Geophysical Research Abstracts
Vol. 16, EGU2014-14234, 2014
EGU General Assembly 2014

Automated calculation of the evapotranspiration and crop coefficients for a large number of peatland sites using diurnal groundwater table fluctuations

Eike Maurer (1,2), Michel Bechtold (1), Ullrich Dettmann (1), and Bärbel Tiemeyer (1)

(1) Thünen Institute of Climate-Smart Agriculture, Germany (eike.maurer@ti.bund.de), (2) Freiberg University of Mining and Technology, Freiberg, Germany

Evapotranspiration is one of the main processes controlling peatland hydrology. Greenhouse gas (GHG) emissions from peatlands are in turn strongly controlled by the groundwater table. Through the increasing political and scientific interest to reduce GHG emissions, monitoring and modelling strategies to optimize re-wetting strategies and to quantify GHG emissions are needed. To achieve these aims, an accurate determination of the evapotranspiration as an essential part of the water balance is required. Many different approaches are known to determine the evapotranspiration. They are mostly either expensive or hard to parameterize. Plant specific crop coefficients (Kc-values) are an option to calculate plant-specific evapotranspiration but due to the lack of Kc-values for typical peatland vegetation types more data on evapotranspiration from peatlands in the temperate zone are required. Furthermore, simple methods to estimate evapotranspiration are needed especially for monitoring projects.

Diurnal groundwater table fluctuations caused by root water uptake and groundwater inflow can be used to calculate daily evapotranspiration rates. This approach was first described by White (1932) who compared groundwater recovery rates at night to the decline during daytime. Besides the groundwater table data only the specific yield (Sy) is needed to calculate evapotranspiration. However, the method has some limitations because not all days can be evaluated which leads to data gaps during rainy and very dry or very wet periods.

This study presents an automated method to calculate the specific yield, evapotranspiration and crop coefficients for a large number of sites covering all major peatland types and their typical land uses in Germany. As an input for our method, only groundwater level, precipitation and grass reference evapotranspiration (ET0) data is required. In a first step, the groundwater level data was smoothed by a LOESS function. In a second step, site-specific SY values were determined from precipitation events and the related water level increase. Parameter values in this routine were systematically varied to obtain the lowest standard error of Sy. Errors were obtained by bootstrapping. The resulting Sy-values correspond well to peatland type and soil properties. After rule-based filtering of the time series, in a third step, the actual evapotranspiration ETa is calculated by the original White-method and a modification by Hays (2003). Daily values of ETa and ET0 are used to derive crop coefficients, which are then aggregated to monthly and annual Kc-values. Applying the method to a large number of sites resulted in plausible crop coefficients which compare well to previously published values of peatland evapotranspiration, as far as information on similar vegetation is available.