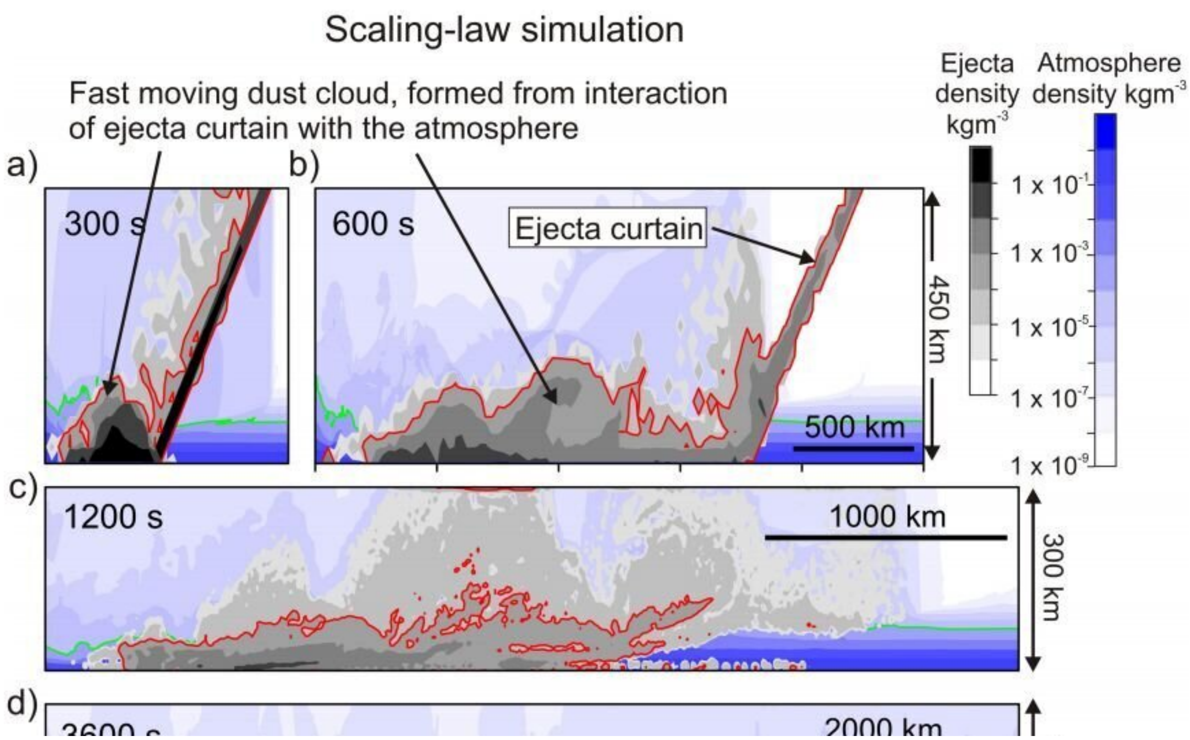
Simulation: Dust could have spread evenly over Earth after Chicxulub asteroid strike

March 26 2020, by Bob Yirka



Simulation of ejecta traveling away from the Chicxulub impact site after (a) 300, (b) 600, (c) 1,200, and (d) 3,600 s. Initial mass-velocity distribution within the ejecta curtain is derived from scaling laws (Housen & Holsapple, 2011). Particle SFD exponent value b = 0.8. After 1 hr, some ejecta have traveled up to 8,000 km from the impact site, are at altitudes of >50 km, and are still moving at velocities >1 km s^{-1} . Ejecta closer to Chicxulub (LHS in Figure 1d) are traveling at lower altitudes and slower speeds, will settle through the atmosphere, and be deposited relatively close to the impact site. Red (dust) and green (atmosphere) lines correspond to a density of 1×10^{-4} kg m^{-3}. Credit: *Geophysical Research Letters* (2020). DOI: 10.1029/2019GL086562

Two researchers, one with the Planetary Science Institute, the other Imperial College, have created a simulation that they believe shows how dust could have spread so evenly over the whole Earth after the Chicxulub asteroid strike. In their paper published in the journal *Geographical Research Letters*, Natalia Artemieva and Joanna Morgan describe the arduous process by which they studied what happened after the asteroid strike that killed off the dinosaurs, and what they learned.

When a volcano erupts, volcanic dust travels through the air and eventually drops to the ground. Places closer to the volcano wind up with deeper carpets of ash and dust because the dust is dispersed as it travels away from the volcano through the air. The same should be true for dust and debris kicked up when an asteroid strikes the ground—that's what happens in most cases. But when the Chicxulub asteroid hit the ground near what is now the Yucatan peninsula, the dust it kicked up settled in an even coat over the entire Earth. How this might have happened has been a mystery until now.

To find the answer, Artemieva and Morgan embarked on a research mission that wound up spanning an entire decade. They studied asteroid strikes, large volcanic eruptions and even explosions, looking for a similar incident. But it was not until they analyzed the comet Shoemaker-Levy 9 striking Jupiter that they found what they had hypothesized: an impact could result in dust spreading horizontally over a very widespread area. And better yet, the whole scenario had happened in modern times, allowing it to be recorded—and allowing the researchers to watch the proceedings unfold.

They found that the reason the dust was able to spread was because it warmed the atmosphere once it arrived there, which created a conveyance system. With that discovery in hand, the researchers went back to their lab and created a simulation showing the dust from the Chicxulub strike warming the atmosphere. And just as happened on Jupiter, the simulation showed the dust being carried horizontally—in their case, all over the Earth—before it finally fell back to the ground in even amounts.

More information: Natalia Artemieva et al. Global K-Pg Layer Deposited From a Dust Cloud, *Geophysical Research Letters* (2020). DOI: 10.1029/2019GL086562

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