

## **RESPONSE TO CC1**

There are more than 150 heat metrics, including many metrics based on synoptic classifications. The first heatwave early warning system was based on synoptic classifications; many others followed worldwide. Please provide a comparison and contrast of how the proposed metric differs from synoptic classifications in use.

### **Response**

We thank the community member for the comment. We agree with the community member that there are many heat metrics, hence, a comparison between metrics might be warranted. We have added some more information to the introduction section to address this concern.

Relative humidity is associated with temperature. Explanations would be helpful as to how this was considered and why absolute humidity was not considered.

### **Response**

We thank the community member for the comment. We have added a justification for choosing relative humidity (RH) over absolute humidity (AH) in the revised manuscript. We reiterate this here:

“We use relative humidity because it provides a direct measure of the moisture content of the atmosphere relative to its capacity to hold moisture, which makes it more intuitive and accessible to the general public. Unlike absolute humidity, RH is widely used in public health communications and is more directly linked to human thermal perception, as it influences the body’s ability to cool itself through sweat evaporation at a given temperature.”

### **Citations**

Nguyen, J. L., Schwartz, J., & Dockery, D. W. (2014). The relationship between indoor and outdoor temperature, apparent temperature, relative humidity, and absolute humidity. *Indoor air*, 24(1), 103-112.

Lowen, A. C., Mubareka, S., Steel, J., & Palese, P. (2007). Influenza virus transmission is dependent on relative humidity and temperature. *PLoS pathogens*, 3(10), e151.

The manuscript needs to make a compelling case that a new metric provides novel insights into heatwave characterization. The manuscript also needs to provide a compelling case that the proposed metric better characterizes physiological heat stress, considering that low and high humidity affect human physiological response to exposure to high ambient temperatures.

### **Response**

We thank the community member for the comment. We have revised the manuscript in several places to provide a nuanced compelling case that the metric brings new insight into heatwaves.

It is not accurate to state that epidemiological studies have focused primarily on temperature. Many publications used temperature-humidity indices.

### **Response**

We thank the community member for the comment. We have revised the manuscript to describe the idea better.

The metric was tested in three extreme heatwaves, but no criteria were provided for how those heatwaves were selected over the hundreds of other heatwaves that occurred over the past decade.

### Response

We thank the community member for the comment. We have added the criteria for selecting these specific events. We select these specific events because their return periods were small (~1 in a 50 year event). We have added this idea to the revised manuscript.

Better characterization of heatwaves does not necessarily translate into improved responses. The 2021 PNW heatdome was accurately forecast, but was so extreme that authorities did not believe it would occur as forecast.

### Response

We thank the community member for the comment. This is well noted in the revised manuscript.

Many low-resource settings often have limited available temperature and humidity data at the scales needed for decision-making.

### Response

We thank the community member for the comment. Specifically, we have added this to the discussion section and written that:

“Although the MELT index offers several advantages, one immediate limitation is its sensitivity to coarse spatial resolutions. At coarser resolutions, the index may fail to adequately capture fine-scale regional features, reducing its usefulness for localized policy-making and decision support.”

The cutting-edge research on heatwave early warning and response systems is developing impact-based forecasts. It would be helpful to discuss the value of forecasts using the new metric vs. impact forecasts.

### Response

We thank the community member for the comment. We add a discussion on the value of this metric relative to impact forecasts, and specifically we add that:

“Additionally, while the MELT index does not directly provide information for impact assessment, it effectively indicates the expected magnitude of a heatwave based solely on atmospheric data, without requiring health or population impact information.”