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CLIMATE CHANGE IMPACT ON HYDROLOGICAL, SEDIMENT, AND NUTRIENT IN LANGAT RIVER BASIN: AN ASSESSMENT USING INTEGRATED MODEL

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ABSTRACT

Climate change, food security, water scarcity and environmental sustainability have all become major global challenges. In modelling the climate change impact, a growing issue on the lack of data management; cannot be solved simply by modelling simulation with missing data. There is an urgent need for innovation, for a better understanding of the current and future water resources, sediment and nutrient load in the river for water resources sustainability. Thus, the adoption of a strategic approach is necessary to planning and simulating the impact of climate change on hydrology, and its component for the respective authority can carry out its function and roles. This research aims are to study the infilling missing data techniques that are fast and reliable, and to speed up the weather data processing generation and impact of climatology on hydrology and its component that influence the development, planning, and management of successful semi-distributed climate assessment modelling in Selangor. The research suggested that artificial neural network (ANN) using a Lavenberg-Marquardt algorithm can successfully regenerate stream flow and sediment missing data for better accuracy of model. The results of the study also suggested that an automatic weather generator can simplify the preparation of weather data from six months to one month. A new automated weather generator input model for rainfall-runoff simulation (SWAT model) has been successfully developed to close the gap by integrating NCO, netCDF, Grads and CDO in a MATLAB environment. Regional daily weather variables were generated with XLs2Ncascii model that preserved the spatial and temporal dependencies and adequately reproduced statistics of the historic weather variables in the upper part of Langat River Basin. Nevertheless, the calibrated model provided an adequate measure of the effectiveness of Xls2Ncascii model coupling the weather generator with the watershed model and demonstrated a framework for streamflow, sediment and nutrient forecasting. The efficiency of the integration between Xls2Ncascii, ANN model output and SWAT model has proven to be improving in comparison using the SWAT model alone. R^2 of 0.8 and NSE 0.75 thus prove that model integration is a great tool for prediction. The climate impact assessment shows that a non-consistent increase and decrease on streamflow with -100% to +250% impacts, sediment yield -100% to +2000% impact and nutrient analysis resulted in -100 to +800% impacts on climate change depending on climate change scenario, models and timespans. The findings of this study could contribute to the improvement of water management in Selangor to reduce the negative impact of climate change.

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INTRODUCTION

1.1   Introduction

The behaviour of sediment towards nutrient must be well understood since this kind of relationship may transfer the environmental problem from upstream to the downstream part of the river. During the storm event, nutrient that exist in the soil carrying as sediment flow into the river due to surface runoff. The contribution of the catchment area in nutrient is quite significant; sediment plays a significant role in nutrient transport in a river (Meyer, 1979, Jarvie *et al*., 2005, Mcdowell., 2003 and Gall *et al*., 2015). At present, one of the ways to study and research the sediment and nutrient is by generating the budget map. Wilkinson *et al*., (2013) concluded that spatial and numerical models map the sediment and nutrient sources as well as the patterns of deposition within the catchment. A model approach will be used in this study to assess the effect of the climate change on simulated transportation pattern of hydrological, sediment and nutrient in the Upper part of Langat River Basin (UPLRB).

Environmental Management and Climate Change Division of Ministry of Natural Resources and Environment (NRE), Malaysia (2012) define climate change as any change in climate over time due to natural causes or human activity. Intergovernmental Panel on Climate Change (IPCC, 2013) defines climate change as a general change in the condition from the climate that may be identified by a statistical test. One of the parameters for assessing climate change is changes in temperature. The rising temperature has brought changes in climate all over the world including Malaysia. More and more flash flood occurrence is reported everywhere. The rise in temperature has resulted in sea level rise. The rise will affect low-lying areas and island, erode shorelines, harm assets/property and destroy ecosystems such as mangroves and wetlands that shield the coasts against storms (McIvor *et al*., 2012). The assessments on climate change are based nowadays on the results of mathematical models. Over the past 40 years, numerical models are useful research tools in environmental studies (Inkala *et al*., 1997).