QUESTIONNAIRE

SCIENTIFIC ACTIVITIES

ADVANCED NOTICE FOR SCIENTIFIC ACTIVITIES IN ANTARCTICA

Finnish Antarctic Research Program / Finnish Meteorological Institute

Questionnaire

Advanced Notice for Antarctic scientific activities

In order to facilitate the advanced notification process Finnish Antarctic Research Program (FINNARP) has developed a questionnaire which is an attachment of the Initial Environmental Evaluation of the FINNARP expedition.

Completed questionnaires should be forwarded to the following address:

FINNARP/Sari Matilainen
Finnish Meteorological Institute
P.O. Box 503
00101 Helsinki

[redacted]

1 Introduction

Activities in the Antarctic shall be planned and conducted so as to have the least possible effect on the environment in Antarctica; in particular the activities should avoid leading to:

- adverse effects on air or weather patterns
- significant adverse effects on air or water quality
- significant changes in the atmospheric, terrestrial, glacial, limnetic or marine environments
- detrimental changes in the distribution, occurrence or productivity of species or populations of animals or plants
- risks to endangered or threatened species or population of such species
- risk of damage to areas of biological, scientific, historical or aesthetical importance, or of significance to the region's characteristic as a wilderness
- other significantly harmful effect on the Antarctic environment and Antarctic related ecosystems

Antarctica is designated as a natural reserve, devoted to peace and science. The fundamental framework for protection in Antarctica is the Protocol on Environmental Protection to the Antarctic Treaty. The Environmental Protocol is in Finland implemented through the Act to Protection of the Environment in Antarctica 18.10.1996/28 v. 1998.

2 General information

2.1 Project

Project title: EXQALIBR.....

Scientific area (quaternary geology, verte-brate zoology etc.): Glaciology, geophysics.....

2.2 Project leader

Name: Aku Riihelä .....

Address: Erik Palmenin aukio 1 .....

Telephone: [redacted] .....

E-mail address: [redacted].....

2.3 Time period

Time period in Antarctica: ~20.11.2026 – 3.2.2027 (estimate).....

2.4 Participants

List of participants in the project:

Name	**Address and phone (home and work)**	**Position/Task**
Aku Riihelä	**Erik Palmenin aukio 1, FI-00560 Helsinki, FINLAND. +**[redacted]	**PI, snow physics measurements**
Antero Kukko	**Vuorimiehentie 5. FI-02150 Espoo, FINLAND.** [redacted]	**Co-PI, laser scanner measurements**
Aleksi Rimali	**Tähteläntie 62, FI-99600 Sodankylä, FINLAND.** [redacted]	**Researcher, PMW drone measurements**

3 Description of the project

Ice loss at Antarctic ice margins has increased with one recent peculiar exception – the Queen Maud Land, where ice gain has been as significant as to slow the overall mass loss of the entire AIS. Exploiting Finnish Antarctic base Aboa at QML, we propose an investigation into the magnitude, causes and effects of the QML mass balance increase, combining satellite observations, atmospheric and ice sheet models, as well as high-resolution UAV laser data of western QML. The goal is to produce a well-resolved 10-year mass balance of the region (2015-2025), capable of serving as a validation for satellite altimeter observations and ice sheet models, for which we decipher the drivers behind the prominent change over the decade, and from which we can assess the implications on the Antarctic including the prediction of continuation for this exceptional mass gain trend.

We will resolve the mass balance equation by terms, applying satellite, reanalysis, in situ, and model data. For precipitation, we will use the CM SAF GIRAFE data, CloudSat/EarthCARE precipitation observations, and optical imagers to detect snowfall events from the brightening of snow surface. Ice discharge is resolved for marine-terminating outlet glaciers of QML with the flux gate method, using Sentinel-1 SAR ice velocities, altimeter elevation change and basal topography data from Antarctic RINGS. Satellite microwave and snow model data are used to resolve surface melt and meltwater percolation, evaporation and drift transport.

In situ we will gather high-resolution verification and validation data for the mass balance; UAV laser scanner will map elevation change on western QML by revisiting sites scanned 2022/23 in LAS3R. This provides verification data for laser- and radar-based altimeter records from IceSAT-2 and CryoSat-2. Novel UAV-mounted L-band radiometers will reach down into the snow and firn layers to map meltwater transport to compare with space observations from SMOS and SMAP. With Swedish iQ2300 initiative we have access to 5-20 m ice cores for reference data on firn vertical profiles. Application of data from GRACE/-FO will provide constraining estimates for total mass balance change, and we expect to array our data for validating ice sheet models e.g. RACMO2. Finally, we explore the causes of the mass increase, both in relative terms and in identifying local and teleconnection drivers (e.g. atmospheric rivers).

3.1 Field work area

List the areas where the scientific activities are done. Give name, coordinates and time period for each area.

Area	Longitude	Latitude	Time period
NM1	-73.067	-12.483	**Dec 2026 – Jan 2027**
NM2_R	-73.068	-12.771	**Dec 2026 – Jan 2027**
PL1	-73.106	-13.568	**Dec 2026 – Jan 2027**
NM3	-73.068	-12.678	**Dec 2026 – Jan 2027**
PL2	-73.141	-13.653	**Dec 2026 – Jan 2027**
PL4	-73.293	-13.703	**Dec 2026 – Jan 2027**
RA1	-72.835	-13.957	**Dec 2026 – Jan 2027**
NM1	-73.068	-12.898	**Dec 2026 – Jan 2027**
PL2	-73.137	-13.643	**Dec 2026 – Jan 2027**
AWS5	-73.105	-13.162	**Dec 2026 – Jan 2027 (recurring)**

4 Environmental impacts

4.1 General evaluation

What kind of impact on the environment is anticipated (e.g. emission to the atmosphere from generators/engines, impact on snow free areas from walking, disposal of chemicals, etc.)?

4.2 Chemicals and radioisotopes

Will the following be brought to Antarctica?

Harmful chemicals ☐ Yes X No

Radioisotopes ☐ Yes X No

If yes, specify the chemicals.

-

Will the project involve disposal of chemicals to ice, soil, water or air? If yes, specify!
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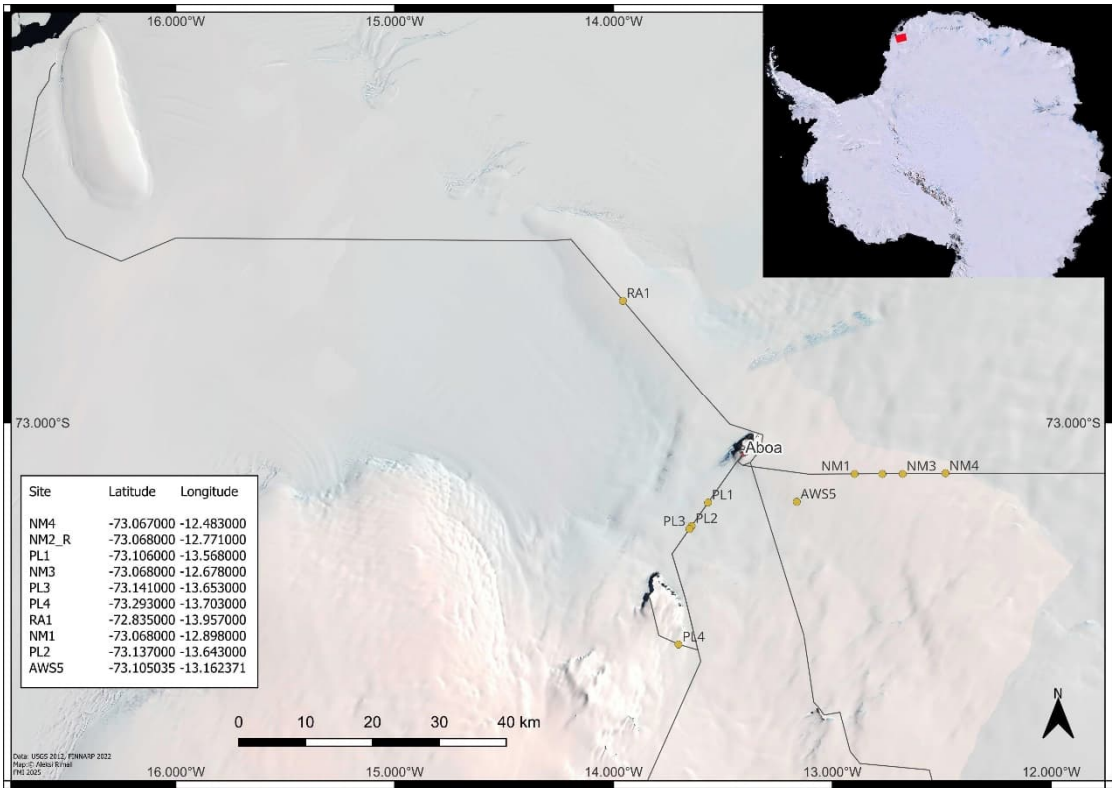
If the scientific activities are done in the station area; area between geodetic container and aerosol container, you may leave the questions in 4.3, 4.4, 4.5 ja 4.6 open.

4.3 Field work

Detailed map of planned field sites in DML during EXQALIBR campaign 2026-27 is presented below.



The field work involves snow pits and flights by two separate drones with imager, radiometer and laser scanner equipment. Over each site, the drones fly a gridded

North-South and East-West pattern covering several sq.km in area. The selection of which site to visit on which operation day shall be made on-site according to current base schedule and expected weather conditions.

The flight operations conform to the guidelines presented in “Environmental Guidelines for Operation of RPAS in Antarctica”:

- Flight altitudes for both drones shall be 100 meters or less.
- No birds or seals shall be disturbed at the sites.
- Both pilots are experienced polar drone operators, and an observer is available for all flights.
- All operations occur at daytime within VLOS. Flight paths are pre-mapped and planned. Weather conditions are assessed prior to and during each operation day.
- No operations take place over particularly sensitive environments or historic sites.
- No waste will be left at observation sites.

How many will participate in the field work?

Three persons will participate – Riihelä, Kukko, and Rimali.

Will the party establish separate field camps? If yes, indicate the expected maximum amount of days spent in one and the same field camp.

No, the party will return to Aboa station each day.

4.4 Environment

Will the project involve contact with especially sensitive environments or an environment with aesthetic values? If yes, specify!

No contact with especially sensitive environments or an environment with aesthetic values.

Will the project involve contact with animals, plants or minerals (e.g. walking on snow free areas, water sampling, catching a bird, mineral sampling)? If yes, specify!

No contact with animals, plants or minerals.

4.5 Alternatives

Are there any alternatives to planned procedures in the project, in order to avoid or minimize environmental impact? Specify with regards to geographic area, methods, time, extent and length of period.

All proposed field sites should be sampled to fulfill the scientific needs of the project.

4.6 Prevention of environmental impact

How will environmental impacts be avoided or minimized?

No waste will be left on the field sites. The only disturbance on the sites will be a small set of 1-m deep snow pits. Most of the equipment used will be electric, leaving no fuel emissions behind.

Be aware that if there have been changes to the activity, you must report it to the Finnish Antarctic Research Program.

Date_____ Signature_____