Vilnius University

Usability of ULs and different user segments

Taurimas VALYS

Vilnius University Business School

BSUIN Webinar, June 17, 2020

Interreg Baltic Sea Region

EUROPEAN UNION
EUROPEAN REGIONAL DEVELOPMENT FUND

BALTIC SEA UNDERGROUND INNOVATION NETWORK

The Baltic Sea Underground Innovation Network (BSUIN) project aims to ***make the underground laboratories in the Baltic Sea region more accessible for innovation, business development and science*** *by improving the information about the underground laboratories, the operation, user experiences and safety.*

KERTTU SAALASTI INSTITUTE UNIVERSITY OF OULU

OULU UNIVERSITY OF APPLIED SCIENCES

UNIVERSITY OF SILESIA IN KATOWICE

SKB

KGHM Cuprum Centrum Badawczo-Rozwojowe

TU BERGAKADEMIE FREIBERG

GFZ Helmholtz Centre POTSDAM

VILNIUS UNIVERSITY 1579 UNIVERSITAS VILNENSIS

NCBJ

BSI BALTIC SCIENTIFIC INSTRUMENTS

TALLINN UNIVERSITY OF TECHNOLOGY

Reiche Zeche, Germany

Today multiple research institutions and partners from industry use the mine as a fundament for the development of new technology, production methods, new materials or to gain reference materials for their databases. In addition, multiple Universities make use of the mine in order to train their students practically in mining and surveying operations. It is intended to develop the mine to a European platform for enhancing mining techniques and education. For this, it is planned to create new access (ramp) and to develop new fields, rooms and drifts.

OVERALL DATA AVAILABILITY

The data of research activities are collected, processed and stored by the performing partners individually. It is possible to provide contact information to these partners. Some general data on the mine are available as textbook or paper.

SPECIALISED KNOWLEDGE, SERVICES:

Specialized knowledge, laboratories and workshops are available in all mining and raw material related fields at the individual departments of the university. The mine management is capable of establishing underground laboratories, workshops and office spaces for long-term projects.

Core user segments: Researchers, Private and Public institutions (R&D departments Local and National authorities), NGOs (think tanks), overall tourists.

Vilnius University

Interreg Baltic Sea Region

EUROPEAN UNION

BSUIN

Äspö Hard Rock Laboratory, Sweden

The current use is for different methodological and technical development for final disposal of spent nuclear fuel in combination with the new use for projects such as environmental, geotechnics, geo-energy, material science and various technical development projects. The aim is to turn the facility over to future research and development stakeholders.

OVERALL DATA AVAILABILITY

All data from SKB's investigations and research activities are stored in SKB's Site Characterization Database (SICADA). The data in the database are available for researchers using Äspö HRL for ongoing or planned research activities at the site. The database contains more than 400 million observations.

SPECIALISED KNOWLEDGE, SERVICES

Specialized knowledge in geology, hydrogeology, geochemistry, groundwater chemistry, geophysics, rock mechanics, rock engineering, clay materials and especially swelling clays etc. Scientific and technical experts available at the site or in different networks. Organization for guiding, planning and starting external projects including experimental services ranging from drilling and measurements to construction of prototypes.

Core user segments: Researchers, Private and Public institutions (R&D, HR departments, Big governmental and foreign / international institutions), NGOs (think tanks), overall tourists.

Vilnius University

Interreg Baltic Sea Region

EUROPEAN UNION

BSUIN

Conceptual Lab development coordinated by KGHM Cuprum R&D Center, Poland

The KGHM mines were constructed mainly for the copper ore excavation, processing and smelting. They are constantly under development for almost 60 years. In selected areas of existing mine workings, pilot/trial panels used to be furnished for research and development purposes.

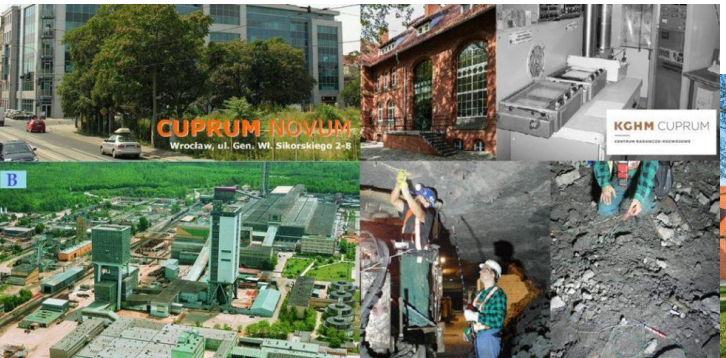
OVERALL DATA AVAILABILITY

All data from KGHM's investigations and research activities are stored in KGHM's archives located at the appropriate departments in the mines and the main offices in the Lubin headquarters. The databases generally are not available for researchers unless they are authorized.

SPECIALISED KNOWLEDGE, SERVICES

Specialized knowledge exists in geology, hydrogeology, geochemistry, groundwater chemistry, geophysics, rock mechanics, rock engineering, clay materials and especially swelling clays etc. Scientific and technical experts available at the site or in networks. Organization for guiding, planning and starting external projects including experimental services ranging from drilling, measurements to the construction of prototypes.

Core user segments: Internal user(s) (KGHM group companies), Researchers, Private and Public institutions (R&D departments, Big governmental and foreign / international institutions), NGOs (think tanks, training centers), overall tourists.



Vilnius University

Interreg Baltic Sea Region

EUROPEAN UNION

EUROPEAN REGIONAL DEVELOPMENT FUND

BSUIN

Ruskeala, Russia

The “Ruskeala” UL was organized for the test, design and construction of touristic destinations in old lost quarries and mines. The current use is for different methodological and technical development of the roof control, investigation of weak zones – which could be a danger for visitors and also environmental, conduct geotechnological, photogrammetry investigations of the underground space etc. The aim is to transfer the experience to other historic mines and quarries in the territory of Russian Federation.

OVERALL DATA AVAILABILITY

All data from the Ruskeala Underground Lab are stored in the Institute of Geology KRC RAS. Nowadays the data are under the transferring stage to databases. It is still available for Karelian researchers.

SPECIALISED KNOWLEDGE, SERVICES

Specialized knowledge in geology, geophysics, rock mechanics, rock engineering. Scientific and technical experts available in the Institute of Geology KRC RAS. Organization for guiding, planning and starting external projects including experimental services ranging from geophysical to tectonophysical study of the area, photogrammetry and other investigations are available in the Karelian Scientific Centre.

Core user segments: Researchers, Private and Public institutions (R&D departments, governmental institutions, other Russian Labs), overall tourists.

UL of Khlopin Institute, Russia

Now in underground laboratory measurements of tritium on the TriCarb 3100 installation are constantly taken. Also, there are three gamma-spectrometer complexes with powerful protection against an external background.

OVERALL DATA AVAILABILITY

All research data and research done in the underground laboratory, are part of the reports in scientific and commercial contracts. Data is available for customers and contractors. There are several publications available in Russian.

SPECIALISED KNOWLEDGE, SERVICES

Any specialized knowledge in the field of geology, hydrogeology, geochemistry, groundwater chemistry, geophysics, mining mechanics, material science of Cambrian clays, etc. are not available, since the subway is a civilian object of a particular category.

Core user segments: Researchers, Private and Public institutions (R&D departments, governmental institutions, other Russian Labs).

Vilnius University

Interreg Baltic Sea Region

EUROPEAN UNION

BSUIN

CALLIO LAB, FINLAND

Callio Lab is located in the Pyhäsalmi Mine, operated by First Quantum Minerals (FQM) The mine's main products are Cu, Zn and pyrite (FS4). The mining operations shall continue to the end of 2019.
In the future, Callio Lab facilitates several types of actors, including research institutions and companies.

OVERALL DATA AVAILABILITY

The Pyhäsalmi Mine, located in the town of Pyhäjärvi, Finland, is one of the deepest known mines in Europe reaching 1,445 metres underground. As mining will end, a globally unique multidisciplinary operating environment, Callio, will emerge. The mine and the surrounding brownfield area offer a diverse range of opportunities for success for new and innovative projects and established operators seeking new horizons alike. The underground environment in the Callio Lab provide excellent opportunities for various areas from fundamental research and R&D activities to commercial and industrial activities (Data center, Energy Storage, also SCIENCE AND RESEARCH (Underground environments provides opportunities for wide range of disciplines in both fundamental research and applied sciences, for example in Elementary Particle Physics, Nuclear Physics, Astrophysics/Cosmology, Geosciences, Microbiology, Biology, Material Sciences, Etc.), PHYSICS AND ASTROPHYSICS, BIOLOGY/MICROBIOLOGY, Rock engineering).

SPECIALISED KNOWLEDGE, SERVICES

Quality system for visitors and a safe working environment down to 1.44 km. Large maintenance halls, restaurant, conferencing and social facilities on the main level at 1.4 km depth. An optical cable is available at practically all levels in the mine. GSM telephone network at the main level (1.4 km). A state-of-the-art microseismic monitoring network installed in the mine.

Core user segments: Researchers, Private and Public institutions (R&D, HR departments, Big governmental and foreign / international institutions), NGOs (think tanks, training centers), overall tourists.

Vilnius University

Interreg Baltic Sea Region

EUROPEAN UNION

BSUIN

UL laboratories and understanding (global) network of underground research

- Globally there are various underground facilities or laboratories commonly located in active or closed mines, in tunnel systems or they are built for this specific purpose.
- There are a vast number of study groups utilizing underground facilities to researches within several disciplines.
- In developing underground laboratories, understanding characteristics, needs and accessibility of research communities applying these facilities is crucial.

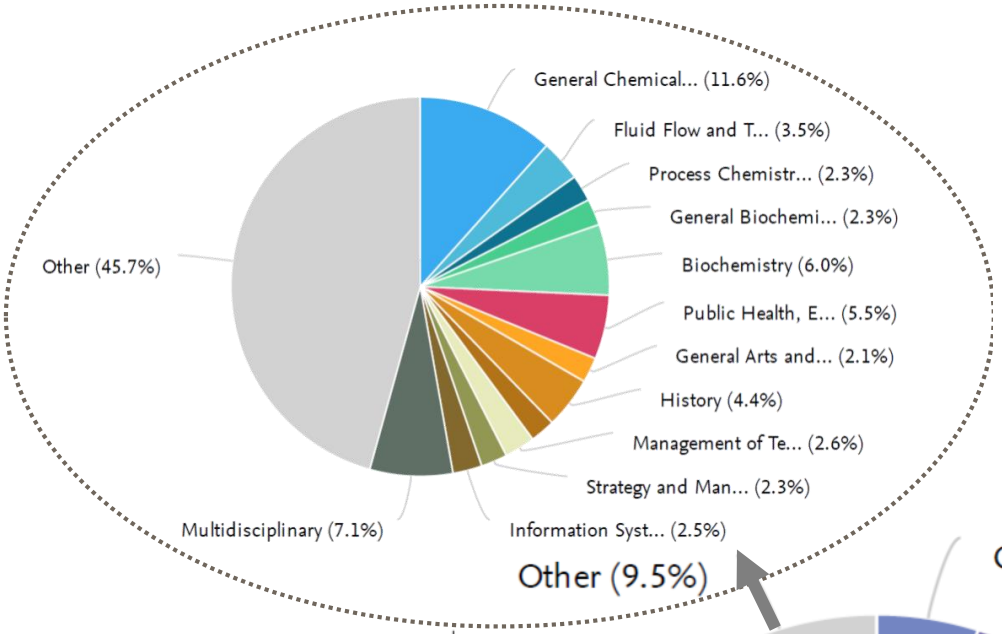
Literature metadata analysis by Geographic Information Systems (GIS)

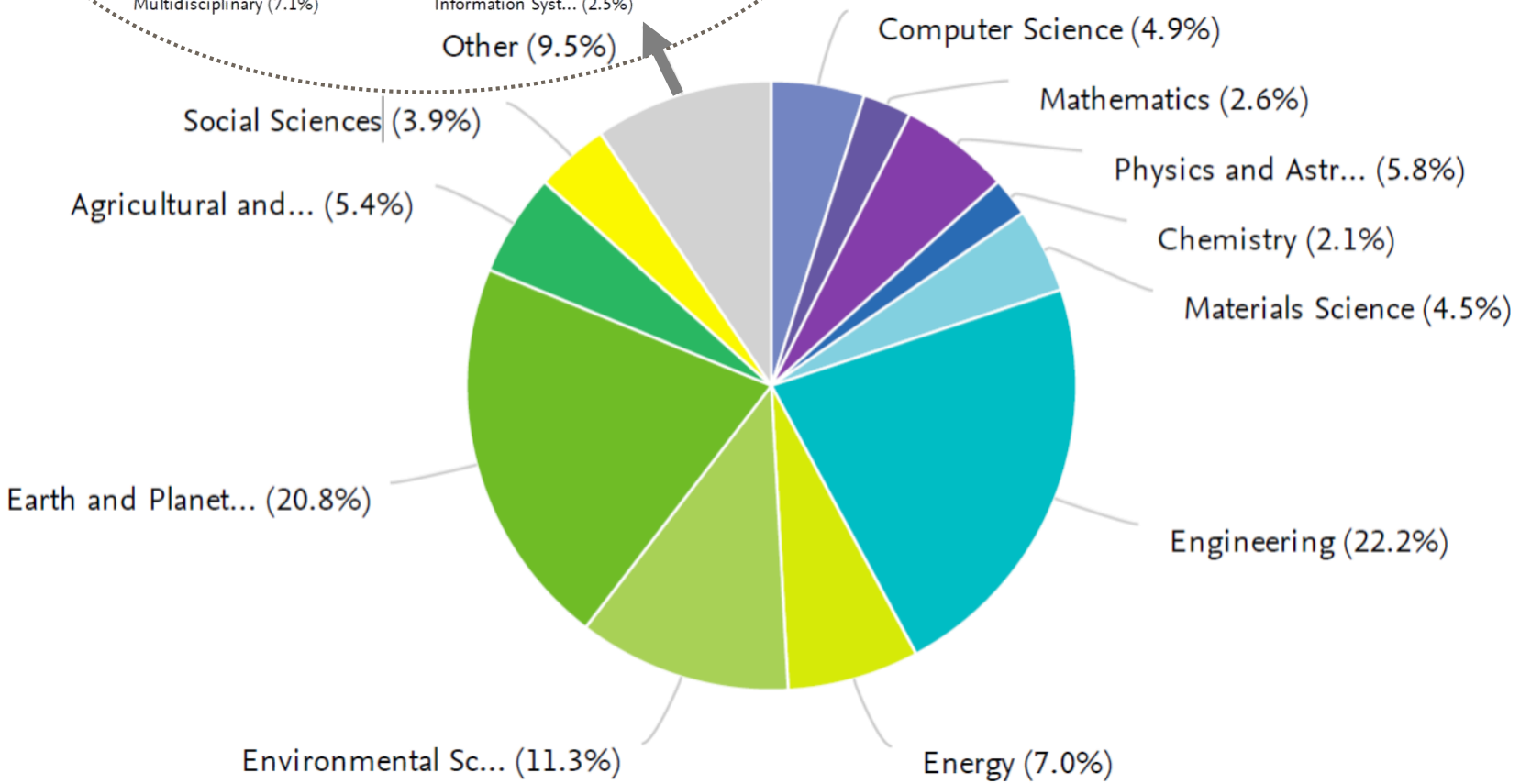
- Publication specific data are compiled from Web of Science literature database.
  - Data includes: authors, addresses, e-mails, keywords, abstracts, publication year, publication type, language
- Articles are positioned by address of corresponding author by using Google geocoding interface
- Local clusters of positioned articles (i.e. corresponding author's institutes) formulated by 10 km tolerance.
- Amount of articles (all and selection with keywords) is summarized (i.e. aggregated) to local clusters and presented on a map by center nodes

Underground research

Disciplines in Scopus publications

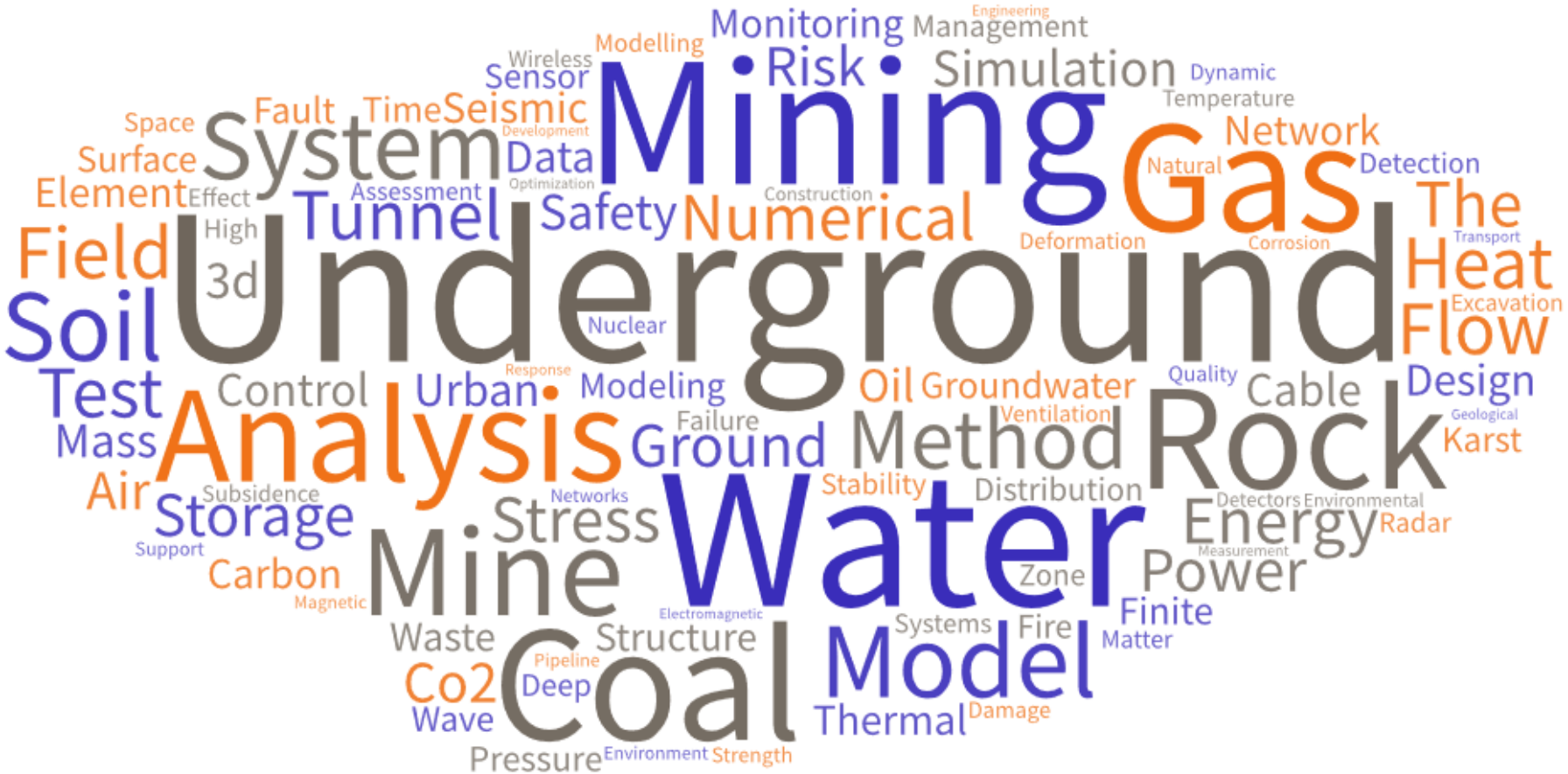
Years 2009-2018





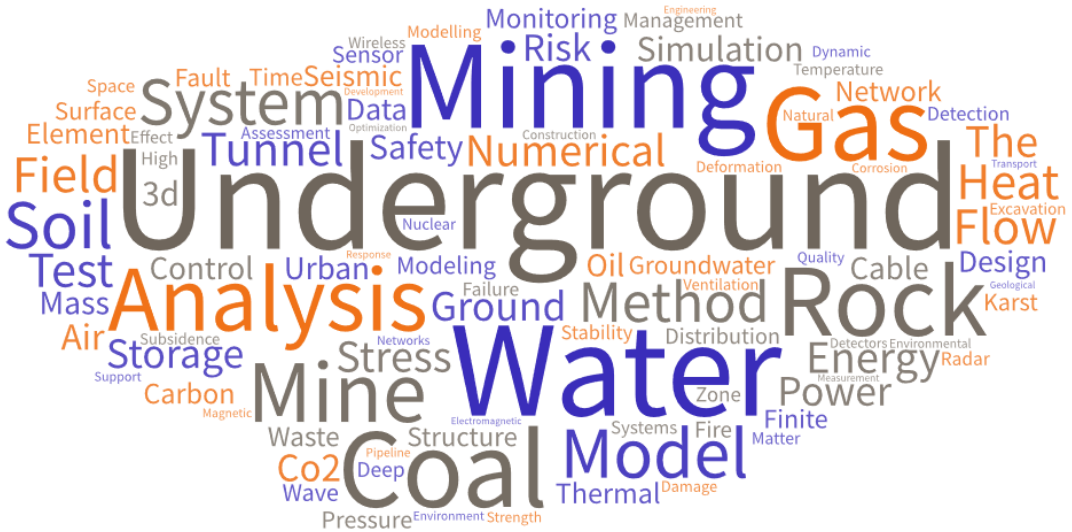
Underground research | 100 most frequent key words | in Web of Science

60215 publications | years 1975-2020



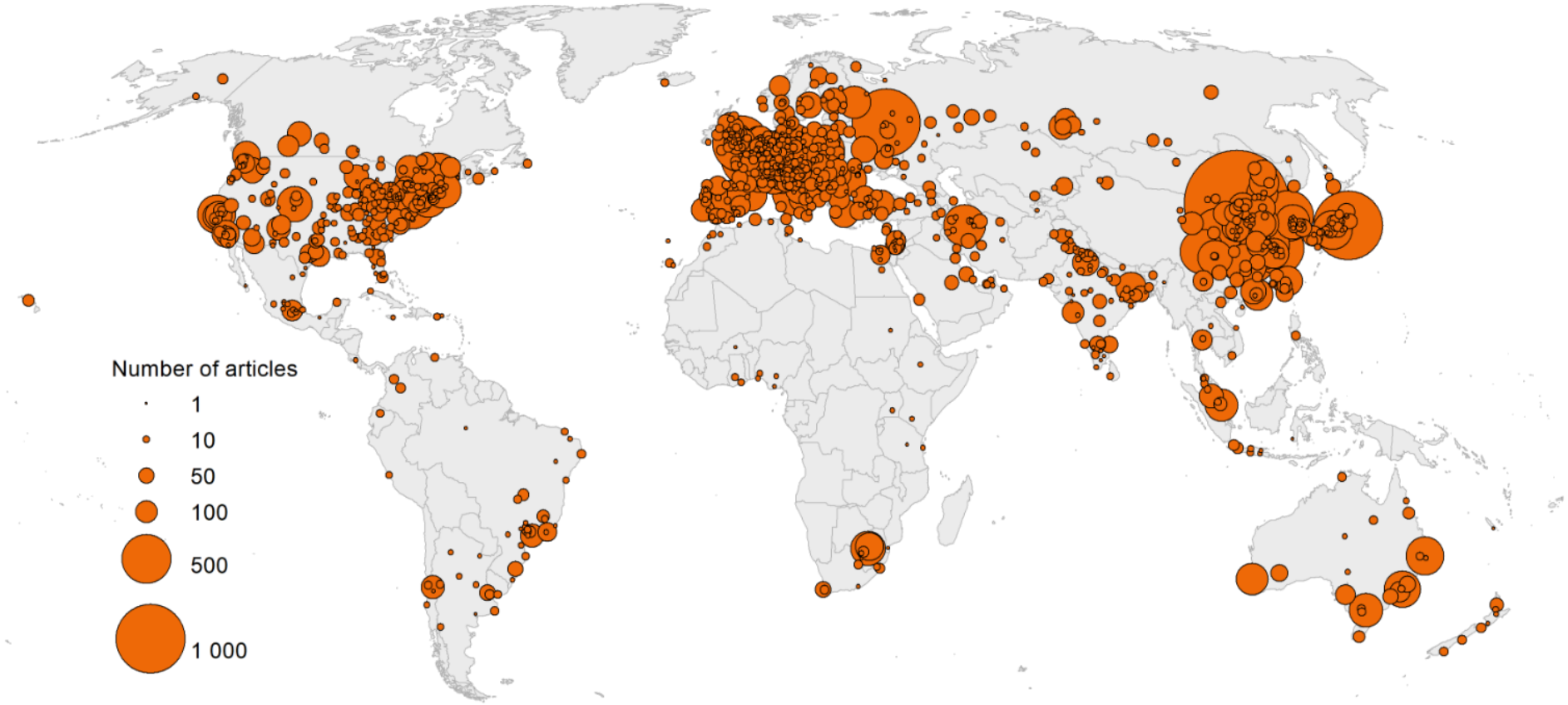
Underground research | 100 most frequent key words | in web of science

60215 publications | years 1975-2020



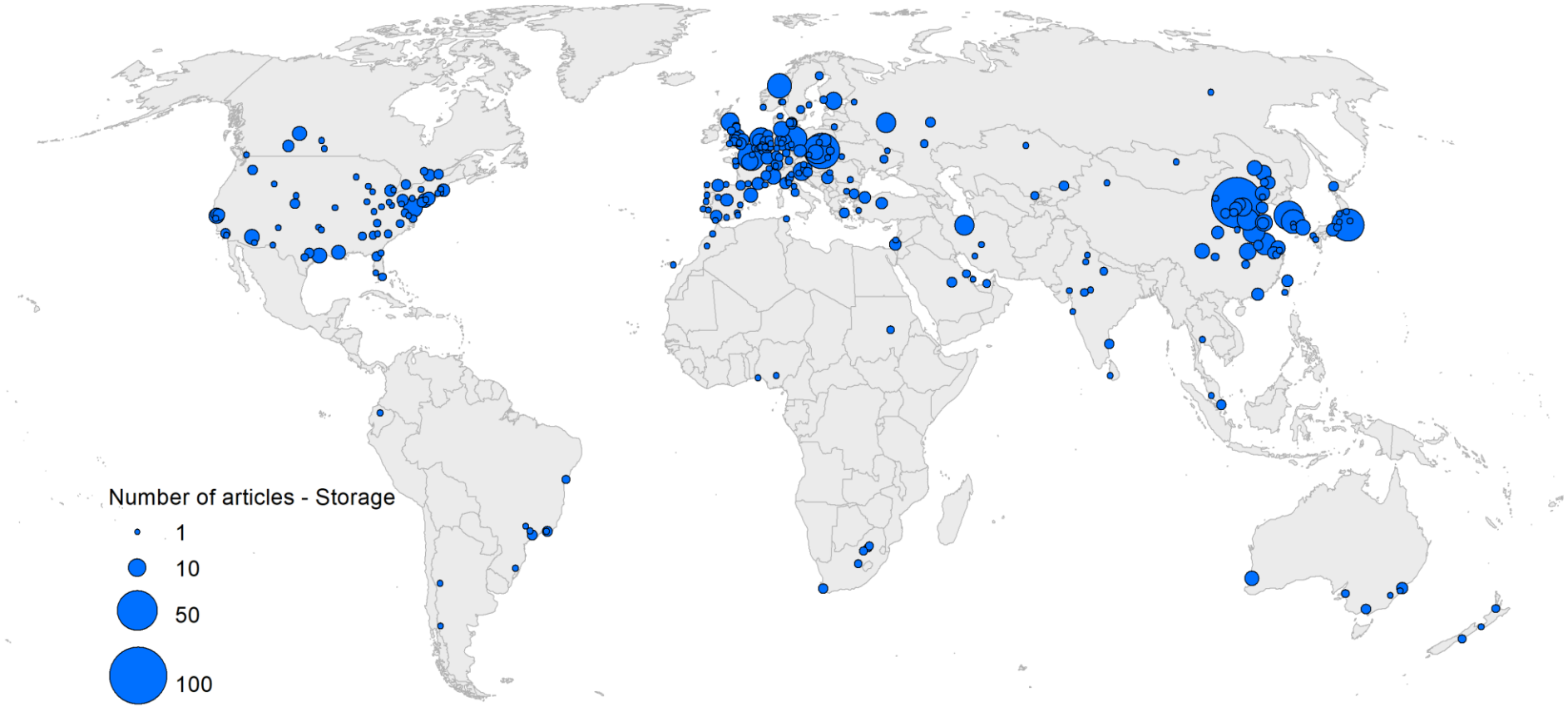
Word	Frequency	%	Rank
underground	8155	2,23	1
water	3007	0,82	2
mining	2654	0,72	3
analysis	2554	0,70	4
coal	2480	0,68	5
rock	2174	0,59	6
mine	1977	0,54	7
system	1906	0,52	8
model	1878	0,51	9
method	1790	0,49	10
gas	1582	0,43	11
numerical	1482	0,40	12
energy	1432	0,39	13
storage	1409	0,38	14
soil	1396	0,38	15
simulation	1374	0,37	16
monitoring	1323	0,36	17
ground	1246	0,34	18
tunnel	1205	0,33	19
power	1181	0,32	20
groundwater	1124	0,31	21
stress	1103	0,30	22
modeling	1089	0,30	23
heat	1016	0,28	24
thermal	1013	0,28	25
network	902	0,25	26
seismic	885	0,24	27
flow	858	0,23	28
control	851	0,23	29
management	851	0,23	30

Underground research – All positioned publications by 10 km clusters (Web of Science)



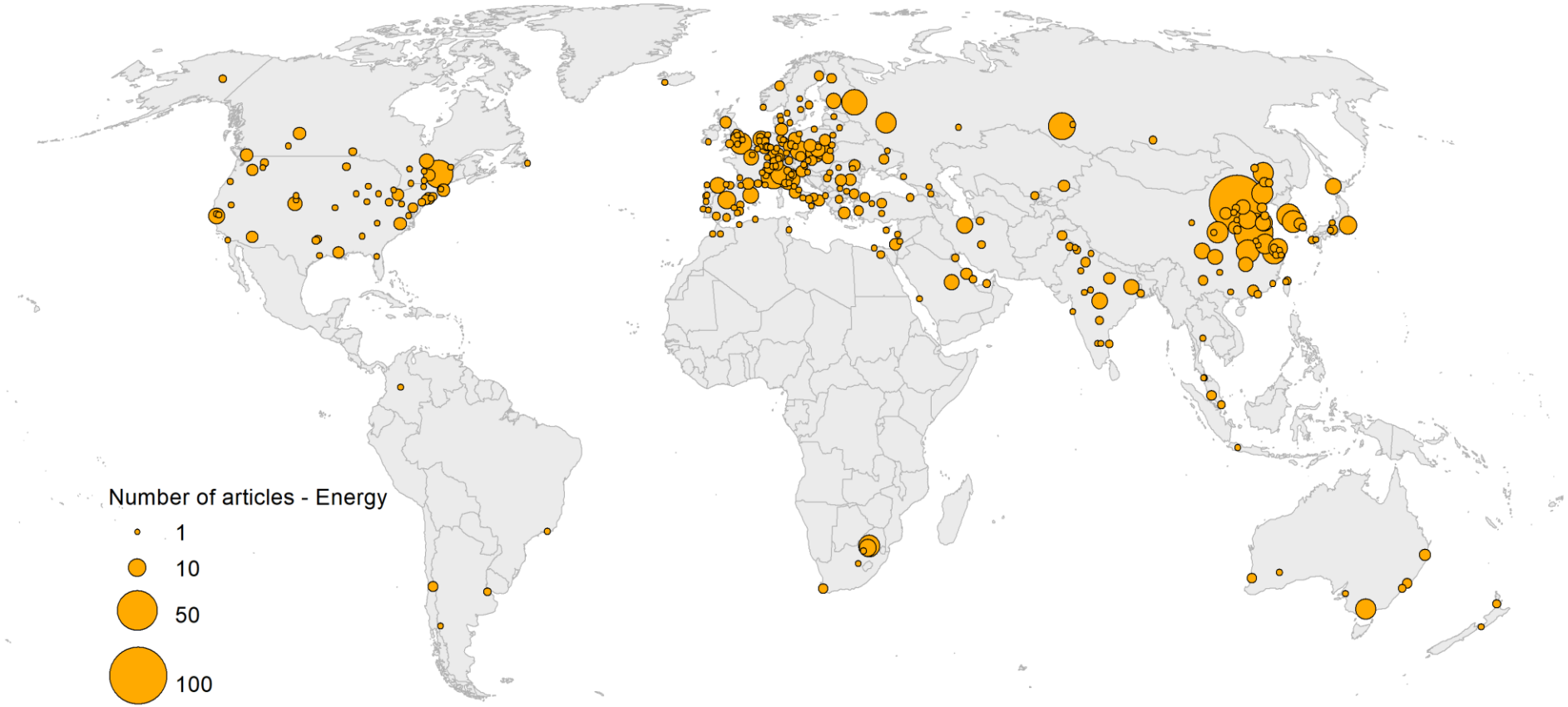
Geographic distribution of 60215 geocoded publications which Web of Science relates to underground.

Underground research – Keyword: Storage – Positioned publications (Web of Science)



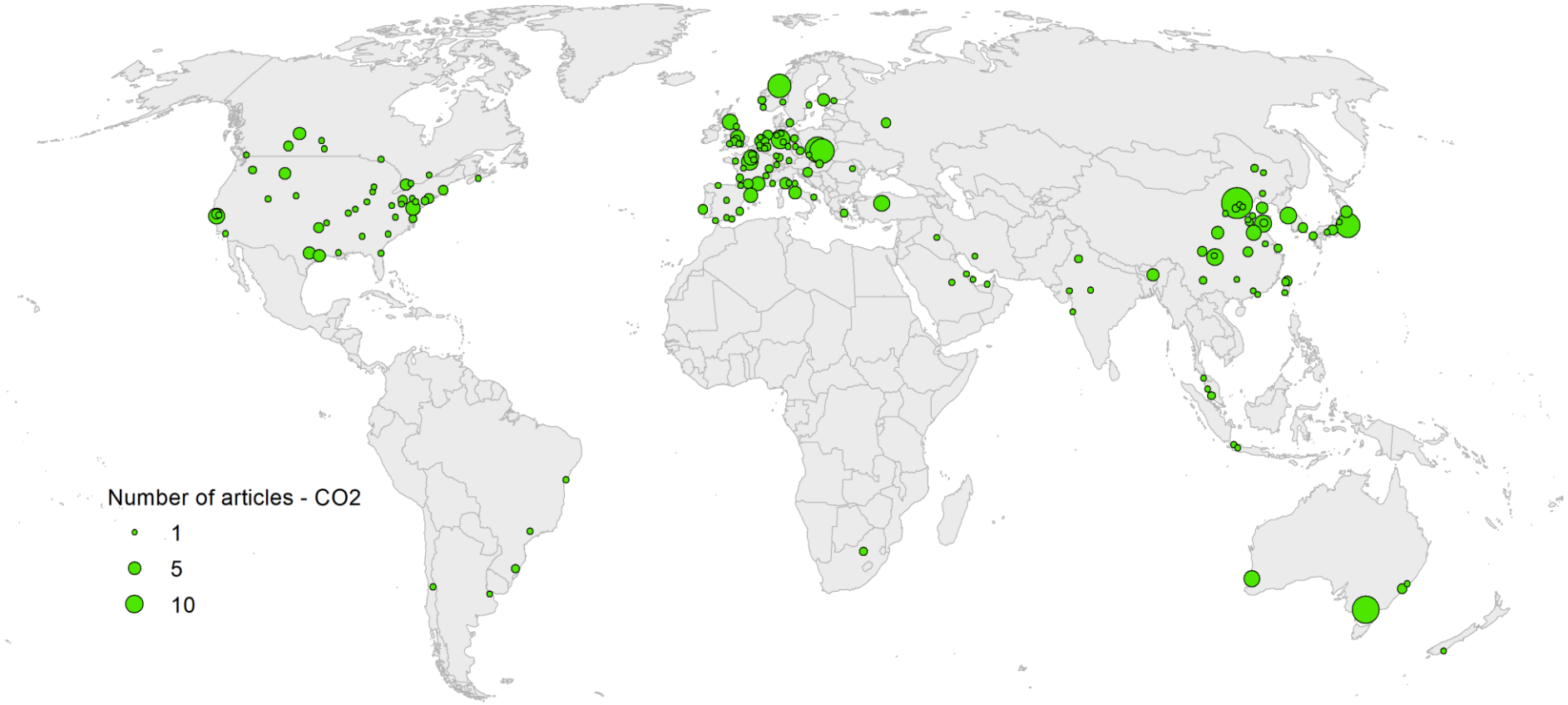
Articles including storage in the keyword list (within the selection of underground related publications). Europe and China form clear hubs.

Underground research – Keyword: Energy – Positioned publications (Web of Science)



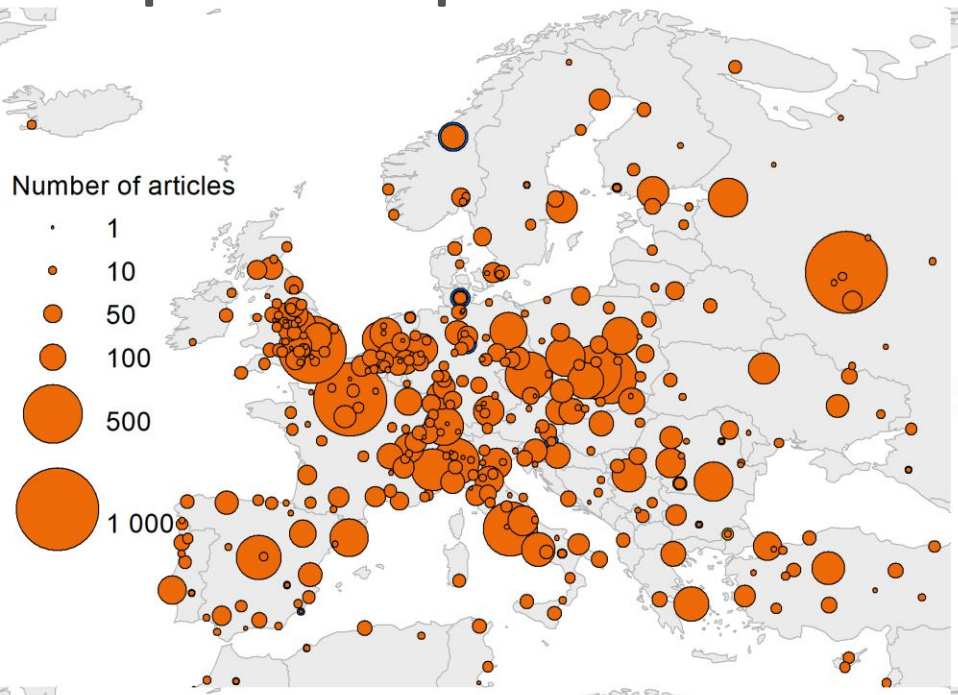
Articles including energy in the keyword list (within the selection of underground related publications). Europe, North-East America and China form clear hubs.

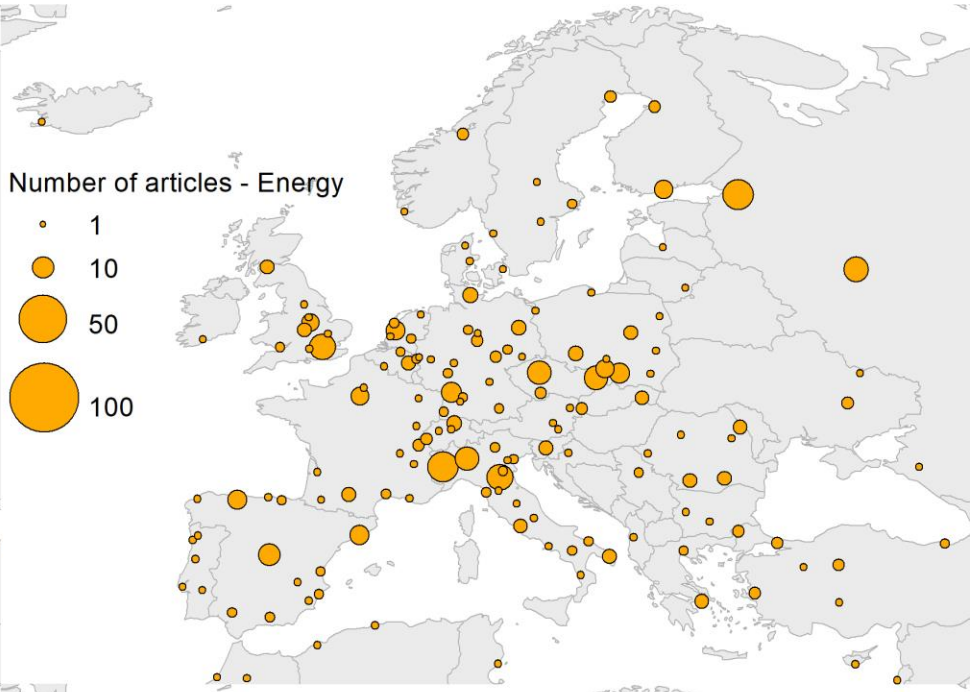
Underground research – Keyword: CO_2 – Positioned publications (Web of Science)

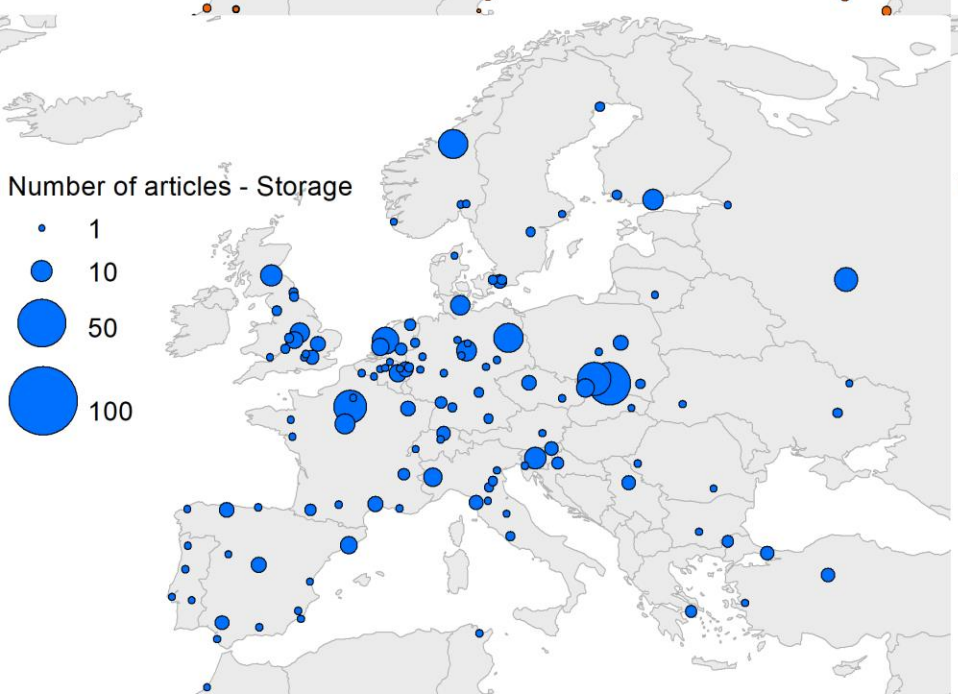


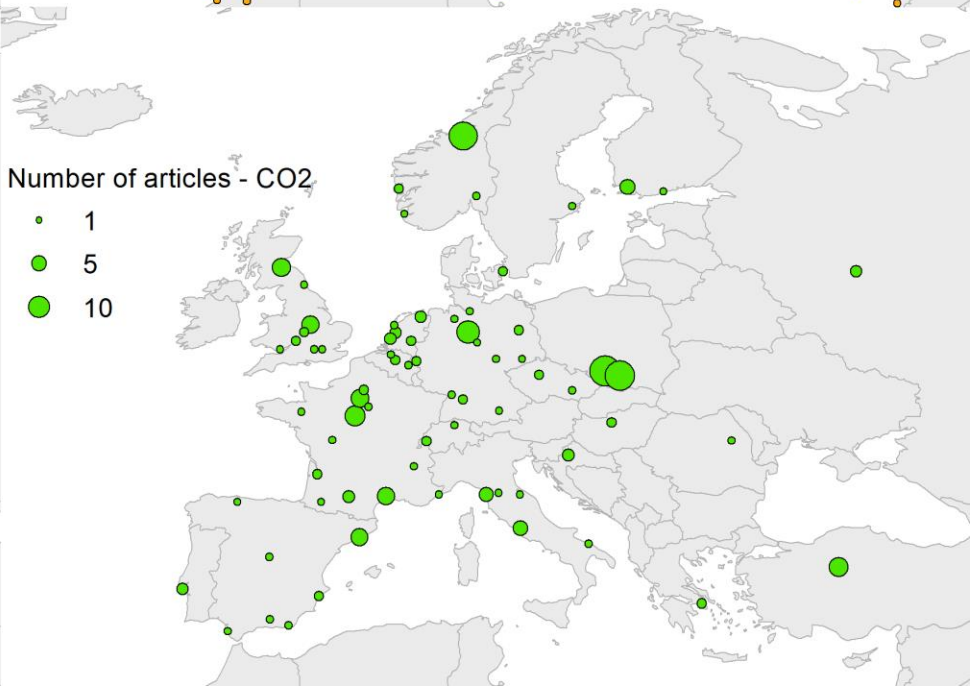
Articles including CO_2 in the keyword list (within the selection of underground related publications). Few stronger hubs are located to Europe and China and Australia.

European scale pattens









Conclusions and next steps

- Positioned article data enables geographic (i.e. spatial) and temporal analysis.
- By keywords (and later by abstracts) patterns of global underground research trends may be explored more in-depth level
- Results (will) indicate how distribution ‘underground’ study fields are organised: **strength and activity of different disciplines and the key temporal elements will be next included to analysis**.
- **Recognised (growing and strong) hubs are potential partners for underground laboratories and thus analysis enables also targeted marketing actions to reach key research organisations.**
- This data enables also to extend the analysis to cover also the networked characteristics of research teams and researchers within underground themes and laboratories.

Contact

Taurimas VALYS
Team Leader, Assoc. Professor in Finance
Vilnius University
taurimas.valys@vm.vu.lt

Ossi Kotavaara
Research director, Adjunct Professor
KSI, University of Oulu
Ossi.Kotavaara@oulu.fi

Interreg
Baltic Sea Region

EUROPEAN UNION

EUROPEAN
REGIONAL
DEVELOPMENT
FUND

More information

Bsuin.eu