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At the next Water Dialogue session

T. Ermolieva, Y. Ermoliev, G. Fischer, M. Makowski, D. Wiberg

will speak about

Methodological challenges in coping with flood risks: Ukrainian and Hungarian flood case studies on the Tisza river

on Tuesday, 6 February 2007

at 11 am

in the Gvishiani Room

Abstract

The talk focuses on research aimed at providing effective support for policy making in integrated management of catastrophic flood risks. The purpose of the seminar is to share experience from two complex case studies of catastrophic floods on Tisza river in Hungary and Ukraine done at IIASA in collaboration with organizations from Hungary, Ukraine and Sweden. We also summarize open research challenges and discuss the development of general methods to deal with specifics of catastrophic risks: inherent spatio-temporal endogenous uncertainties and risks, long-term perspectives and new approaches to discounting, downscaling and upscaling procedures, robust decisions, explicit treatment of spatio-temporal risk exposures and other heterogeneities of various agents such as individuals, farmers, governments and insurers.

The proposed methods deal with floods affecting at once large territories and communities producing interdependent losses. Spatial patterns of the losses depend on various exogenous and endogenous patterns of rainfalls and runoffs, land use practices, reliability of flood defense system, e.g., breaks of dykes, patterns of inundation, geographical distribution of various values and their vulnerability, pooling and loss-spreading mechanisms, etc. Therefore, managing catastrophic flood risks is a complex multidisciplinary problem that requires integrated modeling incorporating decision variables of multiple agents such as individuals, farmers, producers, land use planners, water authorities, governments, insurers, investors. The available historical observations of losses depend on current and former regional developments and risk management policies. Therefore, they cannot be (in general) used for evaluating impacts of new policies. Moreover, the same catastrophe never strikes twice, i.e., the multidimensional and multimodal, as a rule, distributions of endogenous losses cannot be estimated by standard statistical procedures. For these reasons, the development of so-called adaptive stochastic Monte

Carlo optimization models became a key element of catastrophic flood management. We show that these models allow to generate endogenous losses dependent on policies, which have never been implemented before, whereas embedded stochastic optimization procedure sequentially adjust them towards robust strategies by adaptation through simulations. Losses occur abruptly as “spikes” in time and space and they are rare, therefore, they cannot be treated on average, what requires specific risk measures. As a rule, losses have multimodal and multidimensional heavy-tailed endogenous distributions which are ignored by simple mean-variance approaches.

We shall show that coping with catastrophic floods should rely on integrated risk-based spatially explicit model combining natural, engineering, agricultural, financial and socio-economic systems. The discussion of methodological challenges will relate to selection of risk-adjusted criteria for robust decisions; issues of joint scaling of data, models and decisions; GIS-based catastrophe models (generators); simulation of location-specific risk exposures and losses; fast Adaptive Monte Carlo optimization; the choice of appropriate discounting rates to justify investments into flood defense system; evaluation of multipillar risk-management programs.