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Climatic and ecological responses to medium-sized asteroid collision

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There is a chance of 1 in 2,700 that asteroid Bennu will hit Earth in 2182 CE. The collision of such medium-sized asteroids (~0.3-1 km in diameter) with our planet can inject massive amounts of dust into the atmosphere, with unknown consequences for terrestrial and marine ecosystems. Here, we use the coupled high-top Community Earth System Model Version 2 (CESM2) with interactive chemistry to investigate how medium-sized asteroid strikes would impact climate, vegetation, and marine productivity. Our idealized simulations show that globally dispersed dust layers of up to 400 Tg in mass block shortwave radiation to the surface for nearly two years, resulting in rapid global cooling and delayed weakening of the hydrological cycle for up to four years after the impact. The combined effects of reduced sunlight, cold temperature, and decreased precipitation significantly inhibit photosynthesis in the terrestrial ecosystem for almost nineteen months. Marine phytoplankton production decreases moderately within five months due to reduced sunlight. Subsequently, however, and depending on the iron amount of the asteroid, large diatom blooms occur over the eastern equatorial Pacific and Southern Ocean due to iron fertilization from strong upwelling and dust deposition, respectively.