RELATIVE ROLES OF IMPACT-GENERATED AEROSOLS ON PHOTOSYNTHETIC ACTIVITY FOLLOWING THE CHICXULUB ASTEROID IMPACT

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Wednesday, October 13, 2021
2:55 PM - 3:10 PM
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Abstract

Extreme atmospheric perturbations by impact-generated climate-active aerosols ensuing the Chicxulub impact caused a global-scale catastrophe on the Earth's flora and fauna 66 million years ago [1]. Following a rapid atmospheric heating (days to weeks) by the impact ejecta plume, recent studies show that the post-impact climate transitioned into a prolonged (months to years) impact winter conditions [2-5]. The impact winter is driven by massive aerosol injections (e.g., dust, sulfate and soot), causing severe atmospheric perturbations, leading to the the suppression of photosynthesis [6] and thus mass extinctions at the end-Cretaceous.

Here, we further investigate the evolution of environmental conditions by global circulation model (GCM) simulations using our in-house GCM code (asteroidImpactWRF [7]), based on a planetary atmospheric model [8]. Our main focus is to understand the duration and magnitude of impact winter conditions due to impact-generated aerosols, and therewith assessing the cessation of photosynthesis in terms of the photosynthetically active radiation (PAR). To determine the amount and physical properties of simulated aerosol scenarios (dust, sulfate and soot), we use the inputs reported in [9-10]. Besides, the dust particle size distribution (psd) is constrained by the laser-diffraction grain-size analysis of clay-rich K-Pg boundary sediments from a recent field study in North-Dakota, which is key to govern the atmospheric lifetime of dust particles. Finally, we further discuss the potential implications of the Chicxulub impact, by examining the ecological response to impact aerosol emissions.

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