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Bounding probabilistic sea-level projections within the framework of the possibility theory

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Despite progresses in climate change science, projections of future sea-level rise remain highly uncertain, especially due to large unknowns in the melting processes affecting the ice-sheets in Greenland and Antarctica. Based on climate-models outcomes and the expertise of scientists concerned with these issues, the IPCC provided constraints to the quantiles of sea-level projections. Moreover, additional physical limits to future sea-level rise have been established, although approximately. However, many probability functions can comply with this imprecise knowledge.
In this contribution, we discuss the feasability of using a new framework based on extra-probabilistic theories (namely the possibility theory) to model the uncertainties in sea-level rise projections by 2100 under the RCP 8.5 scenario (Le Cozannet et al., 2016). We highlight that the results provide a concise representation of uncertainties in future sea-level rise and of their intrinsically imprecise nature, including a maximum bound of the total uncertainty. Today, coastal impact studies are increasingly moving away from deterministic sea-level projections, which underestimate the expectancy of damages and adaptation needs compared to probabilistic laws. However, we show that the probability functions used so-far have only explored a rather conservative subset of sea-level projections compliant with the IPCC. Thus, coastal impact studies relying on these probabilistic sea-level projections are expected to underestimate the possibility of large damages and adaptation needs.

Reference

Le Cozannet G., Manceau JC., Rohmer, J. (2016). Bounding probabilistic sea-level rise projections within the framework of the possibility theory. Accepted in Environmental Research Letters.