技术类成果

流域“自然－社会”二元水循环模拟与应用关键技术

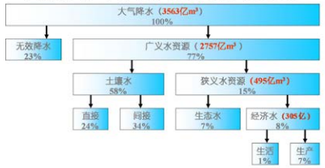
【创新性】

基于高强度人类活动对流域水循环深刻影响的科学认知，于 1999 年原创性的提出了流域“自然－社会”二元水循环模式。经过近 20 年的发展，提出了“实测－分离－耦合－建模－调控”二元动态学科范式，形成了定量模拟与应用技术。研发了流域二元水循环及其伴生过程的综合模拟模型，综合考虑自然和人类活动的影响，提高了模拟的精度、稳定性和普适性；提出了全口径层次化水资源动态评价方法，实现了从径流性水资源评价到全要素评价和量质效一体化评价；提出了基于二元水循环模型的指纹分析归因分析方法，定量揭示自然和人类活动对流域水循环过程的贡献；提出了水资源利用从低效向高效转化的调控模式，通过多目标分析水循环的多维均衡效应，落实到调控措施。

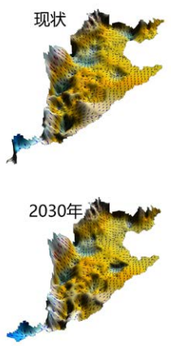
【影响力】

提出的二元水循环理论和方法推动了我国水文水资源学科的发展及学科交叉融合，相关技术和成果应用于黄河、海河、松花江、珠江、淮河、黑河等流域的水资源规划和管理实践。本项成果共发表论文 200 余篇，其中 SCI 60 余篇，出版专著 10 余部，在 EGU、IAHR、APHW、中国水利学会、中国可持续发展研究会等重要学术组织大会上做特邀报告或举办论坛，引起了国内外的广泛关注，并推动了国际水文十年（IHD）和联合国国际水文计划（IHP）的相关主题研究，有效提升了我国水科学研究的国际地位。获得 2006 年度国家科技进步二等奖、2014 年度国家科技进步一等奖以及多项省部级科技进步一等奖。

黄河流域全口径层次化水资源动态评价



海河流域浅层地下水水位及流场变化



海河流域水循环通量解析（mm/a）

主要完成人：王　浩、贾仰文、王建华、秦大庸、严登华、周祖昊、陆垂裕、仇亚琴、游进军、牛存稳

受奖单位：水资源所

KEY TECHNOLOGIES FOR THE SIMULATION AND APPLICATION OF THE "NATURE－SOCIETY"DUALISTIC WATER CYCLE IN RIVER BASINS

【Innovation】

Based on scientific cognition that intensive human activities will produce profound impacts on the water cycle of river basins, IWHR originally put forward the “nature－society” dualistic water cycle model for river basins in 1999. Through 20 years of development, it proposed a binary dynamic disciplinary paradigm of “measurement－separation－coupling－modeling－regulation”, and shaped quantitative simulation and application technology. Our Academy developed comprehensive simulation models for the dualistic water cycle in river basins as well as its associated processes, comprehensively took the impacts of natural and human activities into account, and improved the simulation precision, stability and universality; put forward the dynamic evaluation method for hierarchical water resources in full aperture, realizing the shift from the evaluation of runoff water resources to that of all factors and to that of quantity, quality and efficiency integration; came up with the attribution analysis method of fingerprint analysis based on the dualistic water cycle model, quantitatively revealed the contributions of natural and human activities had made to the water cycle process of river basins; proposed a regulation pattern for water resource utilization from low efficiency to high efficiency, and implemented regulatory measures by analyzing the multi-dimensional equilibrium effect of the water cycle through multiple objectives.

【Influence】

Its dualistic water cycle theory and method have promoted the development of the hydrology and water resources discipline and interdisciplinary integration in China, and relevant technologies and outcomes have been applied in water resources planning and management practice of the basins of Yellow River, Haihe River, Songhua River, Pearl River, Huaihe River and Heihe River. This project has issued nearly 200 papers, with 60 listed into SCI, and published nearly 10 monographs. Our Academy was invited to deliver reports at conferences hosted by major academic organizations, including EGU, IAHR, APHW, CHES and Chinese Society for Sustainable Development, or hold forums, attracting much attention at home and abroad, promoting the research of related subjects like the International Hydrologic Decade (IHD) and the UN International Hydrological Programme (IHP), and effectively raising the international status of China’s hydraulic research. The project won the second prize of the National Science and Technology Progress Award in 2006 and the first prize in 2014, as well as various provincial and ministerial first prizes for scientific and technological advancements.

Main Contributor : Wang Hao, Jia Yangwen, Wang Jianhua, Qin Dayong, Yan Denghua, Zhou Zuhao, Lu Chuiyu, Qiu Yaqin, You Jinjun, Niu Cunwen

Award-winning Unit : Department of Water Resources