# Northern Europe Set for Increases in Lightning

As the climate warms across Europe, a rise in severe thunderstorms could bring a dramatic increase in related hazards, including lightning and hailstones.

A recent study predicts greater instances of lightning and other extreme weather across northern Europe. Credit: iStock/marcwildschuetz

By Michael Allen 12 February 2020

If greenhouse gas emissions continue to rise, damaging weather linked to thunderstorms —including lightning, large hailstones, and severe winds—will likely increase across Europe over this century.

Using historic weather data and reports, a team led by Anja Rädler (https://www.researchgate.net/profile/Anja_Raedler) and Pieter Groenemeijer (https://www.essl.org/cms/author/pieterg/) at the European Severe Storms Laboratory (ESSL) in Germany developed a model to predict the

likelihood of thunderstorms and related severe hazards at any location over a 6-hour period on the basis of atmospheric conditions. They applied the new model to an ensemble of 14 regional climate models to assess future changes in the frequency of thunderstorm-linked hazards across Europe. Their results cover two carbon emissions scenarios: In one, emissions peak in 2040, whereas in the other, emissions continue to rise.

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The results (https://www.nature.com/articles/s41612-019-0083-7), published in *npj Climate and Atmospheric Science*, show a strong increase in lightning frequency—the number of 6-hour periods with lightning—across northern and eastern Europe. They predict a smaller increase across central Europe, whereas southwestern and southeastern Europe are likely to see decreases in lightning frequency. Changes are largest in the continuing emissions scenario, with 20% increases in lightning frequency projected in northern and eastern Europe by 2071–2100.

Large hail and winds of more than 25 meters per second are also predicted to increase, at a greater rate than lightning occurrences. These instances of extreme weather are predicted to have an upward trend throughout Europe, including areas where storm frequency is expected to fall.

Groenemeijer said that if you look at the Iberian Peninsula, for example, “there might be fewer storms, but at the same time more of these storms may be severe, so the resulting effect can still be an increase in severe weather.”

The authors suggest that in the worst-case emissions scenario, hail larger than 5 centimeters —bigger than a golf ball—will become more likely across Europe, with a doubling of frequency in some areas. Hailstones larger than 2 centimeters are predicted to be 40%–80% more likely across central and eastern Europe, with similar projections for severe wind.

## Extreme Weather Events Driven by Temperature, Humidity

The main drivers of these events are increases in humidity and temperature in the lower levels of the atmosphere. These drivers will increase atmospheric instability by allowing more vertical air movement, which leads to more turbulent airflows and an increase in large vertical clouds. All of these factors create better conditions for thunderstorms, lightning, large hailstones, and severe winds.

“We should be really worried about these changes,” Rädler said, “because they will be felt by everyone. Of course, severe hail storms are very rare, and if they increase, they will still be very rare, but they have a large potential to destroy buildings, cars, and crops.”

“I had 5-centimeter hail hitting my home near Munich last year,” Groenemeijer said. He added that the storm damaged insulated cladding on houses and was responsible for smashed windows and dented bodywork on cars. Ultimately, the hailstorm caused nearly US$1 billion worth of damage (https://www.munichre.com/en/company/media-relations/media-information-and-corporate-news/media-information/2020/causing-billions-in-losses-dominate-nat-cat-picture-2019.html).

Although hail can be expensive, it rarely kills people. But strong winds and lightning are different. Last year the ESSL recorded 394 fatalities associated with severe weather events—18% were linked to lightning, and 17% were linked to severe wind.

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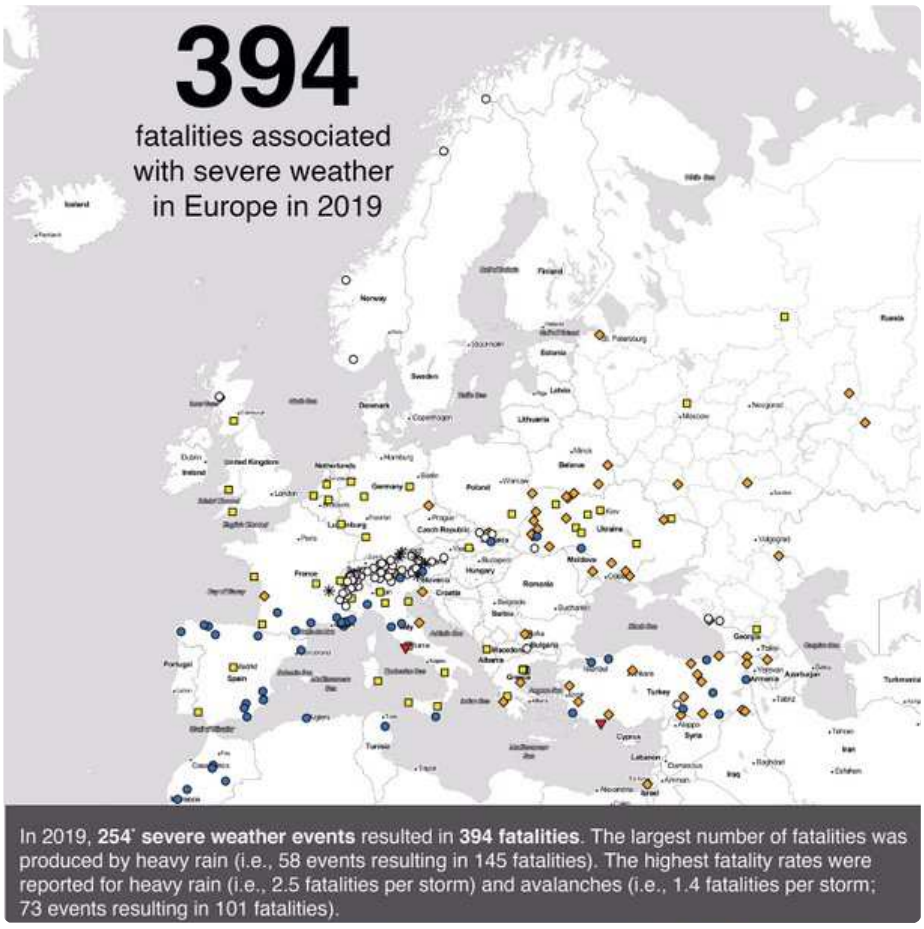
[ESSL/ESWD annual report] In 2019, 254 severe weather events resulted in 394 fatalities. The largest number of fatalities was produced by heavy rain (i.e., 58 events/145 fatalities). The highest fatality rates were reported for heavy rain (i.e., 2.5 fatalities per storm).

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Rädler said the impacts will be less severe if we lower carbon emissions. She added, however, that even if we manage a lower emissions scenario, there will still be increases in severe weather events, so we need to prepare.

Vincenzo Levizzani (http://www.isac.cnr.it/en/users/vincenzo-levizzani), director of research at the Institute of Atmospheric Sciences and Climate in Bologna, Italy, said the new research is a commendable first step but is not conclusive. Although the evidence suggests thunderstorms will become more severe, he is unsure about taking it a step further to discuss individual hazards. "Trying to extrapolate from an ensemble of climate models what will happen in future scenarios concerning all this lightning, wind, hail, and so on, I think it's still a little bit uncertain," he said.

Levizzani agrees with the study authors, however, that we need to prepare for more extreme weather. "I think we have gone too far without doing anything," he explained. "For sure something will happen, it is already happening. And this calls for sustainable actions and modification of our lifestyles and infrastructure."

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