

Impact of hydro-climatic variation variability on river flow dynamics in the Oued Lahdar (Upper Inaouene watershed): Approach using statistical trend analysis

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Abstract

The increasing global climate variability poses a strong threat to water security, both groundwater and surface water, particularly in countries with arid or semi-arid climates. This challenge is attributed to long-term changes in weather patterns and temperature, and it is exacerbated by intensive human activities and the rise in greenhouse gas. In light of this alarming global climatic challenge, the African continent emerges as the most vulnerable and susceptible region. In Morocco, where water resources are stressed due to the severity of climate change and the long dry season, which extends up to 6 months a year, river water inflows are experiencing a dramatic decrease.

This work aims to analyze the long-term changes in hydro-climatic variables (precipitation/rainfall, flow/discharge, temperature) over the period extending from 1970 to 2020 by employing a statistical approach, specifically the Mann-Kendall test and Sen's slope estimator, to detect significant trends.

The results revealed a statistically significant decreasing trend at the Taineste station. This negative trend was confirmed by the Kendall's tau coefficient, indicating a very weak negative rank correlation. Furthermore, Sen's Slope showed a negative value, reflecting the average annual rate of decrease. This confirms that the observed trend is genuine and not attributable to random chance. Moreover, human activities, particularly intensive irrigation, contribute to the intensification of this decrease.

Furthermore, the results confirm the sensitivity of the basin (or watershed) to climatic changes. We conclude that understanding this hydro-climatic variability is essential for developing adaptive water management strategies to protect local water resources from future extreme climatic fluctuations.

Keywords: Hydro-climatic, Mann-Kendall test, Climate variability, Water resources, Lahdar watershed