Hot spots where heatwaves could pose greater health risk

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Cities along Mediterranean coastlines could especially suffer from heatwaves in the future. View over Naples. (Photo: peachy6 / Flickr)

Heatwaves could especially pose an increased health risk this century in Southern European river valleys and along the Mediterranean coast, a study by two Swiss scientists from ETH Zurich has revealed.

During the scorching summer of 2003, thermometers soared to over 40°C in the first two weeks of August; estimates on excess mortality amount to about 40,000 heat-related deaths across Europe; the heatwave caused water shortage and bottlenecks in power supply; the high water temperatures caused fish to die; and Swiss Re estimated the damage caused by reduced crop yields at 13 billion euros.

Heatwaves to become more frequent, more intense

and longer

The fact that such heatwaves could become regular events instead of every once in a while was demonstrated in a highly acclaimed study conducted by researchers from ETH Zurich back in 2004. We can expect the average number of heat waves to balloon from a one every three to five years (1961-1990) to two or three a summer (2071-2100); moreover, the length of the heat waves could increase by a factor of 2 to 5 by the end of the century. Postdoc Erich Fischer and Christoph Schär, a professor from ETH Zurich's Institute for Atmospheric and Climate Science, now explain in detail just which parts of Europe could be hit the hardest by changes in the climatic health risk factors. The study has just been published in the journal Nature Geoscience.

Using six new climate models with a resolution of 25 kilometers, the researchers have been investigating how the health risks in Europe could develop. "We wanted to find out whether future risk zones could be localized despite the considerable uncertainties in the future development of the climatic factors affecting health", says Fischer.

The two climate researchers included the most important climatic health risk factors of heatwaves in their study: the combination of extremely high day and night-time temperatures, high humidity and the duration of the heatwave. One key question for the scientists concerned the impact possible changes in atmospheric humidity might have on the health risk; they studied changes in the heat index, an indicator that combines the health risks of temperature and relative humidity, and calculated how often and in which regions the heat index could exceed the critical threshold value of 40.6°C (the value at which heat warnings are issued in the USA). The models demonstrate that river valleys and the Mediterranean coastal regions will be affected the most. In these areas, the high heat index values could especially trouble risk groups like the elderly, small children and people suffering from cardiovascular or

respiratory disease.

The climate models used reveal considerable differences as regards the temperature rise and changes in the atmospheric humidity over Southern Europe, thus arriving at different future risk scenarios. For instance, there are uncertainties in the duration of future heatwaves, according to Fischer. Nevertheless, the patterns where the climatic risk factors change the most were surprisingly consistent; regardless of which model they based their calculations on, it always came out as the same regions where the number of dangerously hot days is increasing the most dramatically: the river valleys of Southern Europe, such as the Po Valley and the lower reaches of the Danube, and along the Mediterranean coast. The ETH-Zurich researchers therefore see an important contribution in their projections for adaptive measures and the development of real heat warning systems.

Key factors: Temperature and atmospheric humidity

The scientists see two reasons as to why the geographic distribution of the future affected areas is consistent in all models: firstly, due to the low altitude these regions experience particularly high temperatures; secondly, the comparatively high absolute humidity amplifies the health impacts during heatwaves. Although the models predict that the increasing aridity of Southern Europe reduces the relative atmospheric humidity somewhat, a certain level of humidity naturally remains precisely in the especially hard-hit regions along the coasts. Then there is also the fact that the diurnal temperature range, the difference between day and night-time temperatures, remains constant, which means the day and night-time temperatures are increasing in parallel; in other regions of Europe, the nights would warm up somewhat less.

Highly populated areas particularly at risk

It's concerning, says Fischer, that most of these high-risk areas are densely populated, with major cities like Milan, Athens or Naples being affected. Cities are warming up more intensely during the day and cooling off less effectively at night than the open land. However, this so-called "heat island effect" and the cities' air pollution wasn't even accounted for in this study - which means the situation on the ground could get even worse. That said, the two researchers stress that it is possible to adapt to the new conditions up to a certain point by establishing a corresponding infrastructure and certain rules of conduct.

More information: Fischer, E.M., C. Schär, 2010: Consistent geographical patterns of changes in high-impact European heatwaves, Nature Geoscience, doi:10.1038/NGEO866

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