Escherichia coli Transport Simulation in the Tonle Sap Great Lake Using a Two-Dimensional Hydraulic Model Accelerated by GPGPU

A. Kuwagaki[1*], T. Nakamura[2], H. Fujii[3], S. Ly[4], S. Lun[5], S. Heng[6], S. Siev[7], Y. Fujihara[8], K. Hoshikawa[9], C. Peng[10], Y. Tanji[11], K. Miyanaga[12], T. Watanabe[13] and C. Yoshimura[14]

[1,2,7] Department of Transdisciplinary Science and Engineering, Tokyo Tech, Japan.
[3,13] Department of Food, Life and Environmental Sciences, Yamagata University, Japan.
[4,5,6] Faculty of Hydrology and Water Resources Engineering, Institute of Technology of Cambodia, Cambodia.
[8] Department of Environmental Science, Ishikawa Prefectural University, Japan.
[9] Department of Environmental and Civil Engineering, Toyama Prefectural University, Japan.
[10] Faculty of Chemical and Food Engineering, Institute of Technology of Cambodia, Cambodia.
[10,11,12] School of Life Science and Technology, Tokyo Tech, Japan.
[14]Department of Civil and Environmental Engineering, Tokyo Tech, Japan.
**Corresponding author : kuwagaki.a.aa@m.titech.ac.jp*

ABSTRACT

More than one million people live at the floodplain of Tonle Sap Lake which forms several tens floating villages. Although pathogens excreted from the households can contaminate the lake water, recent researches tell that about a half of people have drunk the lake water and about 30 per cent of the water has not been treated. In this work, to get the basic information on the temporal and spatial distribution of pathogen in the lake, transport of *Escherichia coli* (*E. coli*) over a whole area of the lake was simulated. We applied a two-dimensional hydraulic model, which solves the depth-averaged equations in accelerating the calculation speed by a GPGPU technique. After we confirmed the reliability of the model by comparing the simulated results with the observational hydraulic data, we conduct the simulation of *E. coli* transport for a whole area of the lake. Unfortunately, there is no data and information to estimate the amount of *E. coli* excreted from the households. Therefore, in this work, we assumed that the eleven major tributaries continuously excreted *E. coli* with a uniform concentration of 10^7 CFU/100ml, that coincides with a typical concentration of *E. coli* in sewage. Under the assumption, although we could not do the quantitative evaluation of *E. coli* transport, the simulation enables us to get valuable information about the extent and speed of *E. coli* spreading due to the water currents. The simulation result shows that 1) *E. coli* can be transported to a location several tens of kilometres away from the river mouth of each tributary before *E. coli* exhausts its life-span, and 2) the area of high concentration can be expanded drastically by wind-driven circular currents in the lake.

Keywords: *Escherichia coli, Tonle Sap Lake, 2D Numerical Transport Simulation.*

ESTABLISHMENT OF ENVIRONMENTAL CONSERVATION PLATFORM OF TONLE SAP LAKE (SATREPS PROJECT)

THE 4TH INTERNATIONAL SYMPOSIUM ON CONSERVATION AND MANAGEMENT OF TROPICAL LAKES

Sokha Hotel

Date: 16-19 September 2019

PROCEEDINGS

SUPPORED BY: Japan International Cooperation Agency & Japan Science and Technology Agency (JST)