Commentary
Volume 13:3, 2022

Hydrology: Current Research

ISSN: 2157-7587 Open Access

Review of Stable Isotope Hydrograph Separation

Guofang Nasko*

Department of Forestry and Environmental Resources, North Carolina State University, Raleigh, North Carolina, USA

Description

In the last 40 years, storm hydrograph separation utilising stable isotope tracers has resulted in significant breakthroughs in catchment hydrology. Its use as a technology in the ushered in a paradigm change in the way runoff generation was seen. When isotope-based hydrograph separations revealed that stored, pre-event water dominated the storm hydrograph in most natural, humid systems, existing theories that focused on rainfall translation to stream flow as overland flow and rainfall translation to streams via lateral preferential flow had to be significantly revised.

High-frequency event-based isotope data continue to provide a challenge to our knowledge of stream flow formation. Recent field-based laser spectrometer deployments reveal that even at the height of the storm hydrograph, certain wooded catchments with runoff rates of 50% may have no observable rainfall in channel storm flow. Buttle published the most recent significant evaluation of isotope hydrograph separation, with minor revisions along the way.

Over 100 publications have been published using the approach since 1994. IHS now has an impact on the construction of rainfall-runoff model architectures as well as a posteriori model testing and calibration, in addition to case studies of hydrograph components. Despite these advancements, the technique's implicit assumptions remain problematic, and some studies continue to skim over the technique's assumptions and limitations. Furthermore, while the first IHS findings pushed process thinking away from event water dominance, subsequent IHS research has had less impact on modifying process thinking in the last two decades.

Instead of IHS findings generating novel process behaviours, contemporary field-based process research assume pre-event water dominance and strive to demonstrate the mechanisms of stored water mobilisation, connection, and threshold response to precipitation inputs. As a result, IHS no longer leads new process discoveries and looks to be falling behind on cutting-edge runoff theory research. With fundamentally novel discoveries from continuing use of IHS becoming increasingly uncommon, it appears that we have exhausted the technique's easy-to-discover findings, causing some to wonder if the pleasure of isotope hydrograph separation has passed them by.

With the following aims in mind, we present a detailed analysis and assessment of storm hydrograph separation using stable isotopes: To conduct a comprehensive evaluation of IHS progress and to update Buttle's recent comprehensive review paper. Re-examine the technique's assumptions and limitations, especially in light of recent discoveries. To determine and define what can still be done using IHS and where there are still prospects for innovation.

We'll start with a brief history of the early development of several technologies for separating stream flow. Then we'll go over the accomplishments of the previous 20 years in detail. Following that, we have a section that discusses numerous of the problems that have arisen as a result of existing practise and where IHS' basic assumptions have not been followed. Finally, we offer suggestions for moving further with the technique.

Storm hydrographs have been separated graphically and hydrometrically for over 50 years. Simple graphical division of the hydrograph into fast and slow components, frequently equated to storm rainfall and groundwater, was used in many of the early techniques. While these methods are still used in engineering practise today, they have been widely criticised, with some claiming that "the best method of dealing with hydrograph separation is to avoid it altogether" and comparing attempts to separate the storm hydrograph into different components to "unscrambling the omelette." [1-5].

Conflict of Interest

None.

References

1. Klaus, J., and J.J. McDonnell. "Hydrograph separation using stable isotopes: Review and evaluation." *J Hydrol* 505 (2013): 47-64.
2. Penna, Daniele, and H. J. van Meerveld. "Spatial variability in the isotopic composition of water in small catchments and its effect on hydrograph separation." *Wiley Interdiscip Rev: Water* 6 (2019): e1367.
3. Jung, Hyejung, Dong-Chan Koh, Yun S. Kim, and Sung-Wook Jeen, et al. "Stable isotopes of water and nitrate for the identification of groundwater flowpaths: A review." *Water* 12 (2020): 138.
4. Zhou, Jiaxin, Jinkui Wu, Shiwei Liu, and Guoxiong Zeng, et al. "Hydrograph separation in the headwaters of the Shule River basin: combining water chemistry and stable isotopes." *Adv Meteorol* (2015).
5. Pu, Tao, Yuanqing He, Guofeng Zhu, and Ningning Zhang,et al. "Characteristics of water stable isotopes and hydrograph separation in Baishui catchment during the wet season in Mt. Yulong region, south western China." *Hydrol Proces* 27 (2013): 3641-3648.

***Address for Correspondence:** Guofang Nasko, Department of Forestry and Environmental Resources, North Carolina State University, Raleigh, North Carolina, USA, E-mail: guofang.niak@gmail.com*

Received: 19 March, 2022, Manuscript No. hycr-22-64374; **Editor Assigned:** 21 March, 2022, PreQC No. P-64374; **Reviewed:** 26 March, 2022, QC No. Q-64374; **Revised:** 04 April, 2022; Manuscript No R-64374; **Published:** 08 April, 2022; 10.37421/2157-7587.2022.13. 396

How to cite this article: Nasko, Guofang. "Review of Stable Isotope Hydrograph Separation." *Hydrol Current Res* 13 (2022): 396.