Module 5: Disaster Preparedness

- Technical briefs
  - Recap of asteroid risk assessment
  - Relevant policies for emergency preparedness
- Discussion will focus on
  - Policy-related issues for disaster preparedness
  - Preparedness and preparation for response
  - Lessons from other disasters
  - Critical infrastructure protection

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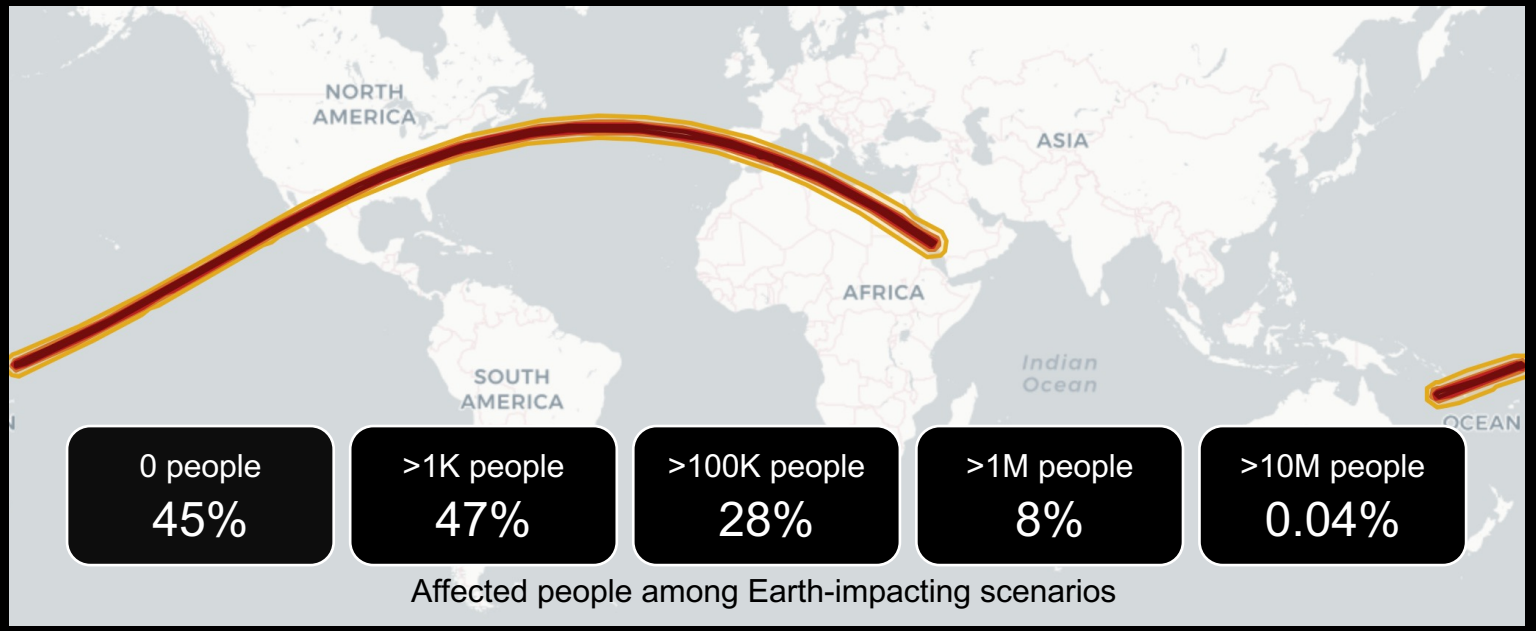

72%
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Recap:
Impact Risk Assessment

Impact Damage Effects, Probabilities, and Regions at Risk

Lorien Wheeler
Jessie Dotson, Grégoire Chomette, Ashley Coates,
Michael Aftosmis, Eric Stern, Donovan Mathias

Asteroid Threat Assessment Project (ATAP)
NASA Ames Research Center

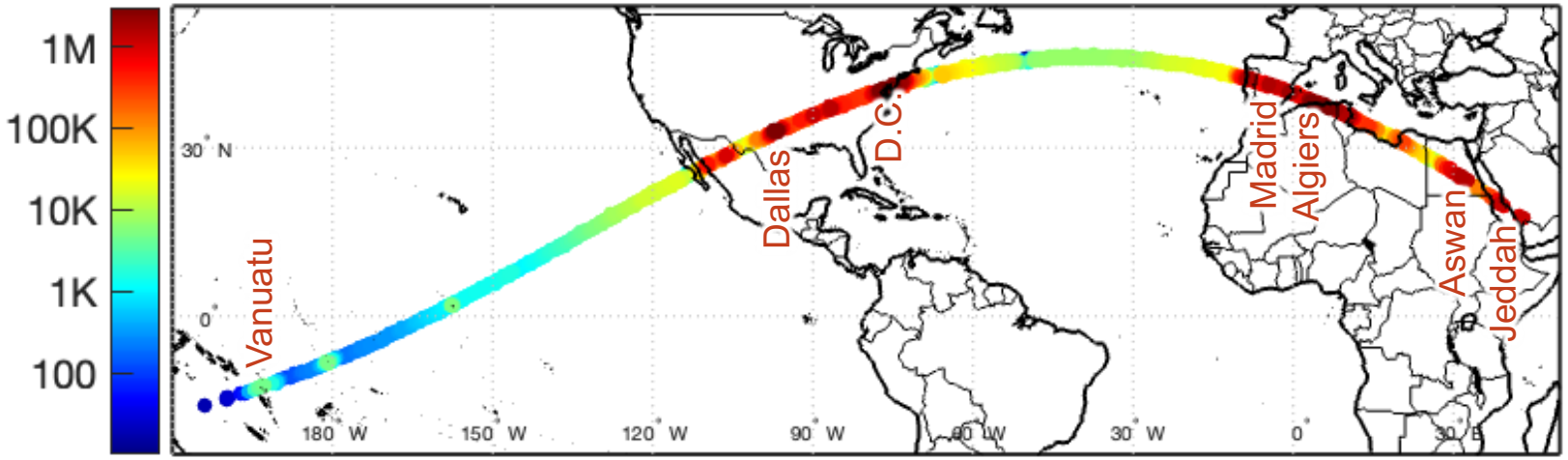
Impact Hazard Summary

72% chance of Earth impact in 14 years by a 60–800 m asteroid with 6–15,000 Mt of impact energy

High risk with large range of potential damage

Little damage or very large damage affecting **tens of thousands to millions** of people are **both likely**.

Average Affected Population along Potential Impact Locations



Range **0–20M people**, average **~270K** among Earth-impact cases

Local Ground Damage:

- Nearly all cases over land or near shore cause large blast damage to populated areas.
- Damage is likely to reach unsurvivable levels, with large areas of serious damage spanning multiple large metro areas, states, or countries.

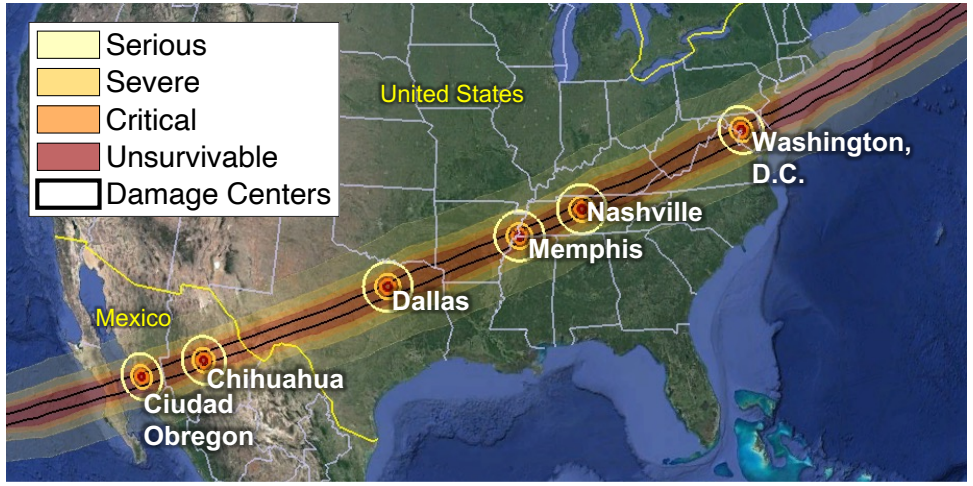
Tsunamis:

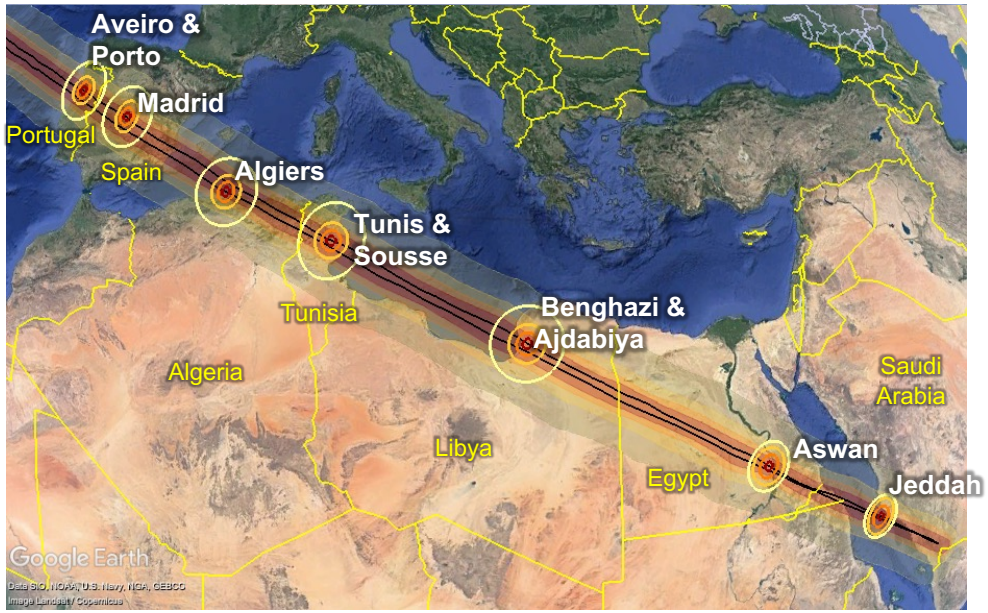
- Large impacts near coasts could cause significant tsunamis.
- Smaller impacts over distant ocean may cause little damage.

Global and Regional Effects:

- Global climate effects are not expected, but largest cases approach estimated thresholds.
- *Potential for other extended environmental or socioeconomic effects is unknown.*

Ground Damage Risk Swath





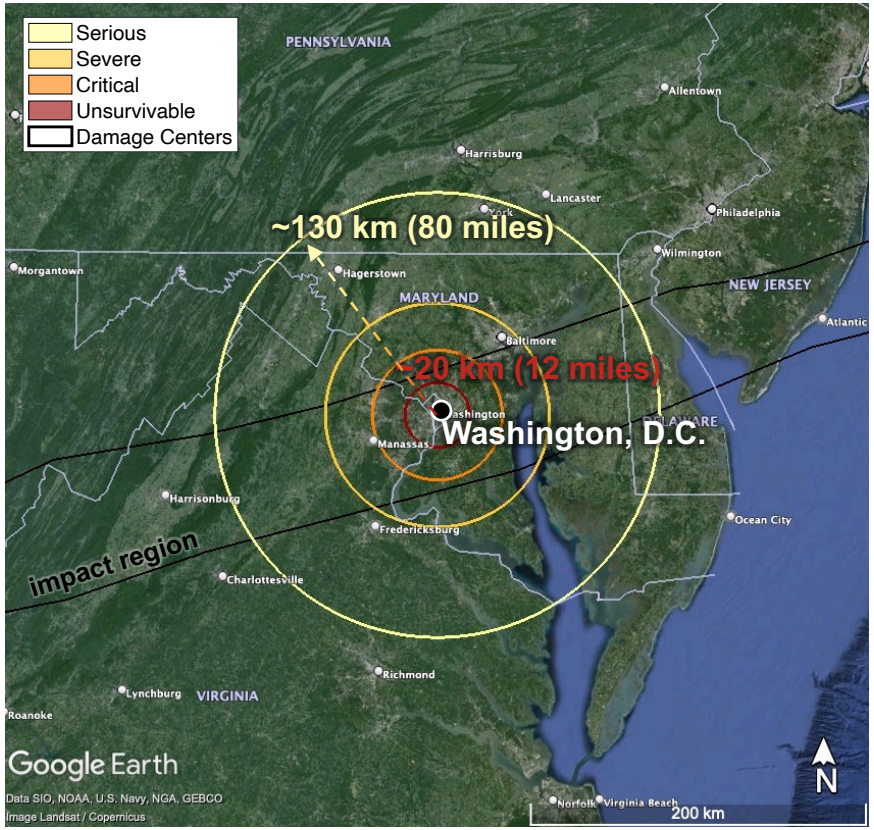
Damage risk swath: Extent of regions *potentially* at risk for ground damage, given ranges of potential impact locations and damage sizes (out to 95th percentile). Rings show median (50th percentile) damage footprints at sample locations.

- Damage severities are likely to reach **unsurvivable levels**, extending to larger areas of structural damage, fires, and shattered windows.
- Damage areas are most likely between **~80 and 180 km (50 and 110 miles) in radius**.
- Largest damage areas could extend out **~300 km (180 miles) or more in radius**.

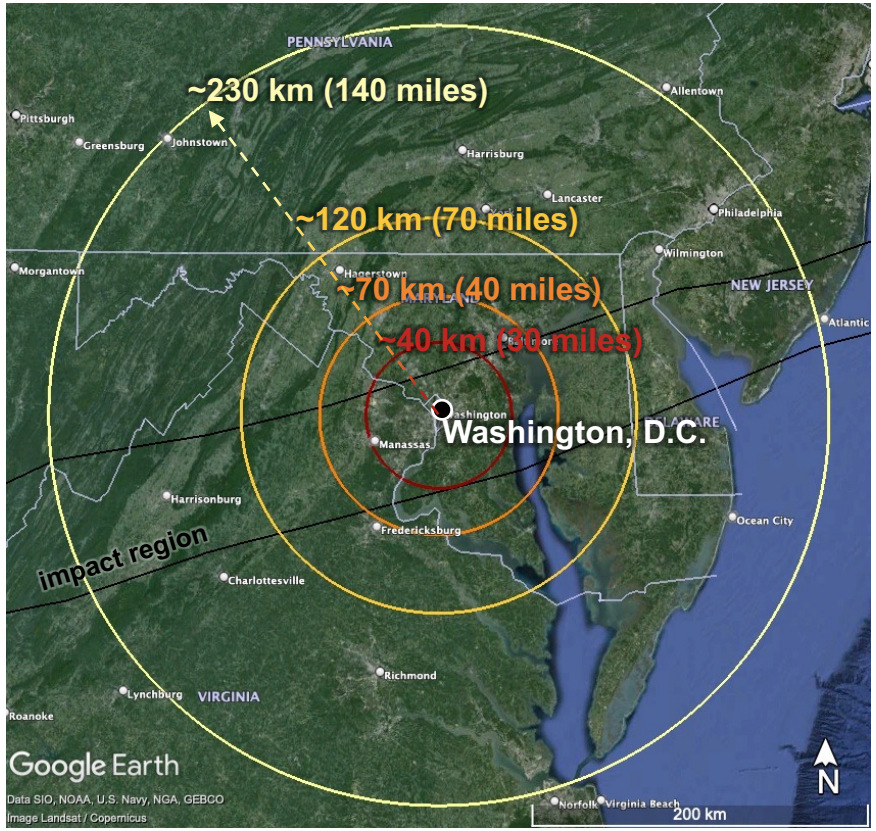
	Damage Level Description
Serious	Windows shatter, some structure damage
Severe	Widespread structure damage, or third-degree burns
Critical	Residential structures collapse, or clothing ignites
Unsurvivable	Devastation, structures flattened or burned

Sample Ground Damage Sizes

Median Damage Size (50th Percentile)



Large Damage Size (95th Percentile)



Likely damage sizes could span multiple large metropolitan areas, counties, or states

Large damage sizes could span multiple states or cover countries

Washington, D.C., USA

highest population damage region along swath

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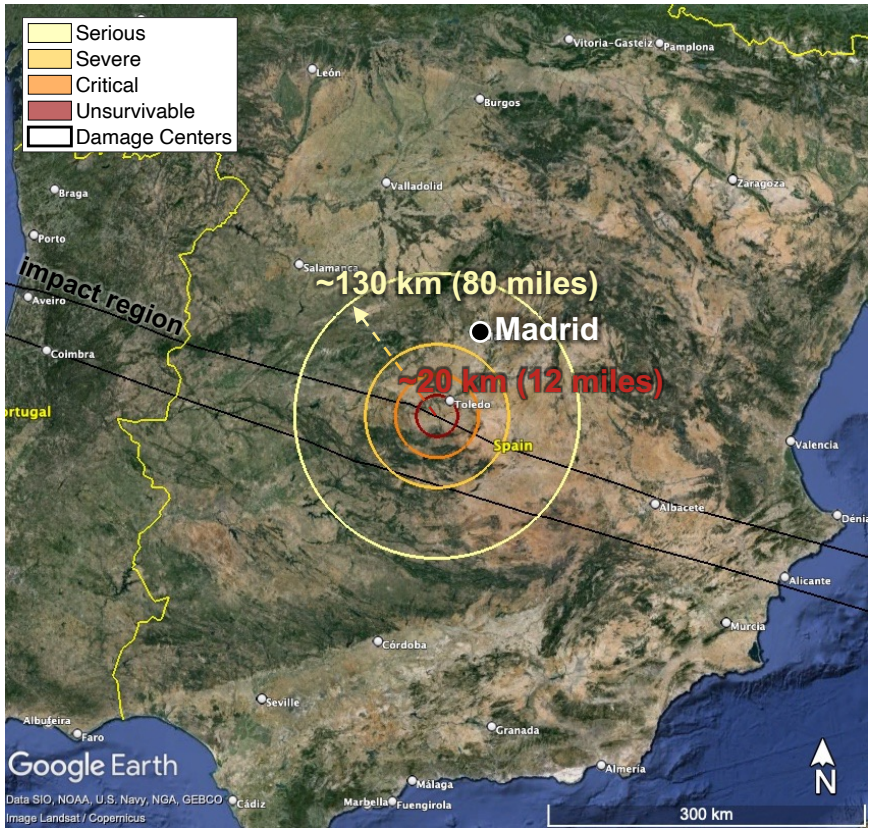

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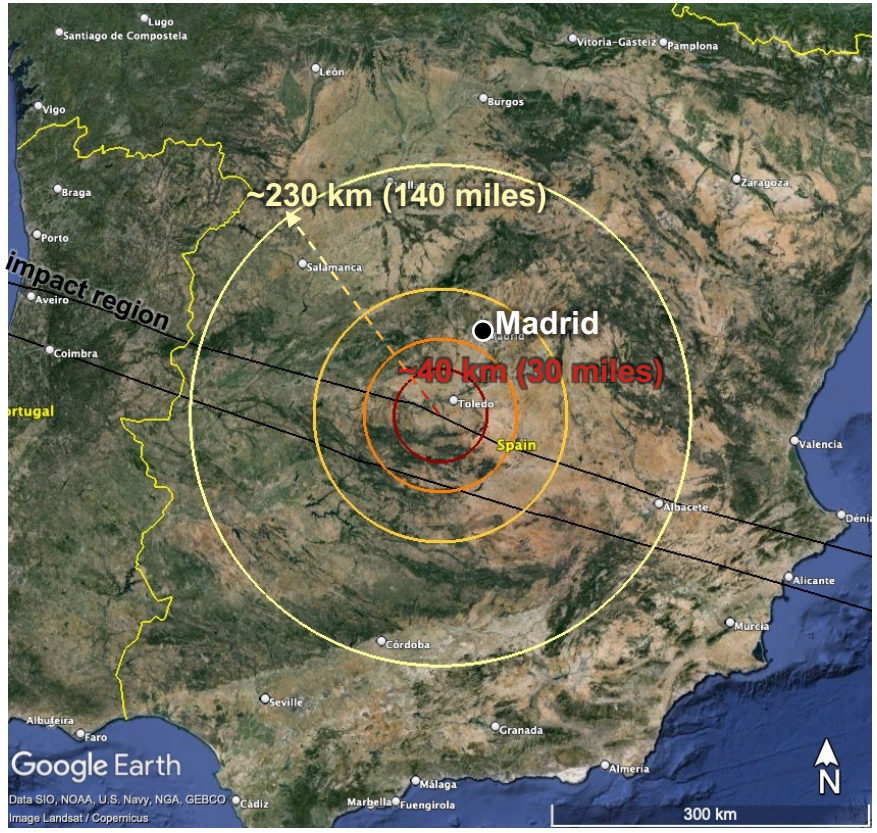

Large damage sizes could span multiple states or cover countries

Madrid, Spain

highest population damage region in Europe

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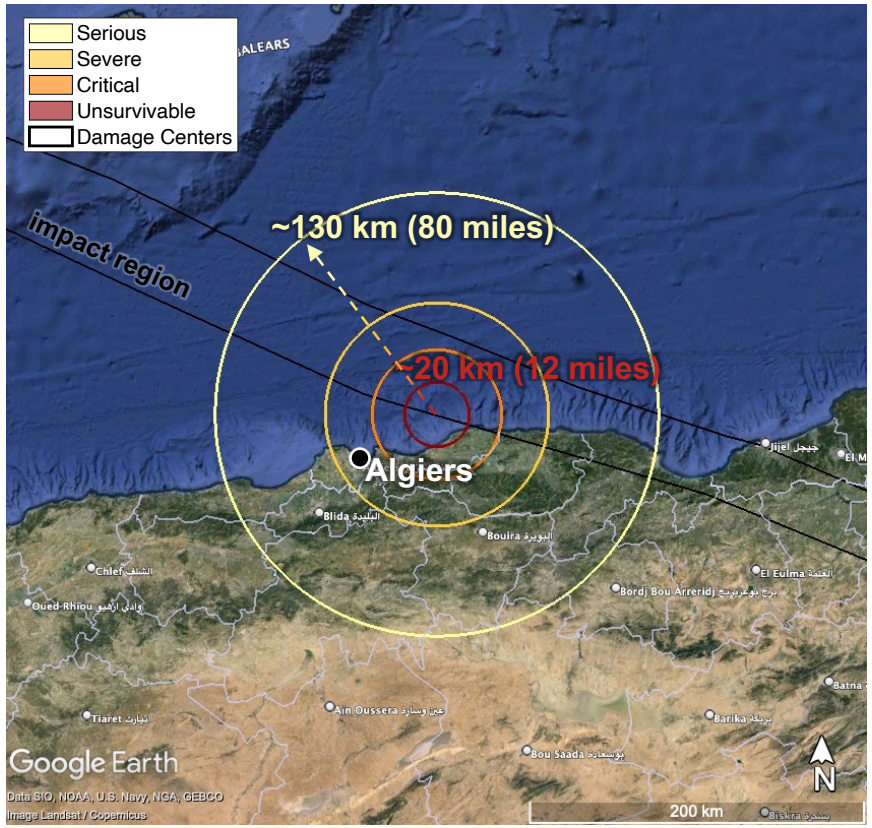

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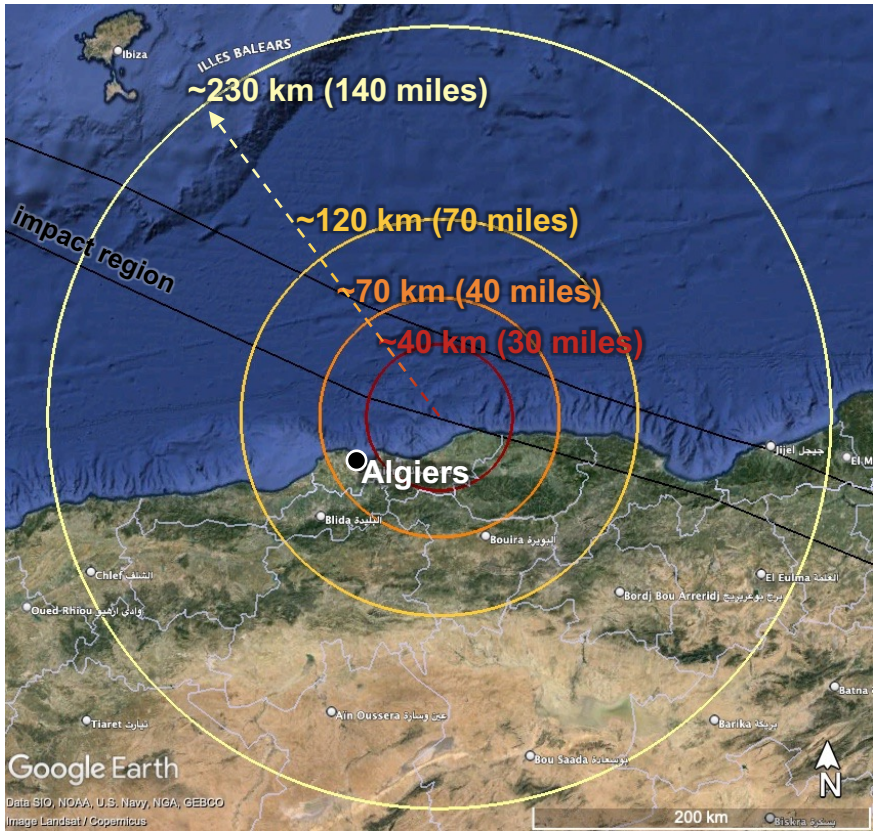

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Algiers, Algeria

highest population damage region in Africa

	Damage Level Description
Serious	Windows shatter, some structural damage
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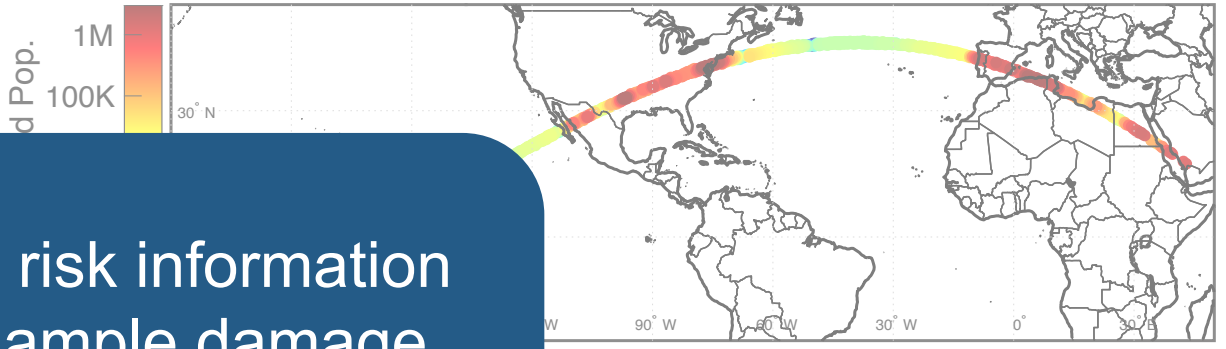
Impact Risk Dashboard

Asteroid and Impact Properties

- Assessment date: 2 April 2024 (T-14 years and 3 months)
- Potential impact date: 12 July 2038
- Earth impact probability: 72%
- Large uncertainties regarding asteroid size, energy, and other properties
- Diameter: ~60–800 m (200–2600 ft), (330–1050 ft), median 220 m (730 ft
- Energy: ~6–15,000 megatons TNT (median 350 Mt

Impact Risk Swath

- Potential impact locations colored by the average number of people affected by local ground damage or tsunami

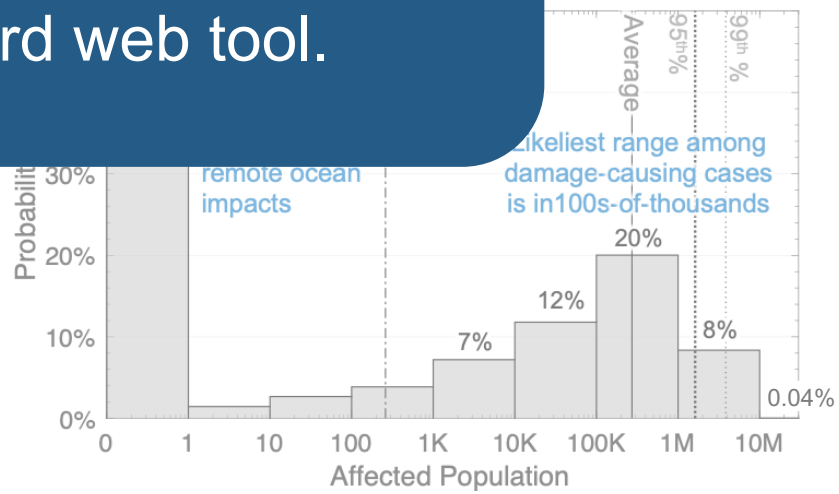


Additional impact risk information and interactive sample damage maps are available on interactive risk dashboard web tool.

Impact Hazards

- Potential damage sizes and location
- Potential for no damage and potenti tens of thousands to millions of peop depending on asteroid size and impact location
- Primary hazard: large blast damage, ranging from blown-out windows to unsurvivable levels
- Ground damage radii: ~20–300 km (12–180 miles), most likely 80–180 km (50–110 miles), median 130 km (80 miles)
- Larger ocean impacts could cause tsunami damage (although less likely and less severe than local blast damage)

Earth impact)



Probabilities of how many people damage could affect if Earth impact occurs

- Range: 0–20 million people
- ~270,000 avg. if Earth impact occurs
- ~200,000 total avg. risk (with ~72% Earth-impact probability)

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- What risk assessments would be provided by other countries or organizations?

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- What additional information would be useful for disaster preparedness and response planning?

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- How would risk assessments from different sources be compared and shared?

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Relevant International Policies for Disaster Preparedness

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NASA

FEMA

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JOHNS HOPKINS
APPLIED PHYSICS LABORATORY

cneos

Ames Research Center

Lawrence Livermore
National Laboratory

Disaster Preparedness for Asteroid Impacts

Earthquake

Volcanic eruption

Flood

Hurricane

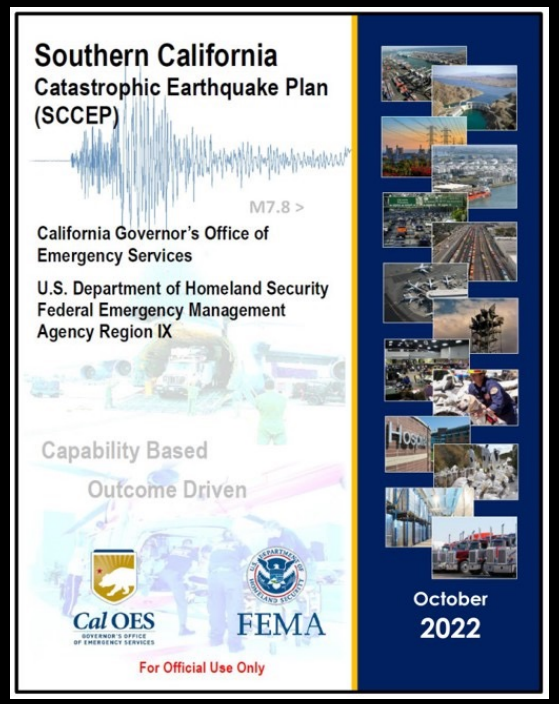
Wildfire

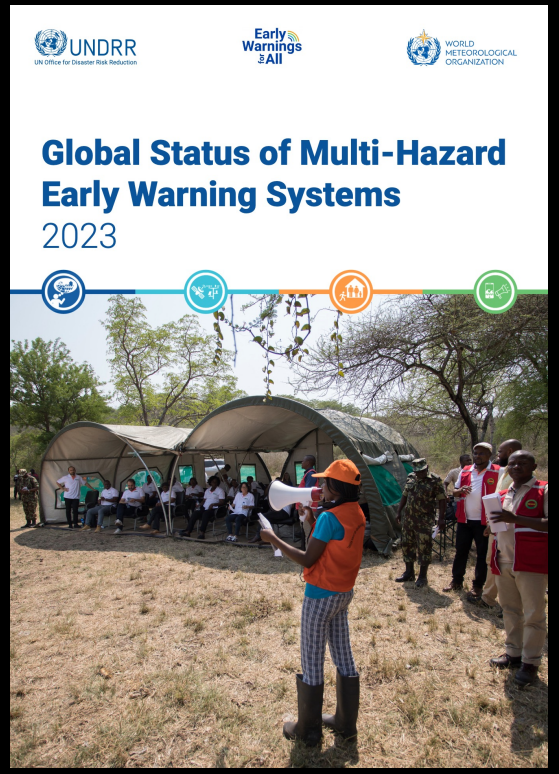
?

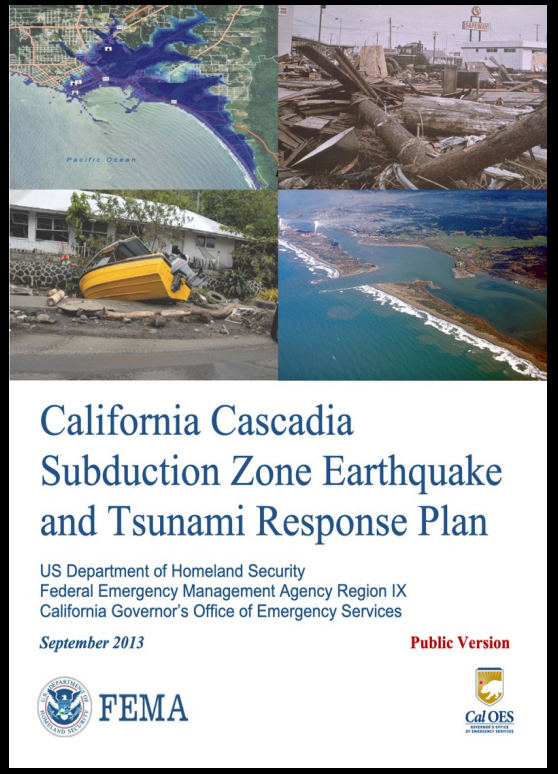
Asteroid impact

Disaster Preparedness for Asteroid Impacts

Should a plan or checklist be considered?







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Asteroid impact

Possible International Organizations for Asteroid Impact Response Coordination and Planning

- The International Charter Space and Major Disasters
  - satellite data to support disaster response worldwide
- United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER)
- United Nations Office for Disaster Risk Reduction (UNDRR)
  - Sendai Framework for Disaster Risk Reduction (2015–2030)
  - United Nations Early Warnings for All initiative
- United Nations Disaster Assessment and Coordination System – 2022 – Office for the Coordination of Humanitarian Affairs (UNOCHA)

Multi-Hazard Early Warning System (MHEWS): A Possible Way Ahead for a Planetary Defense Scenario

- To address the glaring disparity in the coverage of early warning systems (EWSs), in March 2022, the UN Secretary-General set an ambitious new goal: By 2027, everyone on Earth should be protected by EWSs against increasingly extreme weather and climate change.
- The World Meteorological Organization (WMO) and the UN Office for Disaster Risk Reduction (UNDRR) are leading the UN “Early Warnings for All” initiative.
- A similar program could be developed for a planetary defense scenario.
- Future investments over the five years would be used to advance the four key pillars of a MHEWS.
- Progress across four pillars.
- The comprehensiveness of a MHEWS is determined by countries’ self-assessment across four interconnected pillars:
    1. risk knowledge
    2. observations and forecasting
    3. warning dissemination and communication
    4. preparedness to respond

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- What lessons can be learned from earthquakes, tsunamis, and other large-scale disasters to inform multinational preparedness and response efforts in this scenario?

- What relevant international laws, treaties, or other agreements exist that could be adapted to this scenario from the emergency management perspective?

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- Who would be responsible for leading the preparations, and how would international coordination occur?

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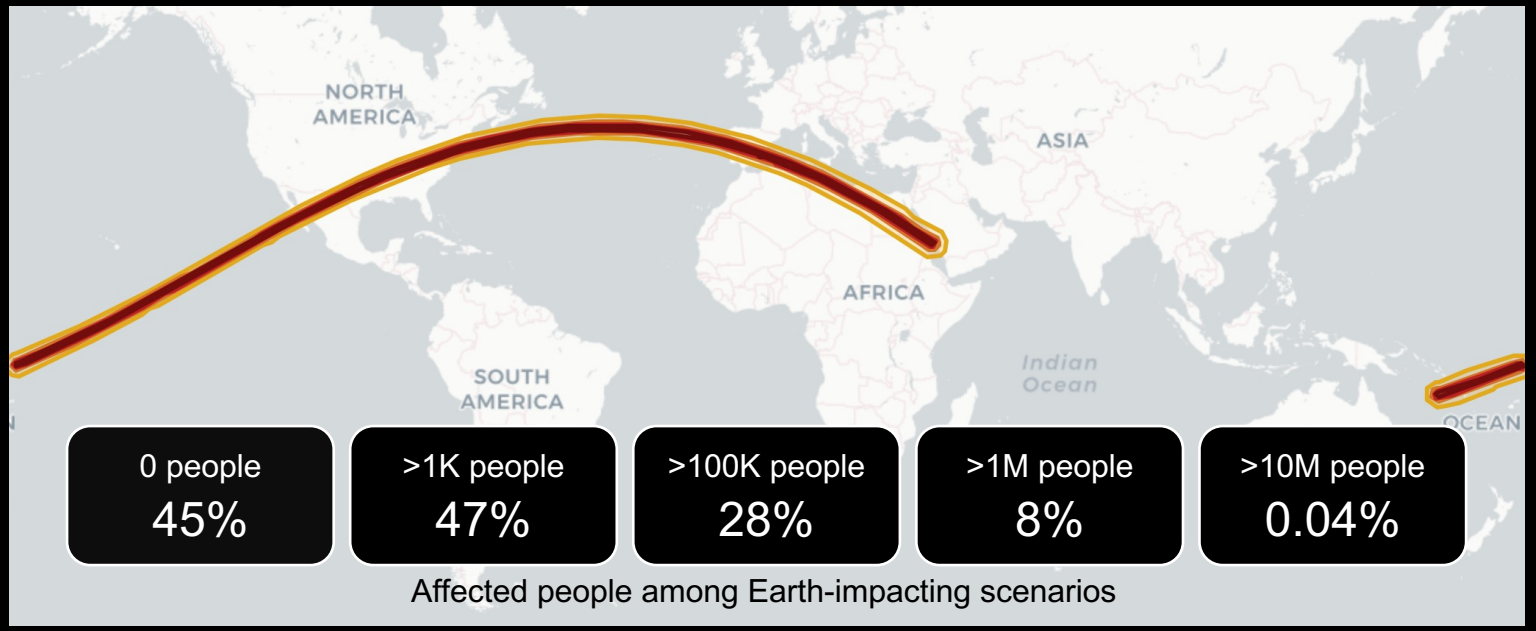

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- How would the recommended space mission courses of action factor into emergency preparedness activities and timelines?
- How would emergency declarations impact allocation of resources?
- What contingencies might need to be planned for?

- How do you develop and sustain a public information strategy for emergency preparedness over the 14 years until impact?

- How do you develop and sustain a public information strategy for emergency preparedness over the 14 years until impact?
- What are the challenges involved with developing and sustaining a state of preparedness over such a long period of time?

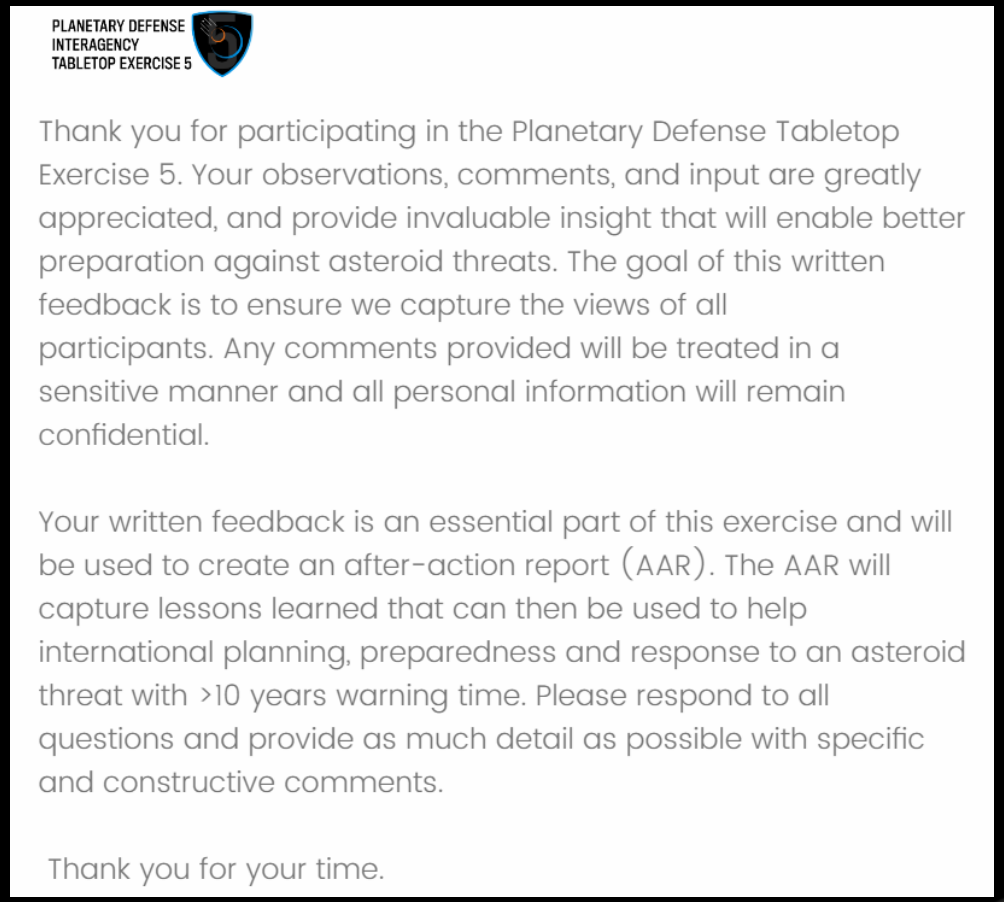
Hot Wash

- Goal is to gather quick comments and impressions
- One representative from each organization to provide:
  - One lesson learned
  - One best practice
- Two areas of interest for comments:
  1. Preparedness, including policy, technology, or capability gaps
  2. Comments on this exercise: strengths, opportunities, and ideas for future exercises
- Please limit responses to **2–3 minutes** so that many organizations can share
- Remember, you can post comments and responses to comments in the chat, too

Your comments and discussions are the data that will help this TTX culminate in an impactful after-action report.

Participant Feedback Forms

- See link posted in XLeap



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Thank you for participating in the Planetary Defense Tabletop Exercise 5. Your observations, comments, and input are greatly appreciated, and provide invaluable insight that will enable better preparation against asteroid threats. The goal of this written feedback is to ensure we capture the views of all participants. Any comments provided will be treated in a sensitive manner and all personal information will remain confidential.

Your written feedback is an essential part of this exercise and will be used to create an after-action report (AAR). The AAR will capture lessons learned that can then be used to help international planning, preparedness and response to an asteroid threat with >10 years warning time. Please respond to all questions and provide as much detail as possible with specific and constructive comments.

Thank you for your time.

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NASA

FEMA

APL
JOHNS HOPKINS
APPLIED PHYSICS LABORATORY

CNEOS

Ames Research Center

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