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## Practical appraisal of extra-probabilistic approach to support decision-making under deep uncertainty for future coastal flooding

Jérémy Rohmer, Gonéri Le Cozannet, Jean Charles Manceau

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

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

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**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)**

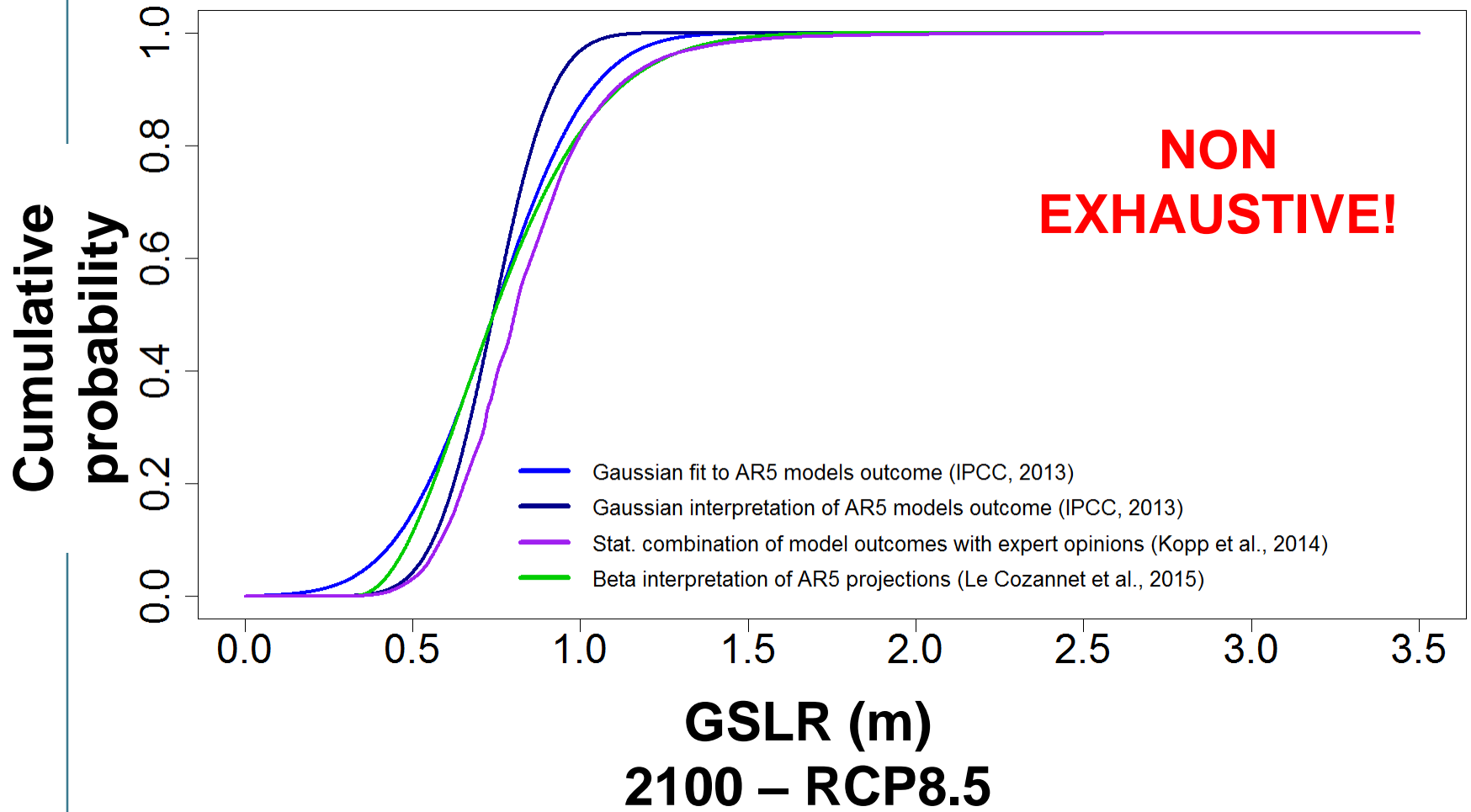
## IPCC uncertainty language

“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

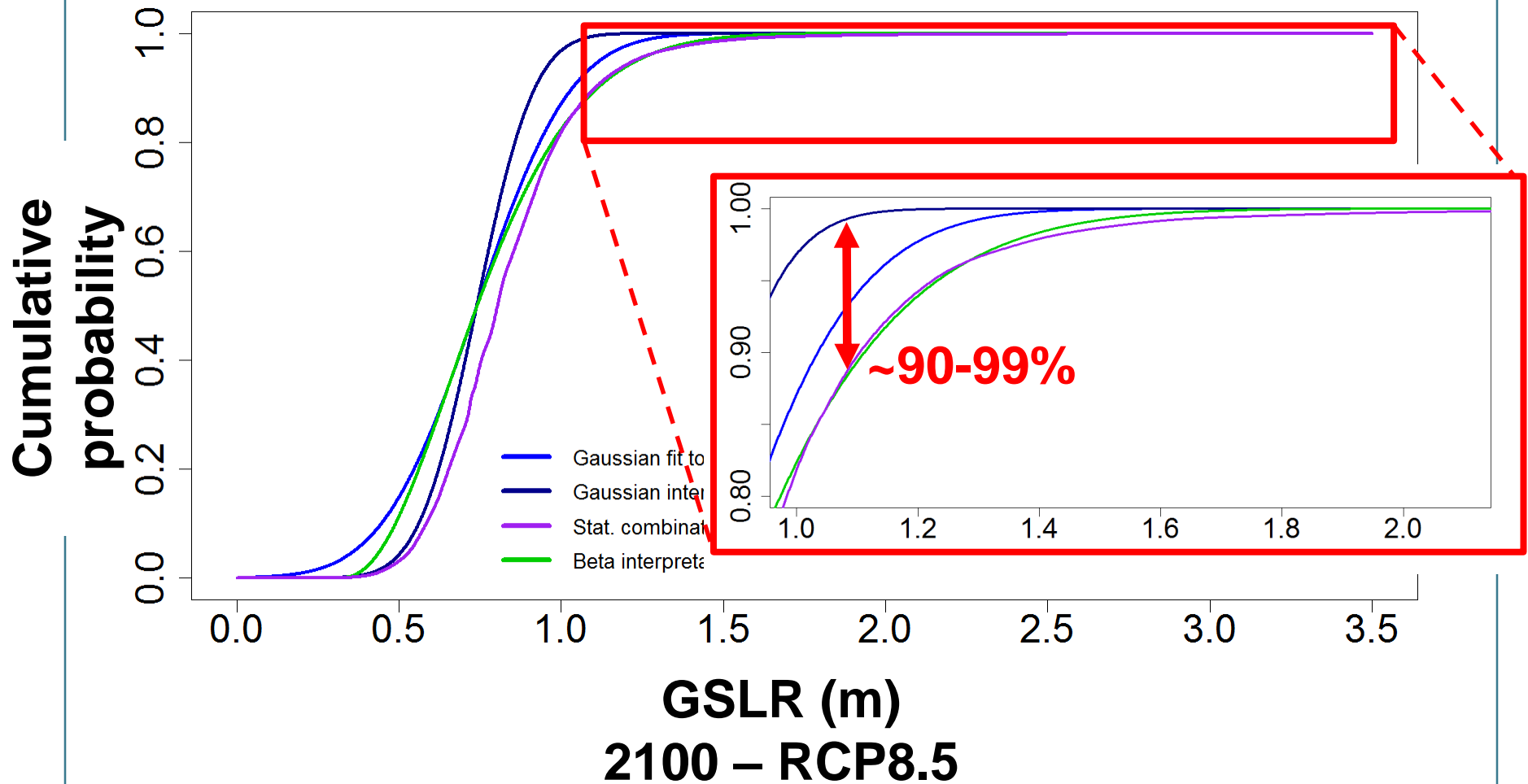
**Mastrandrea et al. (2010)**

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



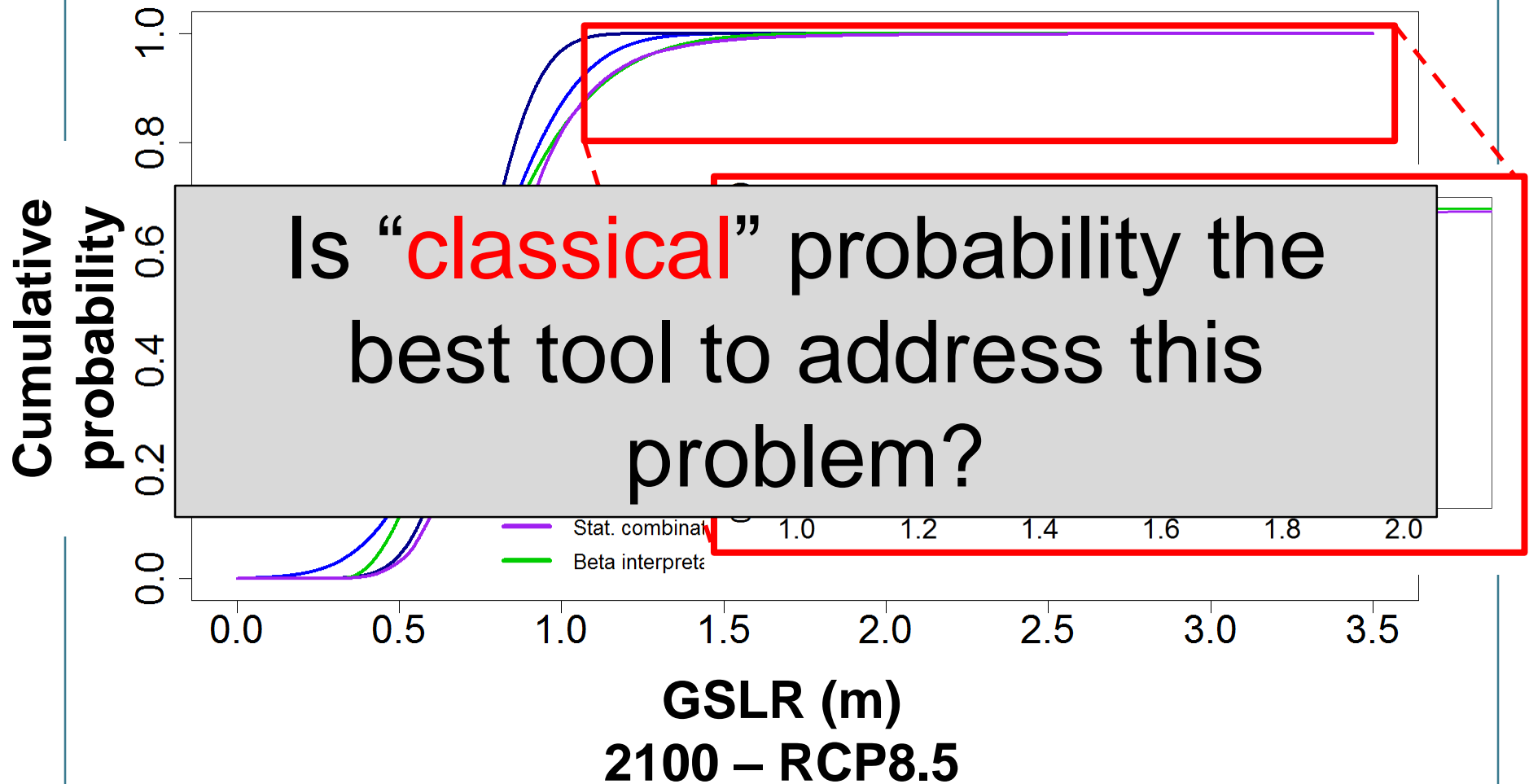
Le Cozannet et al. (2017) based on AR5; see also Bakker et al. (2017)

# Does it matter?



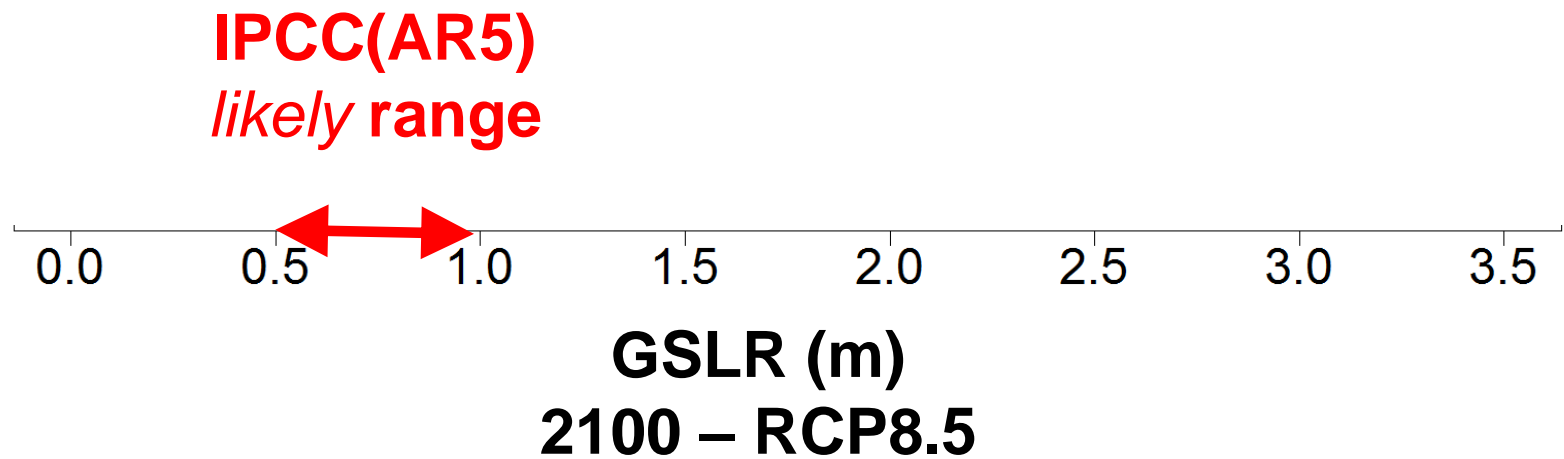
Le Cozannet et al. (2017) based on AR5

## 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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<i>Virtually certain</i>	99-100% probability
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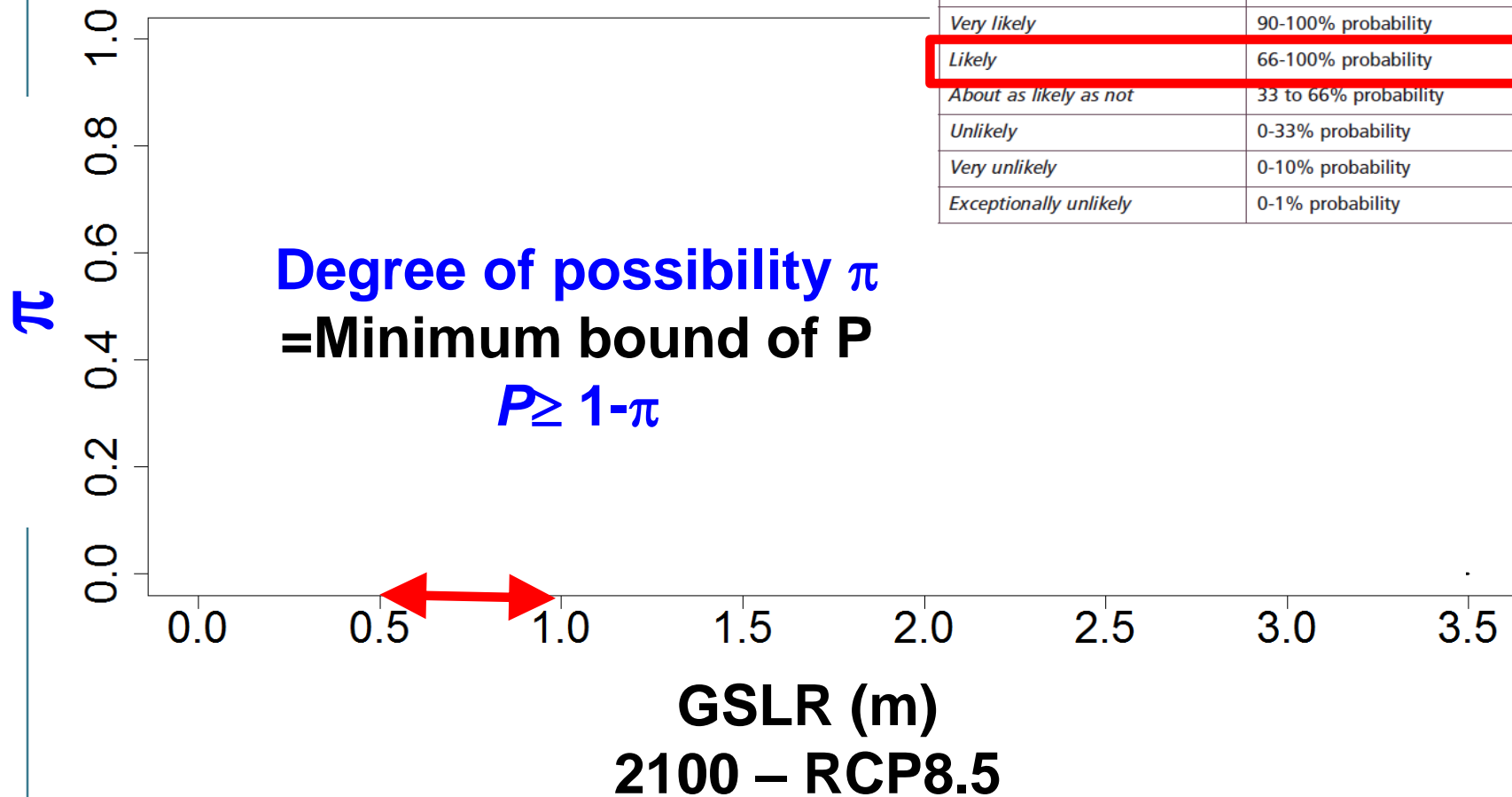
**IPCC(AR5)**  
*likely range*



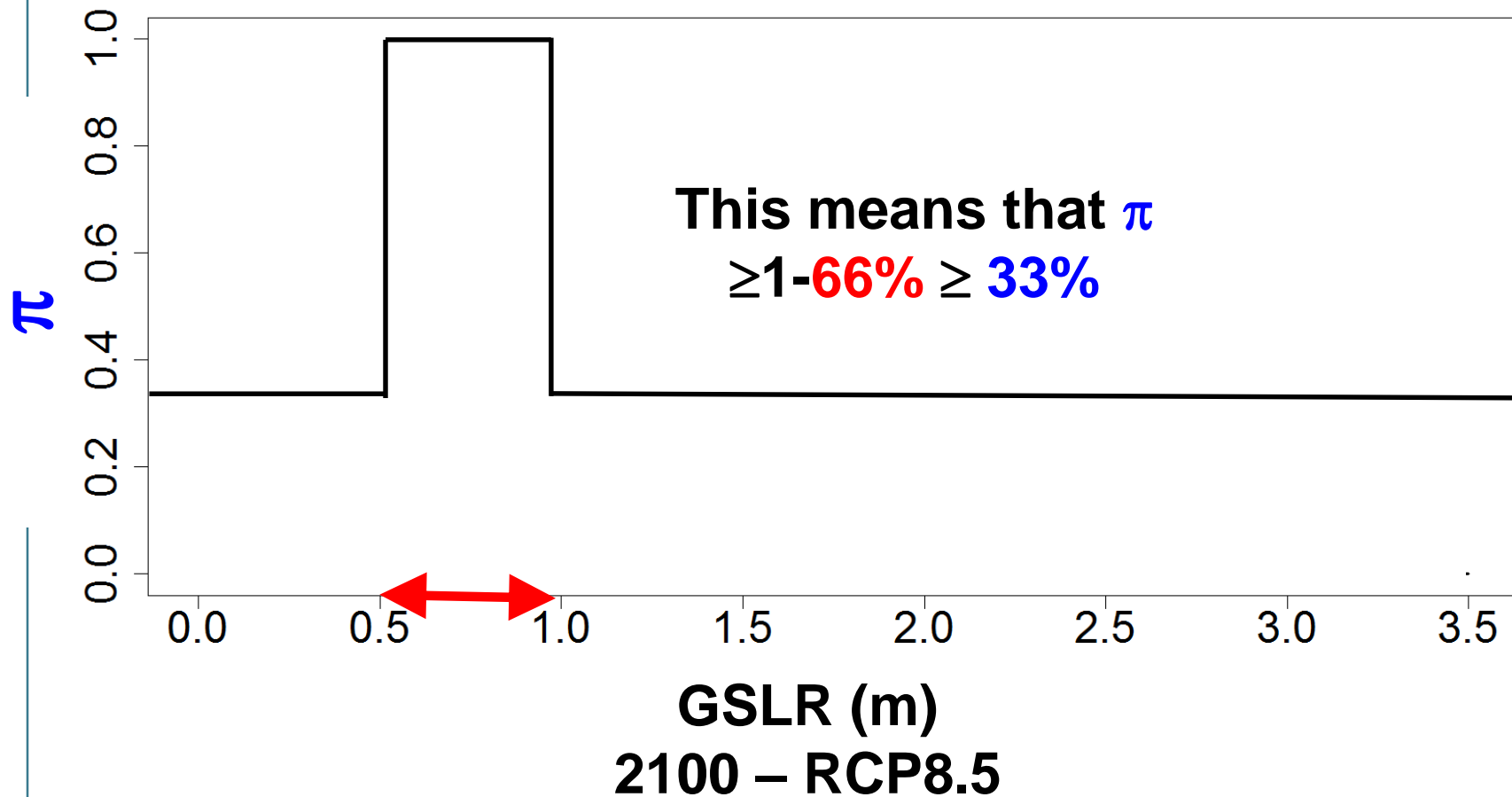
**GSLR (m)**  
**2100 – RCP8.5**

## Possibility setting

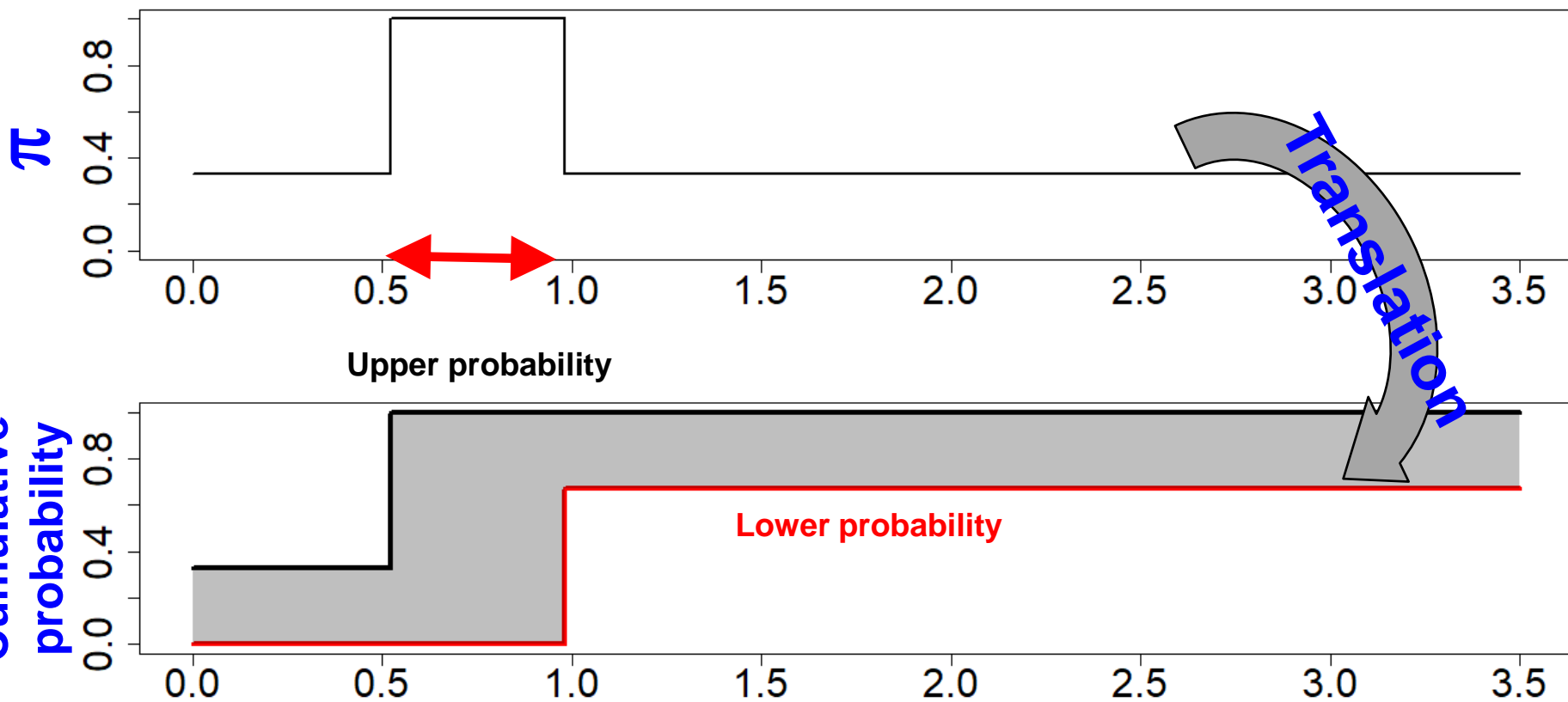
## Probability P that GSLR is within the interval



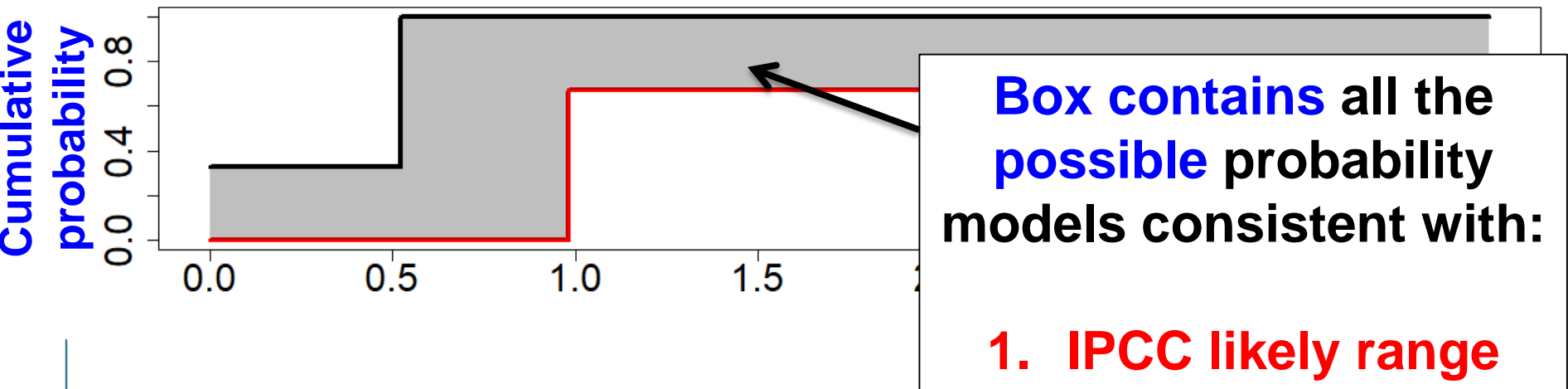
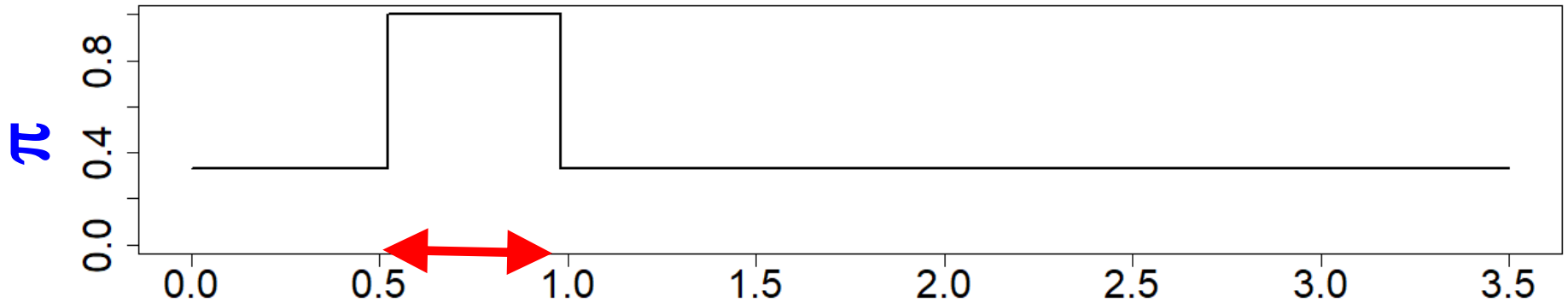
## Possibility setting



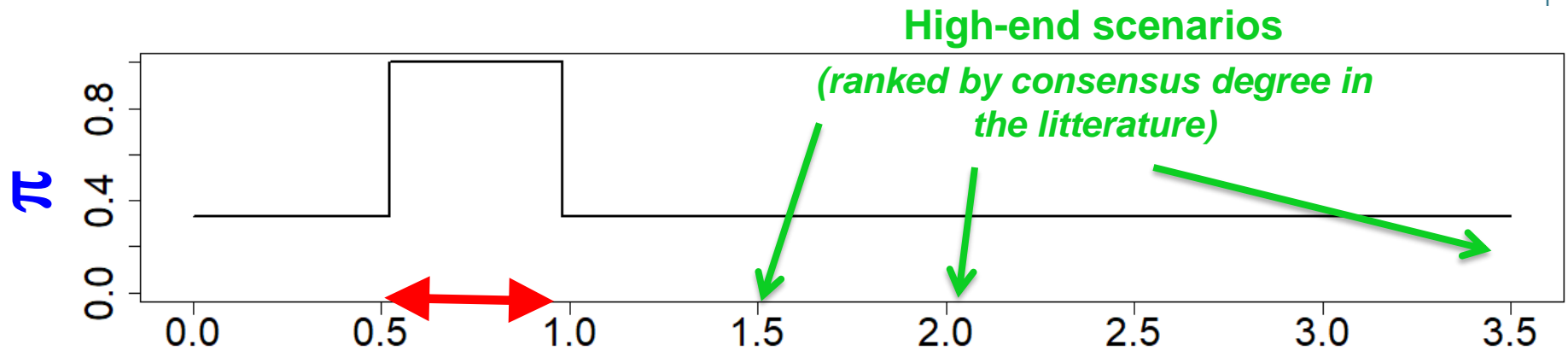
# Extra-probabilities



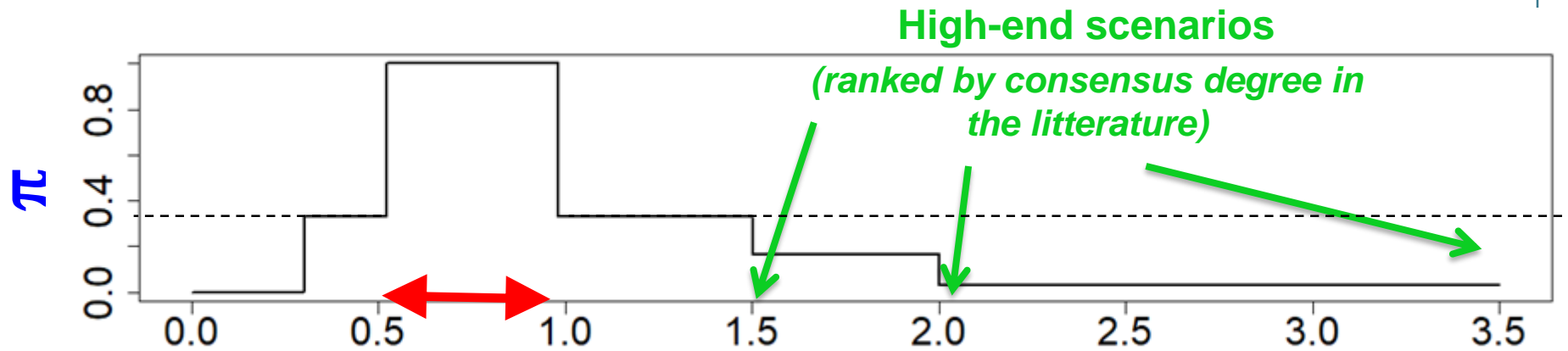
# Extra-probabilities



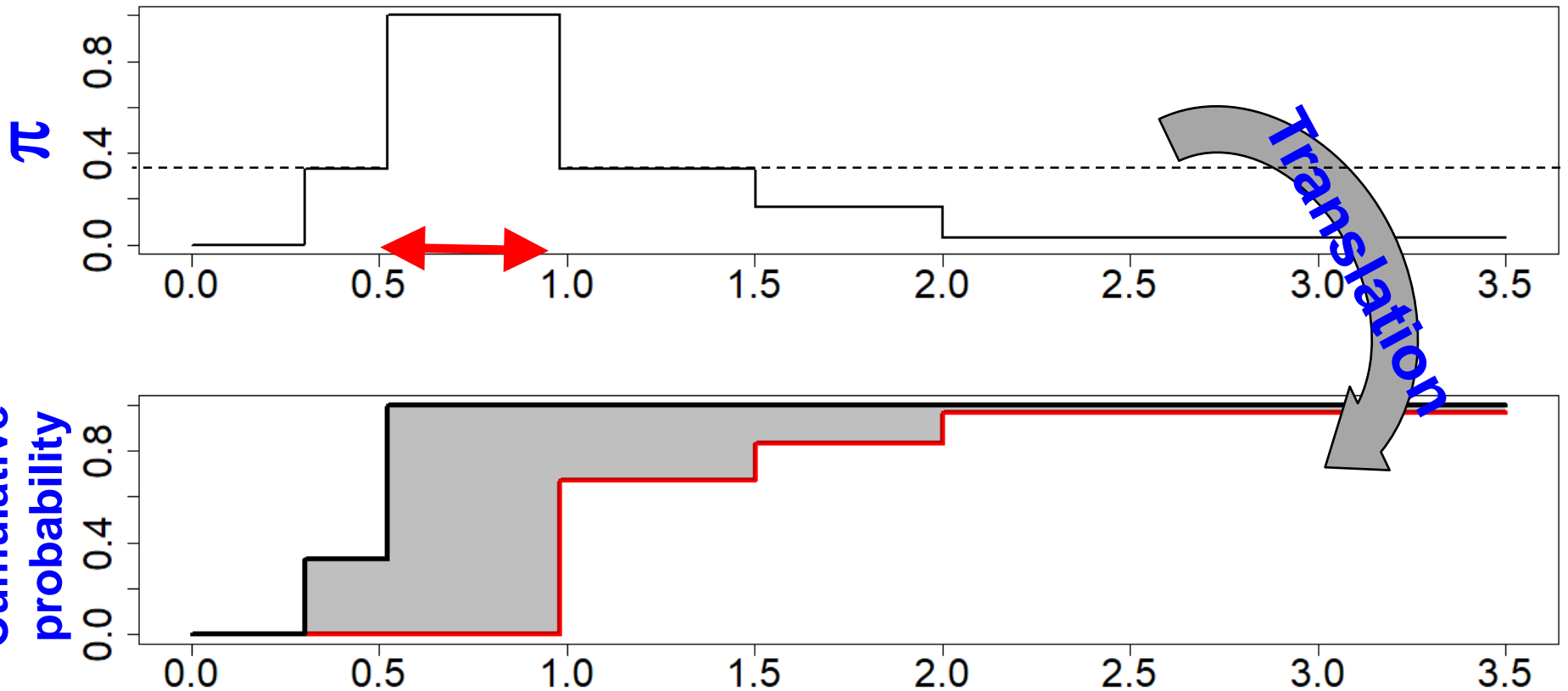
## Let us add more information



## Let us add more information



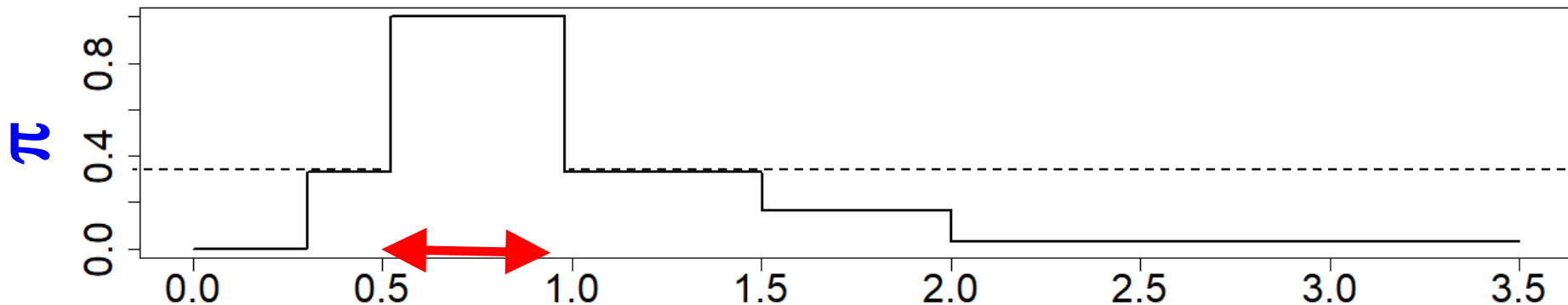
# Translation into probabilities



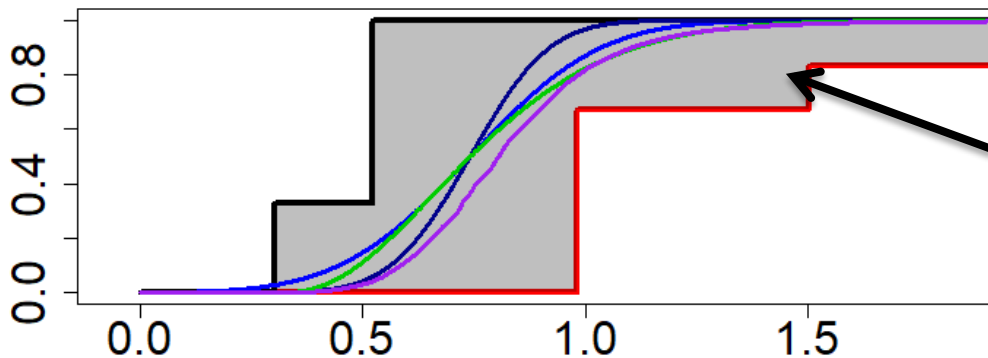
Le Cozannet et al. (2017)



# Translation into probabilities



Cumulative probability

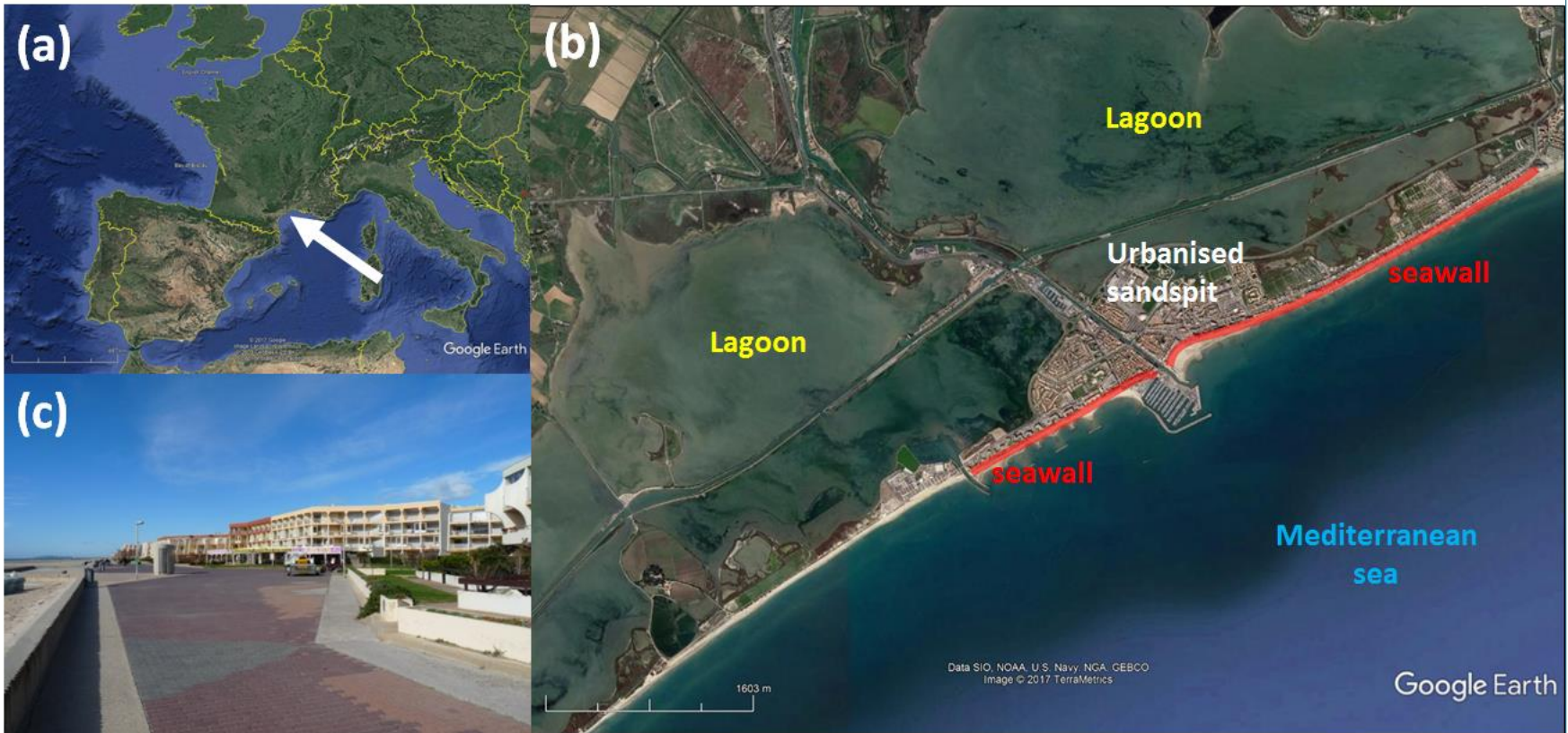


**Box contains all the possible probability models consistent with:**

- 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

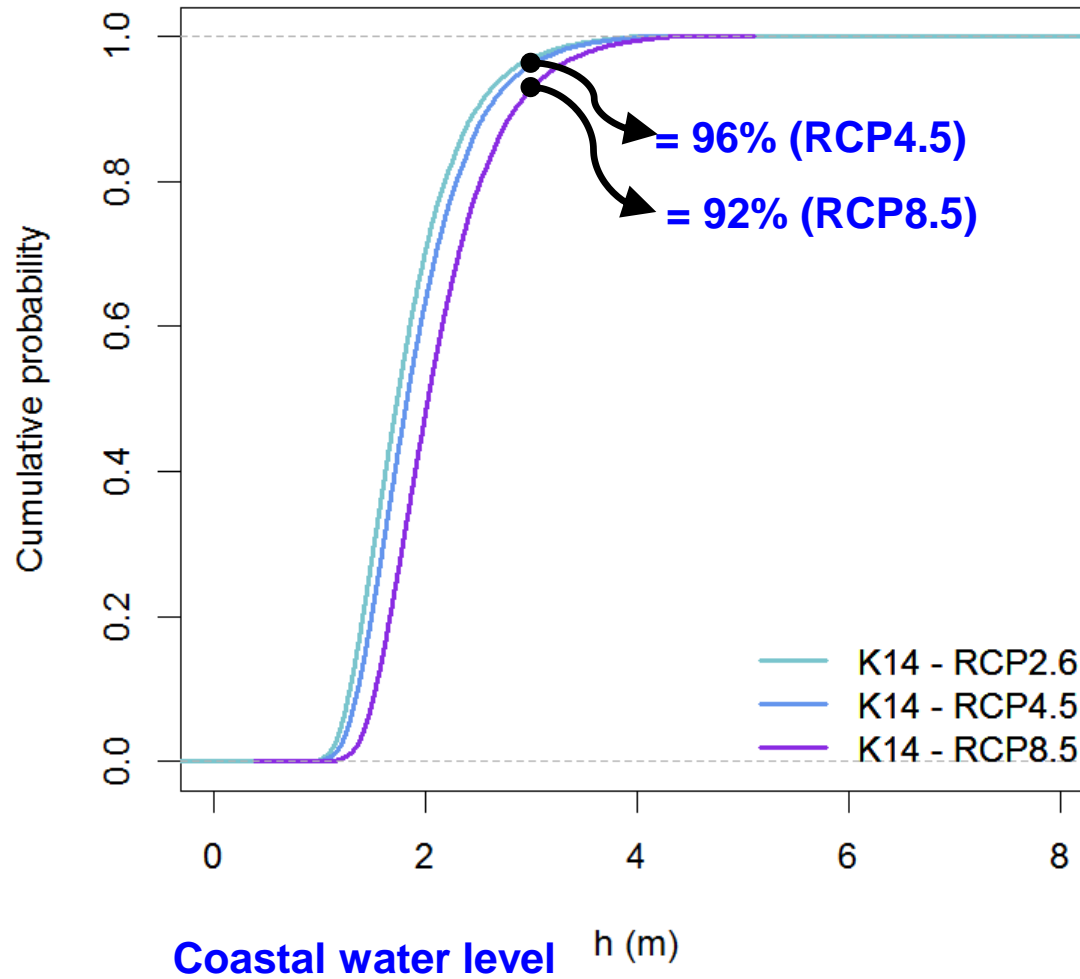


Coastal water level  $h$

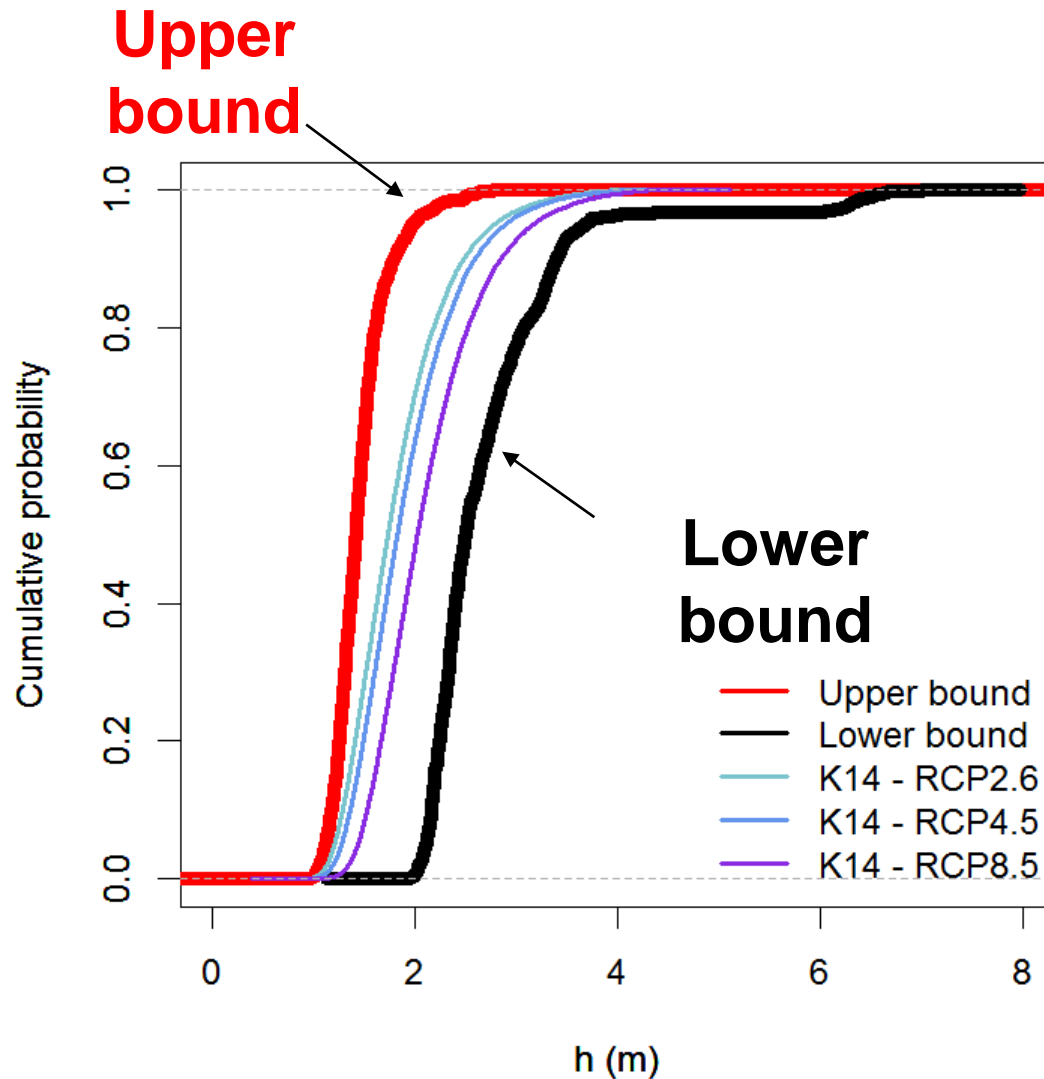


Using probabilities

# Probability of non-exceedance, threshold=3m

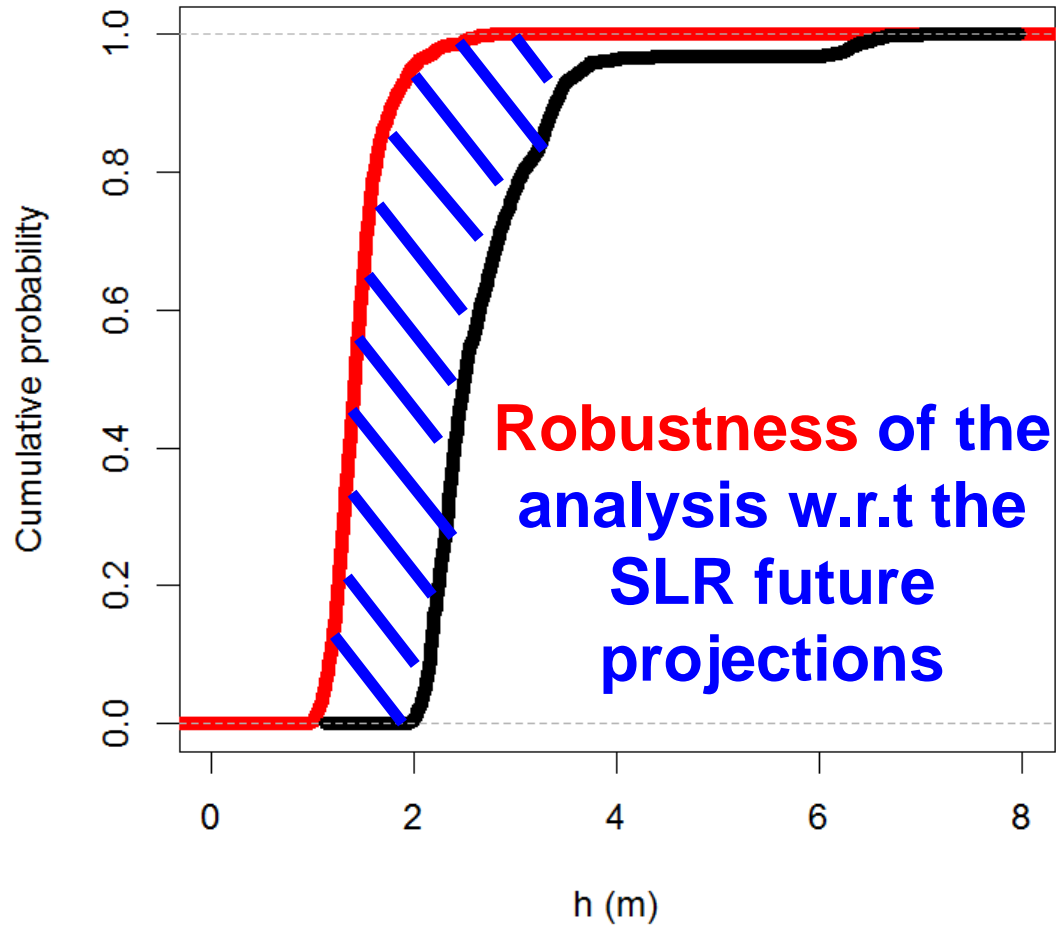


# Using now imprecise probabilities (p-box)



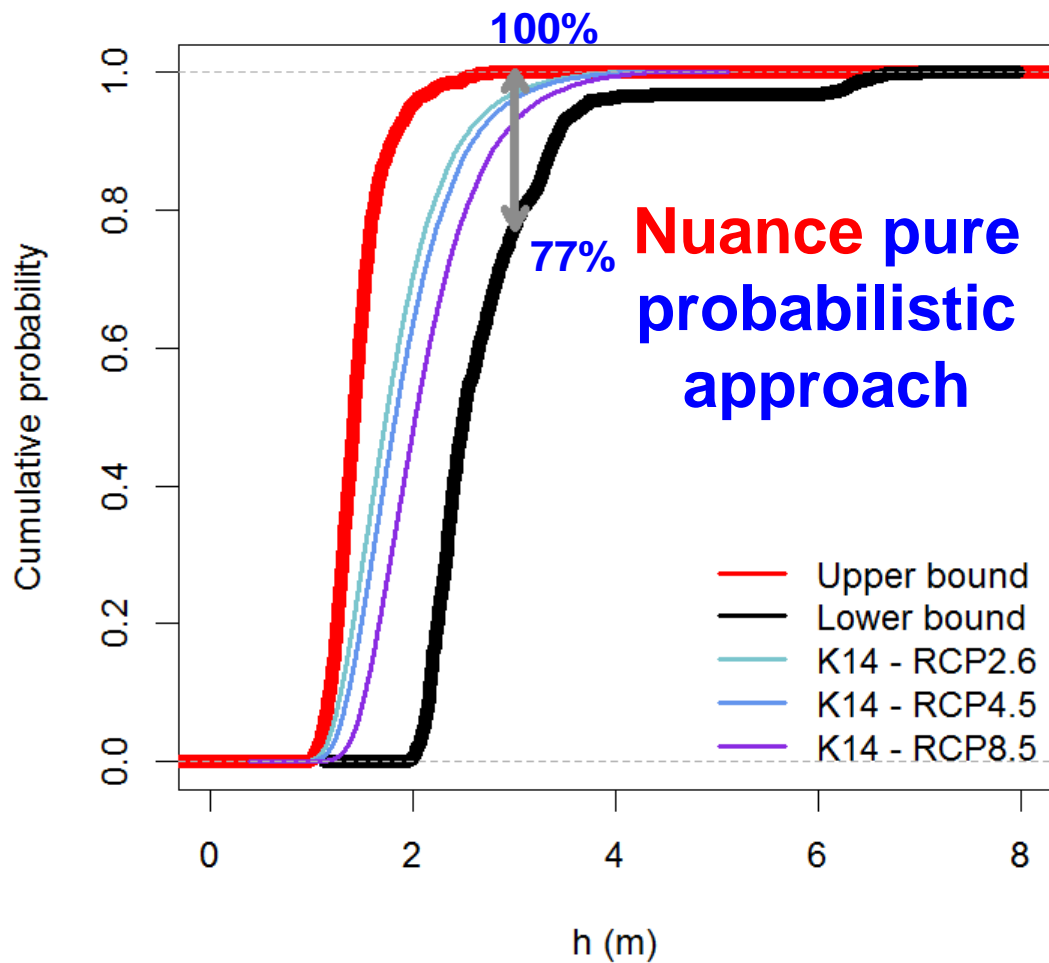
Propagation using algorithm implemented in R (pkg HYRISK, Rohmer et al., 2018)

# 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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## ...and **cons**

Communication

Too sophisticated?

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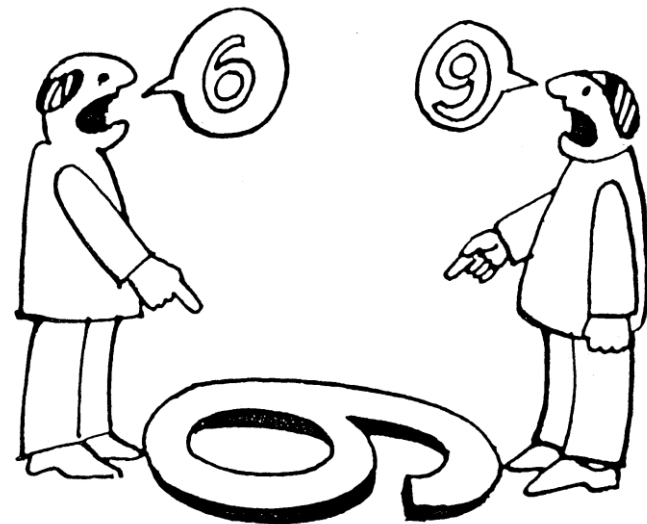
} **This presentation**

## ...and **cons**

Communication

Too sophisticated?

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



**Thank you for your attention!**