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Interactive comment on "Using the nonlinear aquifer storage–discharge relationship to simulate the baseflow of glacier and snowmelt dominated basins in Northwest China" *by* R. Gan and Y. Luo

Anonymous Referee #1

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The authors compare baseflow which is calculated by the Soil and Water Assessment Tool (SWAT) using three different methods:

- representation of the aquifer as a single linear reservoir as originally implemented in SWAT

- representation of the aquifer as two linear reservoirs (Luo et al., 2012)

- representation of the aquifer as a nonlinear reservoir.

Furthermore, results from the recursive digital baseflow filter of Nathan and McMahon (1990) are shown.

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First to the references:

- page 5536, line 20: Replace "Ferker" by "Ferket"!

- page 5539, line 2: Replace "Neistch" by "Neitsch"!

- page 5539, line 16: Replace "Morasi" by "Moriasi"!

- page 5541, line 15: Replace "Morasi" by "Moriasi"!

- page 5547, line 28: Replace "Paolo, V." by "Villani, P."!

As far as I see the following references are listed at the end of the paper but not used in the text: Chu and Shirmohammadi (2004), Eckhardt (2008), Essery (1992), Kirchner (2009), Peterson and Hamlet (1998), Rupp and Woods (2008), Samuel et al. (2012), Szilagyi et al. (2007), and Wittenberg and Sivapalan (1999).

Please clarify the following points:

- Baseflow is usually associated with groundwater discharge into a river. The baseflow modelled by SWAT is just this: groundwater discharge. The baseflow which is calculated with the filter algorithm is different: It is the low frequency component of the streamflow. As such, it will not only comprise groundwater discharge, but probably also the melting water, which plays an important role in the investigated catchments. Is it really meaningful to compare SWAT output and the results of the filter?

- page 5539, line 12-13: The parameters of the non-linear model are calibrated. Are the parameters of the other models calibrated as well? If yes, how? If no, the comparison of the different models is unfair.

- page 5540, line 10: "the nonlinear relation performs much better" - this is not clearly visible from Fig. 2.

- page 5542, lin 25-26: The findings of Partington et al. (2012) are not very significant because they are solely based on model results.

- page 5543, line 2-3: "There is a good agreement in the baseflow patterns of the SWAT and filter methods" - I do not agree with this statement.

- page 5543, line 4: " the direct surface runoff [...] ceases recharging the groundwater" - Direct runoff never recharges the groundwater.

- page 5544, line 3-4: "in the digital filter method, streamflow consists of surface runoff and baseflow" - This is wrong. The filter distinguishes direct runoff (streamflow component varying with high frequency, usually associated with surface runoff and interflow) and baseflow (streamflow component varying with low frequency, usually associated with groundwater discharge).

- page 5546, line 5-7: "the nonlinear aquifer storage–discharge approach performs as well as the two-linear reservoir approach [...] and [has] only two parameters that must be calibrated." - Two linear reservoirs have two parameters as well.

- page 5546, line 8-10: "The parameters a and b in the exponential function that describe the aquifer storage–discharge relationship can be calibrated independently from the observed streamflow data." - On page 5539, line 12-13, it is said that "The parameters a and b can be optimized by fitting the calculated discharge curves to the observed recession curves" and I thought this was done so. How can a and b be calibrated independently from the observed streamflow?

Finally, some minor corrections:

- page 5537, line 13: Omit "river"!

- page 5540, line 22: Omit "to give"!

- page 5541, line 3: Omit ""simulation"!

- page 5561, Fig. 7: Omit "in" in the caption of the ordinate! Units are missing in the equation for S.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 5535, 2013.

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