Technical & Financial Report

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Meeting:	Heat Flow Summer School and workshop on heat flow in Antarctica, Africa, South- and Central America
Date and place:	03 –11 July 2023 in Potsdam, Germany
Organization:	International Heat Flow Commission (IHFC), Task Force VIII of the International Lithosphere Program (ILP), GFZ German Research Center for Geoscience
Size:	Attendees: 24 from 20 countries.
IUGG-Funding:	10.000 $

In July 2023, the International Heat Flow Commission (IHFC), in collaboration with the German Research Centre for Geosciences (GFZ), organized a series of three pivotal events designed to advance the field of geothermal heat flow (GHF) research. These events—spanning a five-day summer school and two specialized workshops – brought together early-career scientists, young researchers, and students from across the globe to receive comprehensive training, engage in knowledge exchange, and contribute to the international heat-flow research community. The events not only facilitated the growth of scientific expertise but also laid the groundwork for collaborative efforts aimed at addressing critical data gaps and research challenges in geothermal heat flow, particularly in underrepresented regions like Antarctica, Africa, and Latin America.

IHFC Heat Flow Summer School

The first of these events, the **Heat Flow Summer School**, took place over five days in July 2023 at GFZ (in Potsdam, Germany). This event was designed to provide early-career scientists and students with in-depth training on techniques for heat-flow determination and evaluation. The summer school was attended by 24 participants selected from a competitive pool of 40 applicants from 30 countries, representing Europe, Asia, and the Americas. The selection process emphasized geographic diversity and gender balance, ensuring an inclusive environment for knowledge exchange.

Under the guidance of internationally recognized experts in geothermal research—such as Graeme Beardsmore (University of Melbourne), Juan Contreras and Raquel Negrete-Aranda (Ensenada Center for Scientific Research and Higher Education), and Massimo Verdoya (University of Genova) – participants engaged in lectures, short talks, and interactive group discussions. The summer school combined theoretical knowledge with practical skills, including fieldwork where participants measured temperature profiles at local boreholes and conducted laboratory experiments to estimate thermal properties. This hands-on experience equipped attendees with practical tools essential for solving challenges they may encounter in their future careers.

One of the primary achievements of the summer school was its focus on cultivating a global network of young researchers interested in heat-flow studies. The event encouraged participants to engage with scientific institutions and the public in their home countries, thereby fostering greater science awareness and promoting the field of geothermal heat flow in regions where it is less established. The summer school also contributed to the professional development of

early-career scientists by enhancing their transferable skills, preparing them to tackle complex geophysical problems and to collaborate on international projects.

Antarctic Heat Flow Workshop

Following the summer school, the **Antarctic Heat Flow Workshop** took place from July 8th to July 9th at GFZ as well. This two-day workshop, led by Tobias Stål from the University of Tasmania, focused on the geothermal heat flow beneath Antarctica, a region where GHF plays a critical role in shaping the ice sheet's dynamics. Understanding GHF in Antarctica is essential for interpreting the thermal state of the ice sheet, how it slides and deforms, and the rheological behavior of the underlying lithosphere. Despite its importance, GHF in Antarctica remains poorly constrained, with large discrepancies between estimates derived from glaciological and geophysical data.

The Antarctic Heat Flow Workshop provided a platform for researchers to discuss current methods of GHF measurement in Antarctica and their limitations. Topics included the challenges of remote data collection, computational modeling of heat flow, and the interpretation of subglacial geothermal heat. The workshop highlighted the importance of interdisciplinary approaches to GHF research, incorporating insights from geophysics, glaciology, and computational sciences. One of the key achievements of the workshop was the development of a set of recommendations for future research, aimed at improving the accuracy and reliability of geothermal heat flow measurements in Antarctica.

The workshop also facilitated networking among participants, strengthening collaborations between young researchers and established experts in Antarctic studies. This event underscored the need for continued research on Antarctic geothermal heat and the importance of international cooperation in addressing the challenges posed by data scarcity and harsh environmental conditions. The workshop also set the stage for future fieldwork and research projects focused on understanding the geothermal properties of Antarctica's subglacial environment, which have implications for global sea-level rise and climate change.

Africa, South Atlantic, and South/Central America Heat Flow Workshop

The third event in the series was the **Africa, South Atlantic, and South/Central America Heat Flow Workshop**, held from July 10th to July 11th at GFZ. This workshop was an integral part of the **Global Heat Flow Data Assessment Project**, initiated by the IHFC in 2021, and focused on addressing significant data gaps in geothermal heat flow research across Africa, the South Atlantic, and Latin America. These regions have historically been underrepresented in global heat-flow studies due to a lack of available data and limited research activity.

One of the primary goals of this workshop was to foster collaboration among researchers and institutions in these regions, with the aim of improving data coverage and the overall quality of heat-flow research. The workshop focused on strategies for collecting new data, improving data accessibility, and promoting heat-flow research in these target areas. Participants discussed the development of new projects and initiatives designed to fill existing data gaps and to ensure that future research is conducted in a coordinated and systematic manner.

Additionally, the workshop succeeded in expanding the professional network of heat-flow researchers working in Africa and Latin America, fostering an environment of collaboration and mutual support. The event laid the groundwork for future research collaborations, promoting long-term partnerships between scientists from different regions and disciplines.

General Achievements and Future Directions

Together, these three events in July 2023 achieved several key milestones in the field of geothermal heat flow research. First, they significantly contributed to the professional development of early-career scientists, equipping them with the skills, knowledge, and

networks necessary to succeed in the field. The events also helped to bridge the gap between different regions of the world, particularly in underrepresented areas such as Antarctica, Africa, and Latin America, by promoting collaboration and data sharing.

Moreover, the workshops and summer school addressed critical challenges in heat-flow research, from improving measurement techniques to developing strategies for filling data gaps. The discussions and recommendations that emerged from these events will guide future research initiatives and contribute to the global understanding of geothermal heat flow and its impact on various geological and environmental processes.

In conclusion, the IHFC Heat Flow Summer School and subsequent workshops not only advanced the scientific understanding of geothermal heat flow but also fostered a spirit of international collaboration. The events helped to build a strong foundation for future research projects, ensuring that geothermal heat flow continues to be a vibrant and expanding area of scientific inquiry. Through these efforts, the IHFC and its partners have strengthened the global heat-flow research community and laid the groundwork for future discoveries that will have lasting impacts on our understanding of the Earth's thermal processes.

The IUGG Budget was used for:

1. **Travel expenses participants/lecturers (sum 5,605 €)**
    a. Andrea Marchetti, Ángela María Gómez García, Daniela Navarro-Perez, Chrysanthi Pontikou, Nishu Chopra, Song Zilong, Insaf Mraidi, Harold Buitrago, Massimo Verdoya
2. **Costs of Venue**
    a. **3,230** €, Workshop room
    b. **1,155** €, Catering