中国・長江流域における異なる土地利用の下で窒素とリンの面源負荷のシミュレーション
Simulation of the Non-point Source of Nitrogen and Phosphorus Loads under Different Land Uses in the Yangtze River Basin, China

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Objective/Methods

Increasing of nutrient loads due to the rapid economic development worsen the water resource in China. When the nutrient loads exceeds the natural purification capacity of the rivers, it will be released into the East China Sea (ECS) and causes serious coastal eutrophication and red tide. In order to estimate the nutrient loads from the Yangtze River basin (YRB), we have developed a catchment water and material circulation model based on the Soil and Water Assessment Tool (SWAT). The model was calibrated by the observation data during 2004-2006 and validated by the data during 2008-2010 of river discharge, sediment as well as water quality data, such as the total nitrogen (T-N) and the total phosphorus (T-P) at major hydrological stations, such as Pingshan, Zhutuo, Yichang, Shashi, Hukou and Datong at main stream.

Results/Conclusion

As the input data of the model, we, at first, estimated the N inputs to the Yangtze River Basin, including the atmospheric deposition, synthetic N fertilizer, as well as N from human waste and animal excrement based on statistical data of China. The results showed that the total amount of N inputs to the whole YRB was approximately 16.4 Tg N in 2010, which was a 2.0-fold increase over 1980. It increased dramatically in the 1990s and then stabilized at a high level in the 2000s. It was also found that the major N inputs were human and animal wastes as well as synthetic fertilizers, but they varied regionally. The contribution of animal waste gradually decreased from upper to lower reaches, but the contribution of N fertilizer increased from upper to lower reaches. Overall, the noticeable sources were the agricultural land in the Sichuan Basin in the upper reaches, the Jiang-Han Plain, the Dongting and Poyang Lake Basins in the middle reaches, and the urban areas in the lower reaches.

Finally, we applied the validated model to simulate daily, monthly and yearly variation (2001-2010) of both river discharge (FLOW) and nutrient loads, such as NO3-N, NH4-N, T-N and T-P transported to ECS. The simulation results showed that the annual mean total FLOW was 2.71×10^{4} m^3 /s and the average yearly amounts of pollutants passing the Datong Station were 2.19×10^{6} t of NO3-N, 2.62×10^{5} t of NH4-N, and T-N was 2.74×10^{6} t of and T-P was 1.06×10^{5} t. Comparison with the existing research, the simulation results indicated that NO3-N flows in the 2000s were about 3.6 times those in the 1980s, NH4-N more than 2.5 times, and T-P more than 1.2 times.

キーワード：面源、窒素・リンの負荷、土地利用、長江流域
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