EDITORIAL

Floods and debris flows are among the most destructive of all water related disasters.

The term flood can be defined as "a temporary condition of surface water (river, lake, sea) in which the water level and/or discharge exceed a certain value, thereby escaping their normal confines". Debris and hyper-concentrated flows result from the interaction of hydrological with geological processes and are triggered when soils get saturated and the stability of the slope is no longer maintained.

There is a need to take into account risks stemmed from these events into the development process in general and land and water resources management in particular.

These hazards have increased considerably worldwide in recent years and are likely to become more frequent and more relevant in the future, due to the effects of increase in population, urbanization, land subsidence and the impact of climate change.

They affect both rural and urban environments, particularly in river basins and in mountain areas, and in recent years they have attracted more and more attention from the scientific and professional communities and concern from the public due to the death toll they claim.

Although floods and debris flows are serious hazards in humid regions, they can also be devastating in semi-arid regions, where high rates of runoff following storms may produce widespread damage down-valley.

To cope with these hazards, it is imperative that human society adopts an effective risk management approach which has to be in harmonious coexistence with appropriate flood and debris flow monitoring and remediation measures.

In practical terms the chance of floods and landslides can never be eliminated entirely. However, their consequences can be mitigated by appropriate behaviour and actions. To be effective, the hazard approach must be embodied in the broader context of integrated river basin planning and management and floods and debris flows must be regarded as one of the many issues involved in the appropriate management of a river basin in both the mountain and coastal areas.

Related to these hazards, the following four developments will deserve the attention of those who are in charge of such measures:

- increase in population and industrialization;
- rapid increase in value of property in urban and industrial areas;
- higher protection levels for rural areas, due to the high quality of agricultural production;
- impact of climate change which is likely to make extreme events more severe and more frequent.

To deal with these challenges involves taking decisions and actions about appropriate levels of risk. These decisions and actions may be divided into the following two processes:

- risk analysis procedures;
- risk management cycle.

It is worth noting that, while in the past the concept of risk was primarily intended as a measure of the probability of a system's failure, it has assumed nowadays a more complex meaning. The risk should be, in fact, considered as a combination of both the probability and the magnitude of the consequence of a system's failure and, therefore, as the expectation of the consequence, taking into account all significant hazards and all significant mechanisms of failure.

Risk analysis procedures require expert knowledge to identify the potential risk of the hazards and then to estimate the likelihood and the economical and environmental impacts of these hazards.

The risk management cycle comprises "the systematic process, administrative decisions, organization, operational skills and abilities to implement policies, strategies and coping capacities of the society and communities to lessen the impact of natural hazards and related environmental and technological disasters". Monitoring, forecasting and early warning play a role of paramount importance in the risk management cycle. To this end, advanced scientific research should be applied in monitoring water-related disasters through appropriate networks of climatic, hydrological and geological characteristics. This process involves International cooperation and an organization with appropriate capabilities and instruments to manage interests at different locations along river basins. Therefore, governments need to establish clear institutional, financial and social mechanisms and associated processes for hazard risk management in order to ensure the safety of people and property and contribute to a harmonious co-existence with floods and debris flows. The commitment of the international community is to support these activities, particularly in developing Countries, where resources are limited. Field studies are the most difficult tasks to carry out within this approach. The difficulties encountered are connected to the complexity of the phenomena investigated and the difficulty of direct observation. The exceptional conditions in which such extreme events occur do not generally permit a sufficient number of observations for the same type of territorial reality to work out the particular behavioural laws for that area. So references to different territorial situations for the same hazard typology are needed.

The ideal sequence that should be pursued in response to the challenge presented by the management and mitigation of floods and debris flows can be outlined as follows:

- A systematic collection of field data should be made to provide a large reliable database;
- Effective mathematical models should be constantly developed, updated, tested and applied;
- Hydrological and geological mapping techniques and identification of possible scenarios should then be set up;
- The best mitigation solutions should be designed and implemented on the basis of the knowledge gained in the planning phase;

- A program of systematic observations at the sites where risk has been mitigated should then be planned and carried out to detect any shortcomings and test the efficiency of the investigations.

Each of the above phases needs improvements and depends, to achieve them, on improvements in the other fields. In this way a sustainable development can be reached. As an example, the application of existing models based on data collected in the field and the development of reliable new ones would allow, on one hand, to better focus what to observe in the field and, on the other hand, improve both mitigation methodologies and measures and hazard mapping procedures. The field application of these latter would then identify new parameters to be introduced in the models. From all these activities would emerge the best mitigation solutions to be applied.

The Special Issue focuses on flood and debris flow management and defence. The idea was to highlight the contributions by some of the delegates that took part in the two International Conferences held in Dubrovnik in 2012 , i.e.

- Monitoring, Simulation, Prevention and Remediation of Dense and Debris Flows
- Flood Recovery, Innovation and Response

More specifically, advanced research outcomes and relevant case studies in various countries have been selected, often giving particular attention to professional and managerial aspects and modelling applications and results on flood and debris flow related issues.

The meetings were jointly organized by the Wessex Institute of Technology, the Universities of Milano and West of England, and the Politecnico of Milano, and sponsored by WIT Transactions on Ecology and Environment and the International Journals of Sustainable Development and Planning and Safety and Security Engineering; with the endorsement of EurAgEng (European Society of Agricultural Engineers), CIGR (International Commission of Agricultural and Biosystems Engineering) and ICID (International Commission on Irrigation and Drainage).

The Conferences provided a forum for researchers, academics and professionals actively involved in improving and interchanging knowledge and expertise in a wide range of technical, social and economic issues related to the broad themes of debris flow remediation and defence and flood recovery, innovation and response.

The Special Issue concerns papers on flood and debris flow related issues presented by renowned international scientists and professionals. Illustrative and informative case studies in different Countries have been selected, giving particular attention to theoretical, experimental, institutional and managerial topics such as: advanced mathematical models, laboratory tests and new integrated hazard defence and mitigation measures.

All the papers in this Special Issue contain a valuable contribution to advanced research and “lessons learned” and to the design of a new balance approach aiming at reducing the vulnerability of the environment to flood and debris flow related hazards.

Daniele de Wrachien
Stefano Mambretti
The Guest Editors