Geophysical Research Abstracts
Vol. 20, EGU2018-15533, 2018
EGU General Assembly 2018

Evapotranspiration over agroforestry systems in Germany and microclimatic effects

Christian Markwitz, Alexander Knohl, and Lukas Siebicke

Georg August University Göttingen, Büsgen Institute, Bioclimatology, Göttingen, Germany
(christian.markwitz@forst.uni-goettingen.de)

The increasing use of crops for food and bioenergy products lead to high expectations for agricultural soils. They need to be productive as they are today or even more and at the same time its functions need to be preserved. Such soil functions comprise the storage and filtration of water, the sequestration of carbon or the sustainable use of fertiliser. Thus, current agricultural management methods have to be improved or new methods need to be developed. Therefore, we investigate if the alternating cultivation of fast growing trees and agricultural crops (agroforestry (AF)) have an effect on evapotranspiration and if such systems are more sustainable in terms of water use than conventional agriculture.

Actual evapotranspiration of AF systems is measured by applying the Surface Energy Balance Residual method, where evapotranspiration rates are calculated as the residual of the net radiation, the sensible- and the ground heat flux. For that in total five sites are equipped with two weather masts each, one at the AF and one at a conventional agricultural system (Conv) without trees, respectively.

During our analysis we found only small differences in cumulative evapotranspiration rates between the AF and Conv treatment over the growing season of 2016. That suggest a sustainable use of the resource water despite the inclusion of trees. Behind the trees, we found an increasing soil temperature in 0.5 m depth with distance from the tree alleys, being lowest within the trees and highest 7 m apart from the trees. This effect is strongest during the summer month, whilst during winter the effect of the trees diminish. Accompanying, the volumetric soil water content is highest within the tree alleys and lowest 7 m behind the trees. We interpret this as an effect of different water use strategies from trees and crops and as a competition process between both. From a microclimate perspective, we've seen higher air temperatures within the AF systems during the summer month over daytime. The increased air temperature led to a decreased relative humidity, whilst the effect inverts during night.

Thus, we conclude that temperate agroforestry systems are sustainable in terms of water use and at the same time lead to favourable growth condition for adjacent crops.