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Mass extinctions, recovery and resilience

Simulations of the environmental effects of the Chicxulub impact imply important contribution to the end-Cretaceous mass extinction

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During the end-Cretaceous mass extinction 66 million years ago, non-avian dinosaurs and many other organisms became extinct. Whether this most recent of the five largest mass extinctions was caused by flood-basalt eruptions or the impact of a large asteroid impact is still under debate. Modeling the climatic effects of the Chicxulub impact can therefore help to assess the possible contribution of an impact to the end-Cretaceous mass extinction.
We investigate the climatic effect of sulfate aerosols and carbon dioxide using a coupled ocean-atmosphere model. Additionally, we explore the biogeochemical effect of sulfur, carbon, iron and phosphate added into the ocean during the impact using a marine biogeochemistry model.
We find a strong decrease of global surface air temperatures by at least 26°C, returning to pre-impact temperatures after about 30 years. The strong ocean mixing induced by the cooling leads to changes in the oxygen distribution, with significantly higher concentrations in the deep ocean 30 to 300 years after the impact. Net primary productivity ceases in the first years after the impact. However, with light returning it exceeds the pre-impact value already after less than 10 years due to the higher availability of iron and phosphor.
The strong environmental perturbations found in our simulations indicate a significant contribution of the impact to the end-Cretaceous mass extinction.