

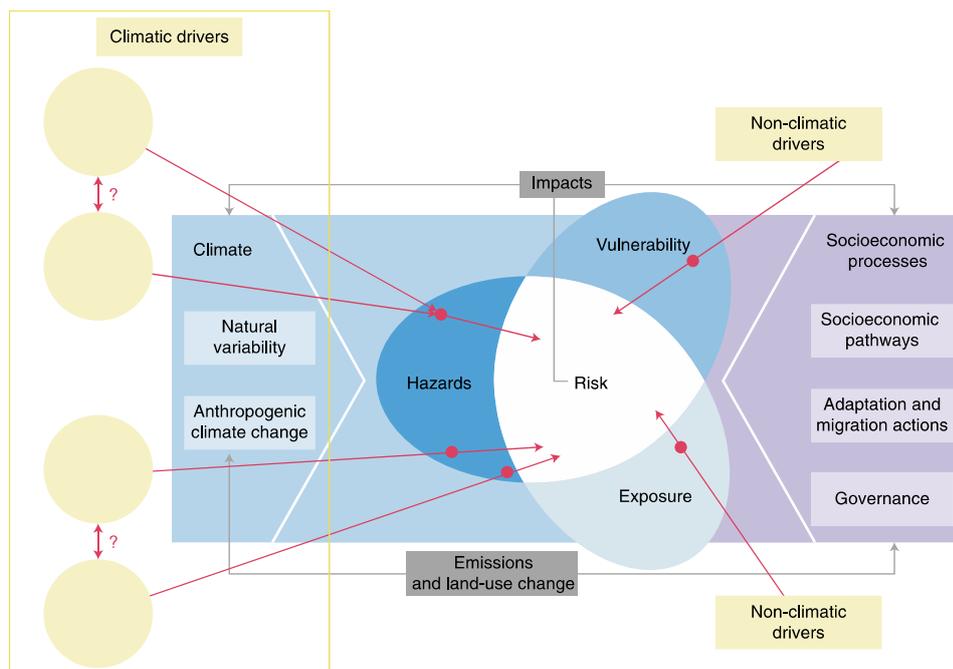
Herrenhausen Conference October 9-11, 2019 EXTREME EVENTS – BUILDING CLIMATE RESILIENT SOCIETIES.

Report of session 5 “Response to Compound Events”

Synthesis research & action agenda

Title	Response to Compound Events
Authors	JAKOB ZSCHEISCHLER (University of Bern, Switzerland) and DAVID N. BRESCH (ETH Zurich / Federal Office of Meteorology and Climatology MeteoSwiss, Zurich, Switzerland)

Context, Motivation, Urgency	<p>Compound weather and climate events refer to the combination of multiple climatic drivers or hazards that contributes to risk. This can be a combination of a heatwave with a drought leading to wildfires and crop failure, or a combination of storm surge and heavy precipitation inland causing a devastating coastal flood. Most large societal or environmental impacts are related to compound events. Consequently, many societal actors are subject to risks associated with compound events. For instance, multiple correlated weather events may affect the supply chain of a company or multiple climate-related disasters in different regions might stretch the limits of the emergency responses of governments. Only in very rare cases simple single driver-impact analyses adequately represent the risk of high-impact events. However, to date many risk assessments typically only consider one driver or hazard at a time. This traditional approach might lead to a potentially large underestimation of risk.</p> <p>Climate change leads to long-term trends in many climate variables, thereby affecting the occurrence of climate extremes such as heatwaves and droughts. At the same time, climate change affects relationships between drivers of compound events. For instance, it might strengthen the relationship between temperature and precipitation, leading to more frequent compound drought and heatwave events.</p> <p>Addressing the challenge of better understanding compound weather events in a changing climate is of high importance to better estimate and project future climate risks. This requires novel ideas and analytical approaches how to deal with current but also newly emerging societal risks related to compound events.</p> <p>Due to the relevance of compound events for nearly all societal sectors, research on compound events needs to be informed by societal needs. A transdisciplinary dialogue between researchers and practitioners is essential to develop relevant research questions addressing how to response to compound events in the near future.</p>
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Compound events and risk. Multiple climate drivers cause one or multiple hazards leading to societal and environmental risk. The climate drivers (represented by yellow circles, varying from local-scale weather to large-scale climate modes) and/or hazards may be mutually dependent. Non-climatic drivers of risk related to vulnerability and exposure may also contribute to risk. (Figure from Zscheischler et al.: Future climate risk from compound events. *Nature Climate Change*, **8**, 469–477, doi:10.1038/s41558-018-0156-3)

<p>Key research questions incl. expected methodologies and disciplines involved</p>	<p>Due to their complexity, research on compound events requires a multidisciplinary approach with contributions from a suite of experts from different scientific domains. Key disciplines to promote compound event research include climate scientists, impact modelers, engineers, statisticians and risk experts.</p> <p>The participants of the session identified the follow key research questions that need to be addressed to advance our knowledge on compound events:</p> <ul style="list-style-type: none"> - Relevant events: Which compound weather and climate events could potentially lead to a large impact in a given system? - Lack of precedent: How can we assess events that have not happened in the historical record but are physically possible and would likely lead to a large impact if they occur? - Analysis: What are the most promising analytical approaches to investigate compound events? - Generalization: How can knowledge from case studies be generalized to learn general characteristics of compound events?
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<p>Priorities for action items & implementation</p>	<p>The session participants identified storylines as a promising tool to address a number of challenges associated with compound events. A storyline is a physically self-consistent unfolding of past events, or of plausible future events. In particular, storylines can be used to perform stress tests in a system (e.g., a city, a transport network, an energy supplier). Stress tests are typically used to explore vulnerabilities of a system. In the context of compound events, stress</p>
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	<p>tests may be used to identify critical weather and climate conditions that could potentially lead to large impacts in the system.</p> <p>To perform stress tests, analysts need to engage with academic and non-academic experts of the given system. It this needs to be decided which experts should be included in the analysis, which will depend largely on the system. In many cases, such an approach will require educating climate scientists and impact modelers in scenario thinking and storytelling.</p> <p>Storylines further need to be underpinned with quantitative information. To achieve this, well-calibrated impacts models (e.g. hydrological models, crop models, energy models) can be used. Often, storylines will usually be very specific to a given system. To generalize insights from a multitude of case studies a common analysis framework needs to be developed.</p>
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How to cite	<p>Zscheischler J., Bresch D. N. (2019) Report of session 5 “Response to Compound Events”: Synthesis research & action agenda. Herrenhausen Conference October 9-11, 2019 Extreme Events – Building Climate Resilient Societies. doi: 10.17871/HK-report-session-5</p> <p>© Author(s) 2019. This work is distributed under the Creative Commons Attribution 4.0 License.</p> 
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