

The inner structure and thickness of ice caps on the Argentina Islands, Wilhelm Archipelago, Antarctica

Jānis Karušs (1), Kristaps Lamsters (1), Māris Krievāns (1), Anatolii Chernov (2), and Jurijs Ješkins (1)

(1) University of Latvia, geology, Riga, Latvia (janis.karuss@inbox.lv), (2) Institute of geology, Taras Shevchenko National University of Kyiv, Kyiv, Ukraine

The attention to the ice caps of the Argentine Islands was firstly drawn by the researchers from British Antarctic Survey in the 1960s noting that they are remnants of the ice shelf but no data of the structure and ice thickness were obtained. Therefore, during several Ukrainian expeditions the first measurements (radiolocation method in 1998, vertical electric-resonance sounding in 2004) of the thickness of glaciers on Galindez and Winter islands were performed (Levashov et al., 2004). After those early attempts no further studies were done. In this study the first data of the thickness, inner structure and subglacial topography of the largest ice caps on the Argentina Islands are obtained.

The ice structure and thickness measurements were done by two ground penetrating radar (GPR) systems – Zond 12-e with 75 MHz antenna and VIY3-300 with 300 MHz antenna. All measurements were recorded in crosswise profile lines with spacing of 25x25 m. The coordinates of each GPR profiles and ground control points were determined with GPS system Magellan Promark 3 allowing taking measurements and post-process results with geodetic accuracy without GSM support. To produce digital elevation models (DEM) of islands and ice caps aerial photographs were captured with drone DJI Phantom 3 Advanced. The control of drone and mission generation was done by Pix4Dcapture mobile application. Usually, flight altitude was 60-70 m with profile overlap of 85%. DEMs and orthophoto maps with the pixel size of 5 to 8 cm were created with Agisoft PhotoScan Pro software. The GPR data from Zond 12-e were processed and analysed with Prism 2.6 software and with Planner and Synchro for data from VIY3-300. Models of the ice surface and subglacial topography were created by interpolation tools in ArcMap software.

During the study, the ice caps on eight of Argentina Islands (Galindez, Winter, Skua, Corner, Uruguay, Irizar and two Barchans) were surveyed. Altogether 11035 aerial photographs were taken and more than 70 km of GPR profiles were recorded. Surveyed ice caps cover the largest parts of the islands and usually at least one side of ice cap ends as a steep ice cliff at the shore of the islands. On the largest islands several ice caps are found. The thickest ice cap is located on the Galindez Island reaching thickness of 35.5 m. The internal structure of ice caps is characterized by seasonal layering interrupted by crevasses at the ice margins. In places, more than 9 m thick layers of drift snow can be distinguished.

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References

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