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Identification of Temporal Trends of Extreme Discharge in Arctic Region

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Examination of streamflow regime and variation in the major northern river basins is critical to better understand and quantify the atmosphere-land-ocean interactions in the Arctic and consequent global impacts. Arctic hydrologic systems exhibit evident temporal variability due to changes in large scale atmospheric circulation. The long term monthly and annual records of discharge of Lena River were analyzed in this study to examine the hydrologic regime and recent changes in arctic region. About ten stations were analyzed based on the continuous data for the record length of 46 to 73 years and drainage area 23,900-696,000 km2 for different stations and a common duration of 1954-1999. For identification of temporal trends, different tests were applied such as Mann–Kendall (MK), Spearman rank correlation (SRC), Sen's robust slope estimator (SSE), and least squares linear regression (LSLR) slope-based test. At 5% significance level, Ljung-Box (Q) test for autocorrelation showed insignificant desired results for 7 out of 10 stations. Using LSLR, 8 stations were found with upward (positive) trend and 2 with downward (negative) for mean annual discharge during the study period. Similarly, for mean monthly discharge, 7 stations gave an upward trend. Amga station showed a maximum variation with an upward mean annual and downward mean monthly trend. Maximum discharge was found to vary during the months of Mar-Nov (Apr-Nov for 2 stations) with peaks in June except for Buyaga and Amga stations where it is in May. It also showed that an early snow melt and late freezing to contribute for more discharge indicates the effects of global warming. Winter's method and LSLR performed better to forecast Lena River discharge using bias, MAD, MSE, and MAPE as performance indices.