# Meteorological triggers of debris flows on the north slopes of the Kyrgyz range, Tien Shan

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We assess how temperature anomalies and precipitation are linked with debris flow events on the north slopes of Kyrgyz range, Tien Shan, Kyrgyzstan. This is an area of frequent and deadly debris flows affecting populated areas. Our database of rain-induced debris flows and glacial lake outburst floods was compiled from local historical sources covering the period 1954-2017 (117 events). The climate database consist of three datasets of temperature data and six datasets of precipitation data over the region. Preference has been given to Berkeley's daily homogenized temperature data (BEST), and GPCC and GHCN-D (pre-1950s) precipitation data. We analysed data for the debris flow-active period each year (May 1 – August 10) and used the linear regression model and Akaike Information Criterion (AIC) to establish links between debris-flow events and meteorological anomalies. We selected the following covariates: the sum of precipitation on the day of the event (P1), and for 3, 5, 7, 14, 21 and 28 days before (P28); and the sum of the temperature anomalies for the same time periods (T1-T28). We carried out all assessments in R for two groups: 22 valleys with rain-induced debris flows, and 6 valleys where at least one glacier lake outburst flood has been registered. Despite the low AIC for the parameter T1 separately, in conjunction with P1, its significance is greatly increased. This also applies to all other parameters of temperature anomalies - their importance is not high, but grows adding precipitation. Outburst-induced debris flows are significantly affected by temperature anomalies. Despite this, the parameter P1 still remains decisive. The number of the temperature parameters in the 100 best outburst debris flow models is 219 versus 159 in the models of rain debris flows. The number of precipitation parameters in the top 100 models of outburst debris flows is 240 against 343 in models of rain debris flows. Our results have been represented numerically and in a map titled "Relationship between debris flow activity and meteorological parameters on the northern slope of Kyrgyz range". The work is now underway to define threshold values of meteorological parameters for the region, which can trigger significant debris flows. The difficulty is in the shortage of meteorological stations situated near debris flow origination sites in high mountains.