

## ***Interactive comment on “Hydrograph separation and scale dependency of natural tracers in a semi-arid catchment” by R. Bohté et al.***

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Response to REFEREE #1 The authors express their gratitude to the reviewer for the constructive comments. The review points out weaknesses in the submitted manuscript. The reviewer rejects the paper in its current version and asks for re-focusing and major revisions before the manuscript can be considered for publication. We structure our response as follows: - General comments on the requested focus shift of the paper - Then we will go through more specific points raised by the reviewer and we will give direct answers or indicate how we want to address the points. Our responses to these comments are of course related to the proposed changes in focus of the manuscript from scale dependency to more the regional hydrological behavior and recommendations for similar work in semi-arid regions.

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Point 1-2: The paper's methodology is insufficient to address the issue of scale dependency of natural tracers, also not at small-scale. When submitting the paper, we believed it is a useful contribution to the literature to put the paper in the perspective of scale dependency, and we decided to stress that point in the manuscript. However, we have to agree with the reviewers that the presented data are limited. We do not have data from 5-10 catchments to elaborate on the scale problem. We therefore accept the reviewers argument that it is not sufficient to address this issue, and we will re-focus the paper accordingly (see below).

Point 3: Shift the focus on hydrograph separation and uncertainty analysis, and interpret the work in terms of regional hydrology and lessons to be learned for hydrological assessment in semi-arid regions. We thank the reviewer for this suggestion and think we are capable of re-structuring the paper as such and shift the focus accordingly. As stated in the current manuscript the hydrological research has been conducted in a semi-arid and data scarce environment in Sub-Saharan Africa, and further insights into the runoff generation mechanism are valuable as very little hydrological process research is carried out in this environment. We propose to structure the manuscript as such that we will focus on hydrograph separation in semi-arid Africa, with its specific drawbacks and opportunities. We then need to present the study area in more detail, will add all tracer results that we conducted together with an analysis of the errors and uncertainty, interpret the hydrological information that we gained from it (as in the current paper) and will draw conclusions about the specific circumstances of doing hydrograph separation in such semi-arid regions. These major revisions of the manuscript we can do in a period of 6-8 weeks, and ask the editor whether this is acceptable.

General comments: Ad 1) It should be r2 all throughout the text. Ad 2) We will perform a sensitivity analysis of the hydrograph separation. Ad 3) We will redraw all figures taking into account the reviewers suggestion. Ad 4) We will provide both in the resubmitted manuscript, as the other hydrochemical parameters

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Specific comments Ad 1) With the change in focus of the paper we will provide a more extensive introduction and also will focus on the hydrograph separation work done in semi-arid regions and especially in Africa. Ad 2) For the resubmitted paper we will elaborate more on the site description and bring in a specific section on the research site. Ad 3) We will provide a more detailed map and description of the research area and setup. Ad 4) Yes, the small forested catchment is the Mataini catchment. We will be more consistent with the naming in the revised version of the manuscript. Ad 5) This is correct, some basic lithological information exists (see also Mul et al, 2006), and we will include it in the revised manuscript. Ad 6) We believe this statement is correct but will be more thorough here and also discuss other findings as those of Brown et al. (1999). Ad 7) We agree that using pre-event water is more appropriate and will use (pre-)event. Ad 8) To the best of the authors' knowledge, we have 3 studies in semi-arid Africa. We propose to elaborate on this in the introduction of the new manuscript and check the literature again. Ad 9) OK. Ad 10) True, we will mention this and discuss the stability of the EC/SiO<sub>2</sub> concentrations. Ad 11) The forth event disappeared in the final version (but will be re-considered in the revised version); the event has the following characteristics: Event nr 2 date 11/4 Vudee(mm) 10 Ndolwa (mm) 10 Duration (hr) 2 Peak rate (m<sup>3</sup>/s)0.5 Runoff coeff (%)6.0 Vudee (%) - Ndolwa (%) -

Ad 12) OK. Ad 13) OK. Ad 14) As indicated in the four sentences below the preceding conditions show that the Ndolwa catchment received much more rainfall in the four weeks before the event, which is also indicated by the higher baseflow contributions ahead of the event. We will rephrase this paragraph more clearly. Ad 15) We agree with the reviewer that there is remarkably little elevation difference in the 18O values for two stations with 500m elevation difference. This is has been reported before in other catchments (e.g. Uhlenbrook et al. 2002), it particular for convective rainfall events. The current average is based on the two seasons , which (Fig 7) are distinctly different, as stated in the text. In addition, the weighted average includes the rainfall values between the seasons, which mix up the signal (see comment 16). However, the rainfall values for the two events (21 Nov and 12 Dec) do show the altitude effect. We will

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adjust the numbers (separate events/seasons more clearly), and rephrase the section. Ad 16) We agree. The argument is that the isotope concentrations difference that we encountered in the two seasons are not reflected in these data. We will rephrase this and make it more clear. Ad 17) OK. Ad 18) We will include the other hydrochemical parameters in the revised manuscript. Ad 19) We will rephrase this sentence to: The Oxygen-18 concentrations show similar values for the different springs, which change during the seasons. The hydrochemical analysis shows a larger spatial variation between the springs, but with less variation between the seasons. Ad 20) Sorry, but we do not understand this point. We neglect evaporation for the event based separations but mention it here as a long term effect giving insight in the behaviour of the hydrological system. Ad 21) See Ad 14). Ad 22-25) See also general comments Ad 3) We will redraw all figures taking into account the reviewers' suggestions.

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