Characterization of Karst Aquifers in Mediterranean Climates

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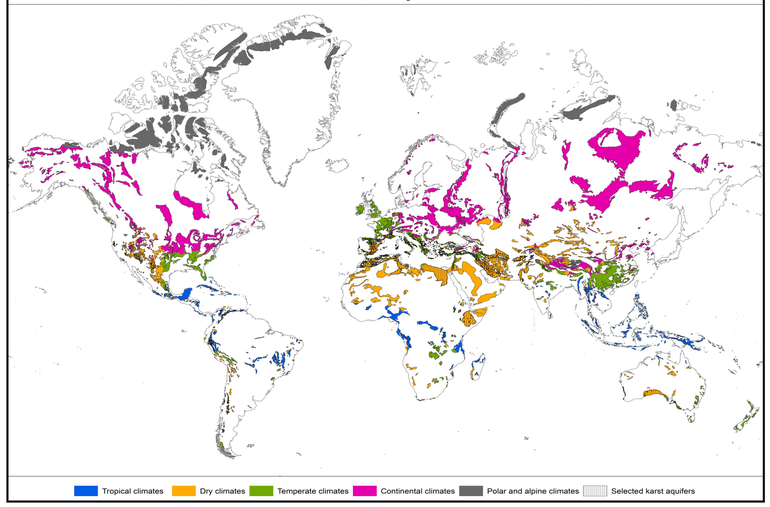
General Goals and Motivation

- Around 10% of the world's population relies on groundwater from karst aquifers (Stevanović, 2019).
- Due to high infiltration capacities and hydraulic condutivities, these karst aquifers are extremly vulnerable to pollution and overexploitation.
- The known worldwide karst aquifers given by WOKAM (Chen et al. 2017) were intersected with the global climate zones from Köppen Geiger in order to select those aquifers which belong to the temperate climate.
- In general, this poster shows maps which present the **parameters** land cover and population density as well as the **characterization factors** temperature and precipitation.

Overview of the WHYMAP Karst Aquifers and their Climate Zones

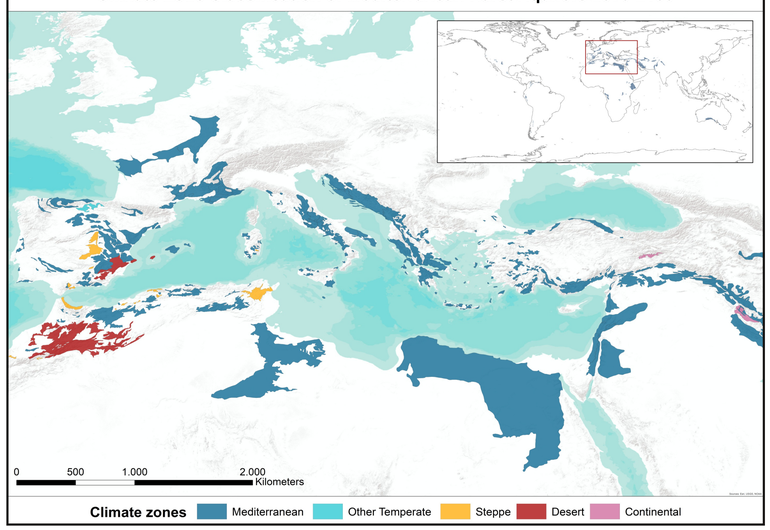


The map shows the classified WHYMAP karst aquifers (Chen et al. 2017) and their current climate zones according to Köppen-Geiger. While intersecting the aquifers and their climate zones, we get 359 aquifers that - to some extent - lie in the temperate climate. Although they are just a small part of the total global aquifers, in the Mediterranean karst aquifers are highly important.

Summary

- A significant percentage (15%) of the aquifers will shift to more dry climates (i.e. desert), making their sustainable management more critical.
- The presented data will be used as an input to assess the vulnerability of Mediterranean aquifers to climate change (e.g. reduced recharge, extreme droughts).

Climate Zone Classification of Mediterranean Karst Aquifers 2070-2100



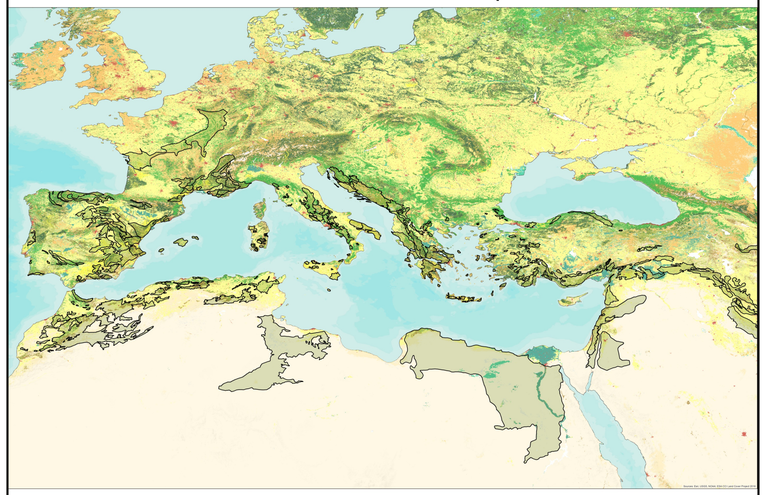
Selected presentation of the **52 aquifers which will leave their current Mediterranean climate** in the next 50 to 80 years. The future climate zones from 2070 to 2100 are based on the Köppen-Geiger method (Beck et al. 2018). Whereas steppe and desert both belong to the dry climates. The other 307 aquifers are going to stay in the Mediterranean climate. This means almost 15% of the aquifers will experience more heat and less precipitation in the near future.

References

- *Beck, H. E. et al. Present and future Köppen-Geiger climate classification maps at 1-km resolution (2018)*
- *Chen, Z., Goldscheider, N. et al. World karst aquifer map (WHYMAP WOKAM) (2017)*

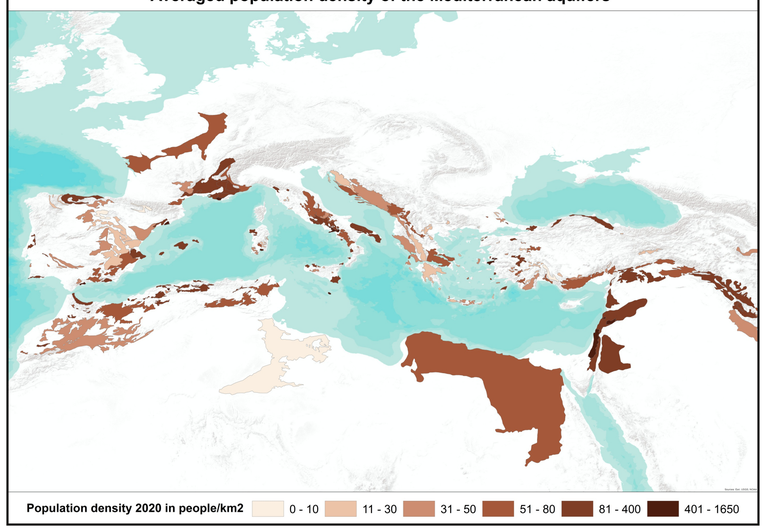
Parameters

Land Cover of the Mediterranean aquifers



Selected presentation of the global land cover, showing the Mediterranean aquifers. The goal is to display the different surfaces of the aquifers, such as bodies of water, crops, forests, grasslands and artificial surfaces. The data used comes from the European Space Agency Climate Change Initiative-Land Cover (ESA CCI-LC) project 2016 which is based on satelite data and local observations.
What kind of land cover exists directly affects the recharge of an aquifer.

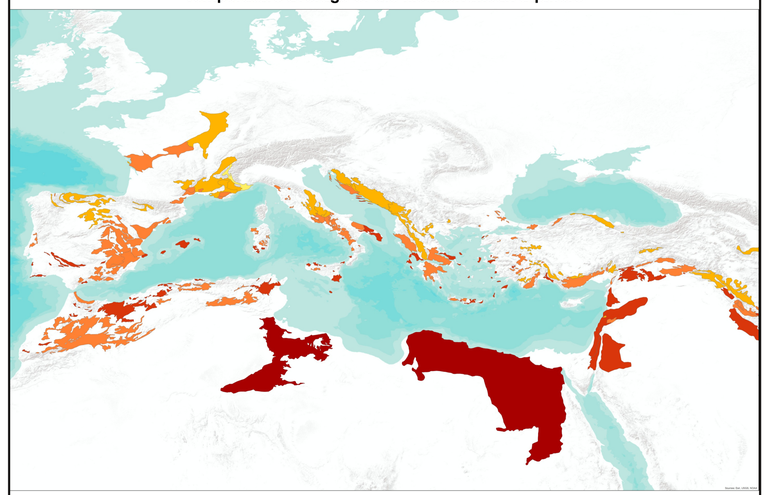
Averaged population density of the Mediterranean aquifers



The map shows the population density of the Mediterranean aquifers. To calculate the population density for each aquifer, a raster file of the current world population from NASA Socioeconomic Data and Applications Center is used. Therefore, each aquifer got a cumulated population value, which is then divided by the givin area of its aquifer.
Most aquifers have a rather high population density. Thus, they are being utilized more than aquifers with a lower population density.

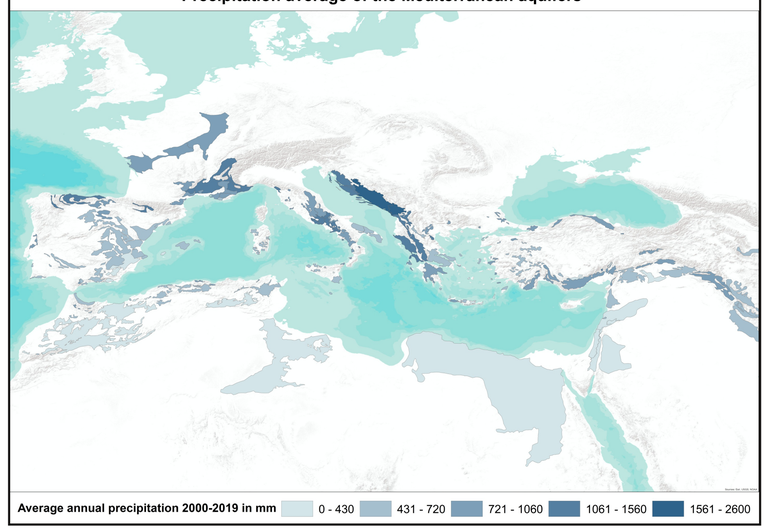
Characterization Factors

Temperature average of the Mediterranean aquifers



The map presents the average temperature of the selected Mediterranean karst aquifers. To calculate the average, the ECMWF (ERA5) Data was used. Each aquifer got a cumulated value for every single month. By averaging all months from January 2000 until December 2019, we get the mean monthly temperature per aquifer and year.
A high average temperature has an immense affect on evapotranspiration and therefore influences the water balance.

Precipitation average of the Mediterranean aquifers



The map displays the average precipitation of the Mediterranean karst aquifers. To calculate the average, the ECMWF (ERA5) Data is used which shows the accumulated liquid and frozen water, including rain and snow, that falls to the Earth's surface each month. All aquifers got one cumulated value for every sigle month. By summing up all months from January 2000 until December 2019 and dividing this result by 20, we get the annual average precipitation per aquifer of the last 20 years.
The Data is collected by local measurements. Precipitation is the main driver of recharge because it provides the aquifer's water supply. By definition, the precipitation in Mediterranean climates diverge in dry summers and wet winters.