REEXAMINING THE IGNITION REQUIREMENTS FOR POST-IMPACT WILDFIRES AND THE THRESHOLD FOR SIGNIFICANT ENVIRONMENTAL CONSEQUENCES.
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Introduction: Local fires can be generated around an impact site by direct radiation from a fireball [e.g., 1] and over larger (perhaps global) regions by atmospheric heating caused by a reaccreting high-energy, vapor-rich plume [2] and possibly extended sheets or rays of lower-energy ejecta. In the case of the 1908 Tunguska blast, which detonated 6-10 km above a Siberian taiga, fires were ignited by a thermal radiation pulse over a 200-500 km^2 area [e.g., 3]. In the case of the Chicxulub impact event at the K/T boundary, fires may have been generated over a much larger region, generating a globally distributed layer of soot [e.g., 4] and possibly localized deposits of charcoal and related residues in North America [e.g., 5; cf., 6]. Recent calculations suggest the Chicxulub fires may have been ignited in some areas of the world and not others, because sufficient mass for the atmospheric heating needed for ignition may not have reaccreted above all areas around the globe [7].

Implications: This suggests that the Chicxulub impact event may be near the threshold size event needed to generate globally distributed fires. If so, then the distribution of fires will depend on projectile trajectories (different for each impact event), the position of the impact relative to the geographic distribution of forested continents (also different for each impact), and the mass incorporated into ejected plumes of material (values that are currently based on model simulations, but still uncertain).

It also implies that other parameters affecting the ignition of fires need to be scrutinized in more detail. Spontaneous ignition of wood is typically produced with 40-70 kW/m^2, depending on the species of tree, its moisture content, and the time it is exposed to heat. If there is an ignition source (e.g., lightening), then only 12 kW/m^2 may be needed. Forest litter (e.g., pine needles) may be easier to spontaneously ignite than wood when temperatures are in excess of 300 °C, but not necessarily at lower temperatures. Variations in these parameters can have a dramatic effect on the extent of wildfires generated by reaccreting ejecta.

Among relatively small impact events, ignition from the fireball may be more important than ignition from a hot atmosphere created by ejecta. However, the intensity of irradiation energy needed to ignite vegetation is far greater for a fireball source, because the period of radiation exposure is far shorter. Measurements of luminous irradiation effects around nuclear test blasts suggest a factor of 4 to more than an order of magnitude more irradiation energy may be needed, depending on the size of the impact.

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