PARAMETRIC STUDIES OF THE EFFECT OF BOLIDES IMPACTS ON EARTH OR THEIR NEAR-SURFACE AIR-BURSTS ON CRATERING.

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Introduction: The aim of these parametric studies is to enhance our understanding of impact processes of bolides on Earth whether on ground or waters. Moreover, large extra-terrestrial bodies often do not reach Earth as whole; they do usually airburst and fragment at certain altitude. If large enough, the subsequent shockwaves from airbursts could reach earth surface and create, if soil conditions are appropriate, depression on the ground. On the other hand, if the shockwaves reach the ocean surface they could lead to, for example, long water waves that can ultimately reach shorelines.

Impact parametric studies: We have conducted several set of numerical simulations using LLNL's eulerian hydrocode GEODYN [1] to simulate both impacts on ground and ocean surfaces. For the ground impact simulations, we have simulated different geological settings, i.e. granite, basalt, sandstone, limestone to name a few, impacted by different sizes of chondrite and nickel-iron impactors at different angle and speed of impact [2]. Similarly, for the ocean impacts, we have simulated several impact scenarios of different sizes, angles and impact speeds in different depth of ocean layer [3]; particularly where the impactor could reach the ocean floor leading to the formation of crater. GEODYN simulation results are then passed on to elastic wave propagation codes for either seismic wave or water wave propagation to receivers or sites of interest on the shoreline.

Numerical results validation and abstraction: When possible numerical results have been compared to work conducted using other hydrocode, analytical solutions, and experimental data [4], [5]. Furthermore, the numerical simulation results have been abstracted as function of scaled height of burst, impactor size, porosity and energy to name a few. Scaling laws for crater formation have been established and compared to existing ones (e.g., [6]). We have also conducted a global sensitivity analysis to identify the key parameters, among the large hyperspace of variables, involved in cratering.

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