

Microplastic drifting down with the snow

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Scientists from the Alfred Wegener Institute use the board helicopter from the icebreaking research vessel Polarstern to collect snow samples. Even in the Arctic the snow is polluted with microplastics. Credit: Alfred-Wegener-Institut / Mine Tekman

Over the past several years, microplastic particles have repeatedly been detected in seawater, drinking water, and even in animals. But these

minute particles are also transported by the atmosphere and subsequently washed out of the air, especially by snow—and even in such remote regions as the Arctic and the Alps. This was demonstrated in a study conducted by experts at the Alfred Wegener Institute and a Swiss colleague, recently published in the journal *Science Advances*.

The fact that the oceans are full of plastic litter has by now become common knowledge: Year after year, several million tonnes of [plastic litter](#) find their way into rivers, coastal waters, and even the Arctic deep sea. Thanks to the motion of waves, and even more to UV radiation from the sun, the litter is gradually broken down into smaller and smaller fragments—referred to as microplastic. This microplastic can be found in marine sediment, in seawater, and in marine organisms that inadvertently ingest it. In comparison, there has been little research to date on whether, and if so, to what extent, microplastic particles are transported by the atmosphere. Only a handful of works are available, e.g. from researchers who were able to confirm the particles' presence in the Pyrenees and near major urban centers in France and China.

A team of experts from the Alfred Wegener Institute, Helmholtz center for Polar and Marine Research (AWI) has now found that microplastic particles can apparently be transported over tremendous distances by the atmosphere and are later washed out of the air by precipitation, particularly snow. As the team led by Dr. Melanie Bergmann and Dr. Gunnar Gerdts report in the journal *Science Advances*, the analyses they conducted on [snow samples](#) from Helgo-land, Bavaria, Bremen, the Swiss Alps and the Arctic confirm that the snow at all sites contained high concentrations of microplastic—even in remote reaches of the Arctic, on the is-land Svalbard, and in snow on drifting ice floes. "It's readily apparent that the majority of the microplastic in the snow comes from the air," says Melanie Bergmann. Her hypothesis is supported by past research conducted on grains of pollen, in which experts confirmed that pollen from the middle latitudes is transported by the air to the

Arctic. These grains are roughly the same size as the [microplastic particles](#); similarly, dust from the Sahara can cover distances of 3,500 km or more, reaching the northeast Atlantic.



Scientists from the Alfred Wegener Institute analyse the content of microplastics in the samples. Credit: Alfred-Wegener-Institut / Melanie Bergmann

The AWI researchers found the highest concentration in samples gathered near a rural road in Bavaria—154,000 particles per litre. Even the snow in the Arctic contained up to 14,400 particles per liter. The types of plastic found also varied greatly between sampling sites: in the Arctic, the researchers chiefly found nitrile rubber, acrylates and paint, which are used in a host of applications. Given its resistance to various types of fuel and broad temperature range, nitrile rubber is often used in

gaskets and hoses. Paints containing plastic are used in several different areas, e.g. to coat the surfaces of buildings, ships, cars and offshore oil rigs. Near the rural road in Bavaria, the samples especially contained various types of rubber, which is used in countless applications, such as automotive tires.

One intriguing aspect of the AWI study: the microplastic concentrations found are considerably higher than those in studies conducted by other researchers, e.g. on dust deposits. According to Gunnar Gerdts, this could be due to one of two reasons: "First of all, snow is extremely efficient when it comes to washing microplastic out of the atmosphere. Secondly, it could be due to the [infrared spectroscopy](#) we used, which allowed us to detect even the smallest particles—down to a size of only 11 micrometers." Gerdts and his colleagues melt the snow and pour the meltwater through a filter; the residue trapped in the filter is then examined with an infrared microscope. Depending on the type of plastic, different wavelengths of the infrared light are absorbed and reflected; in this way, an optical fingerprint can be used to determine what type of plastic they've found.

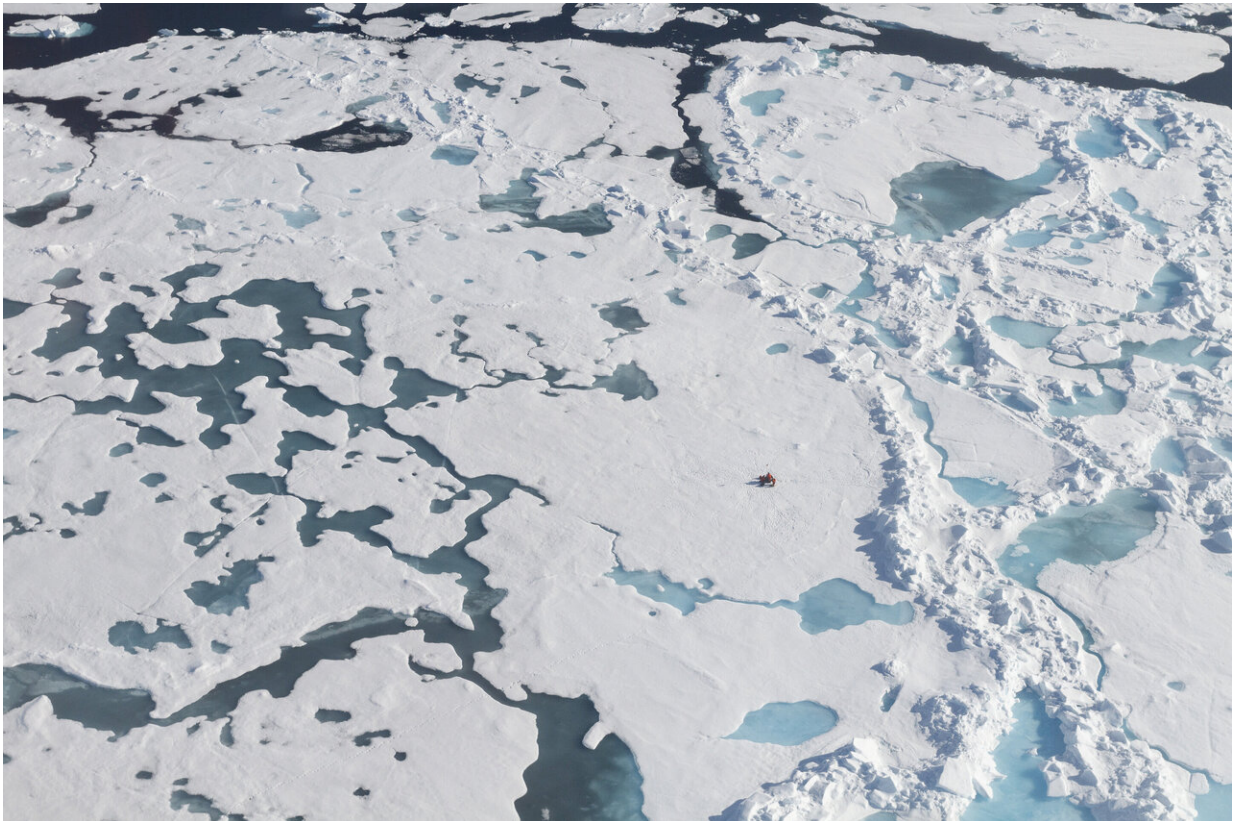


Fresh snow is filled with a chrome steel towel to lockable galss containers. Later the samples are analysed for microplastic concentrations in the lab. The whole sampling takes place without the use of any plastics to prevent the samples from contamination. Credit: Alfred-Wegener-Institut / Jürg Trachsel, WSL-Institut für Schnee- und Lawinenforschung SLF

Whereas other experts sort out microplastic from their samples by hand under the micro-scope, which can easily cause some particles to be overlooked, Gerdts uses his infrared microscope to test all of the residue, ensuring that he and his team hardly miss a thing. "We've automated and standardized the technique so as to rule out the errors that can creep in when manual analysis is used." As such, it's hardly surprising that the

analyses conducted at the AWI yielded especially high particle concentrations.

In light of the meteorological realities, the AWI experts are convinced that a major portion of the microplastic in Europe, and even more so in the Arctic, comes from the atmosphere and [snow](#). According to Melanie Bergmann: "This additional transport route could also explain the high amounts of microplastic that we've found in the Arctic sea ice and the deep sea in previous studies."



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Lastly, there's another key question that motivates her work. "To date there are virtually no studies investigating the extent to which human beings are subject to microplastic contamination." In addition, most research has focused on how animals or human beings absorb microplastic from what they eat. As Bergmann explains: "But once we've determined that large quantities of [microplastic](#) can also be transported by the air, it naturally raises the question as to whether and how much plastic we're inhaling. Older findings from medical research offer promising points of departure for work in this direction." Yet another aspect that warrants a closer look in the future.

More information: M. Bergmann et al., "White and wonderful? Microplastics prevail in snow from the Alps to the Arctic," *Science Advances* (2019). DOI: [10.1126/sciadv.aax1157](https://doi.org/10.1126/sciadv.aax1157) , advances.sciencemag.org/content/5/8/eaax1157

Provided by Alfred Wegener Institute

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