Emerging heat extremes, adaptation and the speed of socio-economic development

Carl-Friedrich Schleussner1,2, Martha M. Vogel3, Peter Pfleiderer1,2, Marina Andrijevic1,2, Friederike E. Otto4, and Sonia I. Seneviratne3
1Climate Analytics, Berlin, Germany
2Integrative Research Institute on Transformations of Human-Environment Systems (IRI THESys), Humboldt-Universität zu Berlin, Berlin, Germany
3Institute for Atmospheric and Climate Science, ETH Zurich, Zurich, Switzerland.
4Environmental Change Institute, University of Oxford, United Kingdom

Heat extremes are among the most pertinent extreme weather hazards. At the same time, adaptation to the impacts of extreme heat can be very effective. The ability of societies to effectively adapt to climate change hazards such as extreme heat, however, critically depends on their level of socio-economic development. Examining the risks posed by future heat extremes to human societies requires to link socio-economic development trajectories with emerging heat extremes. Such an integrated assessment can also provide insights into whether or not it is indeed plausible for societies to “outgrow” climate change by increasing adaptive capacity faster than climate impacts emerge - a narrative that underlies many policy decisions that prioritize economic development over climate action still today.

Here we provide such an integrated assessment by combining a novel approach to project the continuous emergence of heat extremes over the 21st century under different concentration pathways and the pace of socio-economic development under the shared socio-economic pathways accounting for continuous autonomous adaptation. We find that even under the most optimistic scenarios of future development, countries may not be able to outpace unmitigated climate change. Only Paris-Agreement compatible concentration pathways allow for human development to keep up with or even outpace the emerging climate change signal in vulnerable countries in the near future. A similar picture emerges when comparing heat day emergence with future evolution of governance as a proxy for adaptive capacity. Our findings underscore the critical importance of achieving the Paris Agreement goals to enable climate-resilient, sustainable development.