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Flood Risk Curves and Uncertainty Bounds: Separating natural Variability and incomplete Knowledge in Flood Risk Assessments

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Flood risk assessments are frequently associated with significant uncertainty. Optimal decisions about flood mitigation need to take into account this uncertainty. For example, the uncertainty of the risk assessment may influence the choice of mitigation strategies: In situations where only very uncertain statements can be made, provision have to be made for the case that the analysis underestimates the flood risk. Uncertainty analyses have to consider two fundamentally different types of uncertainty: aleatory uncertainty (natural variability) and epistemic uncertainty (incomplete knowledge). Aleatory uncertainty refers to quantities that are inherently variable over time, space or populations of individuals or objects. Epistemic uncertainty results from incomplete knowledge of the object of investigation and is related to our inability to understand, measure and describe the system under investigation. Separating both types of uncertainty may help to make more informed decisions. The separation reveals the uncertainty (epistemic) that can be reduced by more knowledge and the uncertainty (aleatory) that is not reducible. We propose to separate both types of uncertainty in flood risk analysis by providing a flood risk curve that represents natural variability. Incomplete knowledge is described by an uncertainty bound around the flood risk curve. This concept is illustrated with the help of a flood risk analysis for a polder at the river Rhine.