



IUGG Commission on Geophysical Risk and Sustainability

URL: <http://www.iugg-georisk.org/>

## Annual Report

Period covered: 01.12.2004-31.12.2005

The IUGG Commission on Geophysical Risk and Sustainability (IUGG GeoRisk Commission) established by the IUGG Bureau in August 2000 is dedicated (i) to promoting scientific studies applied to the reduction of risk from natural hazards in an increasingly urbanized world and sustainability and (ii) to reducing death and destruction from natural and technological hazards by providing hazards data and information to emergency managers, policy-makers, scientists and the general public in the most timely and effective manner as possible. This includes the integration of knowledge concerning environmental, social and economic processes. The fundamental scope of this Commission is to facilitate communications – between scientists via meetings, workshops and publications, as well as between scientists and decision makers, between scientists and the public, and between scientists and schools.

The GeoRisk Executives and Commissioners are:

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The GeoRisk Commission Executive was appointed by the IUGG Executive during the Executive Board meeting in August 2004 and took office at the Hyderabad GeoRisk Business meeting in December 2004.

## **Statement of the Commission**

A magnitude 9 great earthquake occurred on December 26, 2004 off the west coast of northern Sumatra, South Asia. Huge tsunami waves were triggered by this great earthquake, and the coastal zones around the Indian Ocean were assailed by these tsunami waves. More than 300,000 people lost their lives in a dozen countries and 500,000 were injured, and up to million of these people are still lacking for basic services.

On 7<sup>th</sup> January 2005 the GeoRisk Commission adopted the Statement on the Greatest Earthquake and Tsunami of the Early XXI Century and the Need for Urgent Action to Reduce Natural Disasters in the Indian Ocean Region and Elsewhere. Among major recommendations of the Commission are the following:

1. The countries around the Indian Ocean to set up a Disaster Management Center in order to monitor land, ocean and atmosphere in relation to all kinds of natural hazards, especially those related to coastal regions. Such Centers should be established in any disaster-prone coastal regions where they do not already exist (e.g., Mediterranean Sea and Atlantic Ocean).
2. A Tsunami Warning System to be set up in the region. Before such systems are in operation in the region, the Pacific Tsunami Warning Center in Hawaii should extend its warnings to cover all vulnerable areas in the Indian Ocean.
3. Multidisciplinary and multinational research programs and research networks on geophysical hazards and risks to be developed in the Indian Ocean countries in order to integrate diverse data streams, to improve understanding of the natural phenomena associated with the disasters, to develop predictive modeling capability, and to generate and to disseminate timely and accurate information needed by decision makers and the public.

The Statement can be found at web:

[http://www.iugg-georisk.org/reports/IUGG\\_GeoRisk\\_st\\_full.pdf](http://www.iugg-georisk.org/reports/IUGG_GeoRisk_st_full.pdf)

Based on the Statement of the IUGG GeoRisk Commission, on 10th January 2005 International Union of Geodesy and Geophysics issued a Resolution on the Sumatra earthquake and tsunami (<http://www.iugg.org/tsunamiresolution05.pdf>).

In the light of these tragic events in the Indian Ocean, on 17th January 2005 International Council for Science (ICSU) produced a Position Statement based also on the materials of the IUGG GeoRisk Commission's Statement

([http://www.icsu.org/3\\_mediacentre/INSIGHT\\_SI\\_01\\_2005.html](http://www.icsu.org/3_mediacentre/INSIGHT_SI_01_2005.html))

## **Scientific Meetings Organized by the GeoRisk Commission**

### **1. Hazards 2004 – Hyderabad Workshop**

Hazards 2004 was the name given to the combined meeting that constituted the Third Workshop of the IUGG Commission on Geophysical Risk and Sustainability & the Tenth International Symposium on Natural and Human-Induced Hazards of the Natural Hazards Society. The meeting was held in Hyderabad, India 2-4 December 2004. There were 120 attendees comprising 40 foreign scientists and 80 Indian scientists. The conference itself was

excellently organized. Dr R.K. Chadha and Dr. D. Srinagesh – the Chair and Secretary-General of the Local Organising Committee – had the full support of Dr. V.P. Dimri, their employer and the Director of the National Geophysical Research Institute (NGRI) – one of the Indian CSIR research institutes and the location where the conference was held.



During the Hyderabad business meeting of the GeoRisk Commission. From the left to the right: D. Rowbotham, R. Singh, T. Beer, E. Kontar, A. Jayawardena (first row), A. Ismail-Zadeh, P. Dunbar, Representative of the Indian Ministry of Science and Technology, G. Tetzlaff (second row)

Peer-reviewed papers of two scientific meetings organised by GeoRisk Commission in 2004 (Stockholm and Hyderabad) are to be published in 2006 in a special issue "Geohazards & Georisk" of the Springer journal *Natural Hazard* (Dr. Tom Beer and Dr. Alik Ismail-Zadeh serve as Guest Editors of the special issue).

## 2. International Workshop "Recent Geodynamics, Georisk and Sustainable Development of the Black Sea to Caspian Sea Region" – Baku Workshop

The 4th Advanced Research Workshop organized by the IUGG Commission on Geophysical Risk and Sustainability in association with the International Hydrological Program of UNESCO, American Geophysical Union, Azerbaijan National Academy of Sciences, Heidelberg Academy of Sciences and Humanities, and Earthquakes and Megacities Initiative, was held in Baku, Azerbaijan from 3 to 6 July 2005. About fifty scientists from 12 countries attended, and 19 invited speakers delivered talks at the workshop. The workshop was supported by IUGG, UNESCO, and ExxonMobil Company.

The Workshop brought people of natural, social and political sciences together with the representatives of industry, governments, and mass media to prepare the social and political background for sustainable development in the Black Sea to Caspian Sea region. The invited and contributed presentations dealt with the recent geodynamics of the region, natural hazards (earthquakes, mud volcanoes, landslides, rapid sea level changes), associated risks, and

mitigation of the impacts of geohazards on society. The Program and Abstracts of the Workshop can be downloaded from:  
[http://www.iugg-georisk.org/events/workshops/baku2005/program\\_abstracts.pdf](http://www.iugg-georisk.org/events/workshops/baku2005/program_abstracts.pdf).



Participants of the Baku Workshop. From the left to the right: H. Kipphan, F. Wenzel, Z. Javakhishvili, B. Mueller, S. Alieva, E. Virgino, E. Kontar (first row), J. Knapp, A. Ismail-Zadeh, B. Panahi, T. Beer (second row), G. Delisle, J. Paterson, A. Szollosi-Nagy, T. I. Zadeh (third row), R. Nicolich, V. Kossobokov (fourth row)

The Workshop participants adopted recommendations to governments, relevant UN agencies, ICSU bodies, and funding institutions. The text of the Baku Workshop's recommendations can be found at

<http://www.iugg-georisk.org/events/workshops/baku2005/wsrecommend.pdf>

The Workshop participants visited active mud volcanoes of the Absheron peninsula, Azerbaijan (<http://www.iugg-georisk.org/events/workshops/baku2005/mudvolc.jpg>). Despite their present "peaceful" activity, dynamics of mud volcanoes is quite complicated. One of the mud volcano's eruptions in the middle of XXth century is considered as a large event: gas and mud fountain from the Earth's interior rose to about 1000 m above the orifice of the volcano, and a large area was covered by mud lavas.

One of the first results of the IUGG-UNESCO Workshop in Baku is a new GeoRisk project: "Measuring and Modeling of Direct Groundwater Discharge into the Caspian Sea" prepared and submitted to IHP/IOC/UNESCO. The Caspian Sea is a focal point of important economic activities (oil/gas exploitation, fishing, etc.) and a crossroads for five riparian countries. Unfortunately, serious environmental contamination hazards and other problems exist. One of the most significant issues concerns excessive sea-level fluctuations. For example, rapid sea level rise (~2.48 m in ~18 years since 1978) followed by a rapid drop since 1996 (~0.5 m by 2000) has caused great hardship and expense in the basin. While the cause of these fluctuations in sea level must ultimately be related to the overall water budget, the exact mechanisms remain elusive. In particular, the contribution of groundwater to the water balance of the Caspian Sea is unknown. The project intention is to develop improved

groundwater flow assessment technologies and use of coupled groundwater-ocean models that will add new insights to this serious problem. This project should (1) improve the existing technology to make groundwater discharge assessments based on measurements of radon-222 and (2) develop models that will relate the groundwater contribution to the water level of the Caspian Sea.

Proceedings of the Baku Workshop is under review and will be published by the American Institute of Physics in 2006. The report on the Workshop is to be published in IUGS *Episodes* journal, Vol. 28, No. 3, 2005.

### 3. Marine Risk and Sustainability Session at “Dynamic Planet 2005”

(Co-convenors: Dr. Tom Beer and Dr. Evgeny Kontar)

This outstandingly successful session at the 2005 IAPSO Scientific Assembly (called Dynamic Planet and held jointly with IAG and IABO- the International Association of Biological Oceanography) was given a new topicality and focus after the 26 December 2004 Indian Ocean Tsunami.

Dr. K. Satake, the Chair of the International Tsunami Commission, opened the session with his talk on “Lessons learned from the 2004 Sumatra earthquake and the Asian tsunami”. The tsunami theme was followed by a number of speakers. Prof. D. King from James Cook University who presented his work studying the vulnerability of communities subject to tsunamis and tropical cyclones. Dr. Y. Tyupkin from the Geophysical Centre of the Russian Academy of Sciences presented his results using altimetry data to monitor tsunamis and submarine earthquakes. Dr. V. Morozov from the Shirsov Institute of Oceanology spoke on signal detection before earthquakes and tsunamis. Prof. C. Pattiaratchi of the University of Western Australia kindly filled in and described the recent tsunami event given his first-hand experience (being in Sri Lanka at the time), put it into historical context and gave a brief coastal engineering explanation of the tsunami phenomenon. Mr. R. Othman of the Universiti Teknologi Malaysia supplemented the tsunami component of the session with his poster “Towards the development of subsidence monitoring strategies for offshore platforms in Malaysian waters using GPS technique”

The second theme of the session was that related to coastal contamination from submarine groundwater. Detailed investigations in diverse geographic locations were presented by Prof. J. Zhang of Toyama University; Dr. C. Schrum of Schrum & Wehde Ecosystem Modeling; Prof. G. Kim and Ms J.-M. Lee of Seoul National University both gave oral presentations whereas Ms Y.-L. Hong and Mr Y.-W. Lee of the same university presented posters entitled: “Nutrient fluxes through Submarine Groundwater Discharge (SGD) in the coastal seas of Korea Peninsula” and “Outbreak of red tides under conditions of inorganic nutrient limitation: shipboard observation and real-time monitoring results in the southern sea of Korea” respectively. Prof. M. Schlueter of the Alfred Wegener Institut described the linkage Between Coast and Sea by Sub-Sea-floor Aquifers by looking at the Risks associated with use of Coastal Groundwater.

The third theme of the session was sustainability issues. Three speakers from CSIRO Marine and Atmospheric Research made presentations: Dr. D. McDonald gave a keynote presentation on Management Strategy Evaluation for Coastal Regions; Dr. T. Beer gave the international perspective on Marine Risk and Sustainability, and Dr. E. Grist spoke on the toxicity of

copper on a marine copepod. Dr. F. Rack, Director of the JOI Deep Sea Drilling Programme also gave an invited presentation on “An Evaluation of Risks from Natural and Human-induced Hazards Relating to Continental Margin Processes using Scientific Ocean Drilling and Ocean Observatories”. European perspectives were provided by Dr. E. Kontar with his talk on “Assessment of Maritime Geophysical Risks” and Prof. E. Stanev of the University of Sofia in Bulgaria who reviewed past and present catastrophes in shelf and semi-enclosed seas. Dr. R. Islam, who has recently published a profile of the coastal zone of Bangladesh, spoke on Marine resources, sustainable livelihoods and associated risks in the Bangladeshi context. His talk complemented that of Mr. J. De of the Indian National Institute Of Oceanography on mercury-resistant bacteria in deeper zones in the Bay of Bengal. The final paper of the session was given by Dr. F. Wang of the Institute of Oceanology, Chinese Academy Of Sciences who looked at the Annual to Decadal Variability of the Hydrologic Environment and Its Relationship with Fish Catches in the East China Sea.

### **Scientific Meetings Endorsed by the GeoRisk Commission**

#### **1. 8th Workshop on Nonlinear Dynamics and Earthquake Prediction, Miramare-Trieste, Italy, 3 - 15 October 2005.**

The vulnerability of our civilization to large earthquakes is rapidly growing, raising earthquakes to the ranks of major threats faced by humankind. Earthquake prediction is necessary to reduce the threat by undertaking disaster-preparedness measures. The Eighth Workshop on Non-linear Dynamics and Earthquake Prediction held in the Abdus Salam International Centre for Theoretical Physics in Miramare-Trieste was dedicated to training in advanced methodologies of R&D in fundamental studies of the Earth's evolution and dynamics, of the instability of the Earth lithosphere, and in numerous applied problems, such as earthquake prediction, estimation and mitigation of possible seismic hazard, disaster risk management etc. The workshop, organized by SAND Group of the Centre (<http://www.ictp.it/pages/research/sand.html>) and led by Prof. V. Keilis-Borok, University of California at Los Angeles (USA) and International Institute of Earthquake Prediction Theory, Russian Academy of Sciences (Russia), and Prof. G. Panza of University of Trieste (Italy), was endorsed by the IUGG Commission on Geophysical Risk and Sustainability and by the IASPEI Commission on Earthquake Hazard, Risk and Strong Motion. The Workshop participants represented 20 countries of Africa, America, Asia, and Europe.

The workshop facilitated the link between theoretical and experimental researchers, adequately explaining new achievements in seismology to the wide audience of scientists and engineers, and giving a unified treatment of those methods of seismology that are currently used in interpreting actual data. Among practical aspects, large attention was given to the accuracy and statistical significance of prediction methods, their rate of errors, and to the interaction with disaster management authorities. Natural disasters related to dynamics of the solid Earth, atmosphere, and ocean were considered as critical transitions in complex non-linear hierarchical systems. A special session on disaster prediction and prevention aimed at bridging fundamental research, as reflected by the whole workshop program, and disaster management and prevention through adequate implementation strategies.

## 2. The 2nd International Conference of The Nigerian Union of Planetary and Radio Sciences (NUPRS)

The Conference was held in Port Harcourt, Nigeria on 24 – 26 August 2005. Over 500 participants took part in the Conference. The IUGG GeoRisk Commission's Lecture "Tsunami Disaster" ([http://iugg-georisk.org/presentations/Ismail-Zadeh/aiz\\_nigeria05/index.html](http://iugg-georisk.org/presentations/Ismail-Zadeh/aiz_nigeria05/index.html)) that served as a keynote address, was delivered on behalf of Dr. A. Ismail-Zadeh (Commission's President) by Prof. S.C. Teme (LOC Chairman). This Lecture formed the basis for the Conference. Over forty papers were presented by Nigerian scientists at technical sessions during the Conference. IUGG sectional meetings were organized during the Conference. The 2007 NUPRS Conference will be held in Abuja, the Federal Capital City of Nigeria.

### **Invited Lectures Given by the GeoRisk Commissioners at Scientific Meetings**

#### 1. Press Conference at the European Geoscience Union General Assembly

The Commission was invited to the Press Conference on Sumatra mega-earthquake and tsunami held in Vienna, Austria, on April 26, 2005 during the General Assembly of the European Geoscience Union (EGU). Dr. V. Kossobokov, GeoRisk Commissioner, represented the Commission and took part in discussions on earthquake prediction.

#### 2. IGOS Geohazards Workshop

The IGOS Geohazards Bureau organised and hosted an International Geohazards Workshop which took place from 27th to 29th June 2005 at the bureau's host institution, the BRGM (French Geological Survey) in Orléans, France. This Workshop brought together over 50 experts from across Europe, the Americas, Asia and Africa to work toward improving the mitigation of Geohazards. IUGG GeoRisk Commission was invited to contribute to the Workshop. Dr. A. Ismail-Zadeh, President of the Commission, attended the Workshop and delivered a lecture entitled: "Computational Geodynamics and Earthquake Prediction as Research Tools for Seismic Hazard and Risk Analysis". The lecture is to be placed on the web-page ([http://iugg-georisk.org/presentations/Ismail-Zadeh/aiz\\_igosghws/index.html](http://iugg-georisk.org/presentations/Ismail-Zadeh/aiz_igosghws/index.html)). He also attended the meetings of the IGOS Geohazards Working Group "Science – Long-term fundamental science with potential application to the geohazards observations" to define a work program of the IGOS Geohazards for the next three years.

#### 3. LOICZ II Inaugural Open Science Meeting

Dr. E. Kontar, GeoRisk Commissioner and President of the Commission on Groundwater-Seawater Interactions (CGSI), was invited to deliver a key-note lecture entitled: "Development of New Approaches to Coastal Zone Hazard Observation and Warning Systems" during the Geohazards, Groundwater and Risk Session of LOICZ II Inaugural Open Science Meeting, Egmond aan Zee, The Netherlands, June 28, 2005. The lecture is to be placed on the GeoRisk Commission web-page.

#### 4. AOGS Annual Meeting

Asia-Oceania Geoscience Society (AOGS), a newly founded non-governmental regional association of geoscientists in Asia and Oceania, held its second annual meeting from 20th to 24th June 2005 in Singapore. Dr. Z. Wu, GeoRisk Commissioner and Vice-President of IASPEI, was invited to deliver a public lecture entitled: "Facing Earthquake-Generated Tsunami: Roles of Scientific Knowledge in the Reduction of Natural Disasters". He was representing the IUGG and IASPEI Commissions on the meeting. The lecture is to be published by World Scientific Publisher.

## 5. University of Yamanashi 21<sup>st</sup> Century COE Invited Lecture

On November 24, 2005 Dr. A. Ismail-Zadeh delivered a lecture “Extreme Natural Events: from Modeling and Prediction to Preventive Disaster Management” at the University of Yamanashi 21<sup>st</sup> Century COE in Kofu, Japan. He also met Prof. K. Takeuchi, Vice-President of the GeoRisk Commission, and they discussed further development of the GeoRisk Commission activities. Their joint paper on Preventive Disaster Management is to be published by EOS, AGU Transactions by end 2005.

### **Web-page of the Commission and Webcyclopedia**

The web-page of the Commission is maintained at the new site: <http://www.iugg-georisk.org> (web-master is Mr. D. Krupsky). The page is updated and presents news on the life of the Commission. The webcyclopedia at: <http://www.iugg-georisk.org/webcyclopedia/index.html> continues to collate information. The presentations, given at several meetings organised by the Commission during 2005 or at meetings where Commissioners delivered invited talks, have been incorporated into the webcyclopedia. The Commission continues to search for an editor for the project.

### **GeoScience Unions Initiatives Joint Science Team on Hazards**

The GeoSciences Unions of ICSU (namely IGU, IUGS, IUSS, IUGG) met in Paris in February 2004 and in Boulder in September 2004. They determined five topics for further action. One of these topics is Hazards, and IUGG agreed to lead action on this topic (Dr. Tom Beer is coordinating the team).

The GeoUnions Initiative Joint Science Team on Hazards met during the UN World Conference on Disaster Reduction in Kobe 18-22 January 2005. Twenty invitees attended this meeting, which also functioned as a planning meeting (run by Gordon McBean) for an ICSU programme on Natural Hazards. A positive and exciting outcome of the meeting was an offer from Hormoz Modaresi for BRGM (France) to host a project office for the GeoUnions Hazards Initiative. The BRGM already host the IGOS Geohazards Bureau. The Commission looks forward to the possibility of the IGOS Geohazards program becoming a strong part of the GeoUnions initiative.

### **ICSU Proposals**

The Commission has been involved with the ICSU project “Near Earth Orbit Objects” during the past year. Dr V. Gusiakov attended a planning meeting on this project. The project was successful in being funded.

The Commission submitted two new ICSU project proposals, but unfortunately, both were unsuccessful:

1. Geohazards: Extreme Natural Events and Societal ImplicationS – *GENESIS* (led by IUGG / GeoRisk Commission). Supporting partners of the project proposal are: Geoscience Unions (International Union of Geological Sciences, International Geographical Union, International Union of Soil Sciences, International Society for Photogrammetry and Remote Sensing), Interdisciplinary Bodies / Initiatives (Integrated Global Observing Strategy – Geohazards, Scientific Committee on Oceanic Research, Earthquakes and Megacities Initiative, International Consortium on Landslides).

2. The Role of Science and Data in Disaster Risk Management (led by ICSU CODATA).  
Supporting partner: IUGG / GeoRisk Commission

### **Commission Proposals funded**

1. The Commission supported a proposal put forward by V. Gusiakov titled: "Comprehensive historical earthquake and tsunami database for the South-West Pacific" received funding from IUGG.
2. The Commission proposal put forward by A. Ismail-Zadeh to organize the international workshop "Recent Geodynamics, Georisk and Sustainable Development of the Black Sea to Caspian Sea Region" in Baku, Azerbaijan, 3-6 July 2005 received funding from IUGG, AGU, ExxonMobil, IHP/UNESCO, and Heidelberg Academy of Sciences.
3. The Commission proposal put forward by A. Ismail-Zadeh to organize a symposium on Extreme Natural Events during the EuroScience Open Forum in Munich, 15-19 July 2006 received funding from IUGG.

### **Union sessions at the 2007 IUGG General Assembly in Perugia, Italy**

GeoRisk Commission proposals to organize two Union sessions during the 2007 IUGG GA in Perugia were accepted by the Program Committee:

1. U7: High-Performance Computations in Geosciences (conveners: A. Ismail-Zadeh and Z. Wu)
2. U12: Early Warning of Natural Hazards (convener: R. Singh)

### **Planned activity for 2006**

1. The GeoRisk Commission organizes together with IUGG CMG Committee a special session "Mathematical Aspects of Geohazards" at the 26<sup>th</sup> IUGG Conference on Mathematical Geophysics, to be held on the shore of the sea of Galilee, Israel, June 4-8, 2006.
2. The GeoRisk Commission organizes together with EuroScience a symposium on Extreme Natural Events during the EuroScience Open Forum in Munich, Germany, 15-19 July 2006.

### **Publications**

- Ismail-Zadeh, A.T., Science for mitigation of natural disasters, *EuroScience News*, 30, 1, 2005.
- Ismail-Zadeh, A., and Beer, T., A focus on risk science and sustainable development, *EOS, Transactions of the American Geophysical Union*, vol. 85, No. 44, 453, 2004.
- Ismail-Zadeh, A., and K. Takeuchi, Role of Geoscientific Societies in Preventive Disaster Management of Extreme Natural Events, accepted for publication in *EOS, Transactions of the American Geophysical Union*, 2005.
- Ismail-Zadeh, A. T., and T. Beer (Eds.) *Geohazards and Georisk*, special issue of *Natural Hazards*, Springer, to be published in 2006.
- Ismail-Zadeh, A. T. (Ed.) *Recent Geodynamics, Georisk and Sustainable Development in the Black Sea to Caspian Sea Region*, Proc. of the International Workshop, July 3-6, 2005, Baku, Azerbaijan. American Institute of Physics, to be published in 2006.