WWA rebuttal to Cliff Mass' July 5, 2021 blog post "Was Global Warming The Cause of the Great Northwest Heatwave? Science Says No."

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A recent blog post disputes our newly released statement that climate change played a significant role in the late June heatwave in the Pacific Northwest. However, we find that the deceptive question in that blog's title "Was Global Warming The Cause of the Great Northwest Heatwave?" is a fundamental misinterpretation of causal inference. Causality can be a confusing and sometimes deeply philosophical question but techniques developed by epidemiologists and statisticians to untangle the relative role of the many factors leading to congenital diseases have been routinely applied by us and other groups to understand the role of climate change during extreme weather events.

The most important concept in understanding the causes of complicated events such as disease or heat waves is to recognize that there are always multiple factors that contribute to their origins and development. This is why the title of Professor Mass' blog post is both misleading and incorrect. The effect of global warming on the recent Pacific Northwest heat wave or any weather event for that matter is not a yes or no question. Climate change is one of many factors that influence extreme weather. Indeed, without the particular patterns of high and lower pressure that blocked the normal position of the jet stream, there would have been no heat wave.

Causal inference is then an effort to understand the relative contributions of the important factors contributing to an event and is thus an inherently statistical exercise. We presented two principal findings. Our first statement is that we estimate that the observed high temperatures currently should occur only once in a thousand years but that without climate change these temperatures would have occurred less frequently than once in 150 thousand years. Or essentially never. We then turn the question around in our second statement and find that global warming increased the high temperatures of the once in a millennia heat wave by 2ºC (about 4ºF). These statements are statistical "best estimates" and are made complete with the appropriate caveats and uncertainties presented in our technical document.

While these two statements are essentially equivalent, it may be easier to understand the second. The unusual patterns of winds and pressures that occurred in late June would have led to extreme heat without global warming. But climate change made the heat wave more severe by 4ºF. So instead of Seattle reaching 108ºF on June 26, it would have been only 104ºF, a full degree shy of the June 2009 record.

This may not seem like a lot; indeed 104ºF is a very uncomfortable and dangerous temperature for Seattleites. But your chances of dying increase greatly as temperatures at this level intensify. Undoubtedly, the additional number of deaths across the Pacific Northwest that will be attributed to this additional four degrees will not be small.

The late June Pacific Northwest heat wave was an unanticipated event not foreseen by climate models or statistical analyses of the observed records. Clearly there is much yet to be learned about heat waves and our models and analyses must be improved. But it is also clear that climate change led to a large and dangerous increase in the severity of the heat wave. Professor Mass' blog post is a fundamental misrepresentation of the causality of complex events and irresponsibly under-represents the role of global warming in June of 2021.