Mathematical and Computer Modelling 54 (2011) 1086–1092

Contents lists available at ScienceDirect

Mathematical and Computer Modelling

journal homepage: www.elsevier.com/locate/mcm

Evapotranspiration estimation based on the SEBAL model in the Nansi Lake Wetland of China

Zhongping Sun [a], Bin Wei [a], Wei Su [b,*], Wenming Shen [a], Changzuo Wang [a], Daian You [a], Zheng Liu [c]

[a] Satellite Environment Center, Ministry of Environmental Protection, China
[b] College of Information and Electrical Engineering, China Agricultural University, Beijing, China
[c] China University of Geosciences, Beijing, China

ARTICLE INFO

Article history:
Received 2 September 2010
Accepted 4 November 2010

Keywords:
Evapotranspiration
SEBAL
Nansi Lake
Wetland

ABSTRACT

As a major component of the water budget of a wetland, evaporation has proven difficult to measure evapotranspiration accurately. This paper developed a scheme to assess actual evapotranspiration (ETa) across a range of land uses in Nansi Lake Wetland, China, using a remote sensing technique and the Surface Energy Balance Algorithm for Land (SEBAL) model. The estimation of pixel-scaled ETa was conducted via SEBAL using Landsat-7 ETM+ images, DEM and meteorological data. Compared with the recorded pan evaporation, the estimated evapotranspiration calculated by SEBAL agreed well with the results derived from pan observations. Then, the spatial distribution characteristic of daily evapotranspiration was analyzed by referencing the land-use map of 2000. It was found that the open water body and creed swamp were at a high evapotranspiration rate, while the crop land, grassland and rural residential land took the second place, and the overflow land, town constructed land and bare soil were at the lowest evapotranspiration rate, which accorded with the evapotranspiration theory. The research demonstrates the considerable potential of SEBAL model for estimation of spatial ETa with little ground-based weather data over large areas such as wetlands.

1. Introduction

More and more emphasis is being placed on the preservation of wetlands, due to wetlands providing a unique habitat and the wide variety of plant and animal species; some of them are being threatened or endangered. Many of the world's wetlands are threatened by changes in their water regimes with often adverse consequences for their biota and the provision of ecosystem services of importance to many people [1]. This poses the challenge of not only protecting water supplies dedicated for wetland maintenance, but also of managing those supplies for maximum wetland vitality. So it is widely recognized that wetland vitality is not merely a function of wetness, but also of water quality, timing and depths. Thus, it is valuable to estimate the actual evapotranspiration (ETa) of wetland areas. More accurate determination of ETa could lead to more informed decisions about the conservation, development and management of wetlands.

Evaporation is a major component of the water budget in a wetland, but it has proven difficult to measure accurately. So some researches have developed many methods to estimate evaporation. Meteorological or climatological methods are based on point data, which cannot provide a good estimation of ET in large areas. Although the water balance method can

* Corresponding author. Tel.: +86 010 62737628; fax: +86 010 62737855.
E-mail addresses: sunnybnu114@163.com (Z. Sun), suwei@cau.edu.cn (W. Su).

0895-7177/$ – see front matter
doi:10.1016/j.mcm.2010.11.039