

論文 / 著書情報  
Article / Book Information

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Title(English)	ANALYSIS OF STREAM TEMPERATURE AND HEAT TRANSPORT IN THE TAMA RIVER UNDER STRONG ANTHROPOGENIC INFLUENCES
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Type(English)	Summary

(博士課程)  
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## 論文要旨

THESIS SUMMARY

専攻 : Department of	環境理工学創造	専攻	申請学位 (専攻分野) : Academic Degree Requested	博士 Doctor of	( 工学 )
学生氏名 : Student's Name	Xin Zhuohang		指導教員 (主) : Academic Advisor(main)	木内 豪	
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要旨 (英文 800 語程度)

Thesis Summary (approx.800 English Words )

Water temperature is a key determinant in stream ecology, and changes in temperature can significantly alter fish distribution, growth, mortality, production, and community dynamics. It is therefore important to have a better understanding of the thermal regime of rivers for effective river management and biological protection.

This work studied the Tama River system, which is located in the east of Japan and has been a major river system running through the central Tokyo Metropolitan area. There are two major features of this river. First, the middle and downstream reach runs through highly urbanized areas which suffered from strong anthropogenic impacts. Second, the alluvial sediment has resulted in considerable surface-ground water interaction.

We integrated data analysis, field measurement and modeling approach, and had a goal to provide insights of how human activities alter the stream temperature and heat budget of an urban river. Specifically, the aims of this study were: (1) to reveal the long-term and longitudinal temperature changes in the main stream of the Tama River; (2) to identify the major factors that influenced these past changes by water and heat budgets method; (3) to develop a physical model for predicting water temperature and the corresponding heat fluxes and to apply this model to the mainstream of the Tama River, and (4) to quantify the impacts of each energy component and further provide scientific basis for ecological conservation.

In chapter 2, both long-term (1990 to 2013) and longitudinal (more than 50 km) changes in stream temperature were detected. To clarify the major influencing factors of these past trends, the stream flow rate changes, the temperature and volume of wastewater effluents as well as the relationships between air and stream temperature were investigated. In addition, water and heat budget analyses were carried out to clarify the relative impacts from each heat component considering different hydrological conditions and levels of human impacts. Results indicated that the largest contributions to water and heat gains were attributable to wastewater effluents, while other factors such as groundwater recharge and water withdrawal were found to behave as energy sinks, especially in summer.

In chapter 3, to predict the water temperature and quantify the underlying physical processes, a 1-D deterministic model for river flow and heat transport in the main stream was developed. The model takes all necessary processes that significant in temperature modeling into account, including heat exchanges at the air-water and streambed-water interfaces and advective heat through tributary inflows and wastewater discharge. This model was calibrated using hydrological, meteorological and stream temperature data collected during the intensive periods in summer and winter seasons. Sensitivity analysis was conducted to understand how the simulation results would behave in response to variation of input data and parameters.

In chapter 4, this model was applied and verified by data obtained during a 2-year course field measurement. Results indicated a satisfactory agreement between the observed and simulated stream temperatures. Further, the model was used to simulate the changes in stream temperature that resulted from changes in controllable factors. The specific factors assessed in this study were wastewater discharges and surface-groundwater interactions. Results showed that the existence of wastewater contributed to suppress the stream warming in summer seasons; whereas in other colder seasons, it greatly enhanced the stream temperature at the downstream sites. Regardless of seasons, the interactions between surface and groundwater were found to behave as major energy sinks.

Finally, the findings of this study on stream temperature variability and changes in response to natural and anthropogenic factors can provide biological implications towards better river management and ecological protection.

備考 : 論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。

Note : Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1copy of 800 Words (English).