

Don't underestimate the increasingly warm summer temperatures, says Swiss expert

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What's happened to the summer? I've been asked this question a lot over the past few weeks. Just like May, June was changeable, wet and lacking in sunshine. But it wasn't too cold. According to MeteoSwiss, the

average daily temperature in June was still 0.4 degrees Celsius warmer than the average for the current reference period from 1991 to 2020.

June 2024 nevertheless felt cool, partly because it tended to be colder during the day and warmer at night due to cloud cover. What's more, we compared it with recent years that featured record-high June temperatures. However, it would be presumptuous to use a cool June as the basis upon which to draw conclusions about the entire [summer](#). As a climate researcher who deals with [extreme events](#) in an increasingly warmer world, I would be surprised if this summer didn't turn out to be hot in Switzerland after all.

A look at the trend over the last three decades shows that summers in Europe and Switzerland are warming up faster than anywhere else in the world. Virtually the entire 2.3 degrees Celsius increase in temperature that we have observed in summers since the late 19th century has taken place between the 1980s and the present day. New findings now indicate that Europe and Switzerland are heating up even more than previously expected.

In a recently published study conducted with ETH Professor Sonia Seneviratne and researchers at the Institute for Atmosphere and Climate, we compared the warmer summers in Europe between 1980 and 2022 with the projections of regional climate models. We found that most models fail to fully reflect the observations. This means that simulated warming is less than observed—the models are too optimistic and lag about 15 years behind the actual degree of warming. The reason for this has to do with the improved air quality over Western Europe.

Clean air increases warming

Global climate models use grid cells of around 100 km in length and represent Switzerland with only a handful of pixels—the Alps, which

have a major influence on Switzerland's weather and climate, are barely recognizable.

Regional climate models calculate atmospheric events at a much higher resolution and refine global climate information with detailed regional simulations. They are indispensable for planning adaptation and climate protection measures, especially for small countries with complex topographies. Regional models also form the basis for the national climate services of several European countries, including Switzerland.

However, most of these models fail to consider the fact that man-made air pollution from aerosols in Europe has been declining since its peak around 1980.

Aerosols are very [fine particles](#) suspended in the air that are produced, for instance, when we burn fossil fuels. They offset the warming caused by [greenhouse gases](#) by attenuating short-wave sunlight. Thanks to air pollution control measures, aerosol emissions have been falling for years, and their cooling effect is on the decline. The increasingly clean air is masking the warming less and less.

Discrepancy between the model and observations

Although [global climate models](#) account for the changes in aerosols, regional climate models usually assume constant concentrations for the sake of simplicity. As a result, the increasing temperatures in Switzerland and its neighboring countries have been underestimated to date, as has also perhaps the need for the models' adaptation.

Regional models that neglect to factor in decreasing aerosols currently underestimate the actual summer [warming](#) by more than 0.5 degrees Celsius on average. Under a strong greenhouse gas scenario, this discrepancy could increase by a further degree in Western Europe

towards the end of the century. In the case of [heat](#) waves over Western Europe, the intensification is underestimated even more: between today and 2100 it is likely to be 1 to 1.5 degrees Celsius.

Temperature matters

1.5 degrees Celsius warmer than expected. Does this even matter during a heat wave? In fact, every tenth of a degree is relevant in the case of extreme heat. This is because heat mortality increases exponentially with [temperature](#), which is why even slightly higher temperatures have an even greater impact on people and society.

And what about the summer? Even if we haven't yet experienced a heat wave this summer in Switzerland, the next [heat wave](#) is sure to come, and future events could eclipse what we have experienced so far. However, we are inadequately prepared for extreme heat or a combination of heat and drought. We should not underestimate the increase in summer temperatures.

Provided by ETH Zurich

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