



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.



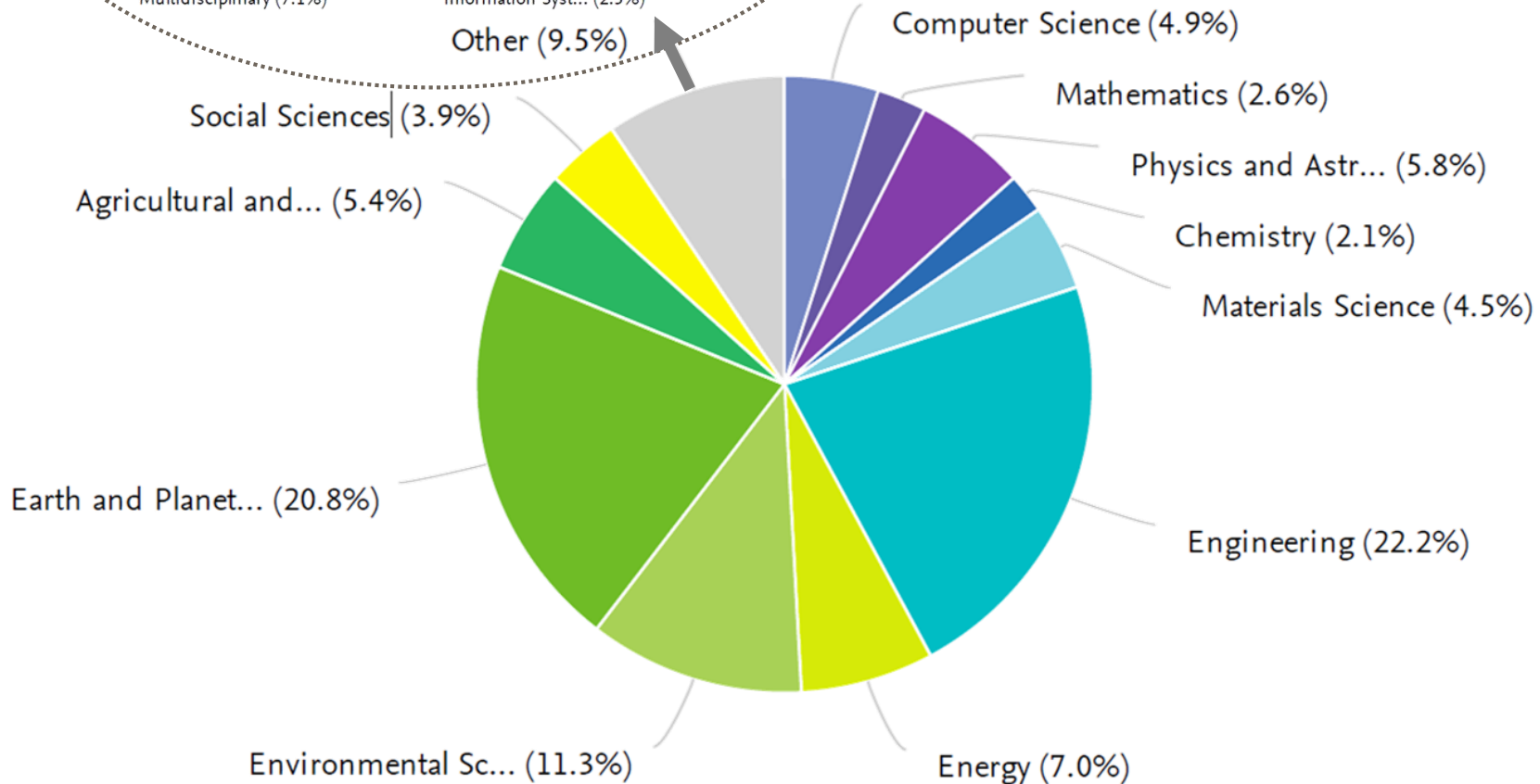
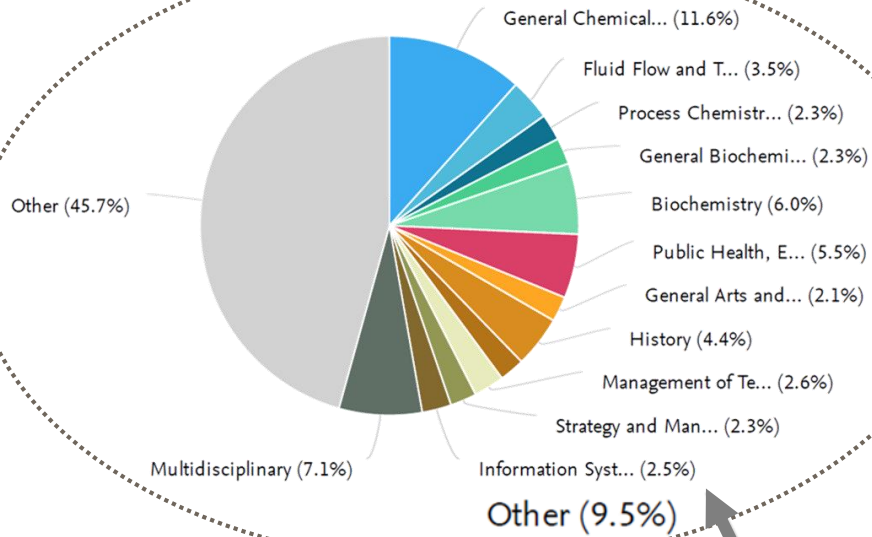
UL laboratories and understanding (global) network of underground research

- 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 utilising underground facilities to researches within several disciplines.
- In developing underground laboratories, understanding characteristics, needs and accessibility of research communities applying these facilities is crucial.
- Aim of this study is to product new knowledge in this field, by analysing geographic structure of the research in this community.
- Geographic information systems/science (GIS) is applied to scrutinise the metadata of scientific literature databases.

Underground research

Disciplines in Scopus publications

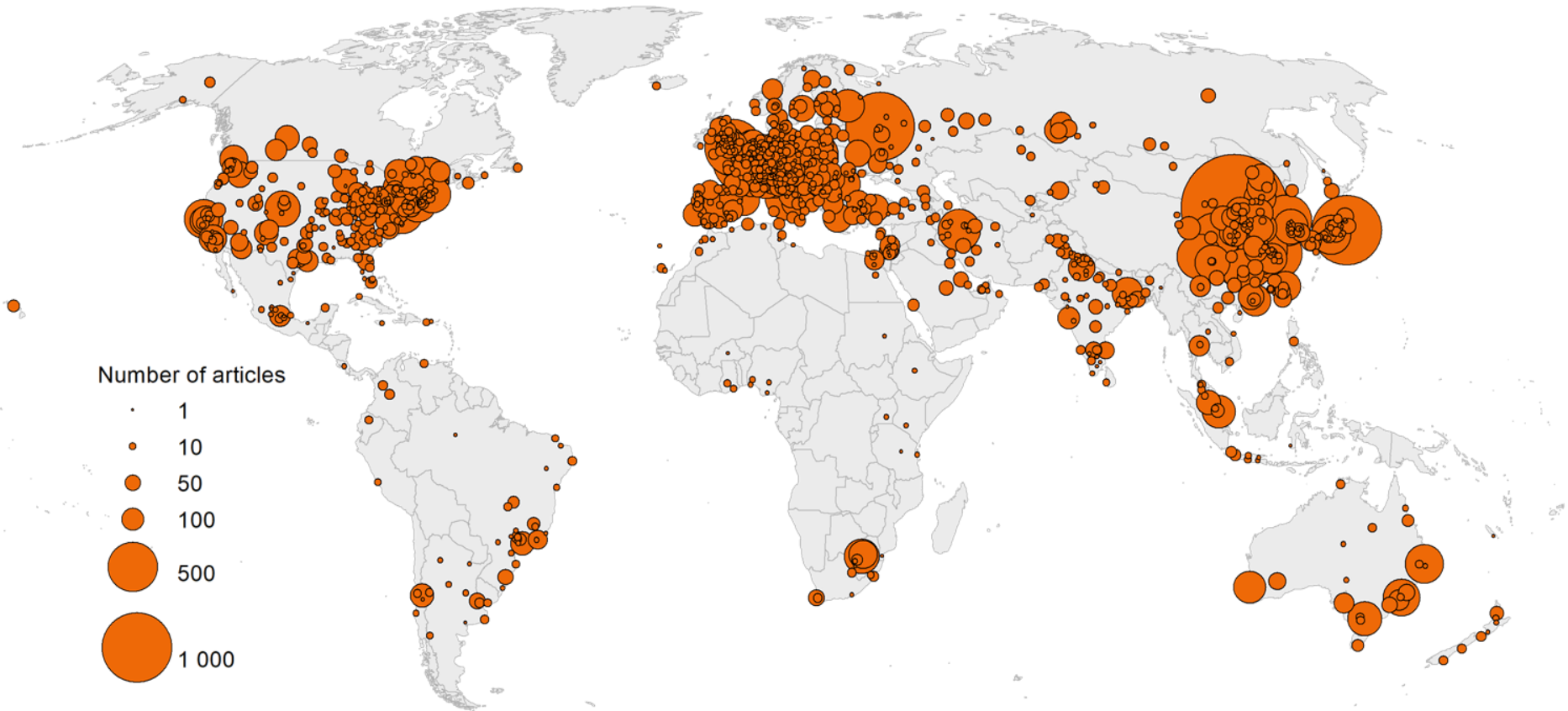
Years 2009-2018



Literature metadata analysis by Geographic Information Systems (GIS)

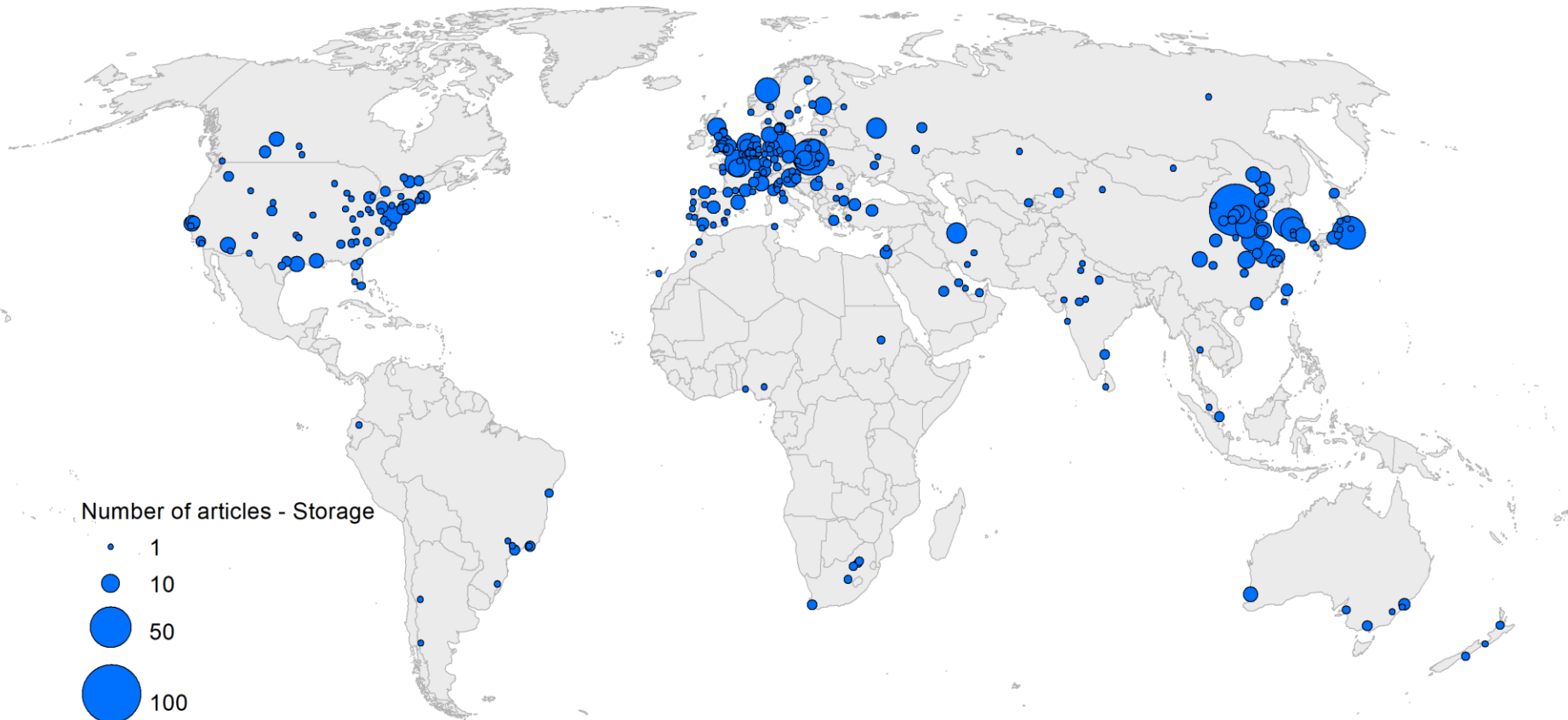
- Publication specific data are compiled from **Web of Science literature database**.
 - Data includes: authors, addresses, e-mails, keywords, abstracts, publication year, publication type, language
- Articles are **positioned by address** of corresponding author by using **Google geocoding interface**
- 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 – All positioned publications by 10 km clusters (Web of Science)



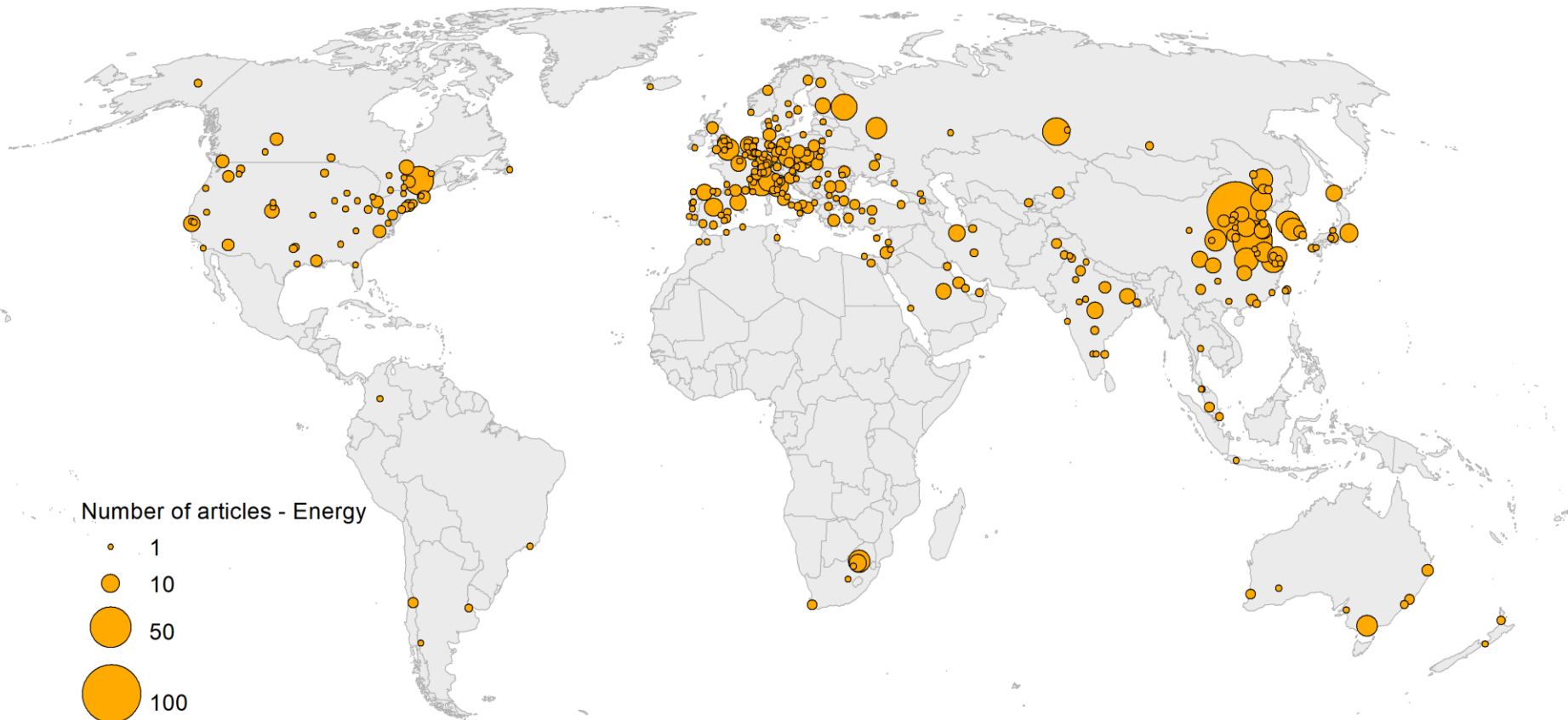
Geographic distribution of 60215 geocoded publications which Web of Science relates to underground.

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



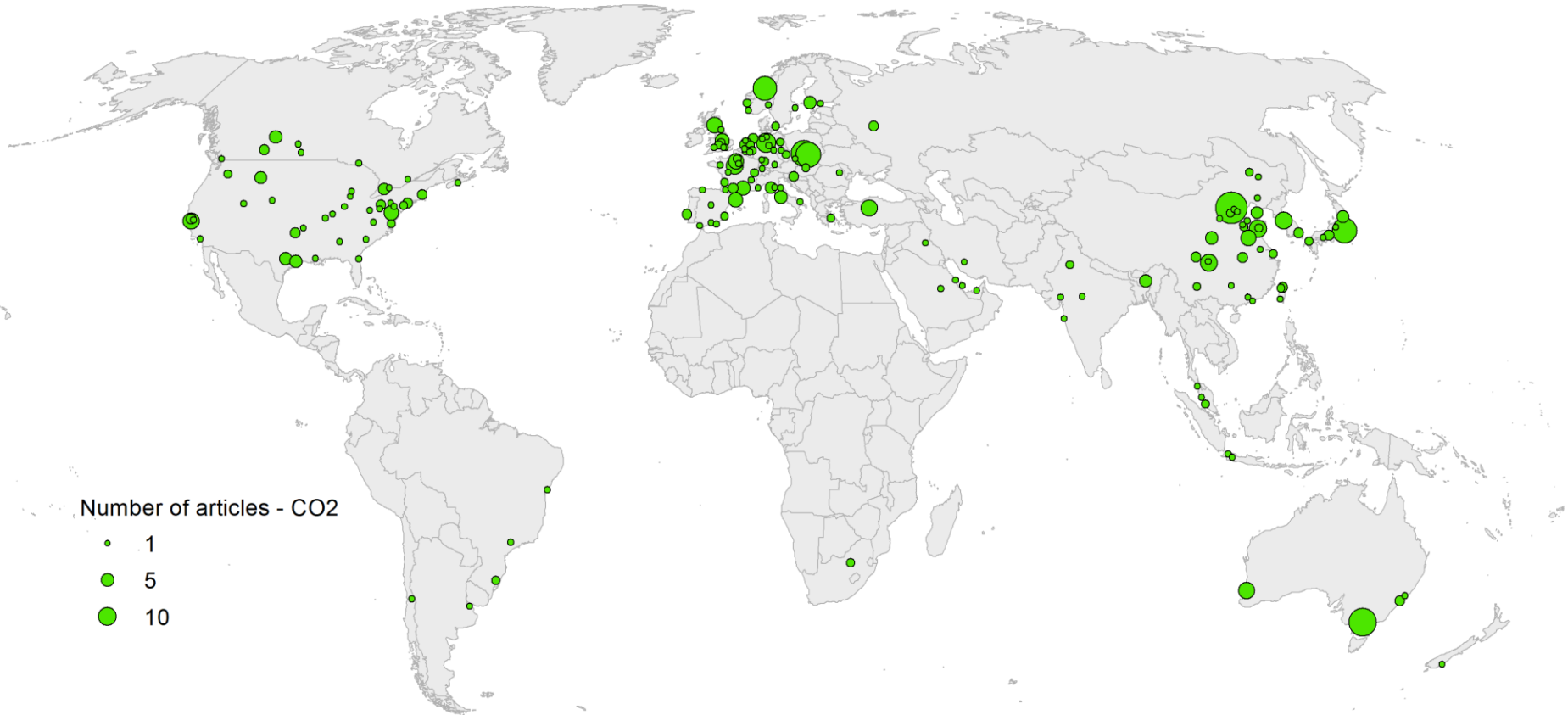
Articles including **storage** in the keyword list (within the selection of underground related publications). Europe and China form clear hubs.

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



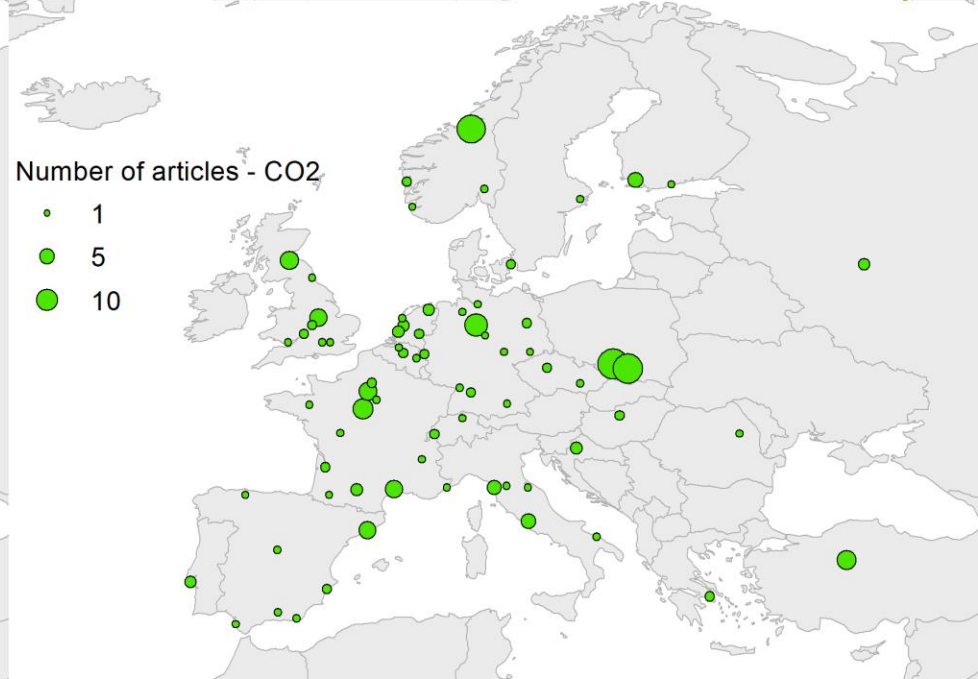
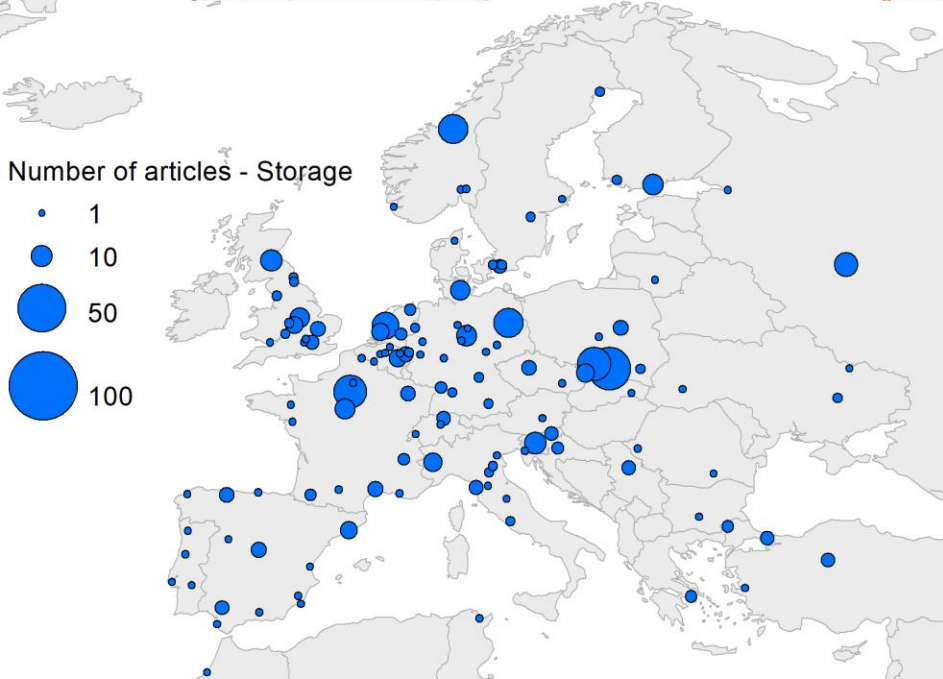
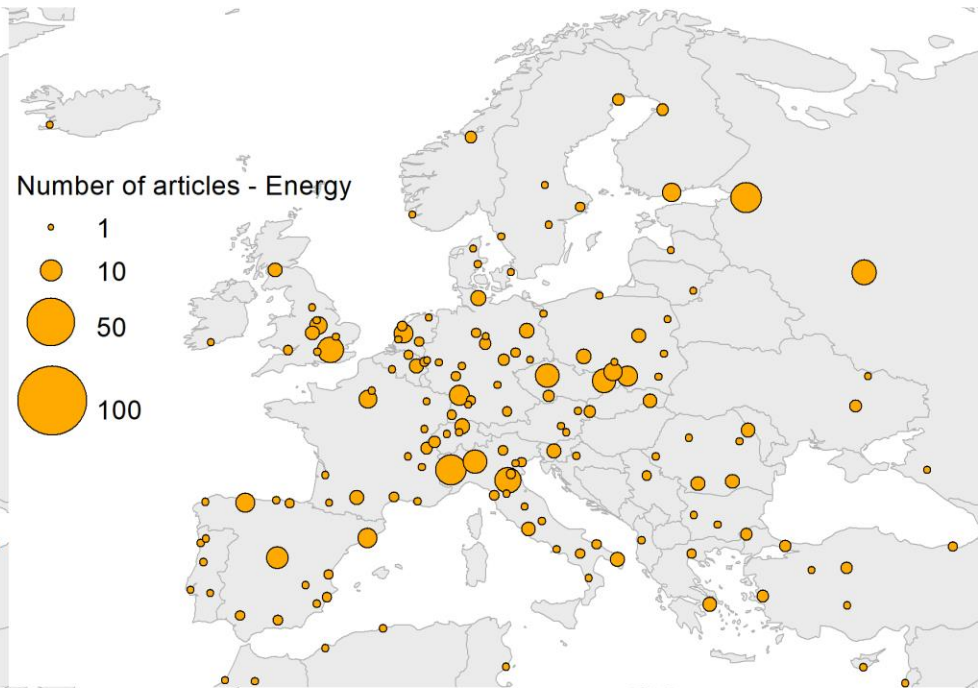
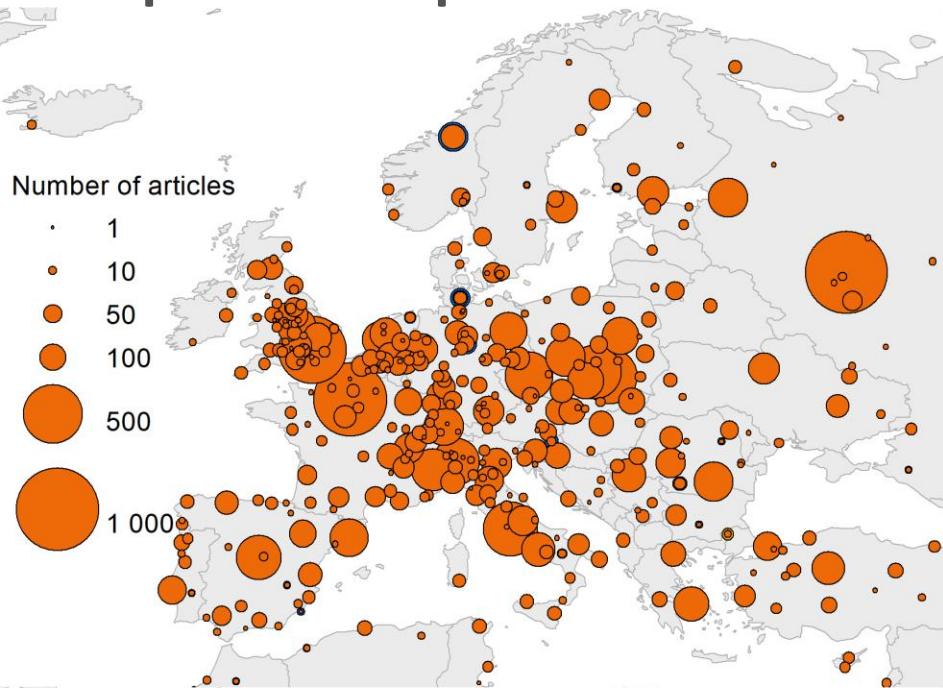
Articles including **energy** in the keyword list (within the selection of underground related publications). Europe, North-East America and China form clear hubs.

Underground research – **Keyword: CO₂** – Positioned publications (Web of Science)



Articles including **CO₂** 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.

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