

Geoscience Information Super-Symposium

34TH INTERNATIONAL GEOLOGICAL CONGRESS

5-10 August 2012 - Brisbane, Australia

In this era of data-intensive scientific discovery – the so-called ‘Fourth Paradigm’ – the significance of interoperable data, information, systems and infrastructures is paramount in advancing the entire geoscience discipline and responding to the great societal challenges. This extensive theme of the 34th IGC will be the first major international geoscience information meeting of the decade. It aims to build on the successes of the 33rd IGC by attracting leading speakers from across the globe to present ‘the state of the science’ and to stimulate discussion on the major challenges ahead that must be addressed in order to move the field of geoscience information to the next level.

The theme encompasses spatial data infrastructure and regional geoinformation initiatives; interoperability and standards; delivery, dissemination and exploitation of geoscience data and information; mathematical geology and geostatistics; model fusion, visualisation, exploration and 3D & 4D modelling; tools – software, hardware, open source and super computers.

Sponsored By

CGI-IUGS

The Commission for the Management and Application of Geoscience Information is a Commission of the International Union of Geological Sciences. Website: www.cgi-iugs.org

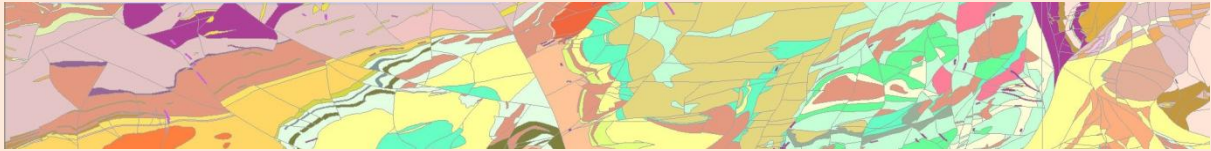
IAMG (International Association for Mathematical Geosciences)

The mission of the IAMG is to promote, worldwide, the advancement of mathematics, statistics and informatics in the Geosciences. Website: iamg.org

GIC (Geoscience Information Consortium)

GIC Mission: Exchange of information among Geological Surveys Organisations related to the use and management of geoscience information systems in support of the earth sciences internationally. Website: www.geology.cz/gic





Full List of Sessions

Theme 5: Geoscience Information

Theme coordinators: Bruce Simons, Simon Cox, Richard Hughes, Robert Tomas, June Hill, Lesley Wyborn

Symposia

5.1 Geoscience Spatial Data Infrastructure

Robert Tomas (robert.tomas@jrc.ec.europa.eu), Bruce Simons (Bruce.Simons@dpi.vic.gov.au)

Symposium for regional geoscience information activities and developments from Oceania, Africa, Asia, Europe and the Americas. The latest news from geoscience-related Spatial Data Infrastructure development around the world, with particular reference to the pan-European INSPIRE initiative and SDI, the North American GIN and Geoconnections initiatives and the Australian AuScope project

5.1.01 Geoscience Information in today's online spatially-enabled world (Kristine Asch & Francois Robida). Covering general contributions to geoscience information and the integration and relationship of geoscience Spatial Data Infrastructure (SDIs) to more generic SDIs.

5.1.02 Geoscience Information Developments in Europe (Robert Tomas & Jean-Jacque Serrano). Recent developments in Europe, including the latest news from the pan-European INSPIRE initiative and Spatial Data Infrastructure.

5.1.03 Geoscience Information developments in North America (Steve Richard & John Broome). Recent developments in North America, including the Geoscience Information Network.

5.1.04 Geoscience Information Developments in the Oceania Region (Mark Rattenbury). Recent developments in Oceania, including the Australian AuScope initiative.

5.1.05 Geoscience Information Developments in the Asia (Koji Wakita). Recent developments in Asia and South East Asia.

5.1.06 Geoscience Information Developments in Africa (Kristine Asch & Dana Capova). Recent developments, technical architecture and infrastructure of geoinformation systems in Africa, including the GIRAF and AEGOS initiatives.

5.1.07 Geoscience Information Developments in South and Central America (Gabriel Asato, Paulina Gana & Jorge Gomez Tapias). Recent developments in South and Central America.

5.2. Information Management - Interoperability and Standards

John Laxton (jll@bgs.ac.uk), Simon Cox (Simon.cox@csiro.au)

Geoscience information management best practise and standards for digital and analogue data; thesauri, dictionaries, vocabularies, ontologies and semantics. Development and application of information exchange formats underpinning interoperability (GeoSciML, GML, EarthResourceML, OGC and other standards), mapping data models to standards; successes, best practise and lessons learnt.

5.2.01 Information Management - managing non-digital data and digital conversion (Marco Amanti & Dana Capova). Looking after the ground truth: the problems and opportunities in managing non-digital data and putting new life into old data through digital conversion and exploitation of paper records, integration of primary documentation and sample collections into comprehensive information systems, virtual museums.

5.2.02 Information Management - developing schematic standards (Peter Baumann Ali Al-Mishwat). Developing Information Models, Databases & Architecture.

5.2.03 Information Management - applying information exchange standards (John Laxton & Simon Cox). Applying information exchange standards, mapping data to information standards, lessons learnt (GML, GeoSciML, EarthResourceML, OGC & other standards).

5.2.04 Content management - semantic standards development (Guillaume Duclaux & Steve Richard). The critical role of thesauri, vocabularies, ontologies and dictionaries in digital systems.

5.2.05 Content management – metadata: can it be automatically generated? (Lesley Wyborn) Indexing and searching geoscientific information. If you can't find the data, why bother collecting and keeping it? However, capturing effective metadata can be time consuming. With increasing volumes of data, systems that automatically generate metadata are becoming critical.

5.2.06 Standardised approaches for the registration and discovery of physical specimens in the digital age (Kerstin Lehnert & Lesley Wyborn). An internationally unified approach is needed for the registration and discovery of physical specimens in the Geoscience community, particularly those that are used to generate new data such as chemical analysis, age determinations and microscope specimens.

5.2.07 Enabling geoscience data to be part of the future grand challenges of global science (Lesley Wyborn). Increasingly geoscience data is being seen as fundamental to issues related to environment, climate, water and the biosphere. Standards development in the Geoscience domain cannot be done in isolation: cross domain linkages with other domains are essential.



5.3. Delivery, dissemination and exploitation of geoscience data and information

Richard Hughes (rah@bgs.ac.uk), Oliver Raymond (Oliver.Raymond@ga.gov.au)

Strategic and technical progress, developments and plans from the OneGeology Global and OneGeology Europe initiatives. The creation of information and knowledge from geoscience data to address societal needs and create societal impacts and benefits; intellectual property and digital rights management in the digital era. Developments and best practise in the delivery of dynamic and static data and information.

This symposium includes:

Presentation by the winner of the OneGeology Best Application Competition.



The main aim of the OneGeology Best Application competition is to demonstrate the wide range of potential applied uses and applications that the OneGeology Portal, and geological data/services that it provides, can offer for easy discoverability, access and use.



www.onegeology.org/igc34/competition.html

5.3.01 Information dissemination & delivery - Decision support systems (Oliver Raymond & Richard Hughes). Best practise in using GIS and geoscience data to help society's problems.
KEYNOTE SPEAKER: Ian Jackson

5.3.02 Dynamic delivery of information (Jean-Jacque Serrano). Harnessing the real time power of the internet with emphasis on geoscience portal developments

5.3.03 Intellectual Property, licensing and the creative commons (Mark Thornton & Greg Jenkins). The problems and issues of disseminating geoscience data in a digital era, including digital rights management, licensing, Intellectual Property Rights, copyright, the cost of public sector data, liability, security and authentication of web-based databases.

5.3.04 OneGeology - Progress to date and future plans (Ian Jackson, John Broome & Francois Robida). An over-arching strategic session to deal with the general progress and operational matters and the future.

5.3.05 OneGeology - Supporting Technology, Tools and Standards (Tim Duffy & Agnes Tellez-Arenas). Papers relating to the OneGeology Technical Working Group progress.

5.3.06 OneGeology - Regional and National Initiatives (Ian Jackson, John Broome & Francois Robida). Regional and national components of OneGeology, such as OneGeology-Europe as well as any national input.

5.4. Tools – software, hardware, open source

Peter Baumann (p.baumann@jacobs-university.de)

Information technology challenges and solutions in the geosciences; data management and assimilation on the petabyte scale; high performance computing, cloud and grid technologies in the geosciences. Digital mapping techniques and methodologies, digital data capture and digital workflows from field to output; digital cartography techniques and standard.

5.4.01 Geosciences and computing – hardware, software and middleware technology and systems for the geosciences (Peter Baumann & Jorge Gomez Tapias). How much more space and speed will we need? Issues relating to the current and future provision of digital storage and network performance

5.4.02 Geosciences and computing – Free and open-source geospatial software (Peter Baumann). Applications for Earth Sciences.

5.4.03 Geosciences and computing – Digital Mapping Techniques (Gabriel Asato). A session about cartographic data management, generalization, cartographic data models, cartographic standards and digital techniques, new products, on line products, symbology libraries, algorithms for cartographic representation, constraints in data representation, etc.

5.4.04 Geosciences and computing – Where to now? (Lesley Wyborn, Lutz Gross & Robert Woodcock). The application of high performance computing, grid cloud and simulation technology in geoscience: GPUs and virtualisation; workflows become king.

5.4.05 Digital Data Capture – Advances in digital data capture in geological mapping (Colm Jordan). The chain of information / workflow from the field to the end user.

5.4.06 Virtual Geoscience Laboratories: enabling integrated online access to infrastructure, data, tools and services (Lesley Wyborn & Robert Woodcock). New models of data access are developing where by digital data libraries can be accessed online, enabling clients to download only the portions of data they require. In more advanced workflows the data selected can be analysed using cloud computing services and there is no need to locally download or store applications.

5.5. Model fusion, visualisation, exploration and 3D & 4-D modelling

Laurent Ailleres (Laurent.Ailleres@monash.edu), Holger Kessler (hke@bgs.ac.uk), Mark Jessell (mark.jessell@gmail.com)

Progress and developments in linking process- and time-dependent models across the environmental science disciplines towards the development of predictive environmental modelling platforms. 2-, 3-, 4- and n-D geoscience information, modelling and immersive visualisation systems; error and uncertainty in such systems; deployment of such systems in geological surveys and agencies.

5.5.01 Multi-dimensional modelling and visualisation of solid earth models - 2D, 3D, 4D, nD (Helmut Schaeben, Nick Smith, Holger Kessler & John Cannon). In this session the objective is to

discuss techniques and systems to aid the visual exploration of solid earth data and models. The scope of this session includes:

- 3D visualization of Earth models and structures at various scales and resolutions
- 4D visualization of time-varying spatial data
- dealing with large datasets interactively in real-time (or near real-time)
- visualizing multiple datasets.

KEYNOTE SPEAKER: Steve Mathers

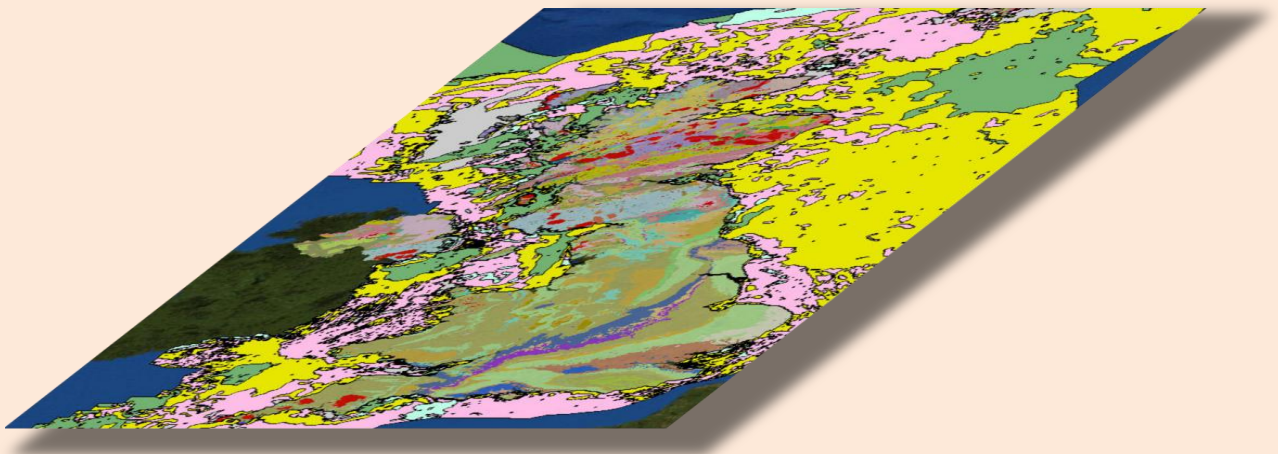
5.5.02 Multi-dimensional modelling - Moving geological surveys to a 3D culture (Mark Rattenbury & Steve Mathers). Overcoming challenges associated with moving traditional 2D mapping processes to the third dimension. KEYNOTE SPEAKER: Holger Kessler

5.5.03 Multi-dimensional modelling - Uncertainty in GIS and 3D modelling (Nick Smith, Mark Jessell & Laurent Ailleres). Approaches to quantify and represent error in interpreted and sparse digital datasets

5.5.04 Visualisation and interaction through virtual reality and augmented reality technologies (Laurent Ailleres & Tim Rawling). Session to cover the future directions of virtual reality and augmented reality technologies in the geosciences.

5.5.05 Model fusion - Linking process models from across the geosciences to other environmental models (Arlei Benedito Macedo, Nick Smith & Holger Kessler). Linking process models from the geosciences to other environmental models, enables a transdisciplinary understanding of the environment. Understanding the many human and natural processes that come together in the zone of human interaction can realistically be achieved and allows a holistic view of water supply, waste management, pollution, natural hazards and natural resources. We welcome submissions that describe plans, methodologies and solutions in this challenging domain.

5.5.06 Model fusion - Integrating Geological and Non-Geological data (Nick Smith, John Laxton, Ollie Raymond & Tim Rawling). Integrating geological and geophysical datasets for 3D modelling.



5.6. Mathematical Geosciences

June Hill (June.Hill@csiro.au), Ricardo Olea (rolea@usgs.gov)

Applications of geomathematical analysis and modelling in the field of resource exploration. New advances and methodological challenges in the analysis of spatial, time-dependent and compositional geoscience data. Application of geostatistical and geomathematical methodologies and tools to the interpretation of geochemical data, remotely sensed data, rock anisotropy, and climate data.

IAMG AWARDS

The IAMG will be presenting the following awards during this symposium:

The William Christian Krumbein Medal is the highest award given by the Association and is awarded to senior scientists for career achievement, which includes distinction in application of mathematics or informatics in the earth sciences, service to the IAMG, and support to professions involved in the earth sciences. There is no stipulated preference for fields of application within the earth sciences.

The John Cedric Griffiths Teaching Award is presented to honour outstanding teaching, especially for teaching that involves application of mathematics or informatics to the Earth's non-renewable natural resources or to sedimentary geology.

5.6.01 Data Analysis in the Geosciences (Vera Pawlowsky-Glahn, Juan J. Egozcue & Raimon Tolosana-Delgado). The session will address new advances and challenges in methods for the analysis of geoscientific data, including spatial, time-dependent and compositional data. KEYNOTE SPEAKERS: Dr Helmut Schaeben, Dr Juan Jose Egozcue

5.6.02 Success stories in geocomplexity: Non-linear processes, networks and patterns in geosciences (Qiuming Cheng & Frits Agterberg). Non-linear models as a rational foundation for the statistics and modelling of natural systems including earthquakes, floods, landslides and climate change. Mineral deposits often exhibit multifractal characteristics and local singularities. Case history studies of this type are particularly welcome in this session. KEYNOTE SPEAKER: Prof Tom Blenkinsop

5.6.03 Geostatistics for Modelling Complex Geological Systems (Jef Caers & Gregoire Mariethoz). This session will focus on novel geostatistical methods that aim to realistically represent complex geological systems in a wide variety of applications, such as oil and gas fields, aquifer modelling, mining deposits etc.... The focus will be on multiple-point geostatistics, process-based and surface-based methods, pattern-based models or advanced variogram-based techniques. Theoretical as well as field application or state-of-the-art reviews are welcome. KEYNOTE SPEAKER: Prof Roussos Dimitrakopoulos

5.6.04 Soft Computing and Intelligent Methods in Mathematical Geology (Ioannis Kapageridis). This session will include research and application papers on the use of soft computing techniques such as neural networks, genetic algorithms, fuzzy systems and intelligent agents systems for solving geosciences problems of classification, prediction, estimation and control.

5.6.05 Stochastic characterisation of rock masses (Peter Dowd). The primary focus of the session would be stochastic modelling of fractures and fracture networks in rock masses and the modelling of fracture propagation under natural and induced conditions. It could also include stochastic modelling of any rock property that characterises rock masses. Applications include enhanced geothermal energy systems; characterisation of rock masses for safe underground disposal of hazardous wastes; mining methods (e.g., block caving). The purposes of the applications include design (e.g., of enhanced geothermal reservoirs or of mining methods) and risk assessment.

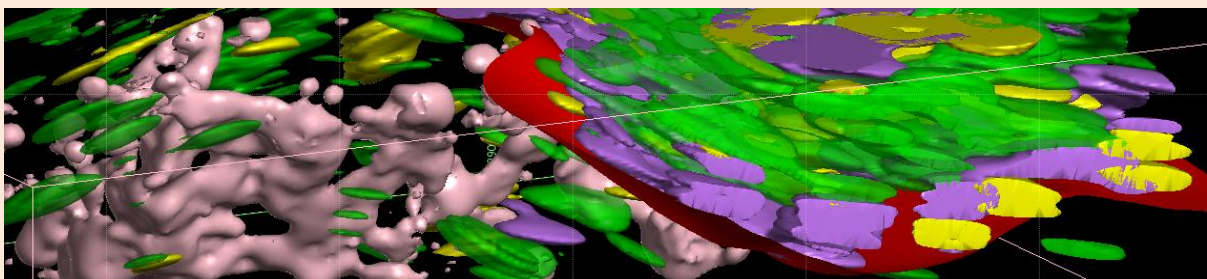
5.6.06 Crystallographic Preferred Orientation and Anisotropy of Rocks (Helmut Schaeben & David Mainprice). As conveners of the session we would like to invite you to participate actively in this session with contributions covering a wide range of topics including:

- data collection by X-ray, neutron, synchrotron or electron backscatter diffraction (EBSD), for post-mortem or in situ study of experimental samples, as well as geological specimens,
- data analysis (integral pole figure or spatially referenced individual orientation data) to compute orientation and misorientation density functions and their characteristics, calculation of anisotropic properties, grain reconstruction, to quantify fabric, phase transformation and metamorphic reactions
- data interpretation in terms of deformation, recrystallization, anisotropic properties and their application to tectonics and geodynamics,
- simulation of texture and fabric development.

Thus both methodological developments and case studies are solicited. KEYNOTE SPEAKER: Dr Steven Reddy

5.6.07 Geomathematics, Geoinformatics and Remote Sensing (Ute Herzfeld). The session will invite contributions on geomathematical and geostatistical methods and algorithms, aimed at innovative analysis of remote-sensing observation, and on computational and geoinformatical implementations. Remote sensing data may include satellite, airborne, field, marine and terrestrial observation types, image-type and discrete measurements. Computational and informatic methods may focus on the mathematical or statistical approach, or on graphical, visual, web, mapping, cyber-infrastructure ...any imaginable component or implementation.

5.6.08 Quantitative mineral resources estimation (Qiuming Cheng & Frits Agterberg). Emphasis in this session is on probabilistic evaluation of regional or global ore and hydrocarbon resources that have not yet been discovered. For example, GIS-based methods such as Weights-of-Evidence and logistic modelling can be used in regional studies. Both mathematical-statistical and subjective, fuzzy-logic type contributions are welcome. KEYNOTE SPEAKERS: Dr Graeme Bonham-Carter, Dr Eric Grunsky



5.6.09 Geoscience information synthesis for mineral prospectivity mapping (Alok Porwal & John Carranza). The session covers mathematical-model-based integration of geoscientific datasets in a GIS-environment for delineating prospective target areas for mineral exploration, with presentations on latest developments including exposition of new models and case histories documenting applications of established models. KEYNOTE SPEAKER: Arianne Ford

5.6.10 Numerical modelling of basins and petroleum system modelling (Paolo Ruffo & Carlo Doglioni). In recent years the numerical geological modelling improved its capabilities to model more geological processes and with more efficiency. The complexity of this modelling still requires both theoretical and experimental developments. Potential topics are:

- Basin modelling in different geodynamic contexts;
- Modelling plate tectonics as a tool for understanding basin evolution;
- Modelling heat flow variability in different tectonic settings;
- Basin Characterisation: palaeo-environment and sedimentation;
- High Pressure-High Temperature: Geomechanics and Petroleum System Modelling;
- Source Characterization and Unconventional Resources;
- Petroleum System Modelling & Reservoir studies;
- Prospect Risk Evaluation & Petroleum System Modelling;
- High Definition Basin Modelling: visualisation and numerical issues of “GigaCells” Models.

KEYNOTE SPEAKERS: Prof Michael Gurnis, Prof Chris Scotese

5.6.11 Spatio-temporal data mining and data analysis (Thomas Landgrebe & Guillaume Duclaux). The increasing prevalence and availability of age-coded digital Geoscientific data is creating opportunities to combine data from multiple sources, and study complex spatio-temporal relationships. This unified analysis across spatio-temporal domains and different modes of data is presenting new challenges associated with a higher degree of simulation and analysis complexity, going beyond what traditional scientific tools are offering. In this session we welcome contributions where formal spatio-temporal data analysis is playing an important role. KEYNOTE SPEAKER: Dr Bruce Eglington

5.6.12 New Theories and Methods in Resources Exploration (Katsuaki Koike, Margaretha Scott & Ryoichi Kouda). This session invites paper combining state-of-the art theories and technologies for exploring and assessing both renewable and non-renewable resources presuming exploitation with minimum environmental impact and geosequestration. (Co-sponsored by ISME). KEYNOTE SPEAKERS: Dr Donald Singer, Dr Magaretha Scott, Dr Katsuaki Koike

5.6.13 Advanced models in sediment dynamics applied to marine geology and climatology (Jan Harff, James Syvitski & Dan Tetzlaff). Recent developments of models have opened new doors in balancing erosion, transport and accumulation of sediments on different temporal and spatial scales. The session invites sedimentologists, marine geologists, basin modellers, paleoceanographers, and – climatologists to discuss the state of the art and future potential in numerical modelling of sediments dynamics on the geological scale as a results of tectonic, climatic and oceanographic forcing. In the session we will shed light on theory, numerical models and parameterization not only for historical reconstructions, but - in connection with climate models - also for future projections. KEYNOTE SPEAKER: Dr Cedric Griffiths

Abstracts of papers are invited for consideration for presentation as Offered Papers at the 34th IGC. Offered Papers may be presented at the 34th IGC as oral or poster presentations. All abstracts will be reviewed by the appropriate Symposium/Session convenors.

Details on abstract submission can be found on the IGC34 website

Abstract submissions close 17 February 2012

www.34igc.org

