

GRANTS PROGRAMME 2013

APPLICATION FORM

(Valid for ICSU Members only)

(Applications must be submitted electronically to rohini@icsu.org)

Deadline for submission is 1 December 2012

Lead applicants* may submit no more than one application. **A ceiling of Euro 30,000 is imposed on all applications.**

Project title:

Mathematics of Climate Change, Related Natural Hazards and Risks

Requested amount(€):30,000
(Maximum Euro 30,000)

Applicants:

Lead Applicant (Organization): International Mathematical Union (IMU)

Contact name & Designation: Ingrid Daubechies, President

Email address: ingrid@math.duke.edu

Supporting Applicant(s) (Organization(s): IUGG, IUTAM, ROLAC, WCRP, IRDR, National Academy of Sciences, Academia Mexicana de Ciencias (?))

Contact name(s) & Designation:

Alik Ismail-Zadeh, IUGG Secretary General

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How will this proposal address ICSU's strategic priorities as defined for the grants programme? (max. 10 lines):

Capacity Building and Science Education, Science for Sustainable Development: This international, multidisciplinary educational and capacity-building workshop will discuss scientific, social, and economic aspects of climate change, related risks, and sustainable

development. Emerging Science: The workshop will explore the interfaces of science, engineering, and policy making. This event, the first to be organized jointly by the three unions -- IMU, IUGG, and IUTAM, in cooperation with ROLAC, WCRP, IRDR, NAS, and AMC -- will involve young scientists, women participants, and attendees from South and Central America. It will address the ICSU strategic plan II by focusing on global environmental change, disaster risk, and science education, and ROLAC priority topics by providing Mathematical Education in the field on Natural Hazards.

Project plan (max 3 pages)

State clearly the objectives of the project and the beneficiaries. Elaborate on its relevance to the review criteria – e.g., innovative nature, interdisciplinary and international nature, visible and measurable outputs, relevance to the programme priorities and priorities of ICSU Regional Offices. If the activity targets young scientists, women scientists, and/or scientists from developing countries – please refer to it here. [N.B. ICSU will not normally support travel grants to attend standard scientific meetings and conferences, nor support fellowship programmes.]

Objectives (1/3 page)

The main objective of the workshop is to facilitate an international, multidisciplinary discussion around the central topics of climate research, environmental hazards, and sustainable development targeted at diverse group of participants, mainly coming from South and Central America. Mathematics, statistics, and mechanics are essential tools in geodesy and geophysics. Broadly defined, quantitative mathematical training is an essential part of preparation of the future generation of researchers dealing with climate changes and natural hazards. Mathematical methods play a defining role in modern climate and natural hazards studies. The proposed advanced educational and capacity-building workshop will allow a diverse group of post-doctoral students and young researchers, including a large group of women scientists, mainly from Central and South America, to learn from and interact with the leading internationally recognized experts in different aspects of the rapidly growing, multifaceted field of global environmental change. The workshop will result in establishing new research ties and specific projects within and outside the Americas. This workshop, the first to be organized jointly by the three international Unions, is symbolic for the overarching impact of the "Mathematics of Planet Earth" (MPE13) program on the worldwide communities of mathematicians, mechanics, and geophysicists.

Project description (2 pages)

The workshop will take place from 29 July to 2 August 2013 and will be hosted by the Centro de Investigacin en Matematicas (CIMAT), Guanajuato, Mexico, as per agreement with the CIMAT Director, Dr. Jose Antonio de la Pena.

Format: The workshop scientific program will consist of a series of lectures delivered by 9 international leaders in the field of climate science and natural hazards (see preliminary program and speaker profiles below). The lecture topics will be divided into three general themes. Each thematic block will be concluded with a round table, facilitated by one of the lecturers and a student, which will help to summarize the presented material and draw conclusions. The workshop will provide an ample opportunity for interaction and informal discussions.

Participants: The workshop will be attended by nine lecturers, 40 post-docs, graduate students, and young researchers within 5-6 years from PhD with geophysical and mathematical background. A significant portion of participants will be coming from Latin America and the Caribbean.

The unions have nominated a Scientific Committee with three co-chairs representing the three unions: Susan Friedlander for IMU (<http://cams.usc.edu/~susanfri/>), Paul Linden for IUTAM (<http://www.damtp.cam.ac.uk/people/p.f.linden/>) and Ilya Zaliapin for IUGG (<http://wolfweb.unr.edu/~zal>).

Science program

The workshop will focus on the modern quantitative data- and model-driven approaches towards predictive understanding of the climate change, the effects of changing climate on other natural hazards, the related risks and socio-economic implications. A particular emphasis will be given to the hazards of Central and South Americas. The workshop presentations will be structured around three main themes.

Theme 1 -- Methodology of the climate and natural hazards research: This theme will focus on the essential methodological aspects of the climate science, with emphasis on the cross-links among geosciences, mathematics, and computer science. Data assimilation, statistical approaches to paleoclimate reconstruction, tracer-based techniques, large-scale numerical modelling, dynamical system theory, Lagrangian transport in geophysical flows are some of the topics that will be presented by the leading experts in the respective fields. A comprehensive review of the past Earth climates and climate forecast approaches will also be given.

Theme 2 -- Climate change and environmental hazards: This theme will review specific data sets and models that quantify the past and present changes in the Earth climate and project them into the future. The speakers will overview various environmental hazards related to the changing Earth climate, their impacts, and mitigation strategies.

Theme 3 -- Socio-economic implications of climate change and extreme hydro-meteorological hazards: The changing climate and the related Natural Hazards and risks pose a multitude of pressing social, economic, and ethical questions. The lectures in this theme will provide a broader view of the climate research and its intrinsic connections with the many important aspects of human life and society.

The confirmed speakers are

- Graciela Canziani, Universidad Nacional del Centro de la Provincia de Buenos Aires, Argentina. Research interests: Studies of Population Dynamics, Ecosystems and Sustainable Development.
- Susan Cutter, Carolina Distinguished Professor of Geography and Director of the Hazards Research Lab at University of South Carolina. Research interests: Natural hazards and risks
- Oscar Velasco Fuentes, Research Fellow at Department of Physical Oceanography, Centro de Investigación Científica y de Educación Superior de Ensenada, Baja California, México. Research interests: fluid dynamics, nonlinear processes in geophysical fluid dynamics.
- Michael Ghil, École Normale Supérieure, Paris, France. Research interests: atmospheric sciences, climate dynamics, extreme events, dynamical and complex systems theory, estimation theory, geophysical fluid dynamics, macroeconomics, numerical methods, physical oceanography, statistical methods, remote sensing and applications.
- Eugenia Kalnay, Distinguished University Professor of Atmospheric and Oceanic Science at the University of Maryland, College Park, USA. Research interests: data assimilation, numerical weather prediction, predictability and ensemble forecasting, coupled ocean-

atmosphere modeling and climate change

- Carlos R. Mechoso, Department of Atmospheric Sciences, University of California Los Angeles, USA. Research interests: ocean-atmosphere interactions, numerical weather prediction, meteorology and climatology of the Southern Hemisphere, and high performance computing

- George Philander, Knox Taylor Professor of Geosciences, Princeton University, USA. Research interests: general circulation, ocean-atmospheric interactions, climate fluctuations, paleoclimates

- Bala Rajaratnam, Assistant Professor of Statistics at Stanford University, USA. Research interests: multivariate statistical analysis, graphical models, random matrix theory, applications in Genomics, Climate and Environmental Sciences, Social Sciences, Finance

- Eli Tziperman, Department of Earth and Planetary Sciences and School of Engineering and Applied Sciences, Harvard University, USA. Research interests: large scale climate and ocean dynamics, including El Nino, thermohaline circulation, abrupt climate change, glacial cycles and equable climates; advanced methods of ocean data assimilation.

Lodging: The lodging for the student participants will be provided by the CIMAT. The housing for speakers and organizers will be covered using the workshop funds.

Travel: The travel for student participants will be partly covered by the workshop funds on competitive basis, using the online applications. The travel for speakers and organizers will be covered using the workshop funds.

Web: A workshop web site has been launched at <http://cams.usc.edu/mathgeo/>. It will provide the essential information for the workshop participants, including the travel grant applications. The workshop web site will be linked to the CIMAT web site and MCA 2013 web site, which will be used for workshop advertisement. The workshop applications will be maintained electronically at CIMAT in collaboration with the Scientific Committee.

Selection of participants: Applications for attending the workshop, including requests for travel funds, will be collected via the workshop web site until March 31, 2013. The Scientific Committee will then make the final decision about the participants according to the available funds.

□ Relevance to review criteria 1/3 page)

The project is relevant to several of the review criteria. "Science for Sustainable Development": The workshop is aimed at the advancement of science related to climate change, natural hazards and risks. The program directly addresses scientific, economic, and social dimensions of sustainable development. "Capacity Building and Science Education": The workshop will provide unique training for a diverse group of young scientists, mainly from Latin America and the Caribbean. Considering that scientific progress on the theme can only come from interdisciplinary research, it is a concerted effort of three unions that each cover an essential part of the theme. Targeting Latin America and the Caribbean will also allow to concentrate on the specific problems of the region: increase of the number of strength of hurricanes in the Caribbean, threat of climate change on the Amazonian forest,

drought along the Pacific coast, etc.

□ Targeting of priority groups (1/3 page)

The workshop will be targeting 40 young researchers -- graduate students and researchers less than 5 years from Ph.D. The main criteria for participation will be excellence, adequacy of the scientific background for the theme of the workshop and motivation of the applicants. At the same time, this is a capacity building workshop for Latin America and the Caribbean. So we will use the following rules. The majority (about 30) of young researchers will come from Latin American and the Caribbean, and no more than 10 could come from a single country. Particular efforts will be applied to ensure diversity in the different research backgrounds (mathematics and statistics, theoretical and applied mechanics, geodesy and geophysics, environmental studies, natural hazards, policy making), gender, nationality, and race. The key ingredient for attaining all these goals is to publicize the project widely and proactively, including personal contacts, so as to generate high quality applications.

Work plan (max 1 page)

Specify time schedule, major events, methodologies to be used, leadership and management structure, and key milestones in the implementation process, etc.

Stage 1: April - December, 2012

Tasks: Nomination of Scientific Committee; selecting and contacting speakers; developing the workshop program; developing and launching workshop web site; workshop approval and securing financial support by IMU, IUGG, and IUTAM; preparation and submission of ICSU proposal.

Details: The project of workshop started in the spring of 2012. The three unions got together to decide on a joint theme and nominated three co-Chairs of high scientific profile for the Scientific Committee, one co-Chair per union. The three co-Chairs are Susan Friedlander for IMU, Ilya Zaliapin for IUGG, and Paul Linden for IUTAM. The Committee worked during the summer 2012, in close consultation with the unions. A highly selective group of workshop lecturers was preliminary contacted during the summer of 2012, as to ensure participation and coordinate the science program. The workshop has been advertised from September 2012 on the MCA2013 website. The workshop site has been launched at <http://www.usc.edu/mathgeo> Each of the unions approved the project by the end of September 2012 and secured respective funding. The ICSU proposal was prepared in October 2012; it has been circulated so as to get feed-back from supporting organizations. The ICSU proposal is to be submitted by December 1, 2012.

Stage 2: January - April, 2013

Tasks: Preparing and distributing workshop advertisement (posters, flyers, web sites); collecting online workshop applications; application review and selection of participants; sending workshop invitation letters.

Details: The workshop advertising will be prepared and circulated by CIMAT starting January 2013. It will target the scientific communities of the three unions; the advertising will be done in all relevant science departments of Latin America and the Caribbean (LAC): mathematics, statistics, physics, geology, engineering, environmental sciences, etc. It will be done by means of posters, electronic messages and personal communications with the leaders of the subject in LAC. The advertisement will also be done via the three organizing Unions, American Geophysical Union, European Geosciences Union, and the Bernoulli society for Mathematical

Statistics and Probability. The online workshop application form will be posted by January 2013. The deadline for applying is March 31, 2013. The applications will be collected at CIMAT and evaluated by the Scientific Committee who may nominate other people to help them. The letters of invitations will be sent in April 2013.

Stage 3: May - July, 2013

Tasks: Final list of participants approved, final logistic arrangements with CIMAT.

Details: The final list of participants will be determined in May 2013, taking into account the responses to the invitation letters. The final version of the workshop program will be approved by the Scientific Committee and speakers in May 2013. Final logistic arrangements with CIMAT regarding lodging, food, and social workshop program.

Stage 4: July 29 - August 2, 2013 -- Workshop (see Project Description above)

Stage 5: August - October, 2013

Tasks: Report

Details: A workshop report will be prepared after the workshop completion. It will document the workshop activities, outline the future avenues for collaboration and development as discussed during the workshop, and suggest the details of a follow-up workshop to be organized in cooperation among IMU, IUGG, and IUTAM.

Expected results (max 1/2 page)

What outcomes are expected from the project: publications (including audience and dissemination plan), new programme initiatives, etc? Explain how an ICSU grant can strengthen your own overall programme of work, e.g., leveraging funds from other sources, enhancing visibility, enhancing impact or role of your organisation. Assess potential follow-on action that may result from the activity.

+ The immediate outcomes of the workshop are (i) increased capacity to address the climate change problems by the next generation of scientists within Latin America and Caribbeans, and outside of Americas; (ii) unique education opportunities for underrepresented groups of scientists; (iii) networking and establishing international and crossdisciplinary ties aimed at sustainable development. The workshop will help increasing the research effort in the field of climate change, related natural hazards and risks. The lectures and focused discussions will identify the areas to be addressed in the future collaborative research and education activities.

+ The workshop will contribute to bridging the gap between scientific communities toward synergistic approach to tackling pressing socio-economic problems related to the changing climate. The project will ensure that more of the unions members get interested in participating to the concreted research effort needed to attain significant results in this demanding field.

+ The lectures recorded during the workshop and electronic presentations will serve for broader dissemination of the workshop ideas and increasing its overall educational impact.

+ The three unions anticipate using the methodological and personal experience gained during the workshop in organizing a follow-up event within three years to consolidate the initiated research developments and make sure that a leadership develops within Latin America and the Caribbean.

+ The ICSU funding is critical in leveraging the funds (Euros 24,600) secured by the Unions and CIMAT for organizing the workshop.

The Role of Supporting Applicants and Other collaborative partners (max 1/2 page per partner)

The role of each supporting applicant (minimum one from the ICSU family) (and other partner organizations such as UN agencies, if relevant), should be clearly described.

Partner 1

International Union of Geodesy and Geophysics (IUGG) will contribute to the project via its Union Commission on Mathematical Geophysics (CMG:

<http://www.iugg.org/about/commissions/cmg.php>). The Commission proposed Prof. I. Zaliapin to become a Scientific Co-Chair of the workshop, and the IUGG Bureau appointed him as a representative of the Union. CMG will assist and collaborate in the project given a long-standing history of international scientific cooperation in mathematical geophysics.

Partner 2

International Union of Theoretical and Applied Mechanics (IUTAM) has appointed Prof. Paul Linden as a Scientific Co-Chair of the workshop. IUTAM will assist and collaborate in the project by advertising the meeting on its website and by identifying potential applicants. IUTAM has also offered \$5,000 in financial support.

Partner 3

Partner 4

Centro de Investigación en Matemáticas (CIMAT) will be hosting the proposed workshop as a satellite activity of MCA2013. (Note that CIMAT is also organizing the Mathematical Congress of the Americas, MCA2013). CIMAT will take care of the local arrangements. In particular, the lodging has already been reserved for the participants of the workshop. CIMAT will also prepare the website. Moreover, CIMAT will provide the funds to pay for the lodging expenses of the young researchers attending the workshop. CIMAT will be in charge of announcing the workshop all over the Americas, including the Caribbean. It will receive the applications of the young researchers willing to participate. CIMAT will also help with the choice of Mexican young researchers to attend the workshop.

Project budget		
Amount requested from the ICSU Grants Programme:		€30000
Estimated breakdown of cost		
Research / Content	€	
Travel / Accommodation for Meetings	€15600	
Training / Teaching	€32000	
Planning / Coordination	€2000	
Other (specify): Food	€5000	
Amount provided by the applicants:		€12600
Amount provided from other sources (specify): CIMAT		€12000



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PROJECT SUMMARY FOR ICSU WEBSITE

Please provide a brief summary (300 words) of the project. This will be published in the ICSU website, should a grant be awarded.

Project Summary

The project is to hold an international, multidisciplinary educational and capacity-building workshop "Mathematics of Climate Change, Related Natural Hazards and Risks". The event will be hosted by Centro de Investigación en Matemáticas (CIMAT) in Guanajuato, Mexico from July 29 to August 2, 2013, as a satellite activity to the first Mathematical Congress of the Americas (<http://www.mca2013.org>). The workshop is the first event jointly co-organized by the three international unions -- IMU, IUGG and IUTAM, in cooperation with ROLAC, WCRP, IRDR, NAS, and MCA; it is part of the world initiative "Mathematics of Planet Earth" (<http://www.mpe2013.org>).

The workshop will allow networking and capacity building across the scientific communities and scientific unions of geodesy and geophysics, theoretical and applied mechanics and mathematics around central themes of climate research, environmental change, and sustainability. It will establish fresh working ties and research projects among the scientists within and outside of Americas on the frontier and at the interface of different academic disciplines.

This advanced educational and capacity-building workshop will allow a selected group of post-doctoral students and young researchers, mainly from Central and South America, to learn from and interact with the leading internationally recognized experts in different aspects of the rapidly growing, multifaceted field of Global Environmental Change and Sustainability. The young scientists of non-mathematical backgrounds will learn about modern developments in mathematics and mechanics and their applications in the Climate Science. On the other side, scientists with mathematical background will learn of the mathematical challenges arising from problems in geosciences.

The workshop will focus on the modern approaches towards predictive understanding of the climate change, the effects of changing climate on other natural hazards, the related risks and socio-economic implications, with particular emphasis to the hazards of Central and South Americas. The workshop will address the three main themes: i) Methodology of the climate and natural hazards research; ii) Climate change and environmental hazards; iii) Socio-economic implications of climate change and extreme hydro-meteorological hazards.