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Long-Term Study of Lake Evaporation and Evaluation of Seven Estimation Methods: Results from Dickie Lake, South-Central Ontario, Canada

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Author(s)

Huaxia YAO

ABSTRACT

Establishing satisfactory calculation methods of lake evaporation has been crucial for research and management of water resources and ecosystems. A 30 year dataset from Dickie Lake, south-central Ontario, Canada added to the limited long-term studies on lake evaporation. Evaporation during ice-free season was calculated separately using seven evaporation methods, based on field meteorology, hydrology and lake water temperature data. Actual evaporation determined during a portion of a year was estimated using a lake energy budget model, and the estimation was used as reference evaporation for evaluation of the seven methods. The deviation of method-induced evaporation from the reference evaporation was compared among the seven methods, and a performance rank was proposed based on the root mean squared deviation and coefficient of efficiency. As for the whole ice-free season (roughly May to November), the water balance was the best method, followed by Makkink, DeBruin-Kejiman, Penman, Priestley-Taylor, Hamon, and Jensen-Haise methods. As for shorter duration (a week to a month), the DeBruin-Kejiman was the best method, followed by Penman, Priestley-Taylor, Makkink, Hamon, Jensen-Haise, and water balance method. Annual and seasonal changes of energy budget terms and the compensation function of lake heat storage in evaporation flux were also analyzed.

KEYWORDS

Long-Term Study, Lake Evaporation, Water Balance, Energy Budget, Lake Temperature, Stream Discharge

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