

The decisive factor and control mechanism of interannual variations in Lake Taihu evaporation

太湖蒸发年际变化主控因子及其影响机制研究

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PI: Wei Wang

Water loss from evaporation is about half of Lake Taihu's volume. Studying the evaporation response to climate change is of great societal importance for drinking water supply in Lake Taihu catchment. Although many environmental factors have been shown to influence lake evaporation through complicated interactions, the decisive constraint to long-term lake evaporation variation, as well as the associated mechanism is still unclear. In this research, we will choose Lake Taihu, a large shallow subtropical lake in Yangzi River Delta as study area. Observations from the Taihu Eddy Flux Network and simulations by NCAR LISSS will be used to address the following six-fold issues: (1) to investigate the temporal and spatial variations in water evaporation and its contributing environmental factors across Lake Taihu. (2) to evaluate and improve the performance of NCAR LISSS long-term simulation by latent heat observations. (3) to simulate the historical (1979-2014) and future (2015-2100) evaporation variations of Lake Taihu with inputs from adjusted reanalysis and climate model products, respectively. (4) to quantify and distinguish the contributions of air temperature, solar radiation, wind speed and atmospheric humidity to interannual variations in Lake Taihu evaporation through latent heat decomposition and sensitivity analysis. (5) to uncover the linkage between energy partitioning (Bowen ratio) and climate warming. (6) to elucidate mechanisms underlying water evaporation variability caused by energy partitioning at Lake Taihu. The study aims to determine the decisive environmental factor of interannual variations in Lake Taihu evaporation, and to clarify the associated physical process. The results can advance our understanding of water evaporation variability, also provide timely data and theory support to the ongoing evaporation prediction and water recourse management at Lake Taihu.

太湖年蒸发量约占其蓄水量的 50%，研究太湖蒸发对气候变化的响应关系到沿岸上千万居民的供水安全。影响湖泊蒸发的气象环境因子众多且相互作用，至今对湖泊蒸发年际变化的主控因子及影响机制尚不明确。本研究以亚热带大型浅水湖泊——太湖为研究对象，基于太湖中尺度通量网观测数据，分析太湖蒸发时空变化特征及其影响因子；利用实测潜热，检验并优化 NCAR LISSS 模型对太湖年际蒸发的模拟能力；用校正后的再分析资料和气候模式产品驱动 LISSS 模型，模拟 1979-2014 年和 2015-2100 年的太湖蒸发年际变化特征；基于影响因子拆分和敏感性分析，量化气温、太阳辐射、风速和大气湿度对太湖蒸发年际变化的贡献；揭示太湖波文比随气温变化的规律；阐明能量分配改变对太湖蒸发的影响过程。旨在确定太湖蒸发年际变化的主控因子，明确能量分配对太湖蒸发的影响机制。本研究结果可为预测太湖蒸发未来变化提供数据支持和理论依据。