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Smell of forest pine can limit climate change- researchers

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New research suggests a strong link between the powerful smell of pine trees and climate change.

Scientists say they've found a mechanism by which these scented vapours turn into aerosols above boreal forests.

These particles promote cooling by reflecting sunlight back into space and helping clouds to form.

The research, published in the journal Nature, fills in a major gap in our understanding, researchers say.

One of the biggest holes in scientific knowledge about climate change relates to the scale of the impact of atmospheric aerosols on temperatures.
Perfumed air

These particles form clouds that block sunlight as well as reflecting rays back into space.

They can be formed in a number of ways, including volcanic activity and by humans, through the burning of coal and oil.

According to the Intergovernmental Panel on Climate Change (IPCC), they "continue to contribute the largest uncertainty to estimates and interpretations of the Earth's changing energy budget."

If you go into a pine forest and notice that pine forest smell, that could be the smell that actually limits climate change"
Dr Mikael Ehn University of Helsinki

One of the most significant but least understood sources of aerosols are the sweet-smelling vapours found in pine forests in North America, northern Europe and Russia.

These aerosols have confounded climate models as scientists haven't been able to accurately predict how many of the particles form.

Now an international team of researchers say they have solved the chemical mystery by which the rich odours become reflective, cooling particles.

They've long understood that the smell of pine, made up of volatile organic compounds, reacts with oxygen in the forest canopy to form these aerosols.

The scientists now found that, in fact, there is an extra step in the process, what they term a "missing link".

They've discovered ultra-low volatility organic vapours in the air that irreversibly condense onto any surface or particle that they meet.

"These vapours are so crazy in structure from what we had known before," said one of the authors, Dr Joel Thornton, from the University of Washington

"It turns out that this level of craziness is what gives them the special properties to stick to those smallest particles and help grow them up in size to become aerosols."

The scientists say that having a clear understanding of the way in which forest smells become aerosols will improve the accuracy with which they can predict the ability of these particles to limit rising temperatures.

"It's certainly crucial for explaining the response of the boreal forest to a changing climate," said Dr Thornton.

"It's thought that the vapours being emitted from the vegetation in the pine forests are contributing roughly half of the aerosols over the forest," he said.

"We've found the reasons how the vapours get converted into particles, so we are basically explaining around 50% of the aerosol particles."
Cooling effect

The authors believe that this is playing a significant role in reducing the impact of rising temperatures. They argue that this effect is likely to strengthen in the future.

"In a warmer world, photosynthesis will become faster with rising CO2, which will lead to more vegetation and more emissions of these vapours," said lead author, Dr Mikael Ehn, now based at the University of Helsinki.

"This should produce more cloud droplets and this should then have a cooling impact, it should be a damping effect."

The researchers sampled the air in the forests of Finland and carried out experiments at an air chamber at the Julich Research Centre in Germany.

They believe that the discovery was down to a combination of technique and technology.

"One very important thing is that before now, people haven't had the instrumentation to detect these ultra-low volatile compounds," said Dr Ehn.

"When you pull them through a metal tube into your instrument they come into contact with the tube walls and they are lost, you won't detect them."

"We have an instrument that is as wall-less as can be, we have a very high flow of air and a very short inlet line so that it is almost sampled right from atmosphere."

The scientists stress that the new understanding is not a panacea for climate change as forests will stop emitting vapours if they become too stressed from heat or lack of water.

However, Dr Ehn believes the vapours could have a significant impact in the medium term.

"If you go into a pine forest and notice that pine forest smell, that could be the smell that actually limits climate change from reaching such levels that it could become really a problem in the world."

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