EGU2020-20315
https://doi.org/10.5194/egusphere-egu2020-20315
EGU General Assembly 2020

New insights about the processes leading to marine extinction at the K-Pg boundary using a coupled biogeochemical-ecosystem model

Le Hir Guillaume[1], fluteau fréderic[1], Hennequin Salome[2], and Goddéris Yves[2]
[1]Institut de Physique du Globe de Paris, Paris, France (lehir@ipgp.fr)
[2]Geosciences Environnement Toulouse

If most experts agree that the Cretaceous-Paleogene (K-Pg) extinction (66 Ma) resulted from a combination of the Chicxulub impact and of Deccan volcanism, the chain of reactions (Bond and Wignall, 2014) leading to the extinction is not well constrained.

In the present study, we use the GEOCLIM model to explore extreme perturbations induced by the two events and to investigate processes leading to the marine extinction. This state-of-the-art numerical tool (geoclimmodel.wordpress.com) includes in particular a marine ecological model in which food webs are simulated and marine organisms are sensitive to abiotic factors of their environment. The characteristics of each “species” of marine organisms, such as the tolerance to pH or temperature changes or the efficiency of predation, are randomly fixed to avoid any determinism in the response to the environmental perturbations.

The response of the Earth system to the onset of Deccan traps and to the Chicxulub impact is explored by forcing the model with the most recent “eruptive sequences” (Schoene et al., 2019, Sprain et al. 2019) and with the assumption of a pulse-like degassing (Chenet et al. 2009) sequence over 500 kyrs that includes CO2 and SO2. This new approach allows us to take into account the interplays between the sulfur and carbon cycles on multiple time scales (from year to 105 yrs) and to capture the model sensitivity to the uncertainties in atmospheric emissions (duration, timing, nature of gases, intensity of pulses, intensity of the impact).

The coupled evolution of the Earth’s climate and oceanic geochemistry during the K-Pg boundary crisis will be presented. Without considering evolution processes, the biotic response (biomass and biodiversity) will be discussed with respect to the ecosystem structure existing before the perturbations.