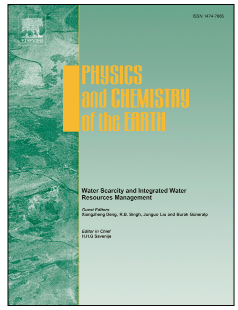
Accepted Manuscript



Effects of climate change on evapotranspiration over the Okavango Delta water resources

Oliver Moses, Wame L. Hambira

PII: S1474-7065(17)30085-2

DOI: 10.1016/j.pce.2018.03.011

Reference: JPCE 2672

To appear in: *Physics and Chemistry of the Earth*

Received Date: 10 April 2017

Revised Date: 8 December 2017

Accepted Date: 22 March 2018

Please cite this article as: Moses, O., Hambira, W.L., Effects of climate change on evapotranspiration over the Okavango Delta water resources, *Physics and Chemistry of the Earth* (2018), doi: 10.1016/j.pce.2018.03.011.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

ACCEPTED MANUSCRIPT

Effects of climate change on evapotranspiration over the Okavango Delta water resources

Oliver Moses* and Wame L. Hambira

*Corresponding author. E-mail address: omoses@ori.ub.bw (O. Moses)
Okavango Research Institute, University of Botswana, Maun, Botswana

Abstract
In semi-arid developing countries, most poor people depend on contaminated surface or groundwater resources since they do not have access to safe and centrally supplied water. These water resources are threatened by several factors that include high evapotranspiration rates. In the Okavango Delta region in the north-western Botswana, communities facing insufficient centrally supplied water rely mainly on the surface water resources of the Delta. The Delta loses about 98% of its water through evapotranspiration. However, the 2% remaining water rescues the communities facing insufficient water from the main stream water supply. To understand the effects of climate change on evapotranspiration over the Okavango Delta water resources, this study analysed trends in the main climatic parameters needed as input variables in evapotranspiration models. The Mann Kendall test was in the analysis. Trend analysis is crucial since it reveals the direction of trends in the climatic parameters, which is helpful in determining the effects of climate change on evapotranspiration. The main climatic parameters required as input variables in evapotranspiration models that were of interest in this study were wind speeds, solar radiation and relative humidity. Very little research has been conducted on these climatic parameters in the Okavango Delta region. The conducted trend analysis was more on wind speeds, which had relatively longer data records than the other two climatic parameters of interest. Generally, statistically significant increasing trends have been found, which suggests that climate change is likely to further increase evapotranspiration over the Okavango Delta water resources.

Key words
Climate change, Evapotranspiration, Okavango Delta water resources, Wind speeds

1. Introduction

Most poor people in semi-arid countries, particularly in Africa and Asia, rely on contaminated surface or groundwater resources since they do not have access to safe and centrally supplied water (Jones et al., 2009; Kujinga et al., 2014). These water resources are threatened by high evapotranspiration rates (Bauer et al., 2004; Helfer et al., 2012) in addition to other factors such as increased per-capita water use, rapid population growth, rural–urban migration and droughts (GWP, 2000; Jones et al., 2009; Nalbantis and Tsakiris 2009; Vörösmarty et al., 2010; Myronidis et al., 2012; Kujinga et al., 2014). Evapotranspiration can be estimated using different methods. The best estimates can be obtained using lysimeter or imaging techniques (Allen et al. 2011; Rahimi et al. 2014; Valipour, 2015). However, due to high costs associated with such techniques, evapotranspiration models are also used. Evapotranspiration models include the Food and Agriculture Organisation (FAO) Penman–Monteith and empirical models that are based on mass transfer, radiation, temperature, and pan evaporation (Allen et al., 1998; Valipour, 2015). They use climatic parameters as input variables (Trajkovic et al., 2011; Davarzani et al., 2014). The FAO Penman–Monteith model requires many climatic parameters which are limited in most regions due to limited meteorological stations, hence empirical models are preferred in such regions (Wang et al., 2009; Valipour, 2015). The most crucial climatic parameters in evapotranspiration models are solar radiation, air temperature, relative humidity and wind speed (Helfer et al., 2012; Valipour, 2015; Liuzzo et al., 2016; Lang et al., 2017).

Patterns of climatic parameters are changing over extended periods of time, i.e., several decades or more, which is a manifestation of climate change (United Nations, 1992; IPCC, 2014). A change in the patterns of climatic parameters due to climate change implies a change in evapotranspiration rates over water resources (Farquharson et al., 1990; Acreman et al., 2003; Bauer et al., 2004; Souch et al., 1998; Evengard et al., 2011; Helfer et al., 2012). This could have significant impacts on water availability, quantity and quality, particularly in poor semi-arid regions (Milly et al., 2005; Dastorani and Poormohammadi, 2012).

* Corresponding author.

Email: omoses@ori.ub.bw, telephone: +267 6817203, Fax: +267 6861835

Download English Version:

https://daneshyari.com/en/article/8912340

Download Persian Version:

https://daneshyari.com/article/8912340

Daneshyari.com