VirtuaField : Virtual Field Trips for Education. Training students to field practice

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LAM
LABORATOIRE D'ASTROPHYSIQUE DE MARSEILLE

Aix*Marseille université

Introduction

An artificial environment which is experienced through sensory stimuli (such as sights and sounds) provided by a computer and in which one's actions partially determine what happens in the environment

VR gets into daily life for gaming…

… But also into professional life

Why not for applications in Geosciences?

Introduction

- **Astronomy, Geology, Geomorphology: Sciences of observations**

Field trips:

How to observe, collect data, and interpret

→ Compiling skills acquired in class rooms

Introduction

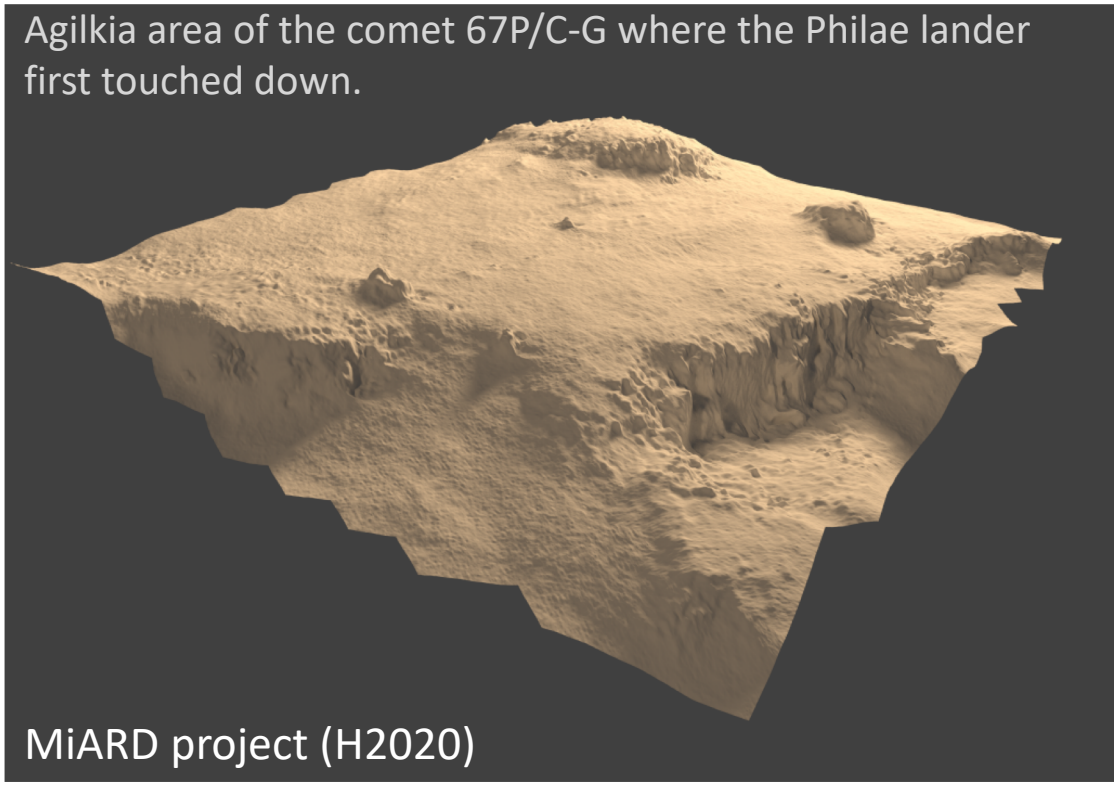
- **Extra-terrestrial outcrops:**

Possibility to have:

→ high-resolution 3D models

→ textured models

(Jorda et al. 2016, Icarus)



Terrain models are the only data sources!

Use of Virtual Reality: 3D view, 1:1 scale and numerical data → Unique way to plenty observe geological/geomorphological features

Introduction

- **Terrestrial geology, geomorphology:**

Digital Outcrop Models: more and more used

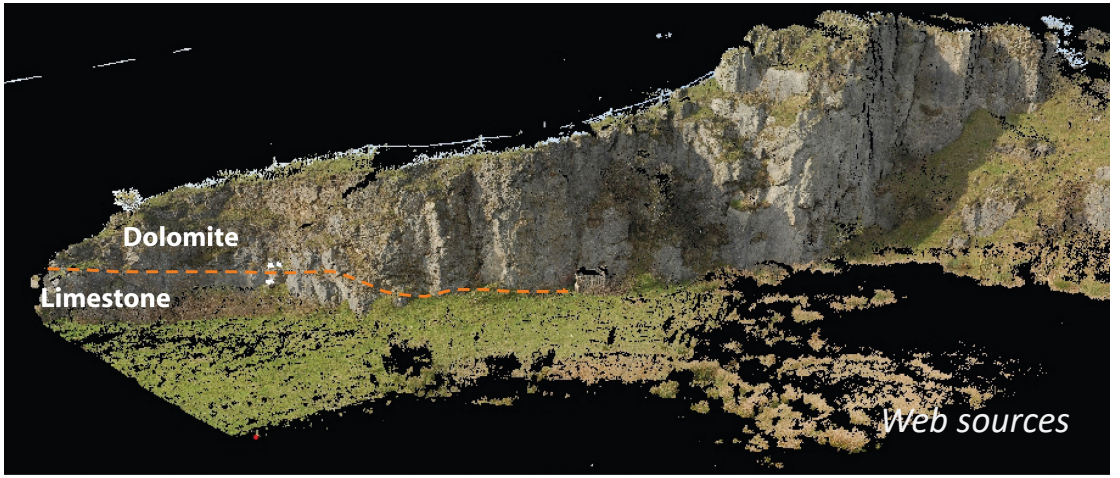
Possibility to have:

→ high-resolution 3D models

→ textured models

Field trips:

Important for students



Field trips:

- **Expensive, only a few / year for students**
- **Dangerousness, human accessibility, conflicting areas, etc.**

Use of Virtual Reality: 3D view, 1:1 scale and numerical data → Virtual Field trip

Outline

- **Pedagogical project *VirtuaField***
- First applications

Pedagogical project in AMU

- **Objectives:**

Field case = book

Virtual field trips in exploratory mode: free movements, visualisation of data/information

Serious game = exerci… book

→ To tra… ility t… …n … field

Debriefing sessions: for converting experiences into learning process!!

V… …n

…*ice*):

- …th
- Pro… …olve at signpost
- Sco…ng of student responses

→ Training to field practice :

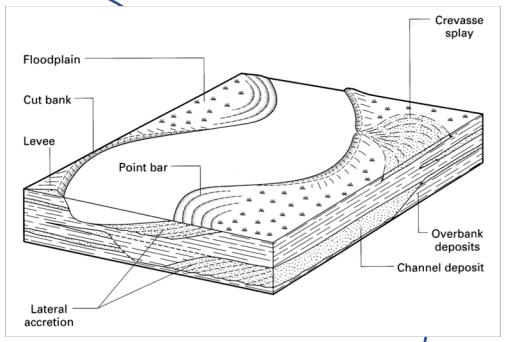
+ autonomous

+ individual visits *(not possible in effective field for security reason)*

Pedagogical project in AMU

- **« Serious game »: geology**

  A scientific question to solve using evid



Thin section
+ Manipulated in th
+ In laboratory

urements
in the scene

Laboratory studies, document readings, etc.
→ Come back to the virtual field
→ Add knowledge in the scene

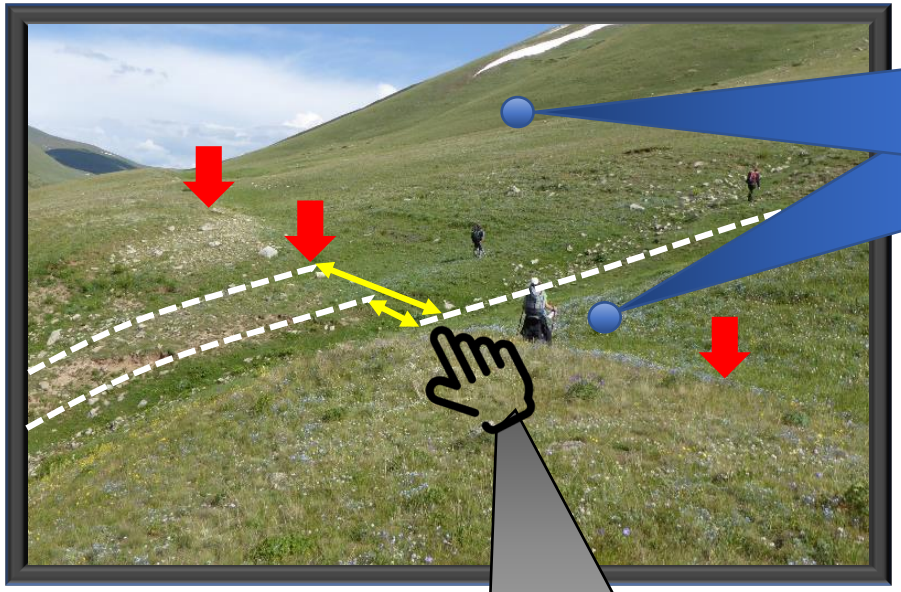
➡ **APP (Approches Par Problèmes) projects (Master): serious game**

➡ **Professionalized projects (Licence): to scan samples**

Pedagogical project in AMU

- **« Serious game »: geomorphology**

  A scientific question to solve using evidences on virtual field



Rock samples:
+ Manipulated in the scene
+ In laboratory

Drawing features in the scene,
measuring displacements...
Simulating earthquakes

➡ **Simulation of an Earthquake!**

➡ **To raise awareness among the public of earthquake events**

Pedagogical project in AMU

- ***VirtuaField* project:**
  - **Grant from « Simulation Applied to Pedagogy » project** *(July 2018, 3 years*)**, AMU**

    → Computers, headsets, softwares

    Human resources: building of datasets for virtual scenes

  - **Softwares:**
    - **For Astronomy:** VR2Planets softwares (VR2Mars, VR2Chury)
    - **For Geology, geomorphology (and Astronomy):**

      to be implemented.

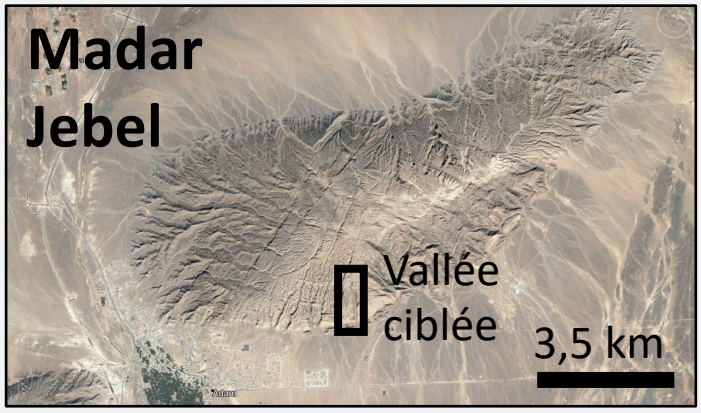
    MIO (*Mediterranean Institute of Oceanology*): Visits under the sea

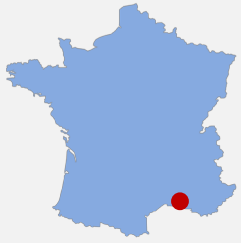
Pedagogical project in AMU

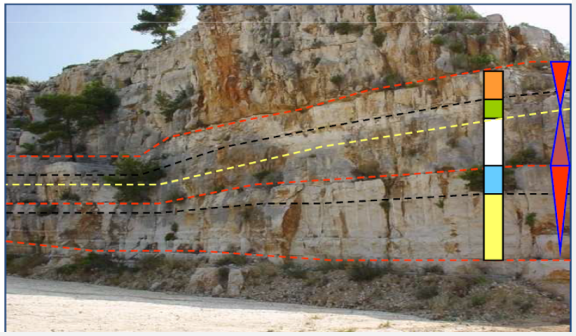
- **Case studies:**

Madar Jebel (Oman)

Structural geology







Cassis (France) *Stratigraphy*

Talas-Fergana fault

Earthquakes recurrence

Monte Vettore (Italy)

Earthquake simulation

(30/10/2016)

Outline

- Pedagogical project *VirtuaField*

- **First applications**

First Applications

- **VR2Planets softwares:**

3D Cave

- Group sessions (up to 15 persons) (meaning a single point of view)
- Autonomous or manual flyover landscapes
- Possibility to interact with the terrain and to extract quantifiable information

Headset

- Flexibility of use (portable) and intuitive
- Possibility to interact with objects
- Possibility to collaborate in the scene (through network)
- 1 set up per user (computer + headset)

First Applications

- **Headset:** comfortable, network meeting

Individual #1

More than 2 hours in the scene

Individual #2

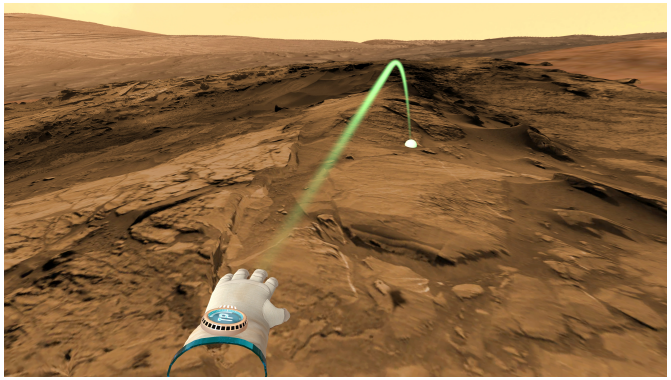
View of individual #1 in the scene, including individual #2

VR2Planets

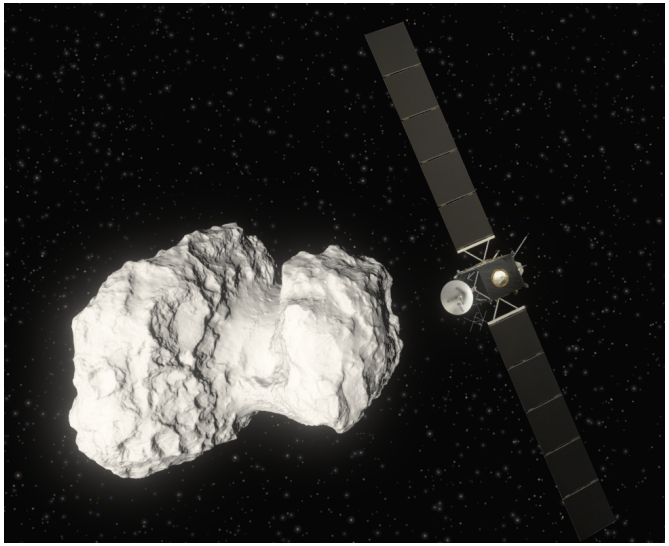
First Applications

- **For Astronomy, VR2Planets softwares:**

VR2Planets



VR2Mars: visits on Mars



VR2Chury: visits on the Comet 67P/C-G

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First Applications

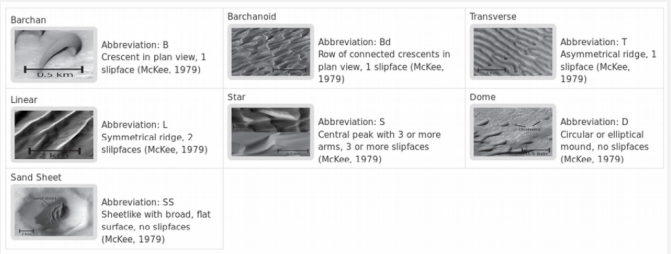
- **Headset:** flexible, comfortable, network meeting, …

VR2Planets

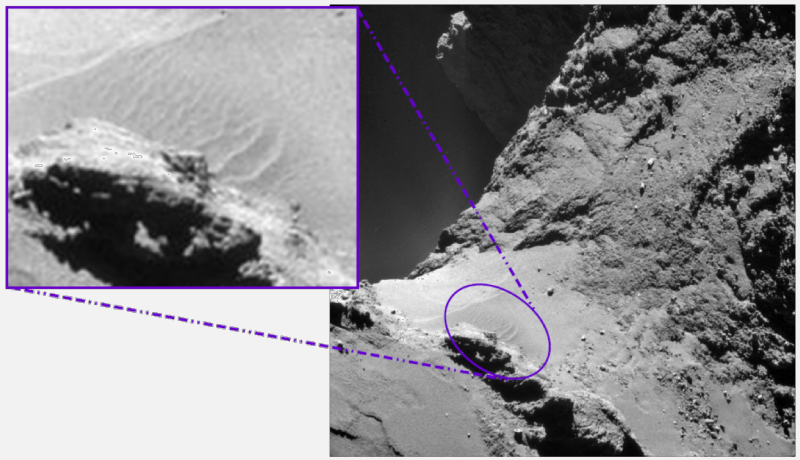
First Applications

- **Training (Master), Astronomy:** *27th November,* ***18th December 2018.***

Classifications of dunes, ripples:



Exploring using VR2Chury/Mars:



L. Jorda (LAM),
C. Matonti (post-doc CEREGE)
S. Viseur (CEREGE)

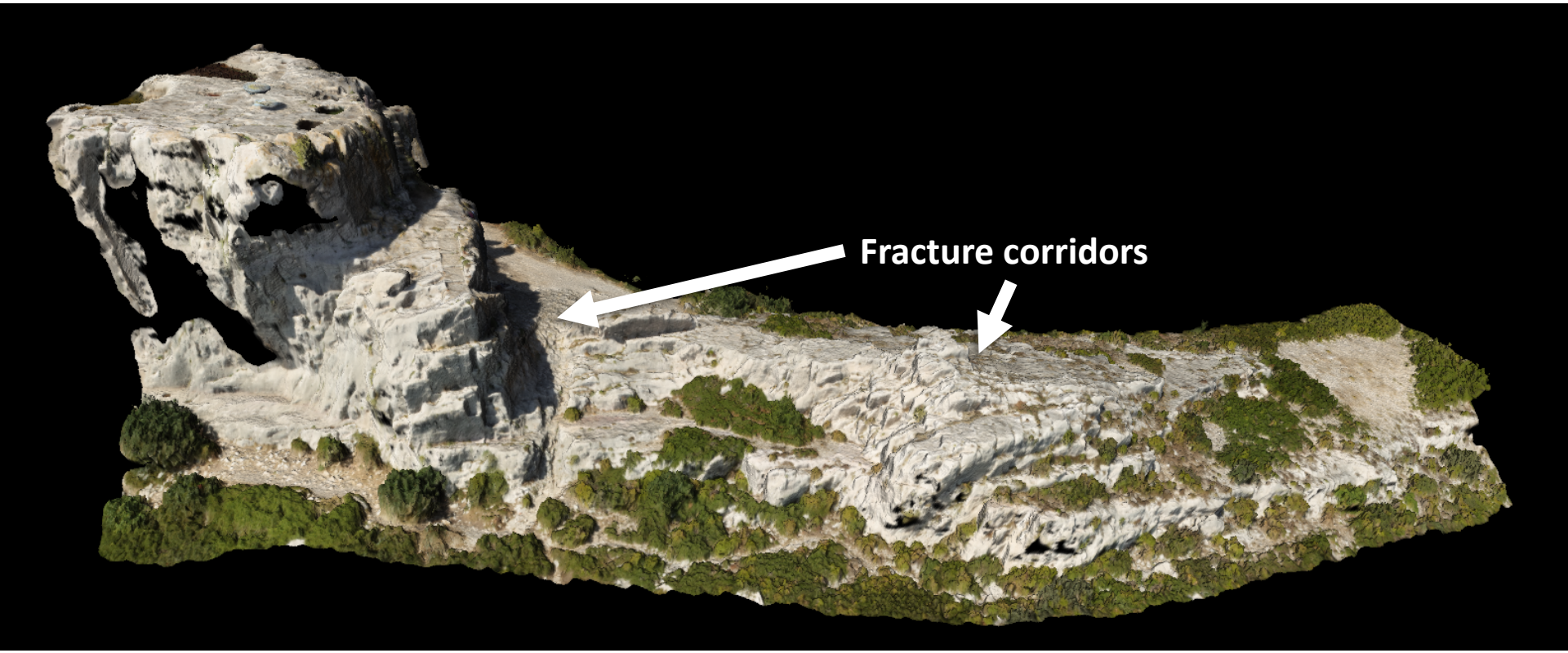
Importing data in QGIS

Measuring, interpreting

Survey for first feedbacks of students

First Applications

- **For geology:** prepare field case dataset



- HR protogrammetric data *(J. Fleury, CEREGE)*
- 3D models of fractures
- …

La Fare les Oliviers, SE France : Fracture interpretation, visualisation.

→ Data acquired in the scope of the BICARBOFRAC project, sponsored by TOTAL SA.

(PI CEREGE: J. Lamarche, Total: B. Gauthier)

TOTAL

First Applications

- **For geology:** prepare sample scanning

Projects for licence students:

→ Easy workflow for scanning:
- Fossils
- Rock samples

→ Expected requirements

in order to:
→ **integrate into the scene**
→ complete web libraries (*sketchfab*)

Fossil acquired by photogrammetry (J. Fleury and B. Marx-Suchéras - CEREGE)

Discussion

- **Use of Virtual Reality in pedagogy**
  - Not a « modern gadget » (**do not replace effective field trips**)
  - For pedagogy purpose:
    - Focus on a specific skill (*e.g., sport*)
    - Importance of debriefing
    - Switch between « virtual scene » and reality
- **Advantages / drawbacks:**
  - ☺ **3D immersive view**, **« as if we were there… »**
  - ☺ **Numerical environment** (add 3D models, etc., not only observable reality…)
  - ☺ **Possibility to preserve 1:1 scale** (students easily loose scale notion on PC)
  - ☺ Handicaped persons, injured students, general public (public events)

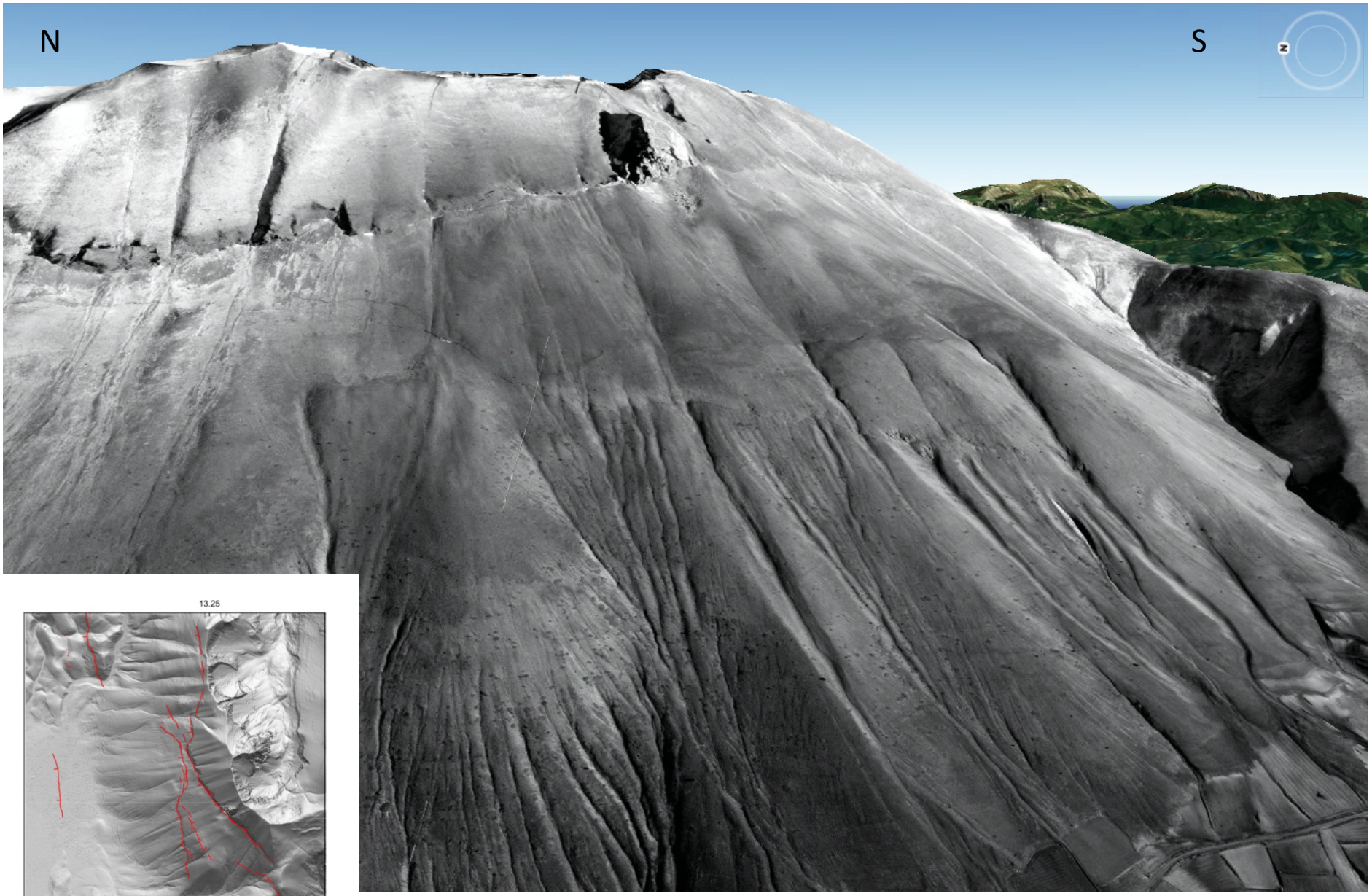
EGU Teaching Structural Geology and Tectonics in the 21st Century

Workshop, April 5-7 2019, Wolkersdorf im Weinviertel (just north of Vienna, Austria)

☹ Human sensitivity (inner ear troubles) → *technological and cognitive progresses, importance of UX*




Thank you for your attention!



Mt Vettore, view toward the East,
Pléiades Image 01/12/2016

Photogrammetrie

Characteristique d'acquisition
147 photos
Zone : 50x30 m

Sortie: nuage de point géoréférencé
150 e+6 pts
Densité : 1 e+6 pts/m²
Résolution **1.5 mm**
Incertitude en Z : 10 mm