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Interglacial heterogeneities in the ice caps of the Argentine islands and their dynamics during first 2 years of GPR investigations

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First information about glaciological observations in the area of the Antarctic Peninsula is dated by the beginning of the 20-th century (French Antarctic Expedition 1904-1907). In 1960-th, Thomas and Sadler (British Antarctic Survey) noted that the ice cap of Galindez Island like the other Argentine Archipelago islands is a relict of the shelf glacier, which subsequent evolution needs further studies. Therefore, during several Ukrainian short-term researches (video-impulse radiolocation method in 1998, vertical electric-resonance sounding in 2004) of island's glaciers on Galindez and Winter islands (the Argentine Archipelago) were organized. These researches reveal that monitoring of glaciers on the Argentine islands is important and should be done regularly. Furthermore, information about changes in island's glaciers movement, deformation and geometrical parameters is considered to be an indicator of worldwide climate changes.

In this paper, results of ground-penetrating radar surveying, drilling with photo-video recording and core sampling, which were done on the glaciers around the station Akademik Vernadsky since April 2017, are described. Major ice caps on the Argentine Archipelago islands (12-14 glaciers in total), ice caps on Petermann and on Eastern part of Booth islands were first time surveyed with GPR in April 2017 – March 2018. GPR monitoring of the glacier on Woozle hill (Galindez Island) has been done once per month since April 2017.

Investigations with VIY3-300 (300 MHz) GPR were started in April 2017 and still in progress, Zond 12-e (75 MHz) GPR was applied in February-March 2018 and drilling was done in March-April 2018. Results show that VIY3-300 helps to investigate glaciers' interior to the depth of 27.5 meters (Time-window 330 ns) and Zond 12-e reliable for identification of deeper ice-rock border (to 100 meters). Drilling was done to the depth of 7 meters and was used to correlate the results on radargrams with ice structure. This drilling technic provides in-situ data with good spatial resolution and helps to understand real structure of ice. Moreover, drilling approved GPR results of the depth to rock in one point of the glacier on Woozle Hill.

Results of GPR investigations show clear stratification of all surveyed glaciers, depth to the ice-rock border primarily is less than 30 meters. There are different heterogeneities in the structure of ice, which are interpreted as layering, crevasses and voids. Monitoring on Woozle Hill shows seasonal and year-to-year dynamics: some reflections become less "bright" on the radargrams and new reflections are observed in other parts. Monitoring of island ice caps help to investigate glaciers' interior structure evolution and evaluate climate changes around sensitive Western coast of Antarctica. Data from GPR will be correlated with weather conditions (temperature variations, wind speed and directions) and direct measurements of snow and ice density.

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