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Re-establishing seasonal mass balance observation at Abramov Glacier, Kyrgyzstan, from 1968 – 2012

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The Abramov Glacier, located in the Pamir Alay in Kyrgyzstan, was subject to intense studies in the frame of various scientific programs under the former USSR. With the breakdown of the Soviet Union, the monitoring was abruptly abandoned in the late nineties. Well documented and continuous seasonal mass balance observations are available for 1968-1994. However, some inconsistencies between different publications lead to in-homogeneous data sets. Recently, the project CATCOS (Capacity Building and Twinning for Climate Observing Systems) was launched, aiming among other goals to re-establish mass balance observation on selected glaciers in Kyrgyzstan. At Abramov Glacier, a new stake network, an automatic weather station (AWS) and two automatic terrestrial cameras with instantaneous data transfer over satellite were installed in 2011. Measurements were repeated and intensified in 2012 and will be subject of a third field campaign in summer 2013.

A complete re-analysis of the long-term mass balance series from 1968 to 1994 delivers corrected mass balance data for Abramov Glacier. To homogenize in-situ mass balance records, a spatially distributed mass balance model driven with local daily temperature and precipitation data was calibrated to each seasonal mass balance survey. The model resolves seasonal mass-balance measurements to a daily timescale and performs spatial inter- and extrapolation of data points based on a consistent algorithm, taking into account the principal factors of mass balance distribution. Summarizing the annually optimized parameters over the entire study period provides a robust model parameter set for years with less extensive direct measurements.

From 1994 to 2011, neither direct point measurements nor meteorological data are available. In order to run the calibrated model developed for the 1960's to 90's, climate input variables were taken from bias corrected Re-analysis data (NCEP/NCAR and JRA). Evaluation of the model results was achieved through observations of snow-lines on Landsat images throughout each mass balance year.

Automatic cameras, installed in August 2011 took repeated oblique photographs of the glacier on a daily basis. Snow-line evolution was analysed on the orthorectified and georeferenced images and complementary on Landsat imagery. Meteorological variables collected in 2012 from the newly installed AWS were used to run the calibrated mass balance model for the hydrological year 2011/2012. All available mass balance point measurements were used for optimization. Evaluation against snow-line observations on terrestrial photographs and satellite images are promising.