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Divide and Conquer: An Approach for Interdisciplinary Risk Assessment and Decision Making under Uncertainty for Groundwater-Related Diseases

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Assessing the potential risk of hydro(geo)logical supply systems to human population is an interdisciplinary field. It relies on the expertise in fields as distant as hydrogeology, medicine, or anthropology, and needs powerful translation concepts to provide decision support and policy making. Reliable health risk estimates need to account for the uncertainties in hydrological, physiological and human behavioral parameters. We propose the use of fault trees to address the task of probabilistic risk analysis (PRA) and to support related management decisions. Fault trees allow decomposing the assessment of health risk into individual manageable modules, thus tackling a complex system by a structural "Divide and Conquer" approach. The complexity within each module can be chosen individually according to data availability, parsimony, relative importance and stage of analysis. The separation in modules allows for a true inter- and multi-disciplinary approach. This presentation highlights the three novel features of our work: (1) we define failure in terms of risk being above a threshold value, whereas previous studies used auxiliary events such as exceedance of critical concentration levels, (2) we plot an integrated fault tree that handles uncertainty in both hydrological and health components in a unified way, and (3) we introduce a new form of stochastic fault tree that allows to weaken the assumption of independent subsystems that is required by a classical fault tree approach. We illustrate our concept in a simple groundwater-related setting.