USGS
science for a changing world

Possible Roles for the U.S. Geological Survey in Impact Hazard Analysis and Response

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Overview

- Role of the USGS in planning for natural hazards
- The USGS Hazards Mission Area
- Specific applications to impact hazards

What is the USGS?

- **The USGS was formed in 1879 to to examine the geologic structures and mineral resources of the Nation**
- **Probably best know for topographic maps**
- **Now has 7 mission areas:**

Core Science Systems
Climate and Land Use Change
Energy and Minerals
Environmental Health
Ecosystems
Natural Hazards
Water

USGS

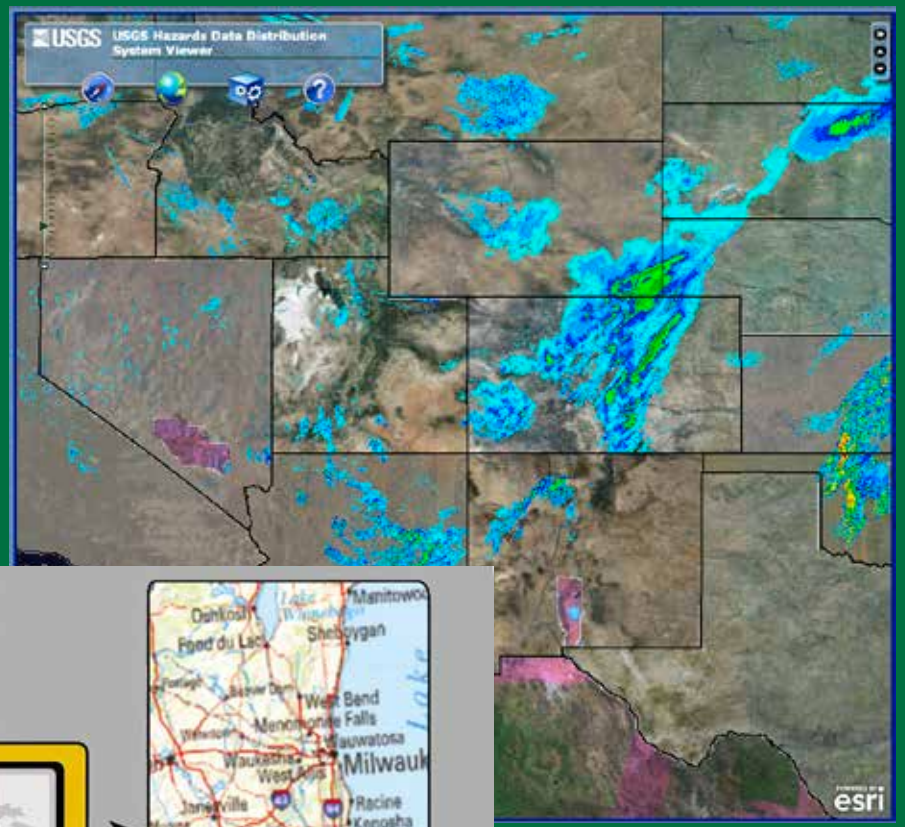
USGS Hazards Mission Area

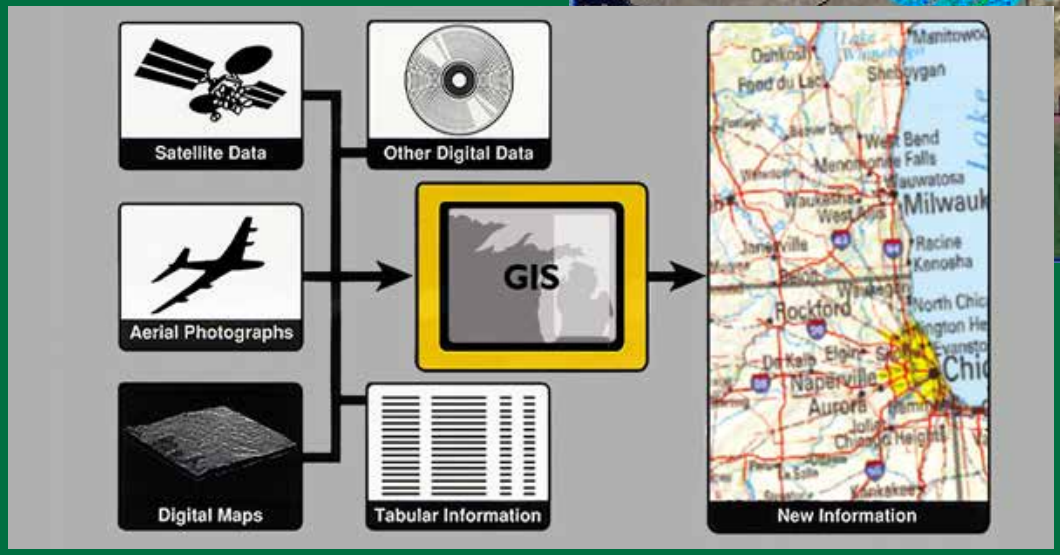
- Has statutory responsibility for earthquakes, volcanic eruptions, and landslides.
- Supports NOAA tsunami warnings
- Supports NOAA flood and severe weather warnings
- Supports USAF/NOAA geomagnetic storm warnings
- Supports tracking zoonotic diseases
- Supports wildfire response
- ...and more...

USGS

USGS Emergency Management

- Portal for real-time data, including orbital images and GIS products
- Partner with >2000 state, local, and tribal governments, NGOs, etc.





USGS

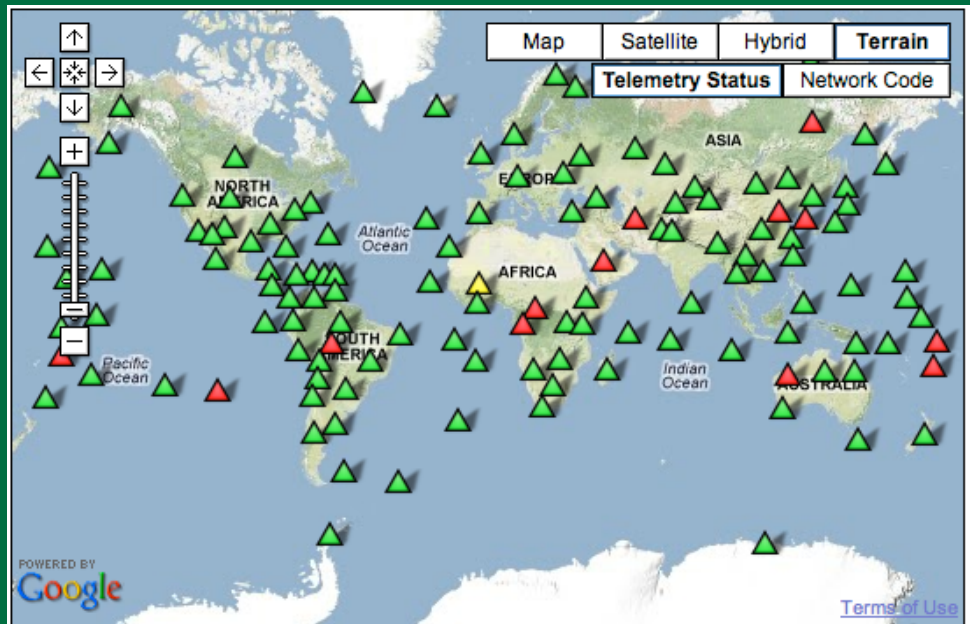
USGS Emergency Management

- Ready to support a local/regional EOC after an impact with real time data to allow rapid and appropriate responses.

USGS

Global Seismographic Network

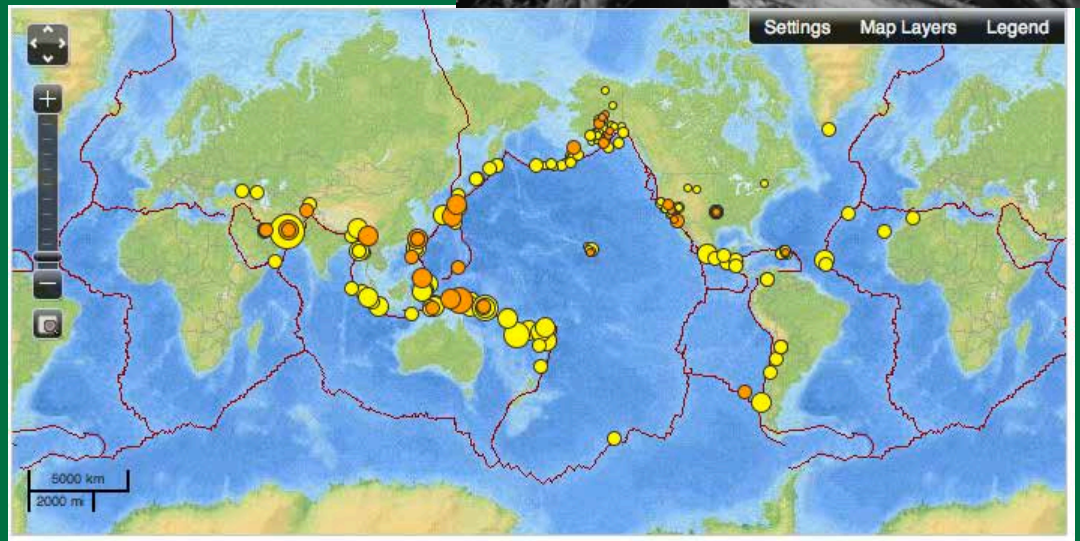
- A permanent digital state-of-the art seismological sensors connected via a telecommunications network. A partnership of USGS, NSF, and IRIS.
- This is the unclassified network that will tell you first where an impact occurred, especially if it is at sea.



USGS

Earthquake Hazards Program

- Part of the National Earthquake Hazards Reduction Program.
- Experts in risk assessment, research on loss reduction, real-time monitoring, and public outreach



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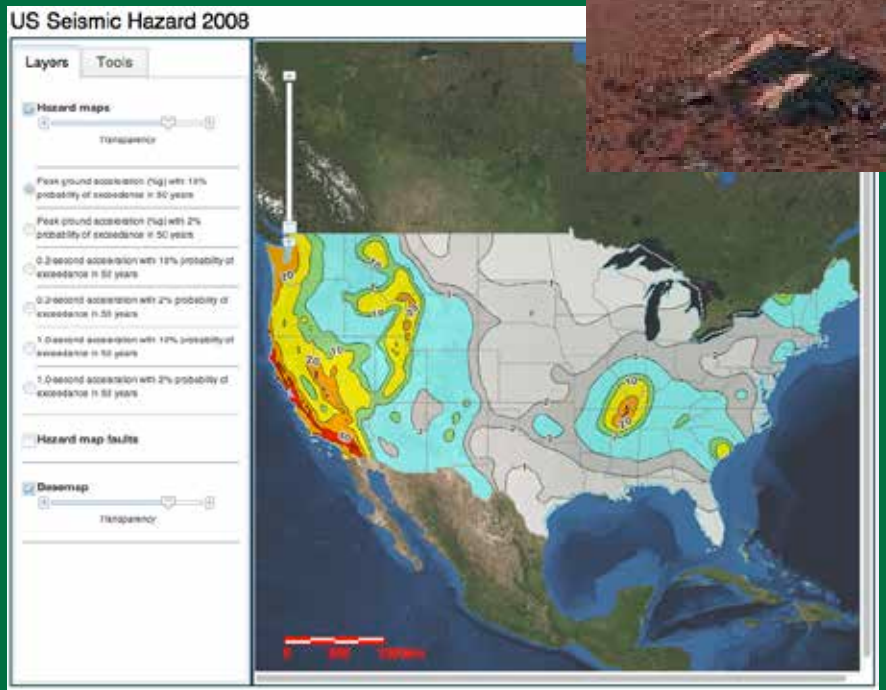
Earthquake Hazards Program

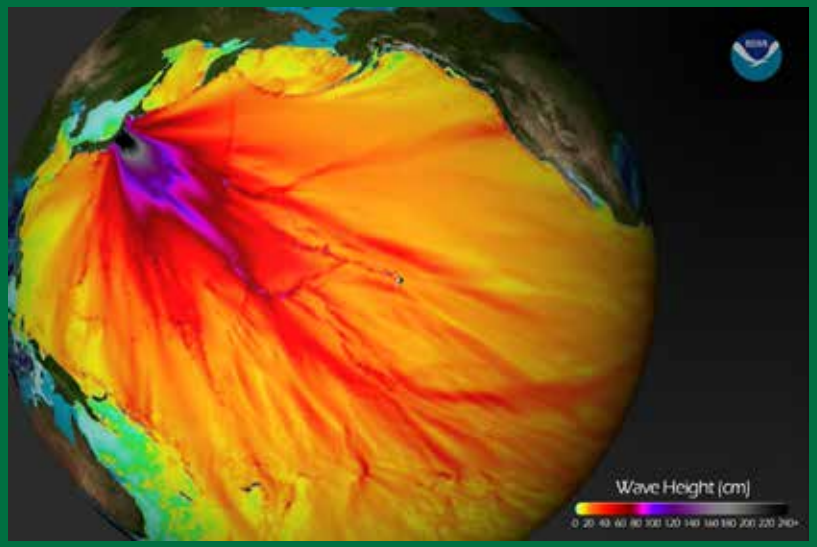
- Seismic shaking will be a major consequence of any significant impact.
- USGS tools will be able to predict the extent of damage.

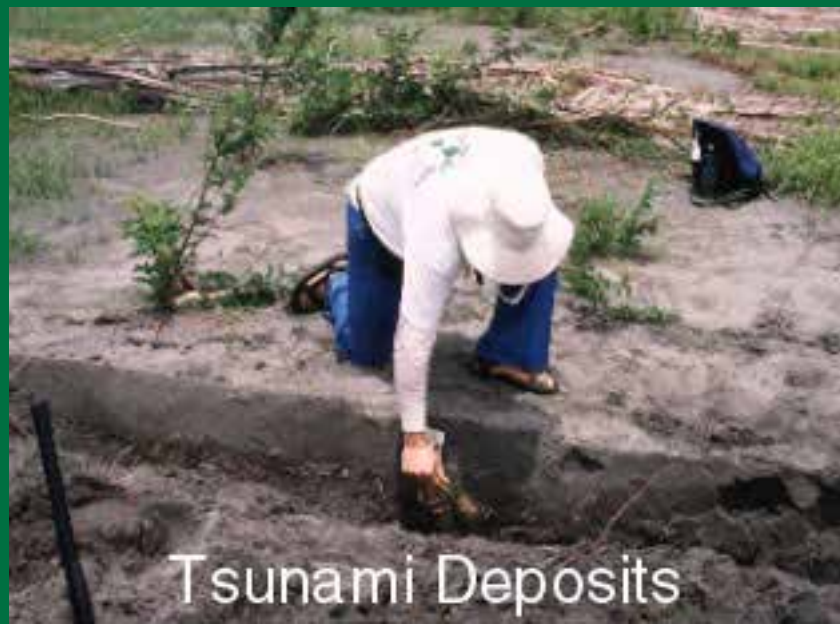


USGS

Coastal and Marine Geology

- Conducts many types of research, including tsunamis
- Extensive experience with modeling and field studies of tsunami deposits, including ancient mega-landslides.





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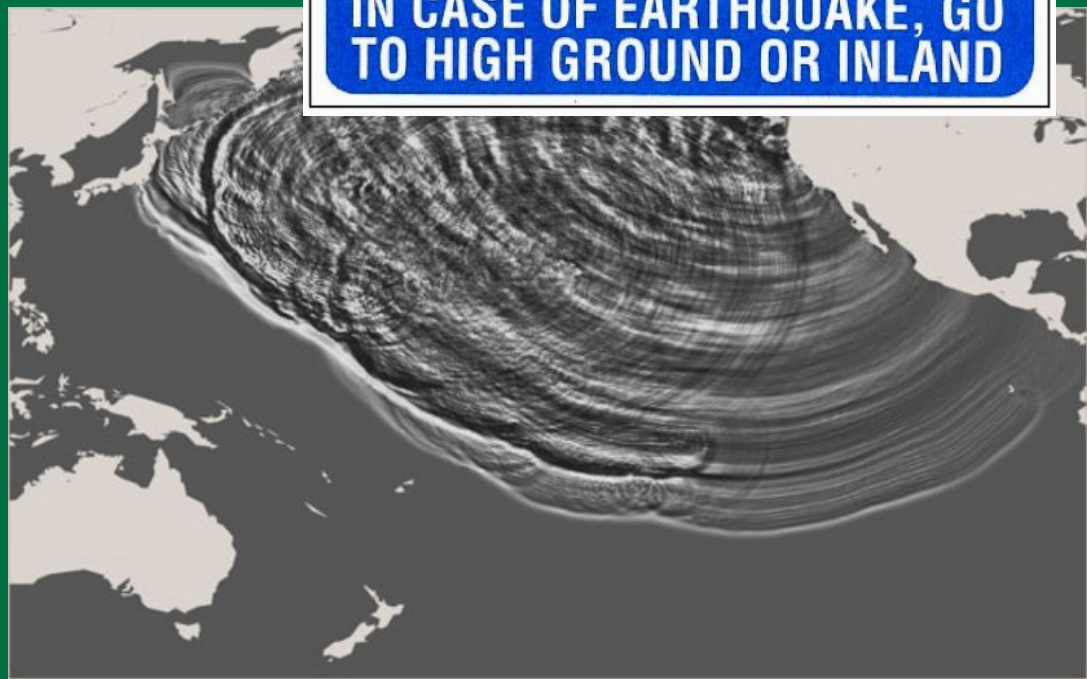
Coastal and Marine Geology

- USGS could provide the tools to predict consequences of impacts in the ocean.
- Part of the system that would issue tsunami warnings after an impact.



USGS

Landslide Hazards Program

- **Landslides cause $1-2 billion in damages and >25 fatalities per year, in the US alone. LHP's goal is to reduce these losses by improving our understanding of the processes and mitigation methods.**

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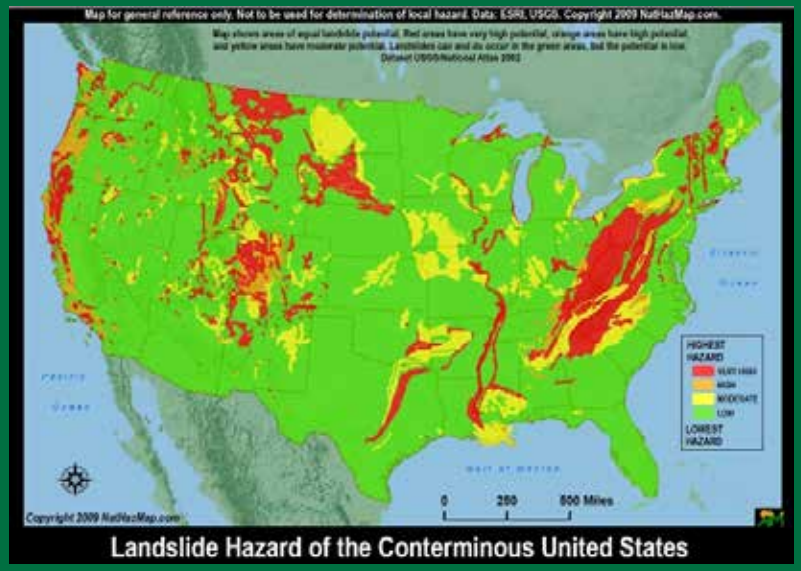
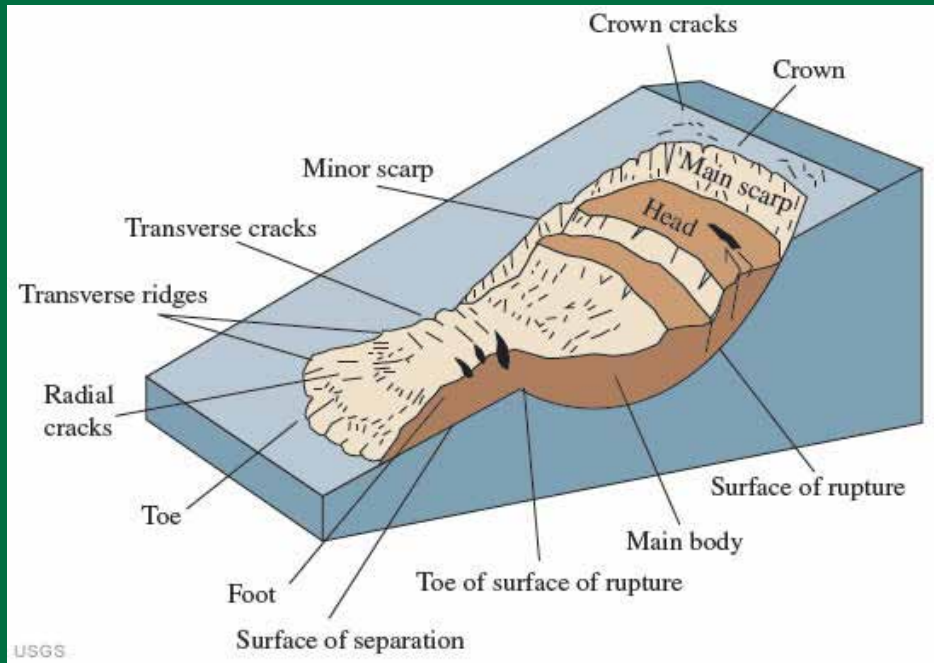
Landslide Hazards Program

- Landslides could be triggered by impacts.
- The collapse of the transient crater is similar to landslides and USGS models and experience may be useful in understanding cratering.



Landslide Hazard of the Conterminous United States



Floods

- The USGS is the Nation's primary provider of information on water. Unless an impact damages a natural or man-made dam, this may not be relevant to an impact scenario on the short term. However, long-term impact to watersheds and water quality due to the ejecta blanket should be considered.

Aerial view of the Missouri River flooding on July 30, 1993, at U.S. Highway 54 just north of Jefferson City, Missouri, looking south (photograph from the Missouri Highway and Transportation Department).

Natural Resources Canada

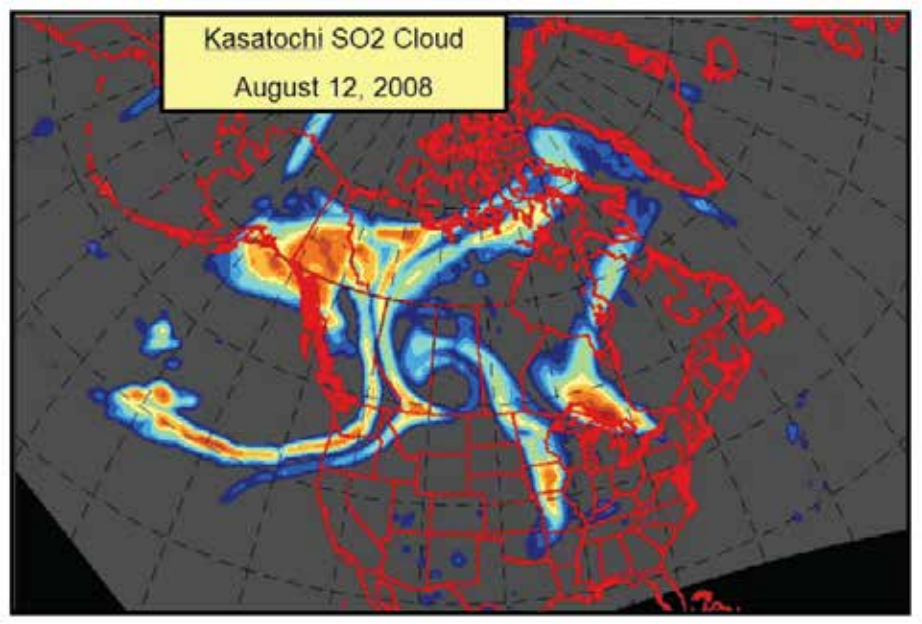
Volcano Hazards Program

- The USGS monitors all active and potentially active volcanoes in the US and assists internationally.
- The volcano observatories play a key role in issuing various emergency warnings.
- Recently, emphasis has been on volcanic ash and aviation hazards.

USGS

Volcano Hazards Program

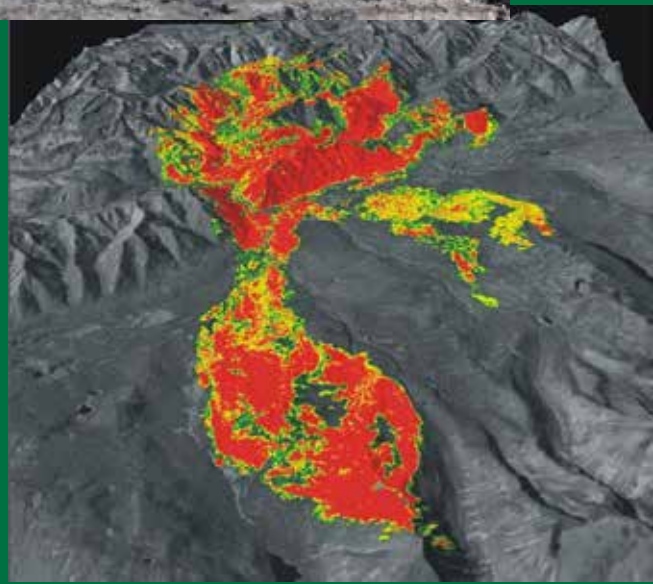
- The plume of material ejected into the atmosphere after an impact could have significant impact to aviation.
- The USGS has extensive experience in modeling the distribution of similar material after a volcanic eruption and communicating such information to aviators.



USGS

Wildfire Hazards

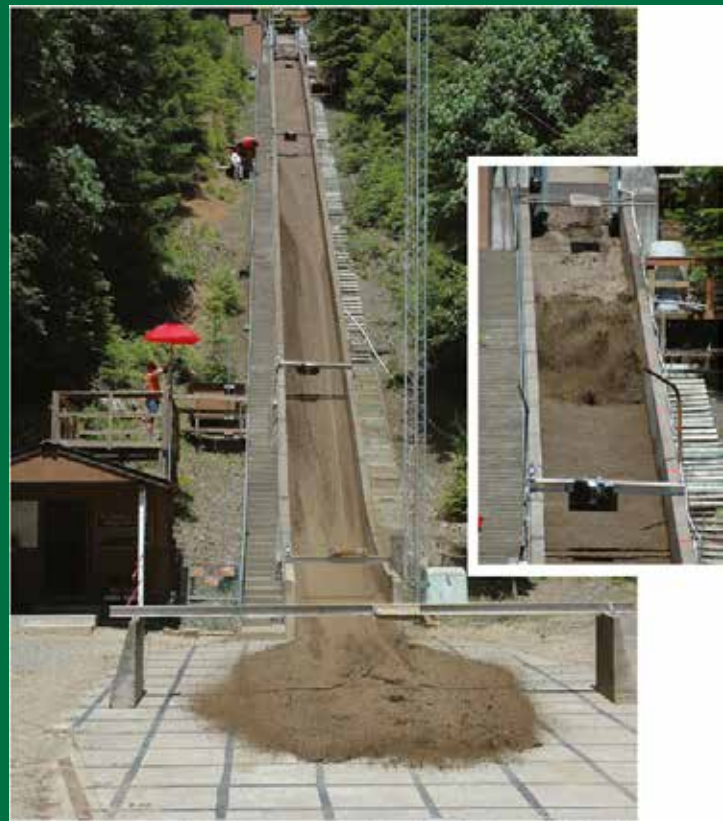
- The USGS is involved in using field and remote sensing methods to assess
  - Fire fuel loads
  - Fire danger
  - Burn severity
  - Post-wildfire debris flow hazards
  - Fire ecology
  - Ash contamination



USGS

Wildfire Hazards

- While impacts might trigger fires, another point of interest is that the denudation caused by the blast and ejecta will mimic the effects of a fire.
- Landscape response (debris flows), ecosystem recovery, and contamination of watersheds are areas where USGS fire science may be able to assist in responding to an impact.



USGS

SAFRR

- Science Applications for Risk Reductions Project focuses on building partnerships to improve the use of USGS information by emergency managers.
- Started in southern California but now national.
- Conducts exercises involving millions of participants (e.g., 13.2 million for ShakeOut).

USGS

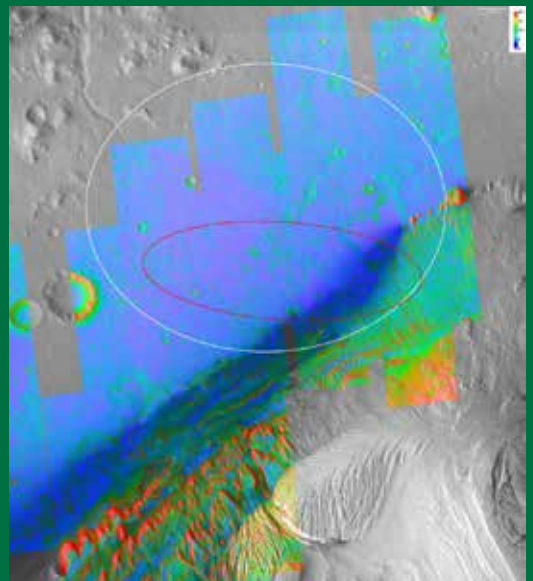
SAFRR

- When impact emergency response drills are ready to go beyond a table top exercise, the USGS has experience organizing large scale events.
- These events expose unexpected vulnerabilities in infrastructure and responses from the public.

USGS

Astrogeology

- Support exploration of the Solar System with science, cartography, software, data archives, etc.
- 50-year history of working with NASA
- Involved in almost every NASA mission to a solid planetary body, and many international ones



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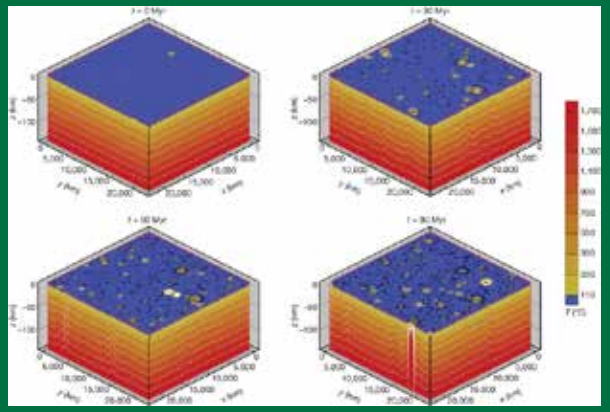
USGS 50 YEARS
ASTROGEOLOGY SCIENCE CENTER
1963 - 2013

Astrogeology

- Can serve as a gateway from NASA to the rest of the USGS.
- Help predict effect of an impact on Earth, especially if it is large enough to create an impact melt sheet.
- Cartographic support for a mission to divert an asteroid.



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Conclusions

- It is hard to develop experience with rare natural catastrophes.
- A reputation for accurate, instead of hyperbolic, information is essential for good decision making.
- The USGS has both of these assets that could be brought to the table to deal with planetary defense.