

FINNARP

Field Operations 2021–22



Photo: Priit Tisler | FINNARP

Editorial



Photo: Mika Kalakoski | FINNARP



The FINNARP 2021 expedition during austral summer 2021–2022 was rather different comparing to our previous expeditions. The global coronavirus pandemic has significantly impacted on expedition planning, logistics and travel arrangements. We also had concerns regarding Aboa station as it had not been visited in two years since the previous expedition was cancelled due to the pandemic.

The travel arrangements had to consider the COMNAP and DROMLAN instructions and the agreed procedures to prevent the spread of coronavirus to Antarctica. In Cape Town, the expedition spent two weeks in quarantine and all expedition members were tested several times before travelling to Antarctica. Half of the expedition's research campaign had to be postponed because the omicron variant caused travel ban to South Africa preventing the second group to travel.

Arriving at Aboa, the station was found in good condition. The year-round measuring systems, however, need development, in case Aboa is long periods without maintenance. The station vehicles had collected quite a lot of ice and it took time to melt them. The coronavirus outbreak in Queen Maud's Land in the mid-season also affected FINNARP's operations. A potential exposure from arriving cargo flight caused additional quarantine measures at Aboa for a week. Despite the difficulties, the FINNARP 2021 expedition managed to implement a significant part of the work plans. As well, it was important to inspect and maintain the station and its infrastructure to ensure that Aboa returns to its pre-pandemic state.

The season was exceptional compared to previous years. Professional activity with good practices is essential for expedition success. With consequences of coronavirus, the FINNARP 2021 expedition was lucky. There were no covid-19 infections among expedition members during the expedition. However, challenges in Antarctic operations will continue. As always, co-operation at all levels is required for Antarctic expeditions and operations.

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Finnish Antarctic research program carried out FINNARP 2021 expedition to the Finnish Antarctic station Aboa, located in Queen Maud Land, between November 2021 and February 2022. Five FINNARP logisticians, one scientist from the Finnish Meteorological Institute (FMI) and two scientists from the Helsinki University (HU) participated in the expedition.

FINNARP 2021 expedition travelled from Finland to the research station Aboa in the middle of November 2021. Due to the coronavirus pandemic, the trip became longer than usual. Before the expedition was allowed to travel to Antarctica, it spent two weeks in a corona quarantine in Cape Town, South Africa. On November 30, 2021, the expedition team flew from Cape Town to Antarctica with a business jet, operated by ALCI Antarctic Logistic Center International. After spending almost a week at the Russian Novolazarevskaya station, the expedition team continued on a ski-equipped Basler BT-67 aircraft to Aboa. The expedition with its cargo arrived at Aboa station on Finland's Independence Day on December 6, 2021.

The expedition team consisted of expedition leader, senior specialist, cook, mechanic, doctor and three aerosol scientists from the Finnish Meteorological Institute and the University of Helsinki.

Aboa had been overwintering moderately well considering the last visit to the station was two years ago. Due to the corona pandemic, Aboa was not visited during the Antarctic season 2020–2021. A lot of snow was accumulated in the vicinity of the station, but the station startup went without major difficulties. The generators were turned on immediately after the team had arrived to Aboa and the station was soon warm. Antarctic winter storms had caused only minor damages to the station.



FINNARP 2021 expedition on Christmas Eve at Aboa Station. From left: Priit Tisler, Pekka Paarala, Zoé Brasseur, Matthew Boyer, Juho Vehviläinen, Mika Kalakoski, Hannu Luoto, David Brus. **Photo: Priit Tisler|FINNARP**



Research station Aboa. **Photo: Pasi Ylirisku|FINNARP**

The weather in the area during the past season was variable. In mid-December, Aboa was ravaged by a storm that lasted nearly 10 days with hurricane-force winds. Wind gusts up to 53 m/s were measured and all scientific and station maintenance work were carried out indoors only. A safety rope was installed between the main building and residential containers to move safely between the containers. Despite the unstable weather, all planned works were completed in time and scientific goals were met.

During the expedition, the FMI and HU scientists studied atmospheric aerosols at Aboa, as well as processes related to aerosols interactions with radiation and clouds. In addition, biological samples were collected, and atmospheric measurements were carried out using a small, unmanned aircraft. The station's permanent measuring equipment was serviced by the expedition's logisticians, and the data was stored for scientific analysis.

The station electrical systems were also partly renewed. An entirely new off-grid electrical system was installed into the gravity container, consisting of several solar panels and batteries. The main weather station solar panels and battery pack were also renewed. There was a lot of co-operation with the Swedish expedition that worked at the neighboring station Wasa. With the help of Swedish colleagues, FINNARP's automatic weather station was excavated from the nearby glacier at a depth of several meters.

In addition, the station was subject to routine maintenance and repair works. Station vehicles, such as snowmobiles, tracked transport vehicles, SUVs and tractor were serviced and repaired. Towards the end of the season, eight new Lynx snowmobiles were transported to Aboa on Basler BT-67 aircraft. The new snowmobiles are for future expeditions to use.

Aboa was closed on February 13, 2022. The expedition travelled on Basler BT-67 aircraft to Novo Airport, and the very next day continued on an Iljushin cargo aircraft to Cape Town. The expedition arrived at Helsinki on February 18, 2022. The Aboa research station was occupied for 71 days.



Expedition cargo flight on the Basen glacier. Photo: Priit Tisler| FINNARP

FINNARP 2021 Expedition

Mika Kalakoski | expedition leader
Priit Tisler | senior specialist
Juho Vehviläinen | medical doctor
Hannu Luoto | mechanical engineer
Pekka Paarala | chef
Zoé Brasseur | scientist
Matthew Boyer | scientist
David Brus, tutkija | scientist



Juho maintaining weather station on the Basen glacier. Photo: Priit Tisler| FINNARP



Station snow mobiles in front of the rocky wall of the Basen nunatak.

Photo: Priit Tisler| FINNARP

Measuring devices and campaigns at Aboa during season 2021/22

Automated year-round measuring devices:

- Automatic weather station (FMI) at Aboa was maintained. Ceilometer was in use during the expedition to determine the height of a cloud base.
- Automatic weather station (FMI), 10 km from Aboa, was maintained.
- Seismometer (HU) at Aboa was maintained. Portable seismometers were installed for the season at Fossilryggen and Plogen nunataks.
- GPS equipment (National Land Survey of Finland, NLS) was maintained.

Measuring campaigns:

- Aerosol and atmospheric measurements by University of Helsinki and Finnish Meteorological Institute.
- Collection of rock samples from Basen nunatak for University of Helsinki.

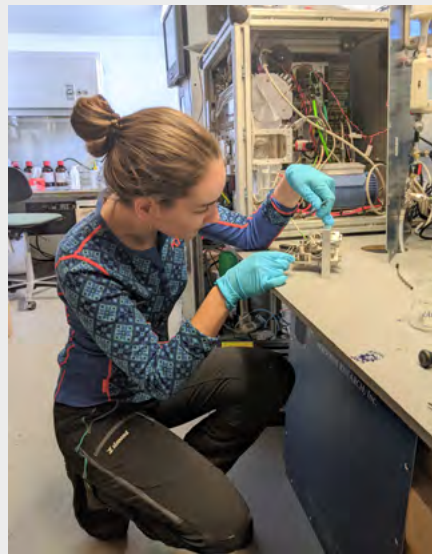
Atmospheric measurements at Aboa

Matt Boyer (INAR, University of Helsinki), Zoé Brasseur (INAR, University of Helsinki) and David Brus (Finnish Meteorological Institute), with the remote participation of Martin Romantschuk (MIBS, University of Helsinki).

Atmospheric measurements were conducted to better understand the climate-forcing properties of atmospheric aerosols measured at Aboa, as well as processes related to their interactions with radiation and clouds. Instrumentation included online and offline techniques to detect and count particles in the atmosphere, measure their chemical compositions, physical properties, and cloud formation potential. In addition, microbiological samples were collected to assess the role of microorganisms, such as bacteria and viruses, in the overall aerosol population at Aboa.

The scientific instruments were installed in an aerosol container located uphill of the main station. The daily routine at the container consisted of checking, maintaining, and calibrating the instruments, as well as analyzing and storing filter samples. Additional atmospheric measurements and filter samples were collected using both rotary and fixed-wing drones.

This field work was part of the Antarctic Climate Forcing Aerosol (ACFA) project funded by the Academy of Finland and was conducted under a consortium set up between the Institute for Atmospheric and Earth System Research (INAR) of the University of Helsinki, the Finnish Meteorological Institute (FMI), and the Molecular and Integrative Biosciences Research Programme (MIBS) of the University of Helsinki.



Fixing an instrument in the aerosol container.

Photo: Matt Boyer | FINNARP 2021



Daily check and maintenance in the aerosol container.

Photo: Zoé Brasseur | FINNARP 2021

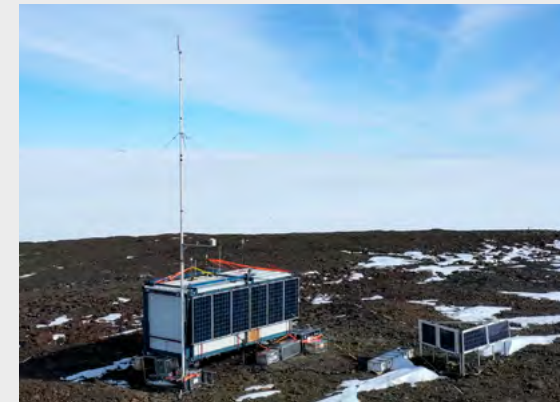
Monitoring the operations during a drone flight on the glacier.

Photo: Zoé Brasseur | FINNARP 2021



The aerosol container located uphill of the Aboa station.

Photo: Matt Boyer | FINNARP 2021



Scientists preparing drones for atmospheric measurements.

Photo: Priit Tisler | FINNARP



Aalto University at the Endurance22 expedition

Ice scientist, professor Jukka Tuhkuri from Aalto University School of Engineering participated on the Endurance22 expedition onboard the South-African research vessel SA Agulhas II to the Weddell Sea in February – March 2022. The expedition was organised by the Falklands Maritime Heritage Trust (FMHT) with the main goal to locate and study Endurance, Sir Ernest Shackleton's ship, which sank in the Weddell Sea in 1915. The other goals of the expedition were to bring the story of Shackleton and Endurance to younger generations and to conduct sea ice research at the Weddell Sea. The expedition team was able to find the wreck, as documented in the expedition website <https://endurance22.org> and widely in the international media.

Aalto University was part of the Science Team of 15 scientist from the Alfred Wegener Institute (AWI), the German Aerospace Center (DLR), Drift+Noise Polar Services (D&N, an AWI spin-off company), the South African Weather Service and Stellenbosch University from South Africa. The research conducted sea ice research, meteorological and oceanographic research, and marine engineering research. Jukka Tuhkuri was the only member of the expedition from Finland. This research by Aalto University was supported by the Academy of Finland and the Finnish Antarctic Research Program (FINNARP), in addition to FMHT.

In the Weddell Sea marginal ice zone and pack ice conditions, Aalto University, jointly with the Stellenbosch University, measured the ice loads on the hull of SA Agulhas II. Parallel observations about ice conditions were conducted: sea ice concentration, thickness, and floe size. The ice conditions were monitored through visual observations but also by using cameras and an electromagnetic (EM) device provided by AWI and operated by D&N. Data was recorded continuously when the ship was in ice. In addition to monitoring sea ice conditions, small scale ice properties were studied by collecting sea ice samples from 15 ice floes. Also the salinity, temperature, and density profiles of the ice were measured. The data from very warm late summer Weddell Sea is rare, thus it is an important addition to our understanding of sea ice loads on ships.

During the expedition, Jukka Tuhkuri was writing a blog in Finnish. The blog can be found at <https://ourblogs.aalto.fi/kohti-etelamannerta>.

South African research vessel SA Agulhas II.

Photo: Jukka Tuhkuri



James-John Matthee from Stellenbosch University measuring the temperature profile of Weddell Sea ice.

Photo: Jukka Tuhkuri



Rotten late summer sea ice at the Weddell Sea.

Photo: Jukka Tuhkuri



Emperor penguins beside the research vessel SA Agulhas II.

Photo: Jukka Tuhkuri

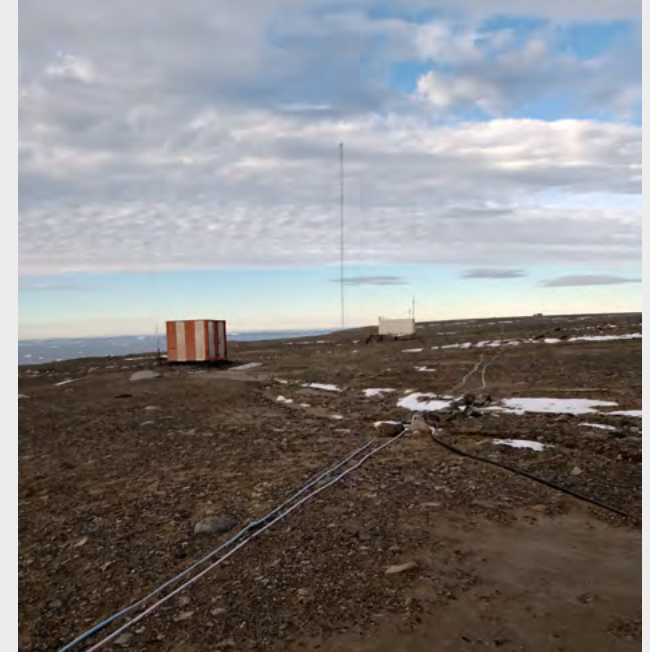
Aerosol measurements in Marambio continue with a renewed equipment

The Finnish Meteorological Institute (FMI), together with the Argentinian weather service (SMN, Servicio Meteorológico Nacional Argentina) and the Institute for Atmospheric and Earth System Research (INAR) of the University of Helsinki have since January 2013 maintained continuous atmospheric composition measurements at the Argentinian research station Marambio, located in the Antarctic Peninsula. Year-round observations are ensured by SMN's technical personnel and annual visits of the Finnish and Argentinian scientists. The measurement activities have received research funding from the Academy of Finland and The Ministry of Defense of Argentina, as well supported logistically by FINNARP and the Argentine Air Force. Long-term co-operation has led to important achievements and results have been utilized e.g., to resolve the sources and sinks of the aerosol particles in Antarctica and to understand the spatial variability of the atmospheric composition. Thorough greenhouse gas composition observations have been also used in order to improve global modelling.

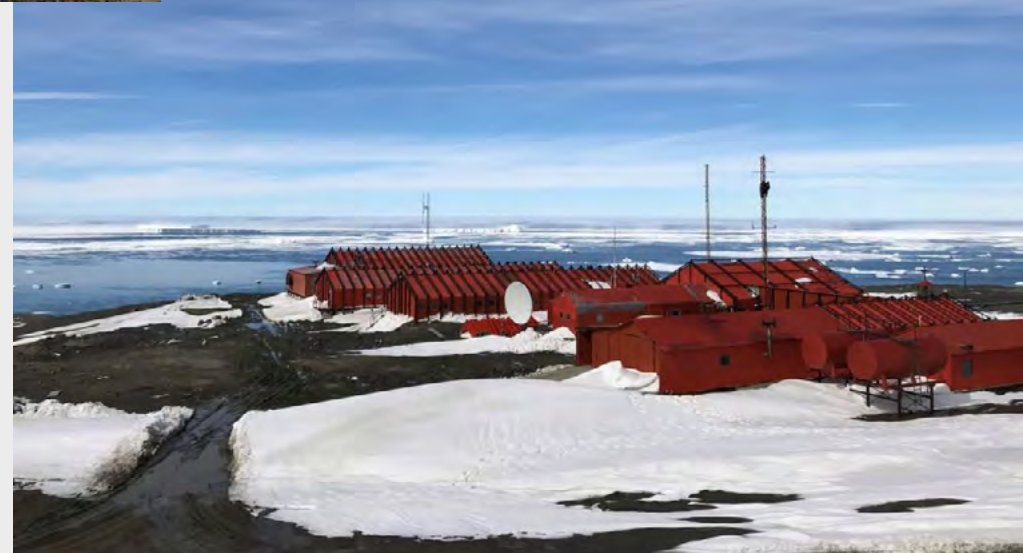
Due to the pandemic, Finnish researchers were not able to visit Marambio during the austral summer 2021–22. However, to ensure the continuity of the unique measurement series, almost 10 years old measurement equipment needed an urgent update. Thus, the expertise of Argentine partners was utilized, and new equipment was deployed with the help of local scientists and technicians. In January 2022, scientist Giselle Marincovich (SMN), visiting first time Marambio, together with station technicians Julián Dimitri (SMN) and Francisco Quarín (SMN), installed the FMI's black carbon, aerosol scattering and size distribution measuring instruments at the Marambio station. As a result, in particular, this equipment provides us the knowledge about the direct impact of aerosols on regional climate. Many thanks to our wonderful Argentinean collaborators!



Installations of aerosol measurement devices during season 2021–22 were done by Julián Dimitri, Francisco Quarín and Giselle Marincovich (SMN).
Photo: Giselle Marincovich



Weather was favorable for setting up the equipment. The location of the observation container at the summery snow-free shore of the Southern Ocean. **Photo: Giselle Marincovich**



Marambio station during austral summer months.
Photo: Eija Asmi