Esther Horvath

Sebastian Grote
Katharina Weiss-Tuider

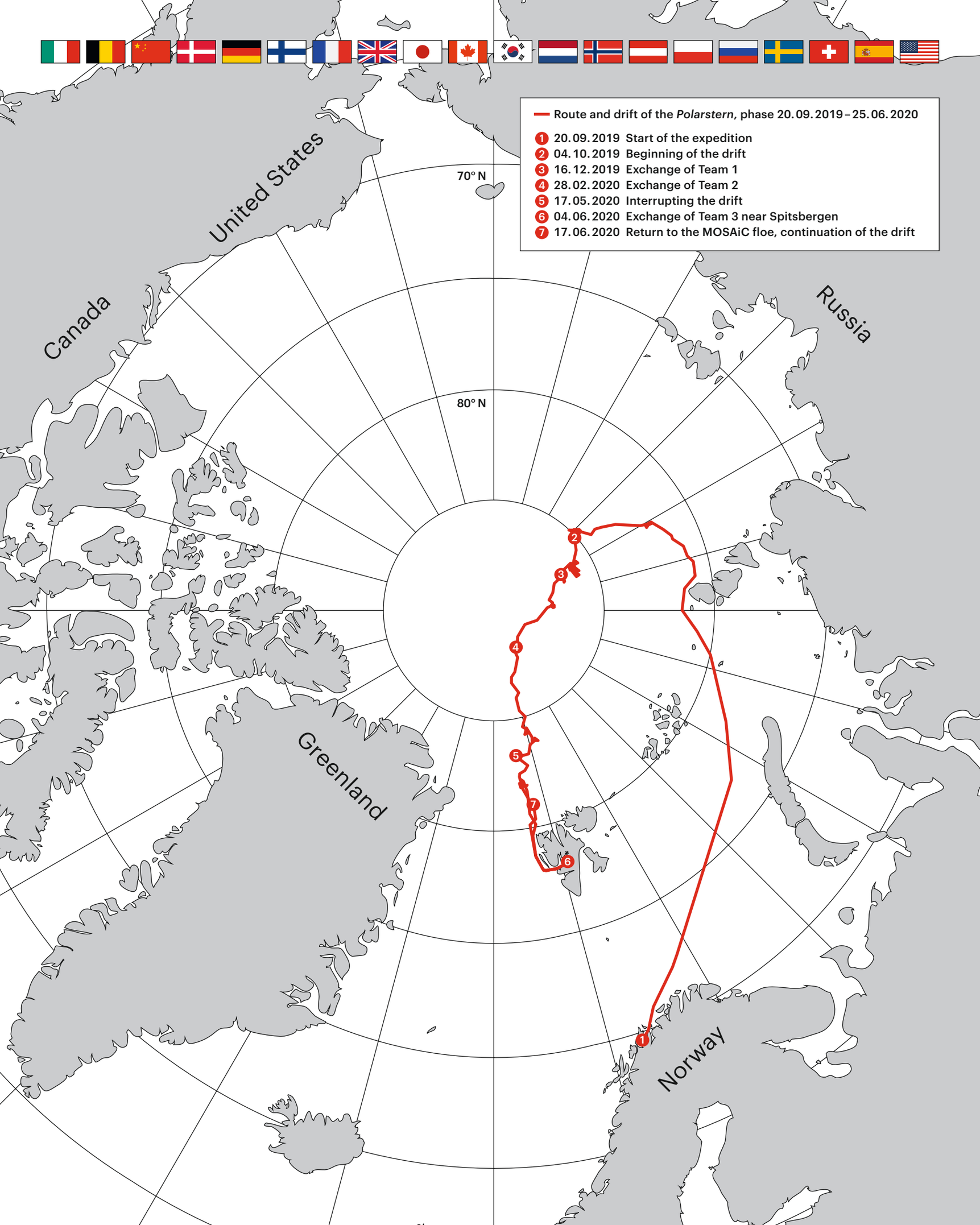
With a foreword
by Markus Rex

With additional images by
UFA Show & Factual

PRESTEL
Munich · London · New York

Into the Arctic Ice

The Largest Polar Expedition of All Time


Route and drift of the *Polarstern*, phase 20.09.2019 – 25.06.2020
1 20.09.2019 Start of the expedition
2 04.10.2019 Beginning of the drift
3 16.12.2019 Exchange of Team 1
4 28.02.2020 Exchange of Team 2
5 17.05.2020 Interrupting the drift
6 04.06.2020 Exchange of Team 3 near Spitsbergen
7 17.06.2020 Return to the MOSAiC floe, continuation of the drift
70° N
80° N
United States
Canada
Russia
Greenland
Norway

Contents

T

During the MOSAiC expedition, scientists from twenty countries are investigating the Arctic over the course of a year. From autumn 2019 until autumn 2020 the German icebreaker *Polarstern*, frozen into the ice, is drifting through the northern polar seas. MOSAiC is being carried out under the direction of the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (AWI). To ensure the success of this unique project and to collect as much valuable data as possible, more than eighty institutions are working together in a research consortium. The expedition has a budget of more than 140 million euros.

This book of photographs documents the MOSAiC expedition, the largest Arctic expedition ever undertaken. Following in the footsteps of the Norwegian explorer Fridtjof Nansen, a total of about 500 expedition members set out in its various phases to understand the climate system of the central Arctic. They have set new milestones in polar research: no ship has ever ventured so far north into the central Arctic in winter as the *Polarstern* during the MOSAiC expedition. Even for the best research icebreaker this is not possible under the ship's own power: the ice is too thick in winter. For this reason the expedition locked itself into the ice in late summer on the Siberian side of the Arctic and allowed itself to be carried by the natural drift of the ice, almost across the North Pole to the sea ice edge in the Atlantic – completely at the mercy of wind and currents and the forces of nature.

While storms raged through the polar night, the tremendous pressure of the ice piled up floes into metres-high mounds around the ship, and while the world on the ice shrank to a small bubble of light from headlamps in the absolute blackness of polar night, the expedition team had unique experiences. The appearance of the first light after a months-long winter night, at first hesitant and fleeting on the horizon, and finally the first sunrise, the summer thaw, azure melt pools on the ice and the sun circling permanently around the horizon – these were indeed impressive moments. And then there were the numerous visits from polar bears, beautiful, awe-inspiring animals that roam nimbly across their icy habitat, making us humans appear small.

"We need solid scientific foundations in order to be able to accurately shape the upcoming political decisions on climate protection based on solid evidence.... Only in this way can our societies take decisions based on well-founded knowledge."

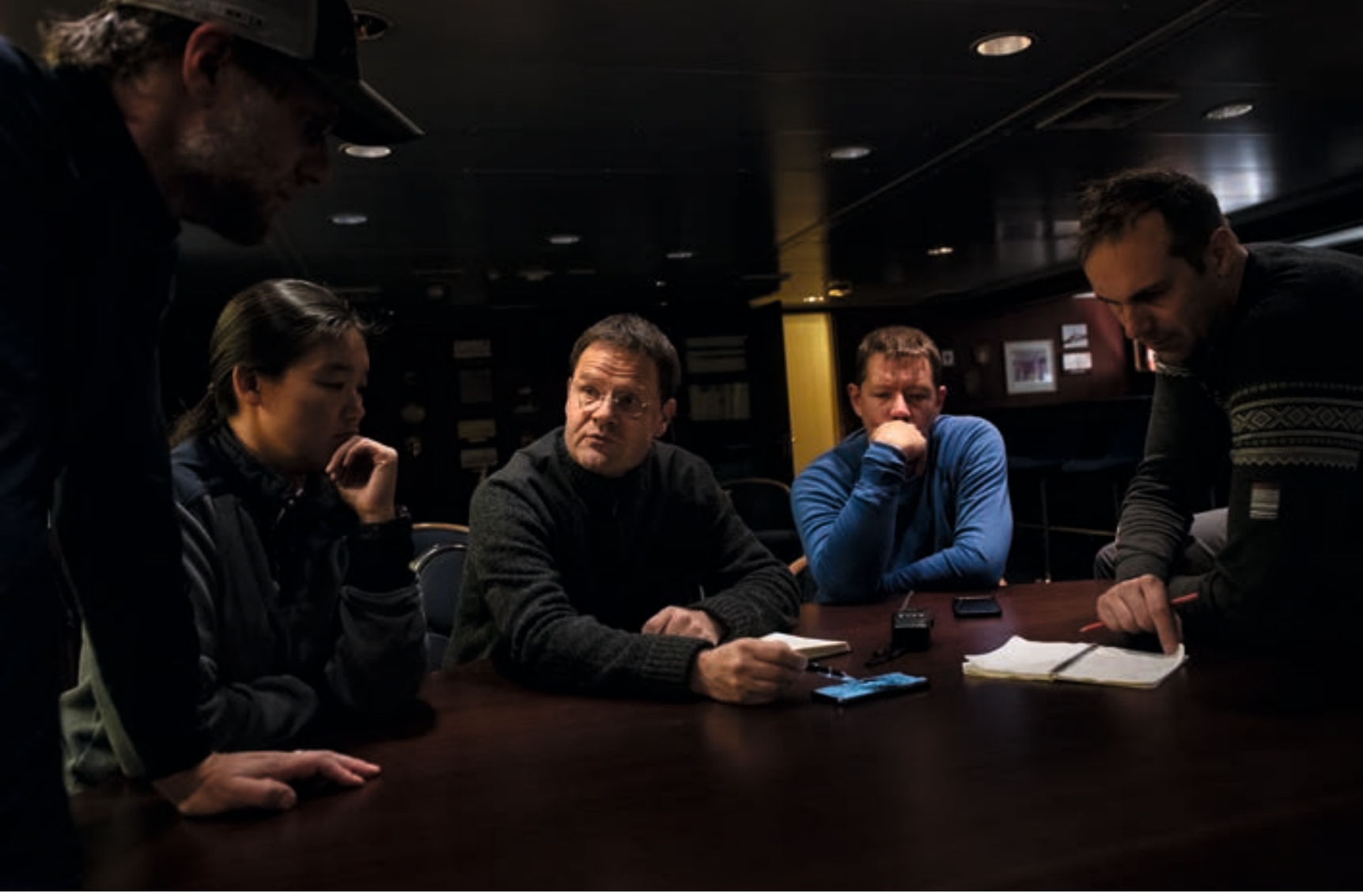
Markus Rex

But there was also normal life on board, everyday things like baking bread rolls, cutting hair, constantly putting on and taking off expedition equipment in order to go out into the icy cold and the storms on the ice. Esther Horvath captured all of this, uniquely documenting everything for us with her fascinating photographs. To browse through this book is to take a trip in time through the various phases of the expedition. As I look at the pictures I too am transported back to this remarkable landscape and can once again feel the atmosphere and moods of the expedition.

But why did we carry out this expedition? Why, in an unprecedented logistical achievement, did we deploy a total of five icebreakers, helicopters and aircraft to supply the main research vessel, the *Polarstern*, and to make possible this once-in-a-century expedition? Why did hundreds of expedition members take great hardships to operate their instruments under the most forbidding conditions on the ice of the central Arctic?

The Arctic is the epicentre of climate change. No other part of our planet is warming as quickly as the Arctic. Here, the rate of the warming is at least twice as fast as on the rest of the planet – and this is even more pronounced in the winter months. I have been travelling to the Arctic since the early 1990s, and it is already a different world to the one that I knew back then. When I arrived at our research station on Svalbard in winter in the 1990s, there was only snow and ice. It was a hard-frozen landscape of glittering white snow crystals and deep-blue blocks of ice. The station lies on the shore of a fjord, but it was frozen in winter and barely discernible. I crossed it countless times on skis and snowmobiles.

When I come to the station today, in the middle of winter, liquid water splashes at my feet. The fjord has rarely frozen over for more than a decade, and waves play merrily in the wind where once there was solid ice. We travel by boat to places where I used to make trips on skis. The station data reveal warming in the winter months of approximately 3°C (5.4°F) per decade – more than 6°C (10.8°F) since the mid-1990s. Nowhere is climate change more apparent. Here there is no need for highly precise measuring instruments or

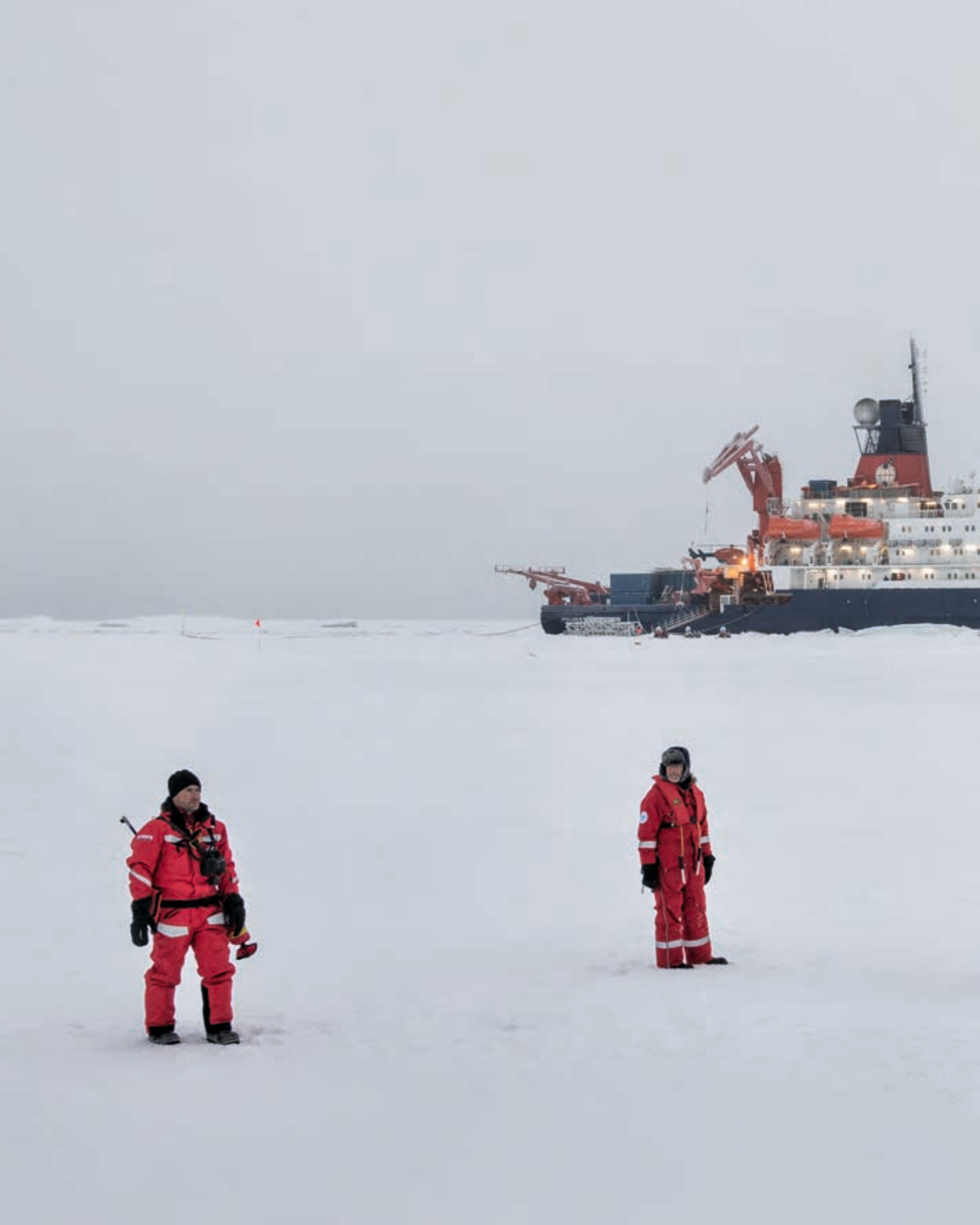


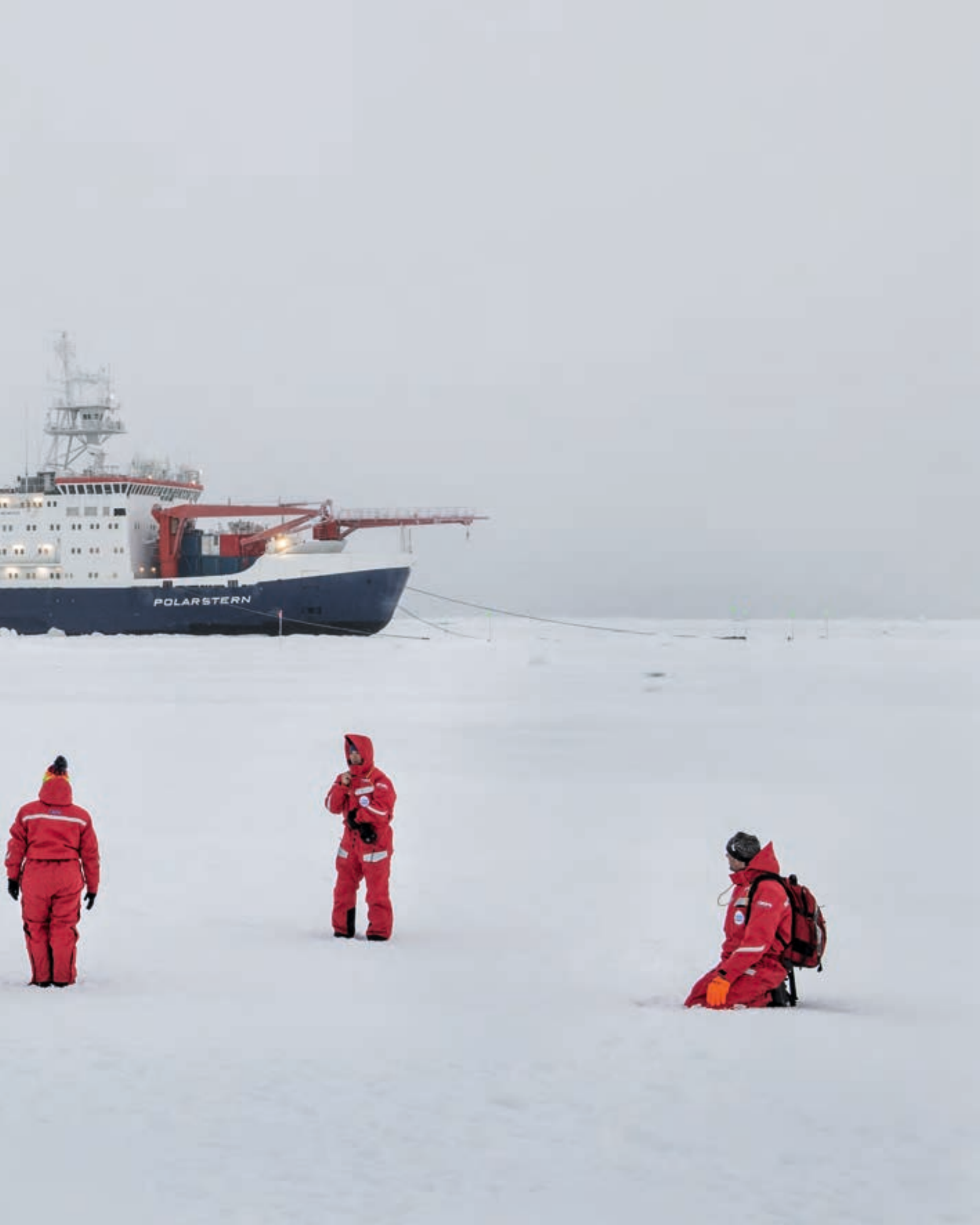
sophisticated statistics to demonstrate climate change: you need only open your eyes. But to understand this change and to be able to predict the future, we need precise observations of dozens of highly complex climatic processes in the central Arctic.

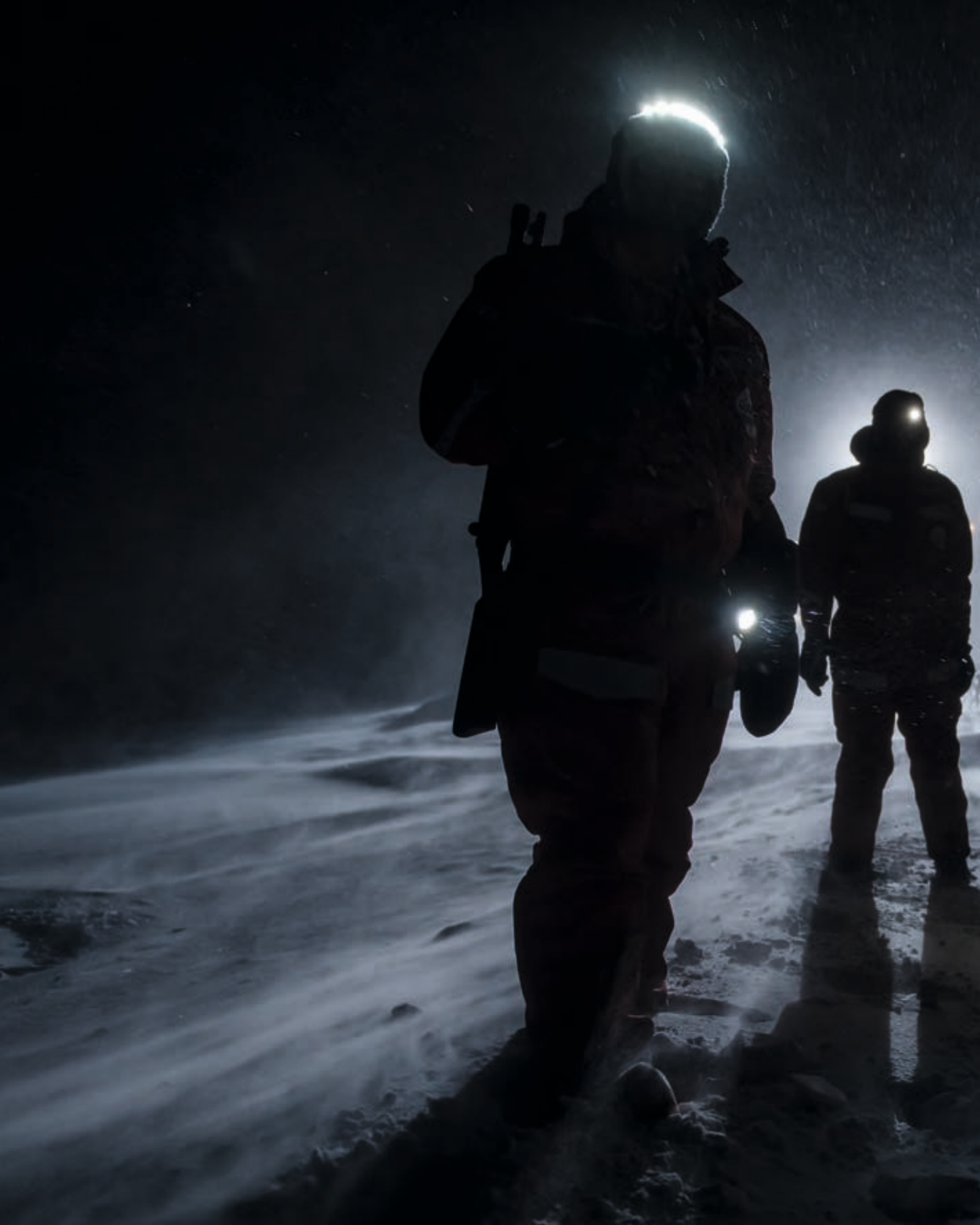
Unfortunately, the Arctic is the region of our planet whose climate system we at present least understand. For the same CO_2 emission scenario, the predictions of different climate models for the warming of the Arctic diverge by a factor of three. For a pessimistic emission scenario, the forecasts for the warming of the Arctic vary between 5 and 15°C (9 and 27°F). And the conditions in the Arctic heavily affect the weather in North America, Europe and northern Asia. The temperature contrast between the cold Arctic and the warmer mid-latitudes drives the main wind system of the Northern Hemisphere, the polar jet stream. As a result of the stronger warming of the Arctic, this wind system is changing, with direct and far-reaching consequences for the weather and climate in Europe, North America and Asia.

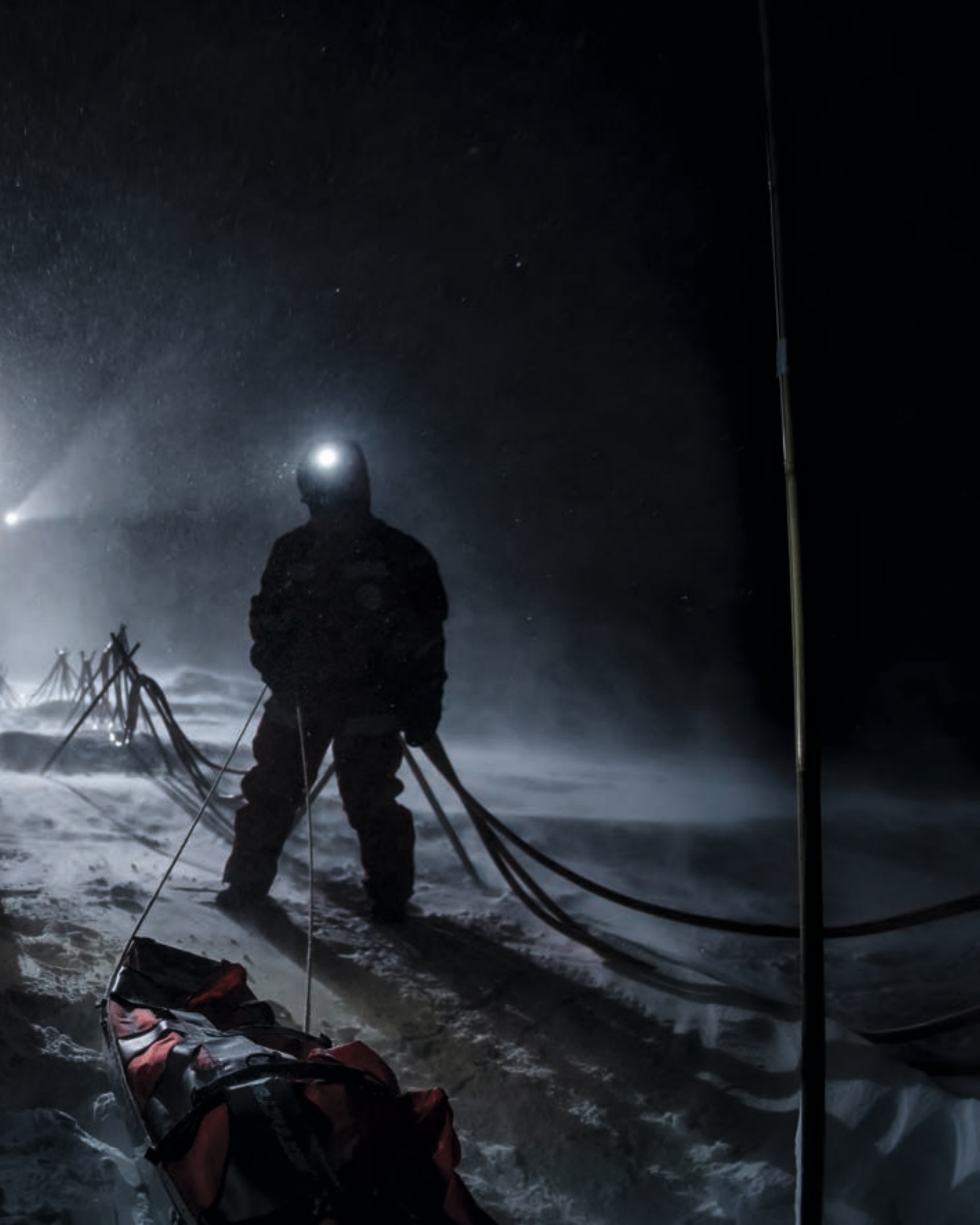
We need solid scientific foundations in order to be able to accurately shape the upcoming political decisions on climate protection based on solid evidence. We need reliable climate models so that we can inform people of the respective consequences of the different pathways for climate protection measures that are under discussion. Only in this way can our societies take decisions based on well-founded knowledge. To this end we must better understand the climate processes of the central Arctic and better represent them in our climate models. This is why we set out on our unique, year-long mission to the central Arctic. Thanks to the photographs in this book, you can come with us.

Markus Rex
Expedition leader, MOSAiC
(Multidisciplinary drifting Observatory for the Study of Arctic Climate)




POLARSTERN





Measuring a vanishing world

Hardly anyone has ever made it this far: hundreds of kilometres from the world's northernmost coastline, in the middle of the Arctic Ocean, surrounded by pack ice, cold and darkness. Storms rage on the surface, keeping the ice in motion. Creaking and groaning, it pushes up to form metres-high towers. During the polar night, only the moonlight provides an idea of the bizarre silhouettes of the ice formations.

It is as if the wind and sea want to reconceive this unique landscape each and every day. At any moment a wide crack could open in the sea ice and reveal the ocean beneath. For a human being, this ocean with its thousands of metres of darkness is a mortal danger. Yet for the life of our planet it plays a crucial role, as does its icy cover – and the entirety of the supposedly distant Arctic.

The Arctic is the epicentre of climate change. Hardly any region on earth has warmed up so quickly in recent decades. In contrast to the temperate latitudes, here the changes are already clearly visible. And the dramatic transformation is progressing faster than expected. It has long been clear that we must say farewell to the Arctic as we know it today. The ice will retreat further in increasingly warmer summers. Massive ice floes that were once metres thick will grow thinner, and those that last for several years will become ever less frequent. The unique setting of the Arctic will disintegrate – with consequences far beyond the seas around the North Pole.

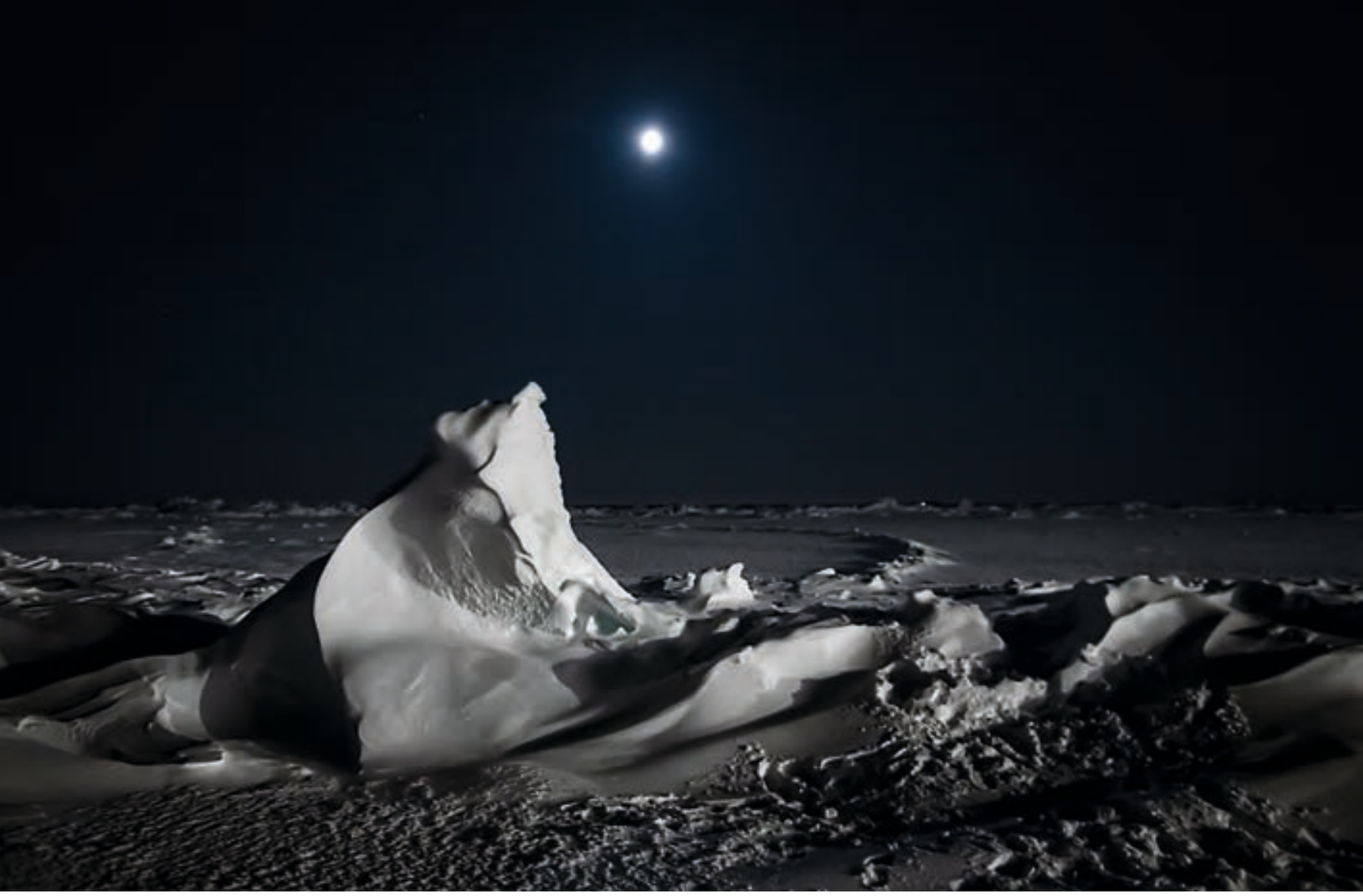
No one can yet say what the loss of the "old" Arctic means for our future. There are no research stations at the North Pole and thus hardly any measurement data – especially not for the polar night, when the central Arctic is shrouded in darkness for the entire winter half-year. The region around the North Pole is largely a blind spot in climate research. It would be an understatement to say that this is the only missing piece of the puzzle. In fact, the framework of the entire region remains unknown. But without understanding the Arctic, it is impossible to understand climate change.

For a decade, scientists have therefore made plans to close this gap in our knowledge. The result is a logistical choreography that has never taken place before in the central Artic. It envisages the German research icebreaker *Polarstern* drifting for a year through the northern polar seas – frozen into the ice – with one hundred expedition members from more than twenty countries on board for each of five legs. They are not the first to venture into the harsh, remote far north to carry out measurements, but, if all goes according to plan, they will be the first to come so close to the North Pole on a modern research icebreaker in the depths of winter; the first to spend the winter in a region almost inaccessible in the darkness and cold of the polar night, on a route determined solely by the natural force of the ice drift.

For participants from all over the world, this is the expedition of their lives. They have prepared for it with great care, learning how to survive at –40 °C (–40 °F) and to work in the dark, how to handle the sensitive measuring instruments and to recognize dangers on the ice before they pose a threat. They know that the opportunity for such a mission does not come a second time.

On 20 September 2019 the MOSAiC expedition of the *Polarstern* finally begins. The first hundred participants set out to sea from Tromsø, Norway, accompanied in the first weeks by additional team members on a second research ship, the Russian vessel *Akademik Fedorov*. Behind them is one of the warmest Artic summers on record, while a months-long journey into the unknown lies ahead. After days on the open sea they break into the ice, and a race against time begins. They set up their research camp on an ice floe and link it to a widespread network of measuring stations. This piece of ice is then simultaneously their home, place of work and research subject. Day after day the sun begins to retreat, until it disappears completely behind the horizon. The polar night begins and covers the ice for 150 days. In the midst of this barren landscape now shrouded in darkness, the *Polarstern* offers protection from icy storms, life-threatening temperatures and hungry polar bears.

The ship is the researchers' observatory, an eye in this vastly unknown region. Here they measure the atmosphere and the ocean with its living creatures. They investigate the ice and the snow that



lies upon it. They are concerned with contexts both large and small. Their questions are closely linked: Exactly how is sea ice formed? What happens when the ice layer breaks open and relatively warm ocean water comes into contact with extremely cold air? What happens to the ecosystem under the extreme conditions of the polar night before explosive new life emerges under the ice in spring with the increasing sunlight? And of course the scientists on this expedition want to find answers to one of the most important questions of our day: To what extent is the Arctic affected by and, at the same time, a driver of climate change?

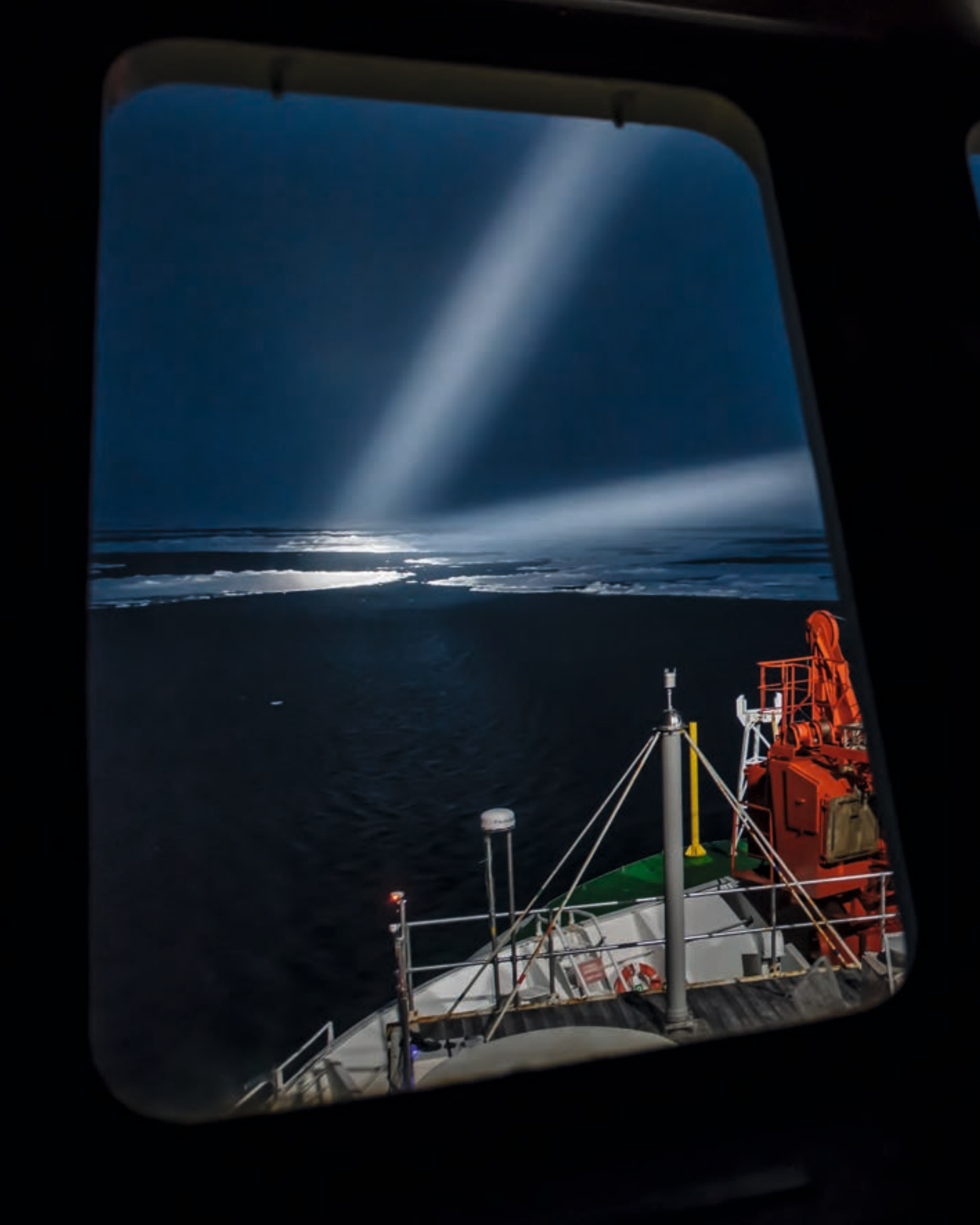
Their work will be a milestone in climate research. Yet the mission also entails unprecedented challenges: scientific, logistical but also interpersonal. People, machines and the sensitive technology of measuring instruments have to operate in the extreme conditions of the Arctic. The calculations must be right and the numbers must square out, because if food, fuel or spare parts run short, for example, the mission can be at risk. And in spite of the most modern technology, success ultimately depends on team members – however diverse they may be in profession, place of origin and age – being able rely on each other during this extreme experience.

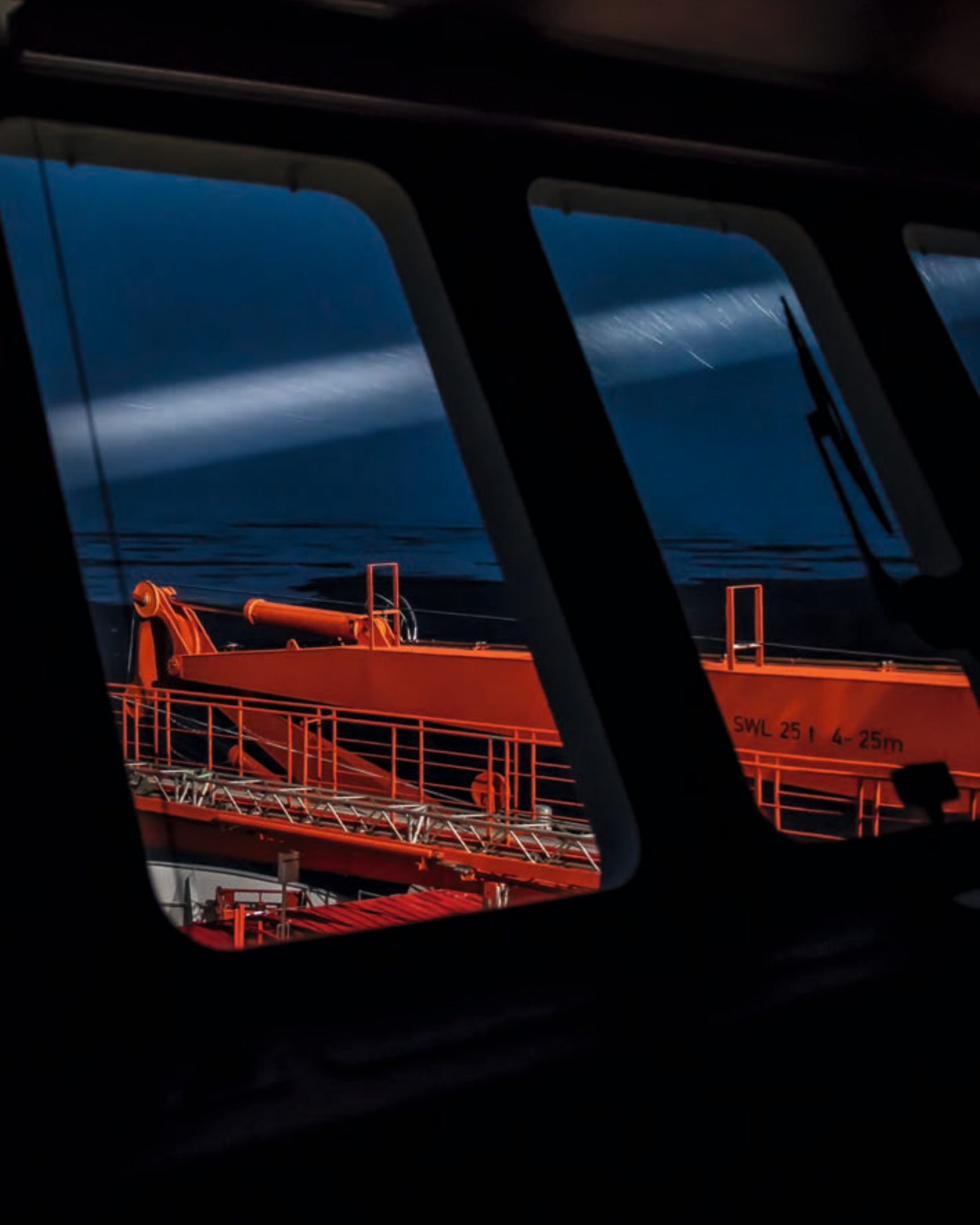
Today we still have an idea of what the polar regions of our planet looked like around a hundred years ago. Explorers such as Roald Amundsen, Robert Scott and Fridtjof Nansen recorded their expeditions and races to the poles with their cameras: grainy grey-white and sepia images, taken in what was thought to be the eternal ice of days past. The images recorded during the *Polarstern* MOSAiC expedition are high-definition. They show in great detail how humans set out to record a disappearing world. And they are an invitation to take part – in the largest Arctic expedition of our time.

Esther Horvath, Sebastian Grote and Katharina Weiss-Tuider, expedition participants. Central Arctic, October 2019

Cast Off

Away into the ice




SWL 25 t 4-25m