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模拟珠江河网的污染物通量及外源输入对入河口通量的贡献

Modeling the pollutant flux in the Pearl River network and the contribution of external waste loads to the riverine flux

关键词: [珠江三角洲河网](#) [物质通量](#) [数值模拟](#) [碳质生化需氧量](#) [无机氮](#) [无机磷](#)

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摘要: 基于一维河网与三维河口耦合水质模型,模拟计算了2000年珠江上游输入河网以及河网输入河口的碳质生化需氧量(CBOD)、氨氮(NH₄)、硝态氮与亚硝态氮(NO₃)和无机磷(IP)等污染物通量,并结合数值实验,量化了外源输入(包括入河网污染物通量与河网污染负荷)对入河口污染物通量对河网区的贡献.研究表明,河网区的污染物通量由入河网通量与河网污染负荷共同控制,通量分配具有显著的空间差异;上游各水系中,以西江的通量最大,约占入河网通量的71%~81%;8个入海口门中,以虎门、磨刀门的通量最大,两者共承接超过一半的入河口通量.此外,数值实验表明,入河网通量与河网污染负荷对CBOD、氨氮的入河口通量均有显著贡献,而硝态氮与亚硝态氮、IP的入河口通量则主要来自入河网通量;磨刀门、虎门分别是入河网通量、河网污染负荷最主要的输出口门.基于模型,亦针对入河口CBOD、氨氮通量对河网污染负荷的响应关系进行了探讨.

Abstract: A 1-D and 3-D coupled water quality model was used to simulate the annual pollutant flux, including carbonaceous biochemical oxygen demand (CBOD), ammonium (NH₄), nitrate plus nitrite (NO₃) and inorganic phosphorus (IP), of the Pearl River network and the estuary in 2000. Numerical experiments were conducted to quantify the contribution of external waste loads (including both the waste loads from the upstream rivers and discharged from the Pearl River Delta Region) to the riverine pollutant fluxes. The results indicate that pollutant fluxes in the river network, showing pronounced spatial variability, are controlled by the combination of the upstream fluxes and waste loads. Among the upstream rivers, the West River is the largest input to the upstream fluxes, with 71%~81% of the total; among the eight river outlets, Humen and Modaomen are the two largest receivers of the riverine fluxes, with the sum more than 50% of the total. Furthermore, numerical experiments suggest that the upstream fluxes and waster loads both have a significant contribution to the riverine fluxes of CBOD and NH₄, whereas the riverine fluxes of NO₃ and IP are primarily fed by the upstream fluxes; Modaomen and Humen appear to be the largest receivers of the upstream fluxes and the water loads, respectively. Based on the model, the response of the riverine fluxes of CBOD and NH₄ to the waste loads was also investigated.

Key words: [Pearl River network](#) [material flux](#) [numerical simulation](#) [carbonaceous biochemical oxygen demand](#) [inorganic nitrogen](#) [inorganic phosphorus](#)

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