News in focus

TOMMY ELIASSEN/SPL

Lightning typically forms with the aid of warm air, which is why it has historically been rare in the Arctic.

IS LIGHTNING STRIKING THE ARCTIC MORE THAN EVER BEFORE?

A reported huge increase could be due to climate change, but others can't confirm the findings.

By Alexandra Witze

Lightning is striking the Arctic many times more often than it did a decade ago, a study suggests — and the rate could soon double. The findings demonstrate yet another way Earth's climate could be changing as the planet warms, although not all researchers agree that the trend is real.

Robert Holzworth, an atmospheric physicist at the University of Washington in Seattle and leader of the study, defends the findings. "We're seeing a symptom of global climate change," he says. Holzworth is director of the World Wide Lightning Location Network (WWLLN), the collection of ground-based sensors that measured the data. He reported the results on 8 December at a virtual meeting of the American Geophysical Union (and published them before peer review as a preprint[1]).

Another lightning-detection network, whose records are not as extensive, does not find the same increase.

Whether or not lightning is increasing in the Arctic could have a significant impact on the region. The past two years have set records for the largest area of land burnt by wildfires — some of them ignited by lightning — and the most carbon dioxide emitted in the Arctic since records began. More lightning would mean even more chances that wildfires will start.

Lightning forms when ice crystals inside convecting storm clouds — those filled with roiling air currents fed by warm air — collide and transfer electrical charge. A charge separation builds up until it hits a threshold, and a lightning stroke is released. Some researchers have predicted that global warming will lead to more convective storms and lightning as air and ocean temperatures rise[2]. However, some modelling studies suggest the opposite[3].

Nonetheless, the World Meteorological Organization in Geneva, Switzerland, added lightning to its list of 'essential climate variables' in 2016, meaning that observations of lightning could help researchers to track the changing global climate.

The Arctic is warming faster than the rest of the planet, so changes in lightning might be most apparent there. August 2019 saw the most northerly stroke ever detected — just 52 kilometres from the North Pole — according

to the Finnish company Vaisala, headquartered in Vantaa, which runs a lightning-detection network. And a July 2014 storm over the Canadian Arctic caused more than 15,000 lightning strokes north of the Arctic Circle[4].

Lightning in the Arctic is normally rare, accounting for around 0.5% of all global strokes detected by the WWLLN.

But Holzworth and his colleagues found that the number of annual summertime lightning strokes above a latitude of 65° N rose from around 35,000 in 2010 to nearly 250,000 this year. The scientists studied the months of June, July and August, when nearly all Arctic lightning occurs. Many of the lightning strokes they observed happened around northern Siberia.

Tracking trends in lightning can be difficult because detection networks grow more efficient over time, as advanced sensors are added. So Holzworth and his colleagues ran several analyses to confirm that there was more Arctic lightning happening, not just more being detected. "There's no question about it," he says.

Verifying a trend

Vaisala's network has not recorded the same trend. Its data go back only to 2012, rather than to 2010. But "we don't see an unambiguous trend toward more lightning at more extreme latitudes", says Ryan Said, a meteorologist and lightning analyst in Vaisala's office in Louisville, Colorado.

In places that see relatively little lightning, such as the Arctic, just a couple of intense thunderstorms can cause a proportionally huge rise in the total number of lightning strokes detected in a given year, Said notes. With so much year-to-year variability, it can be hard to isolate long-term trends.

One way to verify Holzworth's work would be to survey Indigenous and other communities living at high latitudes, says Jessica McCarty, a geographer at Miami University in Oxford, Ohio, who studies Arctic wildfire.

Another way is to follow up with further lightning-detection studies. Holzworth's work shows "an interesting correlation" with changes in global temperature, says Antti Mäkelä, a lightning specialist at the Finnish Meteorological Institute in Helsinki. By next year, Mäkelä and his colleagues will have 20 years of data from a lightning-detection system that spans Norway, Sweden, Finland and Estonia[5] — and they plan to analyse the data set to see whether there has been an increase in lightning in northern Scandinavia.

1. Holzworth, R. H. *et al.* Preprint at ESSOAr https://doi.org/10.1002/essoar.10504658.1 (2020).
2. Price, C. & Rind, D. *J. Geophys. Res.* **99**, 10823–10831 (1994).
3. Finney, D. L. *et al. Nature Clim. Change* **8**, 210–213 (2018).
4. Brown, D. M., Kochtubajda, B. & Said, R. K. *Atmos.–Ocean* **58**, 231–242 (2020).
5. Mäkelä, A., Enno, S.-E. & Haapalainen, J. *Atmos. Res.* **139**, 46–61 (2014).

PRESTIGIOUS AI MEETING TAKES STEPS TO IMPROVE ETHICS OF RESEARCH

For the first time, the organizers of NeurIPS required speakers to consider the societal impact of their work.

By Davide Castelvecchi

After a year of heavy scrutiny and seemingly endless controversy around artificial-intelligence (AI) technologies, the field's most prestigious conference has tried to set a good example. For the first time, the Neural Information Processing Systems (NeurIPS) meeting, which took place completely online in December, required presenters to submit a statement on the broader impact that their research could have on society, including negative effects.

The organizers also appointed a panel of reviewers to scrutinize papers that raised ethical concerns — a process that could lead to their rejection.

"I think there's a lot of value even in getting people to think about these things," says Jack Poulson, founder of the industry watchdog Tech Inquiry in Toronto, Canada. He adds that the policy could help to shift the field's culture.

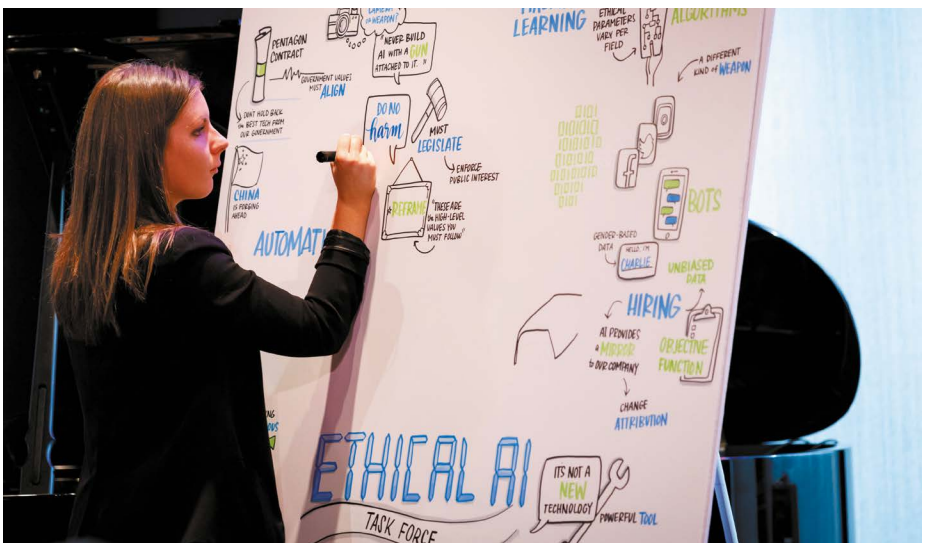
Researchers who work on machine learning are increasingly aware of the challenges posed by harmful uses of the technology, from the creation of falsified videos, or 'deepfakes', to mistakes by police who rely on facial-recognition algorithms when deciding who to arrest.

"There was previously a period of techno optimism," says Iason Gabriel, an ethicist at the AI powerhouse DeepMind, a sister company of Google based in London. "Clearly, that has changed in recent years."

Unintended uses

The idea of conference participants writing an impact statement was inspired by the Future of Computing Academy, a group led by Brent Hecht, a specialist in the human impacts of technology at Microsoft and at Northwestern University in Evanston, Illinois. In 2018, Hecht and his collaborators proposed that authors of computer-science publications should be required to state the potential side effects and unintended uses of their research. Unlike in other scientific disciplines, most peer review in computer science happens when manuscripts are submitted to conferences, rather than to journals. As the field's largest conference, NeurIPS was a natural choice to test this proposal.

The 2020 meeting attracted 9,467 submissions. The reviewers assessed papers mainly on their scientific value, but those with the potential to be accepted could be flagged for a full review by a separate ethics committee led by Gabriel. Of the 290 papers that were flagged, 4 were ultimately rejected by the programme chairs because of ethical considerations, says Marc'Aurelio Ranzato, a computer scientist at Facebook AI Research in New York



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Artificial-intelligence research is coming under increasing ethical scrutiny.