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WhiteIce



Anja Mödl © PNRA

at Mario Zucchelli Station

by Anja Mödl

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The long journey south

POLRIN supported our travel from Europe to Christchurch, New Zealand, the main gateway to our final destination in Antarctica. From there we continued to the Mario-Zucchelli station, with a flight organised by the Italian National Antarctic Research Program (PNRA).

In addition, POLARIN-funding was used to ship our research equipment to Antarctica - an essential part for making this expedition possible.

The first view of Antarctica from the airplane was impressive. In the photo you can see both the sea ice and the mountains, characteristic of Victoria Land. It was a big moment, after month of preparation we were finally there, flying over one of the most remote and beautiful landscapes on Earth.

Roberta Pirazzini © PNRA





Mario-Zucchelli Station

Thanks to POLARIN, we were able to access the Italian Antarctic research station Mario Zucchelli, located on the coast of Terra Nova Bay in northern Victoria Land, East Antarctica.

The station is built on solid rocks and is surrounded by a road-network reaching several kilometres inland. These roads not only provide access to nearby field sites, but also allow us to explore the surroundings by running and hiking.

From the station, the contrast between mountains and sea is striking. The photo shows the base with the partly ice-covered ocean and the volcano Mount Melbourne in the background. It highlights the dynamic nature of this remote environment.

Fieldsite: Nansen-Iceshelf

Our field site is located, about 37 km from the Mario Zucchelli, on the Nansen-Ice Shelf, which results from the junction of the Priestley and the Reeves glaciers.

Accessing the site requires a helicopter flight, which is arranged by the station. Flying over Antarctica by helicopter offers a unique perspective on the vastness of the landscape and is a huge privilege.

On the ice shelf we installed two automatic weather stations that continuously measure atmospheric conditions and the energy exchange between the surface and the atmosphere. The two stations are positioned 70m apart, shown in the photo.



James Bradley © PNRA



Measurements

In addition to the continuous measurements from the automatic weather stations, we also carried out manual measurements of the surface properties such as density, temperature, structure and reflectivity.

For this we combined traditional methods like digging ice pits with specialised instruments like a spectroradiometer, a near-infrared imaging system, as well as thermal and RGB mapping with a drone.

By repeating the same measurements at the same locations several times during the field campaign, we built a timeseries of surface properties and energy balance. This approach allows us to analyse how the ice surface changes over time and better understand the processes shaping it.

Roberta Pirazzini © PNRA



James Bradley © PNRA



Research- The surface scattering layer

Dann van der Broek © PNRA



Anja Mödl © PNRA



Our research focuses on the formation and properties of the surface scattering layer (SSL). This layer develops from bare ice when air temperatures rise above 0°C . Under these conditions, the ice surface begins to melt and the meltwater percolates downward and evaporates. What remains on the surface is a granular layer of ice crystals with air where the water has drained away. This layer resembles snow, but is actually transformed ice. Our goal is to better understand the transformation process and how the SSL changes the surface energy balance to implement this surface structure correctly in global climate models.

The photos illustrate this transformation: on the left, the ice surface before melting, with a clear contrast between bare ice and snow; on the right, after melting, the surface is uniformly covered by the SSL.



Unexpected challenges

This season was marked by exceptionally warm and sunny conditions. Together with strong katabatic winds around Christmas, this led to intense surface melting. While these conditions promoted the formation of the SSL, they also caused surface destabilisation due to subsurface water ponds.

The consequences for our measurements are displayed in the photo. The unstable surface could no longer support the weight of the automatic weather stations. As a result, the anchors loosened, and the station sank into the ice and became tilted, which is problematic for the measurements that require horizontal levelling.

Situations like this highlight how challenging it is to conduct surface-based observations in the harsh environment of Antarctica.

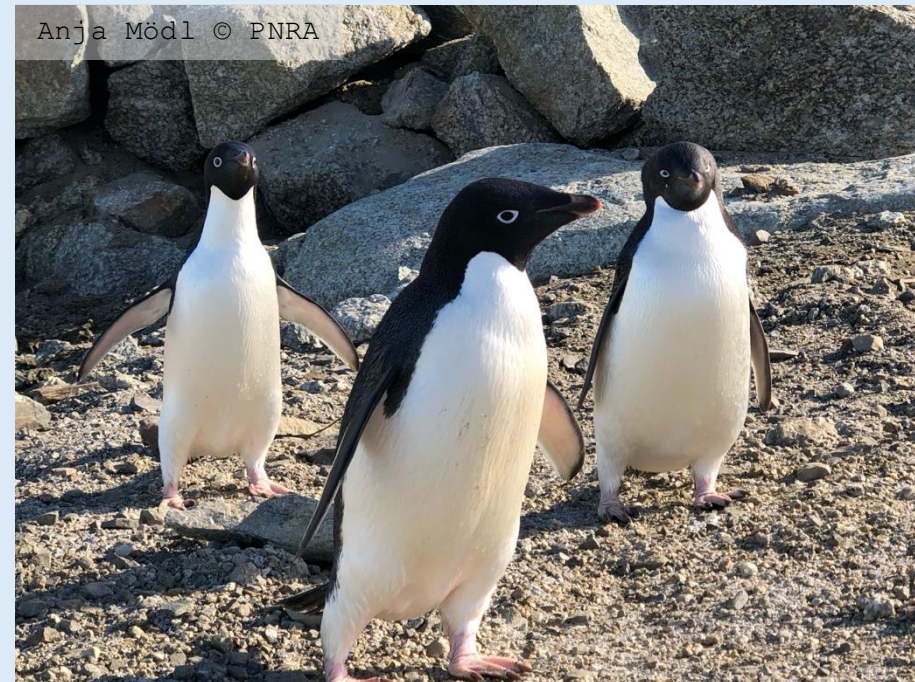
Antarctic Wildlife

Despite the harsh Antarctic climate, we were able to observe a variety of wildlife around the station. Skuas nested nearby, and we eventually even spotted their chicks. Not far from the station is a large Adélie-penguin colony from where some curious penguins occasionally come onto the station. As the sea ice retreats, seals approach the coast, giving us the chance to observe them. Once, we could even sight killer whales hunting for penguins or seals.

Roberta Pirazzini © PNRA



Anja Mödl © PNRA



Marco Troia © PNRA



Roberta Pirazzini © PNRA





Antarctic Landscape

The landscape around the Terra-Nova Bay is unlike anything I have ever seen. Impressive mountain ranges with glaciers terminating as gigantic ice shelves into the ocean. The sea-ice coverage constantly changes and massive icebergs drift in the water. This variety creates a scenery that looks completely different just a few meters away, or when viewed from another direction. No matter how long I look, I never get tired of marvelling at this wonderful panorama.



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Lee Armstrong © PNRA

WhiteIce

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Photo credits: Roberta Pirazzini, Anja Mödl, Daan van der Broek, James Bradley, Marco Troia, Lee Armstrong

WhiteIce was one of the projects successfully selected through POLARIN's first call for transnational access to polar research infrastructures.

Thank you!



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