

Business Meeting of the International Heat Flow Commission (IHFC)

Room 503, International Conference Centre, Kobe, Japan

August 3, 2017 (6 PM onwards)

A business meeting of the IHFC was organized on August 3, 2017 at the venue of the IAG-IASPEI Joint Assembly held in Kobe, Japan. The meeting was attended by 27 members of the Heat Flow community (List attached). Dr. Johannes Schweitzer, the IASPEI Secretary-General / Treasurer, stopped by before the beginning of the meeting and was welcomed by the IHFC Chairman Shaopeng Huang and attendants. The the folowings are the main points of discussion.

1. IHFC Chairman Shaopeng Huang welcomed the participants to the Business Meeting of the International Heat Flow Commission. The following agenda was adopted.
 - Welcome
 - In Memoriam
 - Status Update
 - Standards for Thermal Conductivity Measurement (Dr. Popov)
 - Publications
 - Special Issue in Journal of Geodynamics (Dr. Hamza)
 - IUGG Centennial Monograph (Dr. Cermak)
 - Cosponsor Association Liaisons
 - Proposal for next IUGG in 2019
 - IHFC Dinner (Dr. Yamano)
 - Photo taking
2. Before proceeding further with the agenda, the IHFC paid tributes to two distinguished members of the community, Richard P. Von Herzen (1930-2016) and John H. Sass (1936-2017) who passed away since the last IHFC meeting held in Prague during the 2015 IUGG General Assembly. Dr. Richard P. Von Herzen of the Woods Hole Oceanographic Institution was a pioneer of marine heat flow study. Dr. John H. Sass of the US Geological Survey made great impacts in the research areas of terrestrial heat flow and geothermal energy. The attendnats of the meeting observed a moment of silence in their memory.



Richard P. von Herzen
1930-2016



John H. Sass
1937-2017

3. The purpose of the meeting was to review the achievements of the Commission and exchange ideas with the heat flow community to contribute more effectively to the goals of the IASPEI, IAVCEI and IASPO, Chairman Huang said. He complimented the international heat flow

community for participating in large numbers and for making significant contributions to the success of the IAG-IASPEI Joint Assembly in Kobe. Four IASPEI symposia S24-S27 were organized by the IHFC.

- 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 the IAG-IASPEI 2017. The Chairman thanked the conveners and contributors.

4. Dr. Shaopeng Huang introduced the IHFC poster to the participants. This poster was prepared recently to highlight the history and significant achievements of the IHFC to the broad scientific community in general. He welcomed suggestions to improve the poster contents in the future.

International Heat Flow Commission

Scopes

Terrestrial heat flow density (or heat flow in short) is a measure of the surface energy flux from the interior of the Earth. Heat flow study is one of the fundamental geophysical disciplines. It plays an important role in understanding the Earth's origin, internal constitution, and geodynamic processes. The International Heat Flow Commission (IHFC) is a commission of, and operates generally under guidelines set by the International Association of Seismology and Physics of the Earth's Interior, The International Association of Volcanology and Chemistry of the Earth's Interior, the International Association of the Physical Sciences of the Ocean, and the International Association of the Hydrological Sciences are co-sponsors of the Commission. The scopes of heat flow study are related with the mission of the International Geothermal Association, the International Association of Meteorology and Atmospheric Sciences, and the International Association of Geomagnetism and Aeronomy.

Objectives

The objectives of IHFC are to promote either alone or in co-operation with other international scientific organizations all aspects of geothermal research as they pertain to the missions of the parent and co-sponsoring associations. Included in these activities are:

- Developing and recommending standards and techniques for the determination of all parameters necessary to geothermal research, such as thermophysical properties of materials, underground temperatures, quantification of geothermal energy resources, etc.;
- Gathering, estimating quality and publishing of heat flow density data as well as other geothermal data of interest;
- Organizing or co-sponsoring international scientific meetings and expeditions as necessary;
- Initiating or co-sponsoring the publication of monographs about specific aspects of geothermal problems;
- Creating Working Groups (WG) as necessary for investigating and reporting on specific geothermal problems.

The IHFC currently owns two major databases, the Global Heat Flow Database and the Global Database of Borehole Temperatures for Climate Reconstruction. Most of the work of the IHFC is performed by its working groups. These are organized by one or a group of speakers. Members and speakers of these working group need not necessarily be members of the IHFC. There are currently six Working Groups:

- Heat flow database (Will Gosnold)
- Thermal Properties (Yuri Popov)
- Borehole temperature database (Shaopeng Huang)
- Outreach (Massimo Verdoya)
- Paleoclimate (Jon Sarnoff)
- Applied Geothermics (Christoph Clauser)

Birth of IHFC

In August 1963, at the 13th IUGG General Assembly in Berkeley California, Sir Edward Bullard of Cambridge University called an informal meeting to organize a heat flow committee to promote geothermal research. Bullard's agenda included organizing symposia and field trips, comparing techniques, maintaining a database, and publishing a monograph. He nominated W.H.K. Lee of the University of California at San Diego to be the secretary and instructed Lee to find a deputy secretary who would succeed him 3 years later. Gene Simmons of the Massachusetts Institute of Technology kindly accepted the invitation. Bullard would chair the committee, and Elena Lubimova of the USSR Academy of Sciences would be the vice-chair. The proposed officers and committee members would be appointed by three IUGG Associations: Seismology, Volcanology and Oceanography at the end of the General Assembly.

Sir Edward Bullard (1907-1989)

A few days later, Bullard withdrew as the proposed chairman of the International Heat Flow Committee to run for the IUGG presidency. He then persuaded Francis Birch, a heat flow pioneer at Harvard University, to be the proposed chair. At the end of the IUGG General Assembly the IHFC (later Commission) was established.

The first IHFC consisted of: Francis Birch, chairman; Elena A. Lubimova, vice-chairwoman; William H.K. Lee, secretary; and Gene Simmons, deputy secretary; and the members were: C. J. Barwell, A. E. Beck, T. Boldizar, E. C. Bullard, J. C. Jaeger, A. M. Jessop, M. G. Langford, C. Lomnitz, V. A. Magnitskiy, I. Stogryn, S. Uyeda, and R. P. Van Hees. The International Association of Volcanology appointed the following liaison members: G. Ficca, J. Healy, J. McNitt, and P. Everard.

— Modified from Vladimir Cermak and William H. K. Lee, 2004, EOS, Vol.85 No.2

Former Chairs

 Francis Birch 1963-1967	 Elena Lubimova 1967-1979	 Lajos Stogryn 1979-1983	 Alan Beck 1983-1987	 Seiya Uyeda 1987-1991	 Henry Pollack 1991-1995
 Vladimir Cermak 1995-1999	 Ilmo Kukkonen 1999-2003	 David Chapman 2003-2007	 Christoph Clauser 2007-2011	 Yuri Popov 2011-2015	

Commission Today

Chairman:
 Shaopeng Huang
 USA/China
shaopeng@umich.edu
shaopeng@mail.xjtu.edu.cn

Vice Chairman:
 Massimo Verdoya
 Italy
verdoym@diptis.unige.it

Past Chairman: Yuri Popov (Russia), yurpopov@do.ru
Secretary: Sukanta Roy (India), sukanta.roy@nic.in
Vice Secretary: Beardsmore Graeme (Australia), grazema.beardsmore@hotdryrocks.com

Members: Colin, Williams (USA); Demetrescu, Crisan (Romania); Demashko, Dmitry (Russia); Forster, Andrea (Germany); Gosnold, William (USA); Hamza, Valiya (Brazil); Harris, Robert (USA); He, Lijuan (China); Joeth, Argo (Estonia); Jonas, Michael (South Africa); Kohl, Thomas (Germany); Majorowicz, Jack (Canada); Mazzella, Adelle (Italy); Ragnauer-Lieb, Klaus (Australia); Saar, Martin (Switzerland); Schill, Eva (Switzerland)

Website: <http://www.geophysik.rwth-aachen.de/IHFC>

Global Heat Flow Database

Location of Heat Flow Sites Heat Flow Density

The last IHFC authenticated Global Heat Flow Database was compiled by Henry Pollack. As of the end of 1990, Pollack compiled a global heat flow data set comprising 24,774 observations from 20,201 sites, based on which Pollack et al. [1993, *Geophys. Res.*] estimated the global mean heat flow to be 87 mW/m², with continental and oceanic means of 65 and 101 mW/m², respectively. The global heat loss was estimated to be 44 Terawatts. William D. Gosnold of the University of North Dakota is the current heat flow database custodian who has enlarged the size of database substantially and made regional/national sub-compilations available for download in Microsoft Excel spreadsheets. In addition to the IHFC designated custodian, several researchers [J. H. Davies, 2013; J. H. Davies and Davies, 2010; Furlong and Chapman, 2013; Hamza et al., 2008; Hasterok, 2010; Hofmeister and Criss, 2005; C. Jaupart and Mareschal, 2007; Pollack and Chapman, 2008; Vieira and Hamza, 2011; Von Herzen et al., 2005] have devoted efforts to recompile the database and/or revisit the earth's heat flow distribution. Hasterok [2010] compiled, as part of his Ph.D. dissertation, a data set comprising a total of 38,008 data entries.

Databases

Borehole Locations

Temperatures beneath the Earth's surface consist of two principal components: a steady-state component related to the flow of heat outward from the deeper interior, and a downward-propagating transient component related to the perturbations from changes at the ground surface. The effort among the geothermal community in reconstructing a ground surface temperature history from borehole temperature data adds a new dimension to the study of global climate change. It is widely recognised among the scientific community that the independent climate information comprised in borehole temperatures is complementary to instrumental records and other conventional climate proxies. A global database of borehole temperatures has been constructed for climate research. The global database of borehole temperature consists of more than 1000 boreholes in North America, South America, Europe, Africa, Asia, and Australia. The database is accessible to the scientific community both at the World Data Center and at the University of Michigan. The significances of this database and the results derived from borehole temperatures are highlighted in the Reports of IPCC and the US National Research Council of the National Academies.

Climate Reconstruction

5. Dr. Yuri Popov, the Past Chairman, made a brief presentation on the importance of “Standards for Conductivity Measurements”. He highlighted the sustained efforts by a group of IHFC members to bring out an important publication (ISRM Suggested Methods) on thermal properties measurements:
Yuri Popov, Graeme Beardsmore, Christoph Clauser and Sukanta Roy (2016), 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
 Yuri presented a detailed account of the process since the initiation of the proposal in 2013, during which the manuscript went through several rounds of review at various levels before its final acceptance in 2016. He presented a copy of the work to the Chairman, IHFC.
6. Dr. Shaopeng Huang thanks Dr. Massimo Verdoya, the Vice Chairman of the IHFC and an editorial board member of the Journal of Geodynamics (Elsevier), for the initiative for an IHFC special issue in the Journal on the theme of “Terrestrial heat flow, geodynamics, geothermal energy”. Although Dr. Verdoya was unable to attend the IAG-IASPEI Joint Assembly and the IHFC Business Meeting, he had submitted a proposal to the Journal of Geodynamics. The proposal was echoed by Dr. Valiya Hamza, an IHFC Member and another editorial board member of the Journal. Although an official response from the publisher of the Journal to the proposal is yet to come, we have gratefully received a message from Professor Irina Artemieva, Editor in Chief of the Journal of Geodynamics, showing her full support for such an IHFC special issue. Dr. Hamza further presented some details of the proposal. There so far have been manuscript proposals (see Appendix II, consisting selected papers presented at the IAG-IASPEI Joint Assembly at Kobe and additional papers from the IHFC community. Massimo Verdoya and Valiya Hamza were requested to explore the proposal further with the journal. If the proposal is accepted, a call will be sent for submitting manuscripts for peer review following the guidelines of the journal.
7. Dr. Vladimir Cermak, ex-Chairman of the IHFC, spoke briefly about the proposal to prepare an “IUGG Centennial Monograph” on IHFC activities that would be released during the next IUGG General Assembly in Montreal during the year 2019. He solicited contributions highlighting significant achievements and key milestones of heat flow researches and also requested for a suitable cover page photograph. Dr. Cermak also explained the status of the special issue of the *International Journal of Earth Sciences* comprising papers on heat flow / geothermal research from the IUGG General Assembly in Prague. He mentioned that 12 papers have finally accepted and published online, but the number is not adequate to make an exclusive issue on heat flow / geothermal research. He welcomed other researchers to consider submitting “ready” manuscripts (if any) and asked for their response within two weeks.
8. The IHFC is an inter-association commission of the International Association of Seismology and Physics of the Earth's Interior (IASPEI), the International Association of Volcanology and Chemistry of the Earth's Interior (IAVCEI) and the International Association of the Physical Sciences of the Ocean (IASPO). It operates generally under guidelines set by the IASPEI. The IHFC business meeting usually convenes once in two years – during the IUGG General Assembly and the IASPEI Assembly. It was agreed that inter-commission and inter-association scientific activities are important to increase the visibility of IHFC within the IUGG framework. Makoto Taniguchi highlighted ongoing research efforts on groundwater temperature and climate change studies that link with IAHS activities. Members were asked to explore other possibilities of inter-association work.

9. It was agreed to propose IHFC related symposia and workshops at the next IUGG General Assembly to be held in Montreal. The Chairman solicited proposals from members during the next weeks that could then be forwarded to IASPEI/IUGG.
10. Other issues such as (i) nominating IUGG liaisons to represent the IHFC at various Association meetings of the IUGG and (ii) availability of some funds for IHFC activities from the IASPEI /IUGG and (iii) bank account of IHFC, were discussed. The Chairman asked members to obtain more information regarding funding possibilities before making decisions.
11. A group photograph was taken to mark the occasion. The meeting was followed by a IHFC contributory dinner arranged by Makoto Yamano.



Courtesy of Dmitry Demezhko, IHFC Member

The meeting concluded with a vote of thanks to the Chair and the participants.

Shaopeng Huang
IHFC Chairman
shaopeng@umich.edu
shaopeng@xjtu.edu.cn

Sukanta Roy
IHFC Secretary
sukantaroy@yahoo.com

Appendix I Attendants of the IHFC Business Meeting, Kobe, August 3, 2017

#	Name	Affiliation	Email Address
1	Valiya Hamza	Observatorio Nacianal	hamza@on.br
2	Yuri Popov	Skoltech, Russia	y.popov@skoltech.ru
3	Rim Valiullin	Bashkir State University	valra@geotec.ru
4	Guzel Vakhitova	Bashkir State University	guzel@geotec.ru
5	Ramil Sharafutdinov	Bashkir State University	gframil@inbox.ru

6	Ayrat Ramazanov	Bashkir State University	ayrat.1953@mail.ru
7	Sukanta Roy	Ministry of Earth Sciences & CSIR-NGRI, India	sukantaroy@yahoo.com
8	Shaopeng Huang	U. Michigan/Xian Jiaotong Univ.	shaopeng@umich.edu
9	Cermak Vladimir	Czech. Acad. Sci.	cermak@ig.cas.cz
10	Dmitry Demezhko	Inst. of Geoph., Rus. Acad. Sci.	ddem54@inbox.ru
11	Lijuan He	Institute of Geology and Geophysics, CAS	ljhe@mail.iggcas.ac.cn
12	Makoto Yamano	Earthq Res. Ins., Univ. of Tokyo	yamano@eri.u-tokyo.ac.jp
13	Niels Balling	University of Aarhus, Denmark	niels.balling@geo.ac.dk
14	Irina Sidorove	Inst. Of Geol and Geop., Uzbekistan	sidoirine@yahoo.com
15	Makoto Taniguchi	RIHN	makoto@chikyu.ac.jp
16	Shaowen Liu	Nanjing University, China	shaowliu@nju.edu.cn
17	Linyou Zhang	Institute of Geology and Geophysics, CAS	linyouzhang@mail.iggcas.ac.cn
18	O. Matsubayashi	ATST-GSJ, Japan	matsubayashi-osamu@aist.go.jp
19	Marcus Haynes	Australian National Uni	marcus.haynes@anu.edu.au
20	Hans- Jurgen Forster	GFZ, Germany	forhj@gfz-potsdam.de
21	Andrea Forster	GFZ, Germany	for@gfz-potsdam.de
22	Labani Ray	CSIR-National Geophysical Research Ins.	labani@ngri.res.in
23	David Sauer	DBI, Germany	david.sauer@dbi-gut.de
24	Petr Dedecek	Institute of Geophysics, Czech. Acad. Sci.	pd@ig.cas.cz
25	Akiko Tanaka	GSJ, AIST	akiko-tanaka@aist.go.jp
26	Yuka Masaki	JAMSTEC	yuka5n@jamstec.go.jp
27	Hideki Hamamoto	CESS	hamamoto33@gmail.com

Appendix II List of the intended submissions for an IHFC Special Issue in Journal of Geodynamics

No.	Author(s)	Title	Contact
1	D.Yu. Demezhko, B.D. Hatskevich, and M.G. Mindubaev	The structure of free thermal convection flows in water filled borehole inferred from a laboratory experiments	ddem54@inbox.ru
2	Maria Rosa Duque	An attempt to relate heat flow density, gravity, magnetic, geoid, elevation and seismic data in the SW of the Iberian Peninsula trying to obtain lithosphere thickness and information related with African and Iberian plate borders	mrada@uevora.pt

3	Jian Chang, Nansheng Qiu, Wei Xu	Cenozoic thermal regime of the Jizhong Sub-Basin, East China	changjian@cup.edu.cn
4	Yurii Khachai, Vsevolod Anfilogov, Alexandr Antipin	Formation of the Earth's lithosphere - asthenosphere surface initial heterogeneities	yu-khachay@yandex.ru
5	Mohan Gupta, S.R.Sharma	Heat flow in various parts of Rajasthan Craton, NW Indian Shield and its geodynamic implications	drmohanlalgupta@yahoo.com
6	Mohan Gupta, S.R. Sharma	Presence of potential Enhanced Geothermal Energy systems in NW Himalaya India: Evidence from various geodata	drmohanlalgupta@yahoo.com
7	Lijuan He, Linyou Zhang	Heat flow and thermal evolution of cratons in China	ljhe@mail.iggcas.ac.cn
8	Ben Norden, Andrea Förster, Hans-Jürgen Förster, Sven Fuchs	Temperature prediction in the uppermost sedimentary and crystalline crust: uncertainties related to <i>in-situ</i> (pT) rock-thermal conductivity and geological structure	ben.norden@gfz-potsdam.de
9	Hideki Hamamoto, Yuji Miyashita, Makoto Taniguchi	Integrated evaluation of potential for ground-source heat exchanger in a typical Japanese plain	hamamoto33@gmail.com
10	Hehua Xu , Wentao Zhang , Xiaobin Shi	Numerical simulation of rifting controlled by magmatic underplating in the South China Sea	xhhcn@scsio.ac.cn
11	Jiong Zhang, Shaopeng Huang, Yinhui Zuo, Wei Xu, Wentao Duan, Zhi Liu	Terrestrial Heat flow and 1D Geoelectric Model of the Baiyinchagan Sag, Erlian Basin, Central Asian Orogenic Belt	shaopeng@mail.xjtu.edu.cn
12	Wentao Duan, Shaopeng Huang, Ting Ke, Wei Xu	Numerical Simulation of the Geothermal Effect of the Millennium Eruption of the Changbaishan Tianchi (Mt. Paektu) Volcano at Sino-North Korean Border	shaopeng@mail.xjtu.edu.cn
13	Akiko TANAKA, Shusaku GOTO, and Makoto YAMANO	Data for heat flow studies in and around Japan	akiko-tanaka@aist.go.jp

14	Förster, H.-J., Labani Ray, Fuchs, S., Wulf, R. and FÖRSTER, A.	The thermal diffusivity of high-grade metamorphic rocks as function of T: Implications for temperature prediction for the deeper crust	forhj@gfz-potsdam.de
15	Chuanqing Zhu, Nansheng Qiu, Ming Xu , Shengbiao Hu	Tectonothermal evolution of the lithosphere in the Sichuan Basin since Cretaceous and its dynamic process, SW China	chuanqingzhu@yahoo.co m
16	Sergey Cherkasov	The Use of Unmanned Aerial Vehicle for geothermal exploitation monitoring4.doc	s.cherkasov@sgm.ru
17	Diego Barbero, Arianna Bucci, Domenico Antonio De Luca, Maria Gabriella Forno, Manuela Lasagna	STATISTICAL TEMPERATURE DISTRIBUTION IN THE SHALLOW SUBSURFACE OF THE PIEDMONT PO PLAIN (NW ITALY)	
18	Barbero D., Bucci A. , Chiozzi P., De Luca D. A., Forno M. G., Lasagna M., Verdoya M.	Borehole thermal logs in well fields: the Maggiore Valley case (NW Italy)	
19	Adele Manzella	To be defined	adele.manzella@igg.cnr.i t
20	Hamza, V.M., Alexandrino, C.H.	Reference framework for crustal geotherms, with constraints based on seismic data for the lower crust.	hamza@on.br
21	Sylvia Susanto and Hartmut Holländer	Geothermal Energy Extracted from Upper Carbonate Aquifer beneath a Major City in the Canadian Prairie	susantos@myumanitoba. ca