

**PDC2019
Washington, DC, USA**

*Please send your abstract to iaapdc (at) iaamail.org
You may visit www.pdc.iaaweb.org
(please choose one box to be checked)
(you may also add a general comment - see end of the page)*

- Key International and Political Developments**
- Advancements and Progress in NEO Discovery**
- NEO Characterization Results**
- Deflection and Disruption Models & Testing**
- Mission & Campaign Designs**
- Impact Consequences**
- Disaster Response**
- Decision to Act**
- Public Education & Communication**

Atmospheric Injections from Impacts of Kilometer Scale Asteroids

Darrel Robertson⁽¹⁾, Donovan Mathias⁽²⁾

*⁽¹⁾⁽²⁾NASA Ames Research Center, 258 Allen Road, Moffett Field, CA 94035, USA.
Phone +1 650 604 1331, email Darrel.K.Robertson@NASA.gov*

Keywords: *Asteroid, impact, global, climate, simulation
(Maximum of five keywords separated by comma)*

ABSTRACT

This paper examines the amount of water or rock vapor lofted into the atmosphere from the impact of a kilometer-scale asteroid into the ocean or land, using a hydrocode to simulate the impact. The results will later provide inputs for a global climate model which will examine short and long term effects of impacts on temperature, ozone, water vapor, etc, and to estimate the subsequent effects on vegetation and agriculture, plankton and sealife, and ultimately to improve estimates of fatalities and costs from impacts in the 300 - 1000m size range.

The onset of global climatic effects from asteroid impacts is currently poorly understood. 10km diameter asteroids cause global extinction events, and ~Ø300m asteroids are likely to only cause localized effects. Estimates exist (Toon 1997) but the transition is not well studied. Current US policy is based on the National Research Council 2010 publication "Defending Planet Earth" which simply uses a step jump in global climatic effects for asteroids 1km or larger with fatalities increasing suddenly from on order of 1 million to 1 billion. Recent papers such as Pierazzo 2010 & 2012, Bardeen 2017, Brugger 2017, have begun to couple hydrocodes predicting the lofted water/rock vapor and wildfire soot injections into the atmosphere to global climate models to examine the effects. The ~Ø10km Chicxulub

K-T impact has been investigated, but the onset of significant global climate effects in the 1km range is not yet well studied.

For an asteroid larger than 1km in diameter found on a collision course with Earth, there is no doubt that every effort should be made to mitigate the asteroid in space. For smaller asteroids an impact might be allowable if the trade-off between costs of impact damage versus the costs to mitigate in space understood more completely.

Previous hydrocode simulations (e.g. Robertson & Gislis 2018, and others) have shown that the local blast, thermal, and earthquake effects from sub-1km asteroid impacts are tolerable if far enough from populated areas, and the long range tsunami risk from sub-1km asteroid impacts in ocean basins is also probably tolerable if far enough from populated coastlines. Consequently the total fatalities and cost of damage from impacts in the 300 – 1000 m range will likely depend strongly on the climatic effects. This in turn, together with the predicted impact location, will influence the decision to mitigate in space or not and whether the asteroid needs to be deflected completely off a collision course with Earth, or merely away from populated areas.

This paper will investigate the lofted material and use damage overlays on areas along the impact corridor of the 2019 IAA Planetary Defense Conference hypothetical scenario to illustrate damage radii and as injection points into the global climate model.

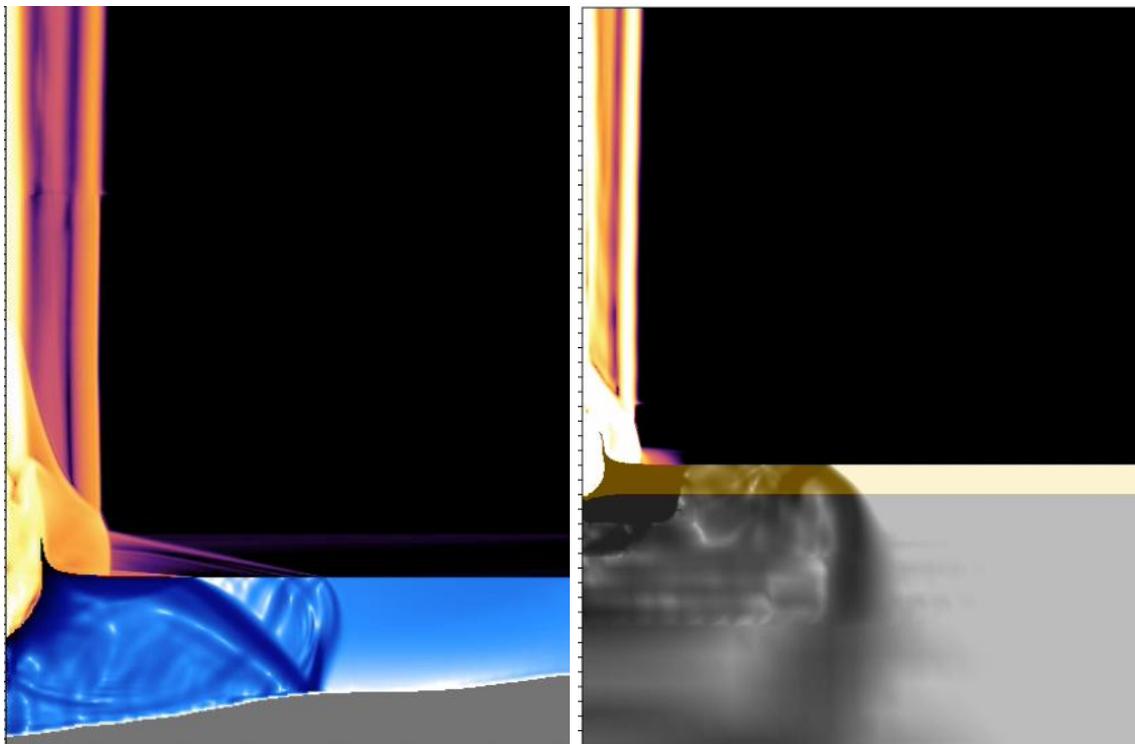


Fig. 1: Simulation of 1GT iron asteroid impacts into water and limestone from Planetary Defense Conference 2017

This is the abstract preparation template for the IAA conference. Each abstract will be evaluated by the members of the program committee and scored based on quality, originality, and relevance to conference. The abstracts will be ranked according to a score and selected for presentation based on the available space. Please note that failure to follow this format will lead to rejections of the paper without review. If selected for presentation a paper or an extended abstracts will be required.

The abstract length should be between 250 and 500 words. It must contain the paper title, the author names, their corresponding affiliation, postal and e-mail addresses. The extended abstract shall be prepared using the following format:

- Paper: standard A4 paper (21.0x29.7 cm)
- Margins: 2.54 cm (all sides)
- Title: 12 pt bold, Arial, centered, all capital letters
- Author names: 12 pt bold, Arial, centered
- Affiliation: 12 pt italic, Arial, centered
- Abstract body: 12 pt, Arial, justified with single line spacing
- Equations, figures, literature may be included with references in the body text

Abstracts must be written in English and should be submitted to the IAA as Microsoft Word files (.doc, .docx) within the deadline. All abstracts must be submitted online to iaapdc (at) iaamail.org It is recommended to proof read the abstract before submission.

Notification about the review process is planned according calendar. This will give the possibility to profit from the “early registration fee” of the conference. Please note that the presenting author of each accepted abstract has to register to the conference.

Comments:

(Alternative session, Time slot, Oral or Poster, Etc...)