



Project acronym: ARCTIC-GBR

Project title: Ground-based Microwave Radars for Arctic Snowpack Monitoring

Project leader: Marco Pasian, University of Pavia, Italy

Discipline: Engineering & Technology: Other - Engineering & Technology

Station(s): Pallas-Sodankylä Research Station (Finland)

ARCTIC-GBR is aimed to study, develop, and test novel microwave radars applicable to the Arctic snowpack, on the grounds of the experience gained from ARCTICWAVE, funded under a previous INTERACT Transnational Access call.

Current radars for snow monitoring must be supplemented by external information to be able to deliver a correct radar profile. For example, the snowpack density must be measured using other means to calculate the speed of the radar wave into the snowpack, in such a way that the radar can return the proper distance of the ground-snow interface from the snow-air interface (i.e., the snowpack depth).

Instead, the new radar we are developing is based on a different working principle, experimentally tested on Alpine snowpacks during the last three winters, and at the Pallas-Sodankylä Research Station during the last spring. It is able to determine, simultaneously, different parameters of the snowpack, including depth, density, liquid water content (LWC), and snow water equivalent (SWE).

This information on the snowpack is particularly relevant for many Arctic snow-science applications, which will benefit from a rapid, non-destructive, and self-consistent ground-based microwave monitoring, including the validation of space-borne radars, most notably Sentinel-1. Concerning the methodology, the scientific working principle of the novel radar architecture is already consolidated, especially for dry snow. Instead, a number of technological improvements are required to increase the performance in terms of accuracy, resolution, and repeatability of the radar profile. Particular attention will be paid to the determination of the

snowpack parameters for wet snow, which is a condition scarcely addressed by all radar systems, due to the sub-optimal penetration of the radar signal into wet snowpacks, and to the comparison with satellite data, when available.

The entire experimental campaign is expected to take place again at the PALLAS-SODANKYLÄ station, Finland, which is the ideal place in terms of in-situ logistics and competences, also taking into account the need for staff able to deliver a precise validation of the radar results against the ground truth (manual analysis).