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Impact Effects & Consequences

Asteroid Impacts and Cascading Hazards

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ABSTRACT

The initial effects from an asteroid impact are generally well characterized and include thermal radiation and blast waves. If the impactor is sufficiently large, either an earthquake or tsunami can also result, depending on whether the impact occurs over land or water. However, the longer-term effects that extend beyond the area initially affected are less well characterized. These longer-term regional effects can generally be categorized as either downwind or as downstream. Downwind events are primarily from the plume that forms from either the debris from an air burst and (or) the ejecta of a surface impact. This type of regional effect will disrupt transportation hubs and corridors within a few hours of impact and may have longer term effects on agriculture and human health. We suggest volcanic plumes are an analog for downwind effects. The regional area affected will depend on both the impactor size and the weather patterns at the time of impact. Downstream effects can result in the cascading effects of debris flows and flooding, both of which result from the initial impact damage and weather-triggering events, such as seasonal monsoons. We suggest extreme wildfires that occur in major watersheds are appropriate analogs for downstream effects as the wildfire-induced damages also combines with post-fire weather events that result in debris flows and floods.

Because regional effects not only depend on the size of the impactor, but also on the location and timing of the event, case studies of impact events in various regions should be conducted to better understand how asteroid impact induced cascading hazards may vary. For this study, we use the initial impact effects from an 800-m asteroid strike at two locations: Dallas, TX, USA and Jebba, Nigeria. These two locations are both along the initial risk corridor for the 8th Planetary Defense Conference exercise and provide a contrast in seasonal weather patterns, regional topography, population distributions, and seasonal economic activity (e.g., agriculture). For exercise purposes, the impact occurs in late October. The prevailing

winds in Texas are generally from west to east, thus blowing the dust in a predictable direction. A multi-state region could be affected. For Nigeria, the prevailing winds are reversed, blowing from the east. Several nations in sub-Saharan west Africa could be adversely affected.

For downstream effects, topography determines where the cascading effects are likely to occur. Texas topography is generally rolling hills and plains that slope towards the Gulf of Mexico. There are several river basins that could be affected by the impactor. Cascading hazards, such as flooding that could be triggered by seasonal rains, could affect downstream communities, such as Galveston and Houston. Jebba, located in central Nigeria on the Niger River, is mountainous terrain. Preliminary analysis suggests that most of the downstream effects will occur along the Niger river. The communities along Niger River already experience seasonal flooding that annually result in loss of life and economic damage. A more detailed analysis of the regional impacts on Texas and Nigeria will be presented at the time of the conference.

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Comments:

((Oral presentation preferred; will try to attend in person if funding allows))