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Severe environmental effects of Chicxulub impact imply key role in end-Cretaceous mass extinction

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66 million years ago, during the most recent of the five severe mass extinctions in Earth's history, non-avian dinosaurs and many other organisms became extinct. The cause of this end-Cretaceous mass extinction is seen in either flood-basalt eruptions or an asteroid impact. Modeling the climatic changes after the Chicxulub asteroid impact allow to assess its contribution to the extinction event and to analyze the short-term and long-term response of the climate and the biosphere to the impact. Existing studies either investigated the effect of dust, which is now believed to play a minor role, or used one-dimensional, non-coupled models. In contrast, we use a coupled climate model to explore the longer lasting cooling due to sulfate aerosols. Based on data from geophysical impact modeling, we set up simulations with different stratospheric residence times for sulfate aerosols. Depending on this residence time, global surface air temperature decreased by at least 26°C, with 3 to 16 years subfreezing temperatures and a recovery time larger than 30 years. Vigorous ocean mixing, caused by the fast cooling of the surface ocean, might have perturbed marine ecosystems by the upwelling of nutrients. The dramatic climatic changes seen in our simulations imply severe environmental effects and therefore a significant contribution of the impact in the end-Cretaceous mass extinction.