3Qs: Hot, hot heat

June 28 2012, by Jason Kornwitz

A record-breaking heat wave hit the East Coast last week, followed by a spate of rain and thunderstorms. Northeastern University news office asked Auroop Ganguly, an associate professor of civil and environmental engineering whose expertise lies in understanding climate change and extreme weather, to explain the relationship between heat waves and global warming.

How do you define and track a heat wave?

Like many other extreme weather phenomena, there is no single way to define or track heat waves, but common definitions take into account their potential impacts. The heat index, for example, is an aggregate measure that combines temperature and humidity — two primary weather factors that determine human perception of heat. On the other hand, human mortality, in the devastating heat waves of Chicago or Paris, for example, is often caused not just by high daytime temperatures but by consecutive nighttime temperatures exceeding certain thresholds. One other measure for heat waves is cooling degree days, which attempts to relate temperatures to energy demand for air conditioning.

For agriculture and food security, heat waves and temperature extremes may be defined through specific thresholds beyond which certain crops cannot survive. Occasionally while studying climate variability or change, we track temperatures that set new records, which would in turn vary depending on the region and the season. One statistical method to define and track extremes is through the rigorous “extreme value theory,” which lead to metrics such as 100-year return periods. This is

the probability that a given temperature will be exceeded once every 100 years on the average.

On the whole, the definition and tracking of heat waves is very much dependent on the end use. Meteorologists often prefer relying on the heat index or record temperatures for given regions and seasons. Energy companies and planners tend to look at cooling degree days. Agricultural planners may be interested in the possibility of temperatures exceeding certain thresholds. Climate scientists interested in adaptation to climate change or in the physical sciences have developed an array of metrics based on the consequences of heat waves or on their linkages to atmospheric physics or a combination.

Do global warming and higher temperatures go hand in hand?

In general, it is very unlikely if not impossible that any one heat wave, cold snap, dry spell or incidence of heavy rainfall could be related to longer-term natural climate variability or anthropogenic, or man-made, global warming. Certainly, a heat wave at this time of the year in the Northeast is not uncommon and should be viewed as weather phenomena rather than climate phenomena. Weather is what's happening at any given moment and climate is average weather over a period of time.

On the other hand, global warming is projected to increase the occurrence of heat waves, implying that longer lasting, more frequent and more intense heat waves are consistent with what one would expect as the Earth continues to get warmer. However, large uncertainties remain when assigning causality to specific instances of regional heat waves or other weather events. In one of my 2009 papers published in the journal Proceedings of the National Academy of Sciences, for example, we found that while heat waves are likely to grow even worse than previ-

ously thought, the remaining uncertainties and geographical variability are also more than previously believed.

What causes climate variability, such as changes in precipitation patterns, and what impact may it have on the environment?

Climate variability may be caused by natural cycles ranging across different time scales, such as the inter-annual El Nino to the 60– to 70-year Atlantic Multidecadal Oscillation. The growing temperature trends owing to anthropogenic global warming, which is superposed over and above natural variability, has been noticed or is projected to occur at multi-decadal to century scales.

At the other end of the time scale are very long-term changes, including changes in monsoon rainfall patterns. These patterns have been suggested as a likely cause for the decay of a 4000-year-old long-lost urban civilization in the Indus valley. These different time scales — from day-to-day weather and natural climate oscillations of several decades to century-scale warming trends and longer-term natural variability in the Earth's climate system — are important to understand and acknowledge when attempting to understand climate change.

Provided by Northeastern University

Citation: 3Qs: Hot, hot heat (2012, June 28) retrieved 21 June 2024 from https://phys.org/news/2012-06-3qs-hot.html