Hydrol. Earth Syst. Sci. Discuss., 9, C3619–C3622, 2012
www.hydrol-earth-syst-sci-discuss.net/9/C3619/2012/

Hydrology and Earth System Sciences Discussions

Interactive comment on "Impact of elevation and weather patterns on the isotopic composition of precipitation in a tropical montane rainforest" *by* D. Windhorst et al.

Anonymous Referee #1

Received and published: 7 August 2012

General comment: This paper deals with the isotopic composition of precipitation in the San Francisco valley, along the eastern slope of the Andes in Ecuador. The authors explore two potential effects on the isotopic composition of precipitation: the altitude effect and the influence of air masses origin. The paper is well written although there are numerous repetitions from one section to another and important details are missing both in the text and on the Figures (see moderate to minor comments). Though the importance of the topic can be understood, their analyses are based on only 26 rain events (from September to December) which is questionable to draw a robust conclusion. Regardless, the authors reliably discuss the altitude effect. However, my main

concern deals with the impact of prevailing air masses. One of the major conclusions of the paper is that a specific isotopic signature of precipitation can be found during the times of SE trade winds. I find this conclusion highly speculative in respect to their poor analysis. Indeed, the authors claim that the isotopic composition of precipitation (deuterium and deuterium excess) in the investigation area is significantly higher when air masses originate from the Southeast. However, the authors do not demonstrate this relationship. Where is it shown that there is a robust link between SE trade winds and isotopic signature? Figure 5 is highly confusing (see my suggestions at the end). In addition, it seems to me that some SE trade winds are still recorded for some of the rain events after mid-October: do those rain events exhibit high deuterium excess, high isotopic composition (maybe the trend should be removed)? Thus, I strongly suggest calculating back trajectories (for example, HYSPLIT model can be use online at http://ready.arl.noaa.gov/HYSPLIT.php) to investigate the potential relationship between isotopic composition and air masses origin. Then, a robust point-by-point analysis could be done by examining the isotopic signature of each event regarding the air mass origin. Actually, my feeling is that the high isotopic composition from September to mid-October and the decreasing trend from mid-October could be also related to other factors such as an increase in precipitation amount upstream the sites of collection. With this these regards, I don't think the manuscript is at the level of publication in HESSD in the present form and major to minor comments will have to be addressed in a revised version.

Moderate to minor comments: Page 8429 - Hypothesis 1 is unclear. It assumes that there is no dominant effect responsible for the depletion of the water stable isotopes signal. Which depletion is concerned by this assumption? Is it the isotopic depletion of air masses originating from the Atlantic Ocean or is it the isotopic depletion of air masses observed along Andean slopes? Or is it the isotopic depletion from mid-October? Page 8430 - Lines 7-8: over which period precipitation amount are given? - Lines 9-10: the fog input is not clear. How does it form? What is the water origin? Does the fog input exhibit seasonality? Page 8433 - Line 3: please mention that these preci-

sions lead to a quadratic uncertainty of 1.7 per mil for deuterium excess. - Lines 4-14: 3 precipitation collectors are set up at each site. I am wondering about the scattering of the isotopic composition of the 3 precipitation samples for one site for each rain event. Can the authors mention some information (for example one sigma per event and per site, the mean sigma for the 26 events for one site)? - Section 3: If I understand well, there were only 26 common events between the 4 sites, right? But how many samples were collected at the lowest station compared with the highest station? - First paragraph of section 3: please, give the range of the isotopic composition for each site. The -16.5 to 2.7 per mil range for oxygen 18 is comparable with the range of isotopic values found by Villacís et al. (2008) at Nuevo Roca Fuerte, upstream the San Francisco valley. Please mention this study (M. Villacís et al., Analysis of the climate controls on the isotopic composition of precipitation (d18O) at Nuevo Rocafuerte, 74.58W, 0.98S, 250 m, Ecuador, C. R. Geoscience 340, 2008). - Please show on Figure 2 precipitation amount at each site. Please discuss the relationship between precipitation and the isotopic composition of precipitation. The authors can also investigate the role of rainout upstream following the method done by Villacís et al. (2008). - Line 18: where is the Amaluza GNIP station? How many isotopic data are available from 1992 to 1994 over the September-December periods (is it a continuous record)? - Line 27: high intercept can also be a signature of arrivals of recycled air masses in the valley Page 8434: - Lines 1-3 are not useful. - Line 12: please give one sigma for deuterium and oxygen 18 mean altitude effect. Indeed, according to Figure 3, the altitude effect is significantly different from one event to another. - Lines 15-17: Regarding the 3 dates for which a negative lapse rate is shown: it is possible that different air masses precipitate at the different sampling sites, isn't it? - According to Figure 4, an altitudinal effect is seen on deuterium excess. Can the authors mention and discuss it here instead of at the end of section 3-3? In general, I would include the discussion of section 3-3 in sections 3-1 and 3-2. - Start of section 3-2: Geographic origin of air masses is one of the potential controls on the isotopic composition of precipitation. But, other factors can be involved. For example, in the recent study done by Vimeux et al. (2011), no significant

relationship between air masses origin and isotopic composition of precipitation was found at the event-scale in a similar valley in the Andes. Page 8435 -Line 11: is the associated figure, figure 2? Page 8436 - Lines 8-13: The seasonal effect on deuterium excess mentioned in those studies is a seasonal effect. I mean that those studies do not claim that there is a relationship between deuterium excess and precipitation at the event-based scale.

Figures and Tables Table 2: the study done by Shugui et al. (2003) in EPSL could be added. Figure 1: please locate the investigation area by indicating longitudes and latitudes. Figure 2: there is no need to show both deuterium and oxygen 18. The authors could only show one isotope and add deuterium excess (Figure 4) on Figure 2. This could allow the reader to see if any relationship exists between deuterium and deuterium excess for example. Please also add on this Figure precipitation amount for each site. Please mention in the caption where is the Amaluza GNIP station and how many data are available for each month. Figure 3: please add deuterium excess on this Figure to illustrate the altitude effect mentioned at the end of section 3-3. Figure 5: This figure is highly confusing and should be improved. For example, the authors could mention which direction corresponds to southeasterly winds and use a different color for this case. They could also indicate only the mean wind directions during one rain event, separating the different climate stations (so for example, we will see only 4 markers on the Figure for one rain event, with a specific color for SE origin and a specific code to distinguish the climate stations).

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 8425, 2012.