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Newsletter n. 4

Status of the IMPROVE Project

IMPROVE has completed in last August its 3rd year of activity. To-date IMPROVE has organized 4 Network Schools and 5 Specialized Short Courses in which 96 external students have joined the 15 IMPROVE Early Stage Researchers; 2 large experiments at Krafla, Iceland, and Mount Etna, Sicily; two Open Days; and a number of parallel activities aimed at favouring the growth of the next generation of European leading scientists in volcanology. The research activities of the ESRs are beginning to yield their first major results in terms of scientific production. So far, 10 publications in high-impact, peer-reviewed journals have been published, several others are submitted or being prepared, and the ESRs have shared their research and results at more than 80 prestigious conferences around the world.

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Innovative Multi-disciplinary
European Research training network on
VolcanoEs

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Third Specialized Short Course in Granada, Spain

Data Analysis and Pattern Recognition



The IMPROVE course on “Data Analysis and Pattern Recognition” was held from January 24 to 26, 2024, in Granada, Spain, and was organized by Professor María del Carmen Benítez at the University of Granada.

The main goal of the course was to introduce students to the fundamental concepts of Data Analysis and Pattern Recognition, techniques that are crucial for analyzing the massive amounts of data collected from volcano monitoring system and for identifying potential sensor problems or malfunctions.

The course was attended by 17 students, including 5 Early Stage Researchers from the IMPROVE project. The other 12 students came from various high-level European research institutions.

Gabriel Girela Arjona

Visiting the city of Granada is always a huge pleasure, especially if you are accompanying its rich history, culture and stunning architecture with some machine learning and data analysis. Despite having no prior background in these topics, the course was structured in a way that made complex concepts accessible and easy to grasp – special mention to Joe's exercise (Note: Joseph Carthy, IMPROVE Early Stage researcher) and the muffins he gave us as a reward for fulfilling it! On top of that, learning what other people work on at different institutions is always exciting and inspiring. Having the chance to learn new skills directly from where they are being developed, reuniting with some of the other ESRs and meeting new people will always be, personally, the best thing of being part of IMPROVE.

Fifth Specialized Short Course in Munich, Germany

Petrophysical Properties



The Fifth Specialized Short Course on “Petrophysical Properties: From the Laboratory to the Field and Modelling” was held at Ludwig-Maximilians University in Munich, Germany, from April 8 to 10, 2024. The course was organized by Professor Bettina Scheu, Dr. Jackie Kendrick, and Dr. Anthony Lamur, who also conducted the lectures, laboratory tours, and hands-on practice.

Participants were introduced to theoretical concepts and various techniques for characterizing petrophysical properties both in the field and in the lab. Further lectures comprised scaling aspects from lab to field, and the complementarity of petrophysical knowledge with geophysical data and models.

During the practical sessions, participants were trained in both field and lab techniques to measure and/or calculate various petrophysical properties, such as bulk density, connected porosity, and permeability, using a set of Krafla rock samples. Later the participants analyzed and discussed different methods to deepen further their understanding of individual benefits and shortcomings, as well as associated precision, of the individual techniques, and of their usage.

A total of 13 students participated in the course: 8 Early Stage Researchers (ESRs) from the IMPROVE project and 5 external participants from LMU Munich.

Ana Martinez Garcia

Our time at the Petrophysical Properties short course in Munich was an incredibly enriching experience! The course covered various rock and reservoir characterization topics, focusing on modern techniques for collecting and analyzing petrophysical data in field and laboratory environments. I greatly appreciated the balance between theory and hands-on practice, including the chance to use several instruments. Working closely with the other ESRs in the laboratory; and Munich, with its rich culture and fantastic places to explore; both offered us a great and completely different perspective compared to the fieldwork.

Fourth Network School in Potsdam, Germany

Multi-facet Science: data, models, infrastructure, industry and communication

The Fourth Network School “Multi-facet Science: data, models, infrastructure, industry and communication” was organized at the GFZ German Research Centre for Geosciences, Germany, from 27 to 31 May 2024. The course covered a variety of subjects and presented examples in data analysis, numerical modeling, analogical approaches, and the use of infrastructures for science, highlighting them as key elements for multi-scale science. The course included both scientific and technological aspects, presented through relevant application cases such as source modeling through the integration of multidisciplinary approaches and multiparametric data. One relevant aspect was represented by examples of cooperation involving industry and small-medium enterprises, aimed in particular to present how scientific knowledge contributes to define industrial advance. The course also focused on additional skills such as project management, research leadership, and effective communication. Additional transferable and soft skills included project scouting, reading project calls, project preparation and writing, career planning, and goal setting. Finally, non-academic contributions were addressed, including business-oriented planning and organization, cost and time management, value engineering, and work-life balance. One day was dedicated to visit Berlin, including a river tour designed to showcase the many facets of the city from a different perspective. This trip also provided an opportunity to continue discussions involving the teachers and the students.

The IMPROVE 4th School in Potsdam was attended by 19 students, represented by the 15 IMPROVE ESRs plus other 4 external students.



Elisabeth Glück

After more than 2 years into the project, the network school in Potsdam was a great opportunity to catch up with the other ESRs scientifically but also on a personal level. The lectures during the week were very diverse in their topics, but since IMPROVE taught us over the last years to understand and talk the interdisciplinary “language” of volcanology it was an interesting mix for everyone.

The last day of the school was dedicated to career development, which included a workshop on how to give an elevator-pitch. I never thought of practicing this, but after a couple of rehearsals in a speed-dating format with the whole group the “ehms” and “hmmms” got less and now I know how to get my point across in a short amount of time - something that is useful in any career.

Even more interdisciplinary than the lectures was our field trip: We didn't climb on volcanoes or do field measurements this time, but we visited Berlin – doing a boat tour, going to a classical concert and discovering the city with its history was also nice for a change and a fun day with the whole group.

Fourth/sixth Specialized Short Course in Pontedera (Pisa), Italy

Geochemical and Geophysical Methods for Volcano Monitoring and Geothermal Exploration

The IMPROVE course on “Geochemical and Geophysical Methods for Volcano Monitoring and Geothermal Exploration” took place at the West Systems s.r.l in Pontedera (Pisa), Italy, from September 30 to October 3, 2024, and was organized by Dr. Giulio Bini (IMPROVE ESR and Course Director), Dr. Giancarlo Tamburello and Dr. Antonio Costa from INGV Bologna, and Leonardo Coppo from West Systems s.r.l. This course trained the participants on the basic concepts of geochemical and geophysical volcano monitoring and geothermal exploration by using ground- and drone-based data acquisitions. Participants had hands-on opportunities to conduct measurements of the soil CO₂ emission and temperature at the Biancane geothermal area (Larderello, Italy). They then applied statistical methods to process this data, which allowed them to map and quantify gas emissions and estimate the geothermal potential of the area. The course was attended by 16 participants, including 6 Early Stage Researchers from the IMPROVE project. The other 10 participants came from various European and African (Algeria) research institutions, and from industry partners of IMPROVE, such as



Landsvirkjun, the national power company of Iceland.



Joseph Carthy

The 4/6 SSC represented a great opportunity for me to gain exposure to the wide range of geophysical research that is facilitated by the IMPROVE project. This course offered great insights on how geochemistry plays an important role in monitoring different systems, and offered great hands-on experience for how to apply different methods to map out CO₂ flux emissions. This was a fascinating course, and seeing the different statistical tools in use for geochemical applications offered me great food for thought that might also influence my future research. Additionally, the field work represented a great learning opportunity, where we saw how different types of measurements are done on the ground, and then how these measurements are integrated and used to build regional maps of emissions that can inform monitoring services as to the state of volcanic and geothermal areas.

Double prestigious awards for the IMPROVE ESR Giulio Bini



Giulio Bini, IMPROVE Early Stage Researcher, has been double-honored. In July 2023 he was awarded the Silver Medal of ETH Zurich for his outstanding doctoral thesis entitled “Interpreting the dynamics of magmatic-hydrothermal systems using the chemistry of gas emissions: the case of the Nisyros caldera (Aegean Arc, Greece)”. One year after, in July 2024, during the 2nd Congress of the Italian Geochemical Society at Perugia, Italy, Giulio received the Tonani Award of the Italian Geochemical Society (SOGEI) for the Best Doctoral Thesis in Applied Geochemistry.



Giulio Bini

Winning the Tonani Award for the best doctoral thesis in Applied Geochemistry is an honor, not only because of the prestige of the Italian Geochemical Society (SOGEI) but also because it validates years of dedicated research. My thesis focused on interpreting the dynamics of magmatic-hydrothermal systems using the chemistry of gas emissions, which I believe addresses some key challenges in the volcanology field today, such as filtering the magmatic signature within surface gas emissions and identifying the underlying causes of volcanic unrests. This recognition fuels my passion for advancing geochemical research and underscores the importance of applied geochemistry for understanding how volcanoes behave.

Digital Training Modules

IMPROVE Digital Training Modules are on line and ready to support your learning. Covering a variety of topics, these lessons offer valuable resources for your improvement. Feel free to visit them on www.improve-etn.eu and on IMPROVE youtube channel (<https://www.youtube.com/channel/UCkylt5mH7MWx7Uk2ToqNMBw>).

Upcoming Event

IMPROVE-EPOS-KMT workshop on science-industry cooperation



Photo by Sonia Heidi Maria Grenierby

IMPROVE, EPOS (European Plate Observing System), and the KMT (Krafla Magma Testbed) project are co-organizing a workshop in Dublin on November 21-22, 2024, to foster collaboration between science and industry in the field of high-temperature and near-magma geosciences. For further information, visit <https://www.improve-etn.eu>.