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Characterizing hydro-meteorological extremes from a societal perspective

Ekaterina Bogdanovich¹, Lars Guenther², Markus Reichstein¹, Georg Ruhrmann³, and René Orth¹

¹Max Planck Institute for Biogeochemistry, Biogeochemical Integration, Jena, Germany (ebogdan@bgc-jena.mpg.de)

²University of Hamburg, Hamburg, Germany

³Friedrich Schiller University Jena, Jena, Germany

Extreme hydro-meteorological events often affect the economy, social life, health, and well-being. One indicator for the impact of extreme events on society is the concurrently increased societal attention. Such increases can help to measure and understand the vulnerability of the society to extreme events, and to evaluate the relevance of an event, which is important for disaster research and risk management. In this study, we analyzed and characterized hydro-meteorological extreme events from a societal impact perspective. In particular, we investigated the impact of heat waves on societal attention in European countries with contrasting climate (Germany, Spain, and Sweden) using Google trends data during 2010–2019. Thus, we seek to answer two general research questions: (i) how and when do extreme events trigger societal attention, (ii) are there temperature thresholds at which societal attention increases?

To describe heat waves, we used maximum, minimum, average, and apparent temperature, aggregated to a weekly time scale. We analyzed the relationship between temperature and societal attention using piecewise regression to identify potential temperature-related thresholds in societal attention. The threshold is determined as the breaking point between two linear models fitted to data. We determined the corresponding goodness of fit by computing R^2 for each temperature variable. The variable with the highest R^2 is considered as the most influential one.

The overall relationship between temperature and Google attention to heat waves is significant in all countries and reveals clear temperature thresholds. The variable with the highest explanatory power is the weekly average of the daily maximum temperatures, which accounts for 71% of google attention in Germany, 51 % in Sweden, and 38 % in Spain. For Germany, similar results are found with media attention. In Sweden, with its colder climate, a lower temperature threshold is identified, indicating higher heat vulnerability. No significant impact of temperatures from the previous weeks is found. While further work is needed to improve the understanding of the attention-heat coupling, the demonstrated significant societal attention response to heat waves offers the opportunity to characterize heat waves from an impact perspective using the identified temperature variables, time scales, and thresholds.