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Thirteen months in the Arctic

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It will be the **biggest polar expedition in history**: On the 20th of September, the research icebreaker Polarstern will set sail towards the North Pole from Tromsø, Norway. As organised by the Alfred Wegener Institute (AWI), the ship will spend around 13 months in the Arctic. The expedition is called **MOSAic**, which stands for **Multidisciplinary drifting Observatory for the Study of Arctic Climate**. On board there is also a research project of the Paul Scherrer Institute PSI for the study of atmospheric chemistry. PSI researcher Julia Schmale explains what her research is all about.

Ms. Schmale, are you going along on board the Polarstern?

At the end of September, I'm in Tromsø, where the Polarstern casts off. My colleague Ivor Beck and I have set up our red shipping container, which serves as a laboratory and is full of measuring equipment, on board the Polarstern. We have to make sure that all of the people who will be responsible for the experiments over the course of the expedition will be able to operate all of the equipment. I, for example, will not be on the cruise from the beginning, only later. No individual researchers remain on board for the entire duration of the expedition, and by the way, no crew members will do so either. Thirteen months on the ship would be too long a time. Every few months, researchers and crew members will be brought to the Polarstern by other icebreakers, and the ones who have been aboard will be returned to shore. So I will come on board in February 2020 and remain on the Polarstern until April.

This will not be the first time you and your research equipment have taken part in a large-scale research cruise in the polar regions.

Right: From December 2016, I was aboard the research ship Akademik Treshnikov during the three-month expedition around the Antarctic continent. And in the summer of 2018, we went into the northern polar region with the icebreaker Oden. In both research cruises we gained experience – practical, with regard to our research equipment, as well as scientific, with respect to processes in the polar atmosphere.



"For each instrument, we pack all the replacement parts we're likely to need." Julia Schmale, Head of the Molecular Cluster and Particle Processes Group at PSI, is sending her measuring instruments into the Arctic aboard the Polarstern.

(Photo: Paul Scherrer Institute/Mahir Dzambegovic)



Graphical representation of the research that will be carried out during the MOSAic expedition, on board as well as on the polar ice.

(Graphic: Alfred Wegener Institute/Martin Künsting)



And the expedition now will be a continuation of your previous research?

Yes, in part. In the past expeditions, we wanted to find out how cloud formation takes place in the polar regions and how the changes caused by man-made climate change affect it. Changes in the clouds, in turn, influence climate change, because clouds can warm or cool the earth – depending on where they are and when. Over the sea ice, clouds act more like a warm blanket. Especially in winter, when it stays dark and the clouds aren't keeping out the sun. Therefore, we want to investigate to what extent additional man-made particulates affect cloud formation in the far north.

But even before industrialisation, there were already clouds.

Of course, because there are many natural sources of particles: For example, they arise from ocean water and ice. Through the current MOSAiC expedition, we want to understand the Arctic in transition in a concrete and new way. With our project we want to find out, first, how these natural particles change in the course of climate change: whether they, perhaps, deposit a thin extra layer that changes their chemical action. Second, we will take a look at the man-made particulates in the Arctic air: We will be the first to measure over a long period of time, and for the first time so far north, what types of particulates are there and in what concentration.

What is already known about the Arctic atmosphere – and what assumptions will you now be able to test?

We suspect that the Arctic air is more polluted in the winter than in the summer. This is because we have known for some time that in winter the air hangs over the Northern Hemisphere like a cheese dome, which can extend as far as the latitude of Switzerland. Under this dome, man-made particulates are transported to the North Pole. However, we hardly know anything about the atmospheric chemistry in the Arctic winter. We are also doing experiments here at PSI in the smog chamber of the Laboratory for Atmospheric Chemistry. But recreating an atmosphere at minus 40 degrees Celsius is anything but simple. And first of all, we would also have to measure the correct composition of both the gases and the aerosol particles, in order to simulate all this realistically in the laboratory.

A practical question: Does the experience of the previous expeditions help you now when you're packing?

Definitely. We have long checklists for every instrument, so we won't forget anything. Because the instruments will be in continuous service for 13 months and different people need to operate and maintain them, everything has to be set down in writing. On such a long expedition, you can be sure that things will not always go smoothly. Things will have to be repaired, and we're prepared for that. Besides all the replacement parts we're likely to need, we also pack things like cable ties, gaffer tape, and straps in our container laboratory: so that in a pinch you can also improvise to make a repair.

And the private luggage? What happens if you forget your toothbrush?

I don't worry about packing for longer stays in remote areas. I've had plenty of practice. And in case anyone forgets something like a toothbrush, there is a little store on board the Polarstern.



You are a researcher, not a politician – do you notice that your research results influence the formation of opinions in politics and society?

Definitely: For example, I am currently collaborating on the AMAP report, the Arctic Monitoring and Assessment Programme. This is about so-called short-lived climate drivers in the Arctic, including the particulates. The next AMAP progress report will be published in 2021.

We also pay attention to the report of the IPCC, the Intergovernmental Panel on Climate Change. For example, research results from the Antarctic circumnavigation could be incorporated into the next edition of the IPCC report. Now too, with MOSAiC, we hope we will produce findings that will be taken into account in a future report.

By way of the IPCC report and AMAP, political decision makers have in hand the information that they need. And while the reports are being written and read, the wheels of science keep on turning.

Interview: Paul Scherrer Institute/Laura Hennemann

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Further information

- **Website of the MOSAiC expedition**
- **A floating lab – infographic about a 2018 expedition on the research vessel Oden**
- **In fresh air and in smog – text from 13 June 2019 about environmental research at PSI**
- **The open-air researcher – portrait of Julia Schmale from 14 December 2016**



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