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Strategic elements for an evaluation of extreme events risks

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Abstract. Extreme events, especially those generated by climate change, have been scientifically approached for a better understanding of their causes as well as for finding efficient ways in which potential damages be diminished if not completely avoided. We consider that the best starting point for diminishing the damages caused by extreme events is an analysis of the extreme events risk through science. In our paper we shall consider the main issues raised by the United Nation International Strategy for Disaster Reduction report and make a constructive analysis in order to extract the main strategic elements for an evaluation of extreme events risks.
Key Words: climate change, risks, HFA, ISDR, evaluation, strategy.

Introduction. Generally, disaster is considered as "a serious disruption of the normal functioning of a community or society involving human, material, economic and environmental losses and impacts exceeding the affected community or society's ability to cope using own resources" (Twigg 2004).

Yearly, hundreds of disasters killed thousands of hundreds of people, affected hundreds million others and cost a total of hundreds of US$ billion. At global level, economic losses from disasters in some countries have been greater than their national GDP. Losses with potentially catastrophic implications for the global economy include the possibility of a major earthquake with an estimated cost of several US$ trillion.

United Nations (UN) Member States adopted in 2000, the strategic framework entitled International Strategy for Disaster Reduction (ISDR) in order to coordinate a wide range of organizations, states, intergovernmental and non-governmental organizations, technical and financial institutions for sharing information to reduce disaster risk and disastrous losses, building resilient communities for a sustainable development. The secretariat of this strategic framework, the ISDR system, named UNISDR, is the global point for the implementation of a ten year plan of action adopted in 2005 by 168 governments to protect lives against disasters, plan named Hyogo Framework Action (HFA). Considering several reports and publication on HFA it is obvious that an increasing attention is given to the impacts of disasters and namely to the tools to reduce the exposure and vulnerability of communities and assets to natural hazards (HFA 2005).

Material and Method. Evaluation of the extreme events risks (EER) is a complex action and it is of the outmost importance to underline and model its strategic elements. The HFA 2005-2010 is a reference plan with priorities on action and indicators from which we could start our selection of main strategic elements for evaluation the risks of extreme events. We propose an opposite starting point in approaching the strategic elements to be evaluated the extreme events risks considering the main indicators for each HFA priority. The HFA strategic goals as priorities on action should be the framework in establishing the strategic elements for an evaluation of extreme events. So, our assumption consists in the strategic starting points in evaluating the EER represented by the HFA strategic goals and the HFA priorities in action.

The HFA strategic goals are:

1. Integration of disaster risk reduction into sustainable development policies and practices.
2. Development and strengthening of institutions, mechanisms and capacities to build resilience to hazards.
3. Systematic incorporation of risk reduction approaches into implementation of emergency preparedness, response and recovery programmes.

The original HFA priorities on Action are:

1. Ensure that disaster risk reduction is a national and local priority with a strong institutional basis for implementation.
2. Identify, assess and monitor disaster risks and enhance early warning.
3. Use knowledge, innovation and education to build a culture of safety and resilience at all levels.
4. Reduce the underlying risk factors.
5. Strengthen disaster preparedness for effective response at all levels.

Although natural hazard are continuously occurring, their societal impacts can be significantly diminished through investments in disaster risk reduction by scientific and technical tools (Ştefănescu et al 2010; Barac et al 2010). The secretariat of the UN strategic framework for ISDR, recognizing the importance of scientific and technical information for disaster risk reduction, established a Scientific and Technical Committee (STC) to address policy topics of scientific and technical nature. The term "scientific" includes the natural, environmental, social, economic, health and engineering sciences, and the term "technical" includes relevant aspects of technology, engineering practice and its implementations. In 2009, a report of ISDR is issued in order to highlight the use of scientific and technical knowledge as an essential base for disaster risk reduction, and make recommendations on key issues and priorities. We consider the main ideas of this report too in recommending the strategic elements for an evaluation of extreme events risks (EER).

Disasters represent a concern for almost all countries and their effects are growing in terms of people affected and economic losses at global level. The number, scale and cost of disasters are increasing mainly as a consequence of growing populations, rapid environmental degradation, unplanned settlements, uncontrolled expanding and ageing infrastructure, growing the number of assets at risk, and more and more complex societies and communities. By 2050 it is expected that the number of megacities in the world, many of which are located in risk exposed zones, will have increased by a third. A continuously changing climate will increase the risks for many regions of the planet (Twigg 2004).

Risk and resilience are influenced by the appropriateness of building design, urban planning and infrastructures for local conditions. Natural hazards strike hardest on both the poor and the rich. According with ISDR report (ISDR 2009), "disparities in vulnerability to natural hazards arise from wide gaps in access to resources and capacities for risk reduction associated with poverty and socio-cultural stratification".

Addressing these factors and their roles will require good foundations of social and economic knowledge and information, and the development of relevant scientific and technical capacities.

In ISDR report, it is recommended to focus on four key selected topics, namely climate change, early warning systems, public health, and socio-economic resilience, rather attempting to cover all of the dimensions of concern to disaster risk reduction, which cover diverse geographical and environmental settings, time frames, hazard types, different communities, sectors, and institutional issues.

These are topics of current global policy concern for which immediate science-based actions are needed, possible and available. Other important topics, such as seismic risk prevention and reduction and the role of ecosystems in risk reduction and management, could be examined as a second degree priority (ISDR 2009). Besides the strategic starting points for EER we shall consider this 4-component approach in establishing the strategic element for EER evaluation.

Results and Discussion. Considering the above methodological ideas, we would underline the main strategic elements for EER to be used and further developed by scientific community.

A main strategic element for risk evaluation of extreme event (EER) is represented by a well defined set of extreme event types connected with their main coordinates, features and frequency. The basic facts of climate change are now well established and they are main references for science and for policy-relevant international scientific cooperation. An increased intensity and frequency for extreme weather conditions, such as heat waves, droughts, storms, tropical cyclones and heavy rainfall, and their impacts will be extended by other related effects that will reduce the communities' capacity to cope with extreme events. There is an urgent need to systematically link disaster risk reduction and climate change adaptation policies.

Another strategic element in evaluation of EER is the connection of alerting system with the climate change adaptation plan. Early warning systems reduce disaster impacts and save lives if properly integrated in the environmental risk management. For the above reason, virtually all governments systematically invest in science-based early warning capacities, particularly through national weather services and authorities. Large communities are often evacuated from risk zones as response to timely warnings on environmental alerts. So, other strategic element for an evaluation of extreme events risks (EER) is represented by an accurate and updated knowledge and understanding of the critical risk area where warning system should be placed, of the main parameters to be transmitted to operators enabled with alert system to communicate timely the occurrence of extreme events. Climate change adaptation plans should contain integrated all-hazard early warning systems that address time scales of minutes through to decades.

Another strategic element in evaluation of EER is the availability of tools provided by the natural sciences, health sciences and social sciences for a given taxonomy of vulnerable areas (Miclean et al 2009; Popa & Coşier 2009).

The natural sciences offer the understanding of the causes and behaviours of most natural hazards and together with the technical sciences permitted the development of systems for surveillance and prediction. The health sciences offer similar achievements for health-related hazards and impacts. Health sector responses to disasters need to be extended to take into account the potential health impacts, including preparedness and recovery, in order to mitigate the global burden of disasters on health, societal and economic dimensions.

The social sciences allow the understanding of human resilience, the factors that influence people's attitude to risk and behaviour during a crisis, the effectiveness of warning messages, channels for distributing messages, and mechanisms for public response, improving our understanding of the health impacts associated with disasters and post disasters. Social and economic understanding is critical for building resilience and reducing disaster risks. Social science research provides significant insights into the conditions and processes that create inequity in exposure and vulnerability and that lead to the establishment of the unsafe conditions of vulnerable communities. It is important to understand why people in some areas expose themselves to extreme events risk such as landslides by building houses on vulnerable sites or what is the perception of individual risk, the influence of institutional, social and economic conditions, and the limitations imposed by poverty, lack of experience and information, short-term goal focus or the weak local governance.

Multi-disciplinary research coupled with efforts to translate knowledge into more effective tools and policies has to bridge the gaps between environmental, humanitarian, development and governmental actors (Straßburger 2006; Iacobescu 2010).

Another strategic element in evaluation of EER is the localization of the environmental policy based on science and technology. The ISDR report (ISDR 2009) considers that "much greater effort is needed to achieve effective involvement of science, technology and policy as support of disaster risk reduction and consequently" we consider in evaluation of extreme events risks (EER). This effectiveness is gained by better mechanisms for integrating science and technology into policy processes. In this respect,

disaster risk reduction requires strategic planning and implementation, technical and scientific expertise with a close and continuous exchange among these fields in order to provide effective and durable solutions at local level.

Another strategic element in evaluation of EER is the intelligent consideration of national and international communication of risk and all risk related problems. It is considered that greater interaction and collaboration among the scientific and technical disciplines including at international level are needed. Diverse expertise from different fields of science is needed in order to produce well suited solutions to risk-related problems. The science community has to find better ways to communicate substantial findings to policy makers and to support rapidly the development and implementation of solutions. This is a matter of developing transdisciplinarly among the natural sciences and engineering, incorporating the social sciences and humanities into problem-solving approaches. International collaboration through projects is essential to maximize the benefits of science with its practical solutions for prevention, preparedness and response (Embrechts 2004).

Another strategic element in evaluation of EER is the consideration of existing national and international capacities to cope with the extreme events and their effects. Attention should be given to systematic efforts to build relevant scientific and technical capacities, for provisioning information and services available adequately developed, for sustainable development (Zimmerli et al 2003; Anyiro 2010). There is an ongoing need for investment in research of both fundamental and applied types. The role and expertise of scientific institutions should be recognized or supported, either within national priority setting or by international agencies.

Conclusions. The ISDR report makes the recommendations to be promoted knowledge into action, to use a problem solving approach that integrates hazards and science, to support the systematic science program and to guide good practice in scientific and technical aspects of disaster risk reduction. From these recommendations, and considering HFA framework we established the main strategic elements for EER to be considered as answers to the problems raised by the unsustainable development occurring in our days at global level. These elements are:

- A well defined set of extreme event types connected with their main coordinates, features and frequency.
- The connection of alerting system with the climate change adaptation plan.
- The availability of tools provided by the natural sciences, health sciences and social sciences for a given taxonomy of vulnerable areas.
- The localization of the environmental policy based on science and technology.
- An intelligent consideration of national and international communication of risk and all risk related problems.
- The consideration of existing national and international capacities to cope with the extreme events and their effects.

By considering the above strategic elements in EER each policy makers community would be able to:

- set up what is the priority on sharing and disseminating scientific information and translating it into practical methods that can readily be integrated into policies, regulations and implementation plans concerning disaster risk reduction.
- establish how strong is education on all levels currently, how comprehensive knowledge management is, and how a greater involvement of science in public awareness-raising and education campaigns.
- found how specific innovations are developed to facilitate the incorporation of science inputs in policymaking.
- institute if holistic, all-hazards, risk-based, problem-solving approach is used to address the multifactor of disaster risk and disaster risk reduction.
- ascertain if there is collaboration of stakeholders, governmental institutions, scientific and technical specialists and members of the communities at risk.
- establish how knowledge sharing and collaboration between disciplines and sectors are made in order to guide scientific research, to make knowledge available for faster

implementation, to bridge the various gaps between risks, disciplines, stakeholders and to support education and training, and information and media communication.
- determine if there are any national, regional and international systematic programmes of scientific research, observations and capacity building to address current problems and emerging risks.

As a general conclusion, all the above elements of the proposed strategy for extreme events evaluation should be considered as recommended references in establishing a policy in approaching the huge occurrence of environmental hazards in any country.

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