EGU2020-9078

Early European Observations of Precipitation Partitioning by Vegetation: A Synthesis and Evaluation of 19th Century Findings

Jan Friesen, Helmholtz Centre for Environmental Research - UFZ, Leipzig, Germany
John Van Stan, Georgia Southern University, Savannah GA, USA

Welcome to our EGU display! For this year's EGU presentation we have chosen to submit our research in a more entertaining version. Based on our publication we teamed up with two graphical artists and turned the paper into a science comic. We hope you enjoy this format and that it will give you some delight in these difficult times!

In our paper we present early European observations and observatories of precipitation partitioning by vegetation and summarize their results.
The science comic 'Roots of the Past – nourish present research' leads two students on a wild time travel to the first observations and observatories of plants and precipitation – the story of ecohydrology. Using past knowledge and new technologies they develop ideas for their own research.

geosciences

MDPI

Review

Early European Observations of Precipitation Partitioning by Vegetation: A Synthesis and Evaluation of 19th Century Findings

Jan Friesen [1,*] and John T. Van Stan II [2]

[1] Department Catchment Hydrology, UFZ - Helmholtz Centre for Environmental Research, Permoserstraße 15, 04318 Leipzig, Germany
[2] Applied Coastal Research Lab and the Department of Geology & Geography, Georgia Southern University, Statesboro, GA 30458, USA; jvanstan@georgiasouthern.edu
* Correspondence: jan.friesen@ufz.de; Tel.: +49-0341-235-1082

Received: 31 July 2019; Accepted: 27 September 2019; Published: 30 September 2019

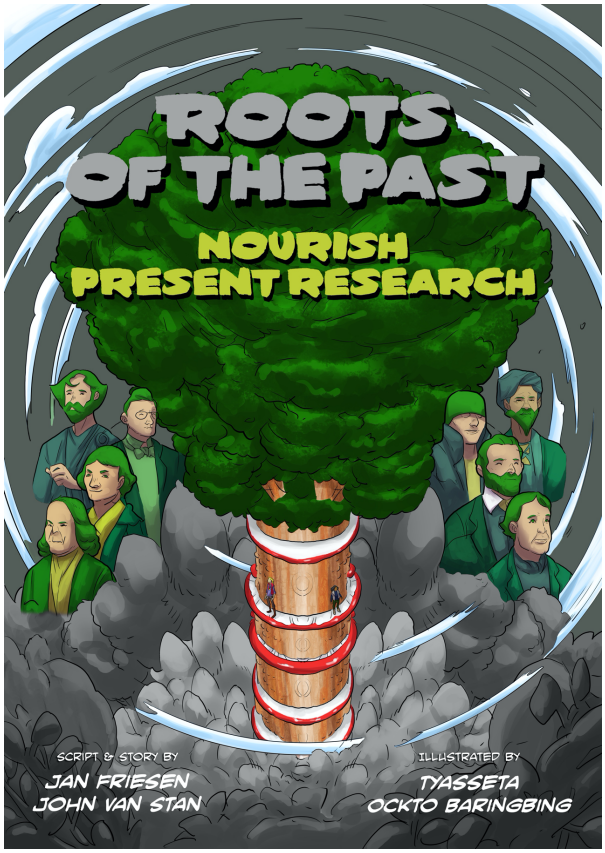
Abstract: The first contact between precipitation and the land surface is often a plant canopy. The resulting precipitation partitioning by vegetation returns water back to the atmosphere (evaporation of intercepted precipitation) and redistributes water to the subcanopy surface as a "drip" flux (throughfall) and water that drains down plant stems (stemflow). Prior to the first benchmark publication of the field by Horton in 1919, European observatories and experimental stations had been observing precipitation partitioning since the mid-19th century. In this paper, we describe these early monitoring networks and studies of precipitation partitioning and show the impressive level of detail. Next to a description of the early studies, results included in this synthesis have been digitized and analyzed to compare them to recent studies. Although many early studies lack modern statistical analyses and monitoring tools that have become standard today, they had many strengths (not necessarily shared by every study, of course), including: A rigorous level of detail regarding stand characteristics (which is often lacking in modern ecohydrological studies); high-resolution spatiotemporal throughfall experiments; and chronosequential data collection and analysis. Moreover, these early studies reveal the roots of interest in precipitation partitioning processes and represent a generally forgotten piece of history shared by the hydrology, meteorology, forestry, and agricultural scientific communities. These studies are therefore relevant today and we hope modern scientists interested in plant-precipitation interactions will find new inspiration in our synthesis and evaluation of this literature.

Keywords: interception evaporation; throughfall; stemflow; forests; crops; rain; snow; fog; rime

1. Introduction

Much of Earth's land surface is covered by vegetation: An estimated 30% is covered by forests [1], another 27% by grasslands [2], and croplands cover an additional 11% [3]. Thus, the first contact between precipitation and the land surface is often a plant canopy. Thereafter, precipitation may travel through various storage elements in the vegetated landscape—epiphytic plants [4], stems [5], understories [6], and litter layers [7]—before reaching the soil surface. The result of these "precipitation partitioning" processes is that a hydrologically-relevant portion of precipitation is returned to the atmosphere (interception) [8], a portion is redistributed as a subcanopy "drip" flux (throughfall), and a portion drains down plant stems (stemflow). By budgeting these different precipitation partitioning components, a better understanding of available soil water and river discharge [9], as well as a deeper subsurface recharge [10] is made possible. In view of the large parts of the globe covered by vegetation, its effect on the water cycle is of great importance [11].

Friesen & van Stan, 2019,
https://doi.org/10.3390/geosciences9100423



Friesen & van Stan, 2020,
https://tinyurl.com/rootsofthepast