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Hydrology and Earth System Sciences
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Discussions

Interactive comment on "Estimating glacier and snowmelt contributions to stream flow in a Central Andes catchment in Chile using natural tracers" *by* M. Rodriguez et al.

Anonymous Referee #2

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This manuscript presents hydrograph separation for a high Andes catchment in Chile using chemical solutes and stable isotopes of water.

General Comments

1. It is very difficult to read this manuscript and evaluate the quality of the work as much of the basic information such as temporal distribution of precipitation and isotopes, sampling dates and the number of water samples from within the catchment, are not given. Many statements are confusing and imprecise. Moreover, many explanations are given in terms of mathematics, rather than physical processes.

2. Although they spent much space dealing with methodology, the key methods on how they determined the water sources and further performed hydrograph separation based on the PCA, are still unclear.

3. I doubt the feasibility of the application of the statistical methods. First, the PCA application in determining the water sources implies that the relationships between the solute concentrations of each source (at least) are temporally constant. However, this is not the case at least for snow and glacier meltwater. Authors did not even mention the fractionation process of solutes and the phenomenon of preferential elution in melting snow and glacier. Please see Leivestad and Muniz (1976), Johannessen and Henriksen (1978), Davies et al. (1982) and Goto-Azuma (1998). Second, isotopic processes and isotope concentrations of snow/water are independent of solute transport processes and concentrations. Thus the PCA application which involved both solutes and isotopes (Table 1) lacked physical basis. Please see Zhou et al. (2008a,b; 2014) for isotopic processes of snow/glacier melting.

4. It was concluded that soil water is an important source. However, no soil water was sampled at all. They mentioned some spring samples only. I don't think that spring water can be regarded as soil water. Spring water could be of different types of origin.

5. Glacier meltwater samples were collected at the outlet of a sub-basin (Fig. 1). I doubt that those samples were entire glacier meltwater samples because glacier generally covers only a small part of a basin. In the case of raining or much snow in the basin, glacier meltwater could only account for a small portion of the entire discharge at the outlet. The discharging process could last for quite a long time after raining, depending on the basin scale. Moreover, only one site is seen for glacier meltwater sampling (Fig. 1). Glacier distribution in the entire catchment is unknown.

6. Analysis is lacking on the hydrological, solute and isotopic processes throughout the manuscript.

Based on the above, I can not recommend publication of the manuscript in the present

HESSD

11, C3244–C3247, 2014

form.

Specific comments

1. Fig.1: Elevation distributions in the catchment can not be seen. It should be colored.

2. P7, Line 10: Give the altitude of the meteorological station.

3. Fig.3: Change to normal form. Readers need to know the extents of the variables.

4. P16, Line 10: Specify what kinds of the solutes were neglected.

5. P18, Line 5: The assumption should be justified.

6. P27, Lines 2-4: Move the words to the method section.

7. P15, Lines 6-7: There are many other causes, not only this one. See Zhou et al. (2008a,b; 2014).

8. Fig.5: Specify the datasets: from within the catchment? Or from the outlet?

9. Fig.4: These data need also to be shown with a figure of temporal variations.

10. P15, Section 4.3: Most statements are incorrect and should be re-written. Refer to Zhou et al. (2008a,b; 2014).

11. Results section: Should be re-written. Too many statements on the methods.

References

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