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Snow cover monitoring in the Kyrgyz Republic through MODIS time series (2000-2010)

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The Kyrgyz Republic is located at the convergence of two mountain systems (Tien Shan and Pamirs) in Central Asia. The region is of great interest all of Central Asia because of its consequent capital in water resources. Theses resources are of importance for electricity production ($\sim$15 TWH/year) and irrigation of agricultural land. Over 50% of the 52 km3 of Kyrgyz runoff water irrigates the Syr Darya River which flows over 2200 km from the confluence of Naryn and Kara Darya rivers to the Aral Sea. Around 40% of the Kyrgyz territory lies above 3000m; part of the water resource is cumulated as snow during large periods of the year. Snow cover is thus an important part of the Kyrgyz hydrological cycle. In this already water-stressed region, both climate change and irrigation expansion could trigger a greater scarcity of the resource in the future. One of the major impact could be a modification of the melting season period and the snow melt behavior. The use of passive optical remote sensing data could provide helpful complementary information for hydrological modeling of these effects, but currently, very few scientific publications concerning the Syr Darya headwaters in Kyrgyztan exist.

Integrated in the EU-FP7 ACQWA Project (www.acqwa.ch), this study proposes 11 years of snow cover analysis using MODIS snow cover product data. The following parameters are retrieved from MODIS data: Snow Cover Area (SCA), Snow Fraction (FRA), snow cover duration and depletion maps. A Digital Elevation Model (DEM) from the NASA-SRTM database is used to better understand the topographic influence on snow melt behavior and a Land Use database (GlobCover 2009) for the environmental context of snow cover evolution.

A statistical analysis of snow cover dynamics is performed on a 2000-2010 8-days temporal resolution dataset. Yearly mean snow cover is 40 $\pm$ 5 % and melting runs with 5%.8j-1 average velocity. We observe a greater variation of the inter-annual snow cover extent in winter (January to March), due to changing surface heat fluxes, as in the year 2007. This context can be related to the actual temperature and precipitation deviation versus 1960-1990 reference. From the snow melting maps, we observe that the snow repartition follows largely the topography as elevated regions of Kyrgyztan are covered with snow throughout the year whereas below 3000 meters most of the snow melts between March and April.