Research Of Fluctuation Of Glacier Kashkatash

Bushueva I.S., Solomina O.N.
Institute of geography Russian Academy of Sciences, Moscow, Russia

SECTION: ENVIRONMENTAL/ECOLOGICAL AND URBAN/REGIONAL MODELLING

Introduction. Global Changes have a great influence on our life, and glaciers as one of the best indicator of climate changes should be well estimated. Understanding of fluctuations of glaciers in past can help us to make prognosis for the future. Like most mountain glaciers those in the Caucasus are currently retreating, and this process is rather poorly documented in this area. We focused our study on a typical valley glacier Kashkatash, located in the Elbrus Area.

Methodology. The process of creation of our reconstruction can be separated in two steps according to the methods of research. The first step includes analysis of glacier spread from the end of XIX century to nowadays. We used cartographic materials, repeated photographs and historical data. We have satellite images (Corona of 1971, ASTER of 2005, EROS+ASTER of 2006), aerial photographs of 1957, 1965 and 1987, map of 1890 (scale 1:100 000), topographic map of scale 1:25 000 created in 1957, oblique photographs from 1911 till 2009 and different plans. The remote sensing images did not require any processing. The aerial photographs were not georectified and orthorectified. To delete distortions, firstly, we digitized the contours from the topographic map to create digital elevation model. Then we get the coordinates for characteristic points of relief from satellite images (approximately 25 for glacier forefield), and using DEM the aerial photographs were corrected. We have an oblique photograph, made by H. Burmeister (1913) in 1911, and during the field work in 2009 we visited the same point, from which the photograph was made, to repeat the photograph. Overlapping and comparison of these photos allow of indicating of changes occurred in last 100 years. Other old photographs (1927, 1932, 1939, 1949, 1983) we used as additional information. Kashkatash was visited several times during XX century, and some explorers drew plans and made descriptions of glacier. None of these plans has scale and coordinate grid, so if it was possible we georectified them using characteristic points and lines of relief.

Having prepared the data, we digitized the borders of the glacier tongue for different years and made some calculations, such as changes of the glacier length, changes of the altitude of the glacier tongue, velocities of fluctuations.

On the second step we used proxy data to make the reconstruction older then the end of XIX century. During the field work in 2008 and 2009, we collected approximately 100 samples of pine (cores and disks) and measured lichens on approximately 50 surfaces and moraines. We get the coordinates for samples using GPS-receivers. The capacity of GPS is 15 meters, but in mountain conditions it sometimes does not work well. Therefore some of the samples cannot be considered because of big errors in their coordinates.

Results. We created the reconstruction of Kashkatash glacier for 20 years from XVII century to nowadays. The distinctive characteristic of this reconstruction is that all positions of glacier have spatial fixation. It gives the possibility to use it for modeling and makes forecasts.

Conclusions. The analysis shows that since XVII century the glacier has the periods of retreat and the periods of advances as well (the last advance was in 1980s), but now the rate of glacier retreat increased. The next investigations in this discipline are necessary to identify reasons of glaciers' fluctuation. The increased rate of glacier retreat and plant colonization of the forefields agrees well with the global warming trends in the second half of 20th century.