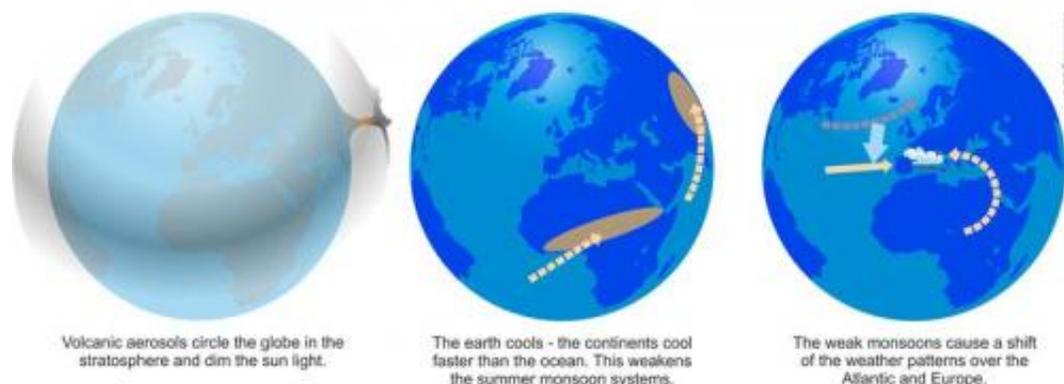


Missing monsoon lead to 'years without a summer'

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Intense volcanic eruptions in the tropics lead to a weakening of monsoons and further result in rainy summers in parts of Europe (schematic figure). Credit: Stefan Brönnimann.

Why do cold, rainy summers in Europe follow intense volcanic eruptions in the tropics? A research team based at the University of Bern may have found the answer: volcanic emissions in the atmosphere block sunlight and can thereby affect the amount of precipitation in other parts of the world.

Historical records provide evidence that strong [volcanic eruptions](#) in the tropics are often followed by a cold and rainy summer in Central Europe. These "years without a summer" often lead to catastrophic famines; the last time in 1816 after the eruption of the Tambora volcano

in Indonesia when even in Switzerland many people starved to death. Although it is known that volcanic eruptions lead to a cooling of the climate, it has until now been unclear where the additional rain comes from.

A newly published study from the international team of the Oeschger Center for Climate Change Research at the University of Bern brings light to this issue: "We believe that oscillations in the African monsoon may be responsible for the rainy European summers", says Stefan Brönnimann, principal investigator of the study from the Oeschger Center.

Less sunlight allows precipitation zones to shift

Brönnimann and his team are researching the effects of 14 intense tropical eruptions of the last 400 years on the climate of Europe and monsoon regions. The eruptions inject large amounts of aerosols into the stratosphere, where these microscopic particles reflect incoming sunlight. The decreased incoming solar radiation following volcanic eruptions leads to a cooling that is more pronounced over the continents than over the ocean. As a result, the summer monsoons in Africa and Asia are weakened.

According to the study, this not only leads to droughts in the Sahel, but also to a southward shift of the Atlantic low-pressure systems as well as enhanced thunderstorm formation. This process can, in turn, explain the increased precipitation over southern Central Europe and the northern Mediterranean, which was characteristic for the case of the year 1816.

Volcanic eruptions threaten food security

"The study shows, once again, how regions separated by great distances

can affect each other climatically", says Stefan Brönnimann. The findings of the study therefore hold a very practical relevance for today, as the researcher states: "Cyclic rainfall regimes like the monsoon are important for food security in many parts of the world. Although large volcanic eruptions are quite rare, they help us better understand the monsoon systems."

As noted by Brönnimann, a better understanding of the connection between volcanic eruptions and precipitation can even prove to be useful in the fight against [climate change](#). The suggestion of slowing down warming using so-called geoengineering techniques – for example by artificially injecting particles into the stratosphere that reflect sunlight – can be seen in a new light, as even this could influence monsoon systems.

More information: Wegmann, M., S. Brönnimann, J. Bhend, J. Franke, D. Folini, M. Wild, J. Luterbacher: "Volcanic influence on European summer precipitation through monsoons: Possible cause for "Years Without a Summer". *Journal of Climate*, [DOI: 10.1175/JCLI-D-13-00524.1](https://doi.org/10.1175/JCLI-D-13-00524.1).

Provided by University of Bern

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