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Permafrost distribution and active layer thickness in the Aksu catchment, Central Tian Shan (P.R. China)

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Climate change actually leads to an accelerated ablation and retreat of high mountain glaciers in most parts of the world, and to a runoff increase of the related rivers in the short to middle term. Whereas this is a well-known fact, the additional runoff supplied by slowly melting ground-ice and perennial snow fields is almost unknown. However, this periglacial contribution is significant in extremely arid mountain areas as e.g. the Central Tian Shan. Here, the rivers form the vital source for the development of the Taklamakan basin, rich in natural resources, and strongly suffering from water shortage. Main scientific tasks in our subproject hence include an improvement of knowledge on permafrost distribution and active layer thickness, and their role for water discharge in the Aksu catchment.
A dense network of 46 high resolution thermistor strings and mini data loggers were installed in the Gukur catchment (130 km^2), a tributary of the Aksu river. Hourly temperatures are recorded at the ground surface and at various depths of up to 150 cm. First results indicate that the depth of the active layer and the propagation of the diurnal temperature signal depend - besides altitude, slope and aspect - largely on snow thickness/-distribution and substratum. The detailed identification of parameters determining the active layer thickness and thaw dynamics is fundamental for the large scale modelling of the state of the permafrost in the Central Tian Shan.

The field studies will contribute to a better understanding of the thermal effects of substantial debris cover of subsurface ice-rich material or ground-ice, and of the temperature regime of rock glaciers and ice-cored moraines. These features store large amounts of ice in a permafrost environment over long time periods. In addition to the generally ice-rich top of the permafrost in the fine grained silty sediments in valleys and lee positions, they might have considerable influence on the amount and annual distribution of water discharge in the Aksu catchment under climate change conditions.

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