“Advancing researCh on exTreme hUmid heAt and health – ACTUAL.”

Abstract

Extreme weather events are considered among the most hazardous environmental factors for human health. In particular, there is strong evidence that very hot conditions lead to increased mortality and morbidity across countries and regions. From the perspective of human physiology, hot temperatures are particularly harmful with concurrent high humidity. Therefore, recently humid heat has been considered a suitable proxy to measure heat stress and thus quantify its potential health impacts in different disciplines. For example, heat stress indicators resulting from combinations of temperature and humidity (with other weather variables) are extensively used in a wide range of disciplines—from occupational or sports medicine to research in climatology and meteorology (i.e., climate change projections, impact assessments). In the epidemiological literature, however, the role of humidity as a driver of heat stress remains unclear, and even debatable based on the contradictive findings obtained so far. Clarifying inconsistencies in the temperature-humidity-health triangle and providing reliable, robust scientific evidence on the **ACTUAL** impact of humid heat among populations is urgently needed to efficiently address health-related challenges from climate change.

ACTUAL aims to **advance knowledge on the impact of humid heat on human health through the development and application of new methodologies, data resources and settings beyond the current state-of-the-art approaches in climate epidemiology**. The project will seek to answer the question: "Is temperature enough to capture the effect of heat stress? or should we consider humidity as well? and, in which settings or populations?″ I propose an ambitious program of work consisting of a series of different case studies (**CS**) or experiments carefully designed to test 3 hypotheses proposed based on current evidence: (1) Heat stress is mostly driven by humid heat only in very extreme conditions during exceptional heat events and in specific high-risk locations; (2) Heat strain in general populations is triggered by high humidity, while in more fail individuals, exposure to high temperatures is enough for triggering adverse health effects; (3) Current study settings mostly used in climate epidemiology are not suitable for assessing the health impact of humid heat. Specifically, **CS0** will provide a theoretical framework illustrating the complex links between temperature, humidity, and health. The outcome of the assessment will allow the design of more robust modelling approaches to assess the health impacts of heat (humid, dry) in the subsequent **CS**s. Then, capitalizing on my expertise in large-scale assessments in climate epidemiology and in the methodological contributions, I will develop and apply novel approaches aiming to; first, compare excess mortality estimates at humid and dry heat events of low probability using a combination of the state-of-the-art methods and a probabilistic risk framework used in climate risk assessment in **CS1**; and second, derive vulnerability profiles to humid heat by summarizing risks from detailed, large multi-location, time series mortality and hospitalization data in **CS2** and from individual-level cardiovascular stress indicators obtained from users of consumer-grade wristband devices across several regions of the world in **CS3**. Finally, **CS4** will aim to comprehensively assess the impact of humid heat on health among a high-risk population, specifically the city of Basse Santa Su and surrounding region (The Gambia in Sub-Saharan Africa). It will consist of an integrated approach including the estimation of high-resolution estimates of thermal

comfort over the study area (**CS4.1**), and personal monitoring of exposure to humid heat and heat strain among the general population (**CS4.2**).

ACTUAL will build on current research from the Climate Change and Health group that I lead at the Institute of Social and Preventive Medicine (ISPM) and the Oeschger Center for Climate Change Research (OCCR) at the University of Bern. Its overarching goal is to extend the frontiers of research on the impact of extreme weather hazards and climate change on human health and set the ground for new research paths for addressing more ambitious research questions (e.g., impact of compound weather events on human health) and in neglected regions of the world.