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Combined response of biodiversity, carbon cycle, and climate to the eruption of the Siberian Traps.

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Numerous studies have pointed at a direct causal link between the end-Permian mass extinction and the eruption of the Siberian Traps (Burgess et al., 2017). Geochemical tracers indeed suggest that large carbon cycle and environmental perturbations at that timeare related to magmatic pulses. Corresponding paleontological data also record the worst mass extinction of the Phanerozoic. The subsequent biotic recovery was likely faster than previously thought, although this crucial interval was marked by alternating diversifications and secondary extinctions phases (Brayard et al., 2009).

Several modeling studies have investigated the geochemical and climatic consequences of the magmatic pulses (Berner, 2003; Grard et al., 2005). Those models included the calculation of the bioproductivity and biomass in the ocean, but never the biodiversity and its associated fluctuations, making the direct comparisons of the model outputs with the paleontological record hardly impossible.

Here we present the results of preliminary numerical experiments coupling a climate-carbon cycle model (GEOCLIM) with a numerical model describing a simple oceanic ecological network composed of one basal level of primary producers and three higher levels of consumers. Characteristics of the simulated species (tolerances to temperature changes, biotic interactions such as competition and predation, etc.) are stochastically fixed. This model coupling allows us to explore the feedbacks between the geological and ecological processes across the Permo-Triassic boundary. Any change in the environmental conditions modifies the ecological network, and in turn the biomass evolution. Finally, the burial of sedimentary organic carbon on the seafloor and the atmospheric CO_2 level are then changed.

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