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Reply on CC2

Klaus Eckhardt

Author comment on "Technical note: How physically based is hydrograph separation by recursive digital filtering?" by Klaus Eckhardt, Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2022-186-AC2, 2022

I will gladly take into account the critical comments on the submitted contribution. I propose the following changes to the text, which will result in the terms "groundwater" and "pre-event water" being largely omitted. Only the term "groundwater recharge" remains in the context of its use by Furey and Gupta (2001).

Lines 7 - 8: "a widely used method to identify the groundwater-borne portion of streamflow" is replaced by "a widely used method to identify streamflow components, which react to precipitation with varying degrees of attenuation and delay".

Line 11: "the aquifer is a linear reservoir" is replaced by "baseflow is runoff from a linear reservoir".

Line 14: "exfiltration of groundwater into surface waters" is replaced by "exfiltration of baseflow into surface waters".

Lines 17 - 22 are replaced by
A catchment can be understood as a signal converter. The precipitation is the input signal that is converted into the output signal, streamflow. In the course of this signal conversion, the water takes different paths through the catchment and is subject to different hydrological processes. This results in streamflow components that are attenuated and delayed to varying degrees compared to the input signal, the precipitation. Usually, two components are distinguished: on the one hand, the so-called baseflow as a low-frequency signal component and, on the other hand, higher-frequency signal components that are generated more quickly and less attenuated in response to precipitation events, the so-called direct runoff. From this idea, it is obvious to low-pass filter streamflow hydrographs to identify these components.

Lines 63 - 64: "(b) The aquifer is a linear reservoir, i.e. the discharge from the aquifer is proportional to the amount of water stored in it. Without further knowledge about the physical properties of the aquifer, this is the most obvious approach." is replaced by "(b) Baseflow is runoff from a linear reservoir, i.e. it is proportional to the amount of water stored in this reservoir.".

Line 115: "the assumption of the aquifer being a linear reservoir" is replaced by "the assumption that baseflow is runoff from a linear reservoir".

Lines 118 - 119: "the exfiltration of groundwater into surface waters" is replaced by "the exfiltration of baseflow into surface waters".

Lines 121 - 124 are replaced by
Furey and Gupta (2001) introduced the parameter d in Eq. (5) as the number of time steps between precipitation and groundwater recharge. A sensitivity analysis they conducted showed that the filter performance was "relatively insensitive to changes in d" so that d = 0 seemed to be an acceptable choice. Furthermore, when using Eq. (1), it is assumed that not only the groundwater recharge but also the generation of baseflow still occurs in the same time step as precipitation. When assessing this prerequisite, it should be noted that the streamflow component calculated with Eq. (1) is usually likely to consist not only of groundwater, but also of transient water sources, including interflow (Cartwright et al., 2014; Yang et al., 2021).

Lines 136 - 137: "This is plausible. The parameter BFImax was introduced as the maximum value of the baseflow index that can be calculated. And the baseflow can at most correspond to the groundwater recharge." is deleted.

Lines 156 - 157 are deleted.
Lines 173 - 174 are deleted.

Added are the references
Cartwright, I., Gilfedder, B., and Hofmann, H.: Contrasts between estimates of baseflow help discern multiple sources of water contributing to rivers, Hydrol. Earth Syst. Sci., 18, 15–30, https://doi.org/10.5194/hess-18-15-2014, 2014.
Yang, W., Xiao, C., Zhang, Z., and Liang, X.: Can the two-parameter recursive digital filter baseflow separation method really be calibrated by the conductivity mass balance method?, Hydrol. Earth Syst. Sci., 25, 1747–1760, https://doi.org/10.5194/hess-25-1747-2021, 2021.