PDC2017
Tokyo, Japan

IAA-PDC-17-06-04

☐**XX Impact Consequences**

Contribution of Asteroid Generated Tsunami to the Impact Hazard

David Morrison and Ethiraj Venkatapathy
NASA Ames Research Center, Moffett Field CA 94035 USA
david.morrison@nasa.gov, ethiraj.venkatapathy-1@nasa.gov

Keywords: *asteroid, tsunami, impact hazard*

The long-standing uncertainty about the importance of asteroid-generated tsunami was addressed at a workshop in August 2016, co-sponsored by NASA and NOAA. Experts from NASA (Ames, JPL), NOAA, DoE (LLNL, SNL, LANL), DHS, FEMA, and academia addressed the hazard of tsunami created by asteroid impacts, focusing primarily on impacting NEAs with diameter <250m. Participants jointly identified key issues and shared information for nearly a year to coordinate their results for discussion at the workshop and to understand differences in the results obtained with different simulation codes. They used modern computational tools to examine 1) Near-field wave generation by the impact; 2) Long-distance wave propagation; 3) Damage from coastal run-up and inundation, and associated hazard. The workshop resulted in broad consensus that the asteroid impact tsunami threat is not as great as previously thought. See website *https://tsunami-workshop.arc.nasa.gov/workshop2016/*

Primary workshop findings were: (1) Airbursts over water are not likely to generate substantial waves. Water impacts produce waves that are quite different from seismically generated tsunami, having shorter wavelength and higher turbulent dissipation. (2) In the case of airbursts and ocean surface impacts from NEAs <250m diameter, most damage to coastal populations is limited to impacts close to the shore, in which case the direct blast damage may be more important than the wave. Detailed evaluation of the inundation is highly dependent on the near-shore bathymetry and shore configuration; understanding these effects generally requires higher resolution models than those used in the workshop. (3) The risk from near-shore impacts may be important for considering individual cases, but they do not contribute significantly to the ensemble hazard. (4) The contribution of impact-produced tsunami to the ensemble hazard is negligible for NEA diameters below about 200m. For larger impacts, the tsunami hazard peaks at about an order of magnitude lower casualty rates than the hazard from land impacts.

Workshop participants noted the important difference between the treatment of risk from individual impacts and the ensemble risk from the entire asteroid population. Understanding the risk from individual impacts (such as those from the hypothetical NEA PDC2017) requires detailed knowledge (or assumptions) about the nature of the impactor and the target, taking into account ocean bathymetry, shore configuration, breakwaters, and distribution of infrastructure and population. In

contrast, evaluation of the global ensemble hazard, based on weighted averages over a wide range of conditions, can be estimated with less precise engineering models. Also, there is no uniform, accepted approach for how to estimate the cost associated with impact tsunamis, based on human casualties or infrastructure damage. It is important when discussing impact hazards to state clearly what metrics are being used. Finally, there is the challenge of properly analyzing and communicating the impact threat. The traditional metric based on average annual fatalities does not convey the rarity or severity of catastrophic events. Alternative formulations are needed as guides for decision makers and for communicating with the public.

****