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Debris cover increase as an essential factor determining evolution of the Djankuat Glacier in the Caucasus

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45-year-long direct monitoring of Djankuat Glacier mass and water balance revealed the continuous increase of its superficial debris cover. Its area was mapped 7 times since 1968 on a basis of photogrammetric surveys, showing more than three-fold increase from 0,104 to 0,344 km2, whereas its share in the entire glacier surface increased more than 4 times (from 3% to 13%); currently supraglacial moraine occupies 61% of the ablation area. Besides, 3 direct and complete areal surveys of debris thickness were carried out in 1983, 1994 and 2010. They consisted of 133-240 measurement points which were distributed either in checkmate order over uniform debris-covered parts of the snout or by transverse profiles across linear morainic ramparts. Procedure of measuring thickness with an accuracy of 1 cm was coming to till piercing down to ice surface with metallic rod or, when impossible, to manual excavations. Maximum detected point values reached 183 cm in 1983, 280 cm in 1994 and 245 cm in 2010, and average debris thickness turned out to increased more than twice during the monitoring period – 26, 39 and 54 cm, for correspondent surveys. Debris cover influence on liquid run-off was estimated by heat balance considerations, based both on records of AWSs, erected on clean and debris-covered ice surface, and on vertical temperature profiles within the lithogenic layer, demonstrating clearly the diurnal cycle attenuation with depth. Sub-debris ablation is higher than clean ice melting rate under a thin debris layer (<6-7 cm), but a thicker one reduces run-off due to its shielding effect. Zones differing by hydrological effect are depicted on glacier maps. In spite of continuous Djankuat Glacier reduction, volume of its superficial debris grew up by 141% between 1983 and 2010 - from 70,33 to 169,59 thousand m3. In case of further progressive debris expansion and thickening, this process would provoke considerable alterations in glacier relief. Prognostic glacier DEMs complied for 2 alternative options (geomorphological effect of superficial moraine disregarded or taken into account) shows that by 2025 the debris cover will reduce hypsometrical lowering rate on the snout by 45% in the latter case. This lead to the assumption about the future role of debris mantle development in Djankuat Glacier evolution: it may become comparable with that exerted by climate change.