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Practical appraisal of **extra-probabilistic** approach:

**support for decision-making under
deep uncertainty for future coastal flooding**

Jérémy Rohmer j.rohmer@brgm.fr

Co-authors: G. Le Cozannet, J.C. Manceau

IPCC uncertainty language

“GMSL will rise between [...] 0.84 m (0.61–1.10 m, likely range) (RCP8.5) by 2100 (medium confidence) relative to 1986-2005” (SROCC, Chap. 4, 09/2019)

Mastrandrea et al. (2010)

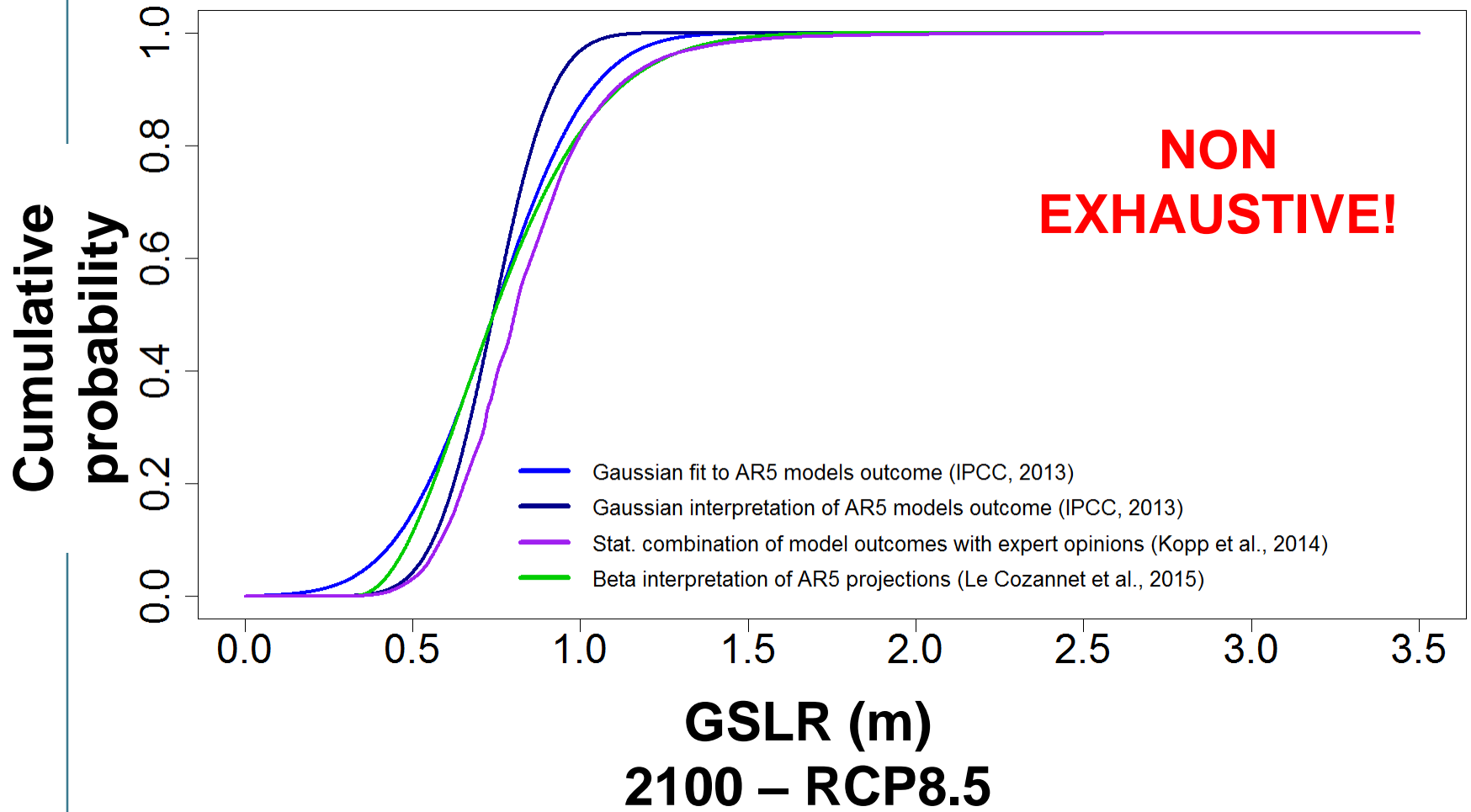
IPCC uncertainty language

“GMSL will rise between [...] **0.84 m (0.61–1.10 m, likely range)** (RCP8.5) by 2100 (medium confidence) relative to 1986-2005” (SROCC, Chap. 4, 09/2019)

Term*	Likelihood of the Outcome
<i>Virtually certain</i>	99-100% probability
<i>Very likely</i>	90-100% probability
<i>Likely</i>	66-100% probability
<i>About as likely as not</i>	33 to 66% probability
<i>Unlikely</i>	0-33% probability
<i>Very unlikely</i>	0-10% probability
<i>Exceptionally unlikely</i>	0-1% probability

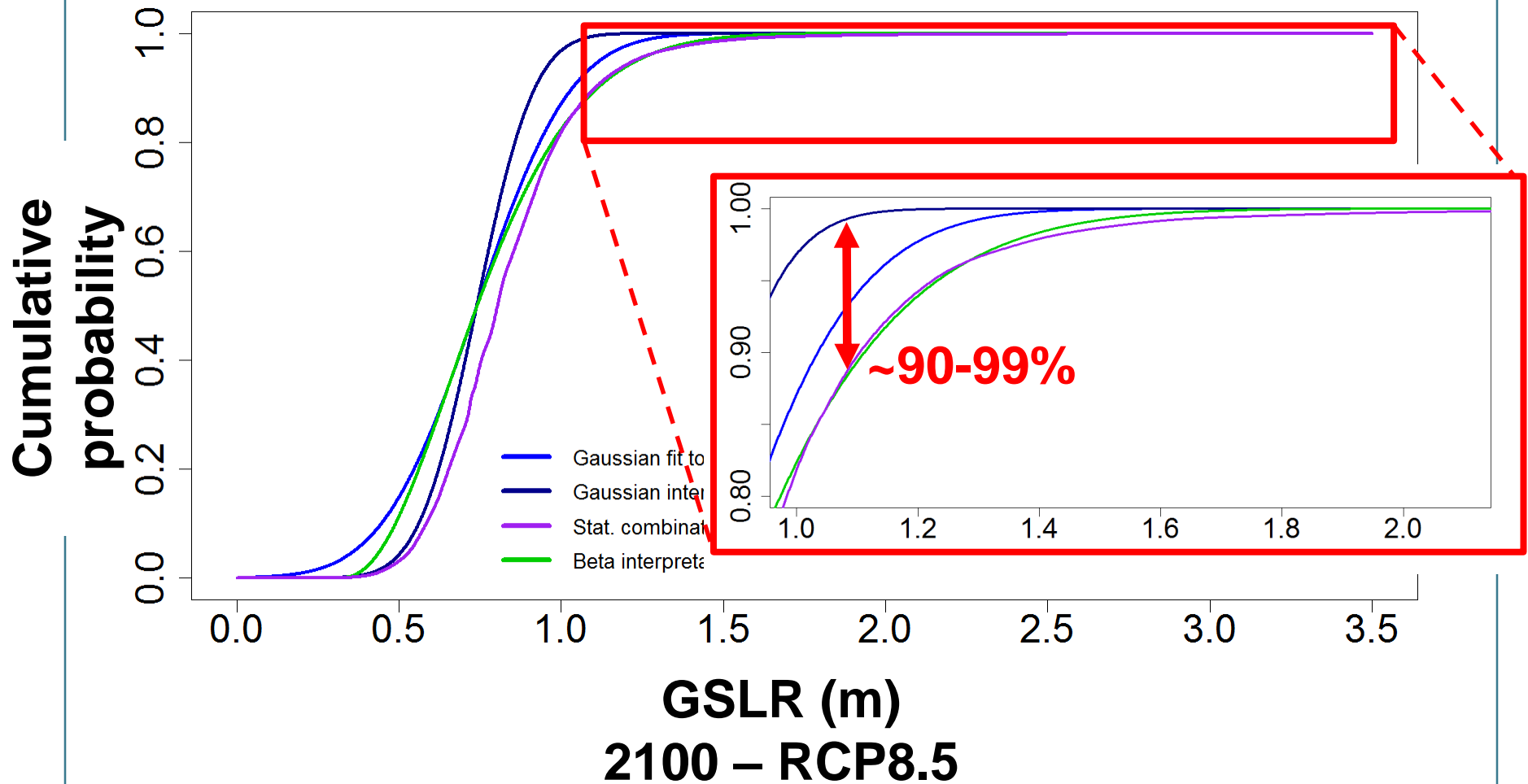
Mastrandrea et al. (2010)

Several credible probabilistic projections based on **slightly different assumptions** have been published



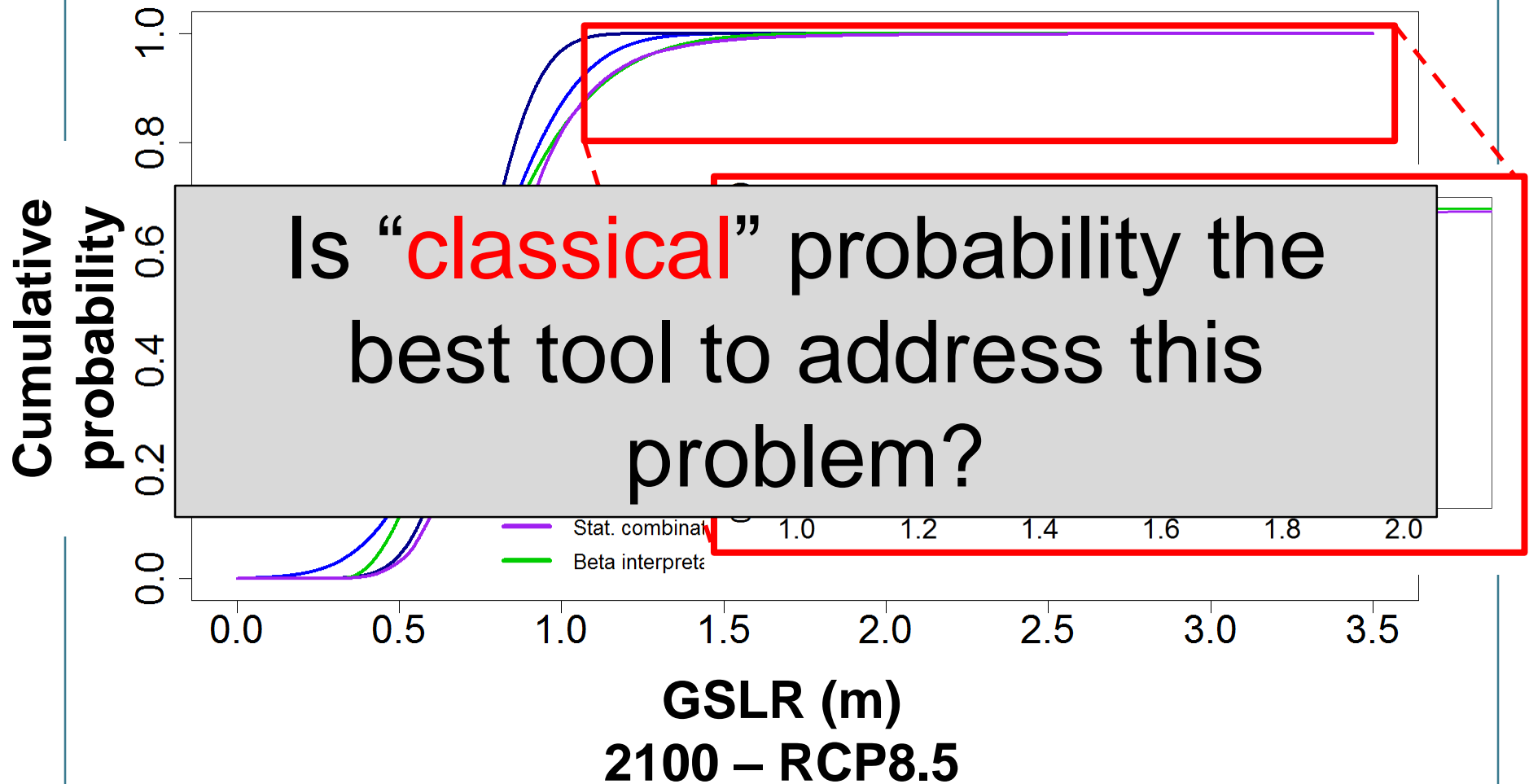
Le Cozannet et al. (2017) based on AR5; see also Bakker et al. (2017)

Does it matter?



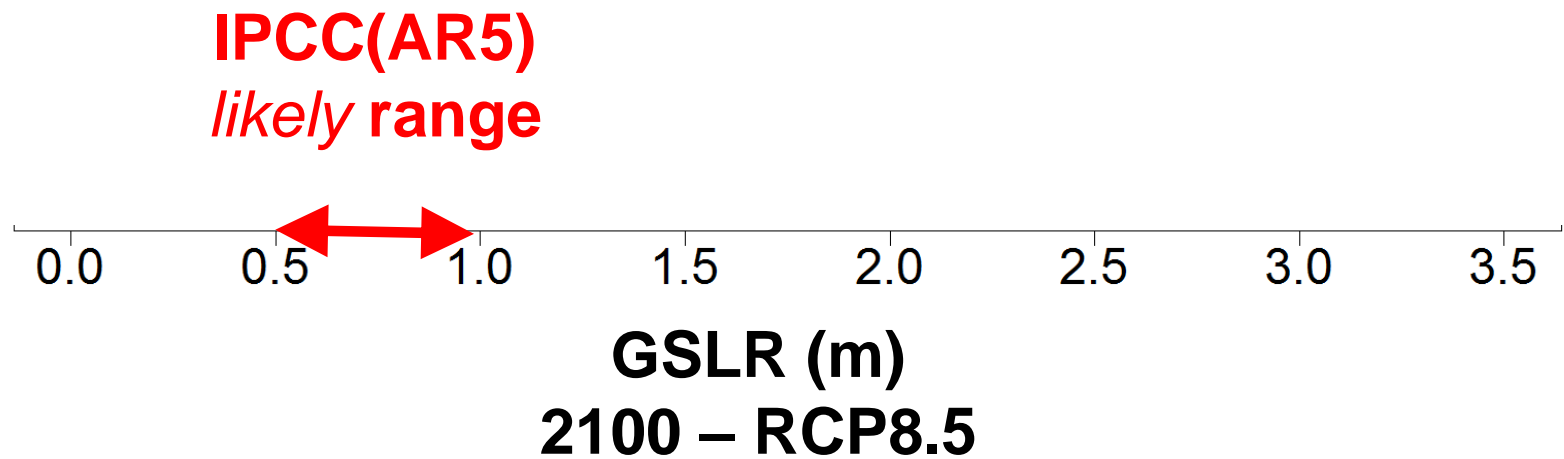
Le Cozannet et al. (2017) based on AR5

Does it matter?



Le Cozannet et al. (2017) based on AR5

Alternative setting: interval



More than just an interval

Probability P that GSLR is within the interval

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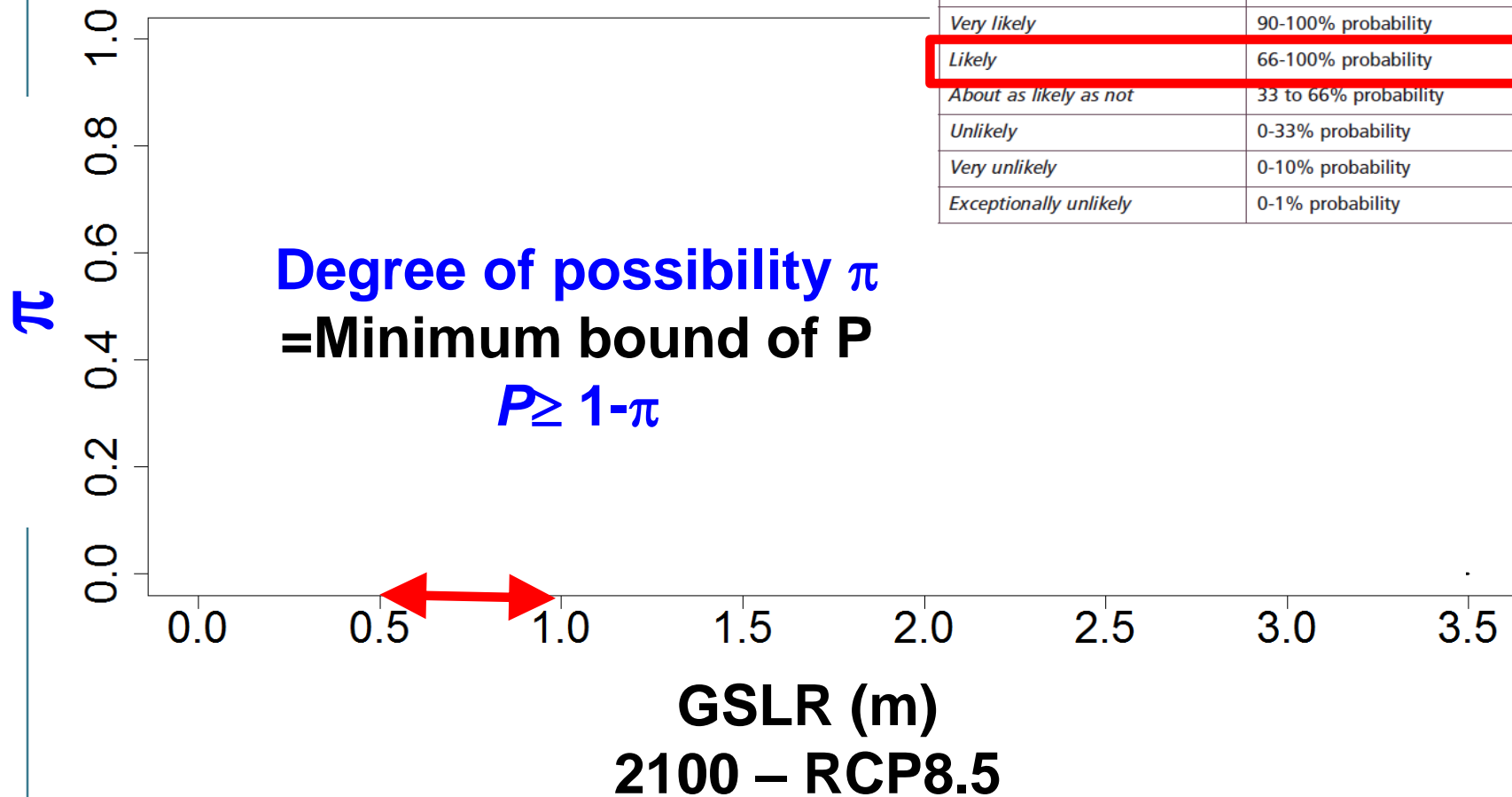
IPCC(AR5)
likely range



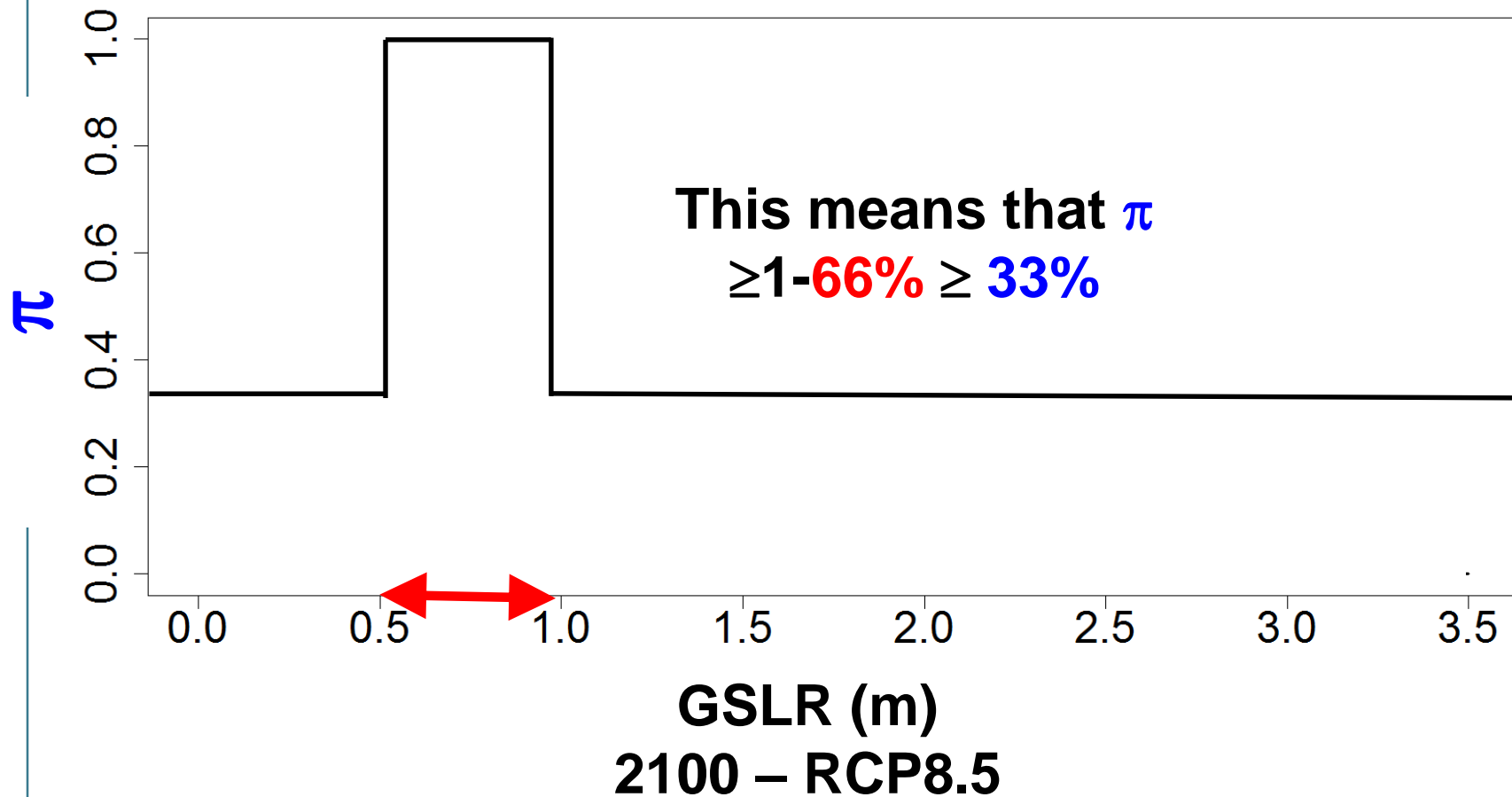
GSLR (m)
2100 – RCP8.5

Possibility setting

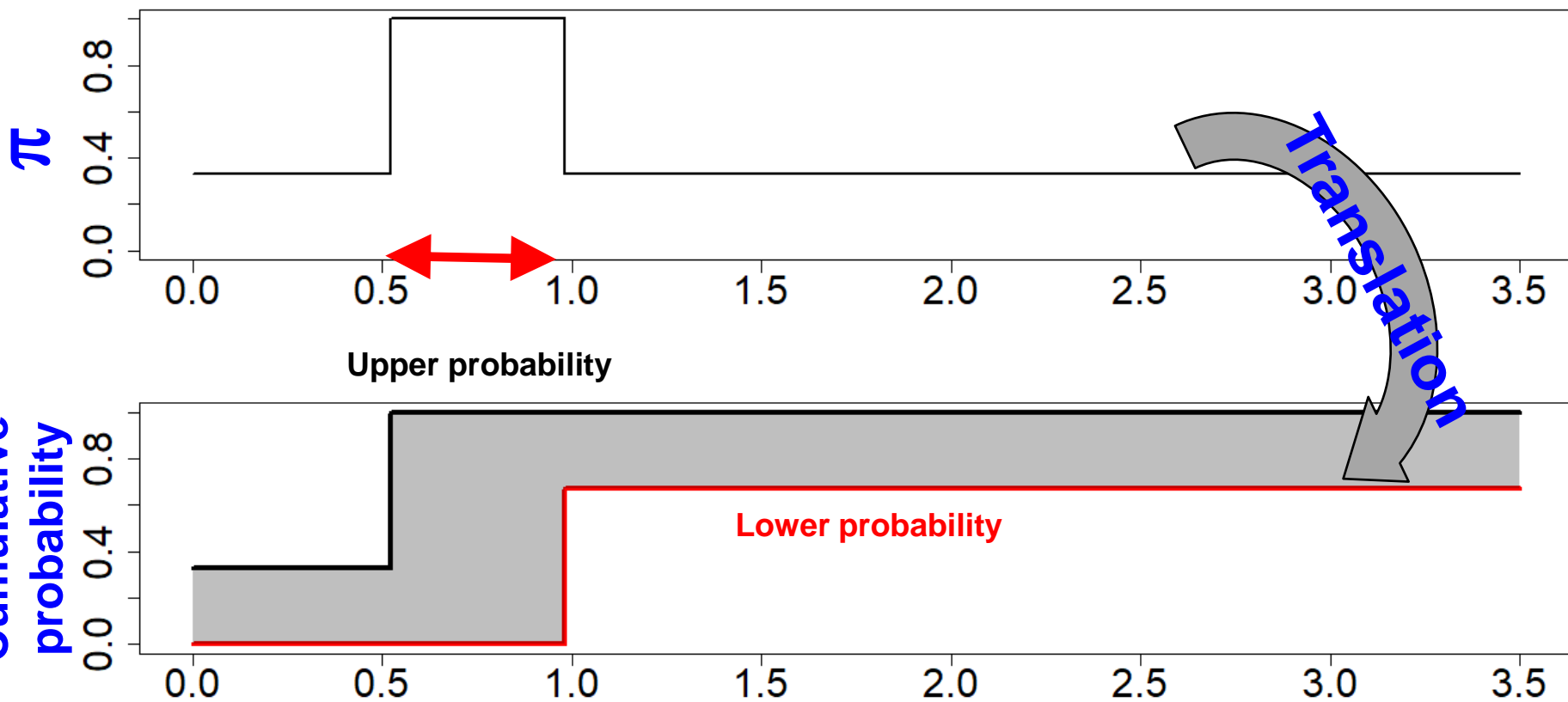
Probability P that GSLR is within the interval



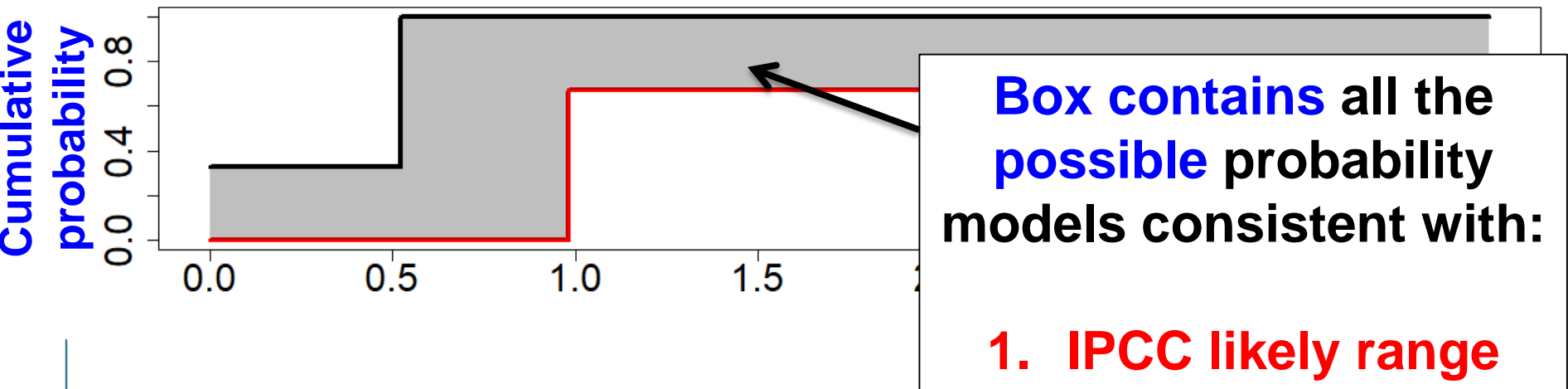
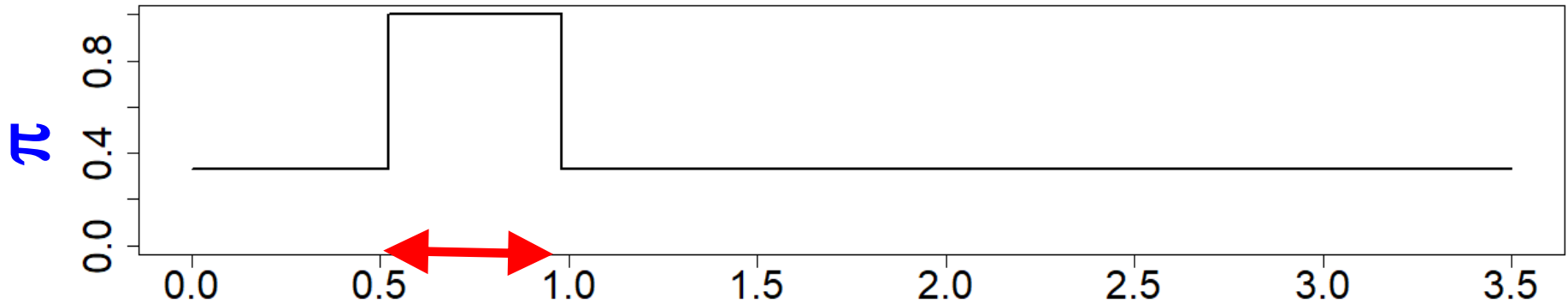
Possibility setting



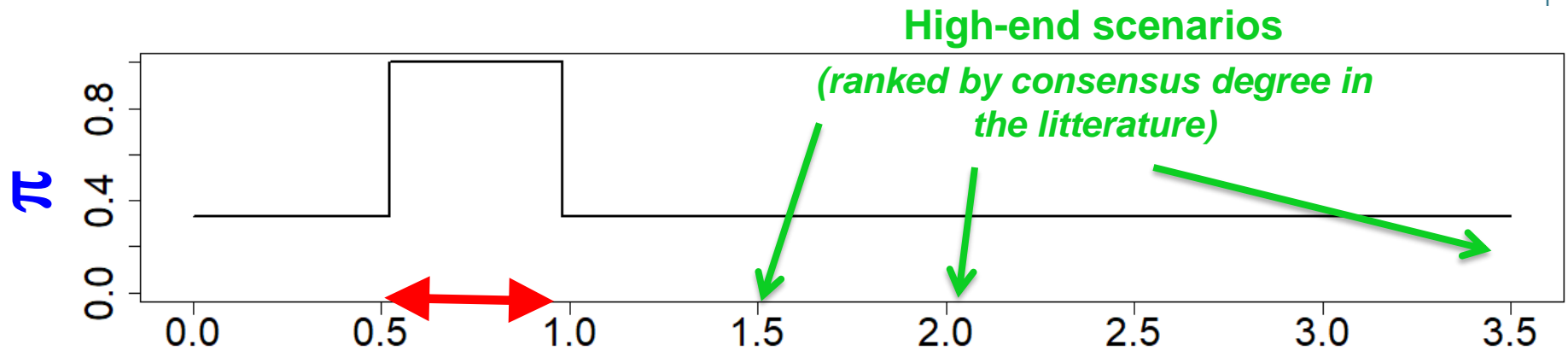
Extra-probabilities



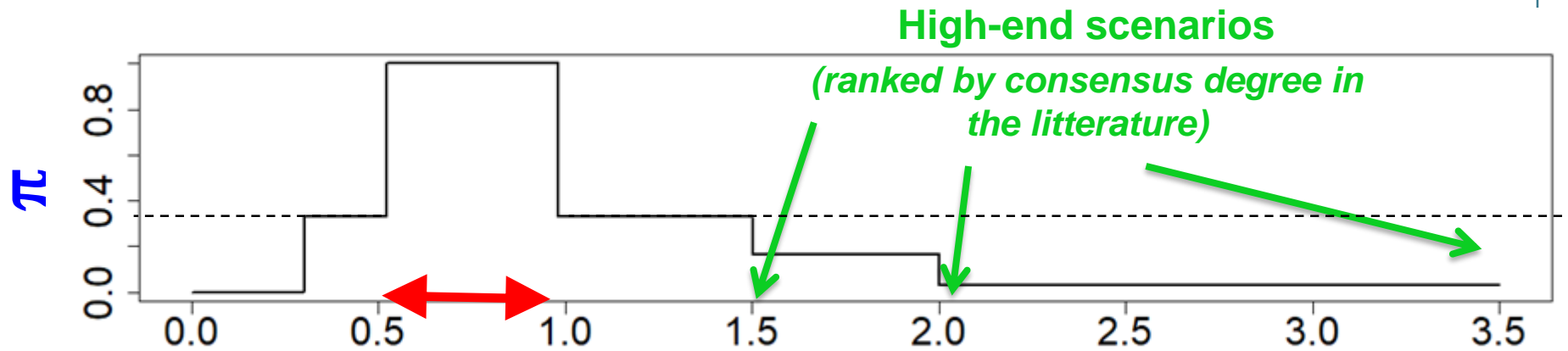
Extra-probabilities



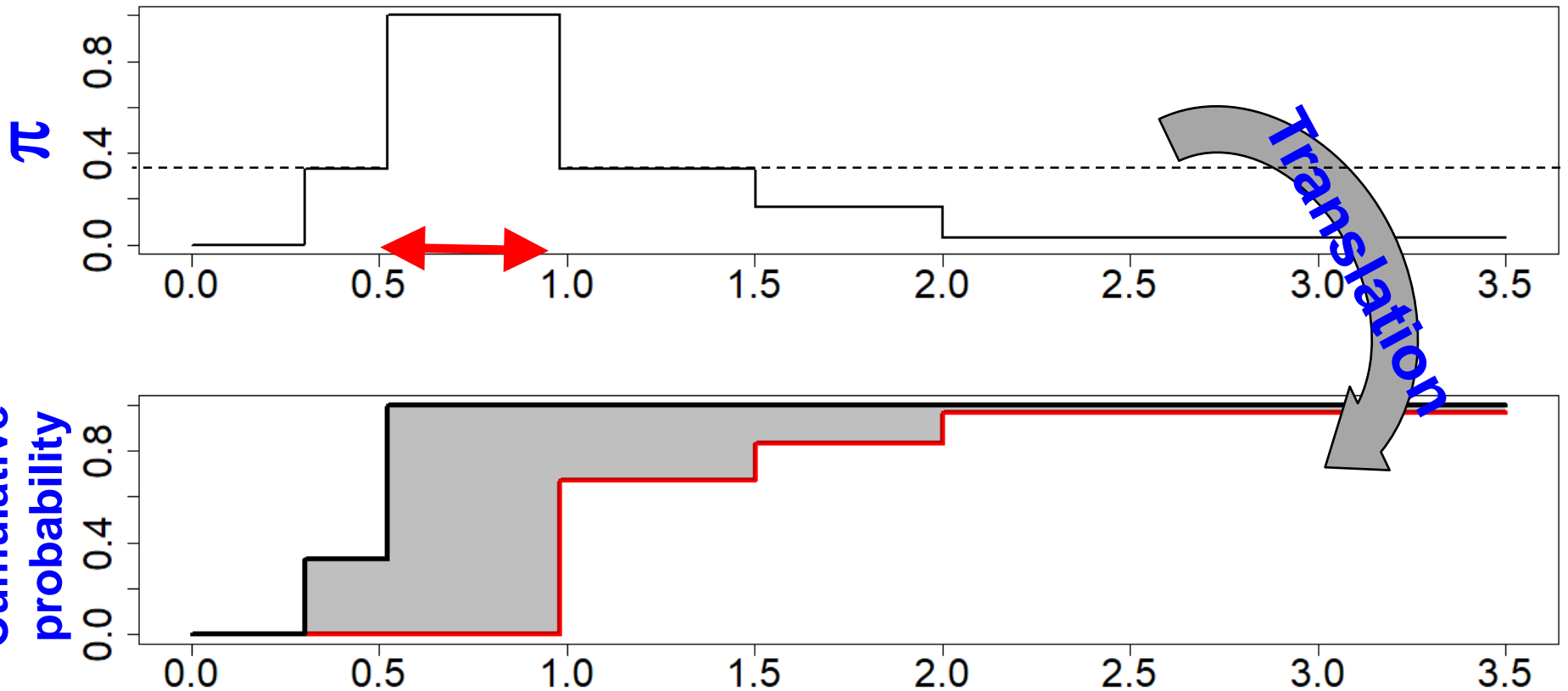
Let us add more information



Let us add more information

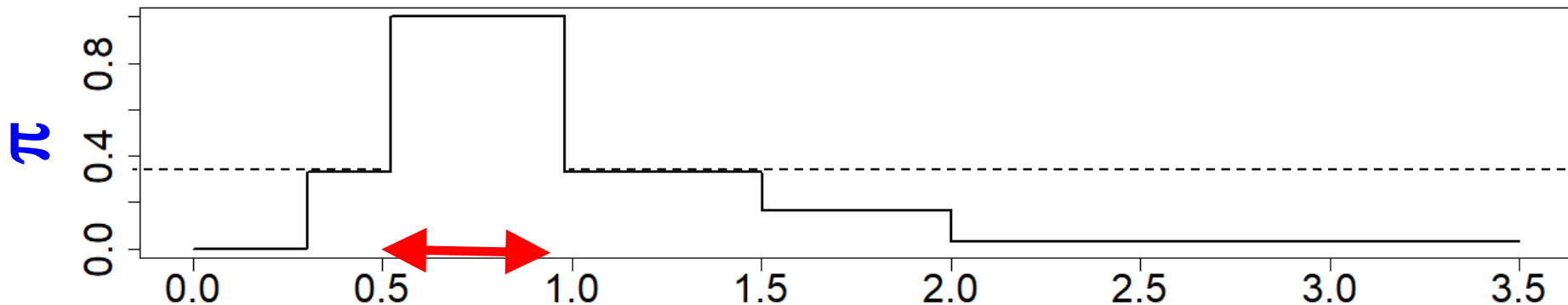


Translation into probabilities

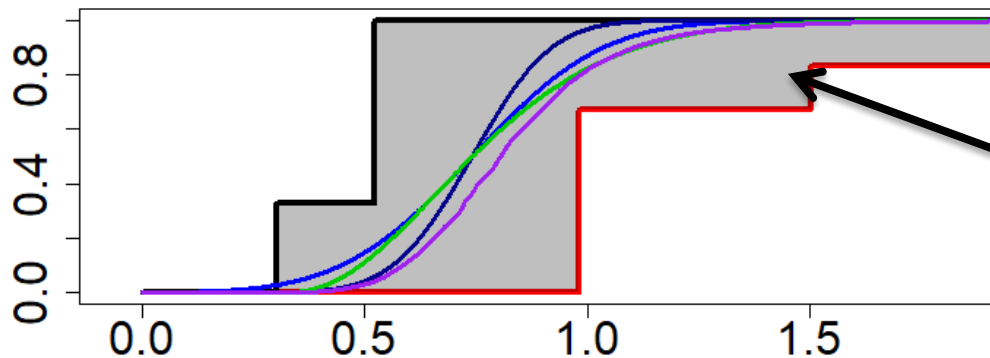


Le Cozannet et al. (2017)

Translation into probabilities



Cumulative probability

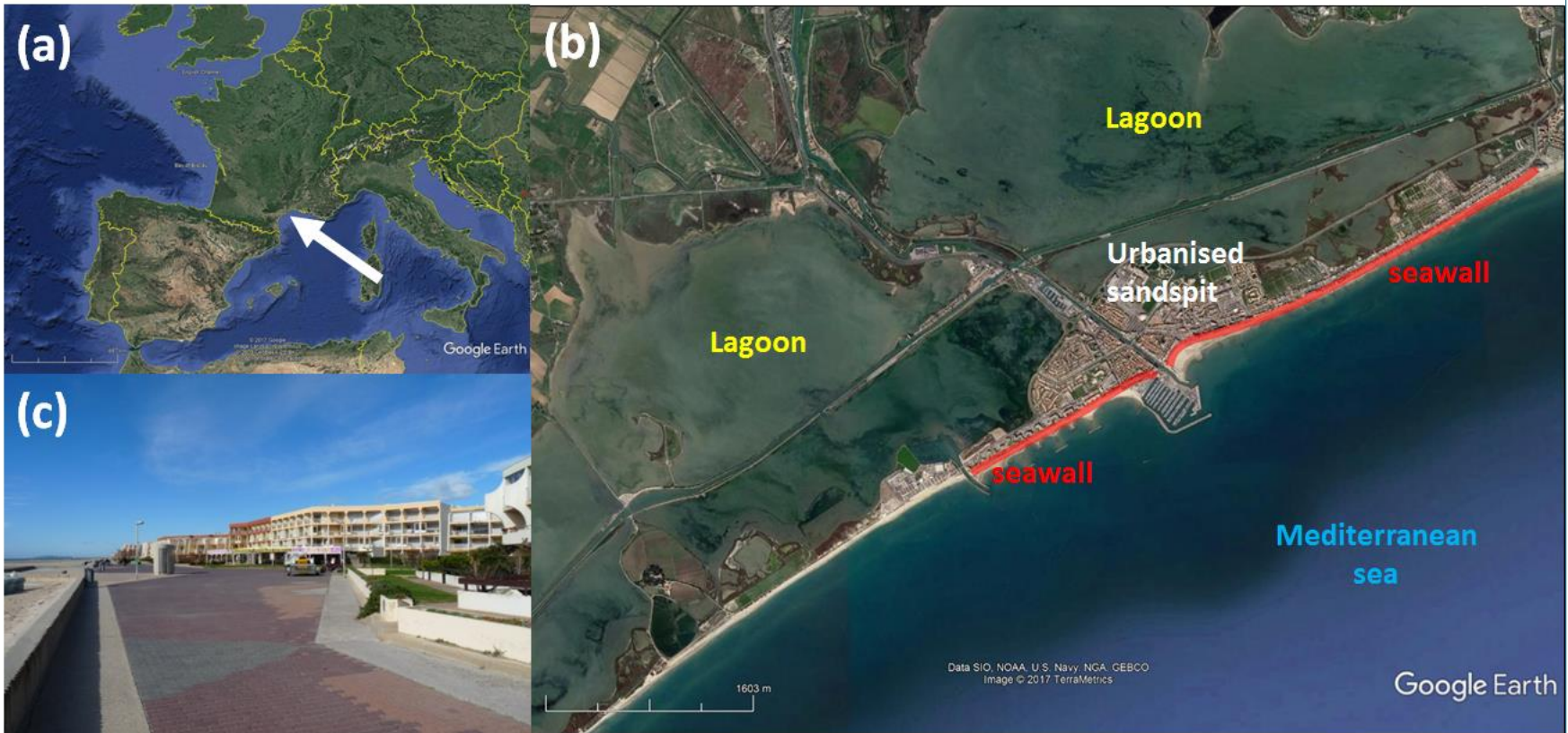


Box contains all the possible probability models consistent with:

- 1. IPCC likely range**
- 2. HE scenarios**

Le Cozannet et al. (2017)

What is the probability of flooding by 2100?



Rohmer et al. (2019)

Climate Change scenario

Scenarios RCP2.6,4.5,6.0,8.5

Global SLR projection

Kopp et al. (2014)'s projections

Highend scenarios

Regional SL variability

Triangle probability law

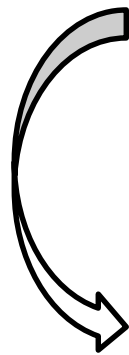
Extreme water levels

Pareto probability law

Wave setup

Uniform probability law

Cascade of uncertainty

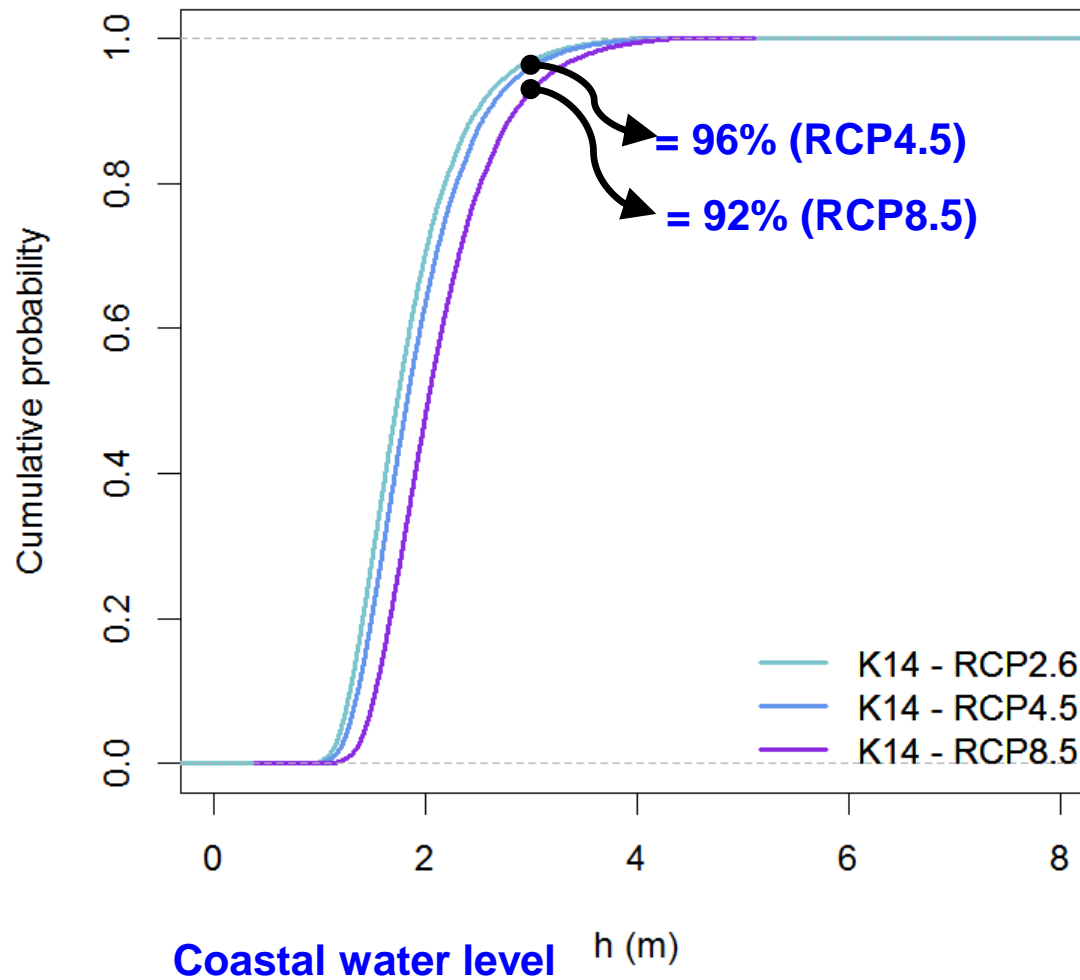


Coastal water level h

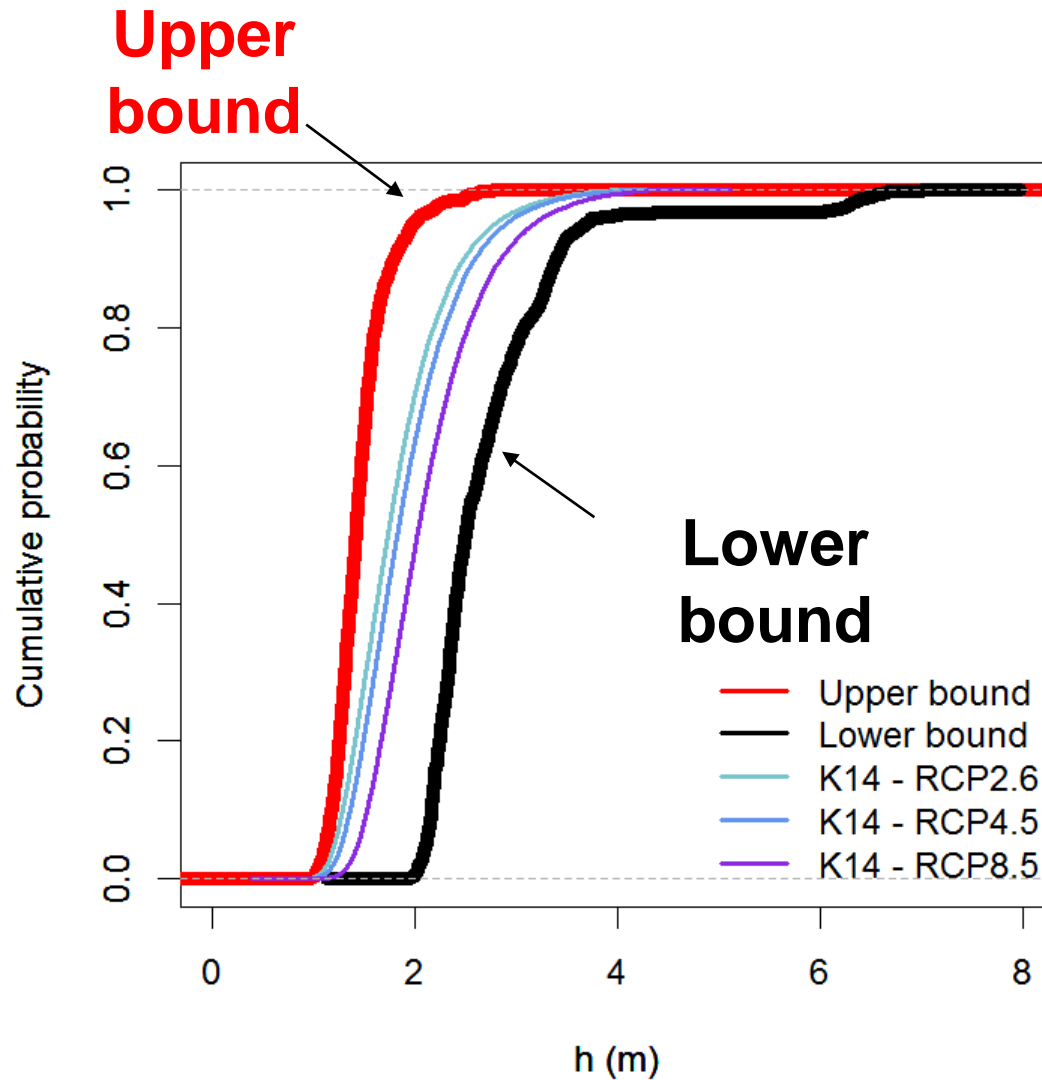


Using probabilities

Probability of non-exceedance, threshold=3m

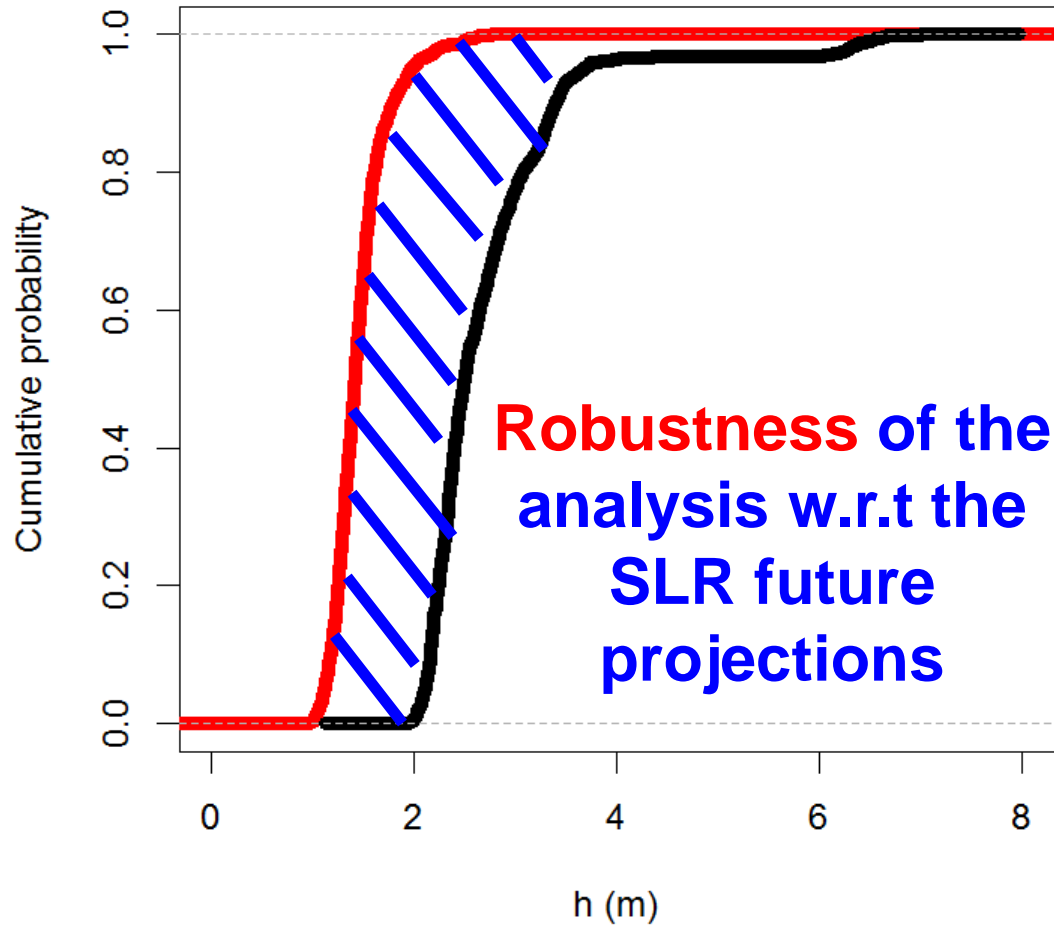


Using now imprecise probabilities (p-box)



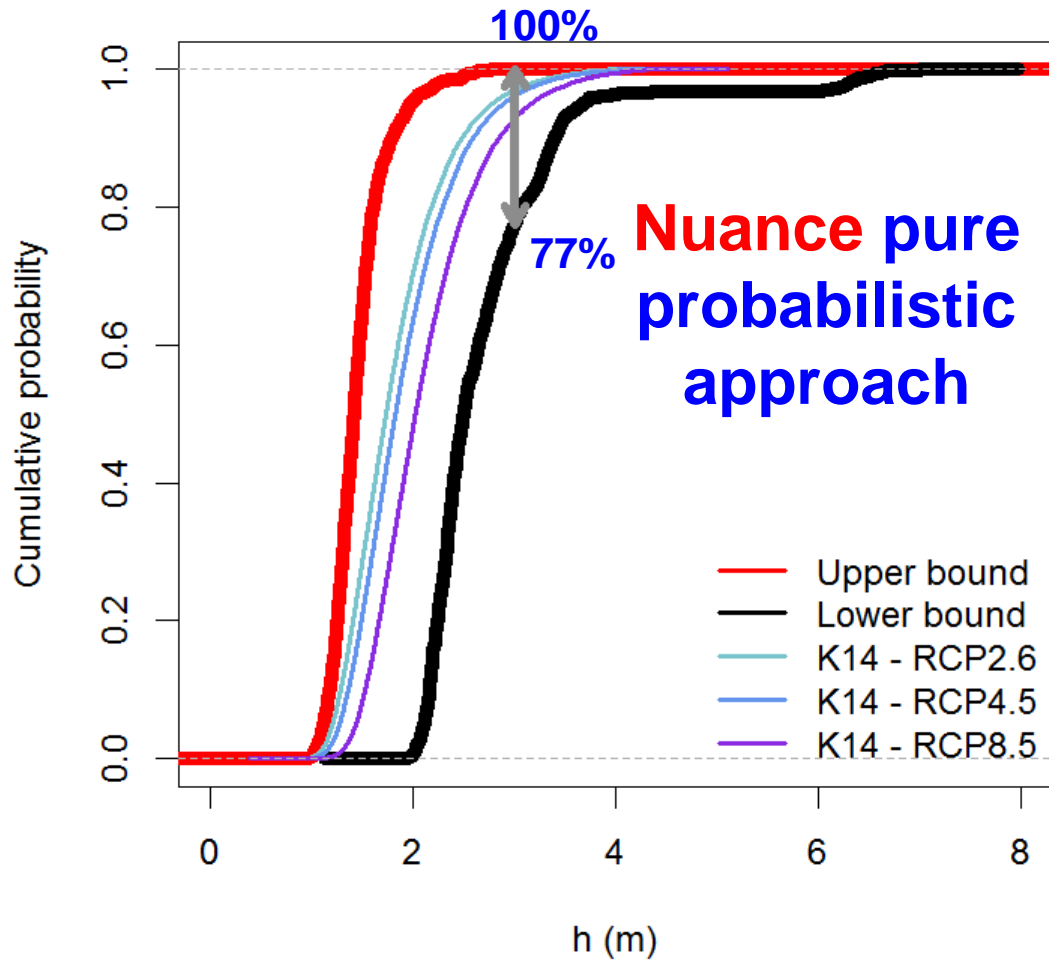
Propagation using algorithm implemented in R (pkg HYRISK, Rohmer et al., 2018)

Using now imprecise probabilities (p-box)



Rohmer et al. (2019)

Probability of non-exceedance, threshold=3m



Rohmer et al. (2019)

Summary

Pros...

Nuance too confident probabilistic results

Picture **what is unknown**

Support decision-making w.r.t deep uncertainties

Guide new **knowledge gathering**

} **This presentation**

See also...



[Climatic Change](#)

July 2019, Volume 155, [Issue 1](#), pp 95–109 | [Cite as](#)

Addressing ambiguity in probabilistic assessments of future coastal flooding using possibility distributions

Authors

[Authors and affiliations](#)

Jérémy Rohmer , Gonéri Le Cozannet, Jean-Charles Manceau

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} **This presentation**

...and **cons**

Communication

Too sophisticated?

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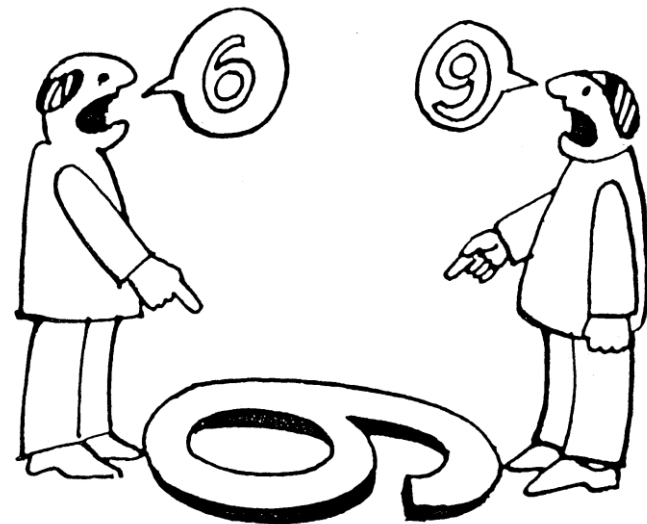
} **This presentation**

...and **cons**

Communication

Too sophisticated?

> **Need for different perspectives** (extra-probabilistic, frequentist, Bayesian, robust, etc.)



Thank you for your attention!