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Isotopic and hydrochemical characterisation of a (semi)-arid catchment in the Tajik Pamirs

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In the (semi)-arid Central Asian mountains large rivers such as the Panj and Amu-Darya, whose water is excessively exploited for irrigation purposes, are mainly fed from snow- and glacial melt occurring in the Pamir and Tien Shan mountains (elevations over 5000 m). The Pamir mountains receive their precipitation as snow in winter and spring due to westerly winds originating in the Atlantic.

To understand the current and future key hydrological processes in an exemplary drainage system in the Tajik Pamir we use a combination of isotope-hydrological and hydrochemical methods, remote sensing techniques and enhanced hydrological simulation models.

Investigations focus on the Gunt catchment (ca. 14,000 km^2) in the (semi)-arid Tajik Pamir, which is representative for the entire region. Almost in the middle of the catchment the Gunt river crosses a naturally dammed reservoir, lake Yashikul with an extend of ca. 20 km.

As a first step towards estimation of the origin, interaction and dynamics of stream and subsurface water components, samples for hydrochemical and isotopical analyses are and will be taken monthly from river water and groundwater. Groundwater recharge and discharge, streamflow components as well as water residence times will be characterised and quantified by hydrochemical information (e.g. anions and cations) and stable and radioactive environmental isotopes (e.g. ^{2}H, ^{3}H, ^{18}O).

In several field campaigns beginning in August 2011 we sampled both water of the stream, of selected tributaries and groundwater. Among others the stable water isotopes ($\delta^{2}H$ and $\delta^{18}O$) of the samples were analysed. Though results of the first Tritium screening of selected sampling points show almost no distinctive features, stable isotopes highlight variations between the different end members.

The isotopic data show that with an increasing flow length the Gunt water is enriched by heavier stable water isotopes. One reason might be an altitude effect - from the sources to the mouth it is an altitude range of about 4500 m.

In comparison of the stream water, the tributaries and the groundwater there are significant differences between these runoff components in their isotopical (^{2}H and ^{18}O) signature. The data show that the isotopic composition of the Gunt below the lake reservoir must be a result of a mixture of lake water and water from the following tributaries. The different tributaries itself show an isotopic signal which leads to a possible distinction between northern and southern tributaries.

Therefore the stable-isotopes data could be used to give an information about the altitude of the different subbasins and their exposition to the westerlies.

The mineralization of the Gunt is higher than the concentrations of anions and cations in the tributaries. This leads to the next notice, that the stream water, which is primarly marked by the water of the lake Yashikul, is, with an increasing flow length, thinned out by the tributaries' water.

By using the hydrochemical data it should be possible to quantify the inflow contributions of the different runoff components.