



08-15-2022

Heat index is greatly underestimated on the hottest days



By **Chrissy Sexton**
Earth.com staff writer

Researchers at [UC Berkeley](#) have found that with today's heat waves, the [temperature](#) is a lot more stressful to the human body than what is indicated by the heat index. The experts report that the heat index calculated by meteorologists at the National Weather Service (NWS) may underestimate the perceived temperature by more than 20 degrees Fahrenheit on the hottest days of the year.

The heat index is a measure of humidity combined with the air temperature, which represents how it actually feels when you step outside. It indicates how humans can deal with heat when the humidity is high – when sweating is less effective at cooling the body down.

According to the researchers, a higher heat index means that the human body is

more stressed during heat waves than what is accounted for by public health officials. A heat index above 103 is considered by the NWS to be dangerous, and above 125 to be extremely dangerous.

“Most of the time, the heat index that the National Weather Service is giving you is just the right value. It’s only in these extreme cases where they’re getting the wrong number,” said Professor David Romps. “Where it matters is when you start to map the heat index back onto physiological states and you realize, oh, these people are being stressed to a condition of very elevated skin blood flow where the body is coming close to running out of tricks for compensating for this kind of heat and humidity. So, we’re closer to that edge than we thought we were before.”

The heat index was devised in 1979 by physicist Robert Steadman, who created simple equations to calculate the hot and humid conditions of summer. However, Steadman left the index undefined for many conditions that we are now experiencing much more frequently in a hotter climate. For example, with a relative humidity of 80 percent, the heat index is not defined for temperatures above 88 degrees Fahrenheit or for below 59 degrees Fahrenheit.

Professor Romps explained that meteorologists have extrapolated into these areas to get numbers that are correct most of the time, but not based on any understanding of human physiology. “There’s no scientific basis for these numbers.”

The researchers set out to expand upon Steadman’s work to make the heat index accurate at all temperatures and all humidities between zero and 100.

“The original table had a very short range of temperature and humidity and then a blank region where Steadman said the human model failed,” said graduate student Yi-Chuan Lu. “Steadman had the right physics. Our aim was to extend it to all temperatures so that we have a more accurate formula.”

Earlier this year, Professor Romps and Lu published their revised heat index equation. For the current study, they applied this index to the top 100 heat waves that occurred between 1984 and 2020. While they found mostly minor discrepancies from what was reported by the NWS, the team also discovered some instances where the NWS heat index was way off.

One of the most extreme examples occurred during a heat wave in Chicago in July of 1995, when at least 465 people were killed. The maximum heat index reported by the NWS was 135 degrees Fahrenheit – but it actually felt like 154 degrees Fahrenheit, according to the researchers.

“I’m no physiologist, but a lot of things happen to the body when it gets really hot,” said Professor Romps. “Diverting blood to the skin stresses the system because you’re pulling blood that would otherwise be sent to internal organs and sending it to the skin to try to bring up the skin’s temperature. The approximate calculation used by the NWS, and widely adopted, inadvertently downplays the

health risks of severe heat waves.”

Even among the healthiest of individuals, the threshold of heat death is reached at a heat index of 200 degrees Fahrenheit. While Earth is not likely to reach this point in the next few decades, deadly heat conditions are still becoming much more common.

“A 200 F heat index is an upper bound of what is survivable,” said Professor Romps. “But now that we’ve got this model of human thermoregulation that works out at these conditions, what does it actually mean for the future habitability of the United States and the planet as a whole? There are some frightening things we are looking at.”

The study is published in the journal [Environmental Research Letters](#).

—

By [Chrissy Sexton](#), [Earth.com](#) Staff Writer