Assessing River Water Quality Models: Processes, Tools, and the Philippine Applications

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Abstract

Rapid urbanization, industrial expansion, and agricultural intensification in the Philippines have led to the degradation of river systems, thereby making traditional sampling insufficient for accurately assessing pollutant dynamics. As a result, water quality models have become indispensable predictive instruments. This research evaluates the primary processes that influence pollutant fate and transport within rivers, specifically hydrodynamics, reactivity, and water column-bed exchange. To evaluate six commonly used models: SWAT, HEC-RAS, WASP, WEAP, MIKE 11, and QUAL2Kw. The findings demonstrate that SWAT effectively simulates watershed-scale hydrology and pollutant transport, whereas WEAP integrates water quality considerations with demand-driven pollutant loads. HEC-RAS provides a robust hydrodynamic foundation for transport simulations. QUAL2Kw demonstrates efficacy in instream applications characterized by steady-state conditions. However, WASP and MIKE 11 are better suited for modeling intricate, dynamic systems that involve sediment interactions. Given the licensing restrictions inherent in MIKE 11, WASP presents a more readily available and flexible option. Examination of applications within the Philippines reveals ongoing difficulties stemming from data limitations and fragmented monitoring datasets. To mitigate these constraints, this research identifies pertinent institutional data sources and proxy datasets to facilitate the implementation of the model. Thus, this assessment provides a pragmatic foundation for selecting suitable models for the pollutants modelling.

Keywords: Water quality modeling; pollutant dynamics; hydrodynamics; reactivity; water column-bed exchange