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合肥地区不同类型源头溪流暂态存储能力及氮磷滞留特征

Transient storage capacity and nitrogen and phosphorus retention characteristics of different sorts of headwater streams in Hefei area

关键词: 源头溪流 OTIS模型 水文参数 暂态存储指标 氮磷滞留

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摘要: 为揭示合肥地区不同类型源头溪流暂态存储能力及氮磷吸收滞留的基本特征,在城区和城郊筛选4条典型源头溪流,并以 NH_4Cl 、 KH_2PO_4 为添加营养盐,以 NaCl 为保守型示踪剂,开展现场示踪实验.在此基础上,利用OTIS模型水文参数(D 、 A 、 A_S 和 α),计算暂态存储指标(T_S 、 T_C 、 L_S 、 R_H 和 F_{med}^{200}),进而开展暂态存储能力分析,并以 NH_4^+ -N和SRP一阶吸收系数(λ 、 λ_S)解析氮磷滞留特征.结果表明:4条溪流水体的 α 值均处于 10^{-4} ~ 10^{-3} 数量级;各溪流 T_C 基本都显著超过 T_S ,意味着这些溪流水体溶质滞留效应主要来自主渠道流动水体,而不是暂态存储区;根据 T_C 、 T_S 、 L_S 和 R_H 等指标,得到各源头溪流暂态存储能力排序为:二十埠河二级支流>二十埠河一级支流>十五里河源头段>关镇河支渠;4条源头溪流主渠道流动水体与暂态存储区的 NH_4^+ -N、SRP滞留特征存在很大的差异,并且二十埠河一、二级支流和十五里河均不同程度出现 λ - NH_4^+ 、 λ_S - NH_4^+ 为负值的现象,意味着这些水体对于 NH_4^+ -N既具有短期存储作用,也起着“源”的作用.

Abstract: To investigate the capacity of transient storage and characteristics of nitrogen and phosphorus retention of different sorts of headwater streams in Hefei, four typical headstreams were chosen in urban and suburban areas. A series of instantaneous tracer experiments were carried out on the chosen stream reaches by taking NH_4^+Cl and KH_2PO_4 as nutrient additions and NaCl as conservative tracer. Transient storage metrics (i.e. T_S , T_C , L_S , R_H and F_{med}^{200}) were estimated according to the hydrological parameters (i.e. D , A , A_S and α) in OTIS model to explore the capacity of transient storage, and first-order uptake rates of NH_4^+ -N and SRP arising from OTIS model calculation were also used to delineate the characteristics of nitrogen and phosphorus retention for above headstreams. The results showed that the values of exchange coefficient α for the four headstreams were all in the order of magnitude of 10^{-4} ~ 10^{-3} . Nearly all the T_C values were remarkably higher than that of T_S , suggesting that the solute retention effect should be dominated by main channel rather than transient storage zone for the four streams. After considering all these metrics of T_S , T_C , L_S and R_H , the order of transient storage capacity were obtained as the second-order stream of Ershibuhe River>the first-order stream of Ershibuhe River>the headwater stream of Shiwulihe River>Guanzhenhe Creek. Great difference in the NH_4^+ -N and SRP retention between the main channel running water and transient storage zone was found among the four studied streams. Moreover, some negative values of λ - NH_4^+ and λ_S - NH_4^+ were obtained in the first- and second-order streams of Ershibuhe River and the headstream of Shiwulihe River, implying that these stream reaches acted as a short-term storage zone and nutrient source for NH_4^+ -N.

Key words: headwater stream OTIS model hydrological parameters transient storage metrics nitrogen and phosphorus retention

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