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Vulcano Summer School 2019

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Abstract

For the past five years, a two-week summer school has been held at Vulcano, Sicily focusing on bringing together planetary scientists, researchers, students, technicians and policy makers, to provide enhanced field exposure and training on a variety of topics ranging from geology, volcanology, geophysics, oceanography to robotic environmental exploration, astrobiology, and the study of planetary analogues. A number of experiments and sampling campaigns were carried out in June 2019 on the island and in the coastal waters around Vulcano.

1. Introduction

Vulcano is the third largest and southernmost island of the Aeolian archipelago in the Tyrrhenian Sea. The Aeolian Islands include other active volcanoes such as Stromboli. Vulcano, along with Stromboli and Etna, is one of the most closely monitored, heavily studied and researched active volcanoes in the world. Vulcano hosts a large and unique assemblage of high and low temperature volcanic and hydrothermal minerals. The largest part of the island consists of three main edifices built mainly by effusive and strombolian to phreatomagmatic explosive eruptions, within the last 150,000 years. The latest volcanic eruption took place in 1888 and since then the volcano has exhibited two to three phases of enhanced (thermal) activity.

2. Terrestrial Activities

From a planetary perspective, the surface morphology of parts of the Fossa Crater on Vulcano is similar to lunar and martian regions with extremely dry, arid conditions and little or no vegetation cover. Moreover, the diverse and extreme environments present at Vulcano throughout the island provide an essential training ground for testing instruments and techniques foreseen for future robotic missions to Mars and other bodies of high astrobiological interest (e.g. Mars2020 and ExoMars2020 rovers). This year a variety of spectral instruments ranging from visible and near-infrared (VNIR) reflectance and Raman spectroscopy to Laser-Induced Breakdown Spectroscopy (LIBS) were deployed at various sites for mineralogical, biological, and elemental analysis. The in situ survey, and its comparison with laboratory instruments, will serve to inform on the capacities of such techniques to characterize extraterrestrial environments and guide our search for life in the Solar System (e.g. via assessing the detectability of biosignatures).

Figure 1. Briefing during field activities.

Drone photogrammetry surveys were performed on different areas of potential slope instability hazard, while an Integrated Positioning System (IPS) [2] in combination with infrared thermal imagery was

deployed for future mapping and thermal stability analysis of the fumarole fields.

New instrumentation such as a prototype thermal camera to be used on Venus and Mercury was tested and seems to agree with the infrared and in-situ temperature measurements [1]. TEM and IP electric measurements of diffusive CO_2 fields were successfully acquired. Their processing, data analysis, inversion and modelling is ongoing. Last but not least, robotic missions for terrain analysis, locomotion and mapping were undertaken by the ASGARD robot on various lunar and martian analog terrains.

3. Marine Activities

Underwater AUV and ROV missions investigated diffusive CO_2 bubble field to map and quantify emissions. Marine robotic AUV, ROVs and terrestrial robotic traverses highlighted the need for further testing concepts and finding innovative solutions for locomotion on diverse planetary terrains. Oceanographic work such as depth profiles of conductivity and temperature (CTD), pH measurements and biological sampling suggest that ocean acidification occurs close to the marine CO_2 venting sites.

4. Summary and Conclusions

Overall, the summer school successfully exposed junior researchers and students to a broad background on planetary and terrestrial field studies. To this end, various experiments and sampling campaigns were carried out on the island and in the coastal waters around Vulcano.

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