Charles University
Faculty of Science

Institute of Hydrogeology
Engineering Geology
and Applied Geophysics

International Association
for Engineering Geology
and the Environment

Ministry of Education,
Youth and Sport
of the Czech Republic

European Union
European Structural and
Investment Funds
Operational Programme
Research, Development
and Education

Richard Wolters Prize

2022 Edition

Candidate:

Gianvito Scaringi

National IAEG Group of the Czech Republic

About me

An engineering geologist and geotechnical engineer studying the thermo-hydro-mechanics of geomaterials to understand landsliding under climate change

Current title and affiliation

Assistant professor of Soil Mechanics
Charles University, Prague, Czech Republic

Past experience

Postdoctoral Research Fellow
State Key Laboratory of Geohazard Prevention and Geoenvironment Protection, Chengdu, China

Academic title

PhD in Seismic Risk, Structural and Geotechnical Engineering
University of Basilicata, Italy

Professional title

Registered Civil Engineer
Member of the Italian Order of Engineers

About me

Memberships

IAEG, ISSMGE, EGU

Editorial duties

BOEG, Engineering Geology, Landslides, Minerals

Teaching

Basic and advanced soil mechanics, selected topics in engineering geology

Supervising

Currently supervising two PhD students and one MSc candidate

Research projects

PI of a national basic research project
MSCA-IV postdoctoral fellowship awardee
Step-2 ERC Starting Grant (ongoing selection)

About me

Publications

> 50 articles in international journals
> 30 contributions to international conferences and book chapters

H-index = 26 (Scholar), 22 (Scopus)
Cites = 2134 (Scholar), 1710 (Scopus)

Most cited work

Fan, X., Scaringi, G., Korup, O., West, A. J., van Westen, C. J., et al. (2019).
Earthquake-induced chains of geologic hazards: Patterns, mechanisms, and impacts.
Reviews of Geophysics, 57(2), 421-503.

About me

Research-defining works

Scaringi, G., & Loche, M. (2022).
A thermo-hydro-mechanical approach to soil slope stability under climate change. Geomorphology, 401, 108108.

Dai, L., Scaringi, G., Fan, X., Yunus, A. P., Liu-Zeng, J., Xu, Q., & Huang, R. (2021).
Coseismic debris remains in the orogen despite a decade of enhanced landsliding. Geophysical Research Letters, 48(19), e2021GL095850.

Scaringi, G., Hu, W., Xu, Q., & Huang, R. (2018).
Shear-rate-dependent behavior of clayey bimaterial interfaces at landslide stress levels. Geophysical Research Letters, 45(2), 766-777.

My research

Thermally-induced instability of slopes under climate change

We are messing up with our planet: changes that usually occurred on a geological scale are now occurring on a human scale, disrupting many equilibria.

In a geohazards perspectives, climate change is rapidly altering frequencies, magnitudes, patterns, fates of many processes and phenomena.

To predict effects of climate change in temperate and warm climates in soil slopes, we look at changes in precipitation patterns and more widely in atmosphere-soil interaction.

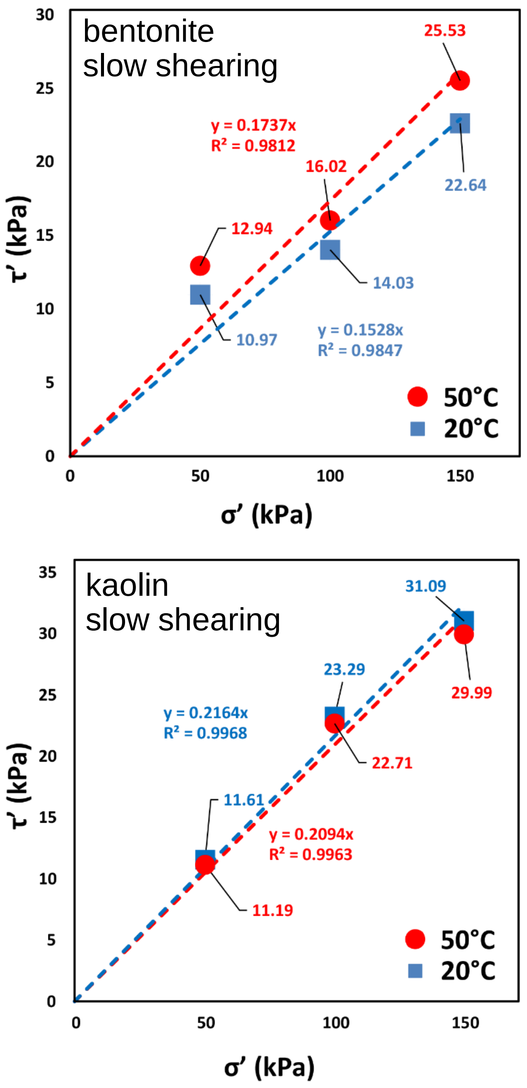
Typically, we do not consider temperature (unless we are dealing with freezing/thawing).

The problem is that soil strength, compressibility, viscosity, all change with temperature.

When we evaluate future **landslide susceptibility** (and hazard and risk) under climate change, we may mis-estimate changes if we do not consider the **direct contribution of temperature in soil hydro-mechanics.**

My research

Thermally-induced instability of slopes under climate change



Loche & Scaringi (in prep.)

Evidence in the laboratory is striking, but there are complications.

The magnitude of the effect of temperature on the residual shear strength depends on the soil mineralogy but also on the rate of shearing:

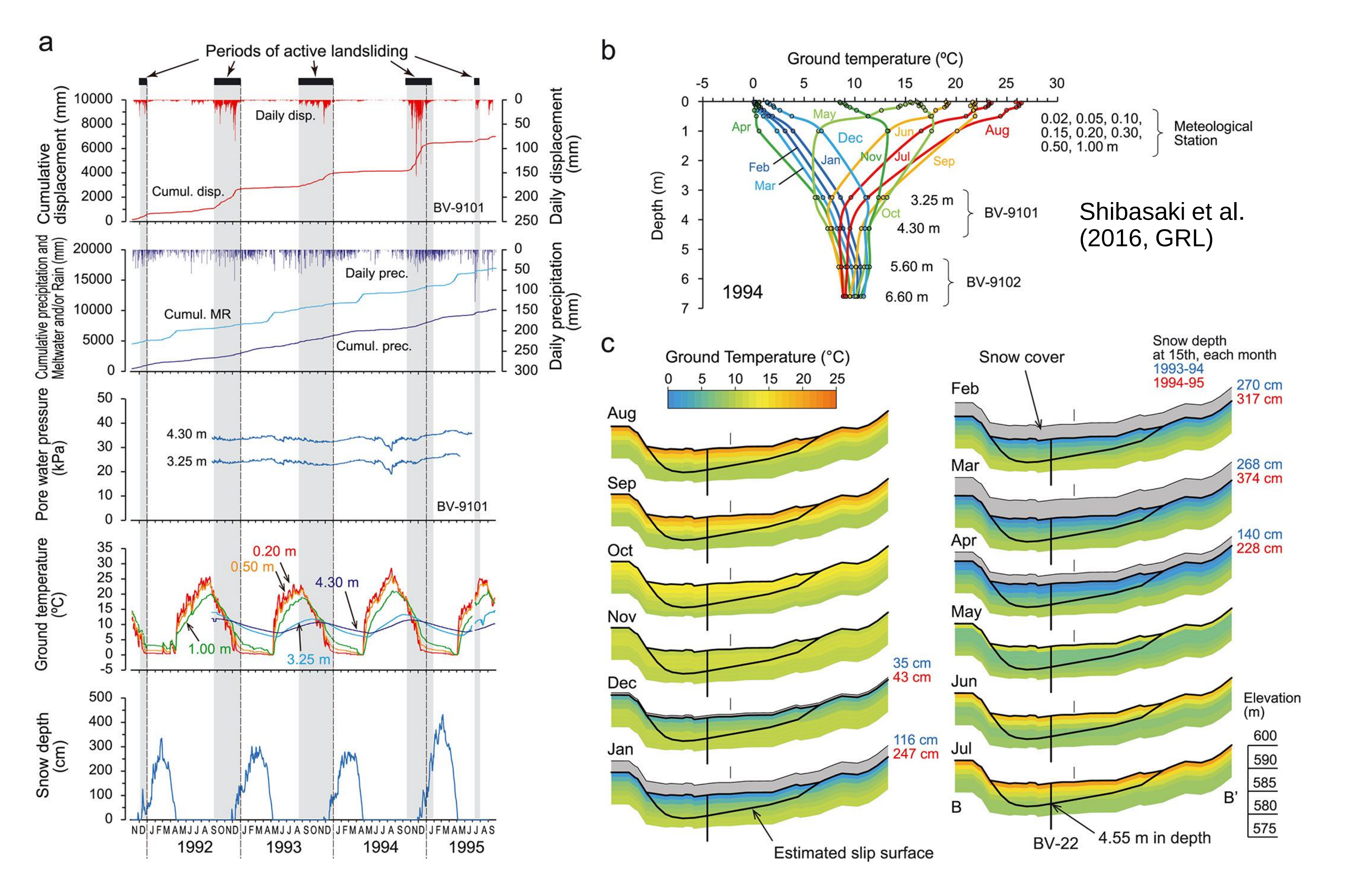
Calcium bentonite (very active clay) weakens when cooled down under slow shearing, but …
… under fast shearing, it **weakens if warmed up**

Kaolin (much less active) **shows the opposite behaviour**, but the magnitude of the thermal effect is much smaller

Evidence fades as the scale increases, owing to forced simplifications in frameworks, in parallel with increasing complexities and heterogeneities of the landscape (Loche & Scaringi, 2022, Geomorphology)

My research

Landsliding activated by cooling



Shibasaki et al. (2016, GRL)

The clearest evidence comes from some landslides in Japan, studied by a research group from Kyoto University.

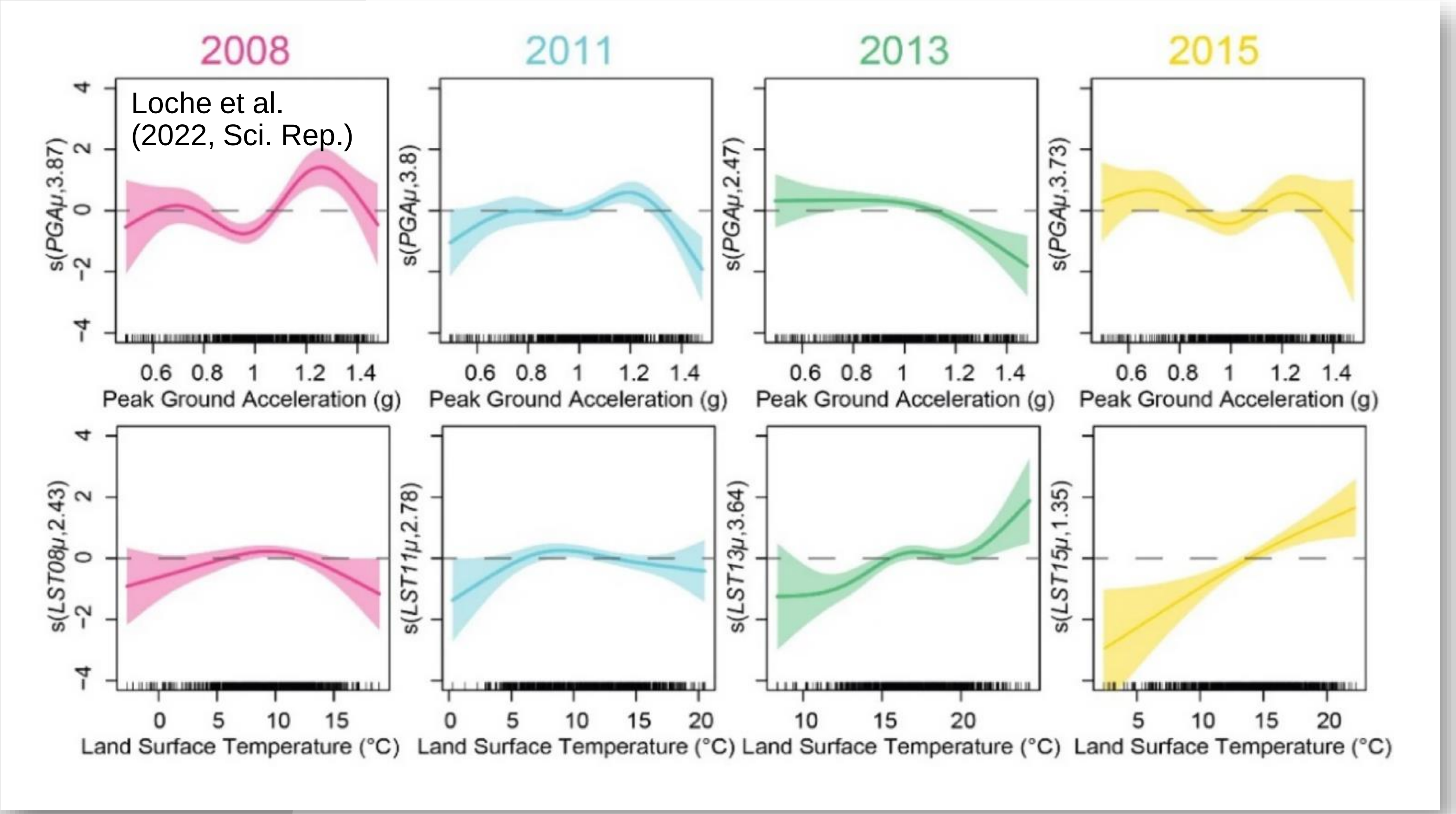
However, it seems that no one else has investigated this matter.

We are setting up thermal monitoring in several clay and non-clay landslides in the Czech Republic to look for answers.

Meanwhile, we are performing temperature-dependent slope stability analyses.

My research

What can we say at a larger scale?

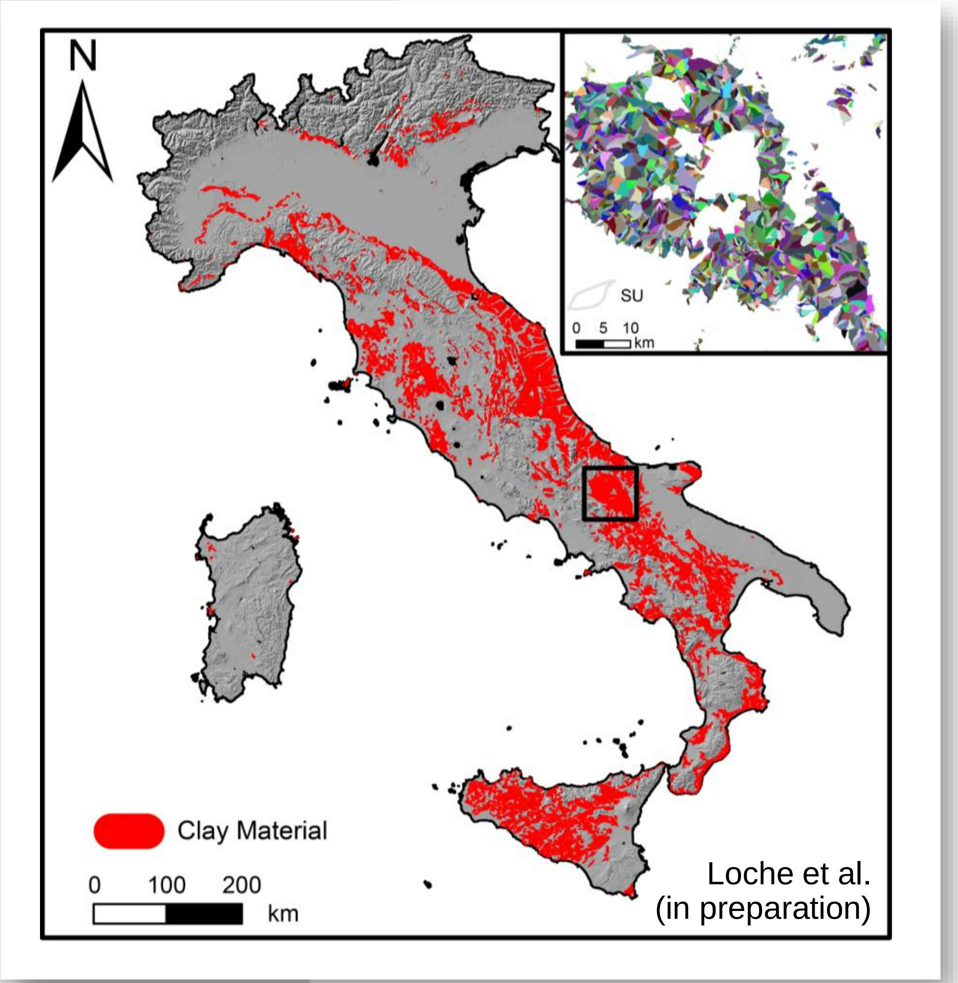


Using a statistical approach, we correlated landsliding and temperature after the Wenchuan earthquake (China, 2008).

We found that higher surface temperatures corresponded to prolonged post-earthquake landsliding in a way uncorrelated with the pattern of vegetation recovery.

My research

This gets complicated in large regions



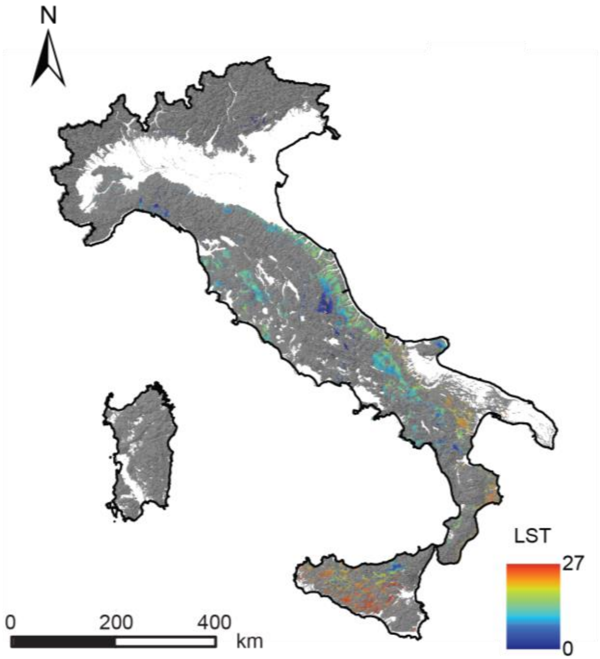
Different climates zones, lithologies, landslide processes

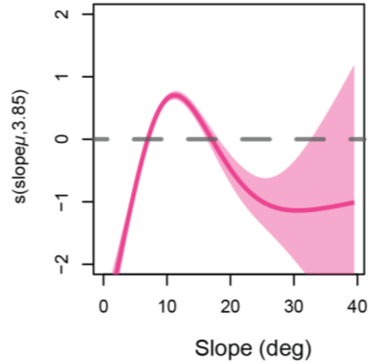
We need to focus, for example, on clay materials

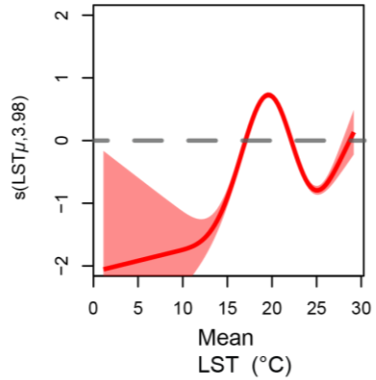
Even better, on slow flows in clay materials

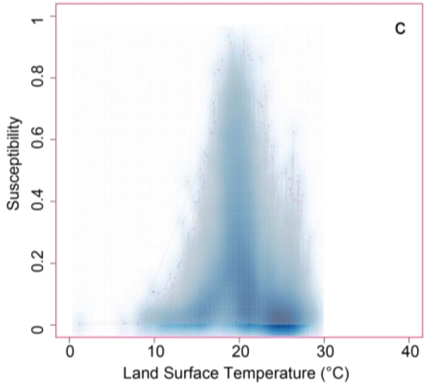
(16530 landslides in the IFFI catalogue, 5572 slope units)

We are studying the correlation with a long-term averaged land surface temperature



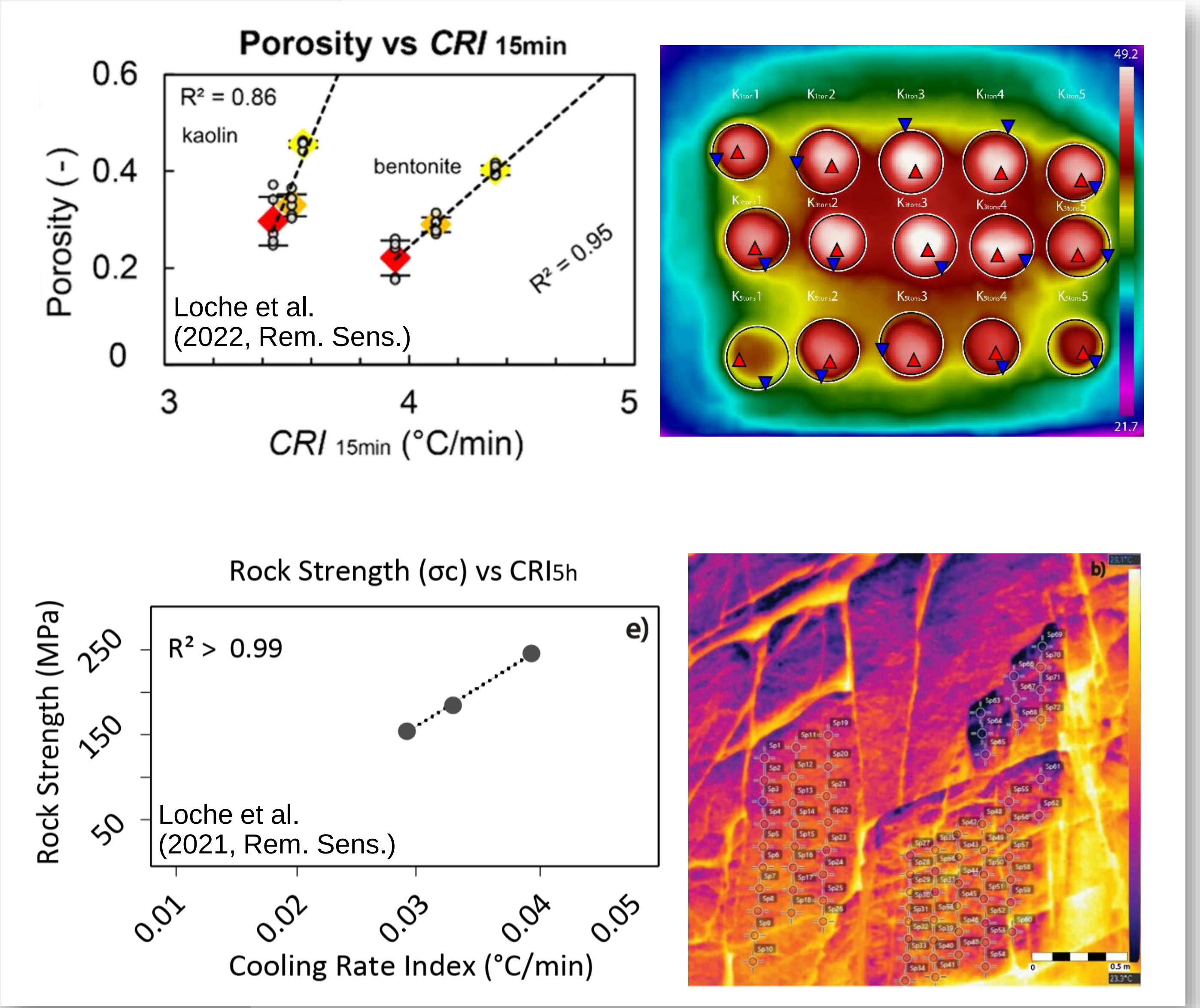






My research

What else can the surface temperature tell?



We can interpret the heating-cooling behaviour of soil and rock under artificial or natural heating (solar irradiation, heat exchange with the atmosphere) to obtain information on physical and mechanical properties.

We evaluated a cooling rate – porosity – mineralogy relationship for clays

We evaluated a cooling rate – compressive strength or degree of fracturing or width of discontinuities for rocks

Much work to do

We are working on:

- Integrating spatial and temporal dimensions
  (essential for predicting trends under climate change scenarios)
- Integrating scales of investigation
- Integrating quantitative lab results into physically-based slope models
- Physically-based upscaling from slopes to catchments
- Further exploiting capabilities of statistical/machine learning algorithms in identifying large-scale patterns/trends

Charles University
Faculty of Science

Institute of Hydrogeology
Engineering Geology
and Applied Geophysics

International Association
for Engineering Geology
and the Environment

Ministry of Education,
Youth and Sport
of the Czech Republic

European Union
European Structural and
Investment Funds
Operational Programme
Research, Development
and Education

Richard Wolters Prize

2022 Edition

Candidate:

Gianvito Scaringi

National IAEG Group of the Czech Republic