



Chemical weathering in a multi-layer aquifer-dominated watershed under intensive agriculture conditions: the Orgeval Critical Zone Observatory, France.

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Extensively instrumented and monitored over the last 50 years, the Orgeval Critical Zone Observatory in France is an observation site in a landscape impacted by agriculture and more importantly since the 1960's. Rivers from the Orgeval watershed are typical multi-layer aquifer fed rivers in a sedimentary basin context. The Orgeval observatory represents a choice place to appreciate the response and resilience capability of the critical zone under an anthropic stress such as the intensive agriculture activities. We have investigated the chemical composition of the different water bodies through the critical zone from the rain to the outlet over one and half hydrological year. We show that elemental and strontium isotopic ratios are adapted to determine the origin of the elements in two nested streams of the critical zone. The chemical weathering of limestone and gypsum dominates water quality at the outlet. The mixtures of water masses inferred by our data are in good agreement with the hydrological knowledge of the watershed. The weathering of rocks released about 50 t/km²/yr. A significant part is leached from atmospheric local dust (20%) especially during the dry season. It seems that these local dusts present in the lower atmosphere constitute a sort of supra layer on the top the critical zone defining the upper boundary of the critical zone. The input of ocean-derived solutes through the rainfalls represents 7 t/km²/yr, therefore significant to the CZO, and in the order of magnitude of the net fertilizer input (10 t/km²/yr). Including physical erosion rates taken from the literature, we estimate that the total denudation rate of the Orgeval CZO is 20 mm/1000 yr, among the lowest chemical denudation rates for carbonate terrains, similar to the rates determined for the entire Seine watershed. This suggests that agricultural practices are not particularly enhancing chemical weathering rates in the Orgeval CZO, in contrast to literature studies on other monitored agricultural streams.