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Climate change risk assessments traditionally follow an analytical structure in which climate information is linked to impact models, and subsequently to damage models and decision-making tools. This structure generates a wide cascade of uncertainties that accumulate with each analytical step, consequently resulting in a wide range of risk estimates. This cascade of uncertainties can suggest that climate change risk assessments are not very useful in the context of decision-making regarding climate adaptation. However, many of the uncertainties revealed in traditionally structured climate risk assessments are not equally relevant to specific decisions, and presenting wide cascades of uncertainties can mask key decision-making parameters. In this paper, we show how the cascade of uncertainty relevant to decision-making can be reduced by applying an uncertainty decomposition approach, which, in study design, initially identifies the uncertainty cascade elements of particular relevance to the focal decision-making context. We compare the full cascade of uncertainties that emerge in a traditional risk assessment based on linked climate scenarios, impact modeling, and damage cost assessment with the uncertainty cascade generated by a detailed assessment of urban flooding risks where the focus is on key uncertainties in decision-making on climate change adaptation. A case study on flooding from extreme precipitation in the Danish city of Odense is used to decompose major sources of uncertainties in the climate modeling, the hydrological modeling, and the damage cost assessment. The decomposition approach reduces the focal range of damage cost estimates by 7% 9 M EUR, which corresponds to a 20% 24% reduction in the full uncertainty range without the application of the decomposition approach. Assuming that damage cost assessments can provide an indication of how much society should be willing to spend on climate adaptation, a decomposition approach as presented here could assist decision-makers in increasing the economic effectiveness when investing in protective measures.

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