

International Symposium on IoT and ML for Ecosystem Restoration & Multihazard Resilience 05th to 09th of June 2021

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From my past experiences as a hydrologist and a hydraulic engineer, from my field work in ungauged experimental basins, and my own understanding of climate change, I may see the following challenges with regard to multi-hazards and water as a constituent part of the ecosystem:

- Better understanding is needed of the dynamics of climate change, and especially to comprehend its diverse impacts on the water cycle and as a triggering factor for a chain of multi-hazards.
- Better deployment is needed of the existing cutting-edge technologies (as well as of the emerging ones) to monitor climate and environmental changes.
- I believe that we shall find ways to take advantages of remote sensing techniques including drones and Internet-of-Things (IoT), Machine Learning (ML), Artificial Intelligence (AI) in our Digital Twins of Water & Earth to live in a safer world.
- The importance of Early Warning Systems for DRR will raise, based on ensemble predictions and possibly Artificial Intelligence (AI) support systems to be used by experts to minimise automatic errors and false alarms.





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Cyber risks should not be neglected in these times of new technologies, such as IoT, cloud computing, big data, or networking.

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Improvements are needed in our educational system to better integrate climate change related questions in the curricula at all levels of education, and to develop open technologies for and to use already existing Open Educational Resources (OER) and Open Learning (OL) tools to a larger extent. UNESCO Chairs and Networks are playing crucial role in these efforts.

Furthermore, life-long learning should be supported and promoted to enhance different policies such as Active Citizenship, Lessons Learned, Building Back Better, Nobody-Is-Left-Behind etc.

In higher education in Europe, we are trying to establish several networks of universities with similar visions and strategies to develop joint programmes, and open their own sources to a larger number of students – internationalisation of education sector is important to deal with climate change.

Virtual universities might not be the right answer, but virtual laboratories to enhance competences of a large circle of students without access to different labs at their own universities, where they are enrolled, may be a potential breakthrough in selected fields in engineering and natural sciences.

Open Science should be supported as much as possible, especially by opening Data Repositories, so that research data will be freely available to researchers around the world.



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- Multi-hazards can be comprehensively understood and mitigated better by joint international efforts (in case of large-scale transboundary events: tsunamis, floods, heat waves, droughts,).
- We need partnerships such as Water4All Partnerships in Europe in the field of water science & water sector, or the ISDR-ICL Sendai Partnerships 2015-2030 for global promotion of understanding and reducing landslide disaster risk, all in our efforts to overcome small-scale research, as well as national and local policies.
- The Sendai Framework for DRR is a good joint platform that asks for different commitments, such as the Kyoto Landslide Commitment 2020 initiated by the International Consortium on Landslides based in Kyoto.
- The definition of risk as a multiplication of hazards and vulnerability and exposure of elements at risk should go into adaptive risk management, where we do not directly combat nature (hazards) but will adapt to natural laws by understanding risks as consequences on nature and society.
- Culture of living with (natural) disasters should be promoted by increasing (social) resilience in all forms to lower their (negative) potential consequences, including individual self-responsibility for disaster risk reduction.





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Van Westen (2013) Remote Sensing and GIS for Natural Hazards Assessment and Disaster Risk Management DOI: 10.1016/B978-0-12-374739-6.00051-8

An important part of our further dealing with multi-hazards should be fully acceptance of uncertainties in our models when planning structural and non-structural measures.

Especially tricky are unknown unknowns that show that our understanding of mutual and compound hazardous events is not perfect.

We will advance our society resilience against multi-hazards only by decisive and smart steps, where technologies play a major but not the only role.