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Gaiagraphy of the critical zone: water and carbon in two contrasted CZOs.

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The critical zone is the habitat of mankind: the zone from which extract most of our water, on which we produce our food and build our civilizations. This is a zone of planetary reaction fuelled by two sources of energy. One is radiated from above – by the sun-, the other is radiated from below – by the deep earth-. The Sun's energy activates the evaporation of the ocean and the circulation of water masses at the surface of our planet while deep earth energy activates plate tectonics, mountain building, hydrothermal and volcanic activity. Their combination is responsible for the existence of the water cycle on the planet that triggers a whole bunch of transformations converting the rocks into soils, consuming CO_2 from the atmosphere, regulating O_2, and supplying nutrients to ecosystems and Life.

The critical zone is so thin that it is hardly visible on the conventional representation of the Earth (atmosphere, ocean, lithosphere, mantle, core). In order to highlight the value and utmost importance of the critical zone in planet-wise biogeochemical cycles, Arènes et al., have proposed in 2018 a new global representation of the Earth, in which the solid Earth is no longer located at the center, but expelled to the surface, while the critical zone now lies at its center. This representation was called a Gaiagraphy by these authors.

Here we will apply this new representation to two tropical critical zone observatories: Luquillo CZO and Guadeloupe CZO in the Lesser Antilles. Based on the long-term data collected by the two observatories, we will present a gaiagraphic view of the local carbon and water cycles. We advocate that this new way of representing the critical zone is more capable of "animating" the exchanges of matter and energy between the Critical zone compartments (rocks, soil, water, biota atmosphere) when compared to the traditional critical zone diagrams. It also allows us to represent the different residence times of carbon and water in those compartments graphically and to take all timescales into account. The Gaiagraphy also draws attention to poorly estimated material flows in standard observations of the critical zone.