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Assessment of water quality variation in Amite River watershed under changing climate and land use

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Abstract Water quality in the Amite River watershed in southeastern Louisiana, USA, has experienced significant spatial and temporal variations over the past decades due to the impacts of land-use change and climate change. To identify water quality variation trends in the watershed under the combined effects of land-use and climate change, a temporal trend analysis and a spatial variation analysis were conducted using a statistical approach and long-term time series data for land use, flow, and water quality parameters including water temperature, dissolved oxygen (DO), total suspended solids (TSS) and total organic carbon (TOC). To understand spatial variation in water quality, the data were split into upstream (Darlington) and downstream (Port Vincent) sets. To understand temporal variation in water quality, the data were split into two groups corresponding to the means of the two periods 1975–1990 and 1990–2005. Results of the statistical analysis show that the global warming has led to an increasing trend in water temperature and a decreasing trend in instream DO, especially in summer months. The mean DO concentration at Darlington dropped from 8.35 mg/L before 1990 to 5.90 mg/L after 1990 due to climate change. The DO concentration at Port Vincent further dropped from 6.76 mg/L before 1990 to 5.75 mg/L after 1990 due to combined effects of land-use and climate change. The DO variation follows a normal distribution. The TSS concentrations were higher at downstream sites in general due to urban development, but no significant temporal variation trend was observed. The TOC concentrations increased over the past decades. Land cover and land-use change also produced a significant increase in TOC concentrations from upstream to downstream sites. The resuts demonstrate that land-use and climate change may adversely affect water quality and the impact of land use and climate change should be taken into account in Total Maximum Daily Load development and water resources management.
Key words watershed; water quality variation; land use; climate change; Amite River, USA