Geophysical Research Abstracts, Vol. 8, 05084, 2006
SRef-ID: 1607-7962/gra/EGU06-A-05084
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Asynchronities of monthly runoff and precipitation extremes in the Transylvanian Basin of the Carpathians

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Monthly river runoff data are analysed at different sub-catchments in the Transylvanian Basin of the Carpathians. Spatial and temporal variability, as a source of hydrological risk are first quantified for the 19 gauging stations. Special attention is paid to the low-flow extremes, but the opposing extremities are also elaborated. Similar analyses are demonstrated for 9 precipitation stations of the region. The absolute minima of runoff exhibit fairly different time variation than the negative extremes of monthly precipitation: Frequency of the absolute minima of runoff exhibits decadal-scale variations, whereas precipitation minima show high frequency with cycles of 2-5 years.

Temporal variability of decadal time-scales are statistically related to the hemispherical warming trend (0.26 K / decade) observed in the 1974-1998 period. Method of instrumental variables is used to estimate linear regression coefficients between regional rainfall and hemispherical mean temperature for this period. The sequence of consecutive years is defined for instrumental variable, that fulfil the main criterion i.e. the non-zero correlation to the independent variable. Regression analysis is also performed for the parallel 9 precipitation stations for independent validation, and for the monthly absolute extremes of the 25 years. Results of the basic 25 years period are validated by the next five years, as independent samples, both for the runoff and precipitation series.

Trends of the runoff are mainly decreasing parallel to the global warming-up tendency of the investigated 25 years. For 0.5 K hemispherical warming, the local order of runoff changes spreads from several percents to tens of percents. The largest area-mean decrease of runoff is analysed for the July-August period with average decrease of 75 %.