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Statistical Analysis of Streamflow Trends in Slovenia

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According to climate change, trends of river discharges were analyzed showing the hydrological change and future projections of hydrological behaviour in Slovenia. In last years droughts and floods are becoming more and more frequent. In the statistical analysis of streamflow trends of Slovenian rivers, available data on the low, mean and high discharges were examined using mean daily discharges and the Hydrospect software, which was developed under the auspices of WMO for detecting changes in hydrological data (Kundzewicz and Robson, 2000). The Mann-Kendall test was applied for the estimation of trends in the river flow index series.

Trend analysis requires long records of observation to distinguish climate change-induced trends from climate variability. The problems of missing values, seasonal and other short-term fluctuations or anthropogenic impacts and lack of homogeneity of data due to the changes in instruments and observation techniques are frequently present in existing hydrological data sets. Therefore the analysis was carried out for 77 water gauging stations representatively distributed across Slovenia with sufficiently long and reliable continuous data sets. The average length of the data sets from the selected water gauging stations is about 50 years. Different indices were used to assess the temporal variation of discharges: annual mean daily discharge, annual maximum daily discharge, two magnitude and frequency series by peak-over-threshold (POT) approach (POT1 and POT3), and two low flow indices describing the different duration of low flows (7 and 30 days). The clustering method was used to classify the results of trends into groups.

The assumption of a general decrease of water quantities in Slovenian rivers was confirmed. The annual mean daily discharges of the analyzed water gauging stations show a significant negative trend for the majority of the stations. Similar results with lower statistical significance show annual minimum 7-day and 30-day mean discharge. For the flood indices, there are generally slightly more stations showing a significant negative trend than a significant positive trend. Significant negative trends were seen for gauging stations with predominantly high-mountain and karstic catchment areas.

Reference: Kundzewicz, Z.W. and Robson, A. (2000). Detecting trend and other changes in hydrological data. WMO Report WMO/TD-No. 1013. Geneva.