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***Climate and
Resources Lab***

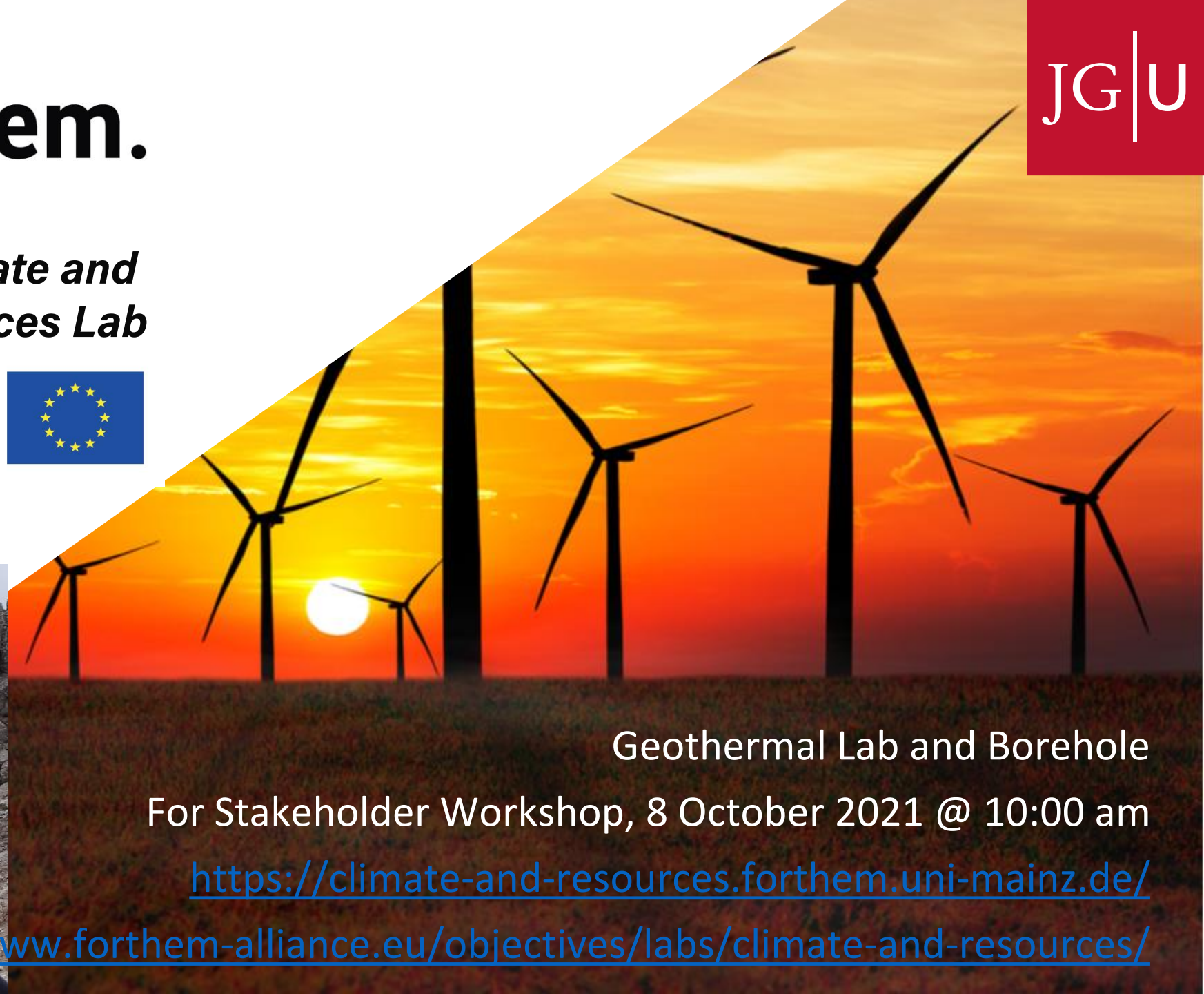
With the support of the
Erasmus+ Programme
of the European Union



JG|U



Prof. Dr. Virginia Toy.
Institut für Geowissenschaften
Universität Mainz



Geothermal Lab and Borehole

For Stakeholder Workshop, 8 October 2021 @ 10:00 am

<https://climate-and-resources.forthem.uni-mainz.de/>

<https://www.forthem-alliance.eu/objectives/labs/climate-and-resources/>



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TRADITIONAL GEOTHERMAL

Relies on the fact temperature increases with depth everywhere on Earth → deep reservoirs of hot water from which energy can be extracted if they are brought to the surface

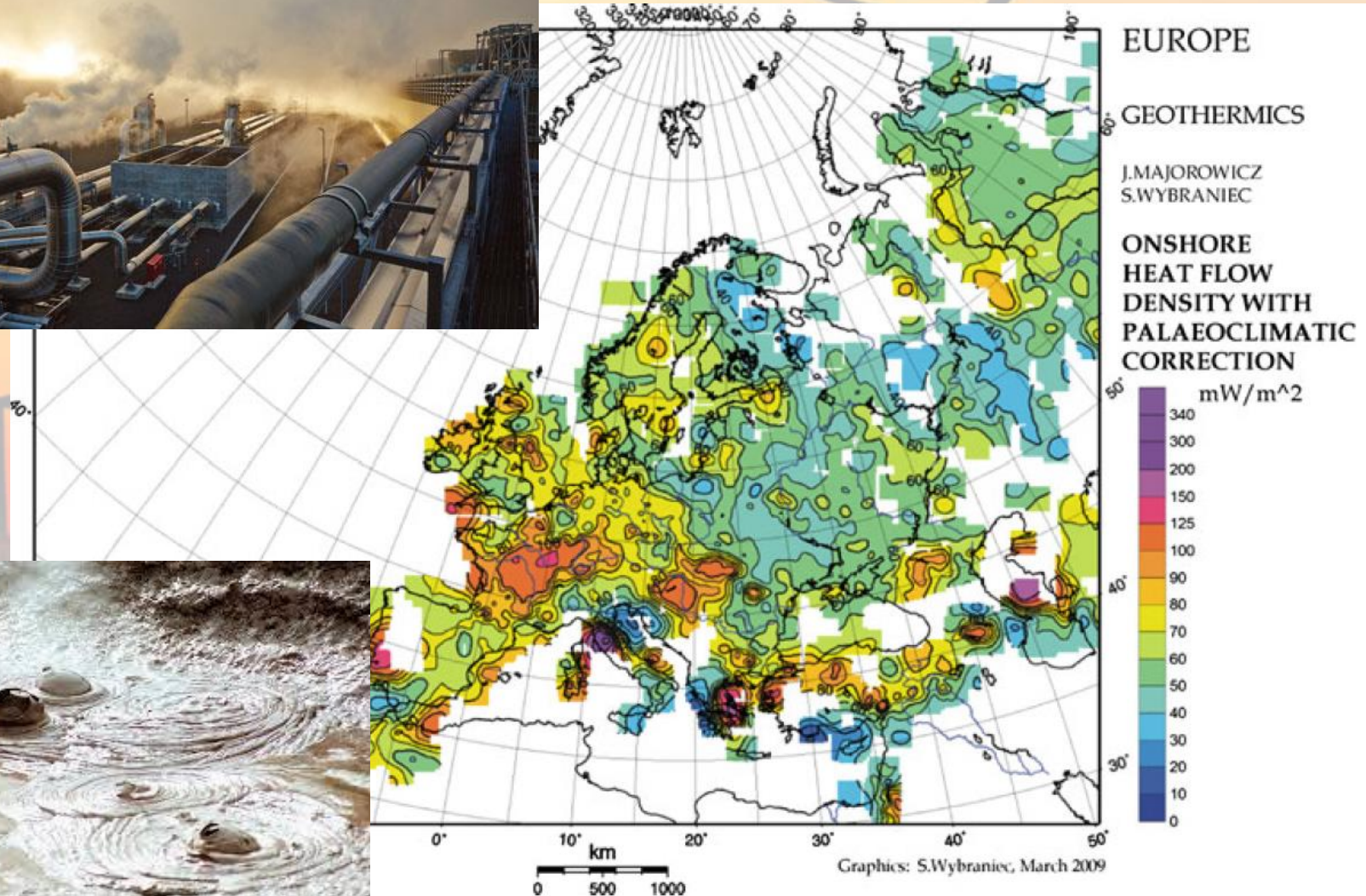
Requires *high thermal gradient*, and careful consideration of *recharge*

*The TeMihi geothermal power station in New Zealand.
Credit: Mighty River Power.*



Boiling mudpools near Rotorua, New Zealand

Majorowicz, J., Wybraniec, S. 2011 New terrestrial heat flow map of Europe after regional paleoclimatic correction application. International Journal of Earth Sciences 100, 881-887, doi: 10.1007/s00531-010-0526-1





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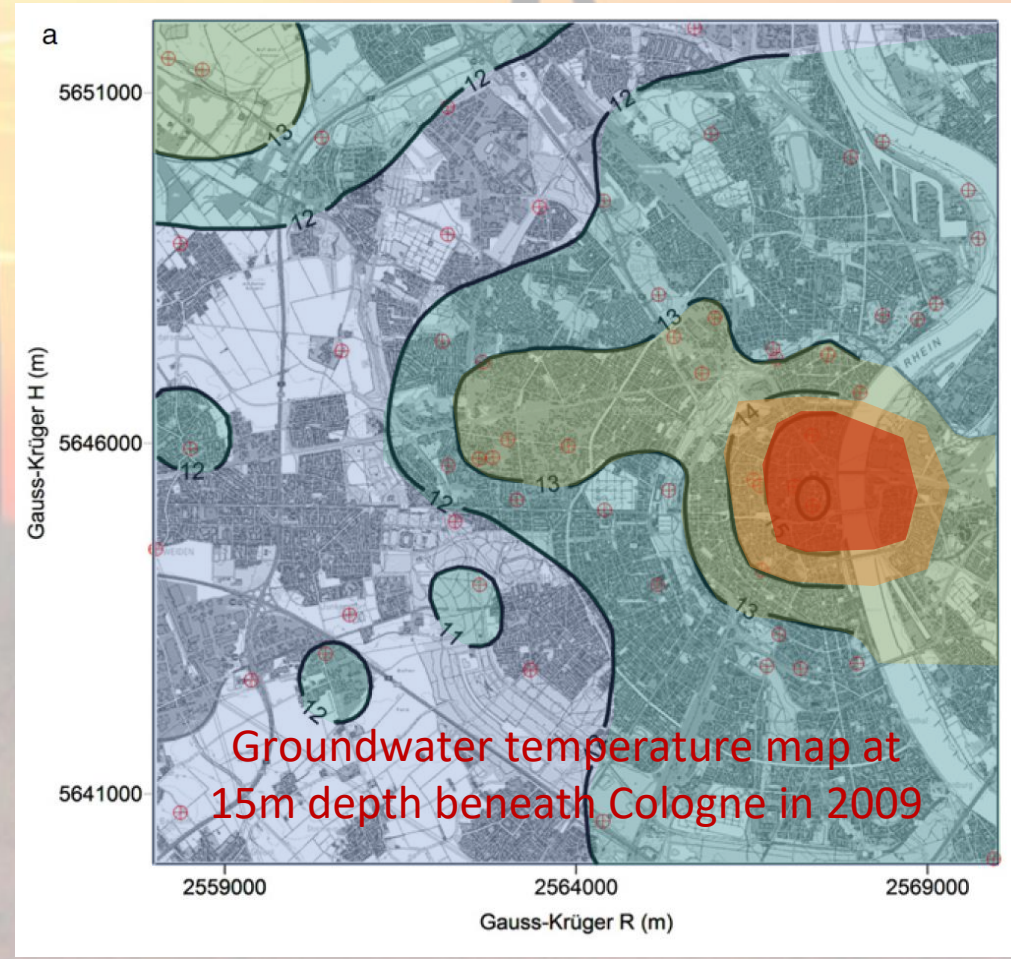
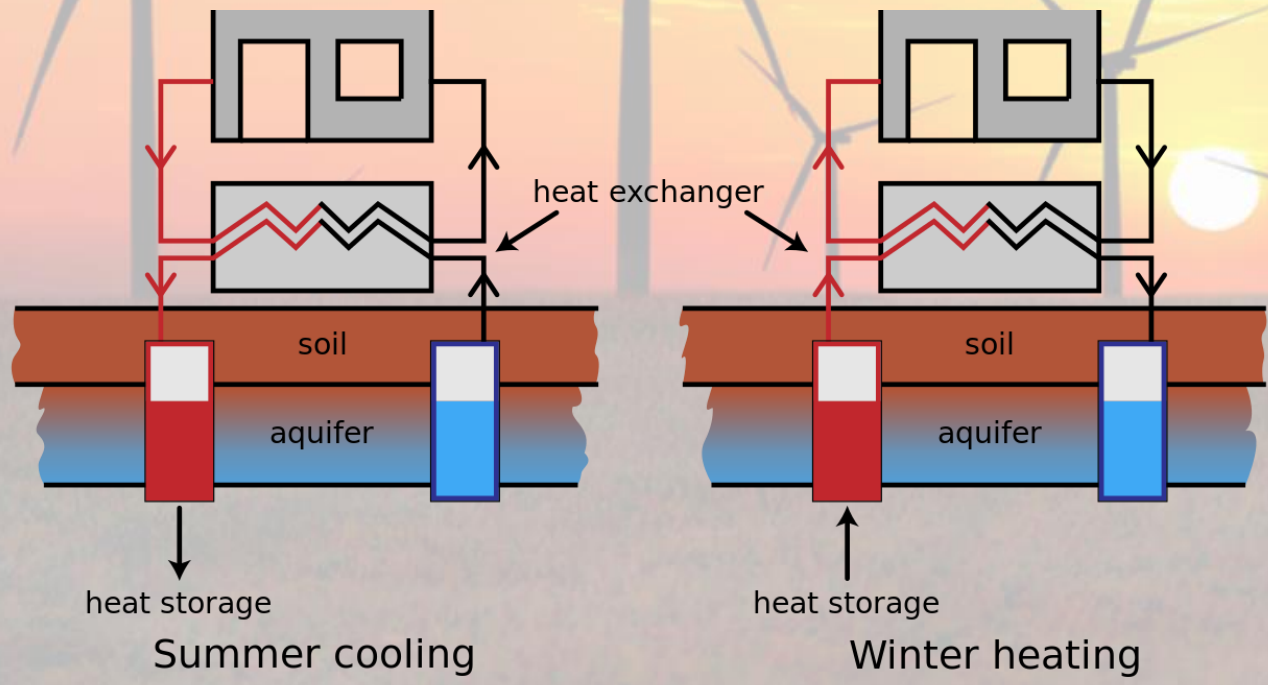
NON-TRADITIONAL GEOTHERMAL

Zhu et al., (2010). Environmental
Research Letters 5, 044002, doi:
10.1088/1748-9326/5/4/044002

In areas with lower geothermal gradients, ie. *low enthalpy geothermal systems*

Local installations, usually for individual buildings

Most commonly *ground sourced heat pumps*





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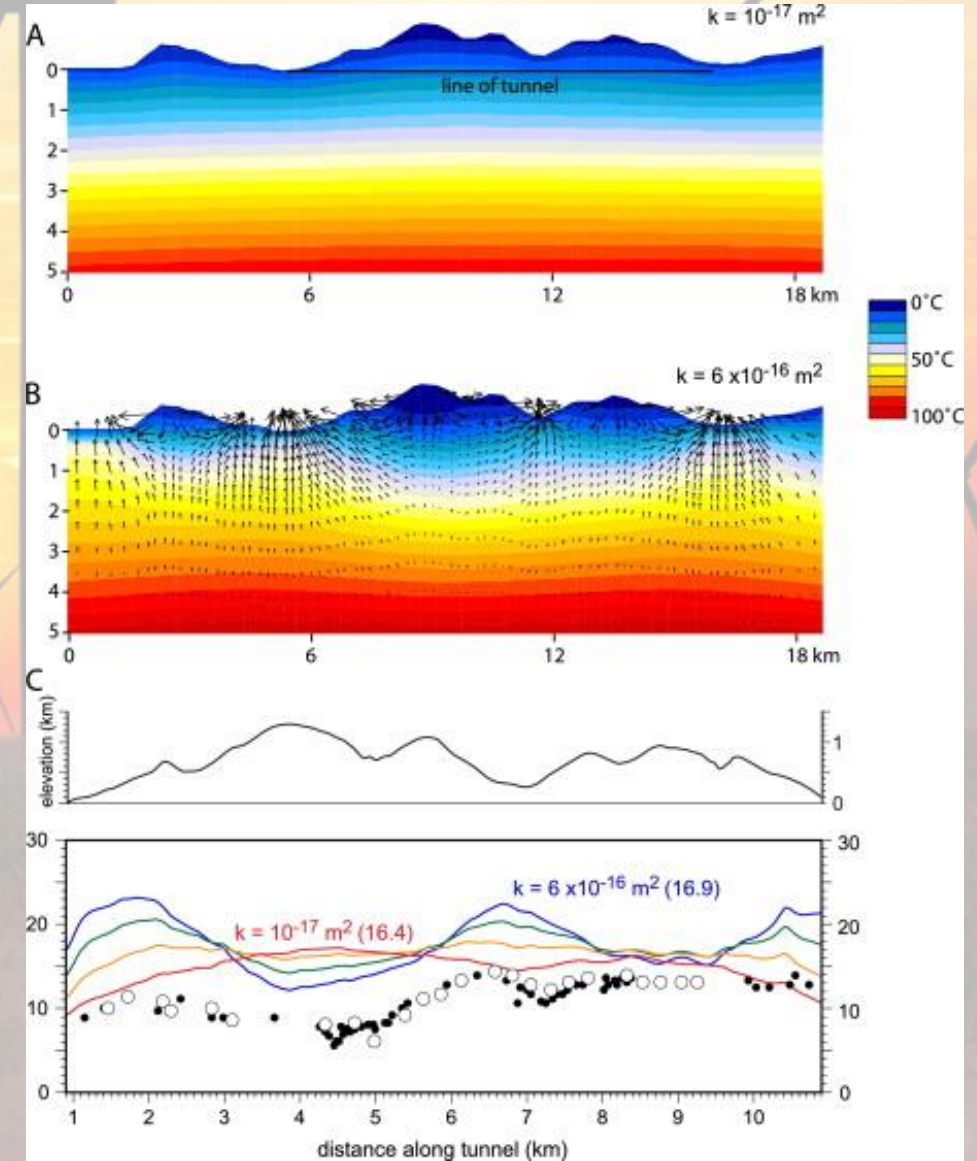
SHALLOW THERMAL STRUCTURE

Groundwater advects heat very efficiently

To determine low enthalpy geothermal potential we have to model how groundwater modifies thermal structure

We need data on subsurface fluid pressures and temperatures, and measurements of the permeabilities of the soils/rocks

The best data come from boreholes





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A RESEARCH BOREHOLE @ JGU ?

The Neubau Erdwissenschaften should include an exploratory 100m borehole and monitoring instruments

Fluid pressure and temperature

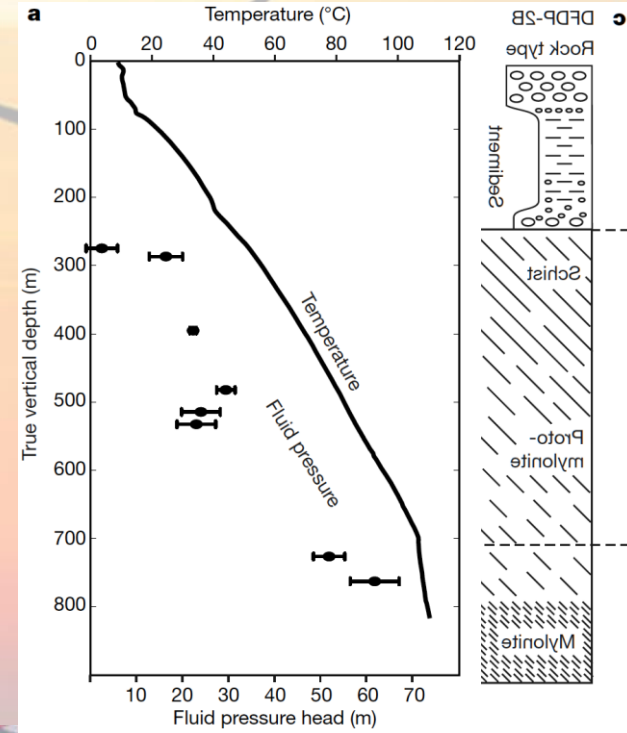
A single fibre optic cable could give temp and strain data

Another horizontal fibre optic cable would resolve 3D

This could be a *Living Lab* where the data are acquired and examined *daily* by our students → research-informed teaching (see <https://www.otago.ac.nz/oerc/lab/> and)

We would also like to engage groups outside the University

Schools, museums, businesses, media?



Wireline logging tool

