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"EFFECTIVE HEIGHT OF BURST" REVISTED

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ABSTRACT

In 1993, Chyba et al. used a pancake model to argue that the 1908 Tunguska airburst was due to a stony asteroid. To estimate the effects at the surface, they used the altitude of maximum energy deposition as a proxy for the equivalent static height of burst and used the scaling laws from nuclear weapons effects literature. After the 1994 impact of Comet Shoemaker-Levy 9, different modeling groups came to different conclusions about the maximum depth achieved by fragments, with the Sandia group arguing for deeper penetration due in part to continued downward flow of vaporized comet after energy deposition was complete. At the 2007 Planetary Defense Conference, Boslough made a similar case for Tunguska, arguing that the "effective height of burst" can be significantly lower than the altitude of maximum energy deposition and concluding that the observed damage can be attributed to downward-directed airburst with a lower total kinetic yield (3-5 Mt as opposed to 10-20 Mt). Recent work by Wheeler & Mathias (2019, in press) rejects the notion that the effective height of burst is lower than the peak energy deposition point, and concludes (in part on that basis) that the most probable Tunguska-scale yield is 20-30 Mt. Because a Tunguska-scale airburst is by far the most likely NEO disaster to take place in our lifetimes, risk assessments rely heavily on our estimates of damage as a function of size and frequency. More certainty in our quantitative risk assessments will require that we converge on a consensus about the size of the Tunguska event, which in turn requires that we come to an agreement on the difference (if any) between "effective height of burst" and peak energy deposition altitude. To this end, we will present new CTH and RAGE simulations in which we isolate that effect as a function of a wide range of impactor mass, entry angle, and velocity.

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