

Working Group on Climate & Health Prospectus to US CLIVAR

1. Motivation

It is increasingly recognized by the public health and medical communities that climate variability and change are significant drivers and threat multipliers of human health outcomes. Indeed, the World Health Organization (WHO) has declared that climate change is the single greatest health threat facing humanity (WHO 2021). A recent study found that 58% of infectious diseases confronted by humanity worldwide have been aggravated by climatic hazards (Mora et al. 2022). Climate variability and change influence human health not only through exposure pathways (heat stress, air quality, extreme events, etc.), but also through interactions with vulnerability factors such as under-resourced communities, health disparity populations, and/or other historically disadvantaged communities. Therefore, it is not surprising that both climate and health researchers see a need to develop interdisciplinary collaborations to focus on the effects of climate on health.



Over the past decade, the number of scientists engaging in research on climate and health has increased dramatically (USGCRP 2016; Harper et al. 2021). Universities across the U.S. are developing new interdisciplinary centers, degree-granting programs, and other academic structures aimed at educating graduate students and fostering interdisciplinary research addressing the relationship between climate and health. Infrastructure is now emerging at the national and international level, such as the [HHS-NOAA Climate and Health Outlook](#), the [National Integrated Heat Health Information System](#), and the newly launched WMO/WHO [ClimaHealth platform](#) to facilitate access to actionable knowledge in order to protect populations from the health risks of climate change. There are, however, several roadblocks to the success of this crucial new research enterprise within the U.S. (NRC 2015), including (1) lack of robust data management and sharing protocols, (2) inadequate communication of uncertainties in climate predictions and projections, and (3) disciplinary segregation across the federal funding landscape—including how to bring together research supported by traditional sponsors of climate research and health researchers supported by the National Institutes for Health (NIH). These roadblocks undermine the viability of this research area. Ongoing disciplinary segregation, in particular, threatens recruitment and retention of a strong, diverse research workforce interested in dedicating careers toward addressing this grand challenge.

The mission of this proposed US CLIVAR Working Group on Climate & Health is to make significant progress on removing these three roadblocks by establishing a community of practice with well-vetted protocols for data management and sharing, improving the quantification, communication and understanding of uncertainties in climate predictions and projections, and by laying the groundwork for partnerships between federal funding agencies such as those currently represented within the Inter Agency Group (IAG) of US CLIVAR and the NIH. Our long-term vision is a scientific community in which researchers can join interdisciplinary teams, access and share data, be able to see a path toward sustained funding, and succeed in harnessing the current state of the art in climate prediction and projection toward limiting the adverse effects of climate variability and change on human health.

A key component of the US CLIVAR mission is “to serve the climate community and society through the coordination and facilitation of research on outstanding climate questions.” Among the crosscutting activities of US CLIVAR are “Knowledge exchange,” “Communicating uncertainty,” and “Building links with research communities” (US CLIVAR Science Plan, p. 53-55). The proposed Working Group feeds into those, in particular the goal of building links between research communities and the need to “engage these communities through its own working groups and ... encouraging agencies to work across disciplinary boundaries.” One of the most important legacies of the proposed Working Group would be a broadened bandwidth of communication and collaboration across the separate and distinct research communities that have been trying to gain traction on the problem of climate change and health.

2. Objectives, Tasks, and Timeline

With the above motivation in mind, the objectives of the proposed US CLIVAR Working Group on Climate & Health are as follows, along with associated tasks and deliverables.

- 1. Address data management, accessibility, and integration issues within and across the climate science and health sectors.** Over the past year, the Predictability, Predictions, and Applications Interface (PPAI) Panel has hosted presentations and science webinars (e.g., Goris 2021; Lo 2021; Zaitchik 2022) aimed at gathering information on the most significant challenges facing the climate and health research community. In the estimation of the featured experts, the most commonly cited roadblock for meaningful progress on interdisciplinary research in the climate and health space is access to high-quality and well documented data. To address this issue, the Working Group will begin by exploring and characterizing the current landscape on data management and accessibility in both sectors, seeking examples of successes in other interdisciplinary communities that we might emulate. A key deliverable under this objective is to collaboratively write and publish a commentary or opinion article emphasizing the scientific gaps and possible models for increasing interdisciplinary collaboration on climate and health through improved data management and accessibility.
- 2. Develop best practices for incorporating climate uncertainty into climate-driven forecasts and/or projections of health outcomes.** Another key finding of the PPAI Panel’s webinar series on climate and health research is that there is not yet a widely recognized methodology for incorporating different forms of climate uncertainty (e.g., internal variability, model uncertainty, and scenario uncertainty) in climate-related health forecasts or projections. By not clearly representing the various sources of error growth in climate simulations, one might be overconfident in the connection between different climate and health parameters (such as temperature and heat exposure). Guided by the expertise represented on the Working Group, we will survey the existing literature in which climate uncertainty is (or is not) incorporated into climate/health predictions, and develop a slate of best practices that can be articulated into a second key deliverable—a paper highlighting these best practices for specific scientific applications. For example, how best to incorporate the internal climate uncertainty when connecting future precipitation projections and vector borne disease distributions. As one potential deliverable, the Working Group will discuss hosting a “hackathon” for hands on training toward incorporating climate uncertainty into climate/health research.

- 3. Identify research gaps and future programs that are key to the development of the workforce underpinning this crucial research enterprise.** The Working Group will begin by examining the current landscape for research at the nexus of climate and health, and discussing with stakeholders, including practicing researchers and science program leads, how best to chart a productive pathway forward.

Given the success of the PPAI Panel webinars in facilitating productive discussion and fact finding on these topics, the Working Group will also look to employ webinars early in its life cycle to assist in achieving the first two objectives. In addition to the quarterly meetings, the Working Group will host webinars aimed at understanding the current ‘pain points’ concerning data management/accessibility, and incorporating climate uncertainty into climate-driven predictions of health outcomes. These webinars will serve to foster communication with the current community of practice, which the Working Group can consider deliberatively, and synthesize into sets of recommendations and best practices and ultimately disseminated to the broader community of scientists, funders, and other stakeholders via publication.

The overall timeline of the proposed Working Group is a three-year life cycle from January 2023 through December 2025. The three objectives will be running in parallel throughout all three years to an extent, although the Working Group will emphasize Objective 1 in 2023 and 2024 including webinars, Objective 2 in 2024 and 2025 including webinars, and Objective 3 will be tackled in 2025 through continued discussions with science agency programs and stakeholders.

3. Publications and Outreach

As discussed in Section 2, two publications are anticipated as deliverables. The first is a commentary or opinion article emphasizing the scientific gaps and possible models for increasing interdisciplinary collaboration on climate and health through improved data management and accessibility. The target venue for this article would be *GeoHealth* or similar. The second is a paper highlighting best practices with regard to incorporating climate uncertainty into climate-driven predictions of health outcomes. The likely target for such a paper would be *PNAS*, *GeoHealth*, or *Eos*.

The Working Group intends to engage with other entities that have already been formed to address aspects of climate and health. This will include initially conducting a broad survey of such groups, and then reaching out to them for knowledge exchange and opening lines of communication. We envision reaching out to, for example, the NIH Working Group on Climate Change and Health, the American Meteorological Society Board on Environment and Health, the AGU GeoHealth Committee, and the National Academy of Medicine Grand Challenge on Climate Change, Human Health, and Equity.

4. Reporting Plan

The objectives of the proposed Working Group are highly relevant to the mission of US CLIVAR, particularly “to serve the climate community and society through the coordination and facilitation of research on outstanding climate questions,” and other aspects of the Science Plan as described in Section 1. Moreover, the proposed Working Group is well aligned with the PPAI Panel, whose mission is “to foster improved practices in the provision, validation and uses of climate information and forecasts through coordinated participation within the US and international climate science and

applications communities.” As mentioned previously, this Working Group prospectus was developed following engagement and discussions with PPAI, and ultimately with the encouragement of the PPAI Panel. We therefore propose to report our progress to the PPAI Panel and seek their advice and continued support throughout the three-year life cycle of the proposed Working Group. Specifically, we will brief the Panel once per year at a meeting of their choosing. We also propose to report on the progress and outcomes of the Working Group in the final year at the annual US CLIVAR Summit (or more frequently, as deemed appropriate by the US CLIVAR Project Office [USCPO] or Scientific Steering Committee [SSC]). We also intend to offer periodic updates to the broader US CLIVAR community by contributing to the monthly US CLIVAR Newsgram and Variations newsletters. Finally, the proposed Working Group will submit a Final Report to the USCPO within six months of the end of the 3-year life cycle of the Working Group.

5. Leadership and Suggested Membership

Key to the success of this Working Group will be **equal representation of perspectives** from both the climate and health communities. Therefore, co-chairs are identified who have not only depth within their respective disciplines, but also experience working across the climate/health disciplinary divide, as well as other programmatic and diversity considerations. The proposed Working Group will be led by Kris Karnauskas and Regina Bures. Dr. Karnauskas is an Associate Professor of Atmospheric and Oceanic Sciences at the University of Colorado Boulder, and has extensive experience with US CLIVAR activities, including serving on multiple Working Groups, co-organizing multiple US CLIVAR workshops, co-chairing the US CLIVAR Process Study and Model Improvement Panel, and serving on the US CLIVAR Scientific Steering Committee. Dr. Karnauskas has also been actively involved in research, educational, and programmatic activities in the climate health space since 2015. Dr. Bures is currently a Senior Program Director at the NIH National Institute of Child Health and Human Development. Dr. Bures is a member of the Steering Committee of the NIH Climate Change and Health Initiative, the HHS Climate Change and Health Equity Working Group, and has specific interests in data integration.

The co-chairs anticipate making invitations to the following 16 scientists to join the Working Group. These individuals have been identified based on their **unique expertise** in either climate science or medicine/public health—or both, and would be highly effective members of the Working Group toward achieving the objectives described above. In addition to disciplinary experience, and consistent with US CLIVAR values, a **multitude of diversity factors** were considered in assembling the membership, particularly gender, institutional/geographic, and career stage.

- Rachel Baker*, Brown University. Epidemiology; environmental science; statistics; disease modeling
- Jane Baldwin*, UC Irvine. Climate dynamics and modeling; climate risk; extreme events
- Kai Chen*, Yale University. Environmental epidemiology; air pollution; exposure assessment
- Naresh Devineni, CUNY. Hydrology, risk management, probability and statistics, machine learning
- Gabriel Filippelli, University of Indiana. Biogeochemistry; global environmental health
- Elizabeth Franlenberg, The University of North Carolina at Chapel Hill. Sociology and public policy; health impacts of extreme events from event through recovery
- Morgan Gorris*, Los Alamos National Laboratory. Infectious disease dynamics and modeling
- Lee Hall**, NIH Parasitology & International Programs. Medicine; parasitology
- Ryan Harp*, Northwestern University. Climate dynamics; climate models; climate observations

- Erin Mordecai, Stanford University. Infectious disease ecology; mathematical & empirical modeling
- Lee Newman, Colorado School of Public Health. Medicine; environmental and occupational health
- Matt Newman**, NOAA PSL. Climate dynamics and variability; climate modeling; climate applications
- John Nielsen-Gammon, Texas A&M University. Atmospheric science; Hydroclimate; Air quality
- Mercedes Pascual, New York University. Infectious disease dynamics; Math/ computational biology
- Jeff Shaman, Columbia University. Climate dynamics; infectious disease transmission; modeling
- Cecilia Sorensen, Columbia University. Medicine; heat stress; women's & community health

* Early career (postdoc, assistant professor, or equivalent)

** Federal employee

6. Resource Requirements

The Working Group is proposed as a joint US CLIVAR–NIH sponsored activity, with equal cost sharing of US CLIVAR and NIH. The budget will cover:

- Travel support for members to participate in a 2-day, in-person meeting each year
- Logistics and travel support for community training hackathon for incorporating climate uncertainty into health outcome predictions/projections
- Page charges for two open access publications
- Staff support for organizing webinars and quarterly virtual Working Group meetings will be provided in-kind by the US CLIVAR Project Office

References

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