

CMG2022 Scientific Program

Monday, 20 June

14:00-16:00 Seoul-time (5:00-7:00 UTC)

14:00-14:30

Conference Opening

Chair: **Ilya Zaliapin**, Secretary of the IUGG Commission on Mathematical Geophysics

Welcome speeches

Alik Ismail-Zadeh, Chair of the IUGG Commission on Mathematical Geophysics

Kathryn Whaler, IUGG President

Sang-Mook Lee, Chair of the CMG2022 Local Organizing Committee

14:30-15:30

Keynote lecture

Chair: **Sang-Mook Lee**, Seoul National University, South Korea

*Space-time analysis using the Cyclostationary Empirical Orthogonal Function (CSEOF) Technique:
A New Trend in Geophysical Data Analysis*

Kwang-Yul Kim, Seoul National University, South Korea

15:30-16:00

Movie / Music

20:00-22:00 Seoul-time (11:00-13:00 UTC)

Theme 5. Geophysical Inversion: Theory, Algorithms, and Applications

Chair: **Malcolm Sambridge**, Australian National University, Australia

20:00-20:30

Optimal resolution tomography

Sergei Lebedev, University of Cambridge, UK (invited)

20:30-21:00

Bayesian inversion with deep generative models

Niklas Linde, University of Lausanne, Switzerland (invited)

21:00-21:30

Towards probabilistic inversions and uncertainty quantification in large-scale seismic inversions

Daniel Peter, KAUST, Saudi Arabia (invited)

21:30-21:45

Mimetic finite difference scheme to solve direct current resistivity forward modelling problem

Deepak Suryavanshi, IISER Pune, India

21:45-22:00

Examples of the use of concept of proximity measures in geophysics

Mikhail Rodkin, Russian Academy of Sciences, Russia

Tuesday, 21 June

8:00-10:00 Seoul-time (23:00-01:00 UTC-time)

Theme 5. Geophysical Inversion: Theory, Algorithms, and Applications

Chair: **Jan Dettmer**, University of Calgary, Canada (TBC)

8:00-8:15

Bayesian joint inversion of seismic sources in different data domains

Mahdi Hamidbeygi, University of Calgary, Canada

8:15-8:30

Uncertainty quantification for joint inversion of magnetotelluric, receiver function, and Rayleigh wave dispersion data

Pejman Shahsavari, University of Calgary, Canada

8:30-8:45

3D Bayesian potential-field data inversion with decorrelation of data residuals using 2D autoregressive models

Emad Ghalenoei, University of Calgary

Theme 3: From the Core to the Space: Different Spheres with Common Mathematics

Chairs: **Roberto Carniel**, Università di Udine, Italy (TBC);

Alexander Fournier, Institut de Physique du Globe de Paris, France (TBC)

8:45-9:00

Fast algorithm for terrain irradiance using compressed view factor matrices

Samuel F Potter, New York University, USA

9:00-9:15

On Stormer problem solution for the superposition of axially symmetric dipole and quadrupole magnetic fields

Jorge F. Brizuela Atencio, Universidad Nacional de Tucuman, Argentina

9:15-9:30

Diffusion of water vapor at lunar polar conditions

Norbert Schorghofer, Planetary Science Institute, USA

9:30-9:45

Forward modelling of strain and inversion for focal mechanisms from distributed acoustic sensing data

Jean Lecoulant, University of Calgary, Canada

9:45-10:00

Measurement-based perturbation theory for parameter estimation in differential equations

Peiliang Xu

15:00-16:00 Seoul-time (6:00-7:00 UTC)

POSTERS

Chairs: **Sang-Mook Lee**, Seoul National University, Republic of Korea;
Alik Ismail-Zadeh, Karlsruhe Institute of Technology;

15:00-15:07

Developing a river migration hazard map using numerical modeling and Monte Carlo methods
Brayden Noh, California Institute of Technology, USA

15:07-15:14

Analysis and comparison of rock magnetic properties of ophiolite and mid-ocean ridge mantle rocks using computational methods
Gilbert Hong, Seoul National University, Republic of Korea

15:14-15:21

A new quadrature-with-extrapolation algorithm for simulating electromagnetic fields in one-dimensional models
Pham Ngoc Kien, Seoul National University, Republic of Korea

15:21-15:28

Seismic velocity structure of the upper mantle beneath the oldest Pacific Ocean basin from finite-frequency travel-time tomography
Hyunsun Kang, Seoul National University, Republic of Korea

15:28-15:35

A preliminary machine-learning analysis of radiogenic geochemistry of the different volcanic edifices linked to the African LLSVP and their possible mantle source relationship
Hogyum Kim, Seoul National University, Republic of Korea

15:35-15:42

Harmonic decompositions analysis of the teleseismic receiver functions for the crustal anisotropic structure
Hobin Lim, Seoul National University, Republic of Korea

15:42-15:49

Earthquake precursory factors derived from earthquake catalogs with explainable machine learning
Jinsu Jang, Kangwon National University, Republic of Korea

20:00-21:00 Seoul-time (11:00-12:00 UTC)

Panel “Basic Science and Mathematics for Sustainable Development”

The aim of the panel is to raise awareness about the United Nations International Year of Basic Sciences for Sustainable Development enthusiastically supported by the International Science Council (ISC) and several ISC Members including IUGG. Distinguished panelists will discuss how basic science, mathematics, science education and policymaking should be integrated in solving fundamental problems of nature and society and in contributing to solving challenging issues of sustainability. Bringing their broad experience in mathematics, (geo)science, education, national and international scientific cooperation and science promotion, the panelists will highlight the ways of achieving sustainable development goals using basic science and science for society.

Panelists:

Qiuming Cheng, Former President, International Association of Mathematical Geosciences; Immediate Past President, International Union of Geological Sciences; Professor of the China University of Geosciences and Member of the Chinese Academy of Sciences, Beijing, China

Motoko Kotani, President-Elect, International Science Council; Executive Vice President for Research, Tohoku University, Sendai, Japan

Michel Spiro, Chair of the Steering Committee, United Nations International Year of Basic Sciences for Development; President, International Union of Pure and Applied Physics; former President of CERN Council, Switzerland

Kathryn Whaler, President, International Union of Geodesy and Geophysics; Professor, University of Edinburgh, UK

Jaejun Yu, Dean of the College of Natural Sciences and Professor, Seoul National University, Republic of Korea

Moderator:

Alik Ismail-Zadeh, Inaugural Secretary of the International Science Council; past Secretary General of the IUGG; Senior Research Fellow, Karlsruhe Institute of Technology, Germany.

Wednesday, 22 June

14:00-16:00 Seoul-time (5:00-7:00 UTC)

Theme 4. Mathematics for Natural Hazards Science

Chair: **Salvatore Grimaldi**

14:00-14:30

Machine learning concepts and methods for addressing probabilistic hydrological forecasting challenges
Georgia Papacharalampous, Czech University of Life Sciences, Czech Republic (invited)

14:30-14:45

Multiphysics resonance of reaction-cross-diffusion waves as nucleation mechanism for earthquakes
Klaus Regenauer-Lieb, Curtin University, Australia

14:45-15:00

Probabilistic Seismic Hazard Assessment (PSHA) in Western Himalaya
Daya Shanker, Indian Institute of Technology Roorkee, India

15:00-16:00

Keynote lecture (2022 Vladimir Keilis-Borok Medalist)

Chairs: **Alik Ismail-Zadeh**, Karlsruhe Institute of Technology, Germany;
Sang-Mook Lee, Seoul National University, Republic of Korea

Linear inverse problems and quadratic spectral estimators of planetary potential-field data collected at satellite altitude: theory and applications

Frederik J Simons, Princeton University, USA

20:00-22:00 Seoul-time (11:00-13:00 UTC)

Theme 4. Mathematics for Natural Hazards Science

Chairs: **Salvatore Grimaldi**, University of Tuscia, Italy; **Daniel Scherzer**, Ecole des Ponts ParisTech, France

20:00-20:30

Assessing numerical lava flow models

Einat Lev, Columbia University, USA (invited)

20:30-20:45

The power release from microstructure and its role for geohazards

Manman Hu, The University of Hong Kong, China

20:45-21:00

Impact of urban heat island on human mortality risk

Katty Huang, University College London, UK

21:00-21:30

How can contemporary climate research help understand epidemic dynamics? Ensemble approach and snapshot attractors

Tamás Kovács, Eötvös University, Hungary (invited)

21:30-21:45

Estimates of the sea-level rise rate from tide gauges: the effects of data heterogeneity

Alexander Shapoval, University of Lodz

21:45-21:52

Hydrological assessment of rain gauges' distribution: application of the fractal dimension concept

Igor Paz, Military Institute of Engineering, Brazil (POSTER)

Thursday, 23 June

8:00-10:00 Seoul-time (23:00-01:00 UTC-time)

Chair: **Ilya Zaliapin**, University of Nevada Reno, USA

Theme 2. Geophysical Fluid Dynamics

8:00-8:30

The relationship between sedimentation dynamics and hydrological connectivity within the deltaic islands of Wax Lake Delta, LA, USA

Doug Edmonds, Indiana University, USA (invited)

8:30-9:00

Critical Tokunaga model for river networks

Yevgeniy Kovchegov, Oregon State University, USA (invited)

Theme 4. Mathematics for Natural Hazards Science

9:00-9:30

Contribution of deformation models to the 2023 U.S. National Seismic Hazard Model

Fred Pollitz, United States Geological Survey, USA (invited)

POSTERS

9:30-9:37

An alternative way of considering anisotropy in isotropic tomography inversion

Hwaju Lee, Seoul National University, Republic of Korea

9:37-9:44

The accurate pressure recovery for geodynamics using penalty method

Sangjin Park, Kangwon National University, Republic of Korea

9:44-9:51

Lithospheric strength inferred from modeling of buckling structure: implications for stress state of the East Sea (Japan Sea)

Seokhyeon Do, Kangwon National University, Republic of Korea

14:00-16:00 Seoul-time (5:00-7:00 UTC)

Theme 2. Geophysical Fluid Dynamics

Chair: **Alik Ismail-Zadeh**, Karlsruhe Institute of Technology, Germany

14:00-14:30

Numerical simulation of magma intrusion, ascend and deposition in volcanic environments

Oleg Melnik, Lomonosov Moscow State University, Russia (invited)

14:30-15:00

On lava domes and the geometry of their vents

Catherine Meriaux, University of Rwanda, Rwanda (invited)

15:00-15:15

Mathematical and numerical models of lava dome dynamics

Natalya Zeinalova, Karlsruhe Institute of Technology, Germany

15:15-15:30

Non-linear waves and ligaments in geophysical flows

Yuli D. Chashechkin, Russian Academy of Sciences, Russia

Theme 5. Geophysical Inversion: Theory, Algorithms, and Applications

Chair: **Kerry Gallagher**, University of Rennes, France

15:30-15:45

Trans-dimensional geoaoustic inversion for an autonomous underwater vehicle survey

Tim Sonnemann, University of Calgary, Canada

15:45-16:00

Processing strategy for airborne vector gravimetry based on spatial gravity modeling

Vadim Vyazmin, Lomonosov Moscow State University, Russia

20:00-22:00 Seoul-time (11:00-13:00 UTC)

Theme 1. Data Sciences, Machine Learning and Artificial Intelligence

Chair: **Daniel Scherzer**, Ecole des Ponts ParisTech, France

20:00-20:30

Local and global multifactorial analysis of turbulent flows

Berengère Dubrulle, CNRS, France (invited)

20:30-20:45

Regular and singular motions in a continuously stratified fluids

Artem A. Ochirov, Russian Academy of Sciences, Russia

20:45-21:00

Multi-fractal scaling behavior of the Himalayan seismicity: Implications on energy dissipation mechanism

Simanchal Padhy, Indian Institute of Technology Roorkee, India

21:00-21:15

Estimating model uncertainties in the scaling function inversion of gravity data

Mahak Singh Chauhan, National Geophysical Research Institute, India

21:15-21:30

On exploiting big data from oil and gas industry social medias: A sentiment analysis of Algerian data

Hasna Yazid, M'hammed Bougara University of Boumerdes, Algeria

21:30-21:45

Well log analysis and lithological classification by artificial neural network (ANN)

Boussa Lamia, Sonatrach Company, Algeria

POSTERS

21:45-21:52

Sediment buoyancy controls subduction kinematics and dynamics: Insight from 3D viscoelastic free subduction model

Jae-Yoon Keum, Kangwon National University, Republic of Korea

21:52-21:59

Development of finite element method-based strain calculation strategy: Application to geological structure models in compressional and extensional settings using discrete element method

Soojung An, Kangwon National University, Republic of Korea

Friday, 24 June

14:00-16:00 Seoul-time (5:00-7:00 UTC)

Theme 1. Data Sciences, Machine Learning and Artificial Intelligence

Chair: **Enamudram Chandrasekhar**, Indian Institute of Technology Bombay, India

14:00-14:30

Integral transforms in the inversion of geophysical data: A simple and comprehensive review
Sundararajan Narasimman, Sultan Qaboos University, Oman (invited)

14:30-14:45

Prediction of ionospheric total electron content data using spatio-temporal residual networks
Nayana N. Shenvi, Goa College of Engineering, India

14:45-15:00

Applying artificial intelligence methods for simulating atmospheric CO₂ concentration from polar temperature proxy records
Nasrin Salehnia, Seoul National University, Republic of Korea

15:00-15:15

Scaling spectral inversion of potential field data to infer sub-surface source distribution
Vijay P. Dimri, CSIR-National Geophysical Research Institute, India

15:15-15:30

Intermittency in drop impact flows in a wave field on a fluid surface
Yuli D. Chashechkin, Russian Academy of Sciences, Russia

15:30-15:45

Multifractal analysis of ionospheric total electron content data
Enamudram Chandrasekhar, Indian Institute of Technology Bombay, India

15:45-16:00

Estimating the parameters of truncated Gutenberg-Richter distribution: new approaches
Vladilen F. Pisarenko, Russian Academy of Sciences, Moscow, Russia

20:00-21:00 Seoul-time (11:00-12:00 UTC)

Discussion / Closing