應用三維模式探討淡水流量對於大腸桿菌水舌擴散之影響

Investigation of the Fecal Coliform Plume Induced by River Discharge Using a Three-dimensional Model

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摘　要

大腸桿菌是一種經常被使用於判斷水體是否受到污染的指標之一，可以透過降雨逕流、畜牧污水及人類生活污水排入至河川，將對生活於沿岸的居民造成健康危害，水中生物亦會因大腸桿菌而增加死亡的風險。淡水河是台灣北部重要感潮河川，隨著居住人口增加與工商業迅速發展，淡水河的水質污染程度日趨嚴重。由於河口區域為淡水與海水之交界，水理特性與水質特性均會受到淡水流量及潮汐作用的相互影響。本研究為瞭解淡水流量對於淡水河口與其近海之大腸桿菌水舌擴散影響，故使用三維水理-大腸桿菌模式(SCHISM-FC)建置淡水河口與其近海之數值模式，模式網格是採用非結構性數值網格以擬合河川與海岸複雜的地形，並使用 2019 年之實測數據進行模式校驗證，以確保 SCHISM-FC 模式之準確性，結果顯示 SCHISM-FC 模式能正確地模擬淡水河口與其近海的水理機制及大腸桿菌的傳輸與分布，最後再應用已驗證後的 SCHISM-FC 模式探討淡水流量對於大腸桿菌水舌擴散之影響，可以做為淡水河口未來水資源管理及相關對策規劃時之參考。

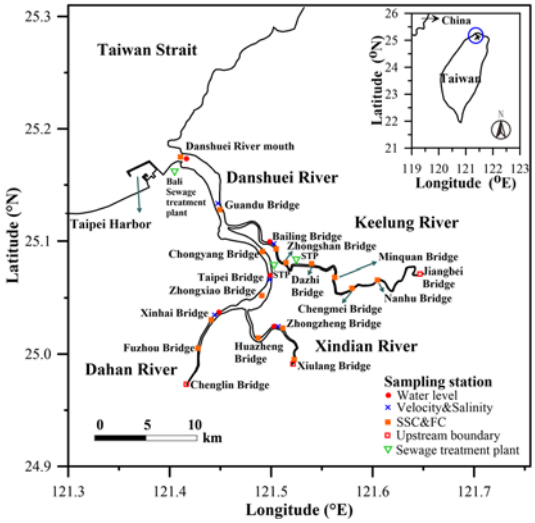
關鍵詞：大腸桿菌，水舌擴散，淡水流量，淡水河口與近海，SCHISM-FC

Abstract

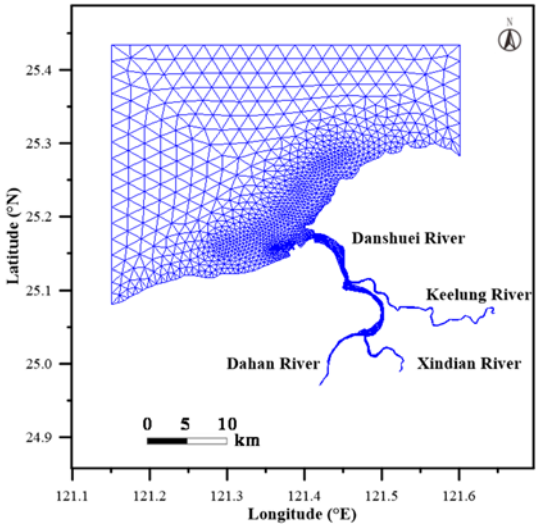
Fecal coliform is one of the indicators often used to determine if a water body was contaminated. Fecal coliform can be discharged into rivers through runoff, stock farming sewage, and domestic sewage that pose the risk of health to people living along the river. The Danshuei River is an important tidal river in northern Taiwan. However, the water quality of the Danshuei River is getting worse due to the increase in population and the rapid development of industry and commerce. To understand the effect of river discharge on the fecal coliform plume, this study established a three-dimensional water quality model (SCHISM-FC), which used unstructured grid to simulate the Danshuei River estuary and its adjacent coastal region. We employed the observational data of 2019 to validate the three-dimensional model of the Danshuei River estuary and its adjacent coastal region. The simulation results were in quantitative agreement with the observational data, the SCHISM-FC model was able to correctly model the hydrological mechanisms and the transport and distribution of fecal coliform in the Danshuei River estuary and its adjacent coastal region. The validated model was utilized to carry out the investigation of the fecal coliform plume induced by river discharge,

will be of great help to the water resources management and related policy plan of the Danshuei River.

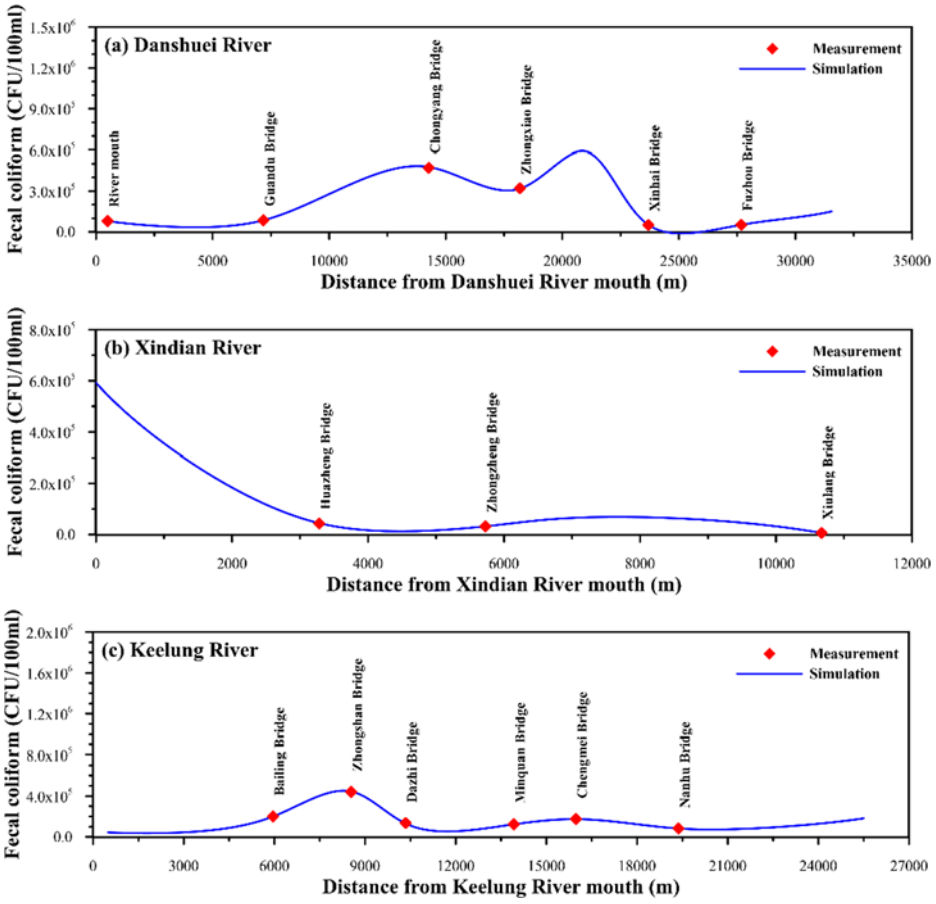
Keywords: Fecal coliform, Plume, River discharge, Danshuei river estuary and coastal area, SCHISM-FC



淡水河流域圖



淡水河流域與外海網格圖



2019 年 10 月 2 日大腸桿菌驗證(a)淡水河-大漢溪(b)新店溪(c)基隆河