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Using stable water isotopes to delineate dominant flow path along hillslopes under varying land uses in a tropical mountain region of South Ecuador

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Knowing the dominant flow paths within a hydrological system is challenging and crucial to assess the relevant discharge generating processes and the fate of water and solutes in the system.
However especially the interpretation of those path ways seems controversy within our study area of the Rio San Francisco in the outskirts of the Amazon basin in a tropical mountainous region of South Ecuador. E.g. the recorded flashiness of the hydrograph contravenes the long mean residence time and hydrogeochemical signature of the event water marking it as old water. Even though theories exist which could reveal these contradictions (e.g. the concept of transmissivity feedback which could be used to explain the rapid mobilization of old water) proof is currently missing to support those concepts.
To further study the fate of the water and water pound solutes we installed along two hillslopes (length about 500m each and decline 230m under forest and 157m under pasture) three wick samplers collecting weekly bulk samples of soil water in 10, 25, 40 cm depths for 2 years. The isotopic signature (δ18O and δ2H) of the soil water as well as the incoming rainfall was analyzed using an isotope laser spectrometer (Picarro).
We propose the usage of stable water isotopes as conservative tracers to validate a 2D setup of the Catchment Modeling Framework (CMF) simulating the water flow and fate of solutes along the hillslopes. The usage of conservative tracers, such as δ18O and δ2H, to validate hydrological models, bears the advantage that not only the amount of transported solute needs to be correctly simulated but also the concentration of the modeled tracer needs to be correctly accounted for. Model structures derived by such a tracer driven calibration procedure thereby are more likely to represent the actual nature of the hydrological system.
Results proving the suitability of the model setup to reproduce the collected isotope data will be shown and the discharge generating processes at hand will be presented.
The results of this study will be most helpful while implementing the correct model routines for further assessments on a catchment scale and to ease the interpretation of previous studies conducted within the same study area.