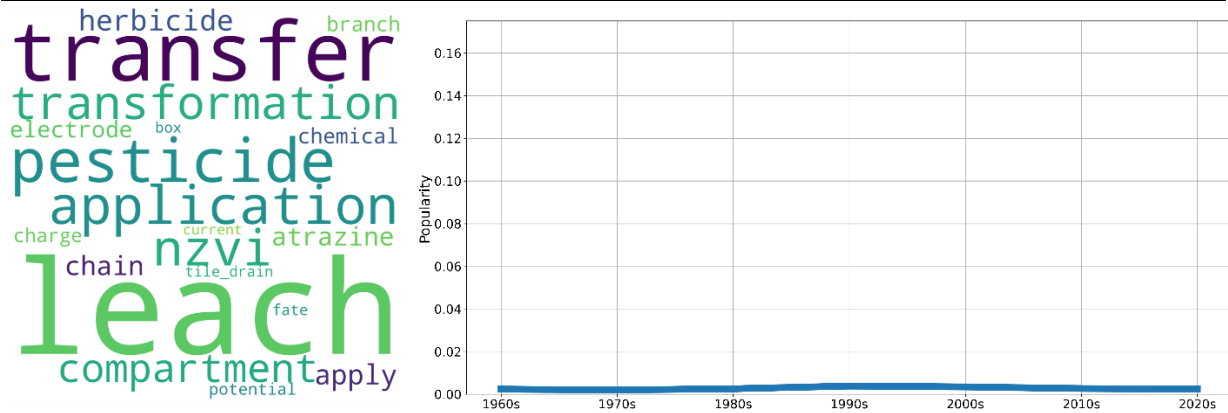
Top associated document titles for topic
The effect of local-scale physical heterogeneity and nonlinear, rate-limited sorption/desorption on contaminant transport in porous media
Modeling plume behavior for nonlinearly sorbing solutes in saturated homogeneous porous media
Characterizing and quantifying the impact of immiscible-liquid dissolution and nonlinear, rate-limited sorption/desorption on low-concentration elution tailing
Evidence of compound-dependent hydrodynamic and mechanical transverse dispersion by multitracer laboratory experiments
Rate limited sorption and nonequilibrium transport of organic chemicals in low organic carbon aquifer materials
Rate-limited mass transfer or macrodispersion: Which dominates plume evolution at the Macrodispersion Experiment (MADE) site?
Characterizing the contribution of diffusive mass transfer to solute transport in sedimentary aquifer systems at laboratory and field scales
On the importance of diffusion and compound-specific mixing for groundwater transport: An investigation from pore to field scale
Transport and biodegradation of solutes in stratified aquifers under enhanced in situ bioremediation conditions
Pore-scale simulation of intragranular diffusion: Effects of incomplete mixing on macroscopic manifestations

Topic 8	
Initial ChatGPT Generated Topic Name	Final Topic Name Assignment
Mass Balance and Flux Estimation in Groundwater Systems	Water Budget Methods



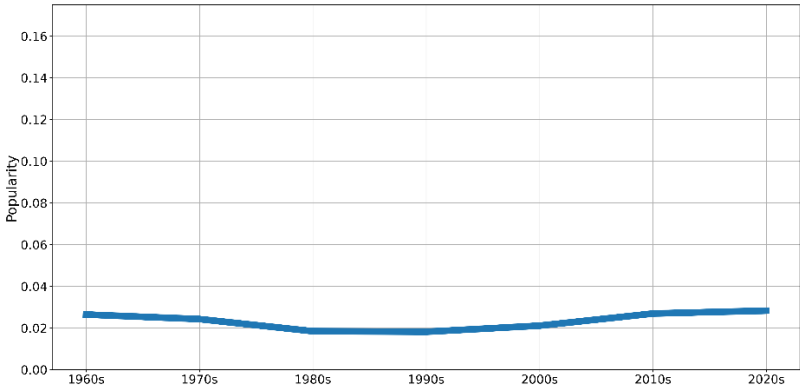
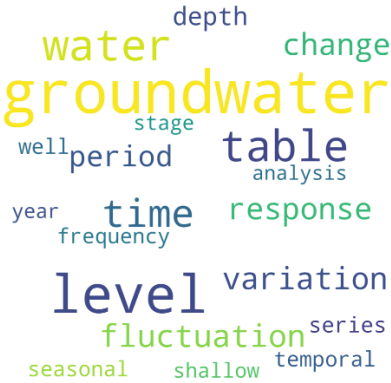
Top associated document titles for topic
Significance of stemflow in groundwater recharge 1: Evaluation of the stemflow contribution to recharge using a mass balance approach
Air-water exchange and mass balance of toxaphene in the Great Lakes
Quantification of natural vapor fluxes of trichloroethene in the unsaturated zone at Picatinny Arsenal, New Jersey
Hydrological and chemical estimates of the water balance of a closed-basin lake in north central Minnesota
Groundwater inflow to a shallow, poorly-mixed wetland estimated from a mass balance of radon
Containment of Sources of Groundwater Contamination: Analysis of Mass Fluxes
Estimating groundwater recharge using the chloride mass-balance method in the West Bank, Palestine
Revised model for molecular diffusion and advection
Mass balance of total mercury and monomethylmercury in coastal embayments of a volcanic island: Significance of submarine groundwater discharge
A Simple Theory For Estimating Well Losses: With Application To Test Wells In Bangladesh

Topic 9	
Initial ChatGPT Generated Topic Name	Final Topic Name Assignment
Contaminant Transport and Leaching in Groundwater	Contaminant Transport and Leaching in Groundwater

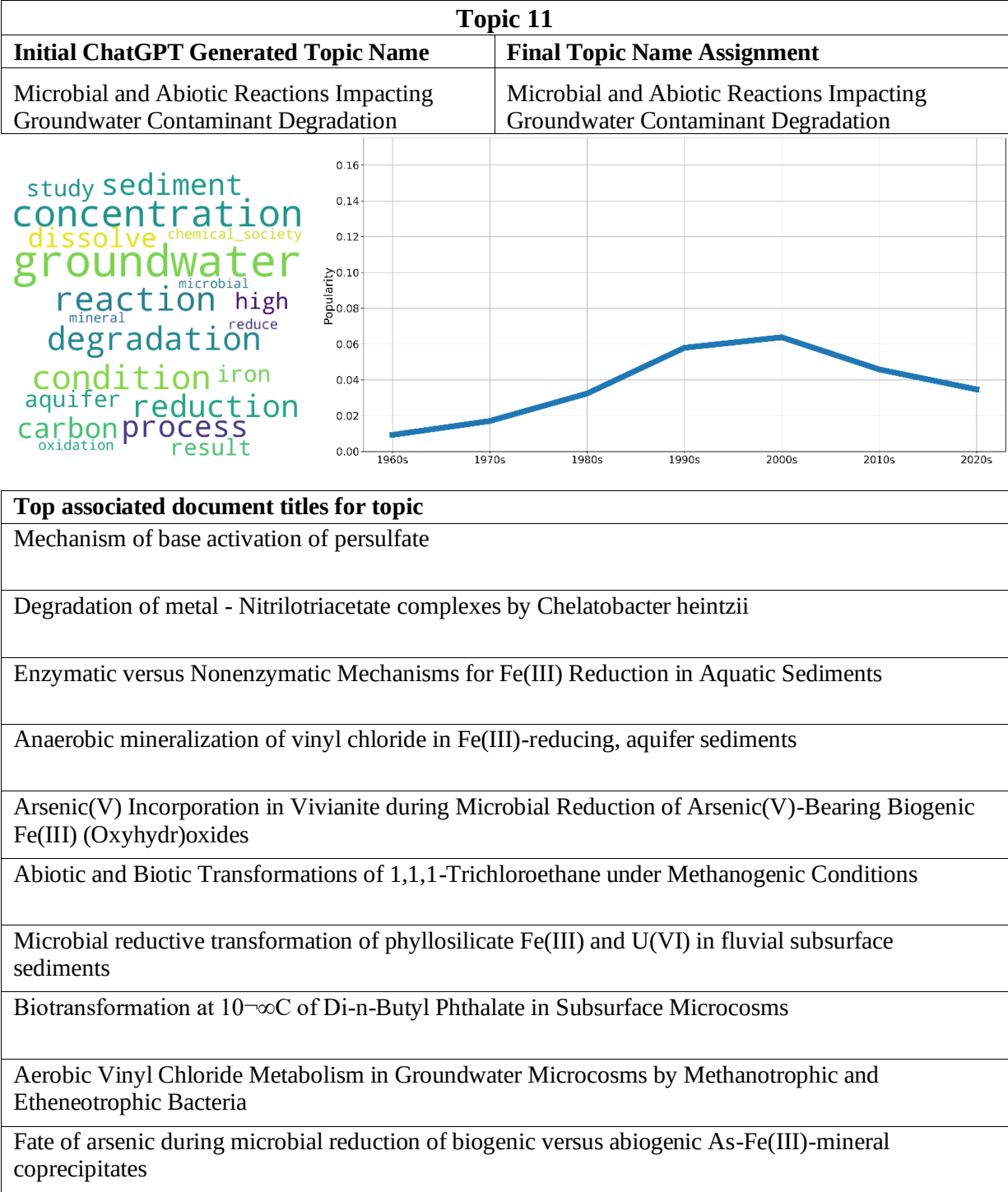


Top associated document titles for topic
Transport of organic contaminants in groundwater
Estimation of leachability and persistence of pesticides at golf courses from point-source monitoring and model to predict pesticide leaching to groundwater
Partial oxidation ("Aging") and surface modification decrease the toxicity of nanosized zerovalent Iron
Fe0 nanoparticles remain mobile in porous media after aging due to slow desorption of polymeric surface modifiers
Reactivity, Selectivity, and Long-Term Performance of Sulfidized Nanoscale Zerovalent Iron with Different Properties
Effects of nano zero-valent iron on oxidation-reduction potential
Incorporating uncertainty in a chemical leaching assessment
An Expert Systems Approach for Assessing the Potential for Pesticide Contamination of Ground Water
Field Use of Orifice Meters
Survival and activity of an atrazine-mineralizing bacterial consortium in rhizosphere soil

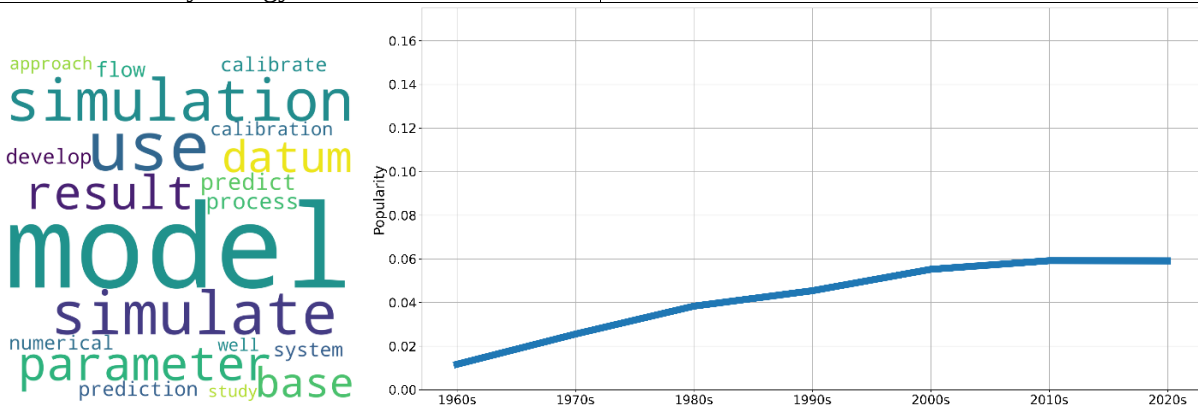
Topic 10	
Initial ChatGPT Generated Topic Name	Final Topic Name Assignment
Temporal and Spectral Analysis of Groundwater Level Fluctuations	Temporal and Spectral Analysis of Groundwater Level Fluctuations



Top associated document titles for topic
Spectral responses of water level in tidal river and groundwater
Spectral analysis of tidal fluctuations in ground water level
Identifying non-stationary groundwater level response to North Atlantic ocean-atmosphere teleconnection patterns using wavelet coherence
Coseismic response of water level in Changping well, China, to the Mw 9.0 Tohoku earthquake
Groundwater responses to the 2011 Tohoku Earthquake on Jeju Island, Korea
Impacts of riparian zone plant water use on temporal scaling of groundwater systems
The effect of hydrogeology on variations in the electrical conductivity of groundwater fluctuations
Historical groundwater trends in northern New England and relations with streamflow and climatic variables
Application of a Mathematical Model to Estimate Water Levels
The prediction of piezometric groundwater levels in observation wells based on prior occurrences

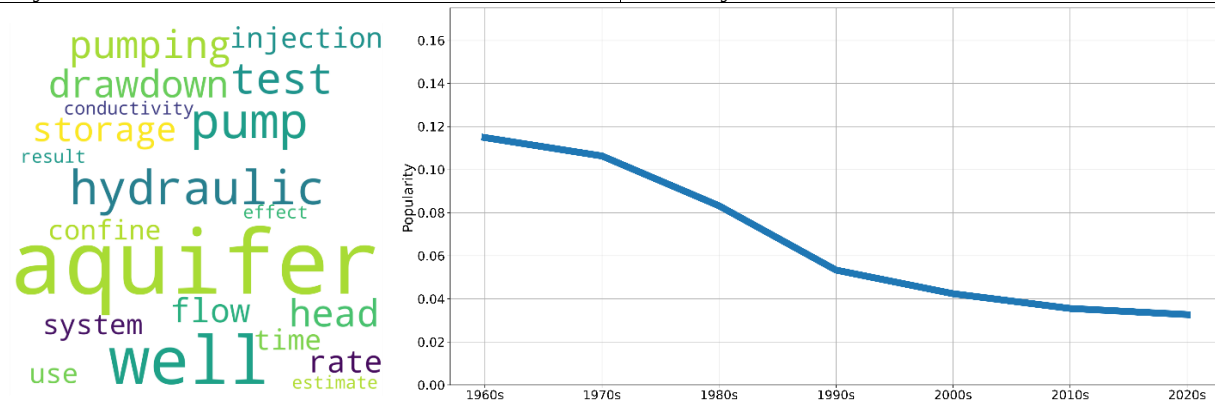


Topic 12	
Initial ChatGPT Generated Topic Name	Final Topic Name Assignment
Numerical Modeling and Simulation in Groundwater Hydrology	Groundwater model parameterization and calibration



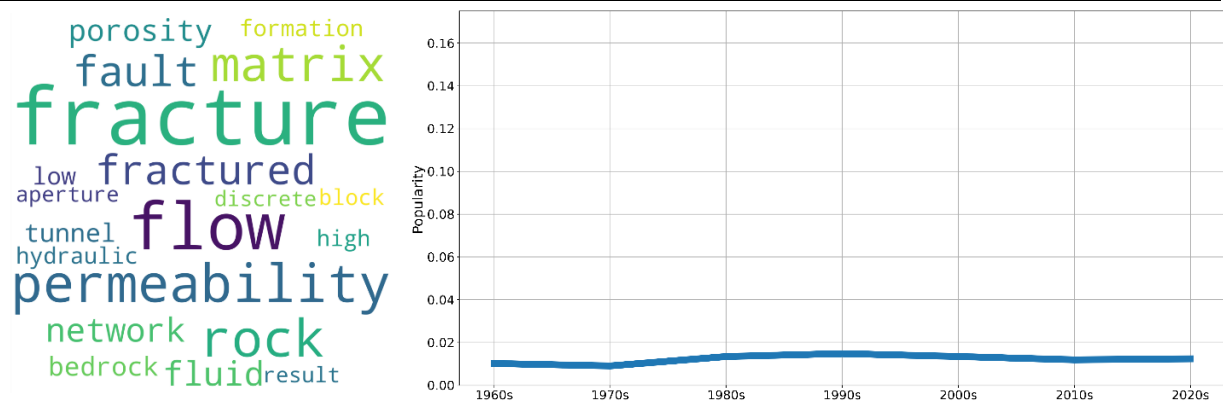
Top associated document titles for topic
Parameterisation, calibration and validation of distributed hydrological models
Scripting MODFLOW Model Development Using Python and FloPy
Certification tests of MODFLOW implementation in the integrated hydrologic model
Modeling hourly subsurface drainage using steady-state and transient methods
Benchmarking data-driven rainfall-runoff models in Great Britain: A comparison of long short-term memory (LSTM)-based models with four lumped conceptual models
Transient modeling of regional groundwater flow using parameter estimates from steady-state automatic calibration
TARSO modeling of water table depths
Improving a complex finite-difference ground water flow model through the use of an analytic element screening model
How much can we gain with increasing model complexity with the same model concepts?
The role of the postaudit in model validation

Topic 13	
Initial ChatGPT Generated Topic Name	Final Topic Name Assignment
"Aquifer Testing and Pumping Analysis" or "Well Hydraulics."	Well Hydraulics



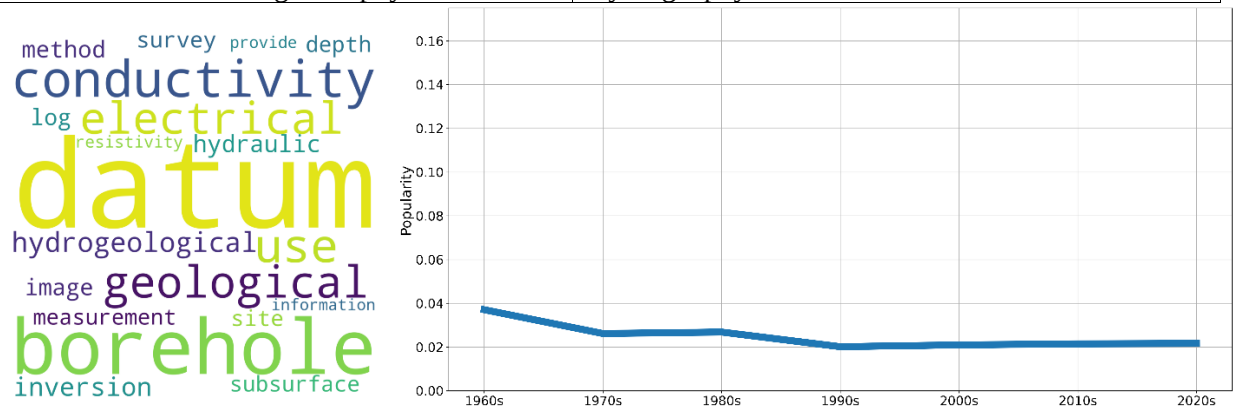
Top associated document titles for topic
Interference Due to Neighboring Wells During Pumping Tests
DRAWDOWN DUE TO PUMPING IN AN ANISOTROPIC AQUIFER
An approximate method for pumping test analysis in non-penetrating wells
Programmable Hand Calculator Programs for Pumping and Injection Wells: III ,Ã Constant Pumping (Injection) Rate, Fully Confined Aquifer, Partially Penetrating Well
Pumping tests using large-diameter observation wells
Estimating Transmissibility from Routine Production Tests of Water Wells
Programmable Hand Calculator Programs for Pumping and Injection Wells: II Constant Pumping (Injection) Rate, Single Fully Penetrating Well, Semiconfined Aquifer
Pumping testing using a siphon well
Radial groundwater flow to a finite diameter well in a leaky confined aquifer with a finite-thickness skin
Horizontal well hydraulics in leaky aquifers

Topic 14	
Initial ChatGPT Generated Topic Name	Final Topic Name Assignment
Fractured Rock Hydrogeology or Fracture Flow in Heterogeneous Media	Fractured rock hydrogeology



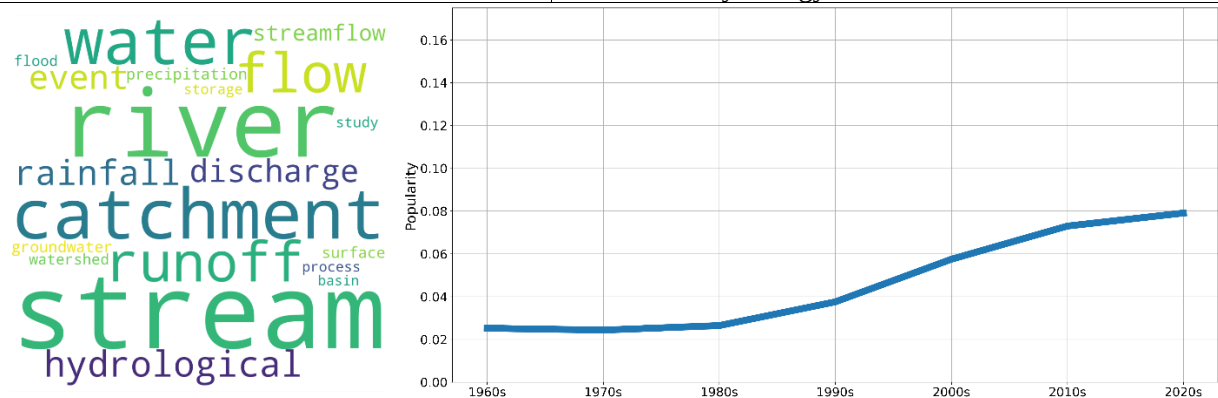
Top associated document titles for topic
Impact of urban and industrial waste on the water quality of Meboudja plain (Algeria)
Numerical simulation of confined aquifers: direct calculation of transient parameters
Donnes isotopiques (8786/Sr) et changements hydrologiques depuis 15 000 ans sur l'Altiplano andin
Cartographie du potentiel en eau souterraine du bassin versant de la Lobo (Centre-Ouest, Côte d'Ivoire): approche par analyse multicritère
Combined inter- and intra-fracture free convection in fracture networks embedded in a low-permeability matrix
Impact of fracture network geometry on free convective flow patterns
Hydrogeological properties of fault zones in a karstified carbonate aquifer (Northern Calcareous Alps, Austria);
Hydrostratigraphic subdivisions and fault barriers of the Edwards aquifer, south-central Texas, U.S.A.
The effect of contact area on the permeability of fractures
Variable-density groundwater flow and solute transport in irregular 2D fracture networks

Topic 15	
Initial ChatGPT Generated Topic Name	Final Topic Name Assignment
"Geophysical Hydrogeology" or "Subsurface Characterization through Geophysics."	Hydrogeophysics



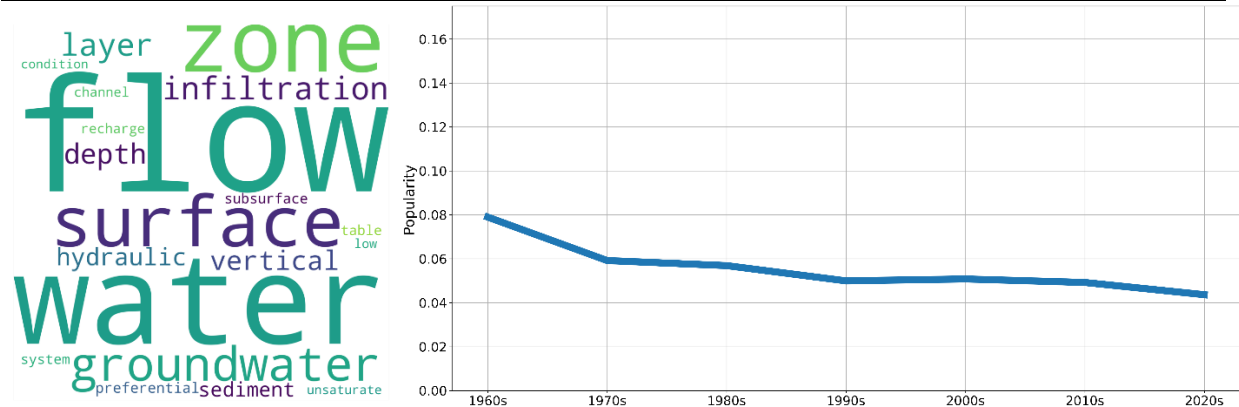
Top associated document titles for topic
Borehole Siting in Crystalline Basement Areas of Nigeria with a Microprocessor Controlled Resistivity Traversing System
Down hole flowmeter analysis using an associated caliper log.
Reservoir Characterization Applying High Resolution Seismic Profiling, Rabis Creek, Denmark
The Application Of Electrical Tomography In The Study Of The Unsaturated Zone In Chalk At Three Sites In Cambridgeshire, United Kingdom
Geophysical and hydrogeologic investigation of groundwater in the Karoo stratigraphic sequence at Sawmills in northern Matabeleland, Zimbabwe: A case history
Electromagnetic Resistivity Profiling For Locating Buried River Channels: A Case Study In Haiti
Goelectrical and Seismic Refraction Investigations Near San Jose, California
Applications of Forward Modeling Resistivity Profiles
Hydrogeological framework and estimation of aquifer hydraulic parameters using goelectrical data: A case study from West Iran;
Geophysical prospecting for groundwater exploration in northwestern Tunisia

Topic 16	
Initial ChatGPT Generated Topic Name	Final Topic Name Assignment
Catchment Hydrology and Runoff Processes	Catchment Hydrology and Runoff Processes



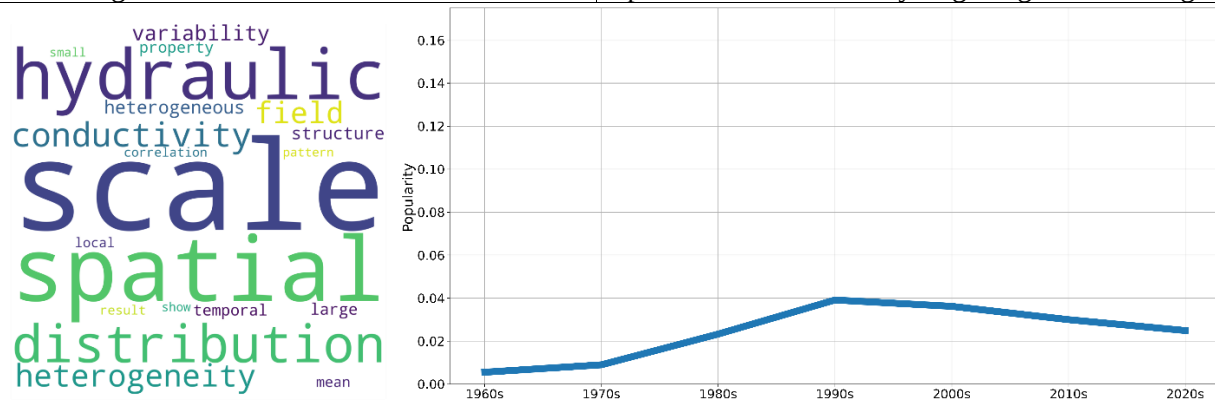
Top associated document titles for topic
Groundwater and meltwater in the snowmelt induced runoff
Are big basins just the sum of small catchments?
Factors affecting dominant peak-flow runoff-generation mechanisms among five neighbouring granitic headwater catchments
Fundamental spatial and temporal disconnections in the hydrology of an intermittent prairie headwater network
Hydrological connectivity of hillslopes and streams: Characteristic time scales and nonlinearities
Hydrochemical deciphering of streamflow generation in semi-arid East Africa
Antecedent moisture conditions and catchment morphology as controls on spatial patterns of runoff generation in small forest catchments
Impact of road-generated storm runoff on a small catchment response
Hydrochemical deciphering of streamflow generation in semi-arid East Africa
Storage controls on the generation of double peak hydrographs in a forested headwater catchment

Topic 17	
Initial ChatGPT Generated Topic Name	Final Topic Name Assignment
Subsurface Flow Dynamics and Hydrological Exchange Processes	Subsurface Flow Dynamics and Hydrological Exchange Processes



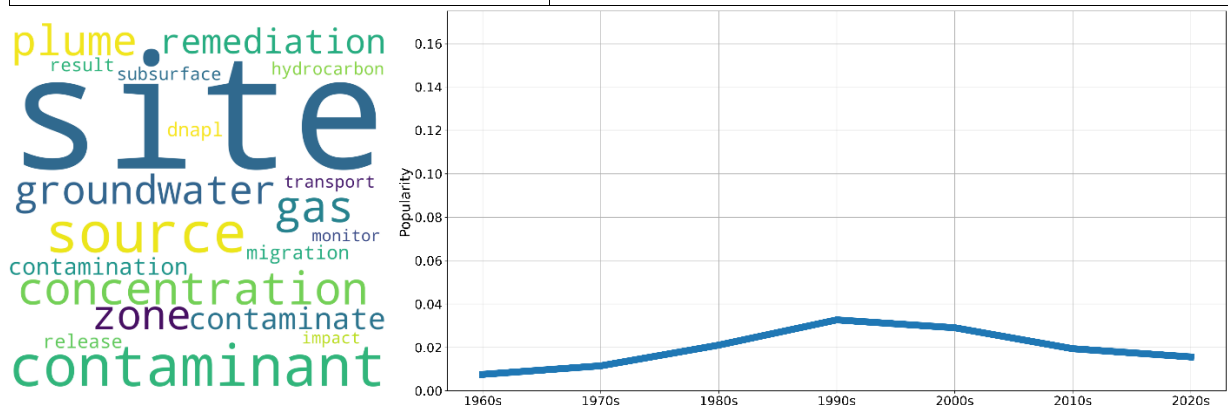
Top associated document titles for topic
Model-Based Analysis of the Effects of Rippled Bed Morphologies on Hyporheic Exchange
Conditions for lateral downslope unsaturated flow and effects of slope angle on soil moisture movement
Simulations of Flow in Crystalline Rock and Recharge from Overlying Glacial Deposits in a Hypothetical New England Setting
Numerical simulation of steady state three-dimensional groundwater flow near lakes
Karst hydrology of the Bruce Peninsula, Ontario, Canada
Spatial and depth variability of streambed vertical hydraulic conductivity under the regional flow regimes
Movement of water through the thick unsaturated zone underlying Oro Grande and Sheep Creek Washes in the western Mojave Desert, USA
When can inverted water tables occur beneath streams?
Variability in the vertical hyporheic water exchange affected by hydraulic conductivity and river morphology at a natural confluent meander bend
The Influence of Ground Water Flow Systems on Pavement Stability in Highway Cuts

Topic 18	
Initial ChatGPT Generated Topic Name	Final Topic Name Assignment
Spatial and Stochastic Hydrogeological Modeling	Spatial and Stochastic Hydrogeological Modeling



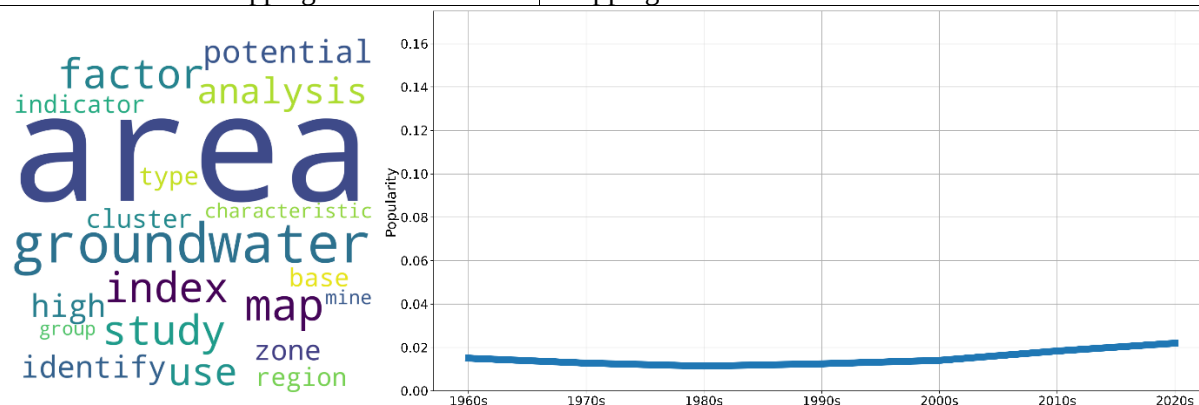
Top associated document titles for topic
A higher order approximation to effective conductivity in media of anisotropic random structure
Stochastic analysis of spatial variability in subsurface flows: 1. Comparison of one and three dimensional flows
Flow in multiscale log conductivity fields with truncated power variograms
Horizontal spatial correlation of hydraulic and reactive transport parameters as related to hierarchical sedimentary architecture at the Borden research site
Uncertainty quantification of environmental performance metrics in heterogeneous aquifers with long-range correlations
Stochastic analysis of field measured unsaturated hydraulic conductivity
Stochastic analysis of steady state groundwater flow in a bounded domain: 2. Two dimensional simulations
Combining stochastic facies and fractal models for representing natural heterogeneity
Effects of non-Gaussian copula-based hydraulic conductivity fields on macrodispersion
Determination of the effective hydraulic conductivity for heterogeneous porous media using a numerical spectral approach: 2. Results

Topic 19	
Initial ChatGPT Generated Topic Name	Final Topic Name Assignment
Contaminant Source Zone Characterization and Remediation	Point-source contamination characterization and remediation

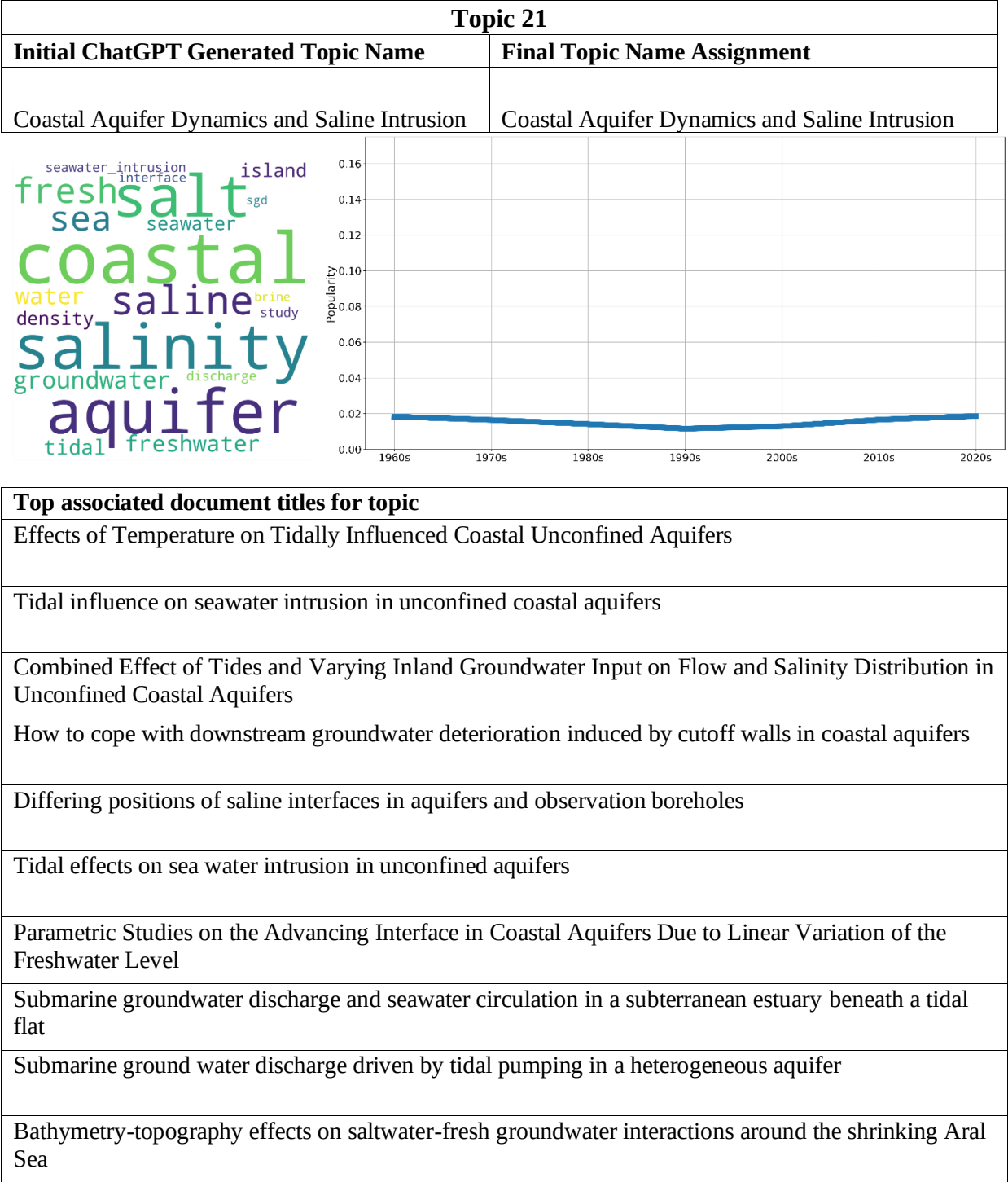


Top associated document titles for topic
Monitoring and remediation products. Buyers guide: Products for site characterization
Modeling the impact of a benzene source zone on the transport behavior of PAHs in groundwater
Denatured ethanol release into gasoline residuals, Part 1: Source behaviour
Denatured ethanol release into gasoline residuals, Part 2: Fate and transport
How Effective Is Thermal Remediation of DNAPL Source Zones in Reducing Groundwater Concentrations?
Solvent release into a Sandy Aquifer. 1. Overview of source distribution and dissolution behavior
Thermal DNAPL Source Zone Treatment Impact on a CVOC Plume
Field study of the partitioning tracer method for detection of dense nonaqueous phase liquid in a trichloroethene-contaminated aquifer
Characterization and remediation of chlorinated volatile organic contaminants in the vadose zone
Progress in Remediation of Groundwater at Petroleum Sites in California

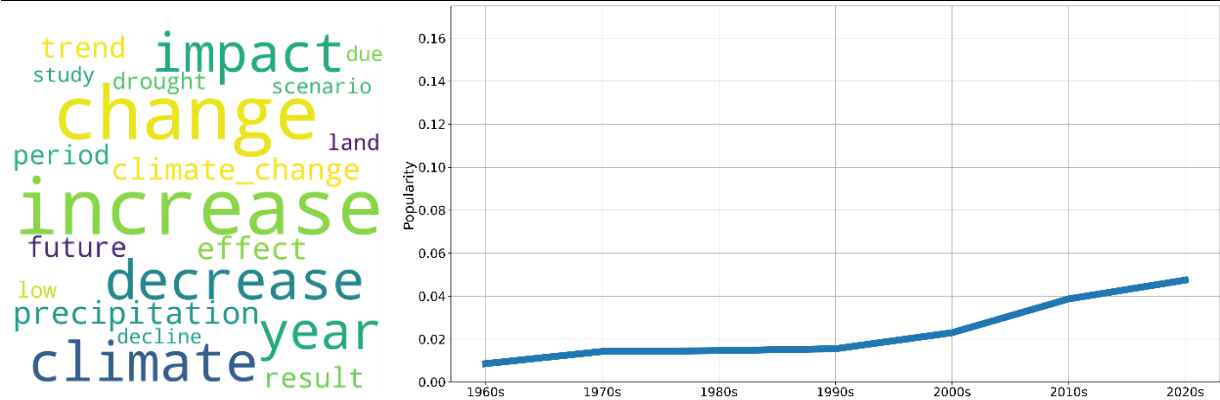
Topic 20	
Initial ChatGPT Generated Topic Name	Final Topic Name Assignment
GIS-Based Groundwater Potential Assessment and Mapping	GIS-Based Groundwater Potential Assessment and Mapping



Top associated document titles for topic
Groundwater potential assessment using GIS and remote sensing: A case study of Guna tana landscape, upper blue Nile Basin, Ethiopia
Evaluation of data-driven model and GIS technique performance for identification of Groundwater Potential Zones: A case of Fincha Catchment, Abay Basin, Ethiopia
Spatial assessment of termites interaction with groundwater potential conditioning parameters in Keffi, Nigeria
GIS-based groundwater spring potential assessment and mapping in the Birjand Township, southern Khorasan Province, Iran
Integration of shannon entropy (SE), frequency ratio (FR) and analytical hierarchy process (AHP) in GIS for suitable groundwater potential zones targeting in the Yoyo river basin, Miganga area, Adamawa Cameroon
GIS-based groundwater spring potential mapping in the Sultan Mountains (Konya, Turkey) using frequency ratio, weights of evidence and logistic regression methods and their comparison
Appraising the accuracy of GIS-based Multi-criteria decision making technique for delineation of Groundwater potential zones
Remote Sensing and GIS Based Groundwater Potential & Recharge Zones Mapping Using Multi-Criteria Decision Making Technique
Identification of Potential Sites for Groundwater Recharge Using a GIS-Based Decision Support System in Jazan Region-Saudi Arabia
Identification of Groundwater Potential Zones Using Proxy Data: Case study of Megech Watershed, Ethiopia

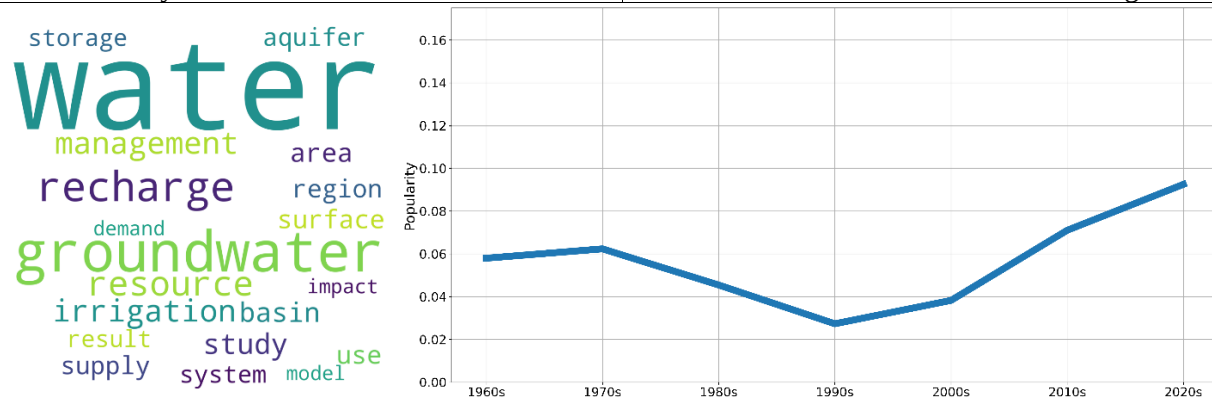


Topic 22	
Initial ChatGPT Generated Topic Name	Final Topic Name Assignment
Climate Change Impacts on Hydrological Systems	Climate Change Impacts on Hydrological Systems



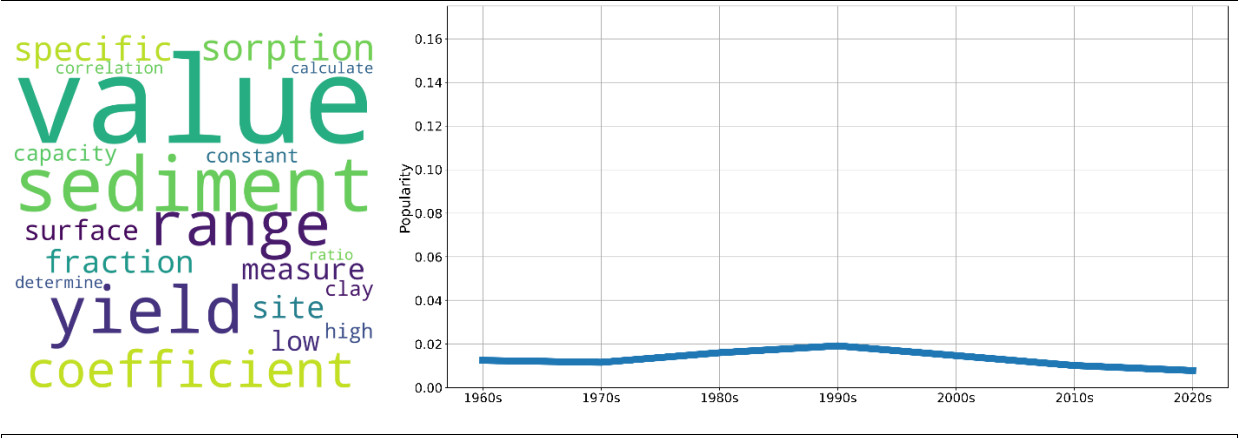
Top associated document titles for topic
Precipitable water conversion rates over the Qinghai-Xizang (Tibet) Plateau: Changing characteristics with global warming
Potential effects of climate change on inundation patterns in the Amazon Basin
Analyzing the Variability in Low-Flow Projections under GCM CMIP5 Scenarios
Decreased streamflow in semi-arid basins following drought-induced tree die-off: A counter-intuitive and indirect climate impact on hydrology
Precipitation-temperature variability and drought episodes in northwest Baja California, Mexico
Double trouble: Subsidence and CO2 respiration due to 1,000 years of Dutch coastal peatlands cultivation
Impact of climate change on freshwater ecosystems: A global-scale analysis of ecologically relevant river flow alterations
Water-table-dependent hydrological changes following peatland forestry drainage and restoration: Analysis of restoration success
A global-scale analysis of water storage dynamics of inland wetlands: Quantifying the impacts of human water use and man-made reservoirs as well as the unavoidable and avoidable impacts of climate change
Simulating the hydrologic impact of Arundo donax invasion on the headwaters of the Nueces River in Texas

Topic 23	
Initial ChatGPT Generated Topic Name	Final Topic Name Assignment
Groundwater Resource Management and Sustainability	Sustainable Groundwater Resource Management



Top associated document titles for topic
The effect of private tubewells on income and income inequality in rural Pakistan
Water footprint of crop production for different crop structures in the Hebei southern plain, North China
Allocation strategy analysis of water resources in South Taiwan
The stabilization role of groundwater when surface water supplies are uncertain: The implications for groundwater development
Effect of diversified crop rotations on groundwater levels and crop water productivity in the North China Plain
Water limits to closing yield gaps
A modeling system for the evaluation of water resources management strategies in Thessaly, Greece
Global Water Scarcity Assessment Incorporating Green Water in Crop Production
Non sustainable groundwater sustaining irrigation: A global assessment
Modelling groundwater flow of the Trifa aquifer, Morocco

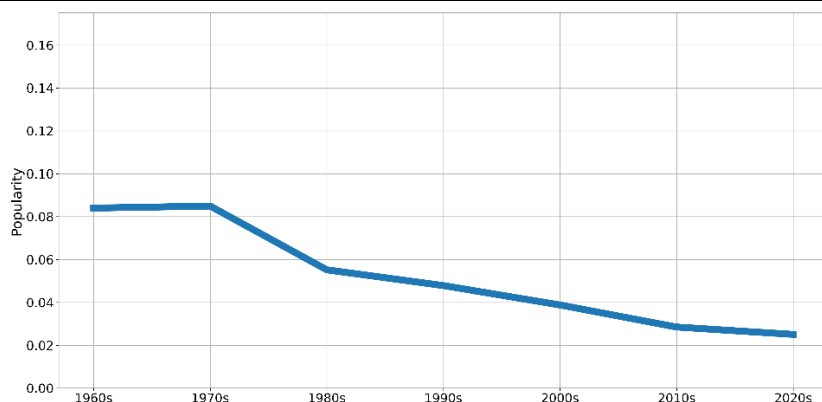
Topic 24	
Initial ChatGPT Generated Topic Name	Final Topic Name Assignment
Sorption and Aquifer Material Characterization	Sorption and Aquifer Material Characterization



Top associated document titles for topic
Impacts of heterogeneous organic matter on phenanthrene sorption: Different aquifer depths
Mineral contributions to atrazine and alachlor sorption in soil mixtures of variable organic carbon and clay content
Non-linear chlorinated-solvent sorption in four aquitards
Development of bifunctional anion-exchange resins with improved selectivity and sorptive kinetics for pertechnetate: Batch-equilibrium experiments
Cadmium and nickel distribution coefficients for sandy aquifer materials
Sorption of volatile organic solvents from aqueous solution onto subsurface solids
Variability of aquifer sorption properties in a field experiment on groundwater transport of organic solutes: Methods and preliminary results
Impacts of heterogeneous organic matter on phenanthrene sorption: Equilibrium and kinetic studies with aquifer material
Effects of temperature on trichloroethylene desorption from silica gel and natural sediments. 1. Isotherms
The Deccan Basalts of Maharashtra, India ,ÄTheir Potential as Aquifers

Topic 25	
Initial ChatGPT Generated Topic Name	Final Topic Name Assignment
Groundwater Contamination and Quality Assessment	Non-point source groundwater contamination assessment

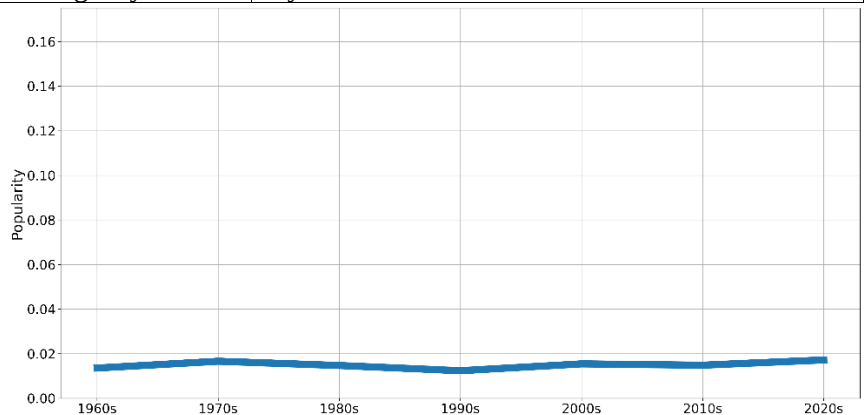
well contamination
level study quality
agricultural
concentration
sample urban pollution
high
water
source ground
land surface
nitrate nitrogen
area load



Top associated document titles for topic
Orthophosphate in Ground Water, Hall County, Nebraska
VOCs, pesticides, nitrate, and their mixtures in groundwater used for drinking water in the United States
Waterborne Disease , A Status Report Emphasizing Outbreaks in Ground Water Systems
An Analysis of Nitrate-Nitrogen in Ground Water Beneath Unsewered Subdivisions
Occurrence of steroid hormones and antibiotics in shallow groundwater impacted by livestock waste control facilities
Occurrence of perfluorinated compounds in raw water from New Jersey public drinking water systems
LEAD AND CADMIUM ASSOCIATED WITH SALTWATER INTRUSION IN A NEW JERSEY AQUIFER SYSTEM
Caffeine and pharmaceuticals as indicators of waste water contamination in wells
Impact of Land Use on Ground Water Quality in Southern Delaware
GROUND WATER USE FOR NUCLEAR POWER PLANTS

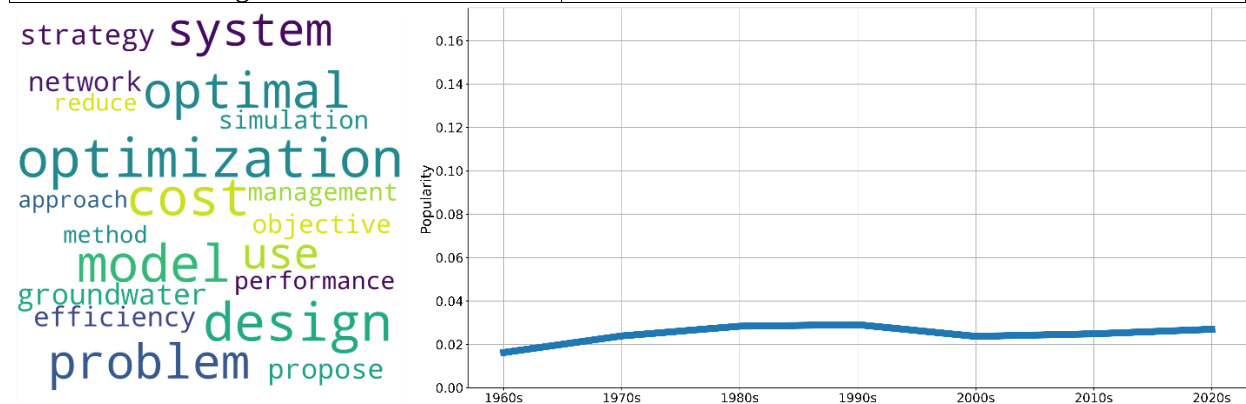
Topic 26	
Initial ChatGPT Generated Topic Name	Final Topic Name Assignment
Karst Hydrology and Spring Discharge Dynamics	Karst Hydrology and Spring Discharge Dynamics

pipe lake inflow
flow system
water
discharge
recession study
spring time
earthquake high
karst outflow
recharge conduit
karstic aquifer cave



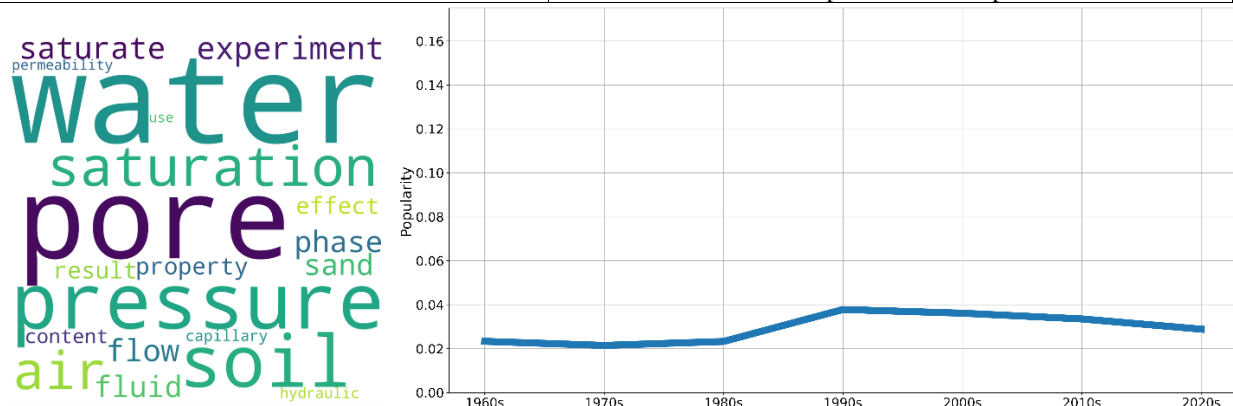
Top associated document titles for topic
Effects of the conduit network on the spring hydrograph of the karst aquifer
Dumanli Spring, Turkey - The largest karstic spring in the world?
Springflow hydrographs: Eogenetic vs. telogenetic karst
Discharge recession patterns of karstic springs as observed in Triassic carbonate aquifers of Slovakia;
Diffuse flow and conduit flow in limestone terrain in the Mendip Hills, Somerset (Great Britain)
The Catchment Area of the Sv. Ivan Karst Spring in Istria (Croatia)
Assessment of regional flow type and groundwater sensitivity to pollution using hydrograph analyses and hydrochemical data of the Selita and Blue Eye karst springs, Albania;
Comparison of the luminescence properties of waters depositing flowstone and stalagmites at Lower Cave, Bristol
Study of hydrographs of karstic aquifers by means of correlation and cross-spectral analysis
Characterization of the hydrodynamic functioning of the Degraças-Sic Karst Aquifer, Portugal;

Topic 27	
Initial ChatGPT Generated Topic Name	Final Topic Name Assignment
Optimal Groundwater Management and Remediation Design	Optimization and Modeling for Groundwater Remediation



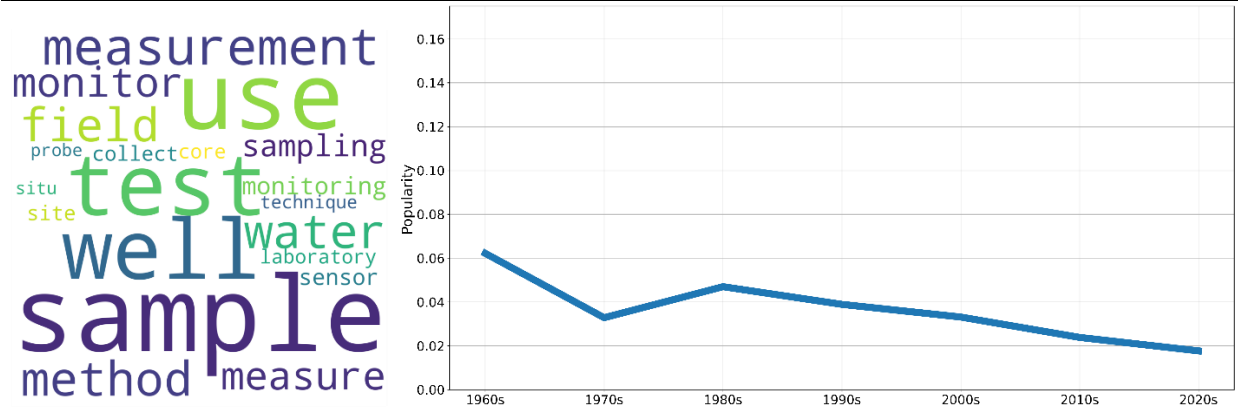
Top associated document titles for topic
Optimal in situ bioremediation design by hybrid genetic algorithm-simulated annealing
Application of optimal control and fuzzy theory for dynamic groundwater remediation design
Chance-constrained multi-objective optimization of groundwater remediation design at DNAPLs-contaminated sites using a multi-algorithm genetically adaptive method
Dynamic optimal groundwater management with inclusion of fixed costs
Genetic algorithm for constrained optimization models and its application in groundwater resources management
An Elitist Multiobjective Tabu Search for Optimal Design of Groundwater Remediation Systems
Optimal design of groundwater remediation systems using a multi-objective fast harmony search algorithm;
Development of the enhanced self-adaptive hybrid genetic algorithm (e-SAHGA)
A niched Pareto tabu search for multi-objective optimal design of groundwater remediation systems
Remediation of heterogeneous aquifers based on multiobjective optimization and adaptive determination of critical realizations

Topic 28	
Initial ChatGPT Generated Topic Name	Final Topic Name Assignment
Pore-Scale Hydrogeology and Porous Media Characterization	Unsaturated and Multiphase flow in porous media



Top associated document titles for topic
Soil aggregate structure effects on dielectric permittivity of an andisol measured by time domain reflectometry
Applicability of ethanol for measuring intrinsic hydraulic properties of sand with various water repellency levels
Pore scale consideration in unstable gravity driven finger flow
Water retention characteristics and pore structure of binary mixtures
Quantification of gas-phase trapping within the capillary fringe using computed microtomography
Size distributions of pore water and entrapped air during drying-infiltration processes of sandstone characterized by water-expulsion porosimetry
Experimental validation of the theory of extending two-phase saturation-pressure relations to three-fluid phase systems for monotonic drainage paths
Pore-scale distribution of mucilage affecting water repellency in the rhizosphere
The transition between sharp and diffusive wetting fronts as a function of imbibing fluid properties
Comparison of measured and predicted suction stress in partially saturated compacted mixtures of sand and clay

Topic 29	
Initial ChatGPT Generated Topic Name	Final Topic Name Assignment
Groundwater Monitoring Techniques and Sampling Methodologies	Groundwater Monitoring Techniques and Sampling Methodologies



Top associated document titles for topic
A COLLECTION MANIFOLD FOR MULTILEVEL GROUND WATER SAMPLING DEVICES
A groundwater profile sampler
GROUNDWATER PROFILE SAMPLER.
The Hydropunch: An In Situ Sampling Tool for Collecting Ground Water from Unconsolidated Sediments
Shaft-mounted time domain reflectometry probe for water content and electrical conductivity measurements
Comparison of Two Integrated Methods for the Collection and Analysis of Volatile Organic Compounds in Ground Water
An acoustic probe for precise determination of deep water levels in boreholes.
A Discrete Point Sampler for Ground Water Monitoring Wells
Solinst Produces High-Quality Bladder Pumps
Drill-Through Casing Driver Drilling Method for Construction of Monitoring Wells in Coarse, Unconsolidated Sediments