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Building bridges between disciplines: A generalized mathematical framework for climate change impact assessment

Anneli Guthke[1], Amin E. Bakhshipour[2], Felipe P.J. de Barros[3], Holger Class[4], James E. Daniell[5], Ulrich Dittmer[2], Markus Friedrich[6], Jannik Haas[1], Cordula Kropp[7], Bruno Merz[8,9], Sergey Oladyshkin[1], Andreas Schäfer[5], Michael Sinsbeck[1], Daniel Straub[10], Kristina Terheiden[11], Silke Wieprecht[11], and Wolfgang Nowak[1]

[1]University of Stuttgart, Institute for Modelling Hydraulic and Environmental Systems, Department of Stochastic Simulation and Safety Research for Hydrosystems, Stuttgart, Germany (anneli.guthke@iws.uni-stuttgart.de)
[2]Institute for Urban Water Management, TU Kaiserslautern, Germany
[3]Sonny Astani Department of Civil and Environmental Engineering, University of Southern California, Los Angeles, CA, USA
[4]Department of Hydromechanics and Modelling of Hydrosystems, University of Stuttgart, Stuttgart, Germany
[5]Geophysical Institute, Karlsruhe Institute of Technology, Karlsruhe, Germany
[6]Department of Transport Planning and Traffic Engineering, University of Stuttgart, Stuttgart, Germany
[7]Department of Environmental Sociology and Technology Assessment, University of Stuttgart, Stuttgart, Germany
[8]GFZ German Research Centre for Geosciences, Section Hydrology, Potsdam, Germany
[9]Institute for Environmental Sciences and Geography, University Potsdam, Germany
[10]Engineering Risk Analysis Group, Technische Universität München, Germany
[11]Department of Hydraulic Engineering and Water Resources Management, University of Stuttgart, Stuttgart, Germany

Climate change impact and risk assessment is per definition a highly interdisciplinary task. Collaboration across disciplines is, unfortunately, often complicated by different perspectives, approaches, and terminology. To help building bridges, we propose a generalized mathematical framework for impact and risk assessment.

In an unprecedented community effort, we have derived a generally applicable risk equation for spatially-distributed and dynamic systems. We start off with a general framing and then refine individual parts of the equation as much as needed. We will show how the individual terms of our unified risk equation explicitly relate to concepts of frequency, intensity, duration, exposure, vulnerability and asset worth. The rigorous mathematical treatment allows investigating the importance of risk factors and serves as a basis for risk management and reduction. Yet, the actual quantification of risk is not our primary goal – rather, the proposed framework forces us to be very precise in definitions and terminology. Thereby, it effectively improves communication and collaboration across disciplines. Indeed, we even learn greatly in cases where we identify limitations that seem to spoil such a mathematically rigorous treatment.

We have successfully applied the framework to various disciplines of civil and environmental engineering, such as flood risk assessment, seismic risk assessment and reliability analysis of critical infrastructure. Users of the equation praise the structured common ground for discussion

and highly recommend at least hypothetically applying this framework to gain a more unified understanding of the problem at hand. In this presentation, we discuss the potential of our proposed framework for risk assessment under climate change. Our transparent and rigorous approach is ideally suited to inform stakeholders and policymakers. Further, we are confident that our approach will serve as a catalyst for interdisciplinary advances toward effective adaptation and mitigation strategies.