

From planetary sciences, earth sciences, volcanology to robotics and agriculture:

Highlights from the 7th Vulcano Summer School, Sicily 2023



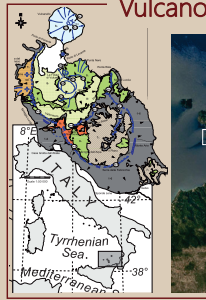
Vikram Unnithan¹, Frank Sohl^{2*}, Christian Riedel³ and all summer school participants⁴

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Summary

The two-week summer school, held for the 7th time, on the island of Vulcano, Sicily, provides an important training ground for more than 50 students, scientists, researchers, and technicians by exposing them to a variety of disciplines such as geology, volcanology, geophysics, astrobiology, planetary sciences and providing valuable hands-on field experience. This year's special theme is the application of robotics for agriculture - how current advances in robotics, especially from space sciences, can aid and support sustainable food production. During the summer school, a number of scientific experiments were carried out to test equipment and gather data. All summer school participants had the possibility and opportunity to work in different teams, explore fields that may not be their own, and get involved in the data acquisition, processing, visualization, and presentation. Lunchtime lectures, evening social events such as poster sessions, astronomy, and GIS classes complemented the field-based activities. The interaction, collaboration and networking between the participants is an important outcome as it helps to foster inter- and transdisciplinary learning and understanding. In addition to institutional funding, the summer school was generously funded by the Helmholtz iFOODis project and EUROPLANET.



Vulcano is an active composite volcanic island forming part of the Aeolian archipelago (see figure right) in southern Italy. The island has a 120k year history of intermittent tectonic, and eruptive or quiescent phases of primarily K-alkaline nature spanning from basalt to rhyolitic rocks. The island offers easy access to a wide variety of morphological terrains, the opportunity to study volcanic and associated tectonic processes and possible planetary analogues. (Figs. Showing location of Vulcano, modified from [De Astis et al \(2013\)](#))

Spectral Work

LIBS (Laser-Induced Breakdown Spectroscopy)

- radiation from a high-power pulsed laser is focused onto sample surface
- ablation of material, plasma production + emission, atomic transitions
- Elemental composition

Raman Spectroscopy

- Non-destructive method. Specific shift of incoming radiation.
- Molecular structure, identification of minerals

Infrared Spectroscopy

- Non-destructive method. Specific shift of incoming radiation.
- Identification of minerals

Advantages for in-situ exploration:

Combined: complementary information



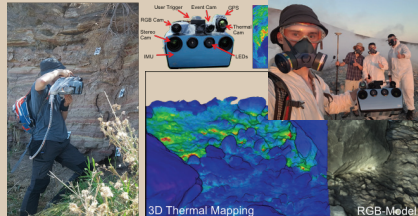
Participants Summer School 2023 - Florian Neu, Martin Messman, Frank Sohl, Danniell Osolano, Thomas Wiedemann, Fabio Broghammer, Armin Dammann, Seán Molony, Orr Rose Bezaly, Dianne van Erp, Martina Occhipinti, Michelle Bettendorf, Giulia Maria Ronca, Nina Gruber, Sam Bekkers, Simon Stapperfend, Lennart Fox, Tobias Planitzer, Klaus Spitzer, Jana Börner, Pascal Semper, Balthazar Dubois, Mickael Bague, Clémentine Pellissier, Oka Bramantio Swiada, Riccardo Giublatto, Dennis Dehlike, Alessandro Pisello, Alessio Posati, Marco Sewitz, Raúl Domínguez, Tobias Stark, Pierre Willenbrock, André Felmet, Simon Felix Jusner, Patrick Irmisch, Hugo Cordier, Danniell Osolano, Maximilian Durner, Marcus Müller, Kristin Rammelkamp, Ana Lomashvili, Christian Riedel, Bernard Foing, Janki Dodiya, Katrin Stephan, Roland Wagner, and Vikram Unnithan

Robotics



Various robots used to test localization, locomotion, data fusion on different planetary analog terrains.

IPS



The Integrated Positioning System (IPS) is a localization platform based on stereo-visual odometry, IMU and GPS, and was used for inspection of fumarole fields and context generation for in-situ spectroscopy measurements

Geophysics (SIP/TEM)

Electric and electromagnetics methods for mapping and understanding the importance of ground water in volcanic processes

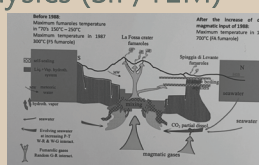
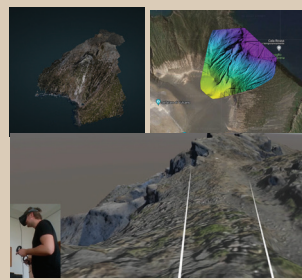


Fig. above adopted from INGV@Vulcano

Drones

Drone based photogrammetry for terrain analysis, geomorphometric, vegetation / agriculture suitability (iFOODIS), and creating immersive virtual reality experiences

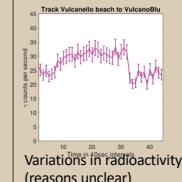


Astronomy

Night time astronomy sessions with a telescope



Radiometrics



Variations in radioactivity (reasons unclear)

Stromboli

Boat trip to Stromboli, with evening views of explosive eruptions



Social Events

Posters, pizza and wine. Important networking opportunities



Kids

A summer school for Chinese school kids (VGCC) was also organized in parallel, and they also participated in various activities



Lectures

Series of daily lunchtime lectures on key topics covered during the summer school; morning briefing reviewing preview day and plans from the day



Acknowledgements

- Many thanks to all the participants for making this summer school a great success!
- Funding support from iFOODIS and EUROPLANET was much appreciated, without which the summer school would have been impossible to organize
- Last but not least, Florian Neu and Martin Messmann for their continued technical support.