Università di Padova

Dipartimento di Geoscienze

Session 8.08 - Mineral and Thermal water: an indicator of deep processes and source of economically valuable minerals

SPATIAL AND TEMPORAL RECONSTRUCTION OF THE TEMPERATURE DISTRIBUTION TO ASSESS THE WATER CIRCULATION IN THE EUGANEAN GEOTHERMAL FIELD (NE ITALY)

Authors: **MARCO POLA**, Fabbri P., Piccinini L., Dalla Libera N., Zampieri D.

Corresponding author : marco.pola@unipd.it

N°abstract ***1713***

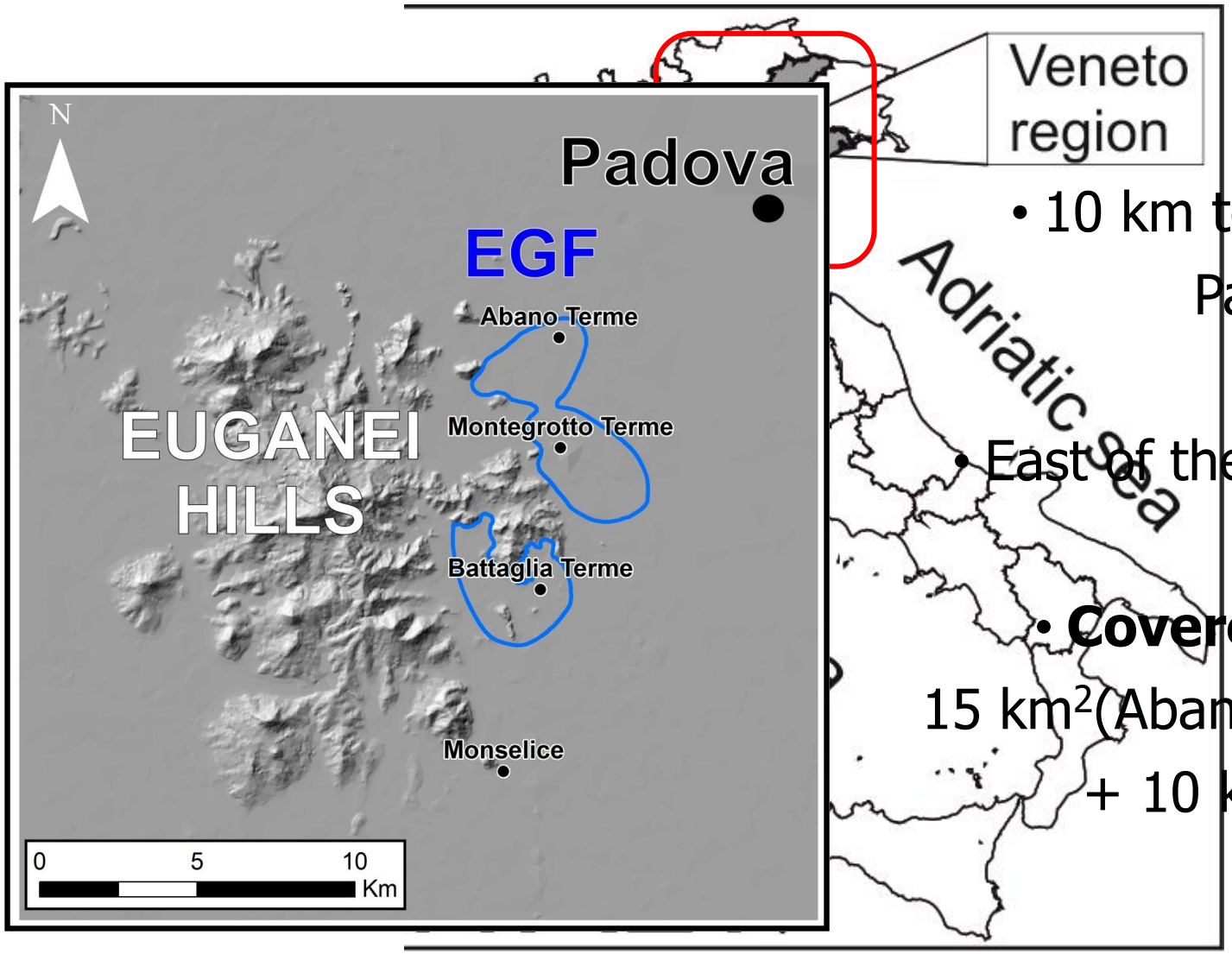
25-29th September 2016 Montpellier, France CORUM CONFERENCE CENTER 43rd IAH congress

SUMMARY

- Overview on the Euganean Geothermal Field (EGF)
- Geological and Hydrogeological settings of the EGF
- Spatial distribution of temperature : anthropic or tectonic control?
- Conclusions

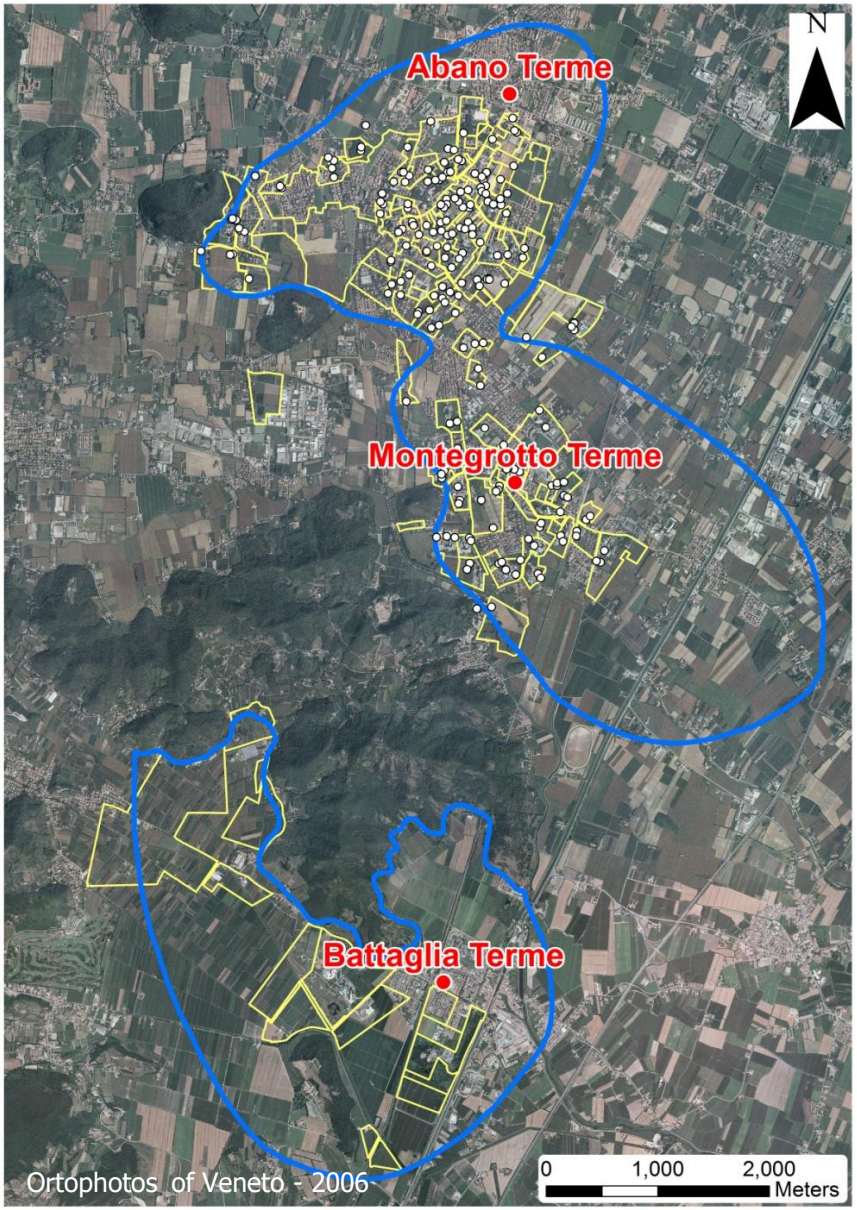
OVERVIEW ON THE EGF

Geographical settings



- 10 km to the SW of Padova
- East of the Euganei Hills
- **Covered Area** = 15 km^2 (Abano-Montegrotto) + 10 km^2 (Battaglia)

OVERVIEW ON THE EGF
Hydrothermal settings

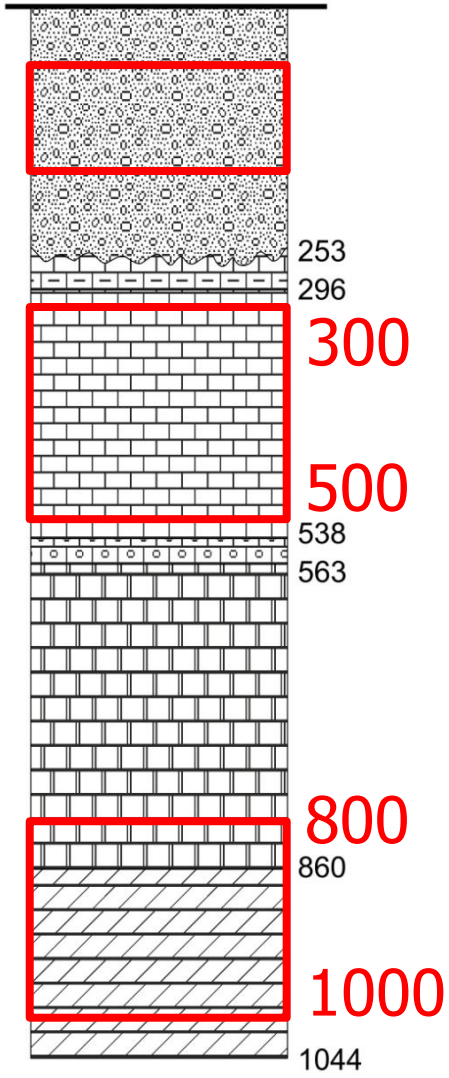


- **Mining claims** =135
- **Active wells** = 170
- **Flow rate** = $14*10^6$ m^3/y
- **Temperature** = 60 - 86°C
- **T.D.S.** = 6 g/L (Cl^- & Na^+~70%)

OVERVIEW ON THE EGF

Hydro-stratigraphy

Metropole 1
(Abano Terme)



Alluvial Cover
(Quaternary)

Scaglia Rossa formation
(Late Cretaceous - Early Eocene)

Maiolica formation
(Late Jurassic - Late Cretaceous)

Rosso Amm. formation (Late Jurassic)

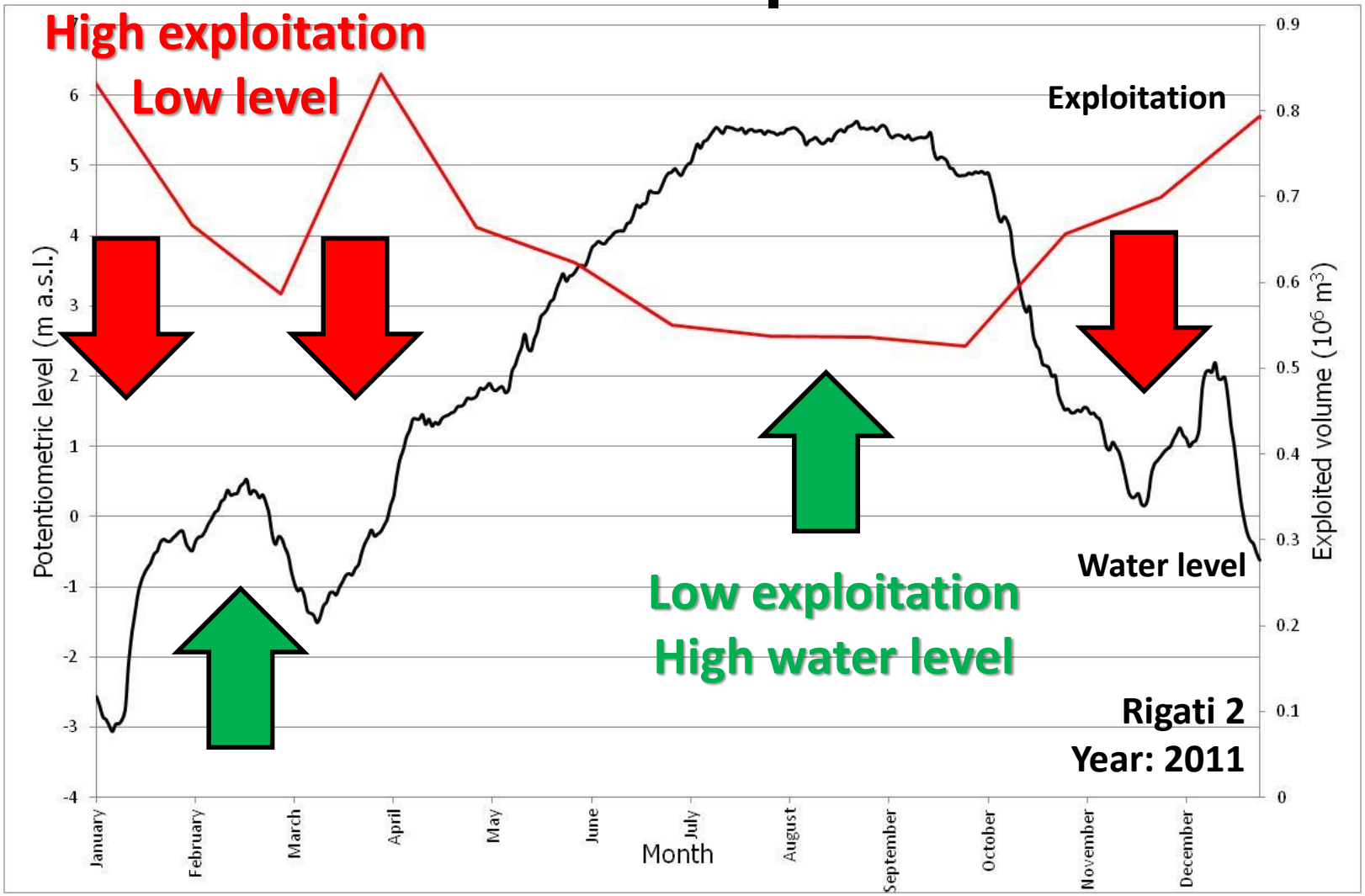
Calcari Grigi formation
(Early - Middle Jurassic)

Dolomia Principale formation
(Late Triassic)

Chiereghin, 2001

OVERVIEW ON THE EGF

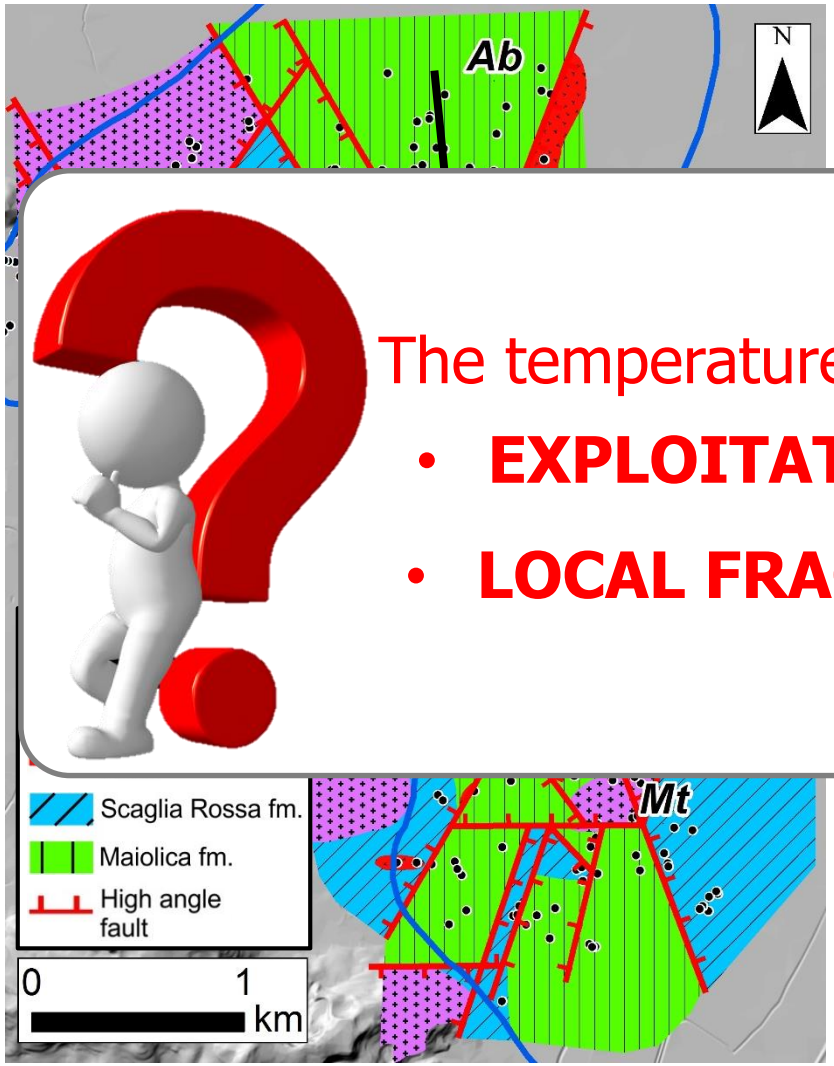
Seasonal variation of the potentiometric level

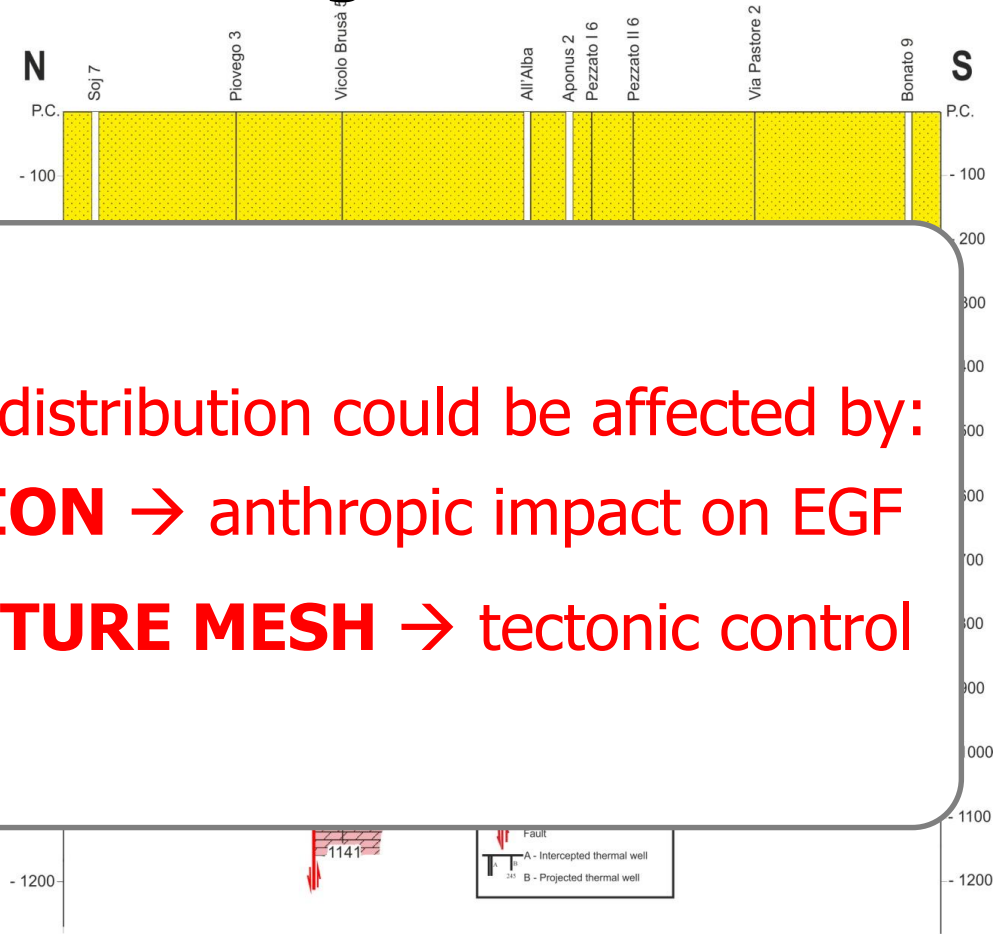


The seasonal variations of the water level are related to the different monthly exploitation rates.

OVERVIEW ON THE EGF

Geological setting



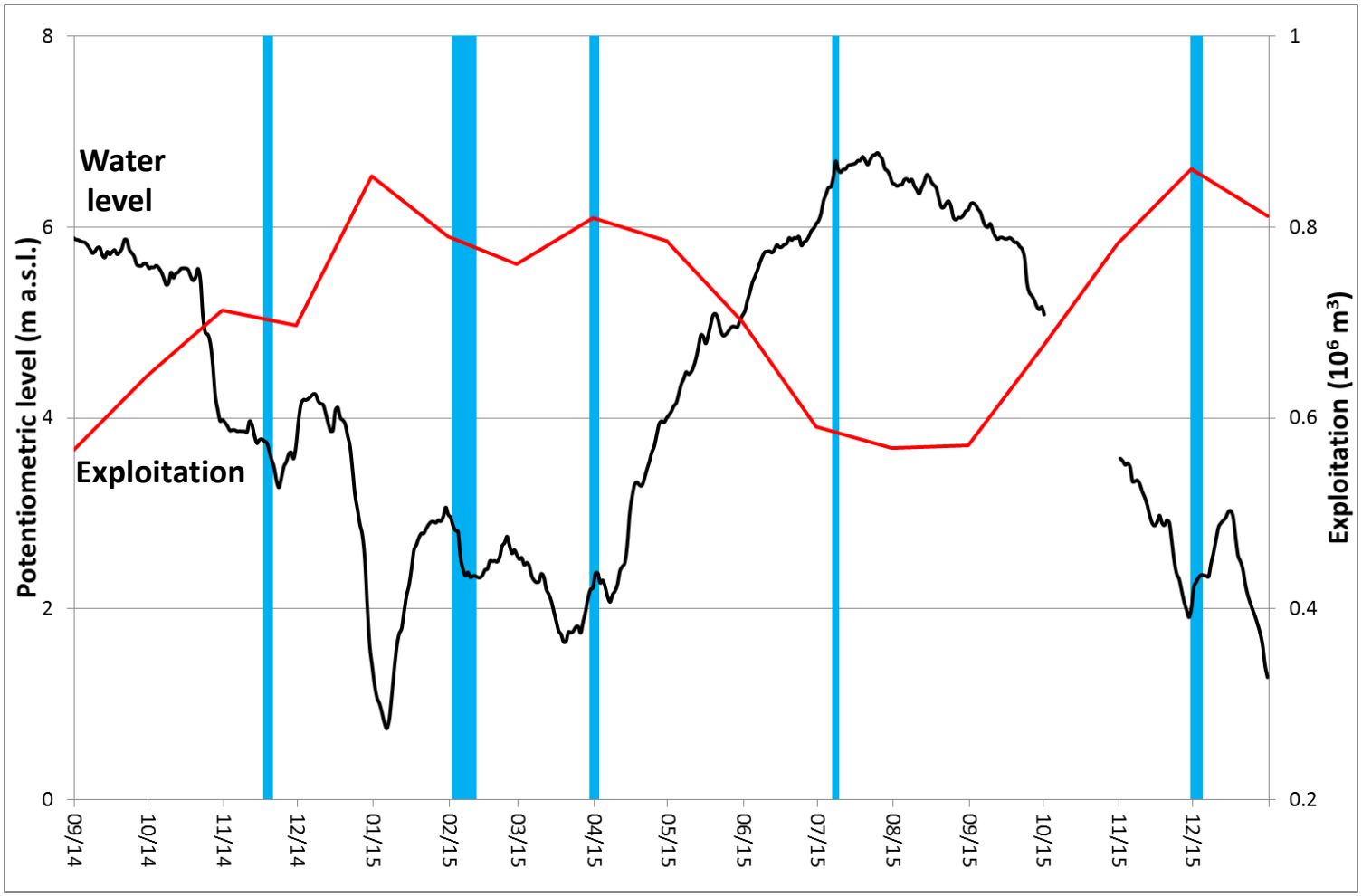


The temperature distribution could be affected by:

- **EXPLOITATION** → anthropic impact on EGF
- **LOCAL FRACTURE MESH** → tectonic control

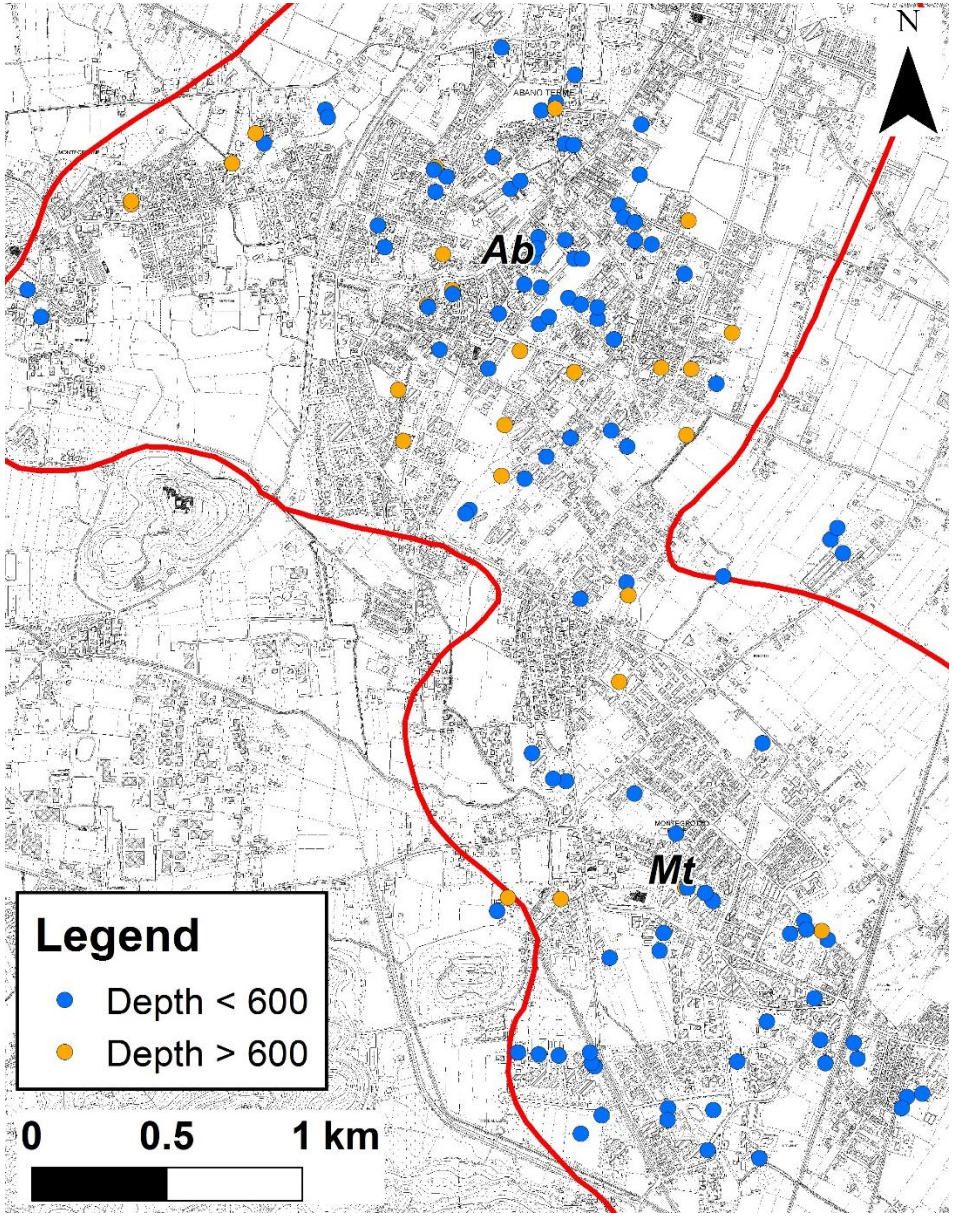
The subsurface of the EGF is fragmented in a mosaic of blocks at different depths.

MONITORING SURVEY
Temporal distribution



Five surveys during periods of higher and lower exploitation are performed to monitor the potentiometric level, the water temperature and the exploited flow rate.

MONITORING SURVEY
Monitored wells

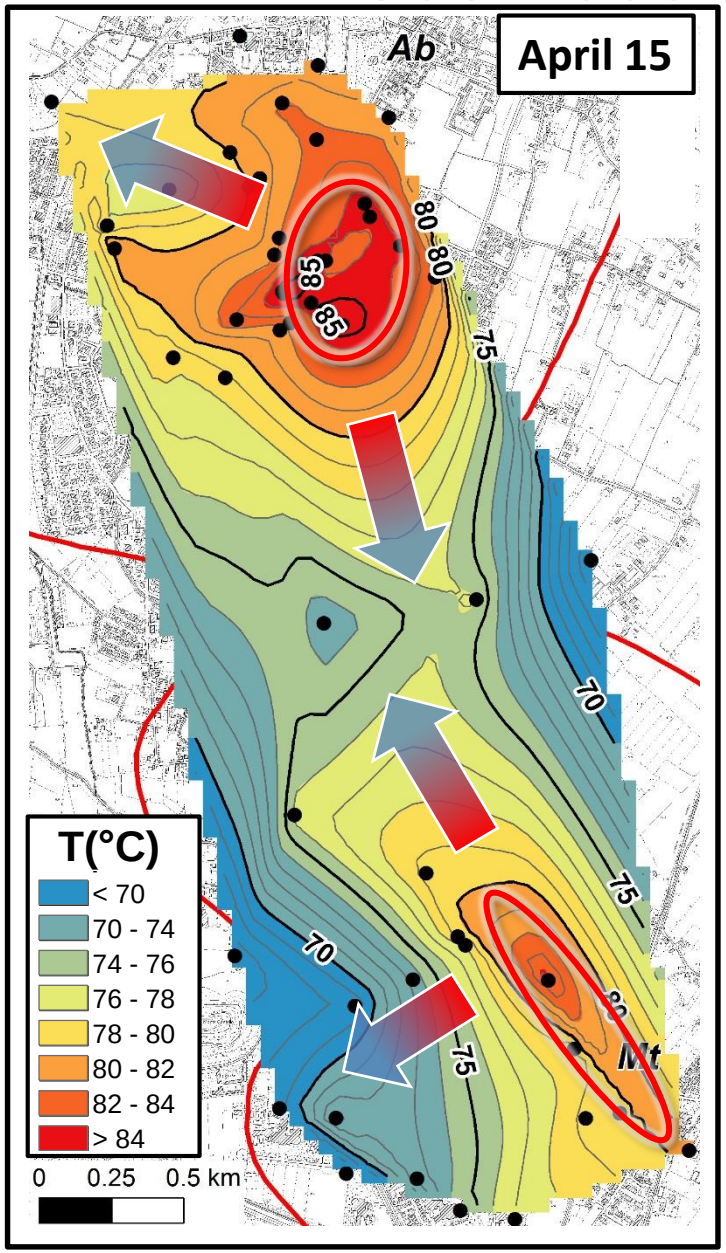


129 monitored wells

- Depth from 139 m to 1064 m
- 102 exploit from the shallow rocky aquifer (300-600 m b.g.l.)
- 27 exploit from the deep rocky aquifer (800-1000 m b.g.l.)

TEMPERATURE

300 - 600 m deep aquifer



Method

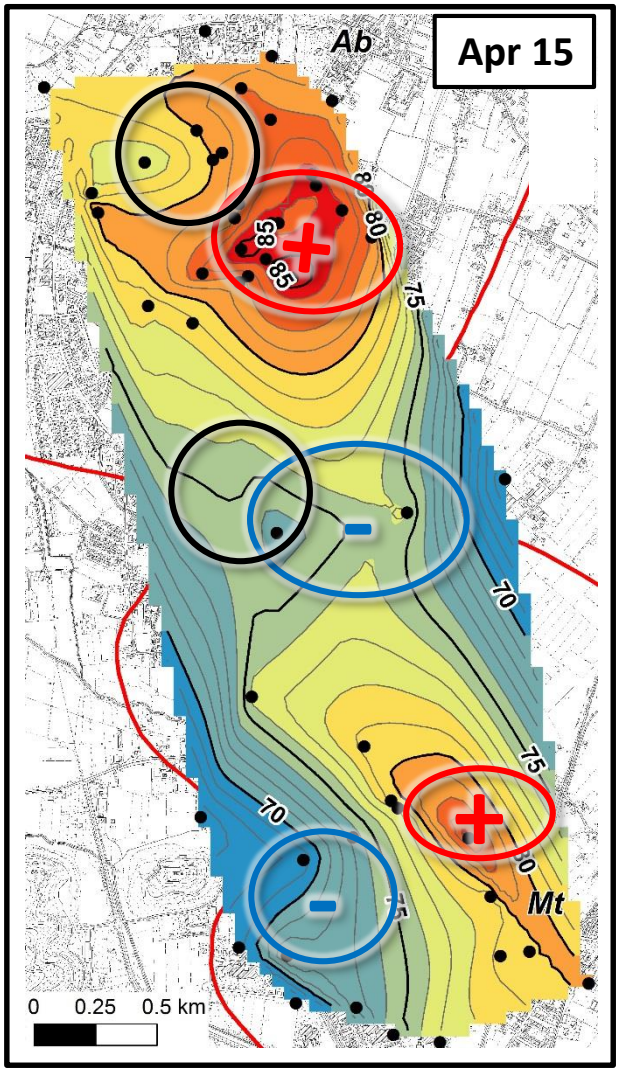
Natural Neighbor Interpolation of approximately 50 temperature values measured in active wells

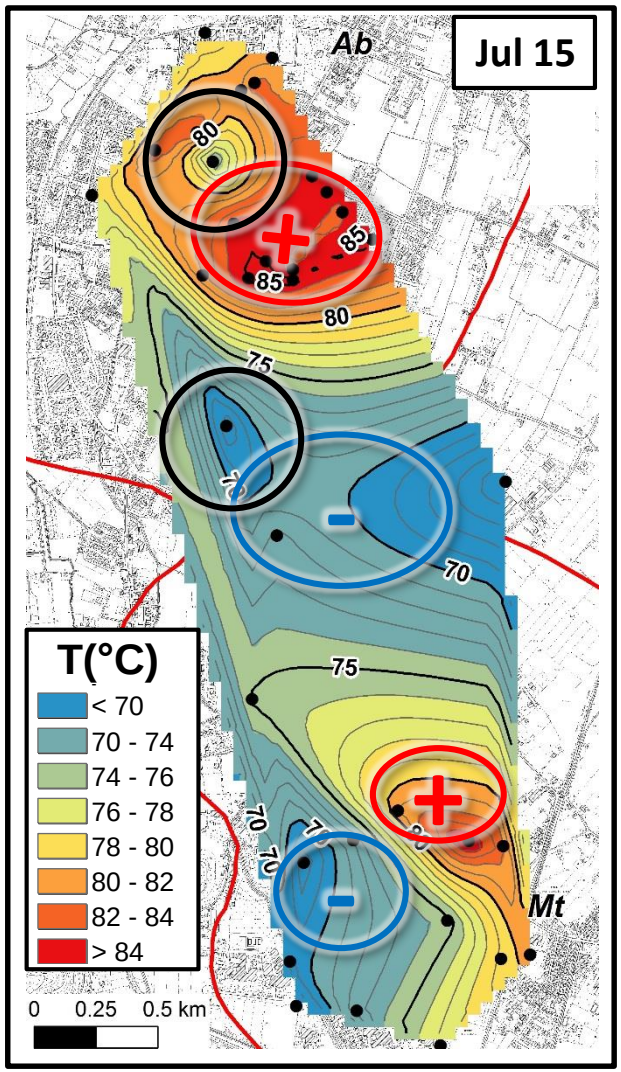
Results

Areas with temperature higher than 84°C

Outward decrease of temperature

TEMPERATURE
300 - 600 m deep aquifer



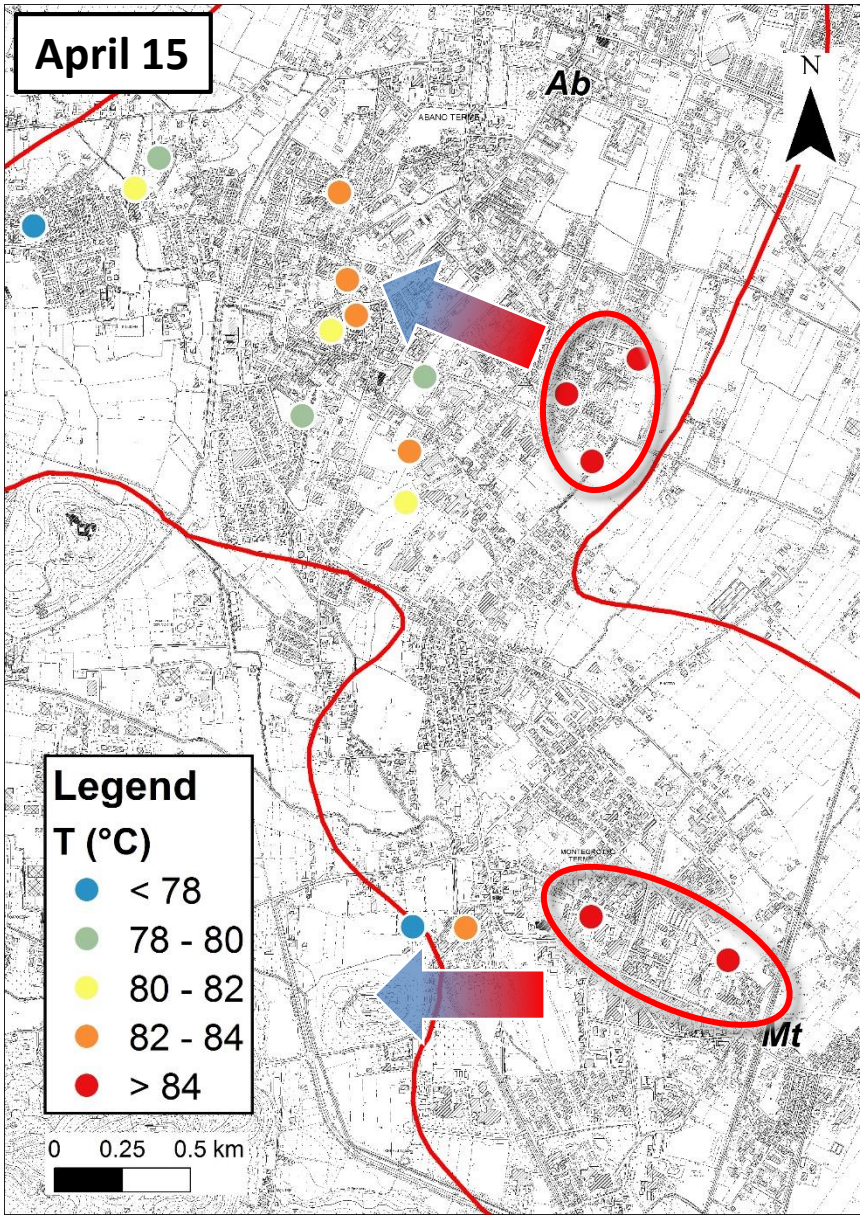


- Comparable spatial distribution
- Local differences due to active/inactive wells

Highest exploitation

Lowest exploitation

TEMPERATURE
600 - 1000 m deep aquifer



Method

Dot map of approximately 20 temperature values measured in active wells

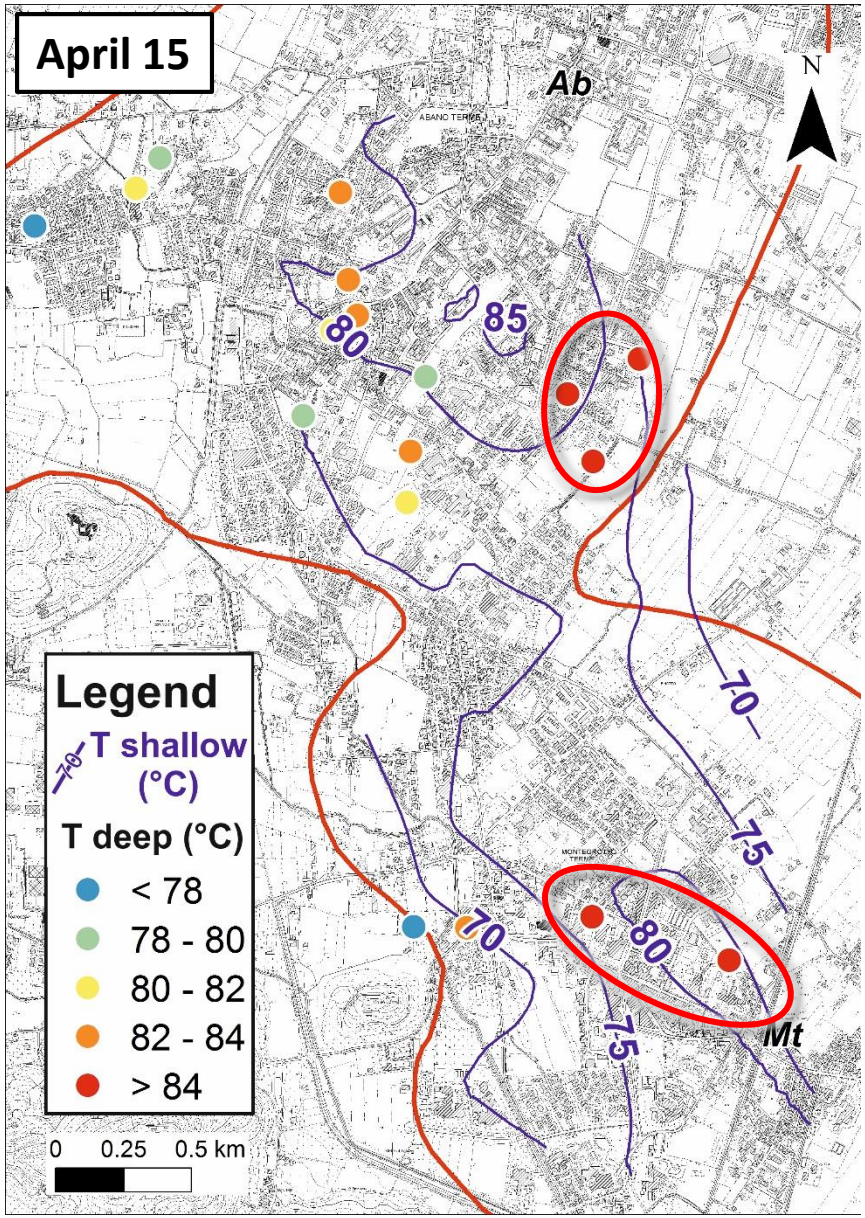
Results

Areas with temperature higher than 84°C

Outward decrease of temperature

TEMPERATURE

Comparison of shallow and deep rocky aquifers

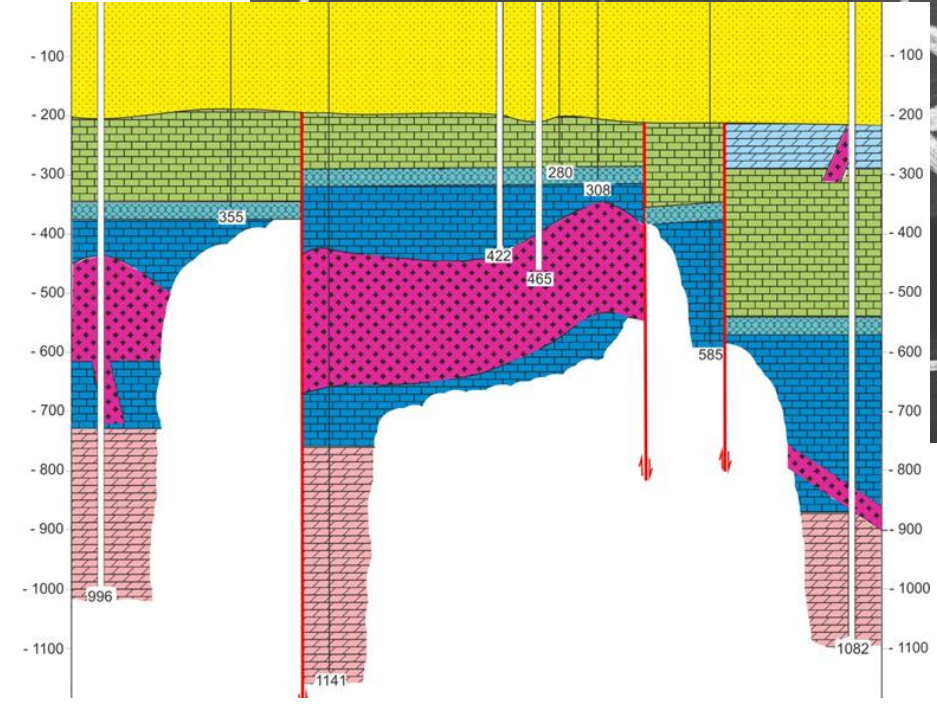


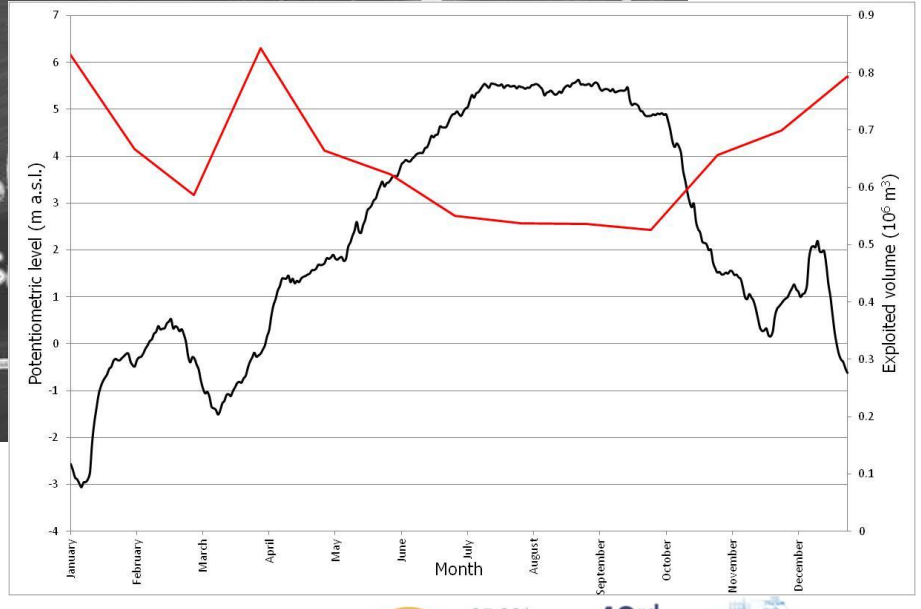
- The water temperature of the deep aquifer is approximately 5°C higher than the water temperature of the shallow one.
- The temperature distributions of the aquifers are roughly comparable.

TEMPERATURE
Concluding remarks

- The temperature distributions among the surveys are comparable
- The temperature distributions between the aquifers are comparable
- Local variations among the surveys are ascribable to different pumping rates

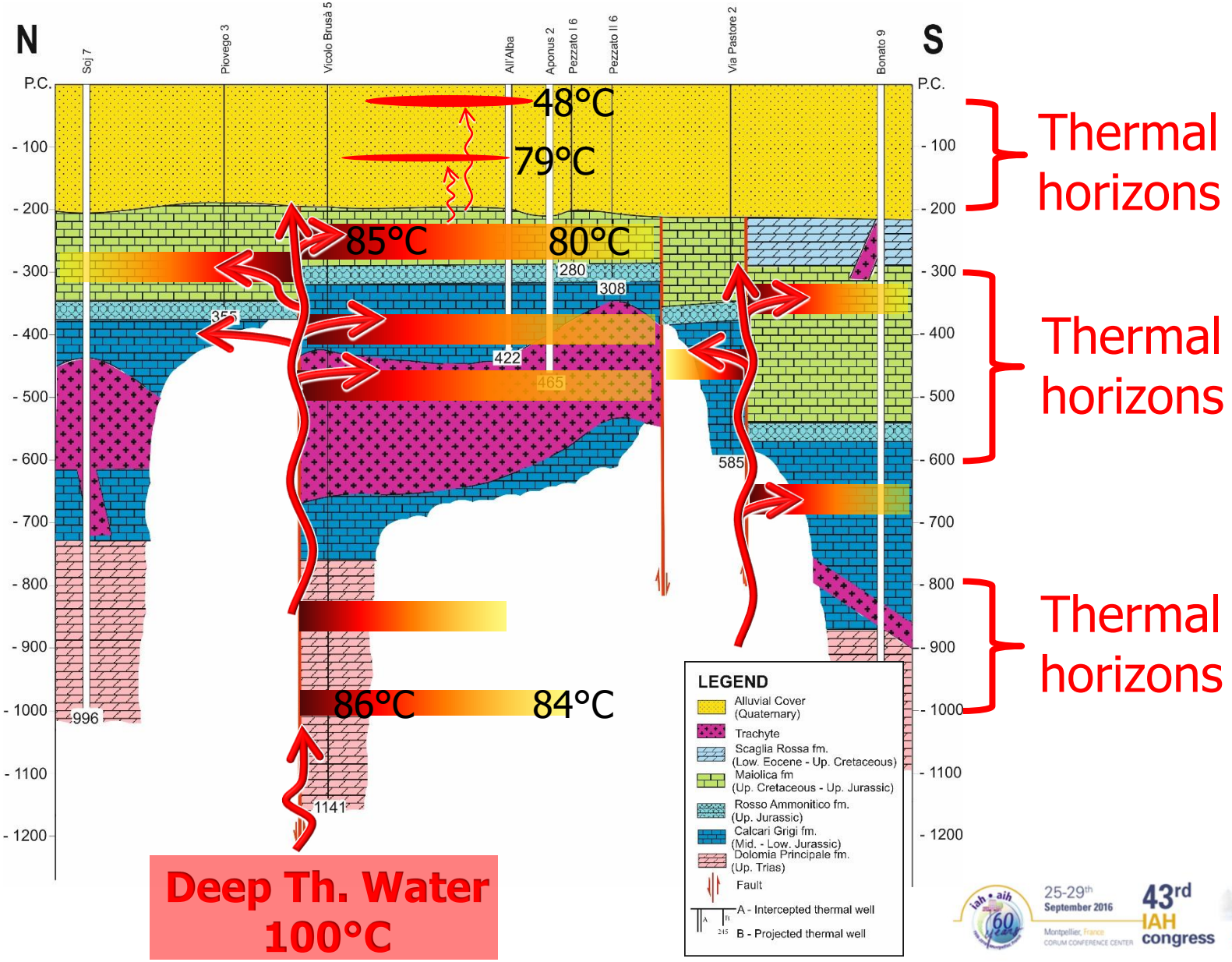
TECTONIC CONTROL **ANTHROPIC IMPACT**





EUGANEAN GEOTHERMAL CIRCUIT

Conceptual model – EGF area



CONCLUSIONS & FUTURE ADVANCES

- The temperature distribution of the Euganean thermal aquifer has been monitored for 1 year.
- The fracture mesh fragmenting the EGF subsurface controls the temperature distribution of the rocky aquifer.
- The anthropic impact (i.e., exploitation) causes minor local variations.
- The mapping will be implemented with the results of vertical thermal logs obtaining a 3D reconstruction of the temperature distribution.
- The results will improve the knowledge and the management of the Euganean thermal resource.

THANK YOU