

# 1   **Our Hot Future Has Arrived—Are we Prepared?**

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## 4 5   **Abstract**

6   Climate change has significantly enhanced dangerous heat events. Many of our institutions are  
7   ill-prepared to provide science-informed and rapid interventions to confront this. The  
8   GeoHealth community is working to bring science, public health, and medical professionals  
9   closer together to grapple with the challenges posed by extreme heat.

## 10 11   **Plain Language Summary**

12   Climate change is bringing extreme heat to an underprepared planet. We need to find ways to  
13   be more climate resilient, and too bolster connections between climate scientists and the  
14   medical field.

## 15 16   **Key points**

- 17       • The impacts of climate change and extreme heat on human health are increasingly  
18       profound
- 19       • Institutions need to be better prepared to protect public health
- 20       • GeoHealth initiatives are bringing climate scientists, public health professionals, and  
21       medical experts closer together on extreme heat

## 22 23   **Article**

24   As I write this during a welcome break in the blazing weather that has dominated the U.S., and  
25   many other parts of the planet this year, I am struck by the future. In this case, a climate  
26   changed future that was supposed to be 10 or even 20 years out, and not now, in 2023. This  
27   particular year has been exceptionally hot due to a triple shot of climate change plus El Niño  
28   plus inter-annual variability, conditions that are projected to continue through 2024. Of course,  
29   the first ingredient, global climate change due to continued emissions of warming gasses by us,  
30   is the general backdrop for this tragic play that we are acting out. El Niño will subside, and  
31   inter-annual variability will do its thing, but our altered climate will continue, and become more  
32   altered so long as we net more carbon emissions into the atmosphere than are removed.

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34   Once we hit that balance of net zero emissions, and only then, will global temperatures stabilize  
35   at whatever level that will be. But are we prepared for the global health impacts of that future  
36   temperature? We were grossly unprepared for the public health crisis presented by summer  
37   2023—why should we expect better in the future? Well, I have many reasons for optimism on  
38   this front, and the increased interest in the topic of GeoHealth is playing a central role in that  
39   feeling of hope. But first, the public health challenges that our hot present has brought us.

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41   Extreme heat kills more people than all other “natural disasters” combined, but we are sorely  
42   behind in preparing for and acting on the health impacts of heat events. Two examples from  
43   the U.S. are illustrative of this. Heat relief policies for our various institutions, such as schools,  
44   are not uniform, are often locally implemented, and are not always based on best practices.

45 Last week my colleague's daughter suffered heat illness when her school ill-advisedly allowed  
46 outdoor play time at 2 in the afternoon for the kids to "run off energy," all while the Heat Index  
47 was hovering around 115-degree Fahrenheit. Kids are far more susceptible to heat illness due  
48 to their size and metabolism, and thus there should be some uniform, even nationally  
49 developed, policies around heat protection.

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51 A second example is from high school and college athletics, where a combination of exertion  
52 and high heat index can cause medical crises. One best practice to protect athletes who appear  
53 overheated is to "cool first, transport second" (to a medical facility), but the local response is  
54 often the other way around. Additionally, the best cooling method for a dangerous heat  
55 situation is having a reservoir of chilled water on hand for immediate immersion of the ill  
56 athlete, something that is not always available on training fields and sporting events. Finally, we  
57 have many ways to measure body temperature, including oral, aural, and skin, but these give  
58 inconsistent results and can be substantially different from the actual body temperature, which  
59 is indicated by rectal thermometers. But there is an aversion to using rectal thermometers  
60 among many, and thus many cases of a "cool" oral temperature will hide a dangerous internal  
61 temperature.

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63 The interdisciplinary dialog that the area of GeoHealth has spawned promises to grapple with  
64 these issues, and bring the science of temperatures and climate much closer to the science of  
65 individual health, and the policies that protect public health. The mantra of "measure, prepare,  
66 and act" is itself multi-disciplinary, with climate scientists informing the measurement and  
67 prediction of extreme heat, public health officials developing and implementing plans to  
68 prepare countries, states, and towns to be more climate resilient, and health and disaster  
69 response professionals acting to step in and treat people who have been impacted. More and  
70 more initiatives are expanding the dialog and broadening the tent to include these sectors.  
71 Some are at universities, such as the Climate and Health program at George Washington  
72 University, the Environmental Resilience Institute at Indiana University (disclaimer as I am the  
73 Executive Director there), the Climate & Health program at the University of Colorado School of  
74 Medicine, the European Centre for Environment and Human Health at the University of Exeter,  
75 and the Climate Change Research Centre at the University of Sydney. Others are associated  
76 with national level programs, such as the new U.S. CLIVAR Working Group on Climate & Health  
77 and the European Climate & Health Observatory, among others. Additionally, the U.S. National  
78 Science Foundation, through its GeoHealth INTERN program, is enhancing training  
79 opportunities for geoscience graduate students to work in the area of public health to grapple  
80 with some of these issues.

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82 These institutions and initiatives are rapidly ramping up our capacity to measure, prepare, and  
83 act, and have commitments to doing so not just for the developed world but also for  
84 developing nations and regions. The challenges in developing regions are myriad, including the  
85 lack of instrumentation, underdeveloped public health institutions, and often inadequate  
86 infrastructure and funding support available to implement the changes needed to confront  
87 climate change and heat. Thus, much more attention needs to be placed on the health equity  
88 challenges that are confronting our climate present, let alone our climate future.

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90 Summer 2023 was a clarion call, a siren blaring emergency, that we should all heed. Because in  
91 the case of climate, heat, and health, and to borrow a phrase from Bachman-Turner Overdrive,  
92 “baby you ain’t seen nothing yet.”