

**PDC2025**  
**Stellenbosch, Cape Town, South Africa**

**Hypothetical Asteroid Threat Exercise**

**LAMB WAVE DRIVEN TSUNAMI DAMAGE QUANTIFICATION ALONG THE 2025  
PDC RISK CORRIDOR**

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Recent events and research have uncovered an additional potential contributor to global risk estimates from airburst and impact events, the Lamb-wave driven global tsunamis. The 2022 explosion of Hunga Tonga–Hunga Ha’apai (HTHH) generated a global Lamb wave that created tsunami waves in the oceans around the world where the water depth provided the conditions needed to create a Proudman resonance, where the velocity of the driving wave (Lamb wave) is close to that of the driven wave (tsunami). We have modeled Lamb-driven tsunamis for HTHH, as well as for the 1883 Krakatau eruption, that match the tsunami observations in terms of timing and amplitude. The simulations provided tsunami model verification and approximate Lamb wave scaling for variable explosion magnitudes. Given the scaling, our simulations have also demonstrated that, counterintuitively, explosions on land can also generate tsunamis. We have run scenarios for the Laacher See volcano, Tunguska airburst, Meteor Crater, and the 2023 PDC scenario with impacts in Dallas and Nigeria. All cases result in global tsunamis of various amplitudes.

For Epoch 1 of 2025 PDC, the risk corridor runs north-south from the Arctic to Antarctic, traversing Europe and Africa. One of the planetary defense data products is a graph of various components of damage (e.g. air blast, heat, etc.) as a function of location along the corridor. Most of the damage is caused by effects that decrease from distance from ground zero, so these graphs tend to strongly reflect the variation in population density along the corridor. By contrast, most of the damage from a global tsunami will be along coastlines that are nowhere near the impact point, even if it is on land. The variation in global damage as a function impact location is not intuitive because tsunami generation depends on ocean bathymetry, which dictates how strongly the Lamb wave couples as it moves along a great circle path. Tsunami run-up distances are a strongly non-linear function of impact location because the coupling and propagation are highly nonlocal and nonlinear. Our results will be compared with other components of the impact damage to assess contribution of this new potential impact.

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**Comments:** *Oral*