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Simultaneous monitoring of mass balance fluctuations of and runoff from Tien Shan glaciers

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INTRODUCTION

Continuous monitoring of changes of glacier mass balance is based on an imitational model of monitoring of mass balance. The model's fundament is a supposition of the possibility of a change in correlation between annual values of mass balance, b_a, and equilibrium line altitude (ELA) (Dyurgerov, 1984, 1988).

Verification of the model for the glacierization area was realized by measurements at Tuyksu Glacier (Zailiyskiy Alatau Range). A number of multiannual measurements of changes of b_a and ELA_a was used from 1957 to 1989. 40 values of b_t and ELA_t were obtained for the summer periods of 1987 to 1989. It is established that relations of $ELA_t(b_t)$ conserve changes as the relations of $ELA_a(b_a)$. The maximum deviations were observed during the extreme positive mass balance. At all altitudes, the relationship between ELA_a and b_a, as well as ELA_t and b_t is approximated by the hypsographic curve. With the linear approximation the errors reach 70 g cm^{-2} in conditions of extreme negative mass balance.

CONCLUSIONS

Simultaneous monitoring of mass balance was undertaken for the three glaciers: Tuyuksu, Sary-Tor (in the central Tien Shan) and Glacier No.1 (in the eastern Tien Shan). During the summer period of 1989, the altitudinal gradient of mass balance db_t/dz varied on these glaciers. Tuyuksu Glacier and Glacier No. 1 showed the maximum differences between the variations of db_t/dz. Glacier No. 1 has a positive db_t/dz in the initial part of the ablation season, when b_t increases with the elevation of ELA_t. The most probable reason for the differences lies in the difference in the proportion of annual total precipitation occurring in summer. Because of different altitude gradients of db_t/dz and ELA_t/db_t, the mass balances of the three glaciers do not vary simultaneously during summer, and at the end of the year have different sign magnitudes.

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