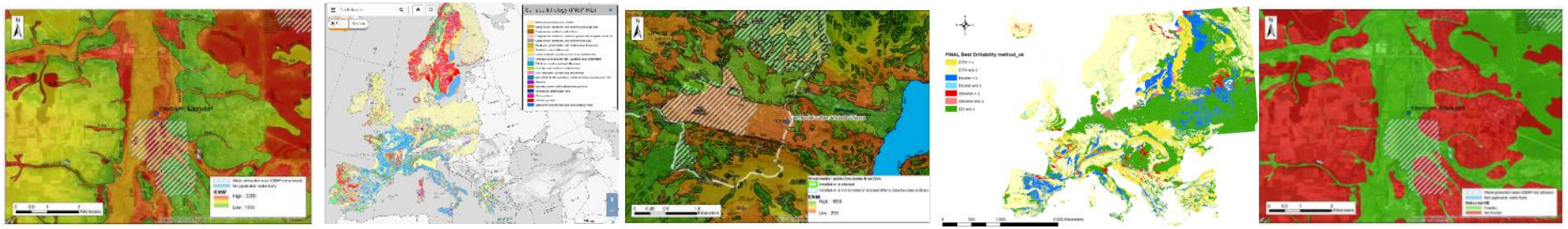


Shallow geothermal maps in Cheap-GSHPs and GEO4CIVHIC European Projects

Workshop on mapping shallow geothermal resources and limitations of use in the context of modern management approaches, Brussels 25.09.2019, Belgium

1. European shallow geothermal map – drillability map

2. Local shallow geothermal map for closed-loop systems

Università degli Studi di Padova – Dipartimento di Geoscienze

1. European shallow geothermal map – drillability map

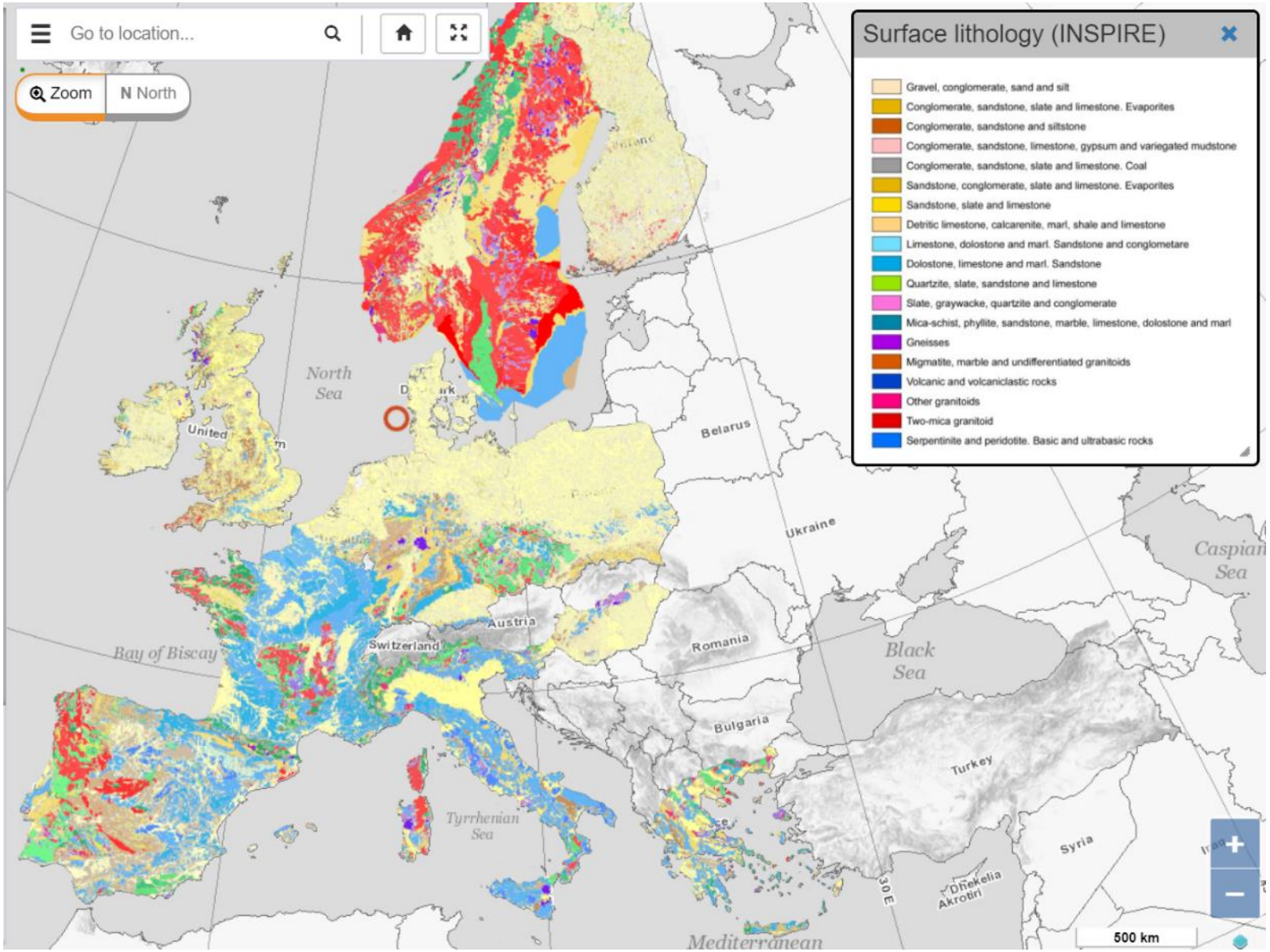
- ✓ **EUROPEAN SCALE mapping**
- ✓ **Target group:** policy makers, energy planning administrator
- ✓ Based on the **geological map** released following the **INSPIRE** (INfrastructure for Spatial InfoRmation in Europe) Directive
- ✓ ESRI Shape (vector file), **Scale 1:1.500.000**, Projection ETRS 1989 LCC
- ✓ considers the most used **drilling methods**

It provides:

- ✓ First information about the geological context
- ✓ First estimation of the best drilling techniques to be applied and time/costs

Pan- European Geological map

Provided by the EuroGeoSurveys' European Geological Data Infrastructure (EGDI)



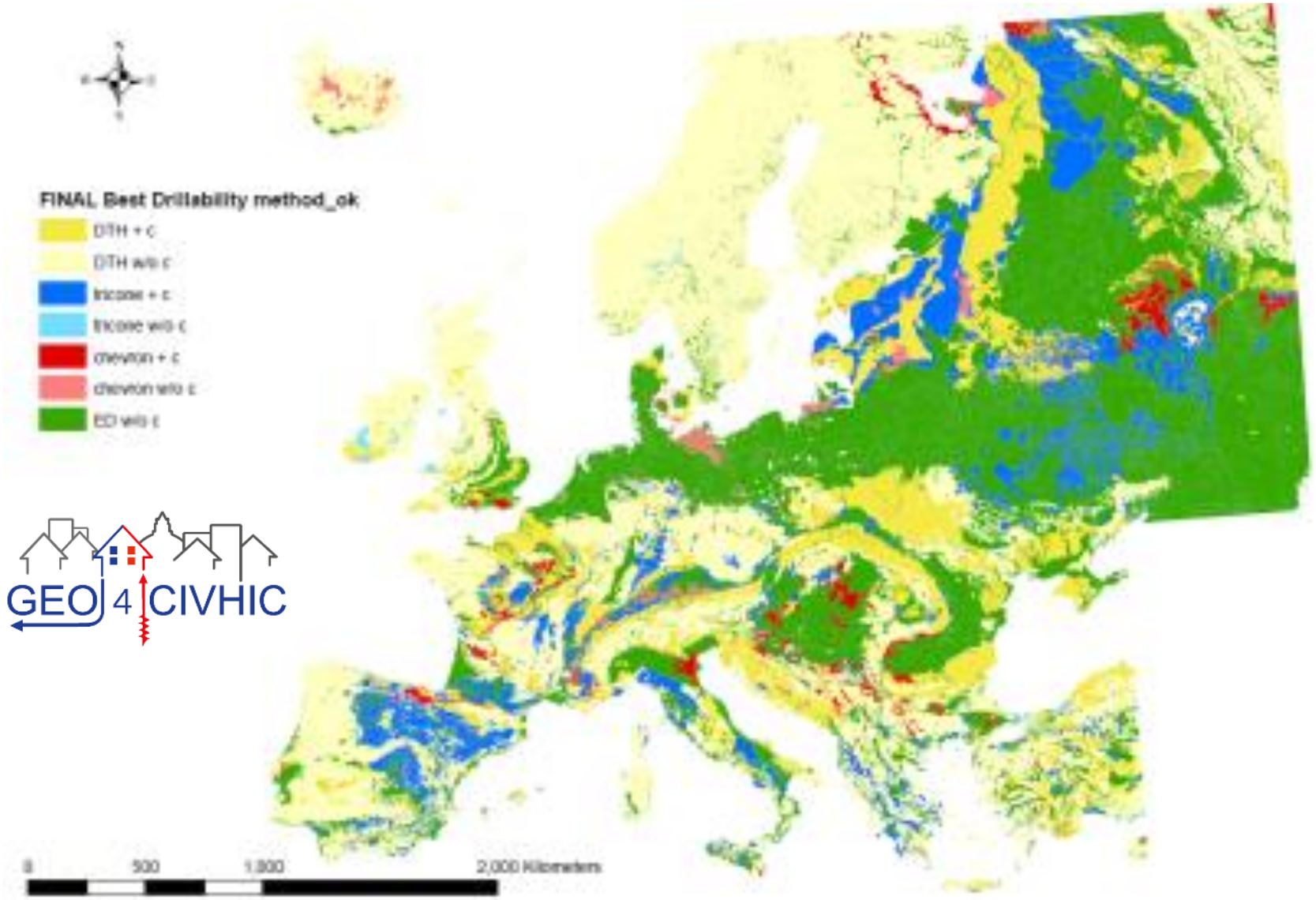
http://www.europe-geology.eu/onshore-geology/geological-map/onegeologyeurope/

Drilling methods

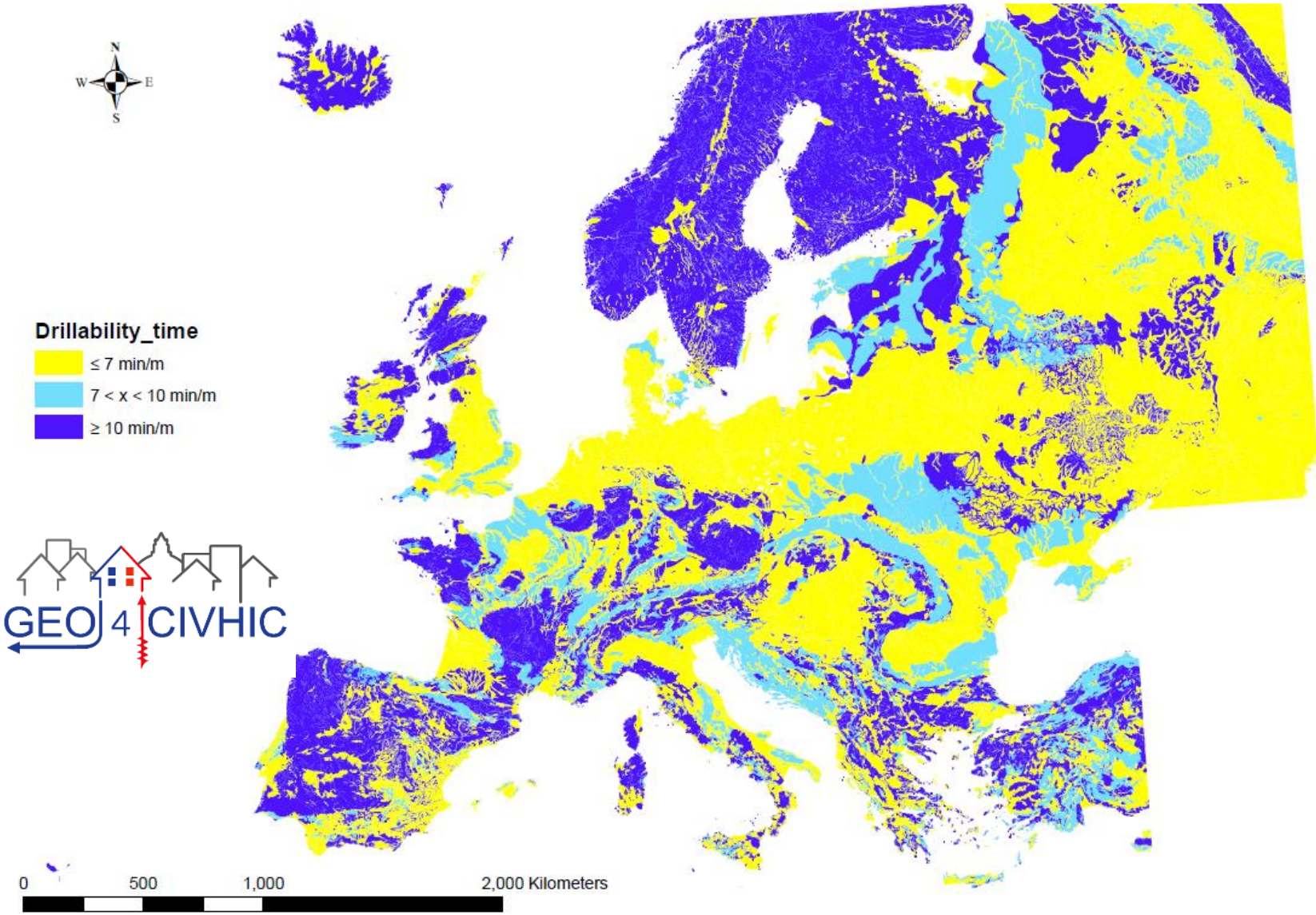
The drilling methods considered by questioning project partners expert in drilling operations (FAU, GEOSERV, GEOGREEN, UBeG, HYDRA, UNIPD-DG) are**:**

1) down-hole hammer WITH casing → **DTH + c**
2) traditional down-hole hammer WITHOUT casing → **DTH w/o c**
3) rotary drilling tricone WITH casing → **tricone + c**
4) rotary drilling tricone WITHOUT casing → **tricone w/o c**
5) chevron WITH casing → **chevron + c**
6) chevron WITHOUT casing → **chevron w/o c**
7) easy drill piling without casing (Cheap-GSHPs technology) → **ED w/o c**
8) easy drill with casing + grout+ probe inserted and extraction of the casing at the end (technology developed in the GEO4CIVHIC project) → **ED + c**
9) enlarged auger for helicoidal heat exchangers (with casing of about 30cm) (Cheap-GSHPs technology) → **EA**

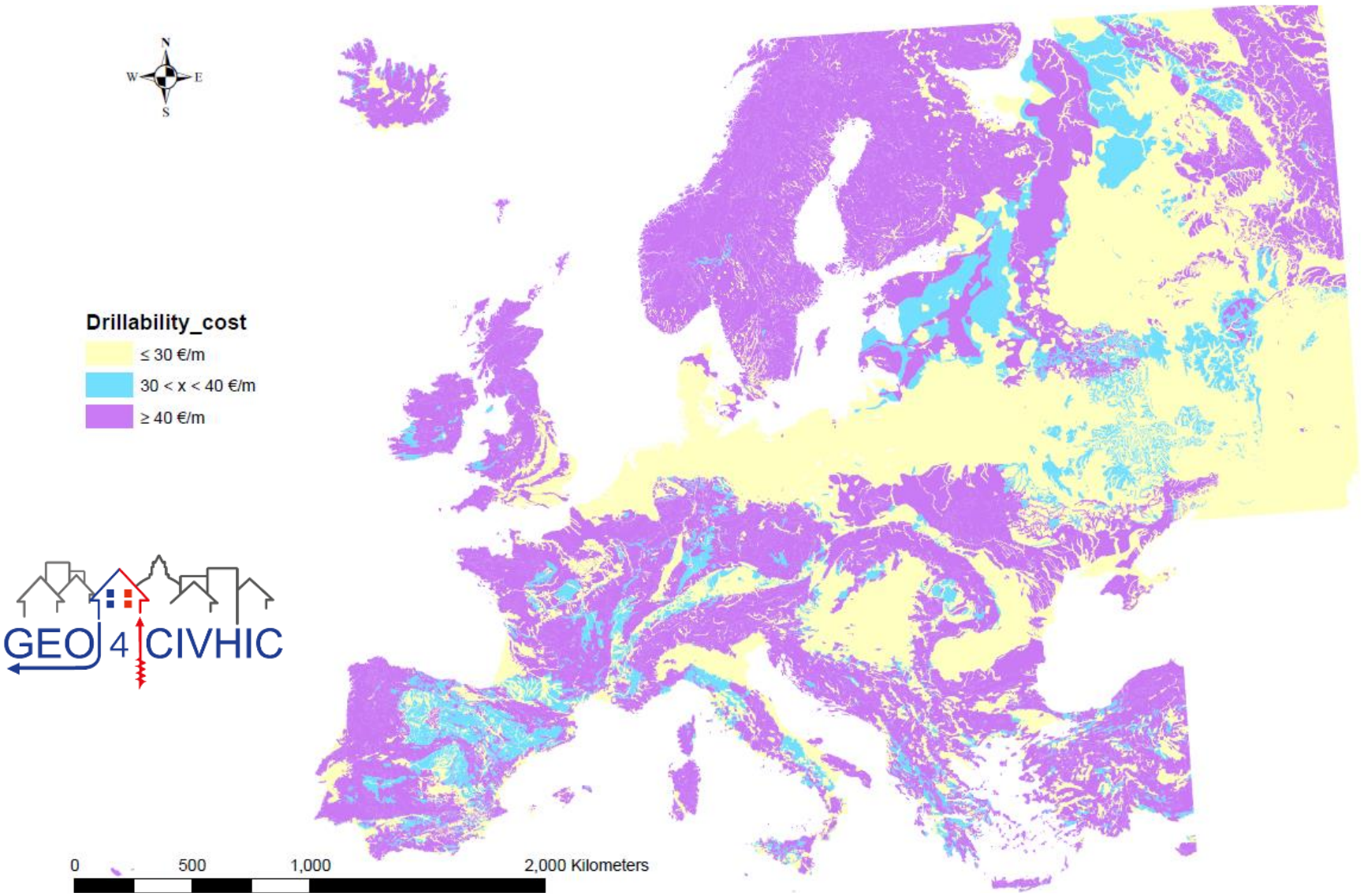
Drilling methods



Drilling time



Drilling costs



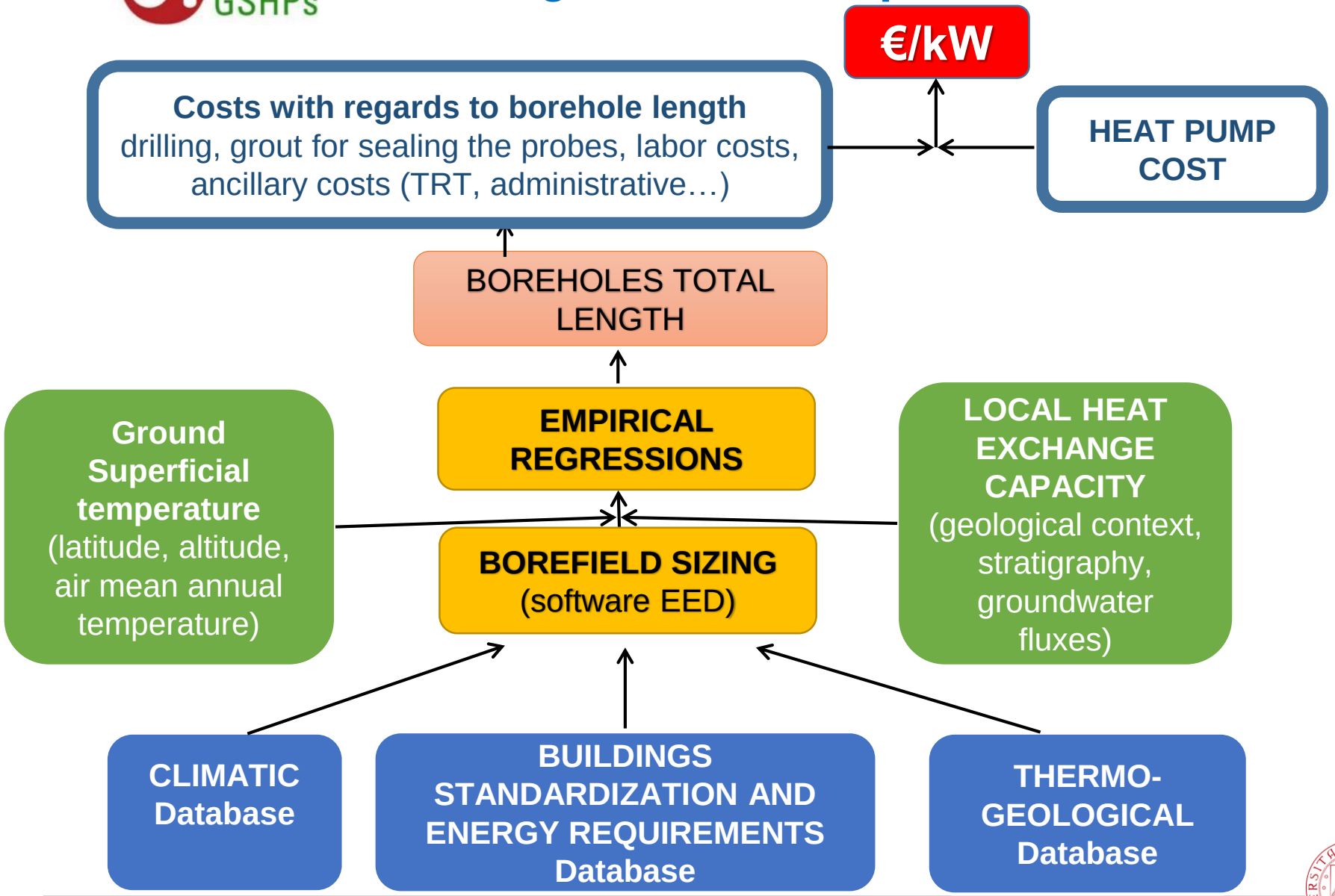
Development of an Application for support in situ workers on Geothermal field

- ✓ Based on the **European drillability maps**

ENVIRONMENT	SUB-ENVIRONMENT	MAIN LITHOLOGY
1 Alluvial plain	1.1 high plain	1.1.a gravel
2 Mountain-hill area	(towards the mountains)	1.1.b sand
3 Coastal area		
	1.2 low plain	1.2.a sand
	(towards the sea)	1.2.b clay
	2.1 valley plain	2.1.a gravel
		2.1.b sand
	2.2 slope	2.2.a limestone
		2.2.b dolomitic limestone
	3.1 rocky coast	3.1.a limestone
		3.1.b marl
	3.2 shoreline	3.2.a sand
		3.2.b silt

1. lithology sub-definition
2. wet recommended thermal conductivity value ($W*m^{-1}K^{-1}$) (database GEO4CIVHIC)
3. drillability method (data from D1.2)
4. drillability time ($min*m^{-1}$) (data from D1.2)
5. drillability costs (€$*m^{-1}$) (data from D1.2)

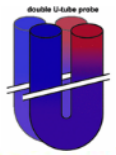
shallow geothermal maps for closed-circuit

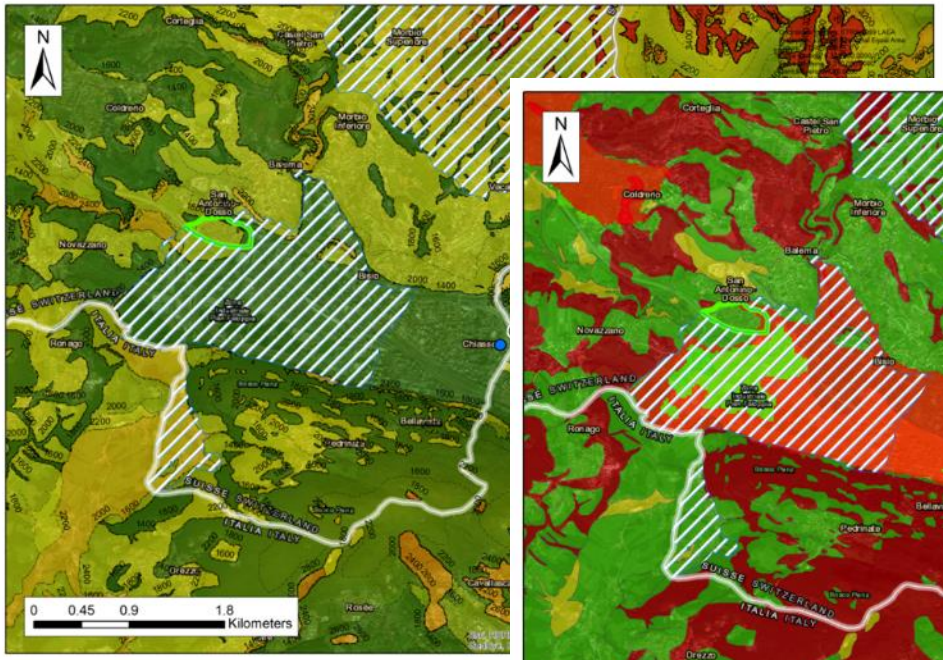


Techno-economic potential of closed-loop shallow geothermal systems

Test sites applications – Chiasso (Switzerland)

€/kW for double U

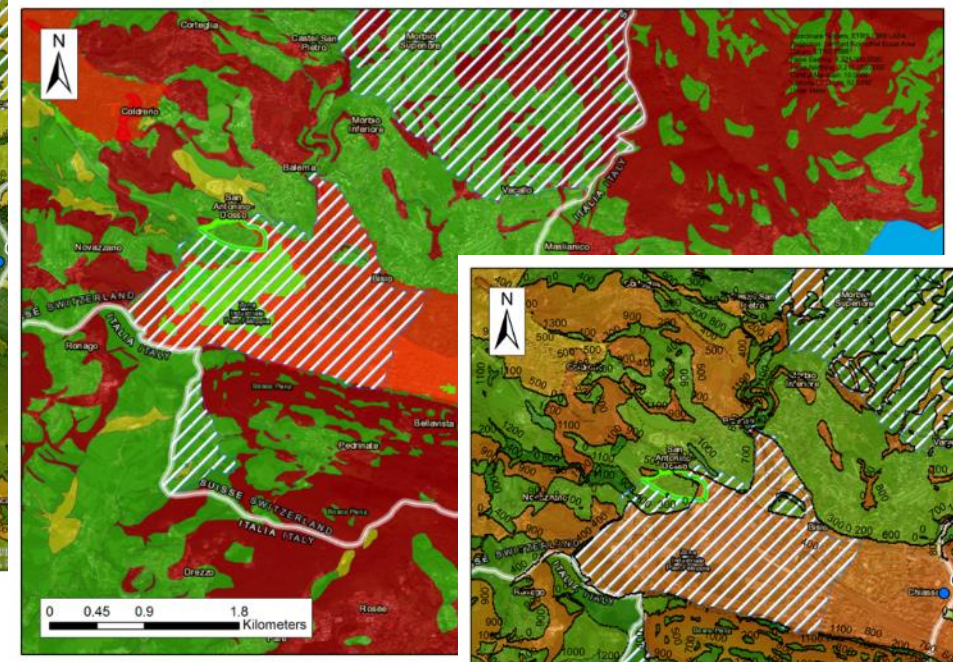


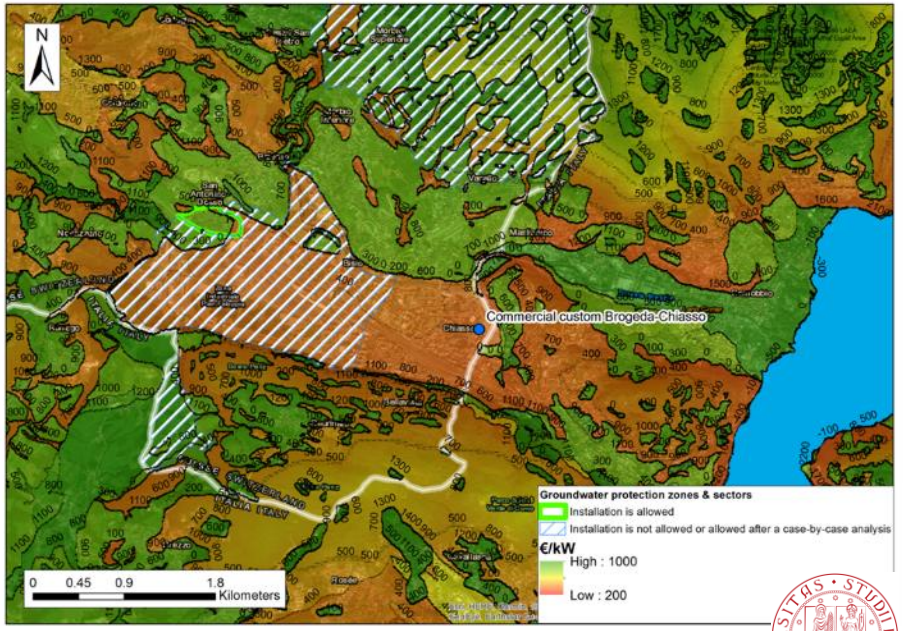


Helix HE feasibility

Cheap GSHPs

€/kW coaxial probe





only in well-defined geological contexts
(no rock, no unsaturated deposits)

2. Local shallow geothermal map

- ✓ **Thematic maps at municipal scale (1:25.000)**
- ✓ **Target group:** geologists, engineers, local authorities, stakeholders, policy makers, administration …
- ✓ Based on **local information (3D data)**:
  Geological / **hydrogeological** data/ local costs / local heat exchange capacity / TRT / ground temperature / building thermal needs etc…
- ✓ To be calibrated/compared with the **real data in the test sites**

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It provides:
- ✓ Suggestions about the best drilling technique to be applied
- ✓ Estimation of drilling time and costs