European Topic Centre
Spatial Information and Analysis

European Environment Agency

Rough estimation of groundwater resources in Europe based on IHME (inter alia)

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- Objective: water accounts
- What do we want? What do we need?
- Data availability

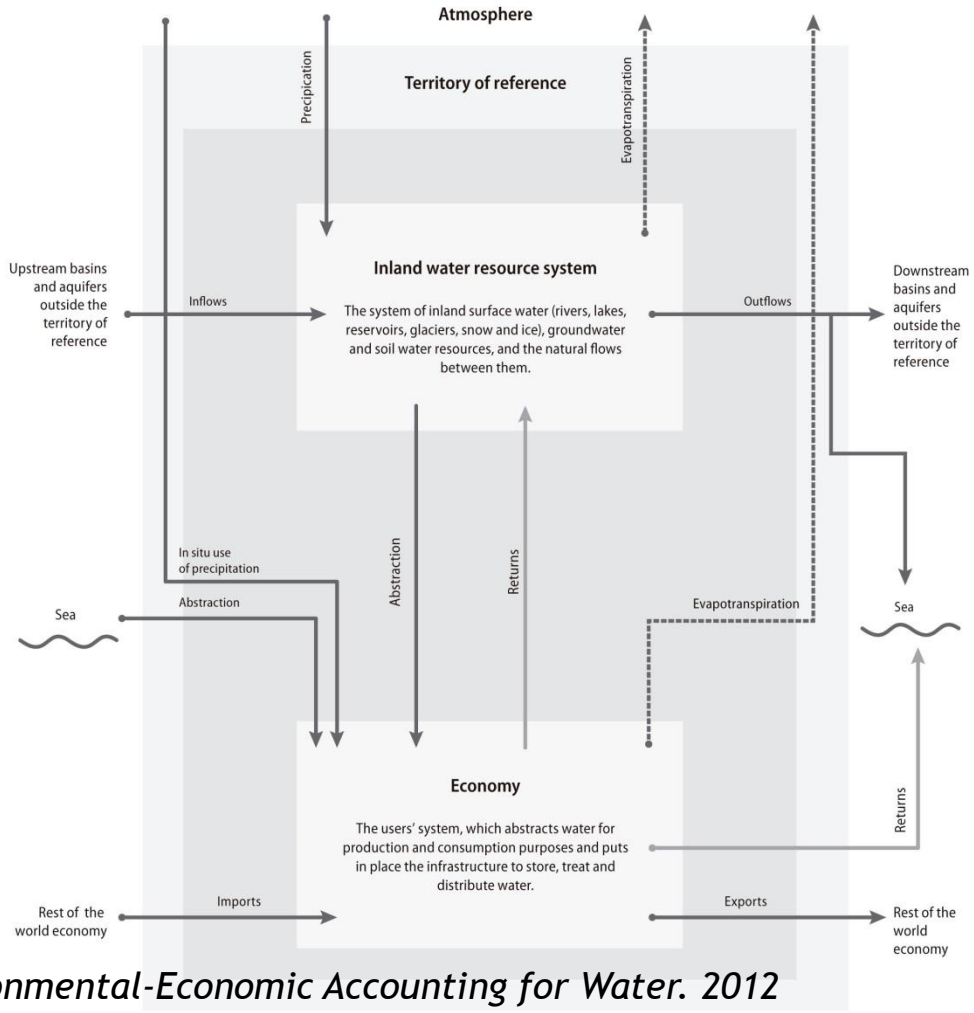
Water accounts

Essential data

- Climatic essential variables (rainfall, snow fall)
- Potential evaporation (in practice, evapotranspiration from crops and vegetation)
- River discharge at sufficient number of gauging stations (e.g. x/ 1000 km of main drain length)
- **Groundwater levels**
- Reservoir and lake variations (but since such data does not exist, is it estimated from river discharge)

Source: EEA. Results and lessons from implementing the Water Assets Accounts on the EEA area. Paving the way forward regular production. 2013

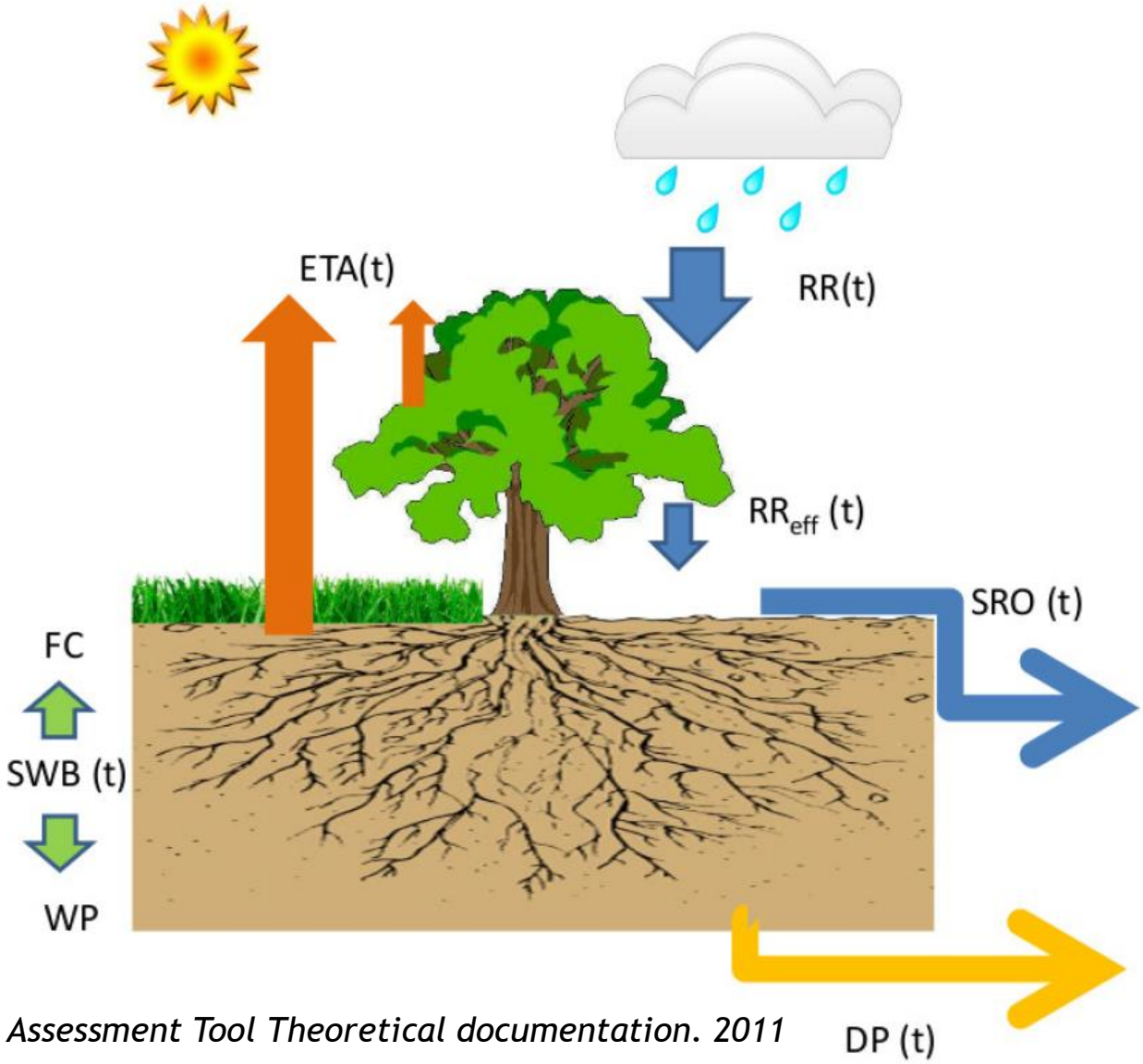
Water accounts: SEEA-W **System of Environmental-Economic Accounting for Water (United Nations Statistic Division)**



Source: United Nations. System of Environmental-Economic Accounting for Water. 2012

Water accounts: SWAT model (from Texas Water Resources Institute)

- Actual Evapotranspiration
- Total rainfall
- Effective rainfall
- Surface runoff
- Soil-water balance
- Field capacity
- Wilting point
- Deep percolation



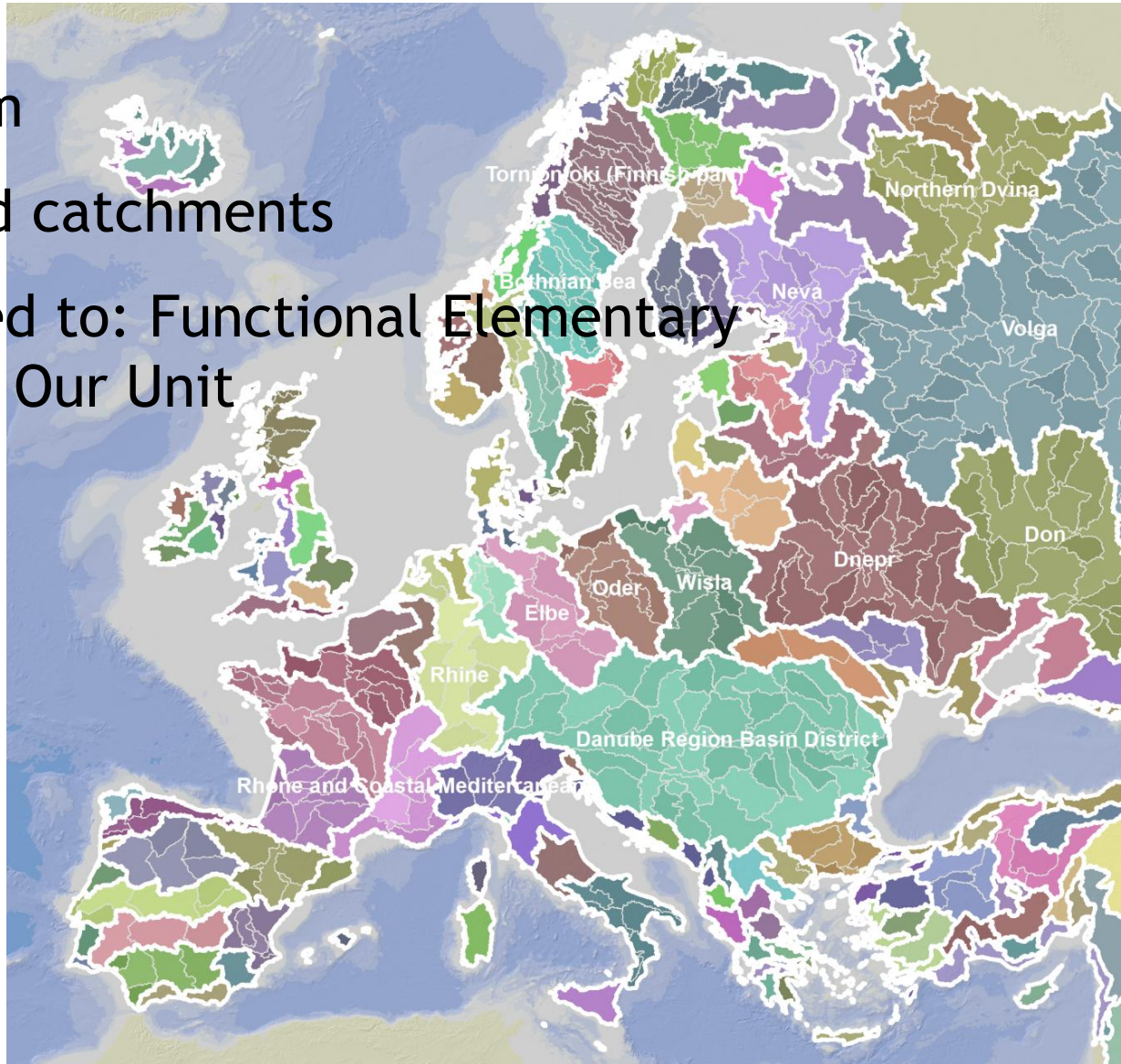
Source: Neitsch et al. Soil Water Assessment Tool Theoretical documentation. 2011

Objective

ECRINS: European Catchment and River Network System

- Hydrological system
- Modelled rivers and catchments

All the data is referred to: Functional Elementary Catchment (FECS) ☞ Our Unit



What do we want?

- What do we want?
  - Water stocks for Europe per FEC
  - That way, aggregations for a catchment can be made or other administrative unit can be easily made
- Is there any data available with sufficient detail?
  - Not at the moment
- So, our aim is to know the stocks of groundwater at European level
  - Options:
    - modelled data… or
    - data derived from actual measures + ancillary information

What do we need?

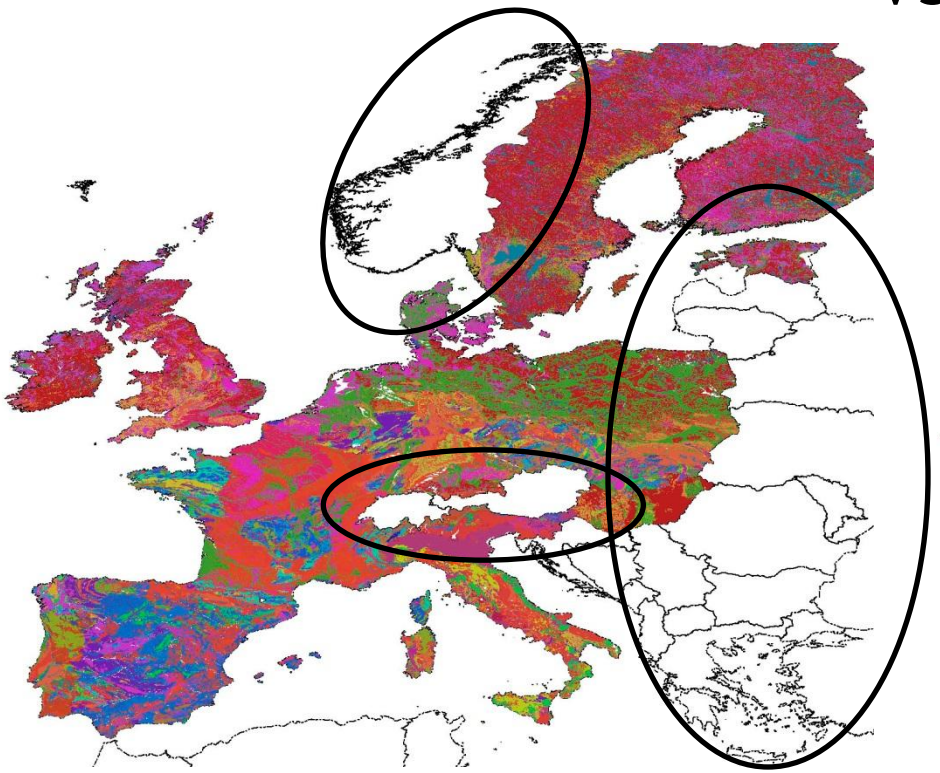
- Proxies to have a rough estimation of the water resources of Europe
  - Geology
  - Aquifers
  - Water table depth
  - Saturated area depth
  - Thickness of the saturated area
  - Groudwater bodies
  - Etc.

Data availability

- Measures of groundwater bodies:
  - WFD reporting
  - National data (too difficult to achieve)
- Ancillary information
  - Aquifers: IHME0
  - Geology
    - OneGeology (experiences on standardization of rocks at European level - ETCSIA)
    - IGME5000 (too coarse)
  - Water table depth (too coarse)
  - Porosity of the rock

Data availability: Geology

One Geology

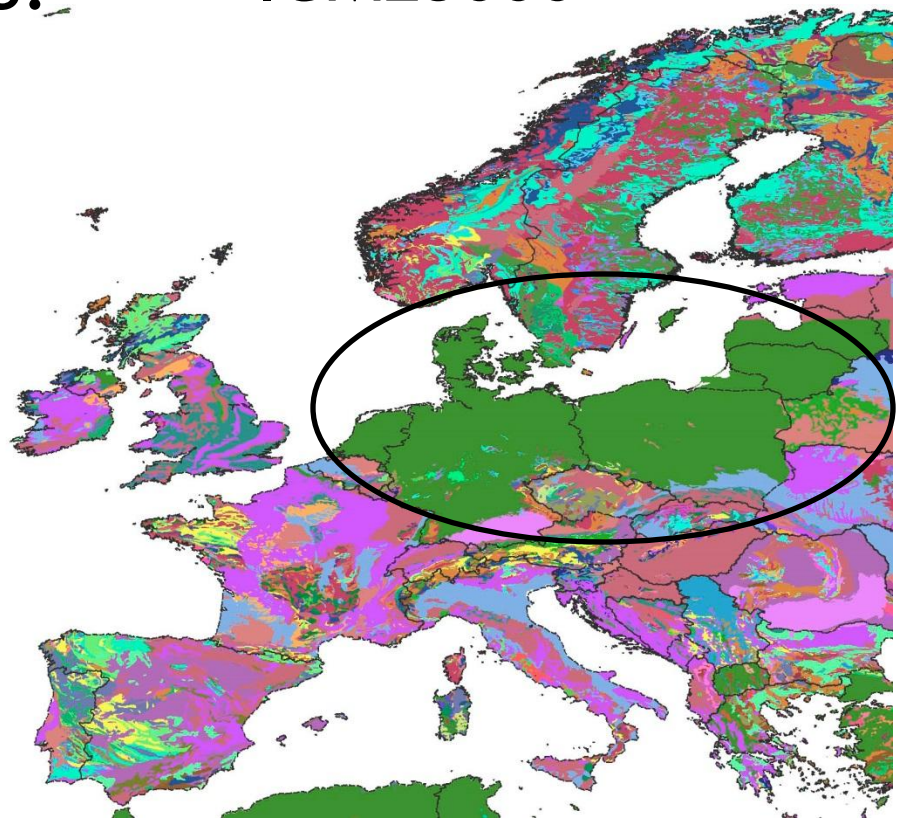


Non-harmonized

Data gaps

VS.

IGME5000



Very coarse

Undifferentited zone

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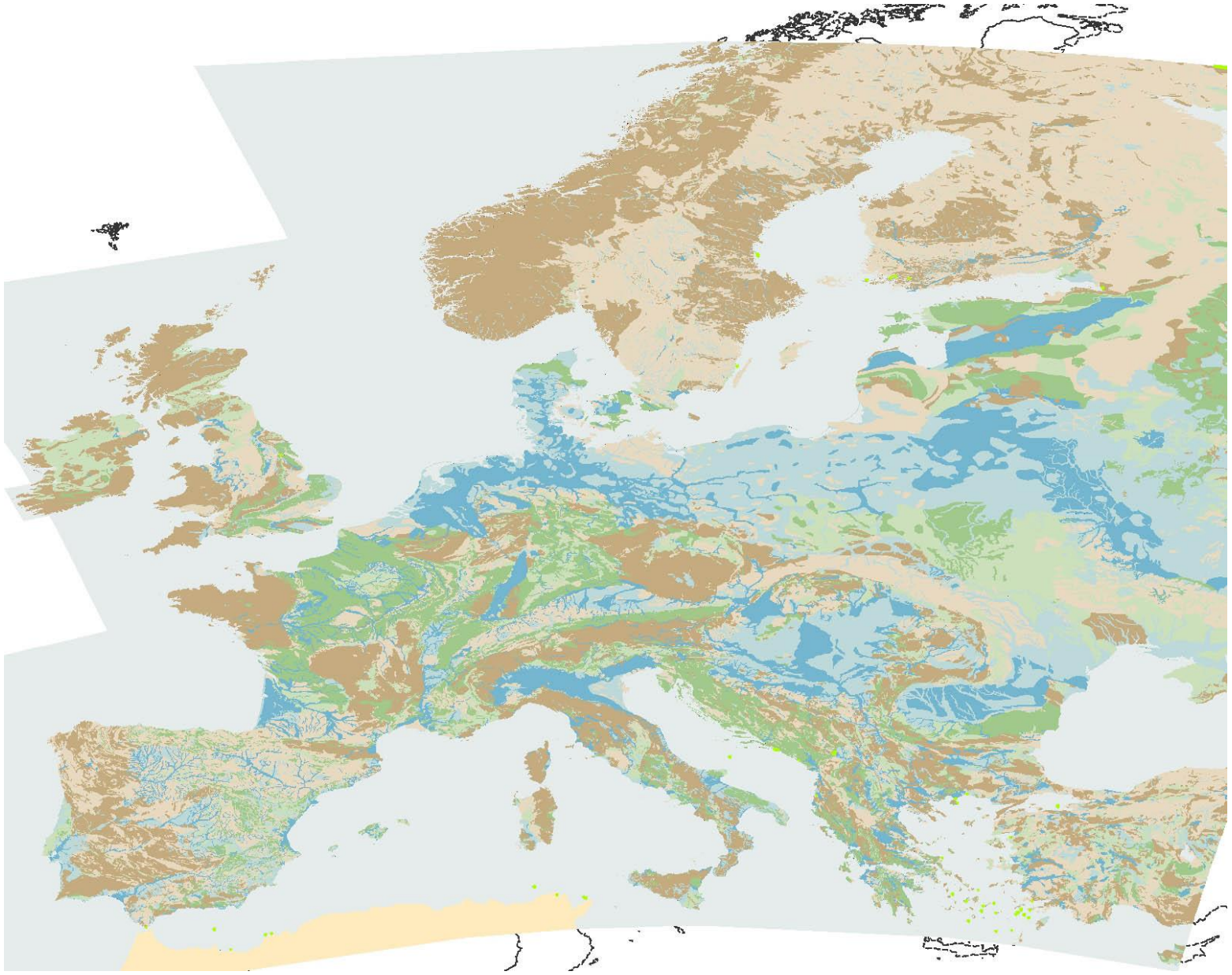
Data availability: aquifers



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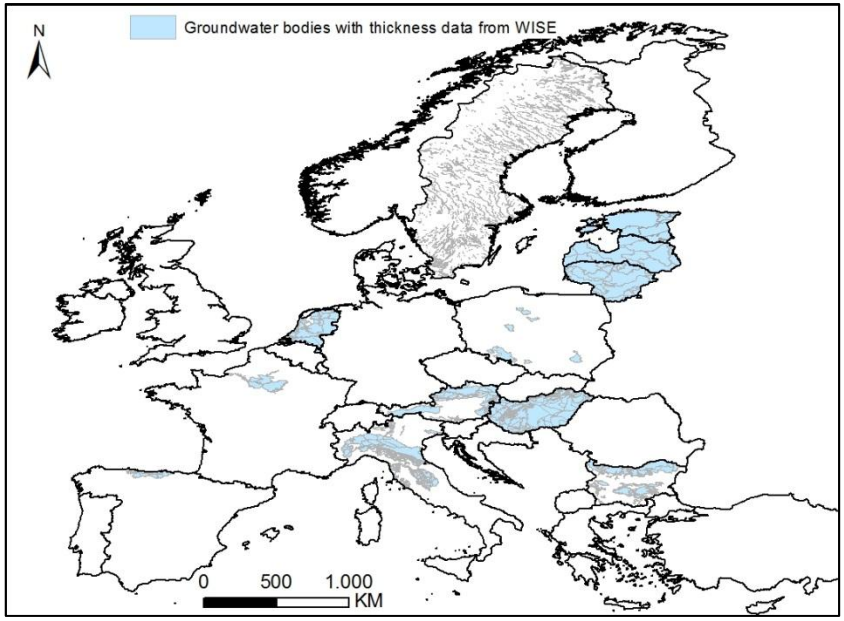
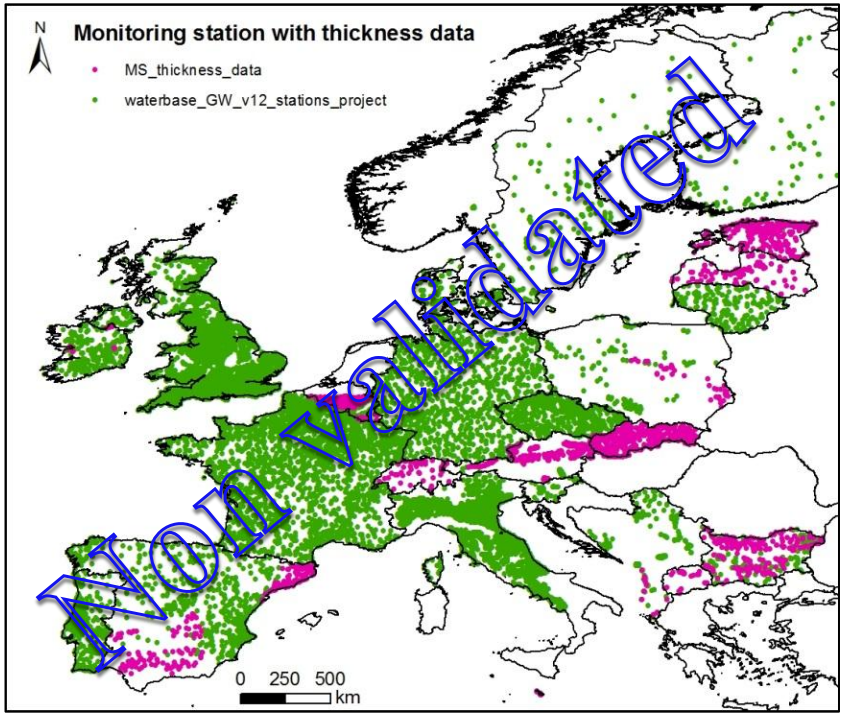
Thickness of groundwater bodies

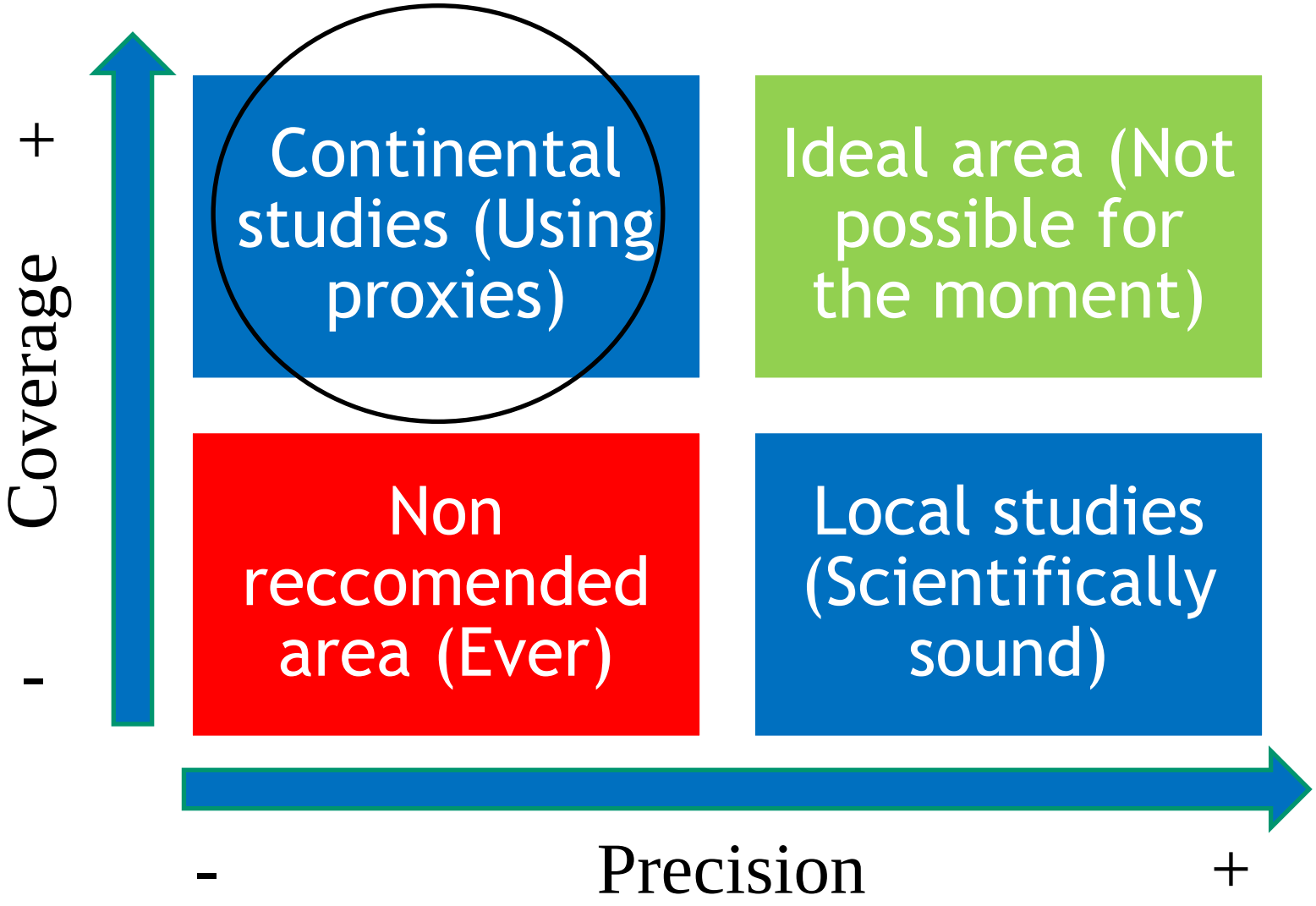


Groundwater bodies

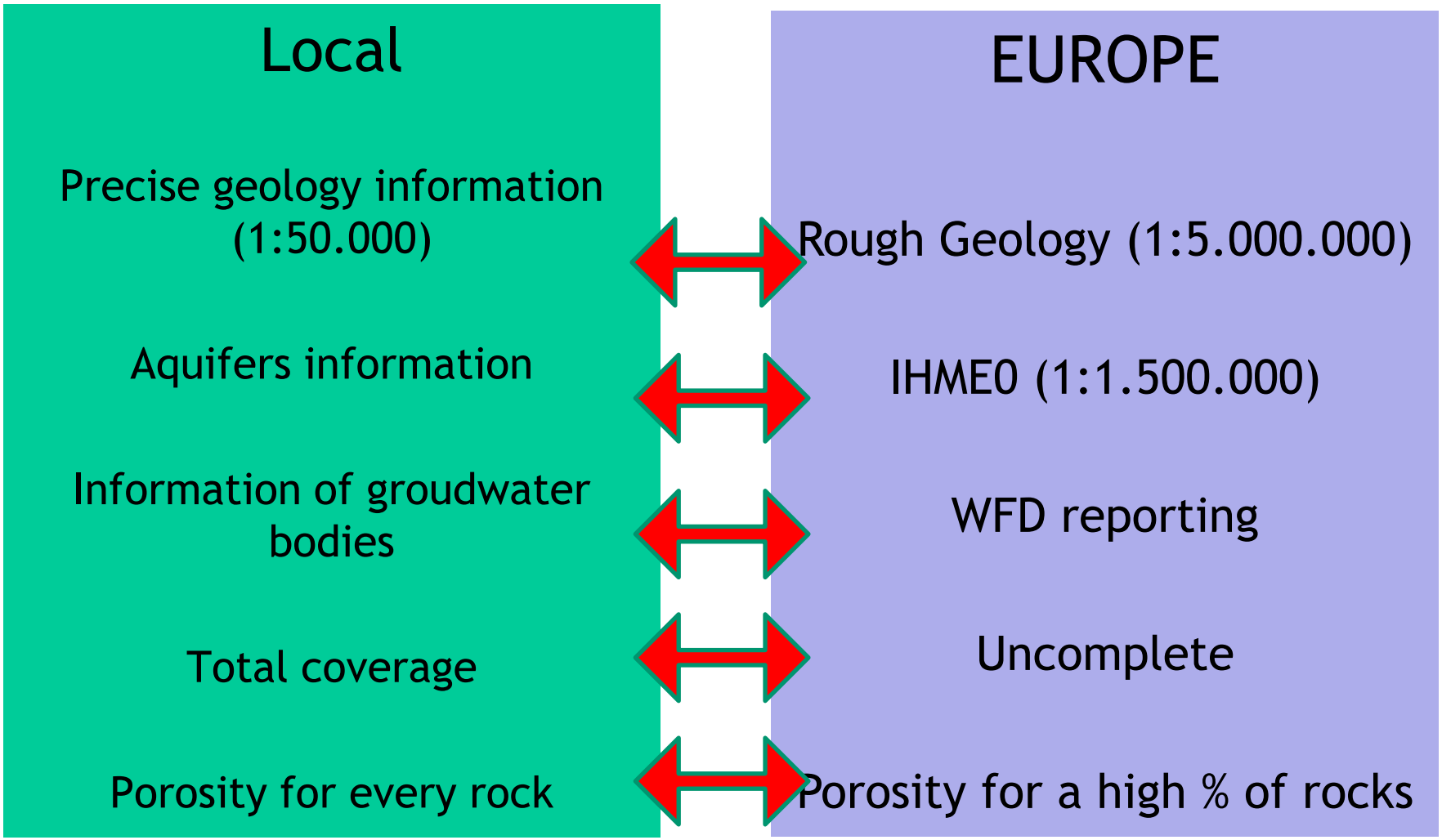
Monitoring stations



Data availability



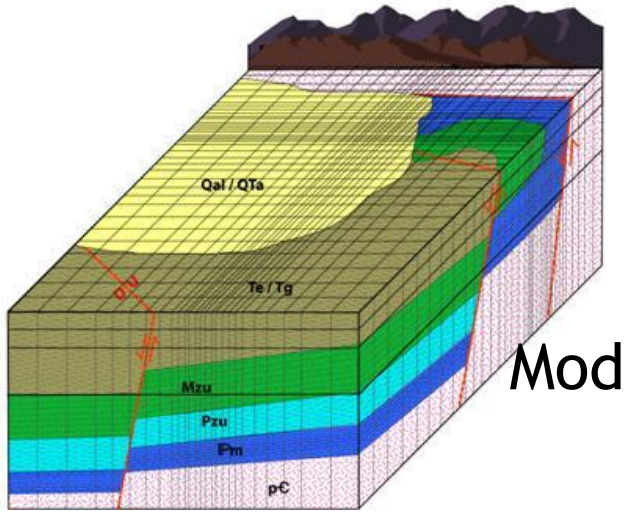
Data availability



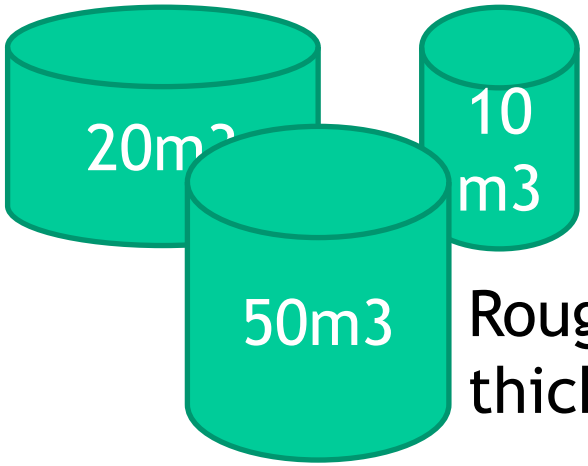
Methodology proposed by EEA

- Consider the groundwater bodies as cylinders and calculate the potential volume of water

Reality

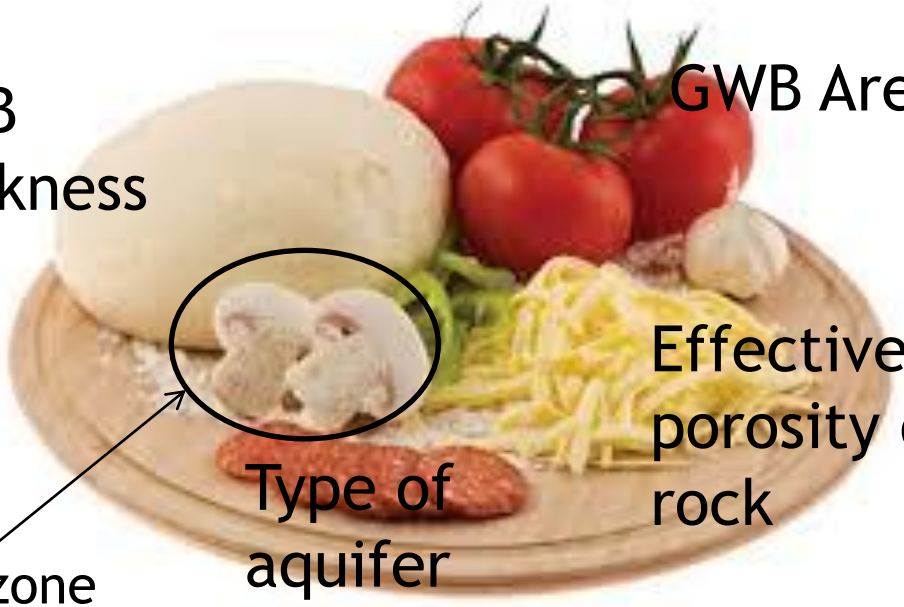


Model



Rough model: Volume = thickness*area*eff.porosity

Recipe



GWB thickness

GWB Area

Effective porosity of rock

Type of aquifer

Saturated zone thickness?

= Stocks

Potential stocks

1 Prepare the layers

2 Mix the layers

3 Assess the result (Is it tasty?)

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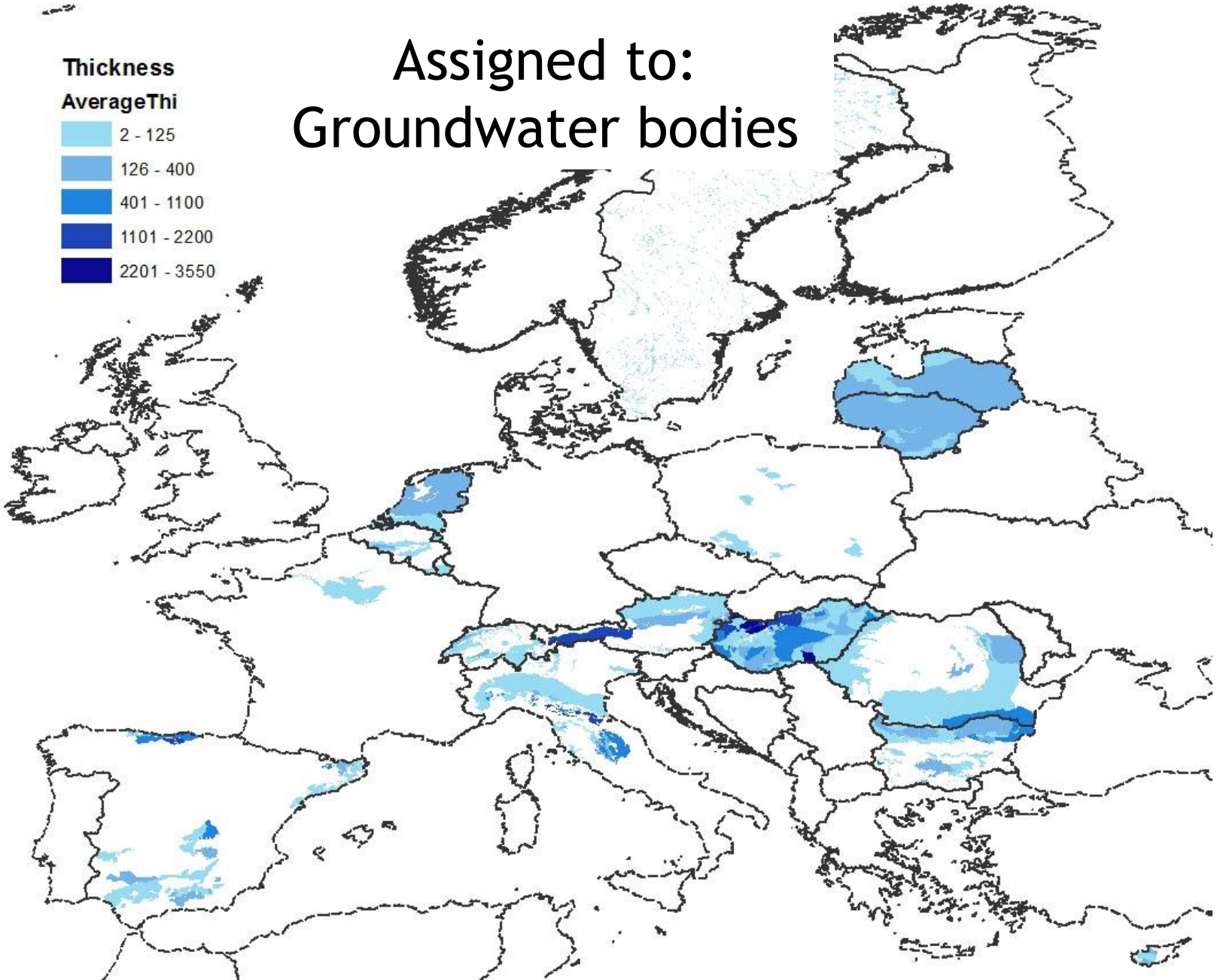
Thickness of groundwater bodies



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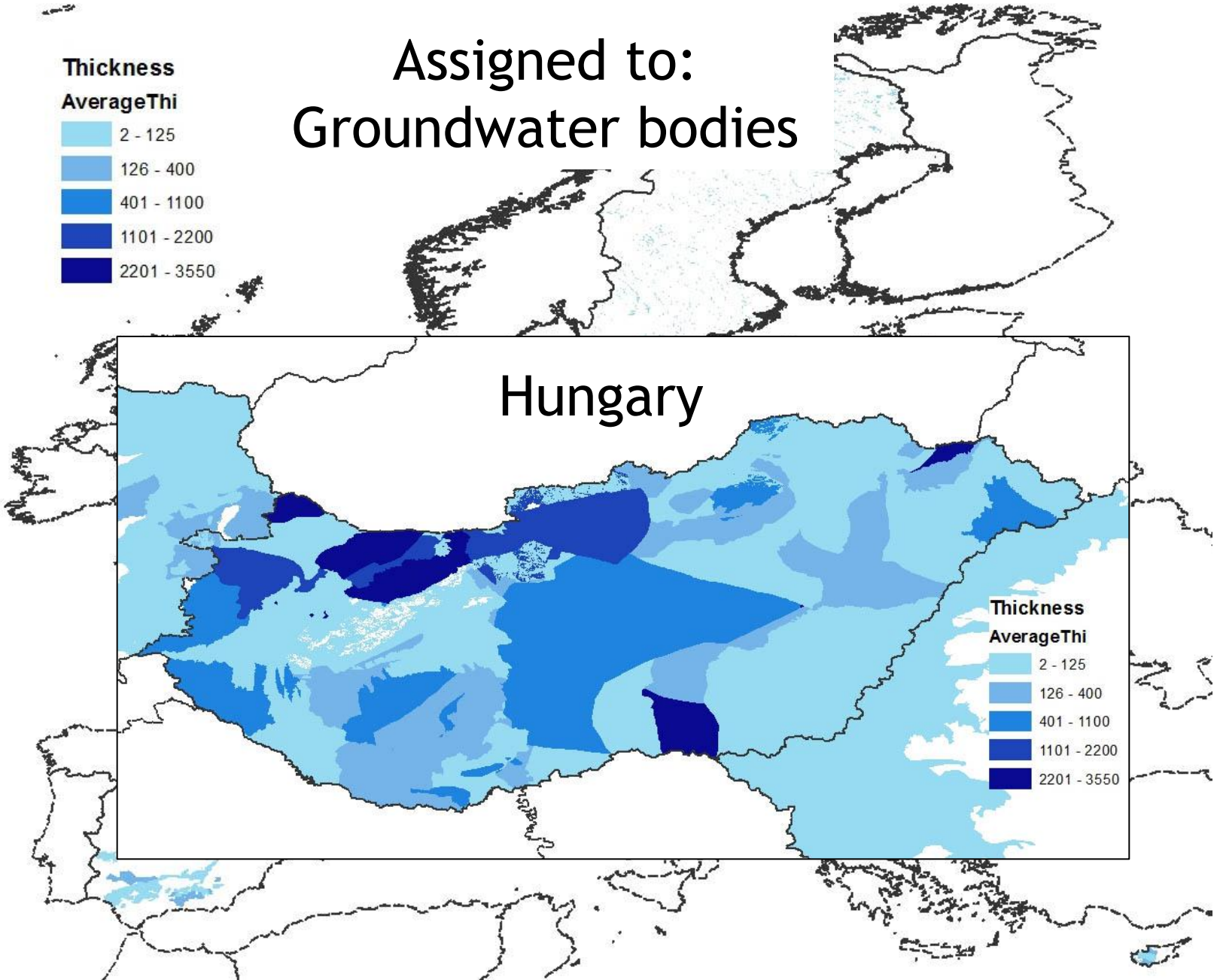
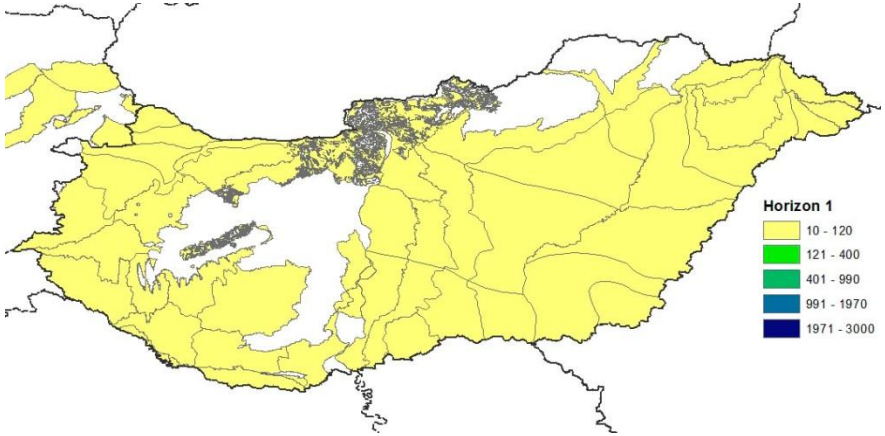
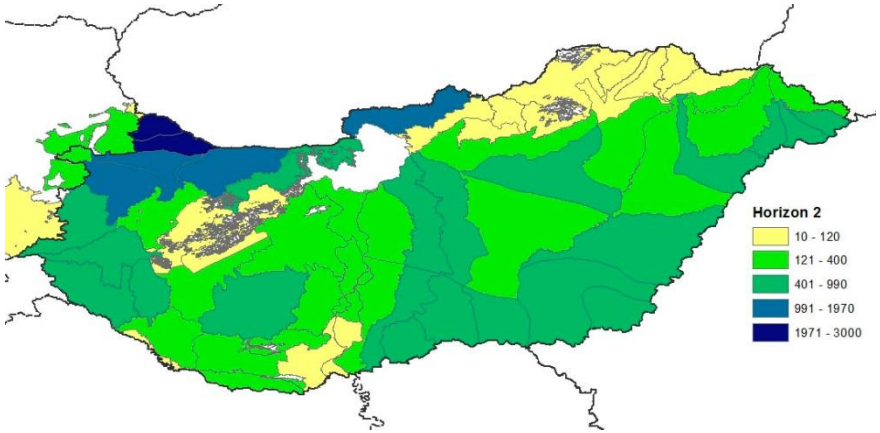
Thickness of groundwater bodies

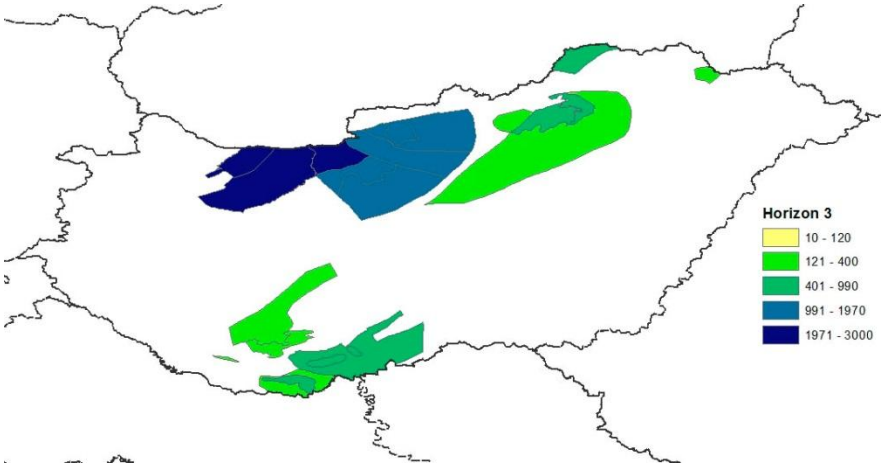


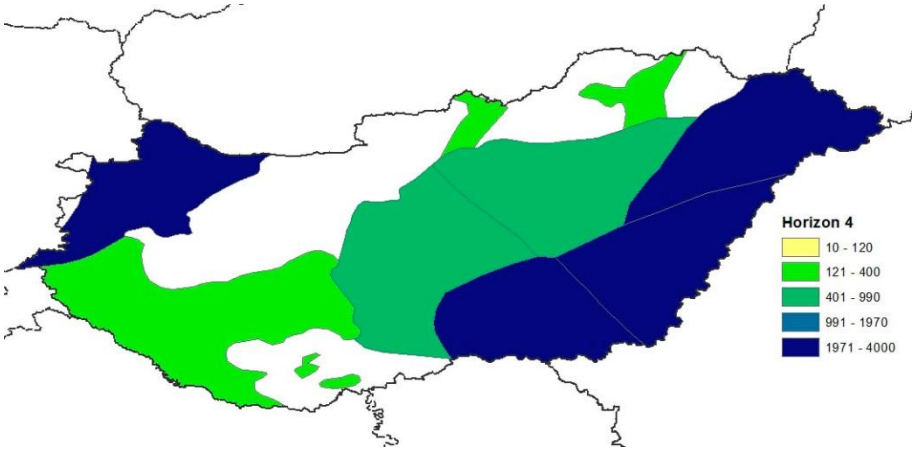
Thickness of groundwater bodies

Different horizons









Porosity

	Effective porosity				
	min	max	Interval	First Quartile	Third Quartile
Sandstone	0.5	10	2.375	3	8
Limestone	5	40	8.75	14	31
Clay	0	5	1.25	1	4
Sand	10	35	6.25	16	29
Claystones	0.5	5	1.125	2	4
Carbonate	5	40	8.75	14	31
Granite	0.0001	0.01	0.0025	0.0025	0.0075
Marl	0.5	10	2.375	3	8
Gneiss	0.0005	0.01	0.0024	0.0029	0.0076
Gravel	13	26	3.25	16	23
Conglomerate	0.5	10	2.375	3	8
Meta-sandstone	0.0005	0.01	0.0024	0.0029	0.0076
Carbonate consolidate	0.1	5	1.225	1.325	3.775
Basalt group	0.1	10	2.475	2.575	7.525
Siliclastic consolidate	0.5	10	2.375	2.875	7.625
granodiorite-diorite group	0.0001	0.01	0.0025	0.0025	0.0075
Mica schist	0.0005	0.01	0.0024	0.0029	0.0076
granite group	0.0001	0.01	0.0025	0.0025	0.0075
Quarcite	0.0005	0.01	0.0024	0.0029	0.0076
Schist group	0.0005	0.01	0.0024	0.0029	0.0076
Dolomite/dolostone	5	40	8.75	14	31

Sources: Sanders (1998) and Custodio and Llamas (1983)

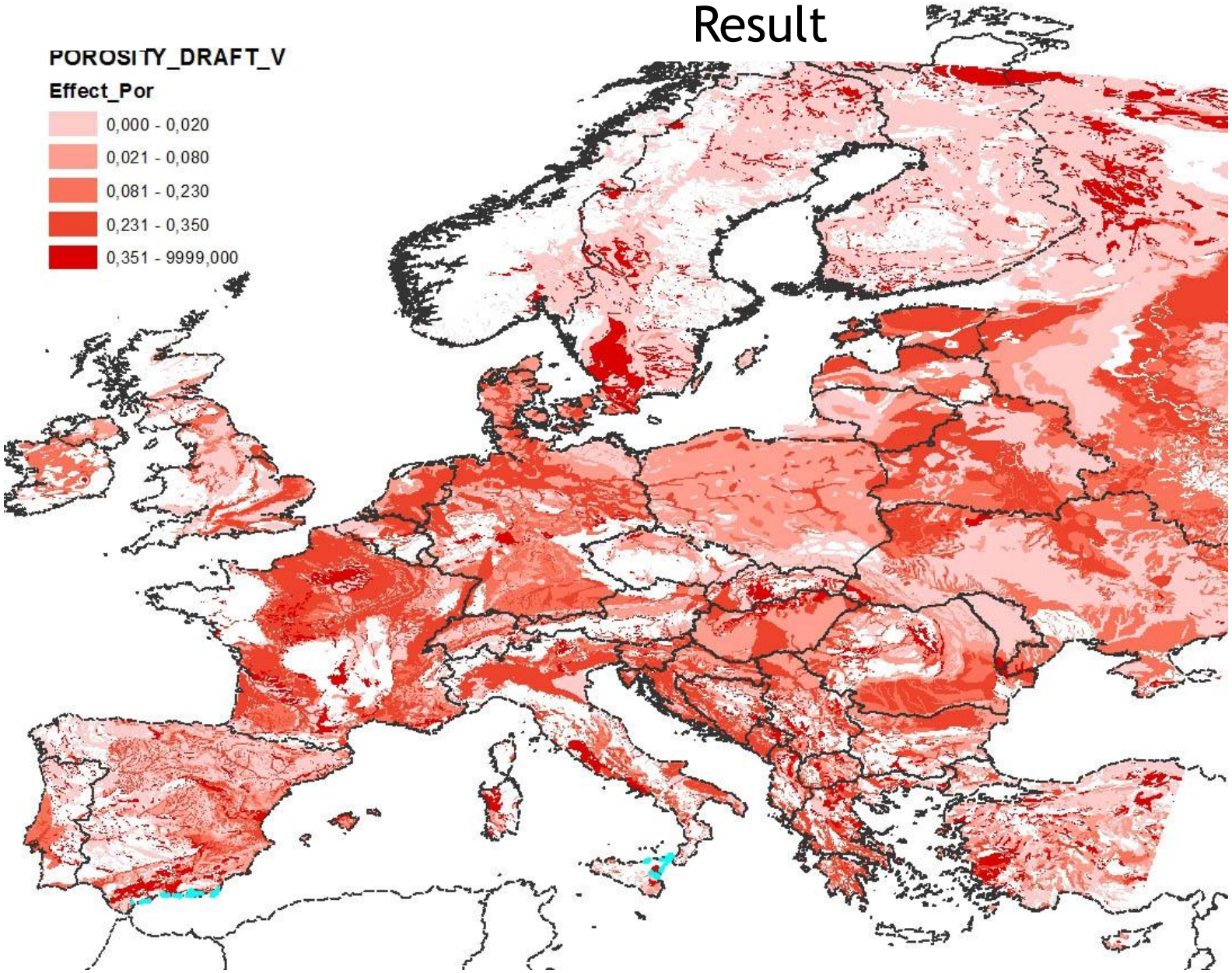
Methodology

- Assigned to: Lithologies
- Just for the aquifers indicated as such in IHME0
- Type of aquifer (IHME0) modify the value of porosity

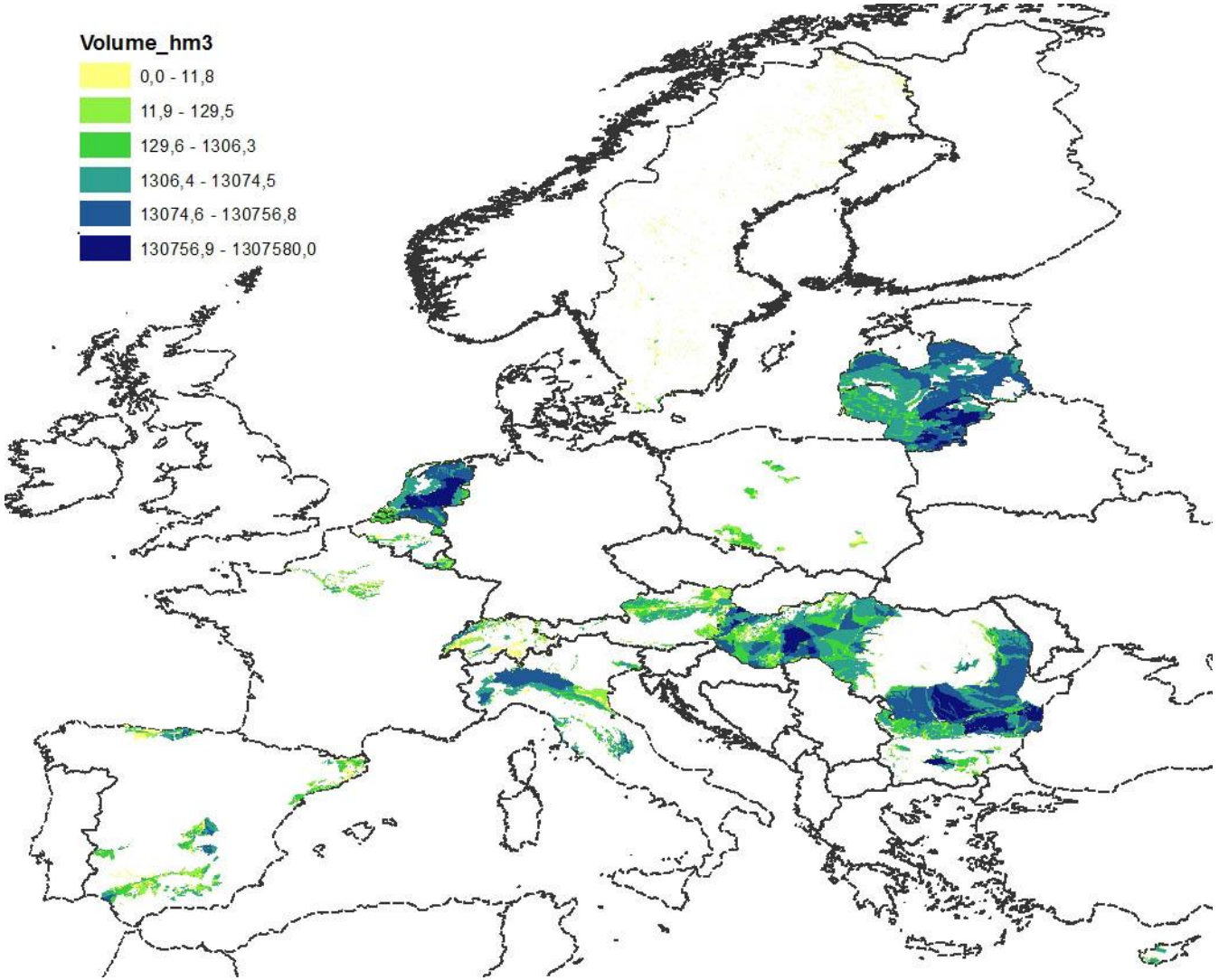
Type of aquifer	Value assigned
Ia. Porous, high productive	Fixed number (due to coincidence with Quaternary deposits not mapped in IGME5000)
Ib. Porous, low productive	First quartile
IIa. Fissured, high productive	Third quartile
IIb. Fissured, low productive	First quartile
IIIa. Local aquifers	Minimum value
IIIa. Practical no aquifers	No value at all

Porosity

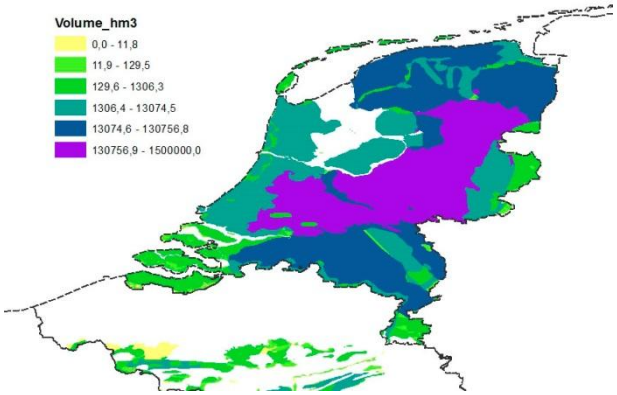
Result



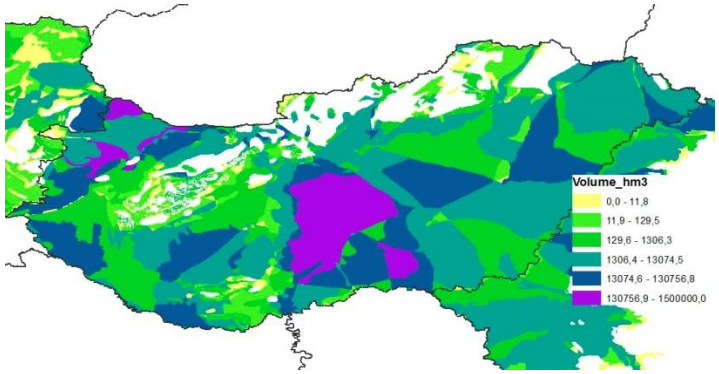
Potential volume of Europe's aquifers (for a 13% of total area)



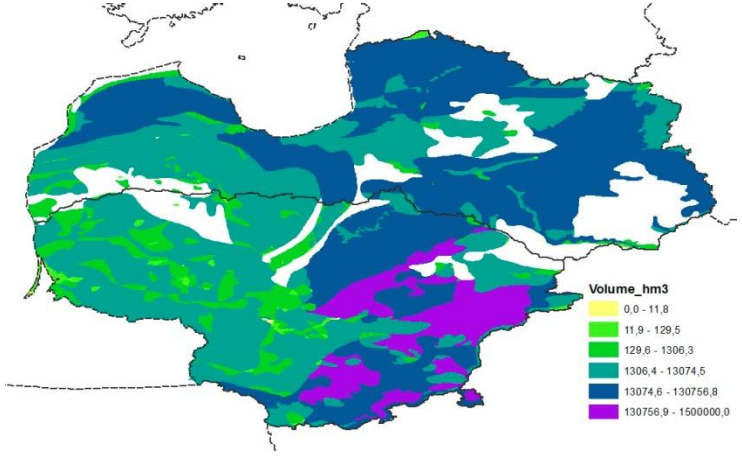
Result



Hungary
3775 Groundwater bodies
20,516,435 Hm^3



Nederlands
266 Groundwater bodies
1,221,528 Hm^3



Latvia
223 Groundwater bodies
1,918,173 Hm^3

Lithuania
305 Groundwater bodies
1,600,945 Hm^3

Alternatives

New WFD reporting data from MS

Saturated zone information?

Or

Ground water table depth

Aquifer's bottom depth

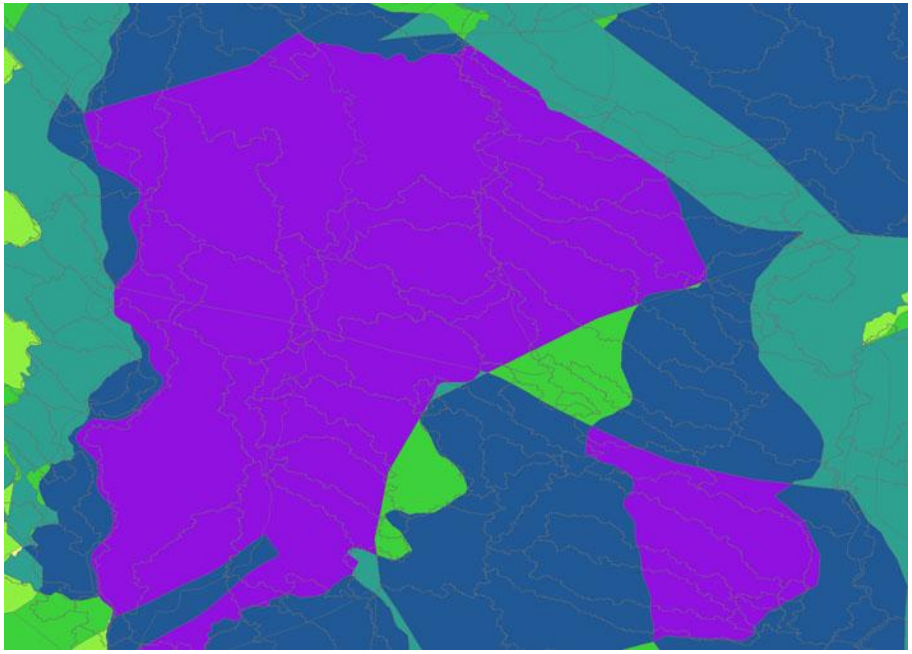
Or

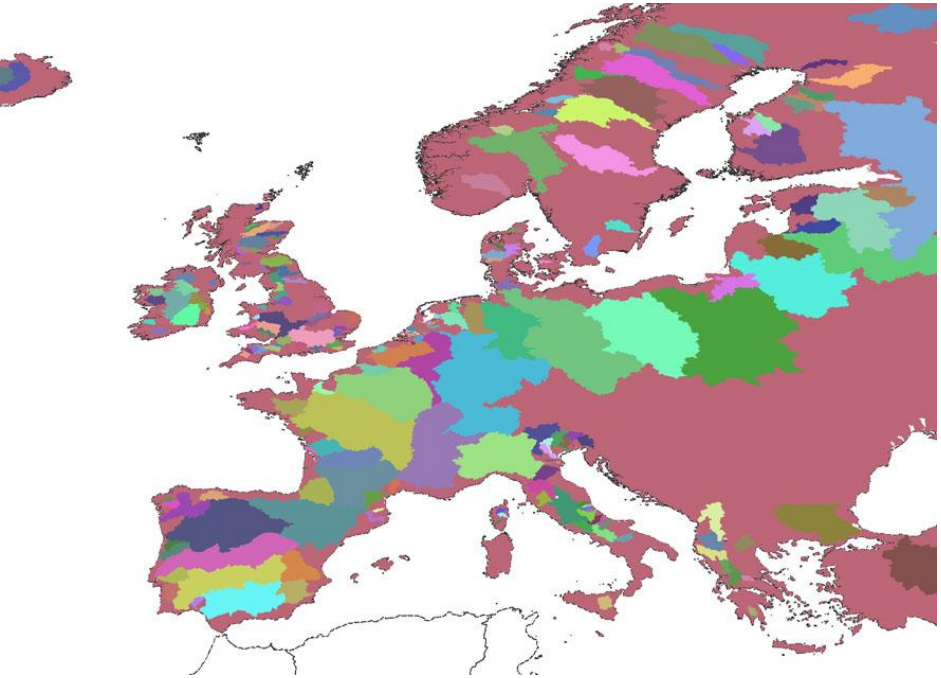
National data…

???

Back to Water Accounts

- Volumes can be assigned to FECs with simple arithmetic operations
- Infinite aggregations and calculations can be made…





- Coverage is not full
- Methodology should be refined

http://sia.eionet.europa.eu

Muchas gracias Moltes gràcies Eskerrik Asko Muitas gracias

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Dziekuje Merci beaucoup Много Благодаря Obrigado

Paldies Ευχαριστώ Tack Thank you very much Dank u

Hvala Köszönöm Dekuj Multumesc Dakujem Danke Takk

Aitäh Grazzi Kiitos Grazie Dêkuji Спаси́бо شُكْرًا

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