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## How to communicate uncertainty in weather warnings to the public? Put it into perspective!

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Communicating the uncertainty underlying weather warnings appears promising. Information about uncertainty can increase confidence in the forecast and support the decision-making process (Joslyn and LeClerc, 2013; LeClerc and Joslyn, 2015; Fundel et al., 2019). However, probabilities can be misunderstood if they are not appropriately communicated (Murphy, 1980; Gigerenzer et al., 2005; Budescu et al., 2014). Uncertainty information in weather warnings might also reduce threat perception and intention to act (Taylor 2021; Schulze & Voss, in prep.).

As part of the WEXICOM project (Weather warnings: from EXtreme event Information to COMunication and action), we conducted a representative experimental online survey in Germany (n=1 721). In close collaboration with Nathalie Popovic (MeteoSwiss), we investigated how the public perceives weather warnings with different formats of uncertainty information. The study tested three combinations of numerical and verbal uncertainty information in weather warnings (numerical probability & verbal probability vs. numerical probability & verbal frequency vs. numerical frequency & verbal frequency). Moreover, we tested all three conditions with and without additional explanation about the probability level at which the weather service typically issues a warning. All combinations were tested for three probability levels (20%; 40%; 60%) in two weather scenarios (hurricane force gale; thunderstorm with extremely heavy rainfall).

We find that low probabilities decreased the perceived risk and warning response – in line with numerous findings in other domains that low probability events are often not taken seriously. Interestingly, the format in which probabilities were communicated did not make a difference: The warning response was independent of whether probability information was given in numerical or verbal form. What was striking, however, was that providing information about the low probability level at which weather services typically issue a warning improved the perception of the warning – especially at low probability levels. Thus, the main problem for the public might not be understanding the uncertainty information but interpreting its magnitude in the context of weather warnings. Here, a simple reference point can help to put low probabilities into perspective.