

International Heat Flow Commission of IASPEI

Minutes of the Main Business Meeting, Montréal, Canada, July 15, 2019

and Subsidiary Meeting (via e-mail)

The IHFC Main Business Meeting was held on Monday July 15, 2019, during the 27th IUGG General Assembly, following the oral sessions of the symposia organized by the IHFC.

Opening: 18.00

Present:

- IHFC Officers and Bureau: S. Huang (Chairman), M. Verdoya (vice-chairman) and Y. Popov (past-chairman),
- IHFC members: C. Demetrescu, E. Schill, V. Hamza, A. Förster, L. He (China)

The meeting was also attended by the following persons

Trevor Lewis (Canada)
Gzulia Zagranowskaya (Russia)
Kirsten Elger (Germany)
Sven Fuchs (Germany)
Hans-Jürgen Förster (Germany)
Shaowen Liu (China)
Hans Thybo (Turkey)
Irina Artemieva (Denmark)
Ke Ting (China)
Gianluca Gola (Italy)
Hideki Hamamoto (Japan)
Osamu Matsubayashi (Japan)
Susanne Benz (USA)
Jeffrey Poort (France)
Yi Li (China)
Petr Dedecek (Czech Rep.)
Vladimir Cermak (Czech Rep.)
Jan Safanda (Czech Rep.)
Junwen Hu (China)
Yibo Wang (China)

Agenda of the IHFC meeting:

1. Welcome and Hats off to senior IHFC members
2. Chairman's Report
3. Deep-time Digital Earth (DDE) initiative
4. Reports from working group speakers and members
 - 4.1 Dr. Popov on thermal physical properties
 - 4.2 Dr. Hamza on IJTHFA
5. Elections of new term officers and members of IHFC
6. Global heat flow database - GHFDB
7. IHFC website
8. Working groups
9. Future activities
10. Special Issue publication

1. Welcome and Hats off to senior IHFC members

Chairman Shaopeng Huang greets participants to the meeting. Moreover, the Chair acknowledges IHFC veterans, in particular Alan Beck (who unfortunately cannot be present), Vladimir Cermak, Trevor Lewis, Yuri Popov Jan Safanda for their service to the commission in the past decades.

2. Chairman's Report

The Chairman reports the main activities of the IHFC in past four years (2015-2019)

- The IHFC Global Heat Flow Database was so far hosted at the University of North Dakota under the custodianship of Professor William Gosnold. The global heat flow data compilation consists of 35,523 terrestrial data points and 23,013 marine data points. The database at this moment can be accessed at <https://engineering.und.edu/research/global-heat-flow-database/>.
- Under the support from the IHFC community and a grant from US NSF to Shaopeng Huang (IHFC Chair), the Global Database of Borehole Temperatures for Climate Reconstruction currently has over 1000 sites. In addition to extending the spatial coverage, efforts have been made to work on the improvement of the accessibility and functionalities of the database. Both the University of Michigan and NCEI/NOAA data outlets have been updated with the addition of the recently acquired borehole data and reconstructions. The colleagues at the NCEI/NOAA have empowered the database with capabilities of Interactive Map, Google Earth Map, Catalog Service, Text Search, and FTP for data sharing at <https://www.ncdc.noaa.gov/data-access/paleoclimatology-data/datasets/borehole>.
- With Vladimir Cermak (IHFC Chair 1995-1999), Shaopeng Huang (IHFC Chair), Dhananjay Ravat and Massimo Verdoya (IHFC Vice Chair) as guest editors, a Special Issue of International Journal of Earth Sciences (IJES), entitled "Heat Flow: Recent Advances", was published in 2018 (<https://link.springer.com/journal/531/107/1/page/1>). The Special Issue includes 12 papers selected from the 24 oral and 28 poster presentations presented at the 26th IUGG General Assembly of Prague, 2015, Symposium S13 "Terrestrial Heat Flow".
- A new online journal *International Journal of Terrestrial Heat Flow and Applied Geothermics* (IJTHFA) was launched (<http://ijthfa.com/index.php/journal/index>). Two issues have so far been published. Valiya Hamza (IHFC Member) is the Editorial Manager and Editor-in-Chief of the IJTHFA. The journal is intended to be a forum for publication of results of high-quality research work dealing with recent advances in field measurement of terrestrial heat flow, regional and global geothermal data analysis, model studies of heat transfer in the Earth's interior and practical applications of geothermal studies.
- A two-day Workshop on Thermal Conductivity of Rocks was successfully held in Chengdu University of Technology, Chengdu, China, October 12-13, 2018. The workshop featured three lectures and one hand-on session instructed by Professor Yuri Popov (IHFC Chair 2011-2015): 1) New role of thermal petrophysics and geothermics in prospecting, exploration and development of unconventional and traditional hydrocarbon fields; 2) Methodology and results of experimental geothermic investigations of scientific deep and industrial wells (1990-2018); 3) Peculiarities of application of optical scanning techniques in geothermic and petrophysical experiments; and 4) Hands-on exercise and best practice with

the Lippmann and Rauen GbR Thermal Conductivity Scanner. Shaopeng Huang (IHFC Chair) was the organizer of the workshop which attracted more than 60 participants.

- A monograph “Geothermics and Its Applications” was published by Science Press. This publication (in Chinese) was to celebrate the 80th birthday of Professor Wang Jiyang (IHFC Member 1987-1995) who is also the lead author of the monograph. The key contributors include Shaopeng Huang (IHFC Chair), Shengbiao Hu (IHFC Member 2003-2011) and Lijuan He (IHFC Member).
- Yuri Popov (IHFC Chair 2011-2015) led the effort to finish a contribution to The International Society for Rock Mechanics and Rock Engineering (ISRM) Suggested Methods. *ISRM Suggested Methods for Determining Thermal Properties of Rocks from Laboratory Tests at Atmospheric Pressure* (Rock Mech Rock Eng, v. 49, pp. 4179–4207, DOI 10.1007/s00603-016-1070-5) was published in 2016. The coauthors of this important paper are Yuri Popov, Graeme Beardsmore (IHFC Vice Secretary), Christoph Clauser (IHFC Chair 2007-2011) and Sukanta Roy (IHFC Secretary).
- At the IAG-IASPEI Joint Assembly in Kobe 2017, the IHFC organized four IASPEI symposia:
 - S24: Methods and instruments of experimental geothermics – application and recent evolution. *Conveners: Yuri Popov and Andrea Förster*
 - S25: Development and application of geothermal databases. *Conveners: Shaopeng Huang and Will Gosnold*
 - S26: Exploring connections between heat flow and tectonics. *Conveners: Valiya M. Hamza and Makoto Yamano*
 - S27: Geothermal Energy: Ground source heat pump, hydrothermal system, and hot dry rocks. *Conveners: Makoto Taniguchi and Philipp Blum.*The four IHFC symposia featured a total of 49 papers distributed over 6 oral sessions and 4 poster sessions
- At this 27th IUGG General Assembly (Montreal 2019), the IHFC organized three joint symposia and one IASPEI symposium:
 - JV04: Advances in Terrestrial Heat Flow Measurement and Interpretation (IAVCEI, IASPEI) *Convener Shaopeng Huang, Co-Conveners Massimo Verdoya, Jacek Majorowicz, Guangzheng Jiang*
 - JS08a: Climate Modeling, Climate Change and Subsurface Temperature Field (IASPEI, IAHS, IAMAS) *Conveners Vladimir Cermak and Makoto Taniguchi*
 - S26: Age Dependences of Terrestrial Heat Flow in Continental and Oceanic Settings (IASPEI) *Convener Valiya Hamza, Co-Conveners Mohan Lal Gupta, Shaowen Liu*
 - JS09a: Tectonophysics of the Continental Lithosphere: Integrating the Thermal Field with Thermo-Barometric, Seismological, Electromagnetic and Seismicity Data (IASPEI, IAVCEI, IAGA) *Convener: Andrea Förster, Co-Conveners: Rainer Kind, Alan Jones, Gianluca Gola*

3. Deep-Time Digital Earth (DEE) Initiative

Deep-time Digital Earth (DDE) is an international effort to bring together multiple disciplinary Earth science databases for deep machine learning. It would be a one-stop digital data outlet allowing earth scientists to access all the data they need to tackle big questions over various time scales. The effort is sponsored by the International Union of Earth Sciences with funding and infrastructure support from China. The IHFC has been invited to play a key role in the DDE program, with the recognition of the fundamental significance of a good understanding of geothermal evolution in the understanding of other Earth science processes. 2015-2019 Chairman Huang presented an overview of the DDE. He proposed for IHFC to accept the invitation and be actively engaged in the DDE program.

4. Reports from working group speakers and members

4.1 Yury Popov reports on the progress in the thermal properties group. An algorithm for determination of equilibrium temperature and temperature gradient from temperature measurements in industrial oil&gas wells was developed within a joint project with Bashkir State University (Russia, Department of Geophysics leaded by Prof. R.Valiullin).

Experimental investigation of vertical variations in terrestrial heat flow were performed for Orenburg region (Russia). The continuous thermal core profiling technique was developed and widely implemented for basic and applied research in oil&gas science and industry in Russia.

New technologies for determination of the thermal properties (thermal conductivity, thermal diffusivity and volumetric heat capacity) from rocks, rock cuttings and well logs were developed.

4.2 Valiya Hamza illustrates the current situation of the international Journal of Terrestrial Heat flow and applied Geothermics (IJTHFA (ijthfa.com)). Hamza stresses that the application for the impact factor of a journal requires at least three issues are published. The third issue is scheduled for March 2020 and contributions will be welcome. Since there is an economical effort for maintaining the journal, donations will also be welcome.

5. Elections of new term Officers and Members of IHFC

Following the IHFC guidelines, the nominating committee, represented by the IHFC officers, proposes the list of members and officers for the new term of the IHFC. The list was created based on the responses to the call for nomination that had been circulated for several months among the broad IHFC community. During the meeting, Hans Thybo also proposes the nomination of Irina Artemieva. The IHFC members attending the Business Meeting accept the inclusion of Irina Artemieva in the list of nominees for the IHFC membership, in view of her potential valuable contribution to the commission activities, even though her nomination came late.

Then, the IHFC members approve the election of the new chair of the commission, Massimo Verdoya (University of Genoa, Italy) who takes the chair of the meeting. According to the IHFC guidelines, the past chair (Shaopeng Huang) is automatically approved.

The majority of the members agree to select first the new term members from the list of nominees and to postpone the election on the vacant officer positions (vice-secretary, secretary and vice-chairman). The election of the remaining officers will be conducted based on suggestions of the newly elected members in a subsidiary business meeting (via e-mail), shortly after the end of the main business meeting. All members agree that to aspire to be an officer a member should have at least one-term experience in the IHFC. Moreover, decide to confirm Sukanta Roy in the IHFC, as his presence is strategic for the next IASPEI meeting (Hyderabad, 2021). The commission members also discuss that the statutes need to be revised during the new term to specify better the rules of the nomination and election process.

Among the several candidates for the committee, the members elected for the new term are:

Artemieva, Irina (Denmark)
Chiozzi, Paolo (Italy)
Dedecek, Petr (Czech Republic)
Demezhko, Dmitry (Russia)
Förster, Andrea (Germany)
Fuchs, Sven (Germany)
Gola, Gianluca (Italy)
Gosnold, William (USA)
Hamza, Valiya (Brasil)
Harris, Robert (USA)

Hasterok, Derrick (Australia)
He, Lijuan (China)
Kohl, Thomas (Germany)
Lee, Youngmin (Korea)
Liu, Shaowen (China)
Nagaraju, Podugu (India)
Negrete-Aranda, Raquel (Mexico)
Poort, Jeffrey (France)
Roy, Sukanta (India)
Tanaka, Akiko (Japan)
Vakhitova, Guzel (Russia)

6. Global Heat Flow Database - GHFDB

Currently, there are several versions of the global heat flow database circulating on the internet and among research groups. One of the major tasks of the International Heat Flow Commission (IHFC) is to gather, publish, and assess quality of heat flow measurements as well as other geothermal data of interest. It has been a quarter century since the last published compilation and analysis of global heat flow data of Pollack et al. (1993, Rev. Geophys.) under the auspices of the IHFC. The participants agree that it is time that the GHFDB is taken back home to the IHFC as officially IHFC-maintained database. According to this line, the IHFC will promote and guide a critical evaluation of the database and revise the data accordingly.

The present custodian of the GHFDB, William Gosnold, is willing to continue his work. The Commission expresses gratitude to Gosnold for his long-term achievements as database custodian. Sven Fuchs, however stresses that there is strong need (i) for an realignment of the database structure, (ii) for a quality assessment of the available data according to the state of the art in heat-flow studies, and (iii) an extension of the type of information contained in the database. Fuchs, seconded by Andrea Förster, proposes the starting of a new project of reassessment and redesign of the GHFDB, by checking and validating the available data and setting-up a modern research data infrastructure (e.g. providing doi for data) with a new data portal. After an intensive discussion, the commission members agree with this proposal and appoint S.F. as the leader of a working group on the database and as future custodian. His task will be leading and coordinating the database reassessment and the development and hosting of a permanent, modern infrastructure for the database.

Fuchs & Förster suggest setting up a heat-flow workshop in May 2020 to discuss on a new structure of the database. This proposal was warmly welcomed by the participants.

7. IHFC website

The official IHFC website is still hosted by Christoph Clauser (IHFC chairman in 2007-2011) of the Aachen University. Professor Clauser, retired in 2018, and has asked to be released from the custodianship of the IHFC website. Sven Fuchs and Andrea Förster offered to take the responsibility and custodianship of the IHFC website. The commission members agreed the migration of the webpage, with S.F. as website administrator. With the approval of the IHFC chair, Fuchs found a new representative web domain (www.ihfc-iugg.org) and will design a new website. He suggests September 1st as likely date for the launch of the new website. All the Commission past and present members are warmly invited to contribute and to supply documentation.

8. Working groups (WG)

The Chair reports about the status of the WG (currently: Heat flow, Borehole temperature, Paleoclimate, Thermal Properties, Outreach, Applied Geothermics). The Chair suggests to close the Outreach group, as every commission member should be actively engaged in outreach regarding heat flow. There was a general agreement on that point. He asked for support in the Applied Geothermics group. One task of this group could be finding synergism and collaboration with the International Geothermal Association (IGA). Eva Schill (KIT) reported that Thomas Kohl (KIT) would be willing to support this work.

Therefore, the following working groups were maintained and newly proposed:

- Heat Flow Data (speaker S. Fuchs)
- Borehole Temperature Data: (speaker S. Huang)
- Applied Geothermics (speakers T. Kohl – M. Verdoya)
- Paleoclimate: (speaker J. Safanda)
- Thermal Properties: (speaker Y. Popov)

The Chairman stresses that each WG should include an adequate number of researchers, thus he invites the speakers to involve the present and past IHFC members in the working groups.

9. Future activities

Next IAGA-IASPEI Assembly will be held in Hyderabad, India, in 2021. Proposal for IHFC symposia should be suggested. The committee members agree to collect proposals by mail after the end of the next weeks.

10. Special Issue publications

Vladimir Cermak, seconded by the Chair, proposes to evaluate the possibility of preparing a special issue in an international journal, to collect the papers and posters presented in the IHFC symposia of Montreal. The proposal was welcome by participants. Prospective contributors will be asked to confirm their interests and preliminary titles.

11. Closing of the meeting and final words by New Chairman

At the end of the meeting, the Chair, Massimo Verdoya thanks the trust of the IHFC community and expresses gratitude to the past Chair, Shaopeng Huang, and to all past members and officers for their extraordinary efforts in promoting geothermal research. He urges from the new members support and inputs as how to enhance the heat flow community's research strength and impact on the broad Earth science community.

The main Business meeting closes on at 21.30.

Subsidiary Business Meeting

Since August 21st 2019, a subsidiary business meeting was held via e-mail to indicate nominations for the positions of Vice-Secretary, Secretary and Vice- Chairman and to vote for those positions. As established in the Main Business meeting, the Chairman, Massimo Verdoya, asked the newly elected members to indicate possible nominations for the vacant Officers. The deadline for submission of nominations was September 1st. At that date, only three candidates were proposed by the IHFC members, namely:

Sukanta Roy as vice-chairman
Andrea Förster, as secretary
Robert Harris as vice-secretary

On September 4th 2019, the nominees were finally approved by the majority of the members.

Thus, the Bureau for the 2019-2023 term is:

Chair: Massimo Verdoya (Italy)
Vice Chair: Sukanta Roy (India)
Past Chair: Shaopeng Huang (China)
Secretary: Andrea Förster (Germany)
Vice Secretary: Robert Harris (USA)

and the members for the 2019-2023 term are:

Artemieva, Irina (Denmark)
Chiozzi, Paolo (Italy)
Dedecek, Petr (Czech Republic)
Demezhko, Dmitry (Russia)
Fuchs, Sven (Germany)
Gola, Gianluca (Italy)
Gosnold, William (USA)
Hamza, Valiya (Brasil)
Hasterok, Derrik (Australia)
He, Lijuan (China)
Kohl, Thomas (Germany)
Lee, Youngmin (Korea)
Liu, Shaowen (China)
Nagaraju, Podugu (India)
Negrete-Aranda, Raquel (Mexico)
Poort, Jeffrey (France)
Tanaka, Akiko (Japan)
Vakhitova, Guzel (Russia)

September 16th, 2019

Massimo Verdoya, IHFC Chairman

Andrea Andrea Förster, IHFC Secretary