



Radio-echo sounding of Caucasus glaciers

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Accurate glacier volume and ice-thickness estimations are highly important for many glaciological applications. Recent glacier reduction is affecting local river discharge and contributes to the global sea level rise. However, direct measurements of ice thickness are very sparse due to its high cost and laboriousness. One of the glacierized mountain regions with a lack of direct ice-thickness measurements is Caucasus. So far data for several seismic and GPR profiles have been reported for only 3 glaciers from more than 1.7 thousands located in Caucasus.

In 2010-2012 a number of ground base and airborne radio-echo sounding surveys have been accomplished in Caucasus Mountains using 20 MHz monopulse radar VIRL-6. Special aerial version of this ground penetrating radar was designed for helicopter-borne measurements. The radar has a relatively long (10 m) receiving and transmitting antennas, which together with receiving, recording and transmitting devices can be mounted on a special girder, being suspended from a helicopter. VIRL-6 radar is light weight and can be quickly transformed into ground version. Equipment has been used on 16 glaciers including biggest glacier in Caucasus - Bezengi (36 km²) most of which have a highly crevassed surfaces and heterogeneous internal structure. Independent data were obtained also for two glaciers using ground version of the same VIRL-6 radar.

In total more than 120 km of radar profiles were obtained. Results showed good agreement between ground and aerial measurements. Ice-thickness values exceeded 420 m for some of the Central Caucasus glaciers. Successful use of VIRL-6 radar in Caucasus opens up the possibility of using such equipment on different types of glaciers in polar and mountain regions, including temperate, polythermal and surging glaciers.