

1<sup>st</sup> WMO/WWRP

# WEATHER & SOCIETY

CONFERENCE, February 28 - 11 March 2022

## How to communicate uncertainty in weather warnings? Public perception in Germany

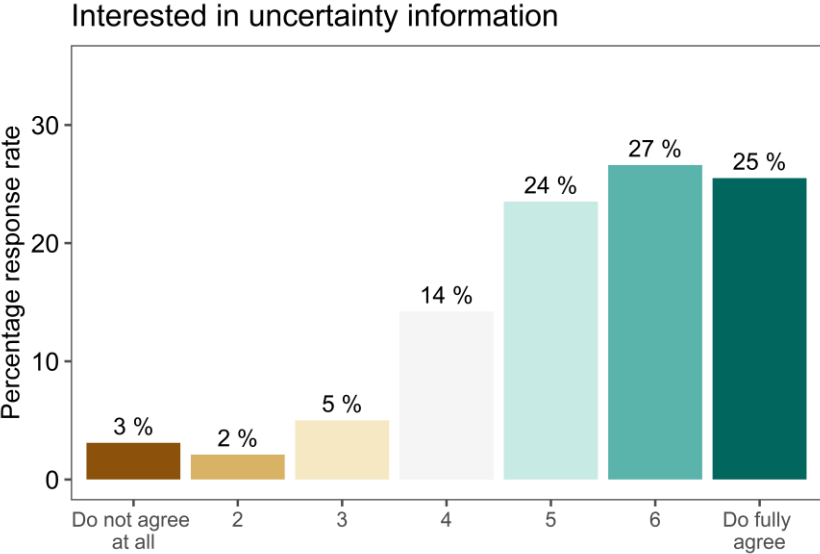
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<sup>2</sup> Federal Office of Meteorology and Climatology MeteoSwiss

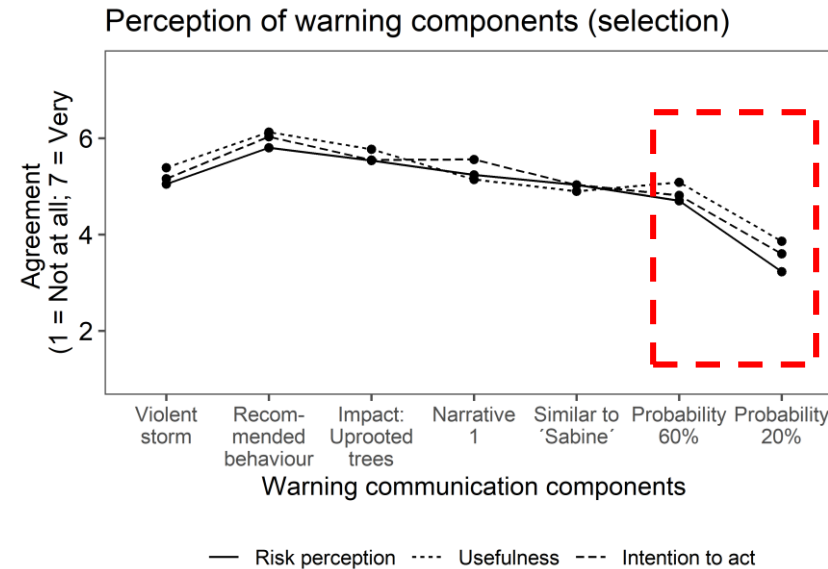
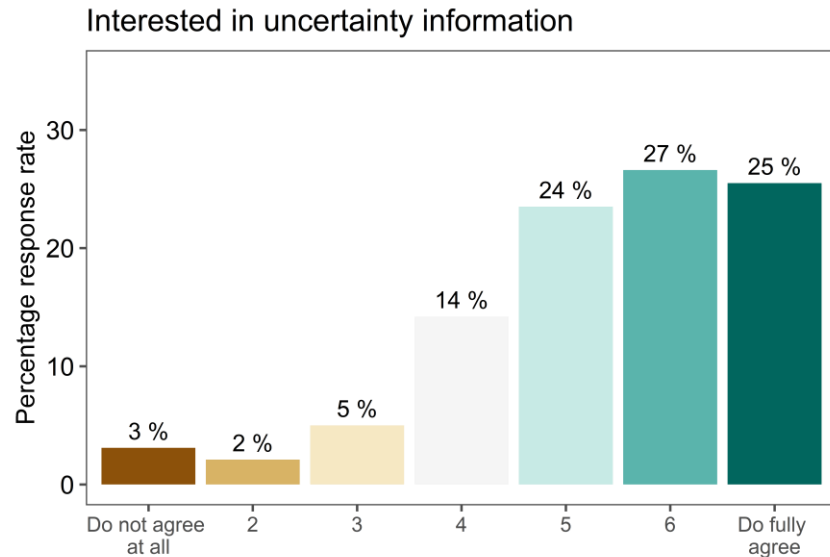
<sup>3</sup> Max Planck Institute for Human Development

# Communicating the uncertainty in weather warnings is double-edged



It promises advantages

# Communicating the uncertainty of weather warnings is double-edged



It promises advantages but is prone to misunderstanding and therefore challenging

# WEXICOM III investigates the perception of weather information with uncertainty information

Fundel, Fleischhut et al. 2019

Fleischhut et al. 2020

Schulze & Voss 2022

Survey 'Uncertainty Information' 2021

How does the German public perceive weather warnings with different formats of uncertainty information?

Autumn 2021  
n = 1 721

# We tested different formats of uncertainty Information

## 3 Formats

### **NumProbVerbProb**

Numerical Probabilistic  
Verbal Probabilistic

... possibly (in 20% of the cases)  
... likely (in 40% of the cases)  
... very likely (in 60% of the cases)

### **NumProbVerbFrequ**

Numerical Probabilistic  
Verbal Frequency

... occasionally (in 20% of cases)  
... often (in 40% of cases)  
... very often (in 60% of cases)

### **NumFrequVerbFrequ**

Numerical Frequency  
Verbal Frequency

... occasionally (in 20 out of 100 cases)  
... often (in 40 out of 100 cases)  
... very often (in 60 out of 100 cases)

# We tested different formats of uncertainty Information

## 2 Explanation

	<b>Without</b> Explanation	<b>With</b> Explanation
<b>NumProbVerbProb</b> Numerical Probabilistic Verbal Probabilistic		Warnings for extreme events (level 4 of 4) such as this are normally issued even with a low predicted probability of occurrence. This is because even with a low probability, the event can occur and have serious consequences.
<b>NumProbVerbFrequ</b> Numerical Probabilistic Verbal Frequency		
<b>NumFrequVerbFrequ</b> Numerical Frequency Verbal Frequency		

We tested for three probability levels in two weather scenarios

## 2 Events

## 3 Probability levels



Hurricane Force Gale  
Level 4 of 4 (120 km/h, Bft 12)

20% 40% 60%



Extreme Thunderstorm  
with Extreme Heavy Rainfall  
Level 4 of 4 (30-40 l/m<sup>2</sup> an hour)

20% 40% 60%

6 different groups of respondents received  
6 warning with uncertainty information

### **Independent Variables**

6 Groups

- 3 Formats
- 2 Explanation

6 Uncertainty warnings each

- 3 Probability levels
- 2 Events

**Control variables**

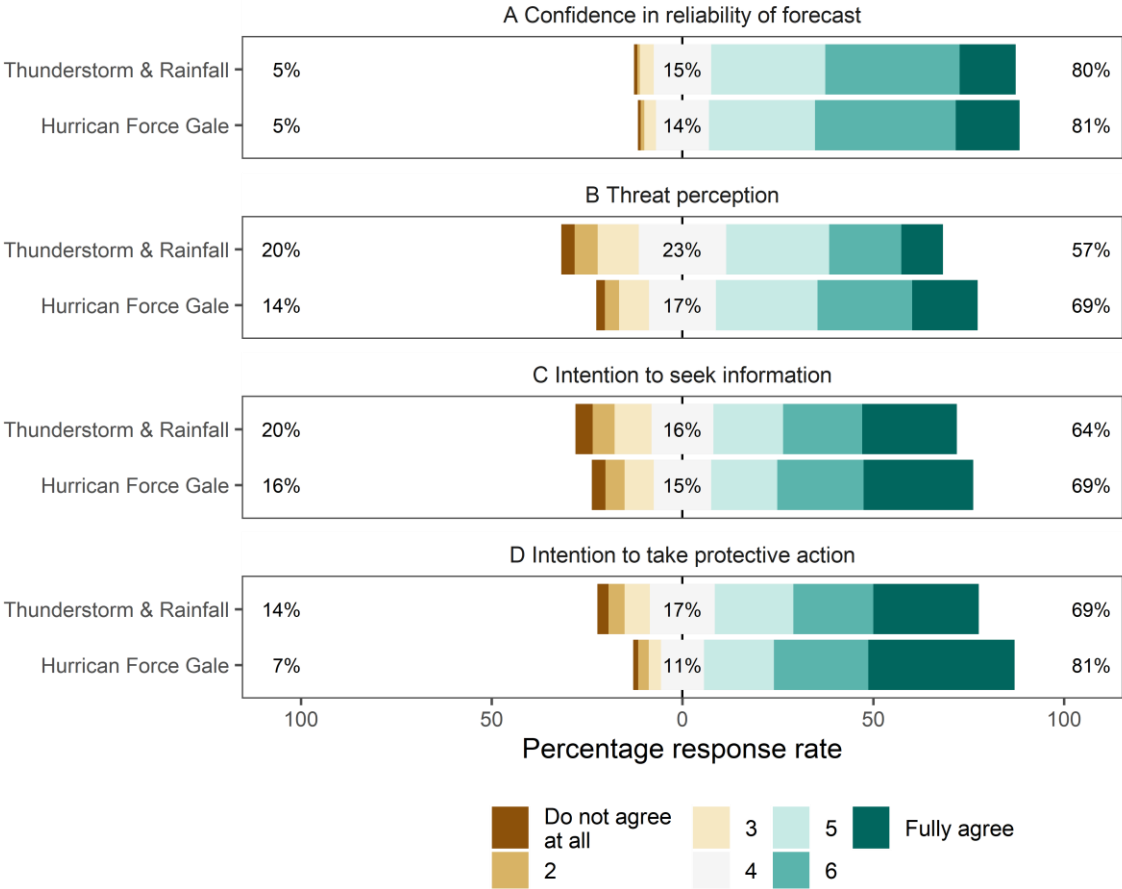
### **Dependent Variables**

1. Confidence in Reliability of Forecasts
2. Threat Perception
3. Intention to seek information
4. Intention to take protective action



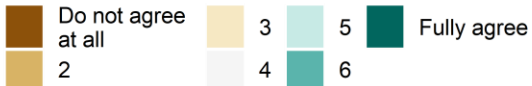
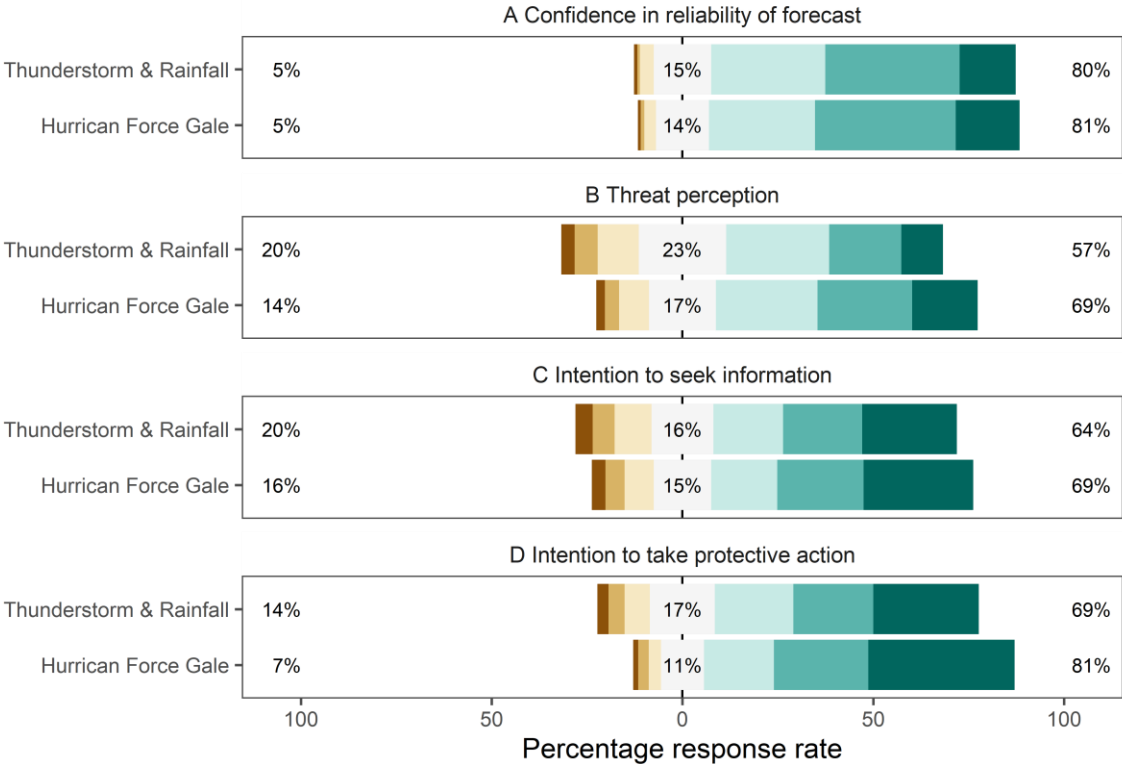
# The majority would respond to a weather warning level 4 (basic warning)

Reaction to basic warnings

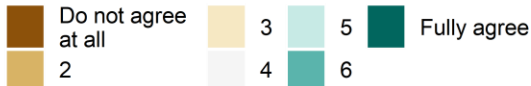
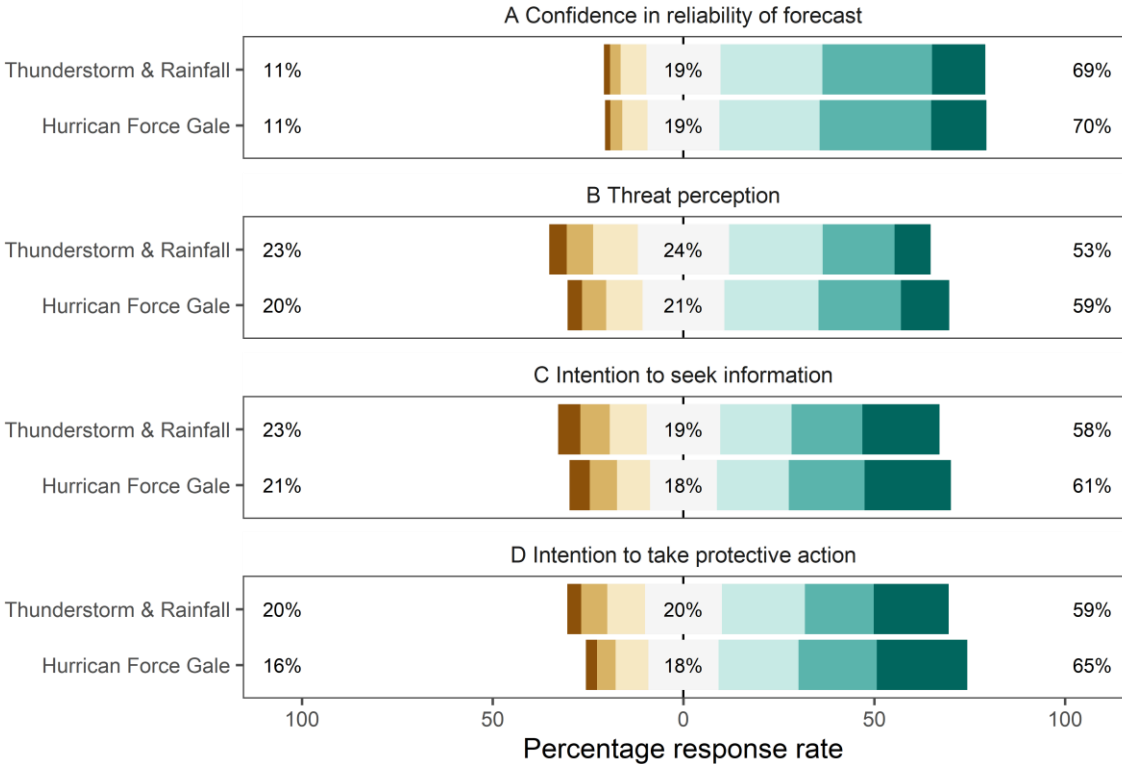


# Uncertainty information reduces the response to warnings

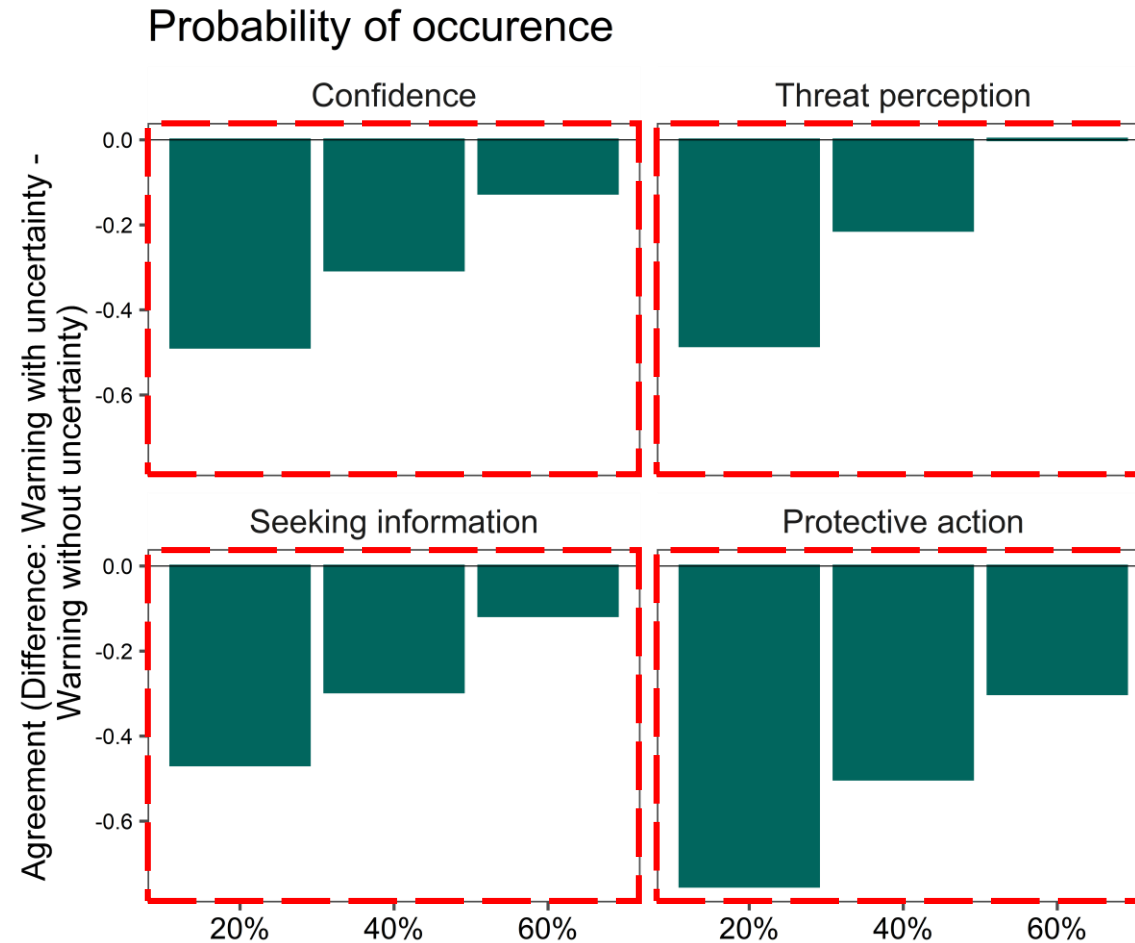
Reaction to basic warnings



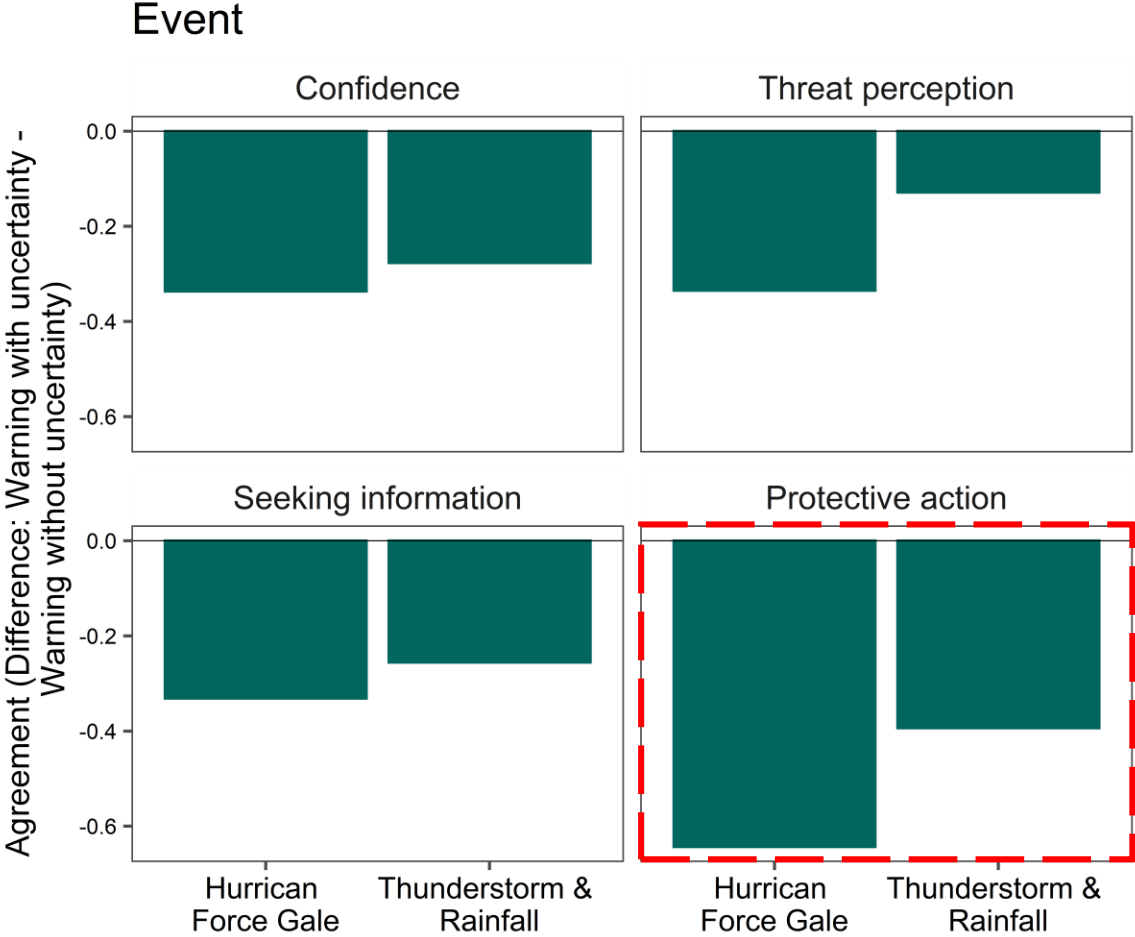
Reaction to warnings with uncertainty information



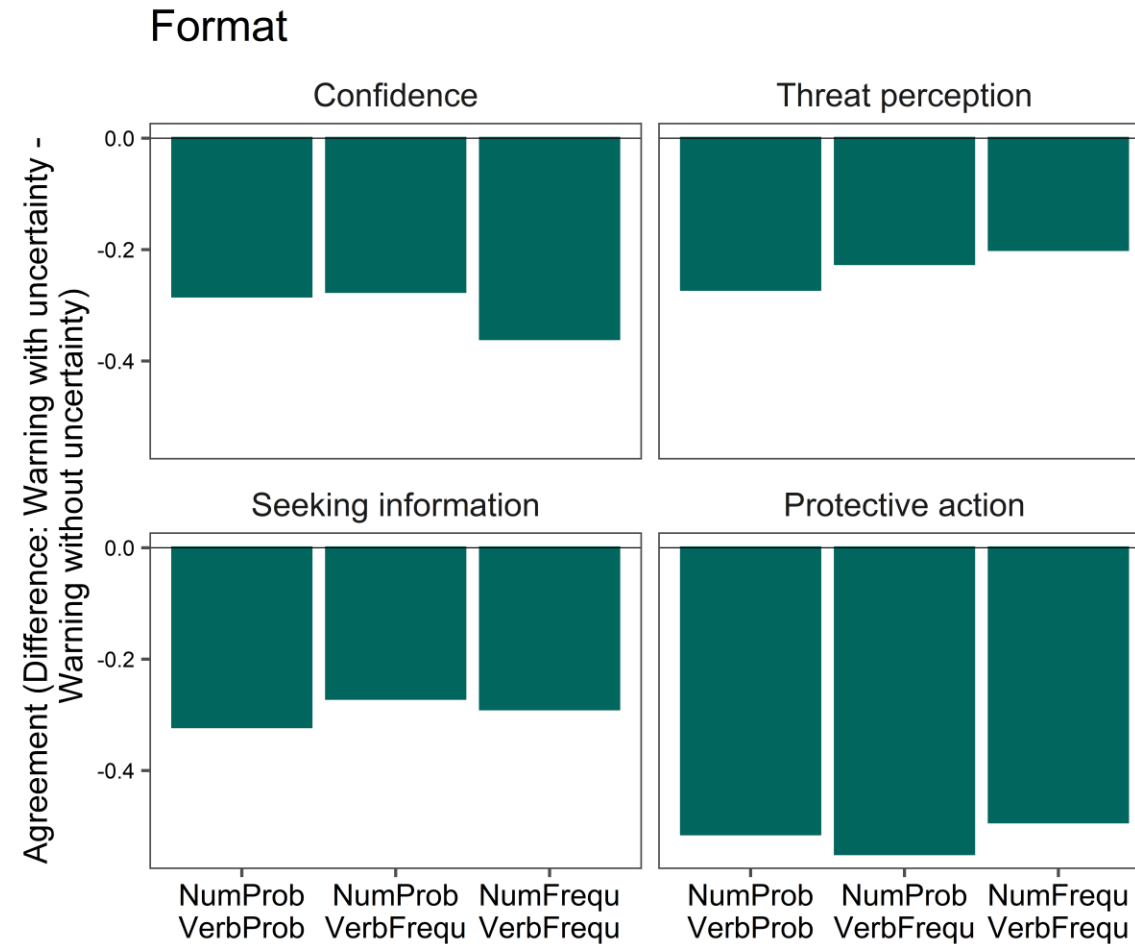
The lower the probability level  
the lower the warning response



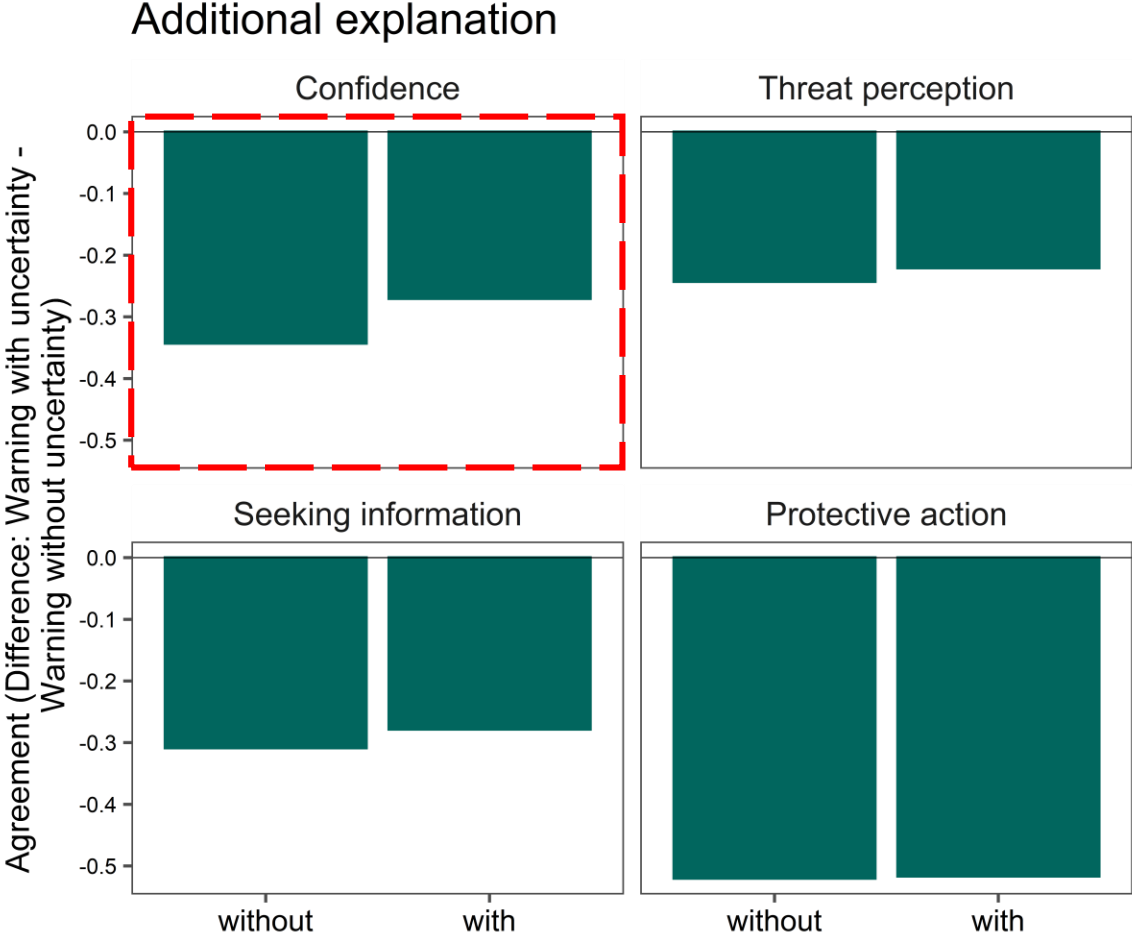
# Uncertainty information has a larger effect on taking action for storm warnings compared to thunderstorm warnings



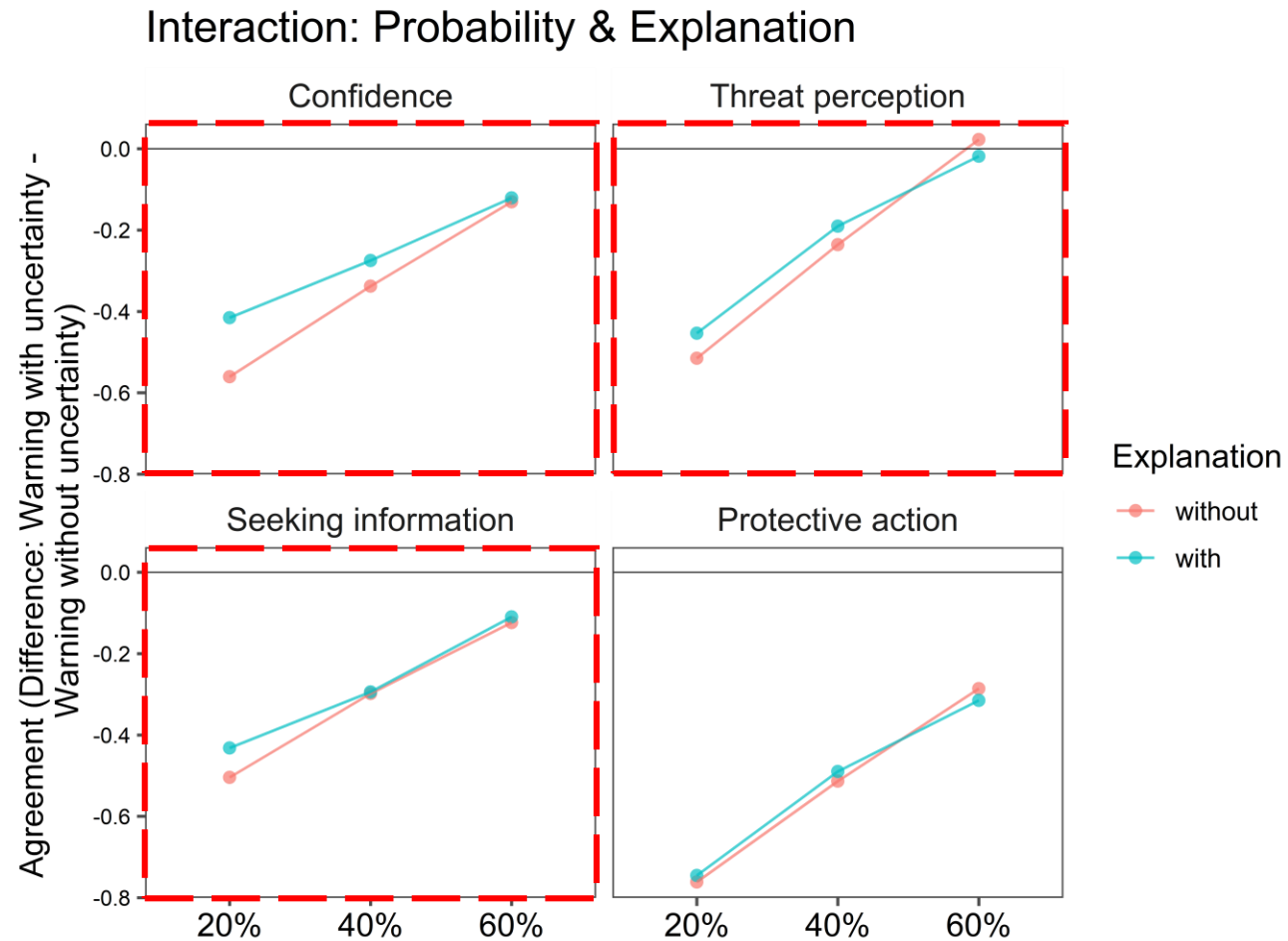
There was no significant effect of the different formats found



# Additional explanation lowers the negative effect of uncertainty information on confidence



# Additional explanation matters for low probabilities



# Interim summary

- Uncertainty information is wanted
- For the majority of the Germans, uncertainty information in warnings does not lead to lower confidence in the reliability of forecasts, perceived risk, and intention to act
- Particularly, low probability levels might decrease warning perception and response
- Different formats of numerical and verbal information did not effect the warning response significantly
- Additional explanation leads to an improved warning perception, especially at low probability levels



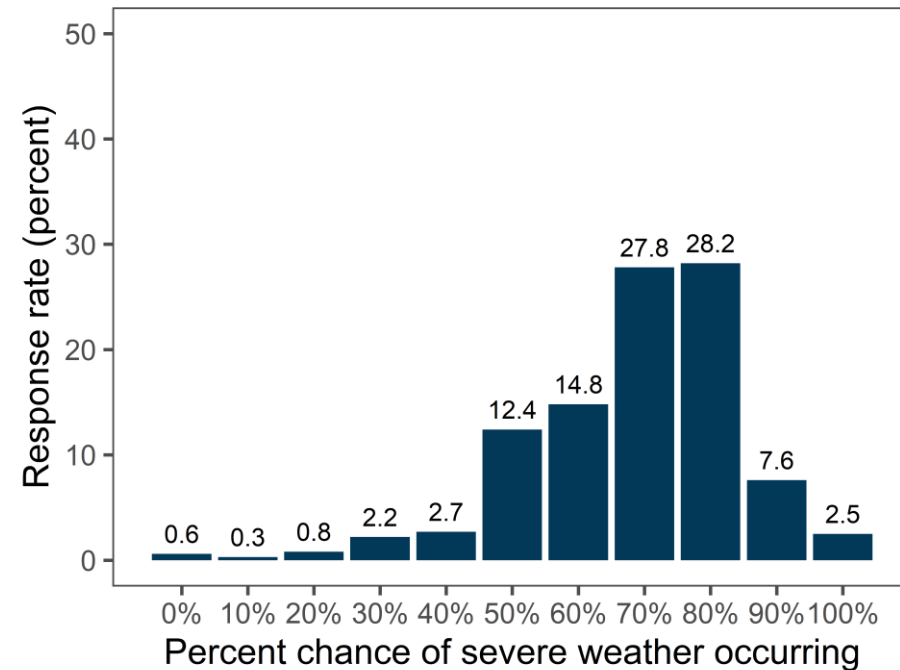
# Interim remarks

- The main problem for the public might not be understanding the uncertainty information
- More problematic seems to be the interpretation of it
- Germans lack experience with warnings with uncertainty information

# People perceive the probability of a severe weather event occurring as a coin flip

March 2021; n = 1086

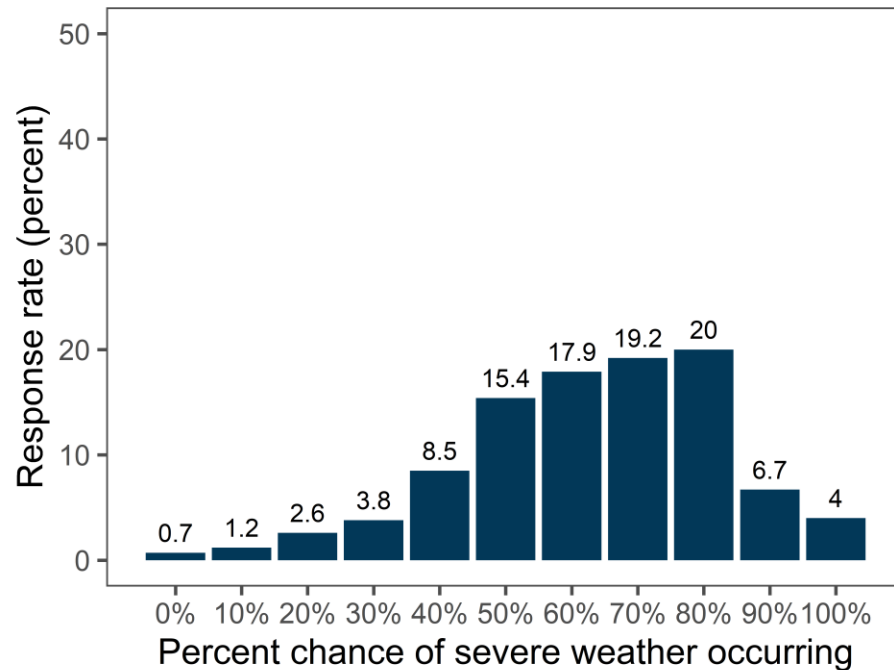
Threshold at which public would alter plans



# Can repeated uncertainty information lower the threshold to act?

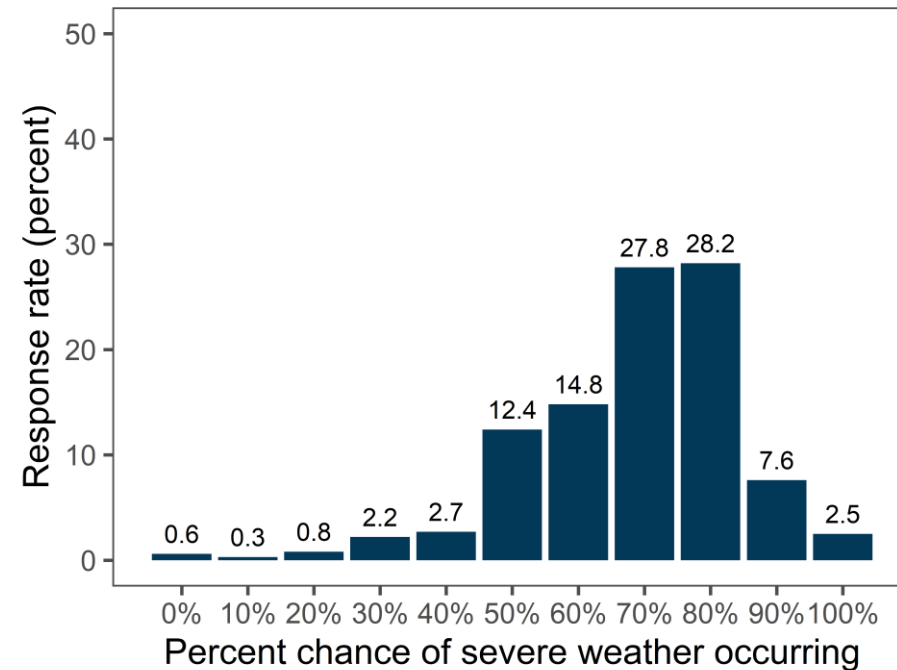
Autumn 2021; n = 1721

Threshold at which public would alter plans



March 2021; n = 1086

Threshold at which public would alter plans



# Final remarks

- People need to have the opportunity to gain experience with uncertainty information in weather warnings
- They need assistance in putting into perspective the uncertainty information in the context of weather warnings

# Thank you for your attention!

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<https://www.geo.fu-berlin.de/met/wexicom/index.html>