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滇池流域高分辨率氮、磷排放清单

High-resolution nitrogen and phosphorus emission inventories of Lake Dianchi Watershed

关键词：排放清单 排放因子 富营养化 流域模型 滇池

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摘要：氮、磷富集是我国浅水湖泊水质恶化和水生态退化的关键原因之一,但以往流域尺度氮、磷排放清单不足以精确识别排放的空间异质性和满足地表过程数值模拟的分辨率要求.为了提高控源减排措施的针对性,以滇池流域为例建立其高分辨率氮、磷排放清单.通过现场调查、采样观测与资料收集,确定各污染源的活动水平和修正排放因子,基于GIS平台核算企业源(工业、第三产业)、生活源(城镇、农村)、城市源(暴雨径流)、农业源(种植业)等7种点源和非点污染源在110个子流域的氮、磷排放量(平均分辨率约5 km×5 km).主要结论包括:1 2008年滇池流域氮、磷排放总量分别为10736 t和542 t,且以城镇生活点源为主,占72.7%和42.8%;2 氮、磷排放空间异质性十分明显,子流域氮、磷排放总量分别为(97.6±291.7) t(1个标准方差)和(4.93±11.8) t,其中全流域70%的氮、磷排放量仅集中在占流域面积16.2%的10个子流域和37.9%的21个子流域,而排放量最大的是盘龙江上游(氮、磷分别占21.9%和20.2%);3 各污染源的排放格局异质性也大,对于氮而言,除了滇池北岸城区和沿流域边界的外围子流域以城镇生活和种植业为最大污染源,东、南、西岸湖盆区大部分则以其他污染源为主;相比而言,磷排放的各子流域最大污染源差异性更大;4 通过与传统分辨率结果的比较,高分辨率排放清单能够更为准确甄别排放格局异质性、污染类型等信息,更加有利于明确控源减排的措施、布局和规模.

Abstract: The enrichments of nitrogen and phosphorous and their interactions with phytoplankton dynamics could be one of substantial reasons for water-quality deterioration and aquatic ecosystems degeneration. However, previous inventories were unable to identify spatial heterogeneity of the emissions and to support the numerical simulation of transport and fate of the nutrients. High-resolution emission inventories of nitrogen (N) and phosphorus (P) was then compiled in GIS platform for Lake Dianchi Watershed on 110 sub-watersheds (~5 km×5 km), including industries, municipal sewage, urban stormwater and agricultural pollution sources. N and P emissions were estimated by updating the emission factors and activity data by in-site experiments and enhanced observations. The results revealed that total N and P emissions in Lake Dianchi Watershed were approximately 10736 t and 542 t in 2008, respectively, with municipal sewage the largest emission source (72.7% of N and 42.8% of P). Spatial heterogeneities of N and P emissions were obvious. The mean N and P emission rates at sub-watershed scale were (97.6±291.7) t and (4.93±11.8) t, respectively. Around 70% of total N emissions were contributed from ten sub-watersheds (16.2% of total area), and around 70% of total P emissions were contributed from 21 sub-watersheds (37.9% of total area). Similarly, the emission pattern of each pollution source was heterogeneous. The largest pollution sources for nitrogen were municipal sewage and agricultural cropland in northern part and the sub-watersheds along the

watershed boundary, while other sources dominated in eastern, southern and western parts. The heterogeneity of pollution sources for phosphorous was even higher. This high-resolution N and P emission inventories were useful in characterizing the type, pattern and size of pollution control and prevention in future.

Key words: Emission inventory emission factor eutrophication watershed modeling Lake Dianchi

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