

Interactive comment on “Tracking the direct impact of rainfall on groundwater at Mt. Fuji by multiple analyses including microbial DNA” by Ayumi Sugiyama et al.

Anonymous Referee #1

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Review of “Tracking the direct impact of rainfall on groundwater at Mt. Fuji by multiple analyses including microbial DNA” by Sugiyama and others

General comment: In this manuscript, the authors were trying to state that the information from microbial DNA in groundwaters was useful as a tracer to determine the contributions of runoff components. Presented data and descriptions include interesting and important information in groundwater pathways in the volcanic environments. However, there are several points have to be improved before publication in Biogeosciences.

1. For the essential part of discussions in this manuscript, it has been assumed that

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the sources of transported bacteria were mainly situated in the soil horizons, and the sources of archaea were mainly in the “geologic layer”. These assumptions may be common recognitions for general microbiologists. But, I feel there is a necessity to show evidences for guaranteeing these assumptions. Or, at least the authors have to explain how these assumptions were likely in this study site. 2. In “Introduction”, the authors are telling:

“Whereas stable isotopic and 25 chemical analyses show average values of the water originated from various sources, microbes transported by groundwater suggest the route and place where they proliferated through their eco-physiological characteristics constrained by their optimal growth condition.”

If the source locations (distributions) of each microbe could be specified, pathways and origins of specific water sources could be identified. If the habitat of a microbe expanded in large spatial area, specifying capability of this microbe were low. Generally, this tendency can be applied also to isotope and chemical tracers. There is another issue. Conservativeness is also important for tracers. If you need to estimate relative contributions precisely of multiple end members, all tracers have to be conservative. In this point, microbial DNA may have disadvantage, because they may proliferate not only at the source points (area), but also in the pathways toward destinations. I think that the microbial DNA is a certainly useful tracer, but it can show its high capability being accompanied with other multiple tracers, such as isotopes and chemical tracers. The logic behind the above sentences was exaggerating the capability of microbial DNA as a tracer, if the authors can not show the sufficient evidences or generally accepted recognitions on the characteristics of microbial DNA as a tracers (spatially specific source and conservativeness).

Individual comments: P2, L2-5

“Though runoff process of stream water and runoff peak response time of streams influenced by rainfall have been well studied (e.g., Hubert et al., 1969; Onda et al.,

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1999; Asai et al., 2001; Tekleab et al., 2014), runoff processes of groundwater affected directly by rainfall is not precisely explained.”

Cited references were not always representative literatures for stating L1-2. For example, Dunne and Black (1970), Beven and Kirkby (1979), Burns et al. (2001), etc. many fundamental studies should be cited.

Dunne, T., and R. D. Black (1970), Partial area contributions to storm runoff in a small New England watershed, *Water Resour. Res.*, 6(5), 1296– 1311, doi:10.1029/WR006i005p01296.

Beven, K. J., and M. J. Kirkby (1979), A physically based, variable contributing area model of basin hydrology, *Hydrol. Sci. Bull.*, 24(1), 43– 69.

Burns, D. A., J. J. McDonnell, R. P. Hooper, N. E. Peters, J. E. Freer, C. Kendall, and K. J. Beven (2001), Quantifying contributions to storm runoff through end-member analysis and hydrologic measurements at the Panola Mountain Research Watershed (Georgia, USA), *Hydrol. Processes*, 15(10), 1903– 1924, doi:10.1002/hyp.246.

The statement of this sentence was not true. Many hydrological studies explained runoff processes of groundwater affected by rainfall.

e.g. McDonnell JJ, Bonell M, Stewart MK, Pearce AJ. (1990), Deuterium variations in storm rainfall: Implications for stream hydrograph separation. *Water Resources Research*. 26(3):455-8.

Kendall, C. and McDonnell, JJ (1993), Effect of intrastorm isotopic heterogeneities of rainfall, soil water, and groundwater on runoff modeling. *IAHS Publication*, 215, 41-48.

Figure 1: Why the unit of depth in the legend panel was m-1?

The line 3 – 5 of the caption was not formed a complete sentence. No indication for “Shibukawa” and no mark for “SP-0m” in the map.

Table 1: Is it possible to show the summary of isotope measurements?

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