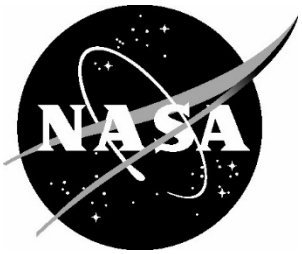
NASA/TM–20250000891



# PDC25 Epoch 2 Risk Assessment Dashboard Content Key

*Ashley Coates*
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*Lorien Wheeler*
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January 2025

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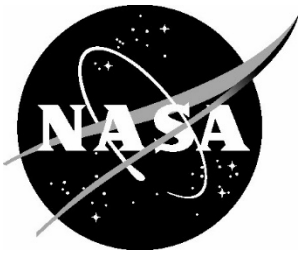
NASA/TM–20250000891



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National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California

January 2025

Available from:

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# 1. Introduction

As part of the 9th IAA Planetary Defense Conference (PDC 2025), a hypothetical asteroid impact exercise is conducted. This exercise assesses a realistic but **fictious hypothetical scenario**, not a real asteroid threat. Information on the hypothetical exercise and related data products can be found on the CNEOS PDC25 Scenario Website at https://cneos.jpl.nasa.gov/pd/cs/pdc25/.

Results of the Probabilistic Asteroid Impact Risk (PAIR) assessment performed for the PDC25 Hypothetical Asteroid Impact Exercise are presented in several forms, including an Asteroid Impact Risk Assessment Interactive Dashboard. This document outlines the contents of the Dashboard .HTML file generated for Epoch 2 of the exercise. Content descriptions in this document include sample screenshots showing key features highlighted with large red arrows. A copy of each dashboard page is included in the Appendix.

# 2. Interactive Dashboard Overview and Contents

The interactive dashboard includes six pages: Summary, Asteroid Properties, Damages, Affected Population, Locations, and Zoomable Maps. Users can navigate between pages using the tabs along the top of the dashboard (Figure 1). Individual pages may have subtabs and drop-down menus to navigate to additional plots and data.


*Figure 1: Use tabs across top of Dashboard to navigate between pages*

Some pages have more content than what fits on a single browser screen at one time, and users may need to scroll down to see all content on a given dashboard page. The top and bottom of each page is marked with a red HYPOTHETICAL EXERCISE banner and can be used as an indicator that the bottom of the page has been reached (Figure 2).

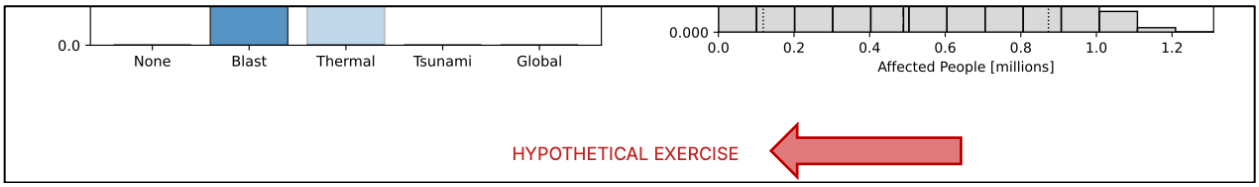



*Figure 2: Red HYPOTHETICAL EXERCISE banners bound information on a given page*

## 2.1 Summary Page

The Summary page includes an impact risk summary quadrant chart highlighting basic information about the hypothetical asteroid known on the assessment date, plus information about the impact location, potential hazards, and the affected population estimates. Most likely ranges are listed for diameter and energy under Asteroid Characterization. Here, most likely is defined as the 68% Highest Probability Density Interval (HPDI 68%). Each of these sections are discussed further in the following pages.

## 2.2 Asteroid Properties Page

The Asteroid Properties page includes graphical statistics about the asteroid properties, entry parameters, and modeling parameters used to model the scenario. Users can navigate through each set of plots using the similarly labeled subtabs located directly below the Asteroid Properties title (Figure 3).

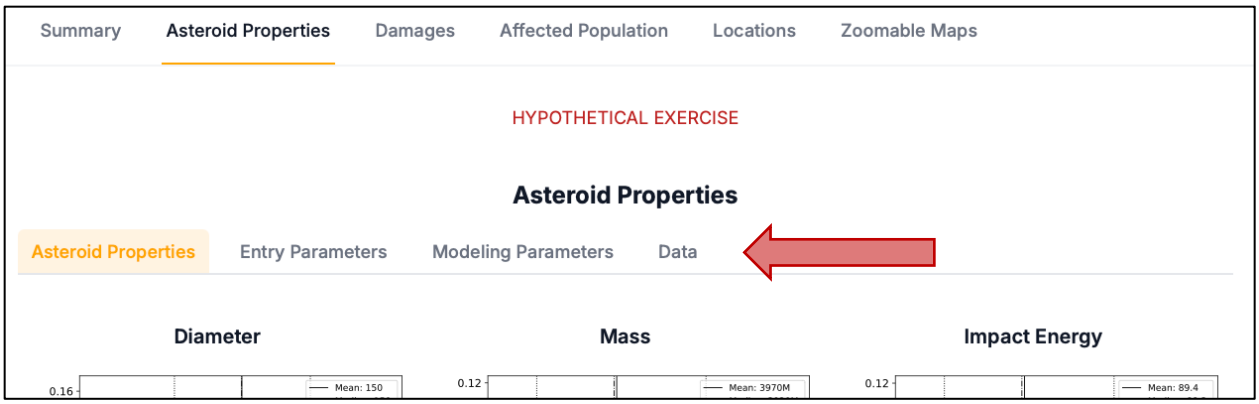



*Figure 3: Use subtabs to navigate through Asteroid Properties subpages*

Statistical data is also provided under the Data subtab including various percentile values, the mean, etc. Users should scroll horizontally to see all data. The data can also be exported to a CSV file using the Export dropdown on the upper right of the Data table (Figure 4) or queried via SQL. Note that the ranges and probabilities represent the cases modeled for this hypothetical scenario (5000 property samples x5000 impact points = 25 million cases modeled) to capture uncertainty in various properties and parameters, not the absolute theoretical limits.

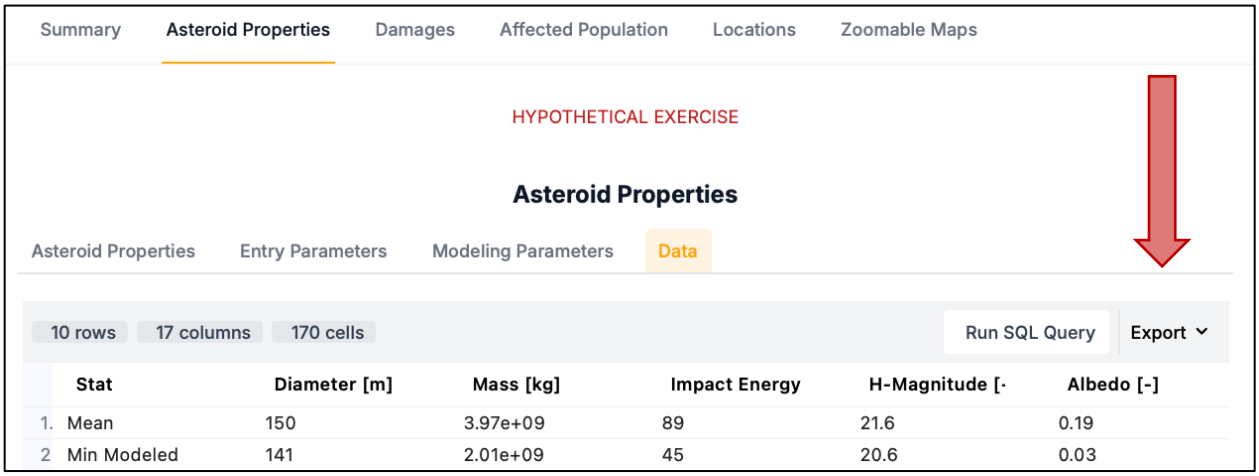



*Figure 4: Use Export dropdown to download data as a CSV file*

## 2.3 Damages Page

The Damages page includes several subtabs taking users to information about the types, sizes, and severities of potential damage from Earth-impacting cases (Figure 5). Additionally, a color-coded table appears above each Damages subpage describing the expected local blast and/or local thermal damage and criteria at each of four severity levels. It is assumed that 10% of the population is affected at the Serious severity level, 30% at the Severe level, 60% at the Critical level, and 100% at the Unsurvivable damage severity level.

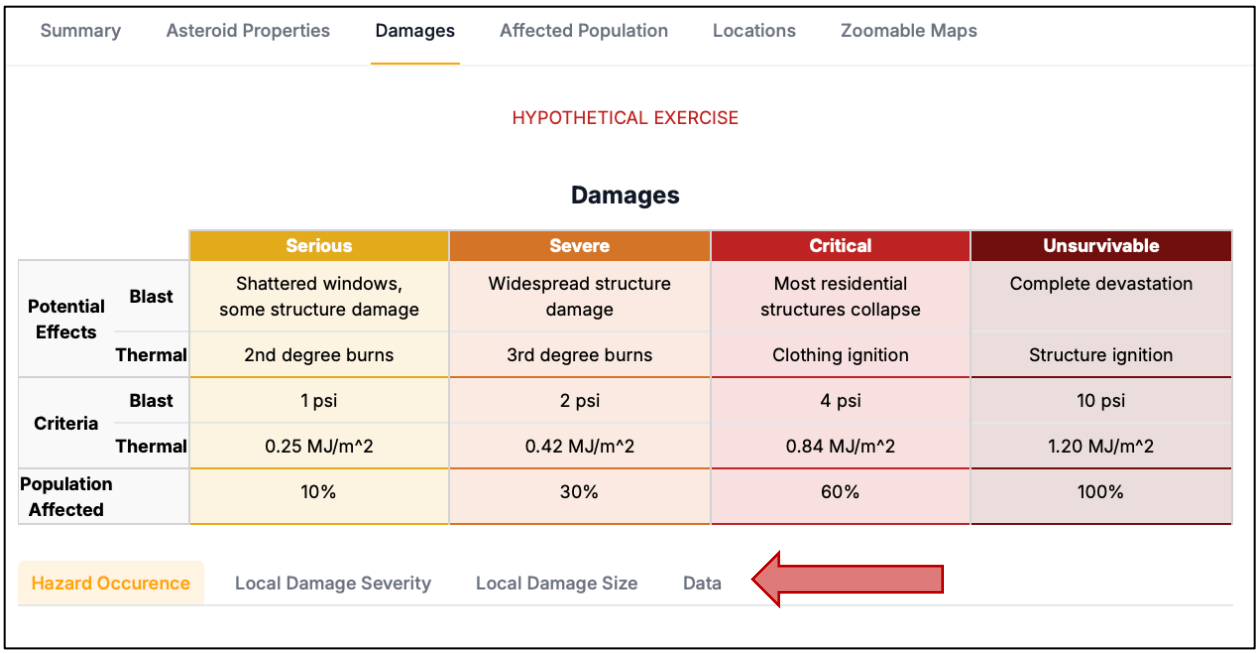



*Figure 5: Use subtabs to navigate through Damages subpages. Use color-coded table as reference for expected local blast and thermal damages at different damage severity levels*

Expanding the information from the Summary page, the Hazard Occurrence subtab includes information on both hazard occurrence and hazard dominance. Hazard occurrence numbers represent the chance that each given hazard may occur. Because a single impact event can cause multiple hazards, the summation of the occurrence probabilities may exceed 100%. Damage dominance bars represent the probability that a given damage type is the primary source of population damage. In this case, one dominant damage is determined for each case modeled, and the summation should be 100%.

The Local Damage Severity subtab contains information on the damage severity of local hazards (blast and thermal) at different locations. Users can navigate between two perspectives – Safety or Risk – using the dropdown menus for each hazard type (Figure 6). The Safety figures highlight where a given severity or better is experienced (i.e., if a person stands at $x$ distance there is $y$ probability that they will see at most $z$ severity damage), whereas the Risk figures highlight where a given severity or worse is experienced (i.e., if a person stands at $x$ distance there is a $y$ probability that they will see at least $z$ severity damage).


*Figure 6: Use dropdown to choose perspective for blast and thermal damage severity results*

The Local Damage Size subtab provides information on the size of damage regions resulting from local hazards (blast and thermal). Plots highlight the probability that the damage radius for a given hazard and severity level is within a specified range. Dropdowns for each hazard type (Figure 7) allow users to navigate between results at different damage severity levels.

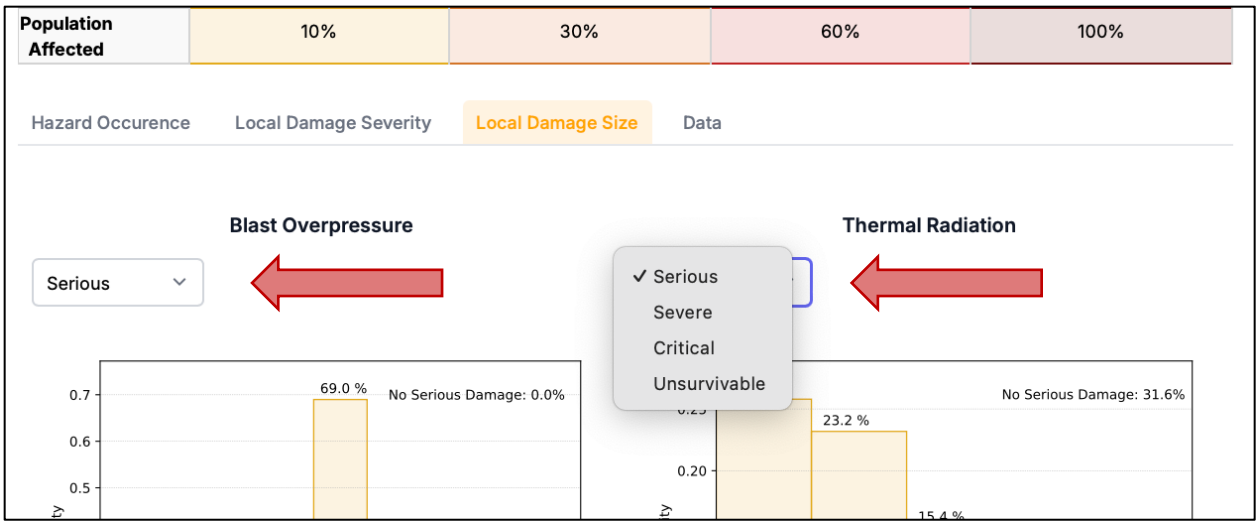



*Figure 7: Use dropdown to choose a severity level for blast and thermal damage size results*

Statistical data is again provided under the Data subtab, including various percentile values, the mean, etc. Users should scroll horizontally to see all data. Damage radius values are determined by the larger of either the blast or thermal radii at a given severity level. The data can also be exported to a CSV file using the Export dropdown on the upper right of the Data table (Figure 8) or queried via SQL. Note that the ranges and probabilities represent the cases modeled for this hypothetical scenario (5000 property samples x 5000 impact points = 25 million cases modeled) to capture uncertainty in various properties and parameters, not the absolute theoretical limits.

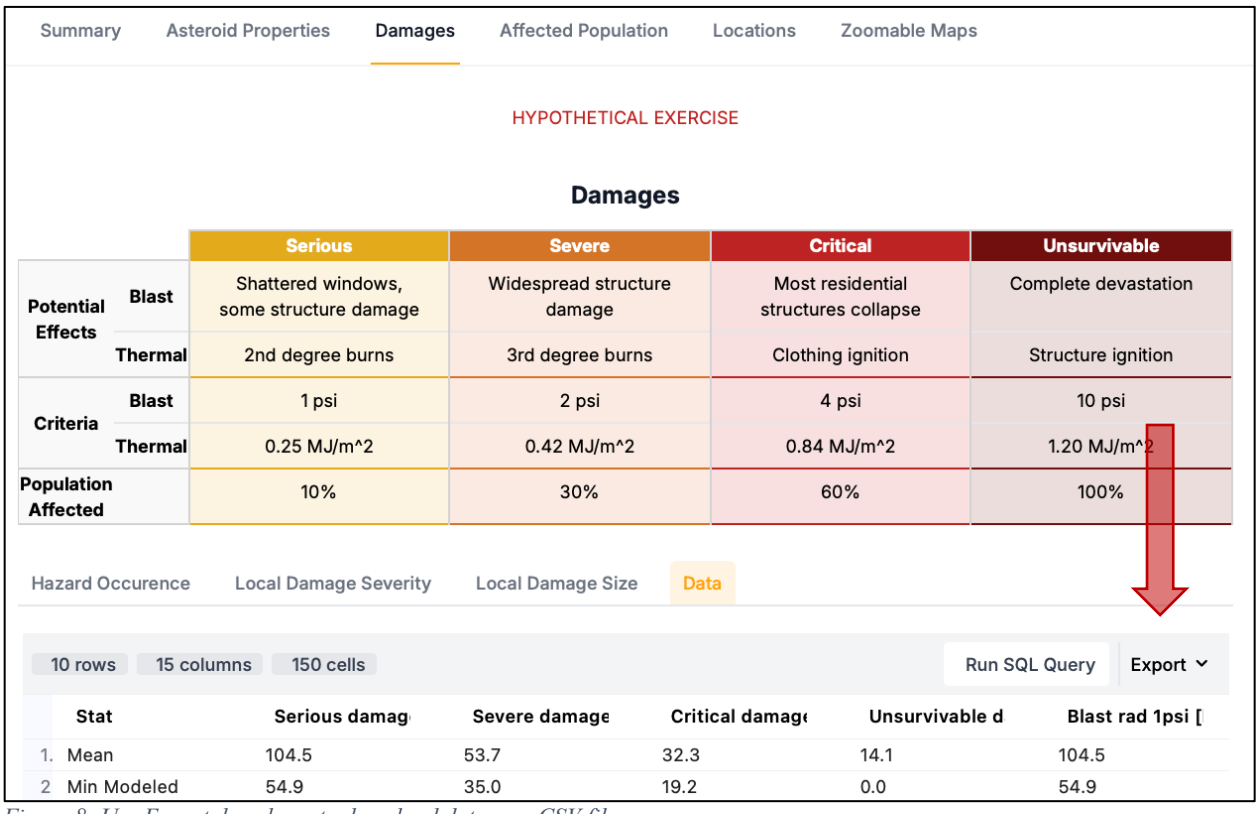



*Figure 8: Use Export dropdown to download data as a CSV file*

## 2.4 Affected Population Page

The Affected Population page has several subtabs taking users to information about the number of people affected by the overall damage and from each potential hazard – local blast and thermal ground damage, tsunami, and/or global effects (Figure 9). Each subtab has two figures, one showing the probability that the number of affected people falls within a given range, and another showing the likelihood that a given number of people or more are affected. The large call out numbers in the top banner (Figure 9) give the probabilities that affected population could exceed various thresholds if impact occurs (e.g., the probability that the damage could affect at least ten thousand people, at least one hundred thousand people, etc.). These values correspond to the right-hand plot on the Total subtab.

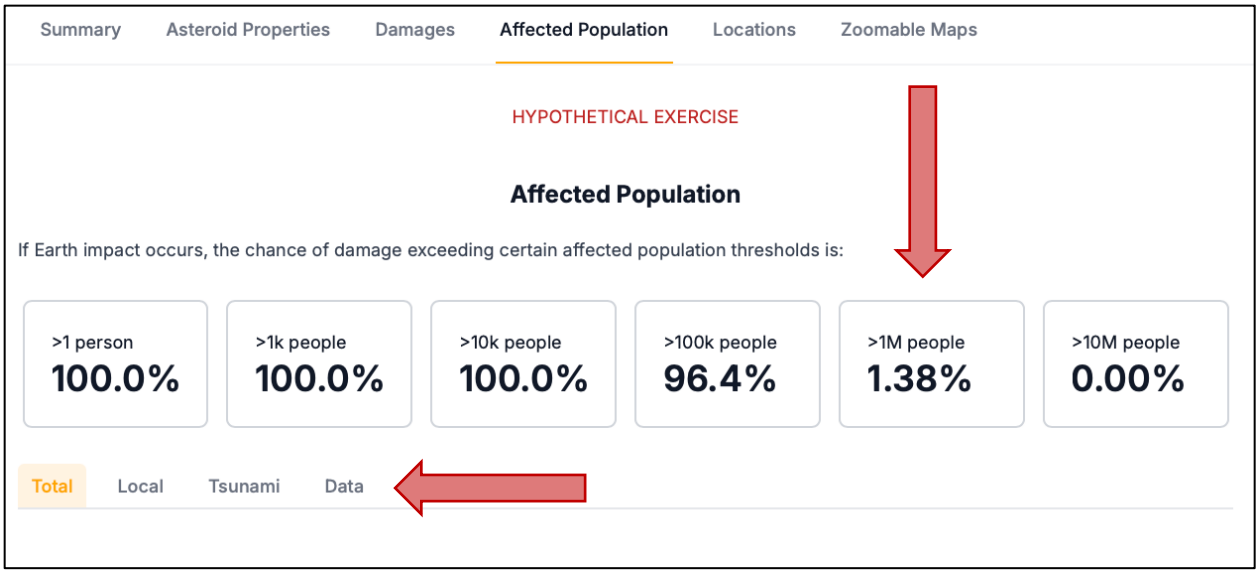



*Figure 9: Use subtabs to navigate through Affected Population subpages. Use highlighted statistics as a quick look at the total probabilities that a given number of people or more are affected among Earth-impacting cases*

Statistical data is again provided under the Data subtab, including various percentile values, the mean, etc. Users should scroll horizontally to see all data. Local population numbers represent the population within the damage area, not the affected number of people. The affected population is determined by multiplying the populations within each damage severity ring by the relative damage severity factor shown in the damage level key (10, 30, 60, 100%). The data can also be exported to a CSV file using the Export dropdown on the upper right of the Data table (Figure 10) or queried via SQL. Note that the ranges and probabilities represent the cases modeled for this hypothetical scenario (5000 property samples x 5000 impact points = 25 million cases modeled) to capture uncertainty in various properties and parameters, not the absolute theoretical limits.

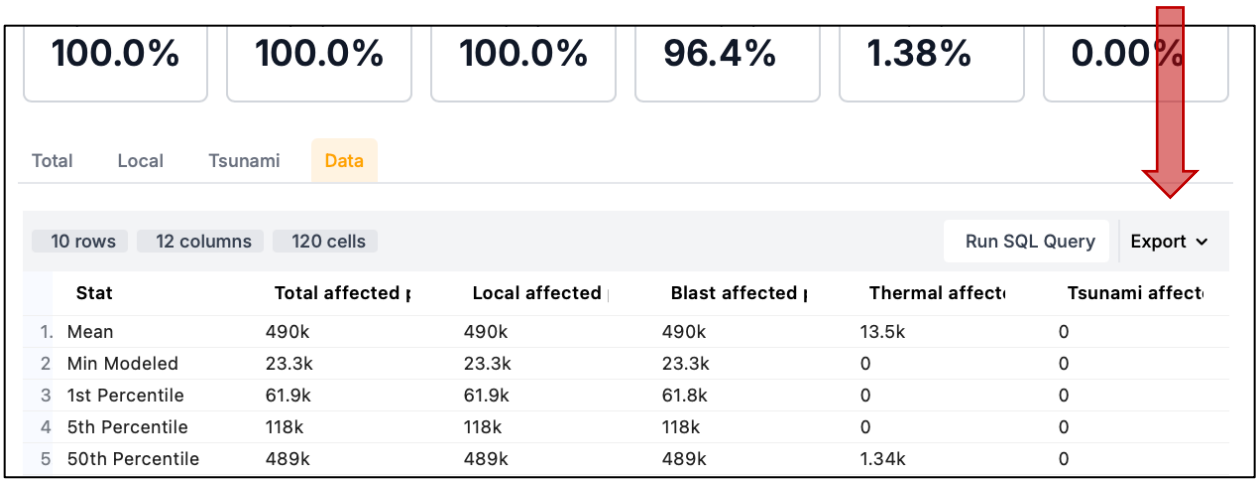



*Figure 10: Use Export dropdown to download data as a CSV file*

## 2.5 Locations Page

The Locations page has two subtabs (Figure 11) taking users to subpages that provide information on the potential impact locations and the average number of people affected at each of those points given the range of potential asteroid sizes and properties. The Location Damage and Risk subpage also includes the likelihood that the impact occurs at a given location, along with information on the average number of people affected by individual hazard types (local or tsunami) at different potential impact locations along the swath.


*Figure 11: Use subtabs to navigate through Locations subpages*

## 2.6 Zoomable Maps Page

The Zoomable Maps page includes two zoomable maps highlighting potential regions at risk to local ground damage along the Swath and for the Worst-Case Scenario among the cases modeled. Users can navigate between the maps using the subtabs (Figure 12). Additionally, a color-coded table appears above each subpage describing the expected local blast and/or local thermal damage and criteria at each of four severity levels. It is assumed that 10% of the population is affected at the Serious severity level, 30% at the Severe level, 60% at the Critical level, and 100% at the Unsurvivable damage severity level.

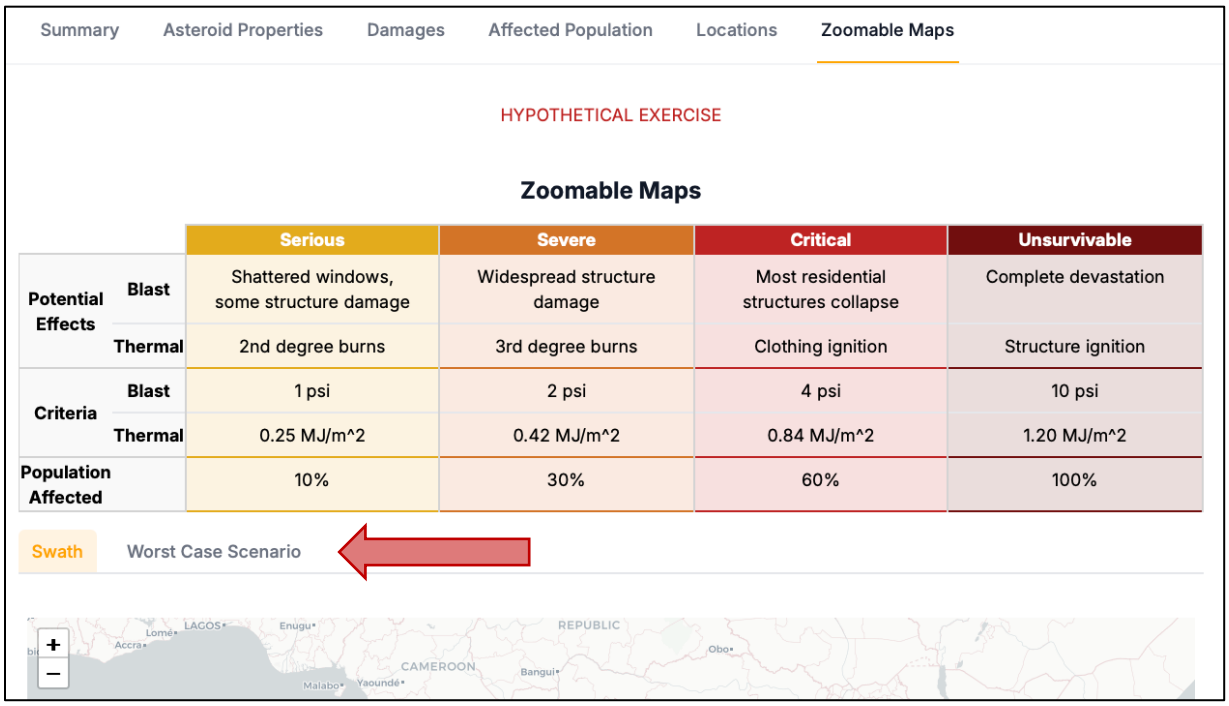



*Figure 12: Use subtabs to navigate through Zoomable Maps subpages. Use color-coded table as reference for expected local blast and thermal damages at different damage severity levels*

Users can click on the different damage severity regions in the Worst-Case Scenario subtab to see the population in each area (Figure 13). The population number represents all people in the circular area, not just the ring, and has not yet been scaled to affected population.

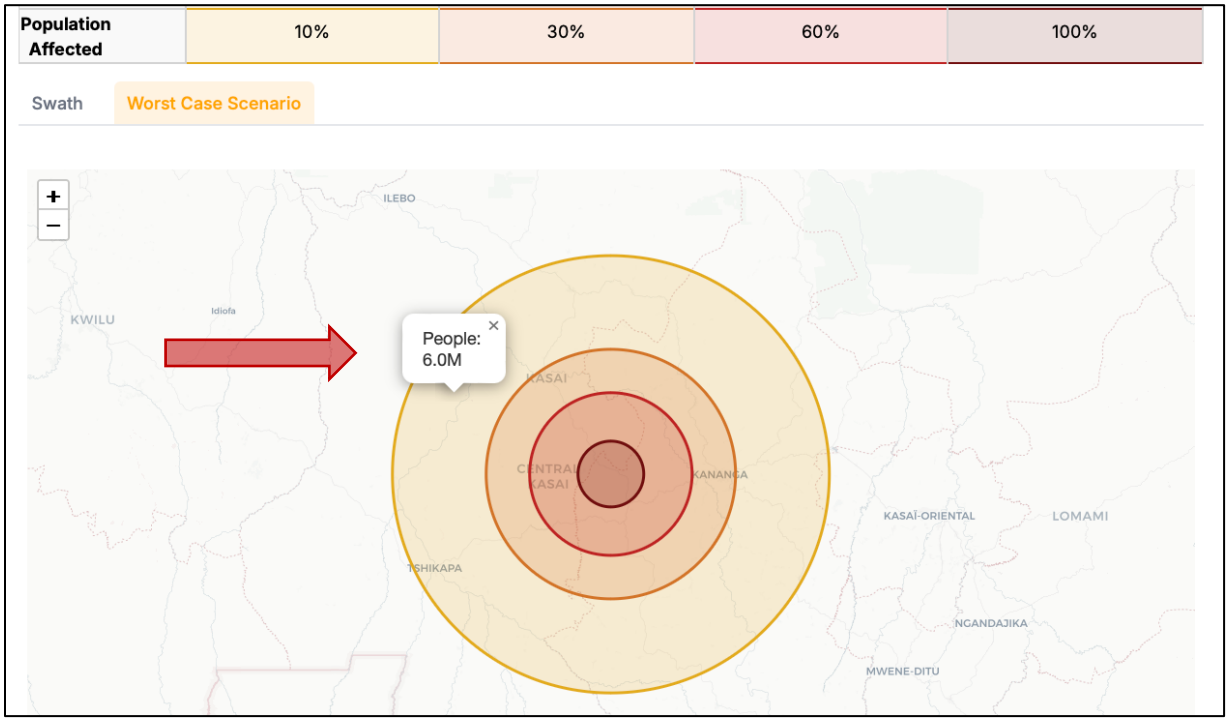



*Figure 13: Click in each damage severity region on the Worst Case Scenario map to see the number of people in each area. Values are for the whole circular area, not just the ring, and have not been scaled to affected population*

## 3. Appendix: Full Dashboard Pages

Summary | Asteroid Properties | Damages | Affected Population | Locations | Zoomable Maps

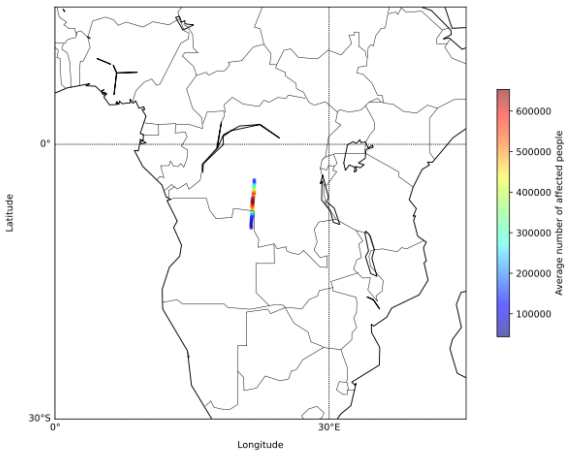
HYPOTHETICAL EXERCISE

## Asteroid Impact Risk Summary - Assessment 2

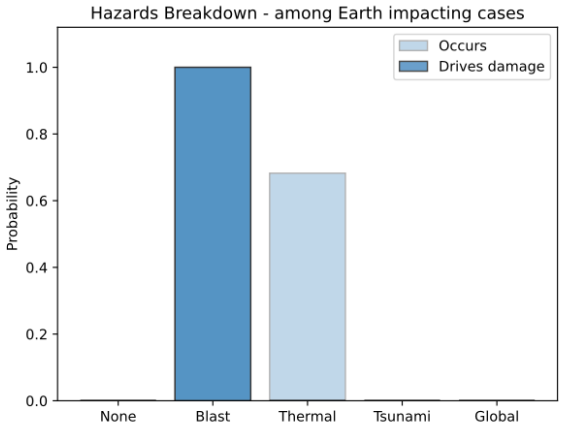
### Asteroid Characterization

- **Date of Assessment:** 28 April 2028
- **Date of Potential Impact:** 24 April 2041
- **Earth Impact Probability:** 100%
- **Observations:** Flyby space mission obtained direct measurement of physical size (volume, shape) and confirmed S taxonomy
- **Diameter (Spherical Equivalent):** Total range is [141 - 159] m, most likely in the [147 - 152] m interval, with a median of 150 m and mean of 150 m
- **Energy:** Total range is [45-158] Mt, most likely in the [63 - 105] Mt interval, with a median of 88 Mt and mean of 89 Mt

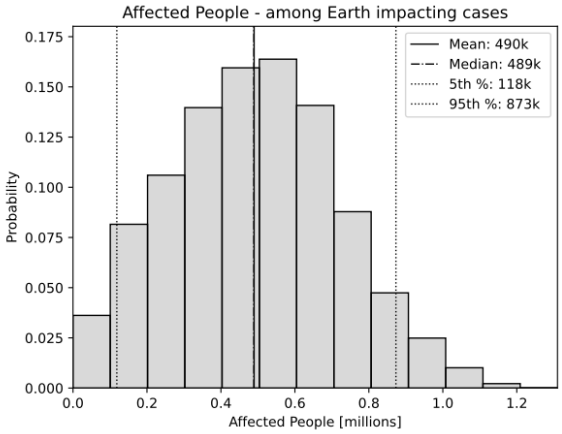
### Locations




### Hazards




### Affected Population




HYPOTHETICAL EXERCISE

These results show a Probabilistic Asteroid Impact Risk assessment performed for the PDC25 Hypothetical Asteroid Impact Exercise, as part of the 9th IAA Planetary Defense Conference (PDC 2025). This exercise assesses a realistic but fictitious hypothetical scenario, not a real asteroid threat.

[Produced by the NASA Asteroid Threat Assessment Project (ATAP), NASA Ames Research Center]

*Figure 14: Summary Page of Interactive Dashboard*

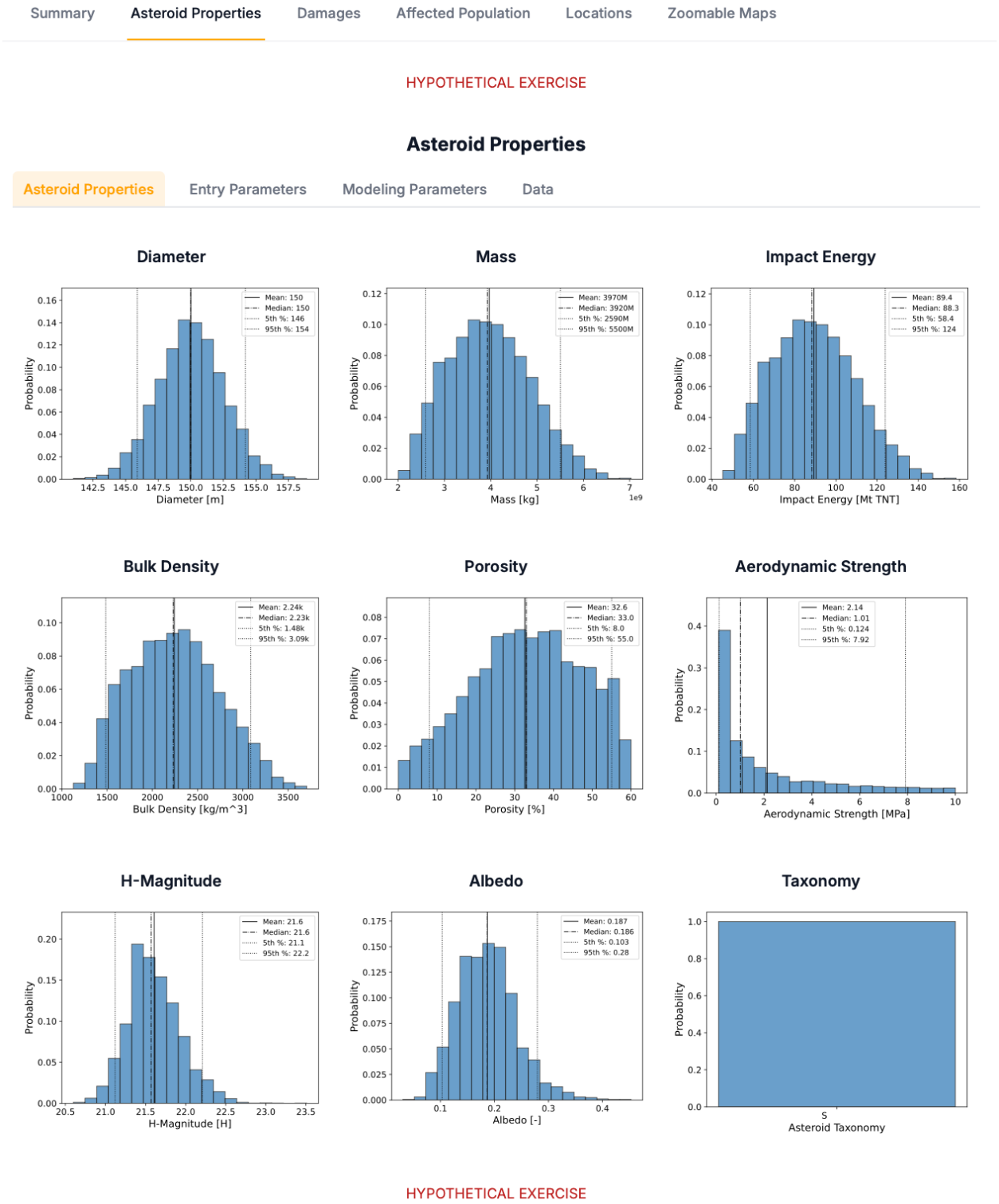



*Figure 15: Asteroid Properties Page of Interactive Dashboard, Asteroid Properties subtab*

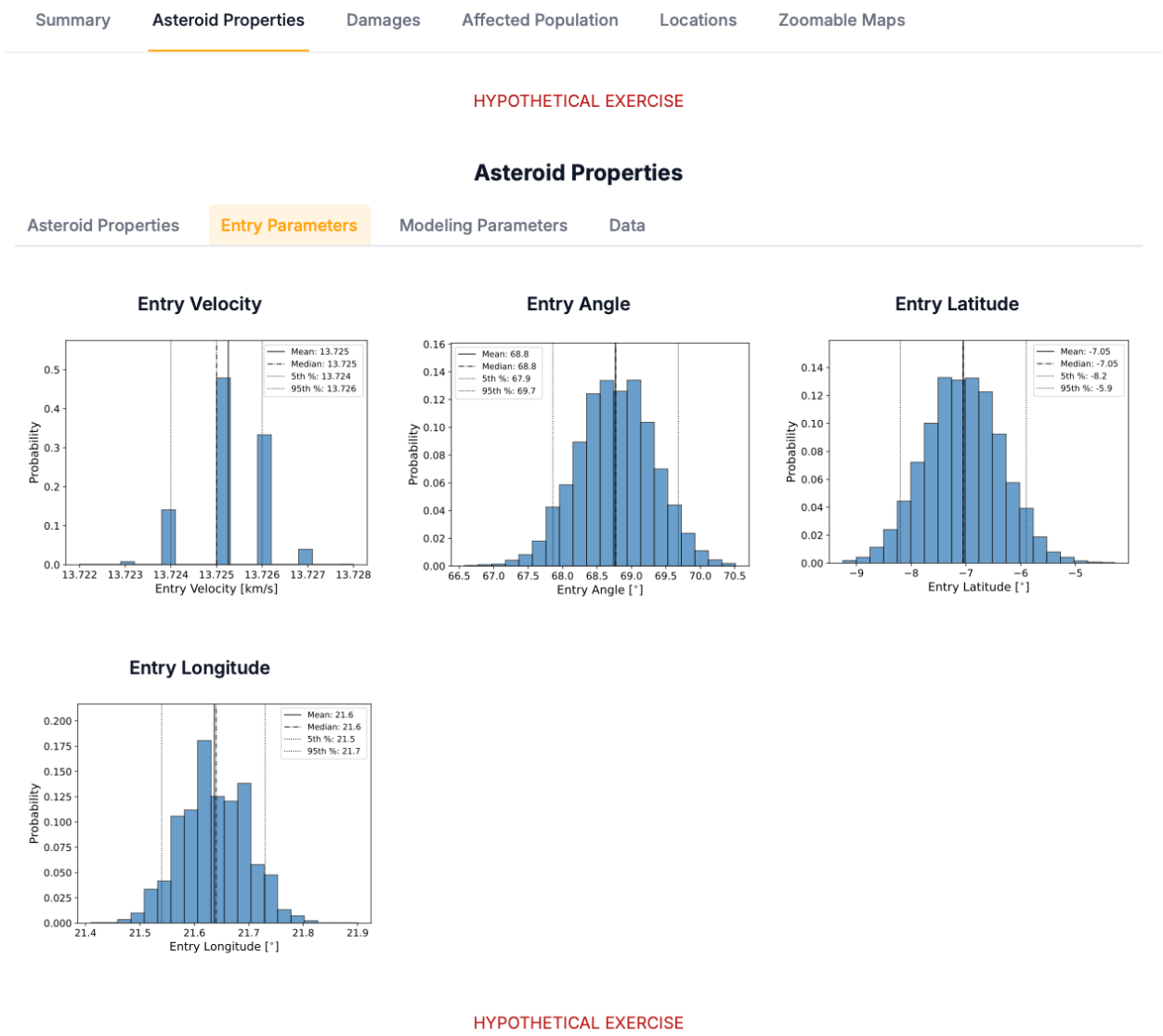



*Figure 16: Asteroid Properties Page of Interactive Dashboard, Entry Parameters subtab*

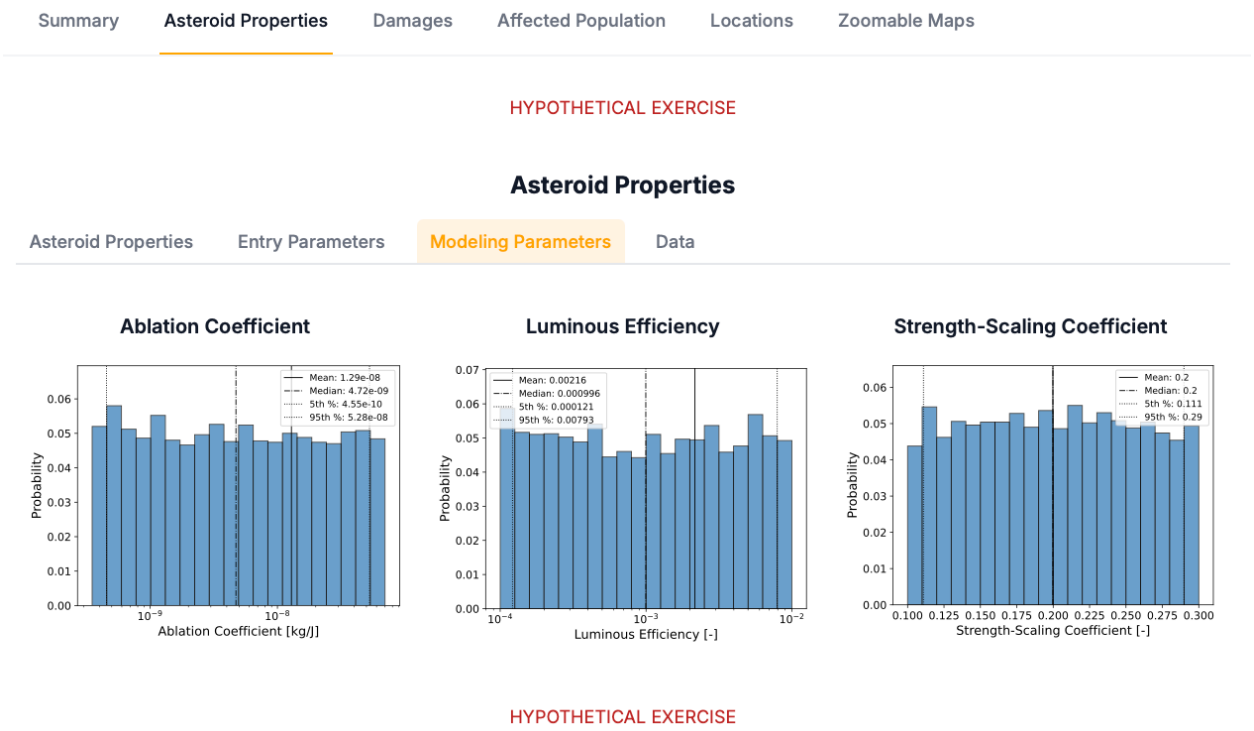



*Figure 17: Asteroid Properties Page of Interactive Dashboard, Modeling Parameters subtab*

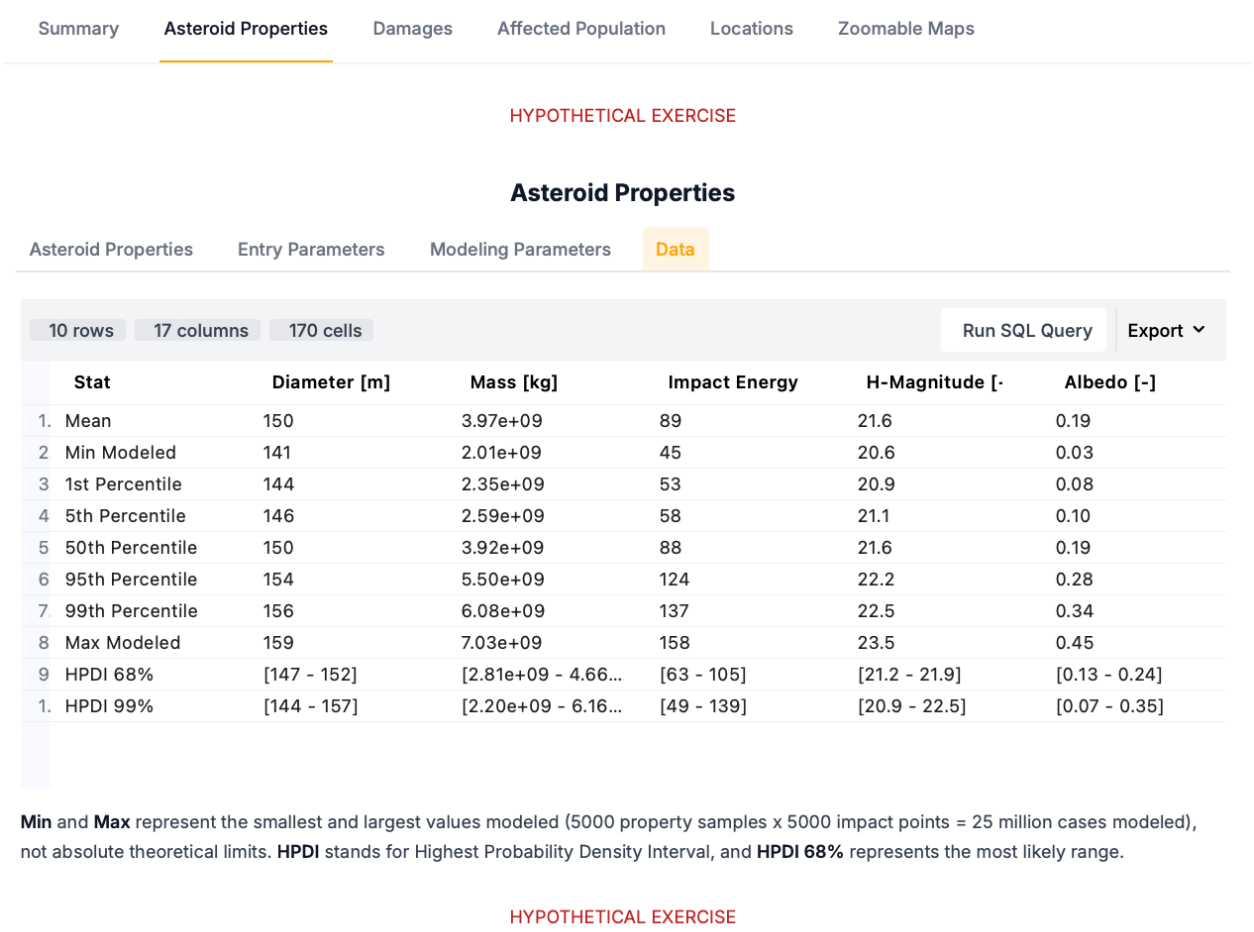



*Figure 18: Asteroid Properties Page of Interactive Dashboard, Data subtab*

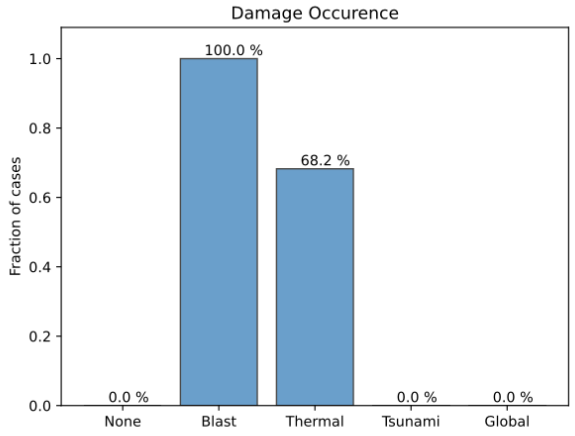
Summary | Asteroid Properties | Damages | Affected Population | Locations | Zoomable Maps

HYPOTHETICAL EXERCISE

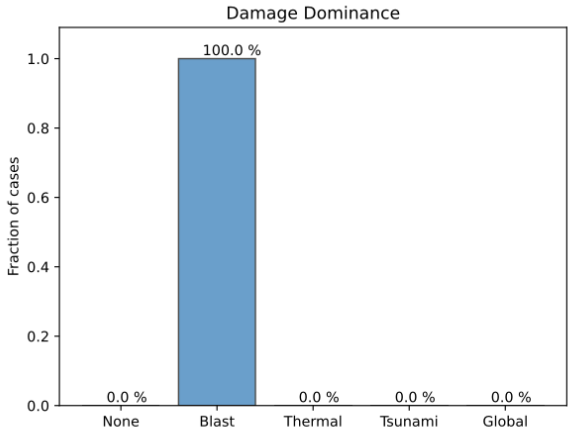
## Damages

| | | Serious | Severe | Critical | Unsurvivable |
|---|---|---|---|---|---|
| Potential Effects | Blast | Shattered windows, some structure damage | Widespread structure damage | Most residential structures collapse | Complete devastation |
| | Thermal | 2nd degree burns | 3rd degree burns | Clothing ignition | Structure ignition |
| Criteria | Blast | 1 psi | 2 psi | 4 psi | 10 psi |
| | Thermal | 0.25 MJ/m^2 | 0.42 MJ/m^2 | 0.84 MJ/m^2 | 1.20 MJ/m^2 |
| Population Affected | | 10% | 30% | 60% | 100% |

Hazard Occurence | Local Damage Severity | Local Damage Size | Data




Fraction of Earth-impacting cases for which damage from each hazard type occurs




Fraction of Earth-impacting cases for which each hazard type is the primary source of population damage

A single impact event can cause multiple hazards (e.g. blast + thermal, tsunami + local near-shore, or global + local or tsunami). Sum of damage occurence probabilities (left figure) may exceed 100%.

HYPOTHETICAL EXERCISE

*Figure 19: Damages Page of Interactive Dashboard, Hazard Occurrence subtab*

Summary | Asteroid Properties | **Damages** | Affected Population | Locations | Zoomable Maps

HYPOTHETICAL EXERCISE

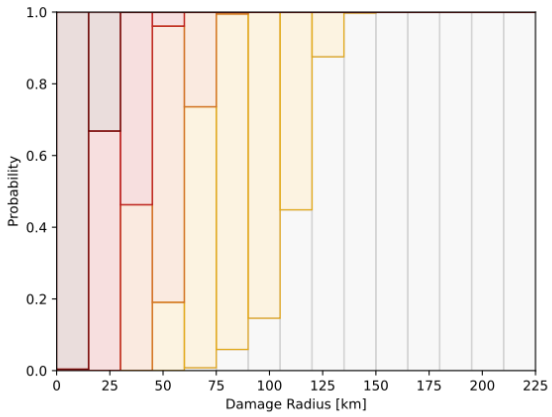
## Damages

| | | Serious | Severe | Critical | Unsurvivable |
|---|---|---|---|---|---|
| **Potential Effects** | **Blast** | Shattered windows, some structure damage | Widespread structure damage | Most residential structures collapse | Complete devastation |
| | **Thermal** | 2nd degree burns | 3rd degree burns | Clothing ignition | Structure ignition |
| **Criteria** | **Blast** | 1 psi | 2 psi | 4 psi | 10 psi |
| | **Thermal** | 0.25 MJ/m^2 | 0.42 MJ/m^2 | 0.84 MJ/m^2 | 1.20 MJ/m^2 |
| **Population Affected** | | 10% | 30% | 60% | 100% |

Hazard Occurence | **Local Damage Severity** | Local Damage Size | Data

### Blast Overpressure

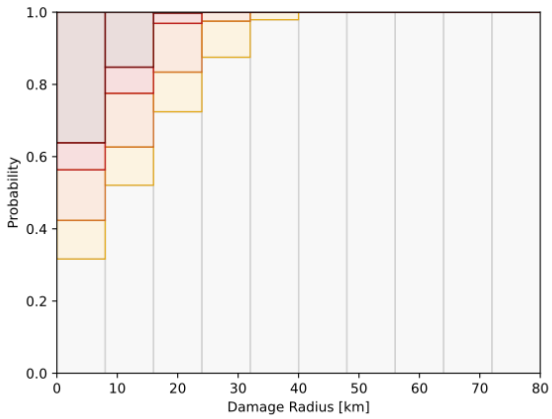
Safety




Probability that blast overpressure damage will be a given severity or better at each distance bin among Earth-impacting cases. Colors correspond to the severities in the damage key, and grey represents damage below the 1 psi threshold

### Thermal Radiation

Safety




Probability that thermal radiation damage will be a given severity or better at each distance bin among Earth-impacting cases. Colors correspond to the severities in the damage key, and grey represents damage below the 0.25 MJ/m^2 threshold

Note that axes are scaled to each plot and differ between hazard types

HYPOTHETICAL EXERCISE

*Figure 20: Damages Page of Interactive Dashboard, Local Damage Severity subtab - Safety*

Summary | Asteroid Properties | **Damages** | Affected Population | Locations | Zoomable Maps

HYPOTHETICAL EXERCISE

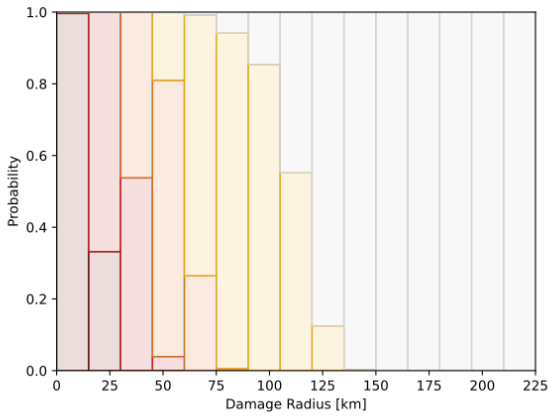
## Damages

| | | Serious | Severe | Critical | Unsurvivable |
|---|---|---|---|---|---|
| **Potential Effects** | **Blast** | Shattered windows, some structure damage | Widespread structure damage | Most residential structures collapse | Complete devastation |
| | **Thermal** | 2nd degree burns | 3rd degree burns | Clothing ignition | Structure ignition |
| **Criteria** | **Blast** | 1 psi | 2 psi | 4 psi | 10 psi |
| | **Thermal** | 0.25 MJ/m^2 | 0.42 MJ/m^2 | 0.84 MJ/m^2 | 1.20 MJ/m^2 |
| **Population Affected** | | 10% | 30% | 60% | 100% |

Hazard Occurence | **Local Damage Severity** | Local Damage Size | Data

### Blast Overpressure

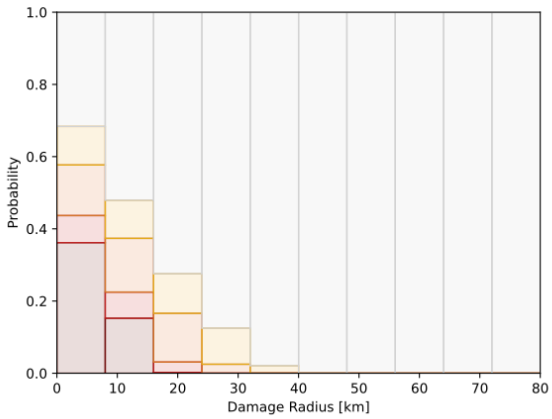
Risk




Probability that blast overpressure damage will be a given severity or worse at each distance bin among Earth-impacting cases. Colors correspond to the severities in the damage key, and grey represents damage below the 1 psi threshold

### Thermal Radiation

Risk




Probability that thermal radiation damage will be a given severity or worse at each distance bin among Earth-impacting cases. Colors correspond to the severities in the damage key, and grey represents damage below the 0.25 MJ/m^2 threshold

Note that axes are scaled to each plot and differ between hazard types

HYPOTHETICAL EXERCISE

*Figure 21: Damages Page of Interactive Dashboard, Local Damage Severity subtab – Risk*

Summary | Asteroid Properties | Damages | Affected Population | Locations | Zoomable Maps

HYPOTHETICAL EXERCISE

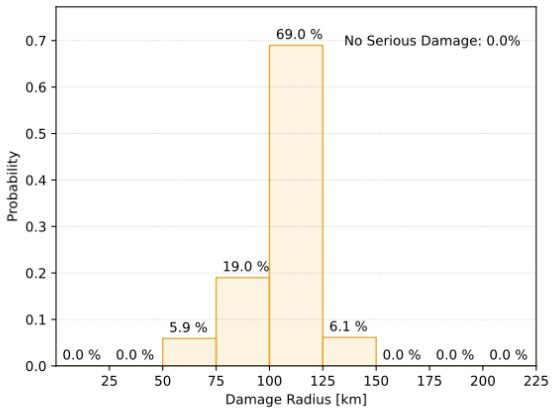
## Damages

| | | Serious | Severe | Critical | Unsurvivable |
|---|---|---|---|---|---|
| Potential Effects | Blast | Shattered windows, some structure damage | Widespread structure damage | Most residential structures collapse | Complete devastation |
| | Thermal | 2nd degree burns | 3rd degree burns | Clothing ignition | Structure ignition |
| Criteria | Blast | 1 psi | 2 psi | 4 psi | 10 psi |
| | Thermal | 0.25 MJ/m^2 | 0.42 MJ/m^2 | 0.84 MJ/m^2 | 1.20 MJ/m^2 |
| Population Affected | | 10% | 30% | 60% | 100% |

Hazard Occurence | Local Damage Severity | Local Damage Size | Data

### Blast Overpressure

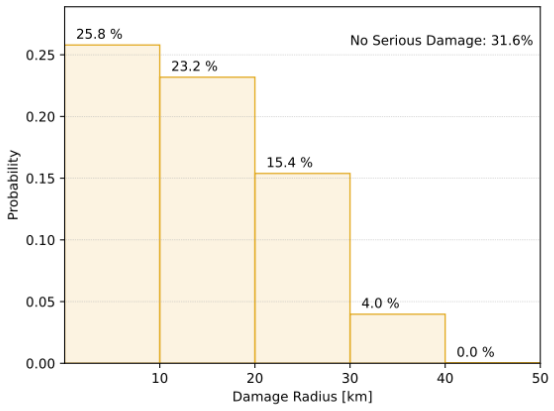
Serious




Probability that the damage radius corresponding to 1 psi blast overpressure (serious) is within a given damage radius bin among Earth impacting cases

### Thermal Radiation

Serious




Probability that the damage radius corresponding to 0.25 MJ/m^2 (serious) is within a given damage radius bin among Earth-impacting cases

Note that axes are scaled to each plot and differ between hazard types and severities

HYPOTHETICAL EXERCISE

*Figure 22: Damages Page of Interactive Dashboard, Local Damage Size subtab – Serious*

Summary | Asteroid Properties | Damages | Affected Population | Locations | Zoomable Maps

HYPOTHETICAL EXERCISE

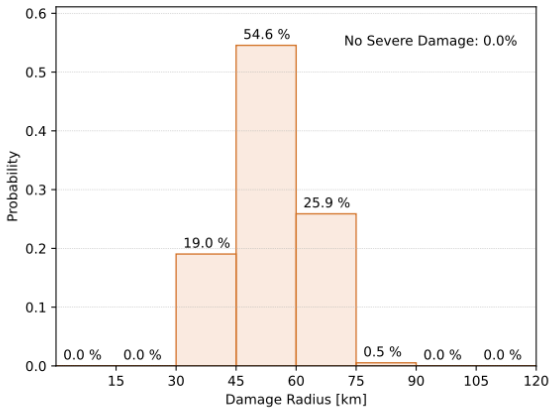
## Damages

| | | Serious | Severe | Critical | Unsurvivable |
|---|---|---|---|---|---|
| Potential Effects | Blast | Shattered windows, some structure damage | Widespread structure damage | Most residential structures collapse | Complete devastation |
| | Thermal | 2nd degree burns | 3rd degree burns | Clothing ignition | Structure ignition |
| Criteria | Blast | 1 psi | 2 psi | 4 psi | 10 psi |
| | Thermal | 0.25 MJ/m^2 | 0.42 MJ/m^2 | 0.84 MJ/m^2 | 1.20 MJ/m^2 |
| Population Affected | | 10% | 30% | 60% | 100% |

Hazard Occurence | Local Damage Severity | Local Damage Size | Data

### Blast Overpressure

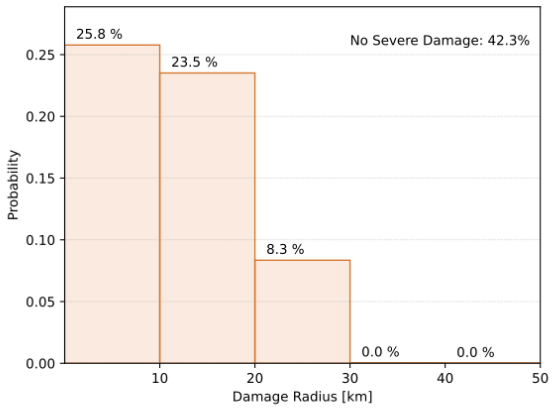
Severe




Probability that the damage radius corresponding to 2 psi blast overpressure (severe) is within a given damage radius bin among Earth impacting cases

### Thermal Radiation

Severe




Probability that the damage radius corresponding to 0.42 MJ/m^2 (severe) is within a given damage radius bin among Earth-impacting cases

Note that axes are scaled to each plot and differ between hazard types and severities

HYPOTHETICAL EXERCISE

*Figure 23: Damages Page of Interactive Dashboard, Local Damage Size subtab – Severe*

Summary | Asteroid Properties | Damages | Affected Population | Locations | Zoomable Maps

HYPOTHETICAL EXERCISE

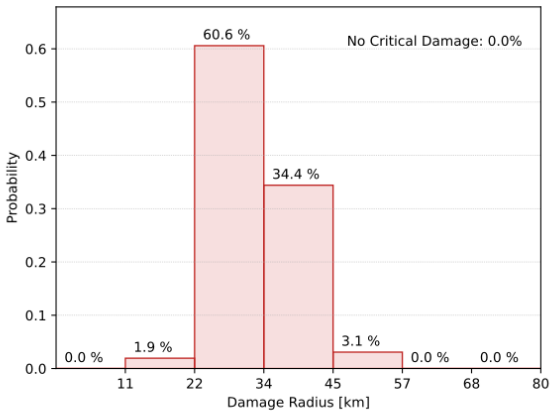
## Damages

| | | Serious | Severe | Critical | Unsurvivable |
|---|---|---|---|---|---|
| Potential Effects | Blast | Shattered windows, some structure damage | Widespread structure damage | Most residential structures collapse | Complete devastation |
| | Thermal | 2nd degree burns | 3rd degree burns | Clothing ignition | Structure ignition |
| Criteria | Blast | 1 psi | 2 psi | 4 psi | 10 psi |
| | Thermal | 0.25 MJ/m^2 | 0.42 MJ/m^2 | 0.84 MJ/m^2 | 1.20 MJ/m^2 |
| Population Affected | | 10% | 30% | 60% | 100% |

Hazard Occurence | Local Damage Severity | Local Damage Size | Data

### Blast Overpressure

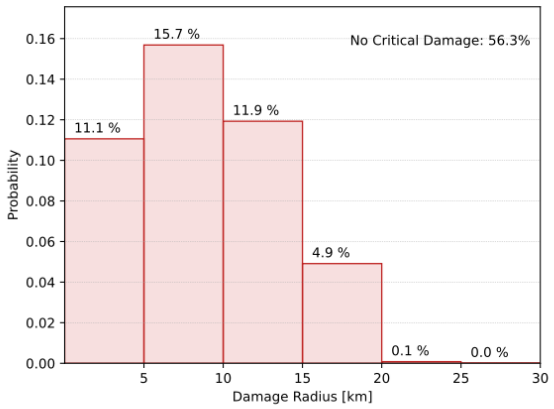
Critical




Probability that the damage radius corresponding to 4 psi blast overpressure (critical) is within a given damage radius bin among Earth impacting cases

### Thermal Radiation

Critical




Probability that the damage radius corresponding to 0.84 MJ/m^2 (critical) is within a given damage radius bin among Earth-impacting cases

Note that axes are scaled to each plot and differ between hazard types and severities

HYPOTHETICAL EXERCISE

*Figure 24: Damages Page of Interactive Dashboard, Local Damage Size subtab – Critical*

Summary | Asteroid Properties | Damages | Affected Population | Locations | Zoomable Maps

HYPOTHETICAL EXERCISE

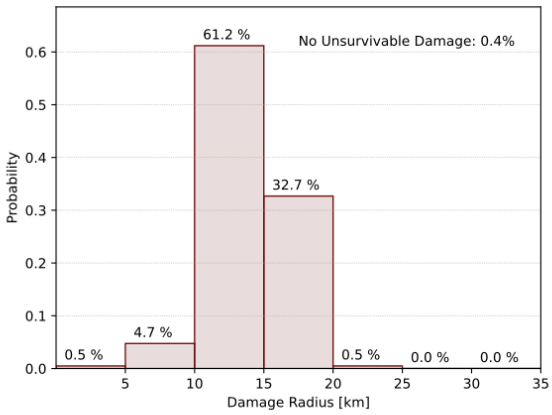
## Damages

| | | Serious | Severe | Critical | Unsurvivable |
|---|---|---|---|---|---|
| Potential Effects | Blast | Shattered windows, some structure damage | Widespread structure damage | Most residential structures collapse | Complete devastation |
| | Thermal | 2nd degree burns | 3rd degree burns | Clothing ignition | Structure ignition |
| Criteria | Blast | 1 psi | 2 psi | 4 psi | 10 psi |
| | Thermal | 0.25 MJ/m^2 | 0.42 MJ/m^2 | 0.84 MJ/m^2 | 1.20 MJ/m^2 |
| Population Affected | | 10% | 30% | 60% | 100% |

Hazard Occurence | Local Damage Severity | Local Damage Size | Data

### Blast Overpressure

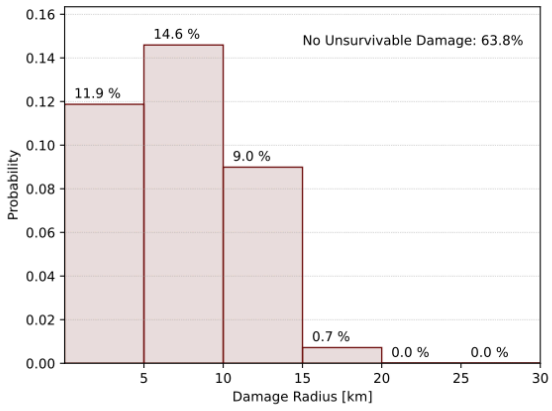
Unsurvivable




Probability that the damage radius corresponding to 10 psi blast overpressure (unsurvivable) is within a given damage radius bin among Earth impacting cases

### Thermal Radiation

Unsurvivable




Probability that the damage radius corresponding to 1.20 MJ/m^2 (unsurvivable) is within a given damage radius bin among Earth-impacting cases

Note that axes are scaled to each plot and differ between hazard types and severities

HYPOTHETICAL EXERCISE

*Figure 25: Damages Page of Interactive Dashboard, Local Damage Size subtab – Unsurvivable*

Summary | Asteroid Properties | Damages | Affected Population | Locations | Zoomable Maps

HYPOTHETICAL EXERCISE

## Damages

| | | Serious | Severe | Critical | Unsurvivable |
|---|---|---|---|---|---|
| **Potential Effects** | **Blast** | Shattered windows, some structure damage | Widespread structure damage | Most residential structures collapse | Complete devastation |
| | **Thermal** | 2nd degree burns | 3rd degree burns | Clothing ignition | Structure ignition |
| **Criteria** | **Blast** | 1 psi | 2 psi | 4 psi | 10 psi |
| | **Thermal** | 0.25 MJ/m^2 | 0.42 MJ/m^2 | 0.84 MJ/m^2 | 1.20 MJ/m^2 |
| **Population Affected** | | 10% | 30% | 60% | 100% |

Hazard Occurence | Local Damage Severity | Local Damage Size | Data

10 rows | 15 columns | 150 cells | Run SQL Query | Export

| | Stat | Serious damag | Severe damage | Critical damag | Unsurvivable d | Blast rad 1psi [ |
|---|---|---|---|---|---|---|
| 1. | Mean | 104.5 | 53.7 | 32.3 | 14.1 | 104.5 |
| 2 | Min Modeled | 54.9 | 35.0 | 19.2 | 0.0 | 54.9 |
| 3 | 1st Percentile | 60.5 | 40.0 | 22.2 | 5.4 | 60.5 |
| 4 | 5th Percentile | 72.6 | 42.9 | 23.9 | 9.6 | 72.6 |
| 5 | 50th Percentile | 105.9 | 52.7 | 31.0 | 13.8 | 105.9 |
| 6 | 95th Percentile | 126.2 | 69.0 | 44.2 | 18.4 | 126.2 |
| 7. | 99th Percentile | 131.5 | 73.8 | 47.9 | 19.7 | 131.5 |
| 8 | Max Modeled | 141.5 | 78.5 | 51.7 | 20.9 | 141.5 |
| 9 | HPDI 68% | [97.2 - 121.1] | [43.4 - 60.3] | [23.4 - 36.6] | [12.5 - 17.0] | [97.2 - 121.1] |
| 1. | HPDI 99% | [59.5 - 133.6] | [38.5 - 74.3] | [21.4 - 48.3] | [5.4 - 20.7] | [59.5 - 133.6] |

**Min** and **Max** represent the smallest and largest values modeled (5000 property samples x 5000 impact points = 25 million cases modeled), not absolute theoretical limits. **HPDI** stands for Highest Probability Density Interval, and **HPDI 68%** represents the most likely range.

HYPOTHETICAL EXERCISE

*Figure 26: Damages Page of Interactive Dashboard, Data subtab*

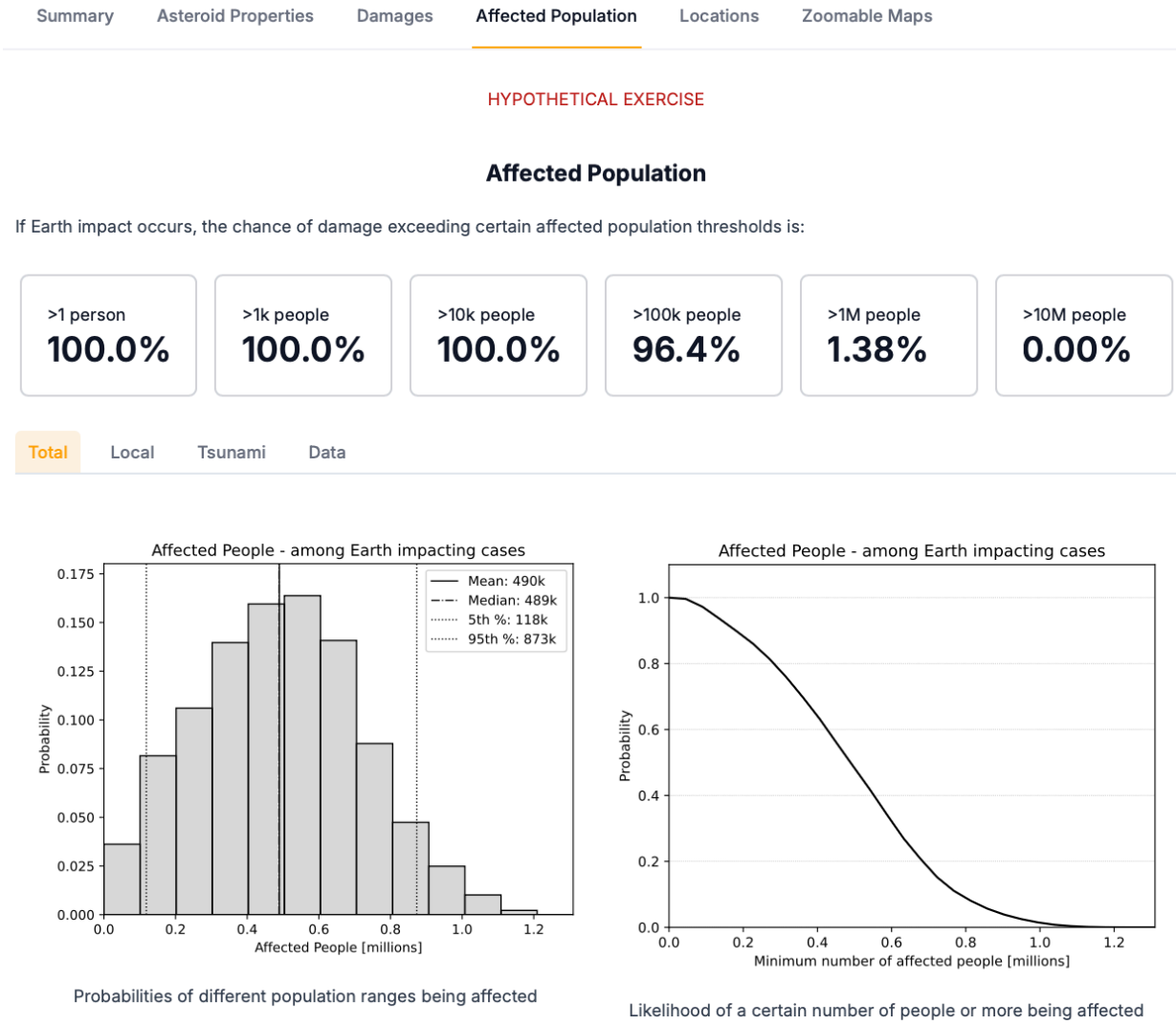



*Figure 27: Affected Population Page of Interactive Dashboard, Total subtab*

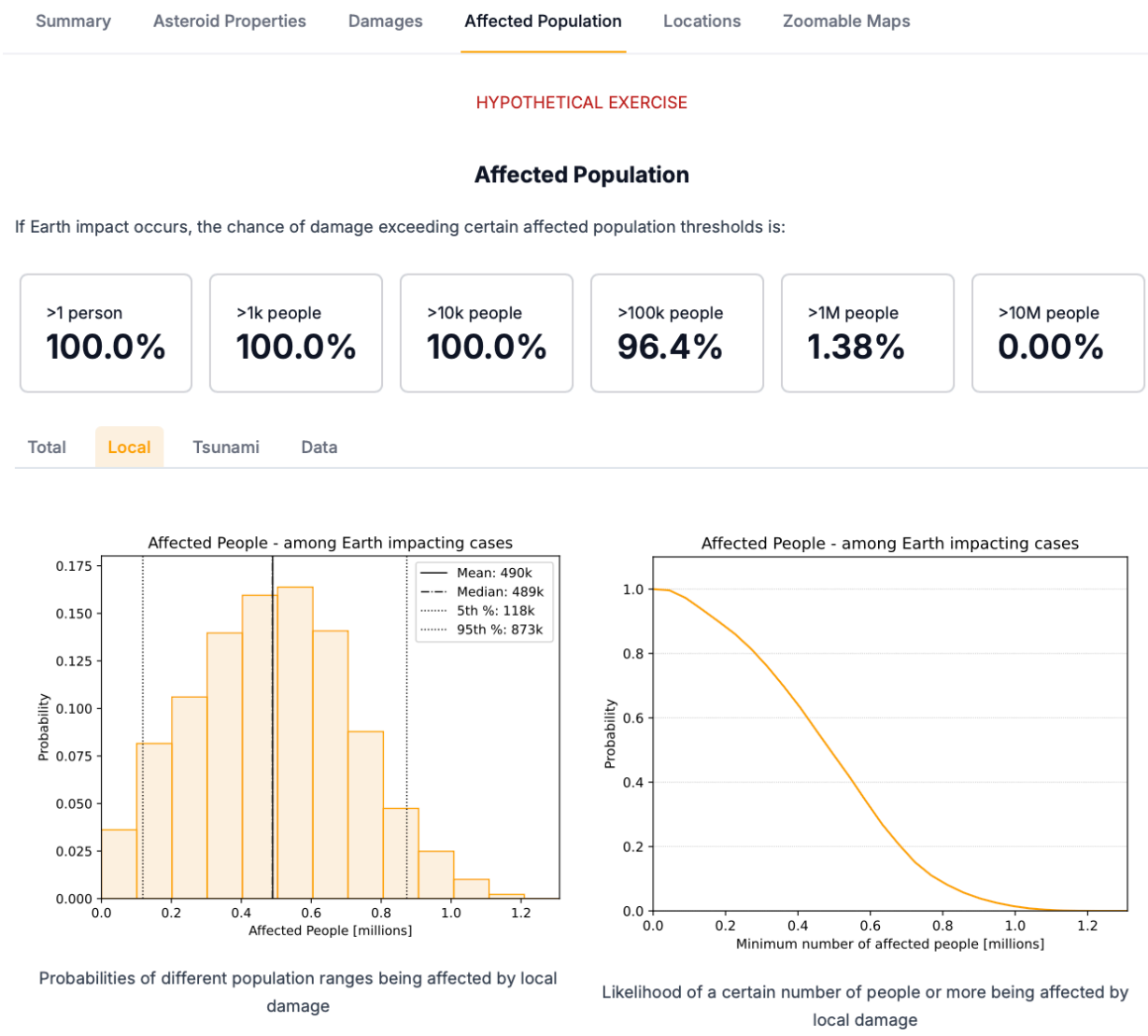



*Figure 28: Affected Population Page of Interactive Dashboard, Local subtab*

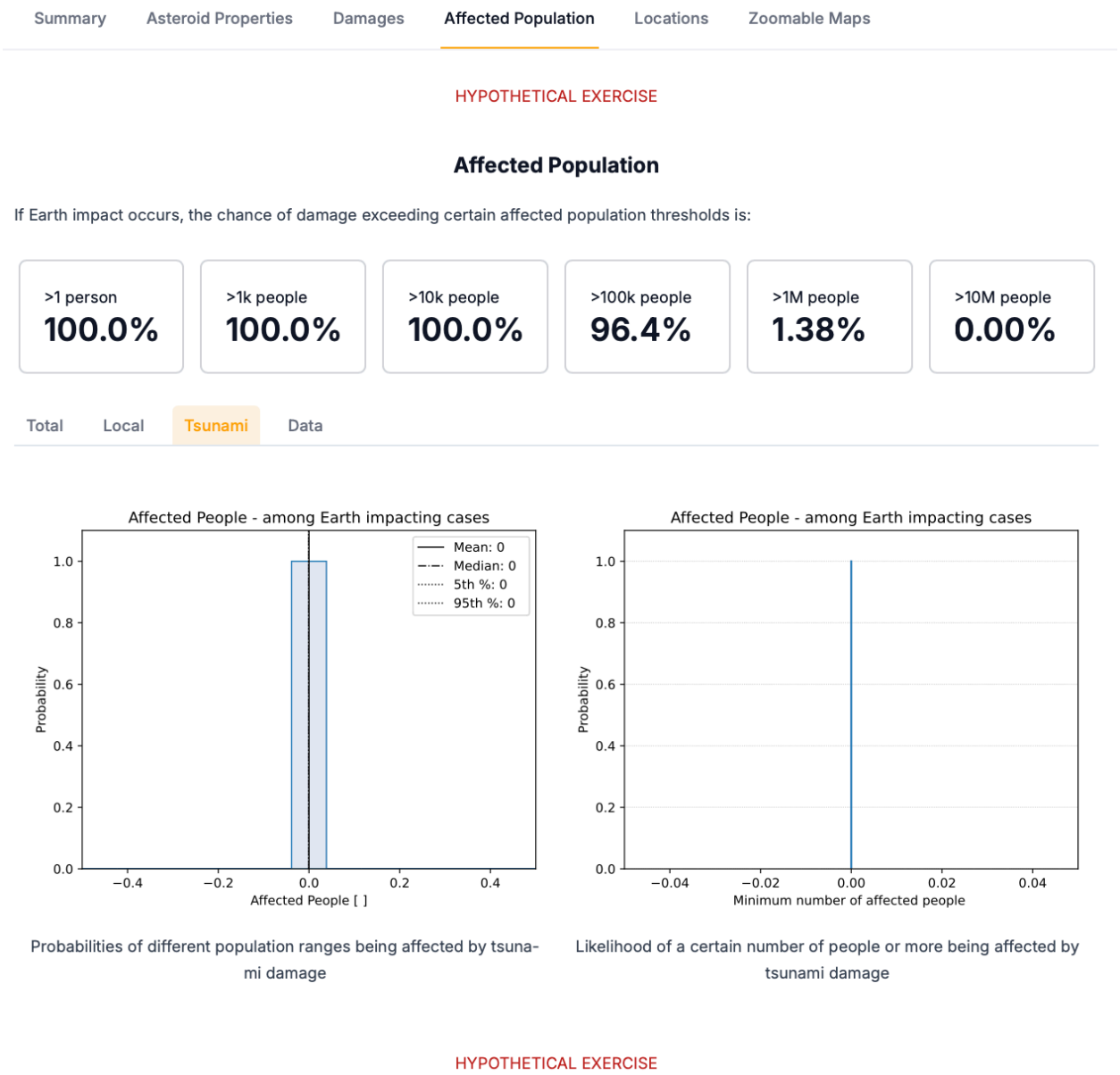



*Figure 29: Affected Population Page of Interactive Dashboard, Tsunami subtab*

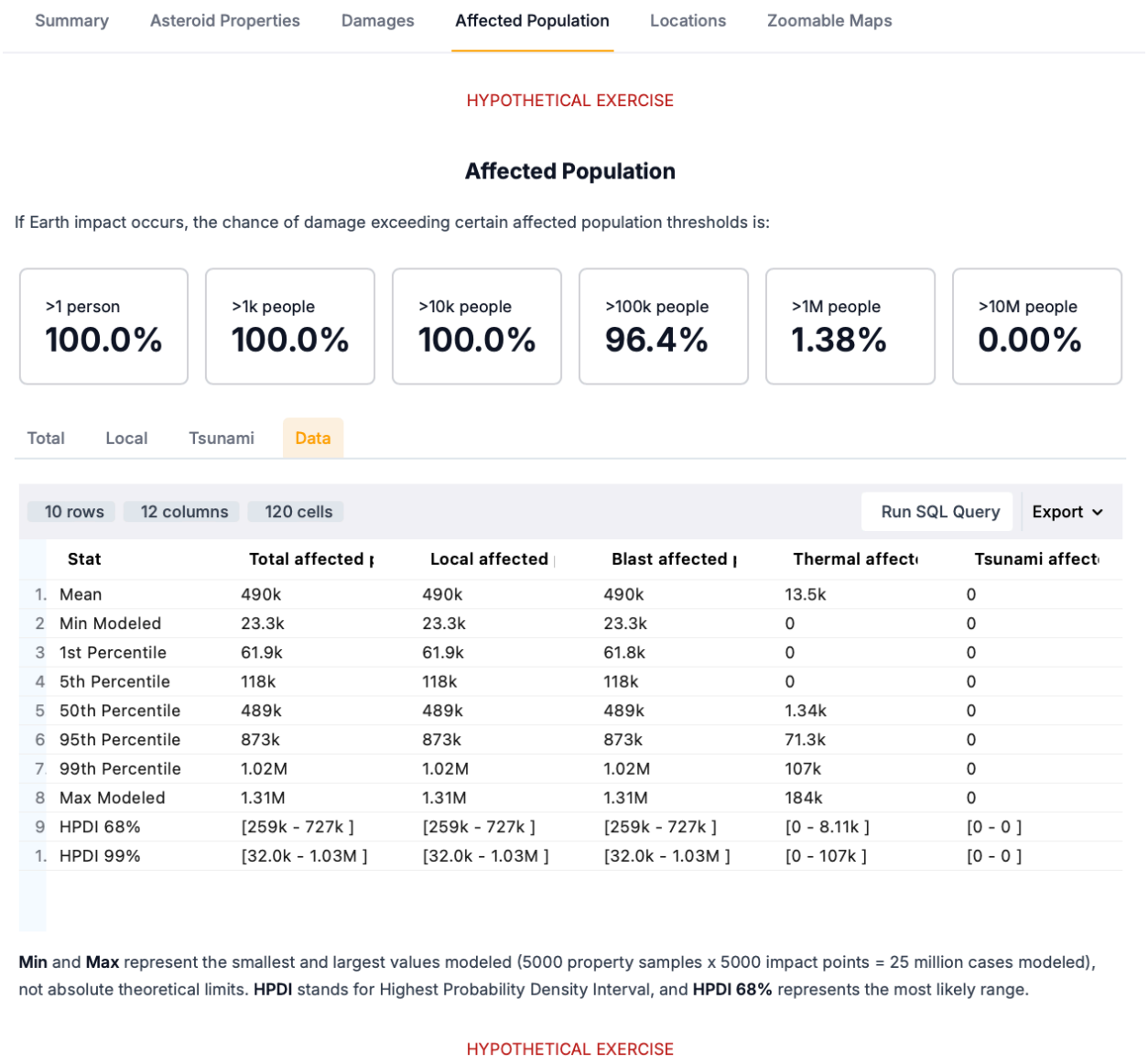


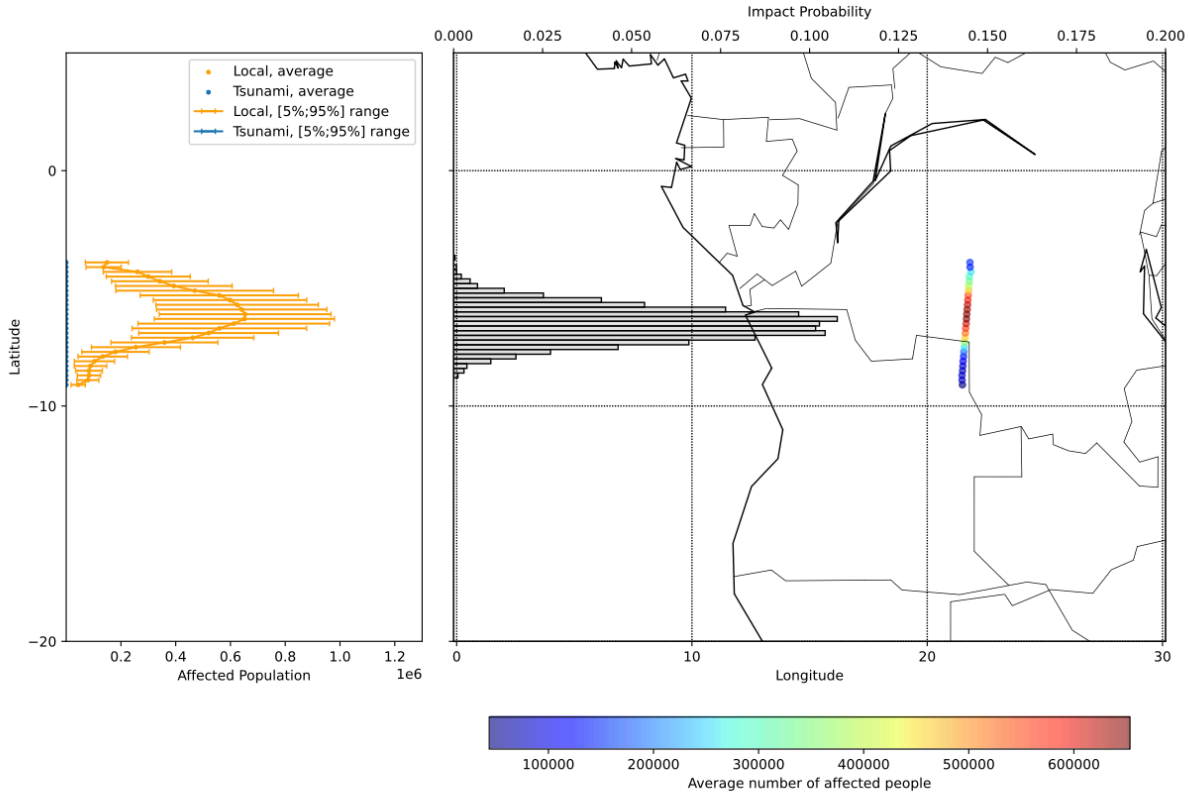

*Figure 30: Affected Population Page of Interactive Dashboard, Data subtab*

Summary | Asteroid Properties | Damages | Affected Population | Locations | Zoomable Maps

HYPOTHETICAL EXERCISE

## Locations

Location Damage and Risk | Broad Location Picture




- Earth-impacting points cross parts of Angola and the Democratic Republic of the Congo.
- Right Figure: Average affected population map and impact probabilities - Map presents the average affected population (bottom colormap) for potential entry points along the swath given the range of potential asteroid sizes and properties. Bar plot presents the likelihood of impact occurring within potential impact regions (top horizontal axis)
- Left Figure: Affected population ranges within each region - Plot presents averages and [5-95%] ranges of people affected by local (greater of blast overpressure and thermal radiation) or tsunami damage within latitude bins along the swath.

HYPOTHETICAL EXERCISE

*Figure 31: Locations Page of Interactive Dashboard, Location Damage and Risk subtab*

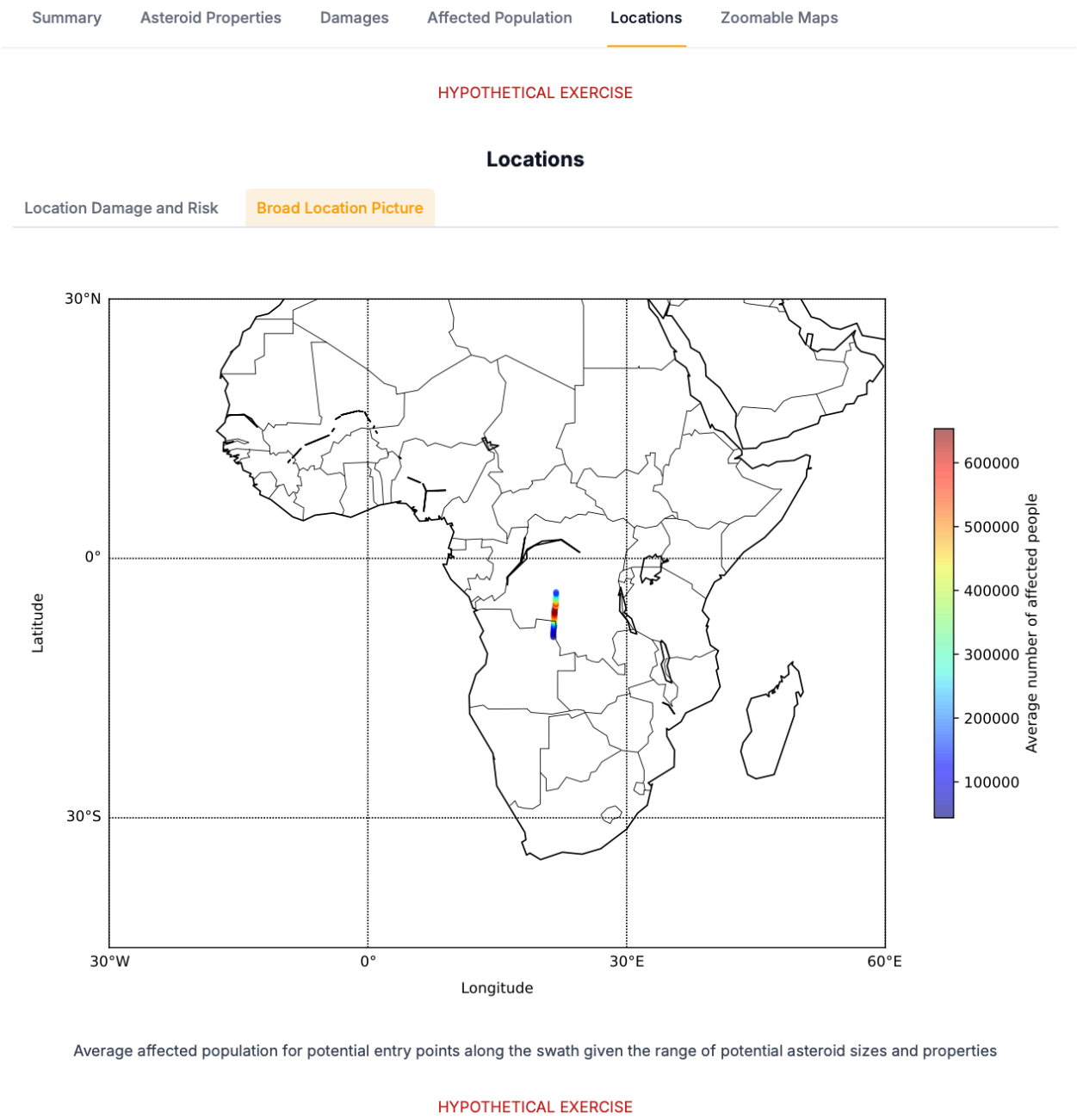



*Figure 32: Locations Page of Interactive Dashboard, Broad Location Picture subtab*

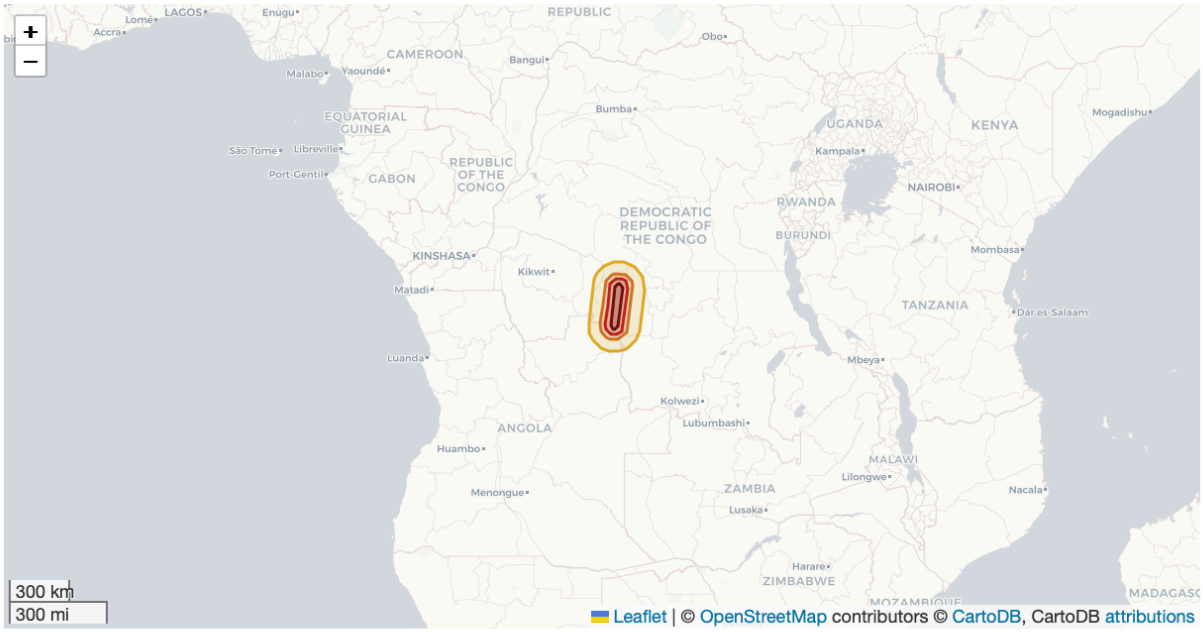
Summary | Asteroid Properties | Damages | Affected Population | Locations | Zoomable Maps

HYPOTHETICAL EXERCISE

## Zoomable Maps

| | | Serious | Severe | Critical | Unsurvivable |
|---|---|---|---|---|---|
| Potential Effects | Blast | Shattered windows, some structure damage | Widespread structure damage | Most residential structures collapse | Complete devastation |
| | Thermal | 2nd degree burns | 3rd degree burns | Clothing ignition | Structure ignition |
| Criteria | Blast | 1 psi | 2 psi | 4 psi | 10 psi |
| | Thermal | 0.25 MJ/m^2 | 0.42 MJ/m^2 | 0.84 MJ/m^2 | 1.20 MJ/m^2 |
| Population Affected | | 10% | 30% | 60% | 100% |

Swath | Worst Case Scenario




Damage Risk Swath: Extent of regions potentially at risk for local ground damage, given ranges of potential impact locations and damage sizes. Damage severity levels serious, severe, critical, and unsurvivable shown out to the 95th percentile.

HYPOTHETICAL EXERCISE

*Figure 33: Zoomable Maps Page of Interactive Dashboard, Swath subtab*

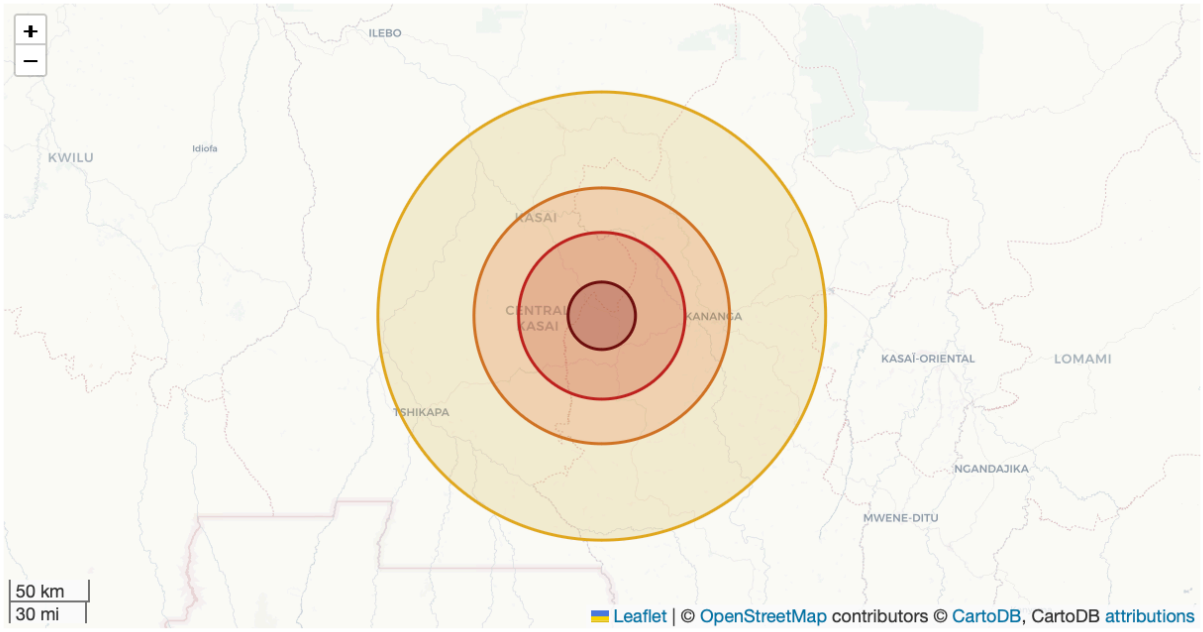
Summary | Asteroid Properties | Damages | Affected Population | Locations | Zoomable Maps

HYPOTHETICAL EXERCISE

## Zoomable Maps

| | | Serious | Severe | Critical | Unsurvivable |
|---|---|---|---|---|---|
| Potential Effects | Blast | Shattered windows, some structure damage | Widespread structure damage | Most residential structures collapse | Complete devastation |
| | Thermal | 2nd degree burns | 3rd degree burns | Clothing ignition | Structure ignition |
| Criteria | Blast | 1 psi | 2 psi | 4 psi | 10 psi |
| | Thermal | 0.25 MJ/m^2 | 0.42 MJ/m^2 | 0.84 MJ/m^2 | 1.20 MJ/m^2 |
| Population Affected | | 10% | 30% | 60% | 100% |

Swath | Worst Case Scenario




Worst case scenario among cases modeled in terms of total affected people

HYPOTHETICAL EXERCISE

*Figure 34: Zoomable Maps Page of Interactive Dashboard, Worst Case Scenario subtab*