# NASA's Surface Topography and Vegetation Study

*Applications Panel – Earth Science*


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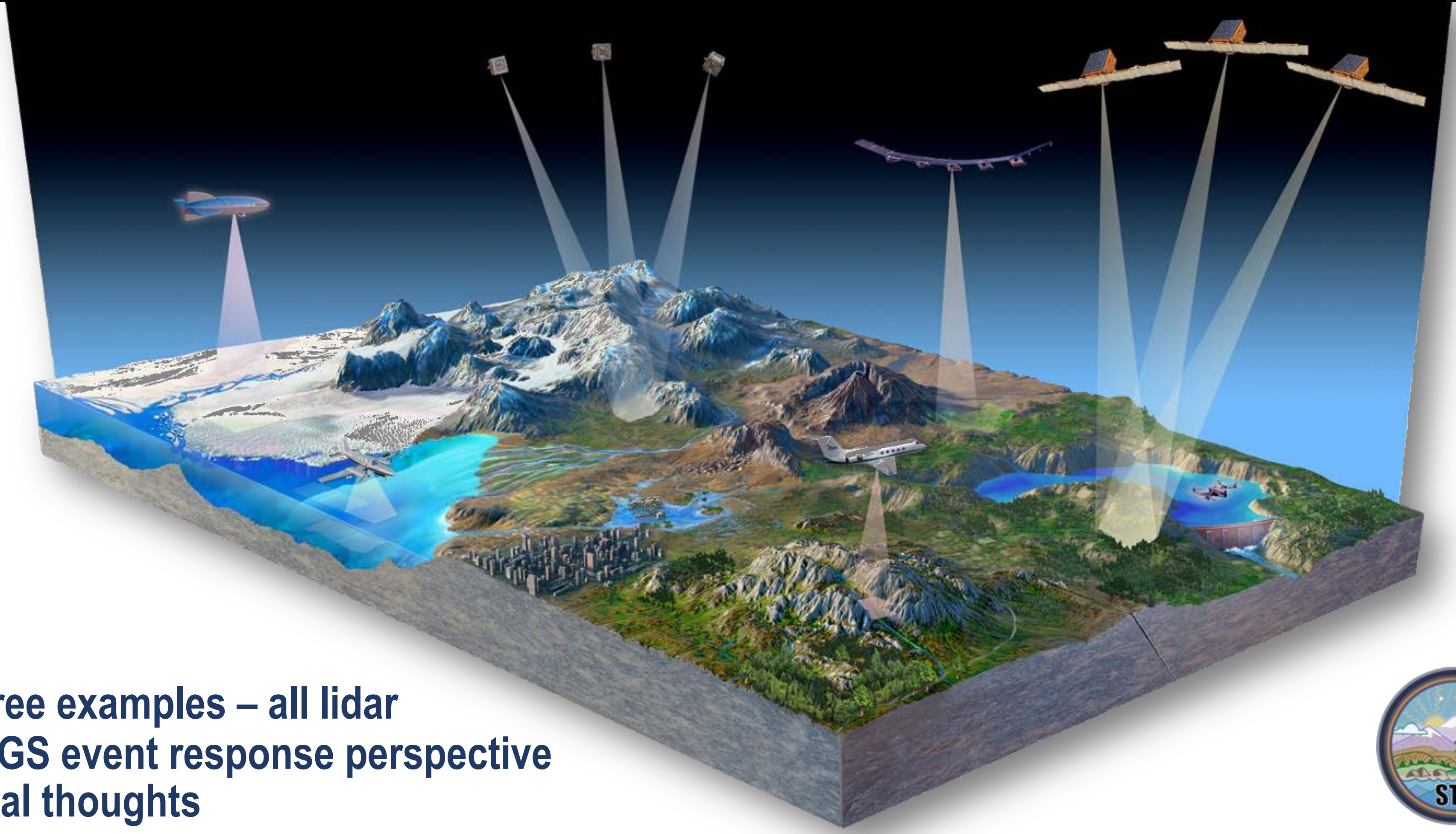
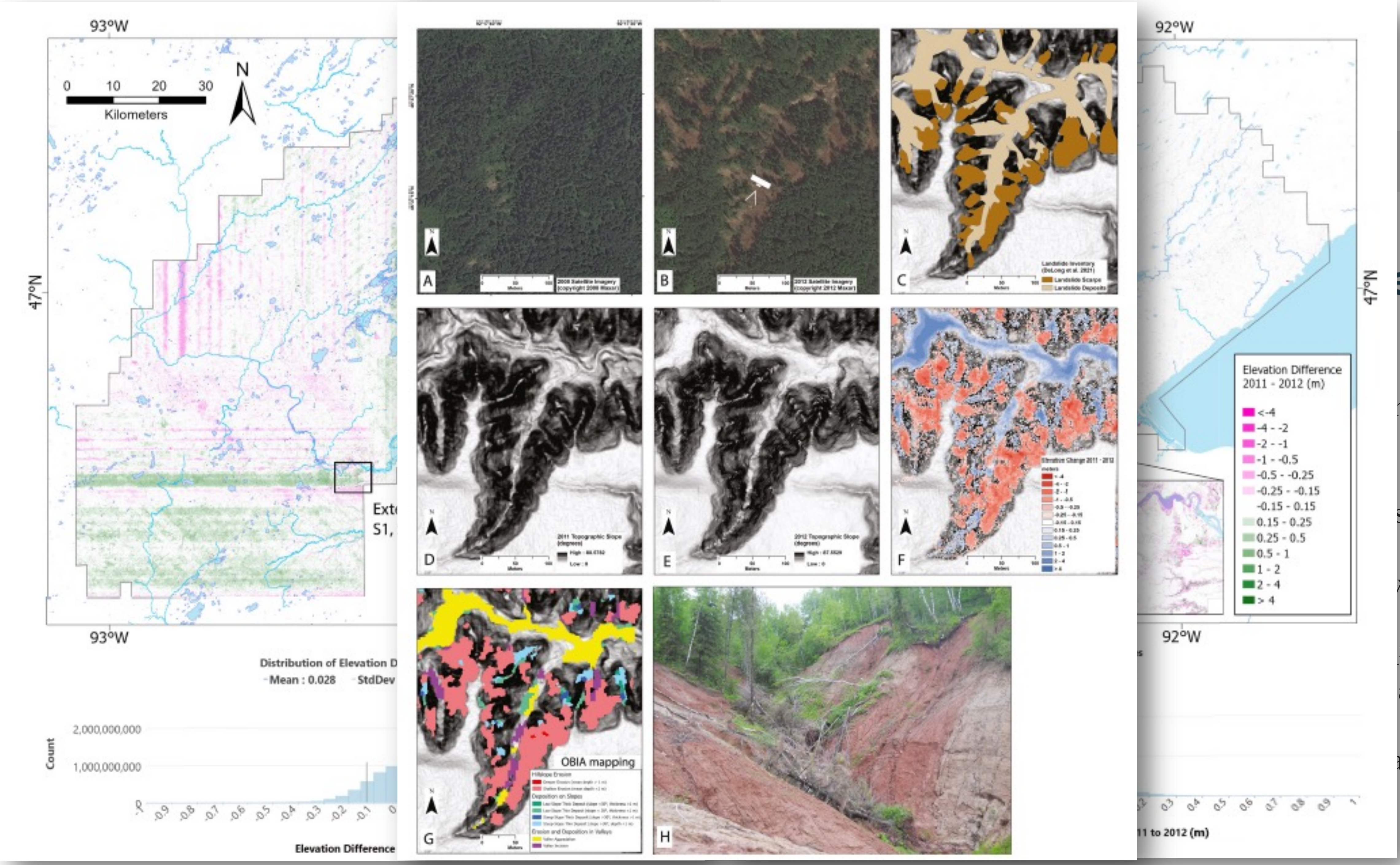
and others

USGS science for a changing world

1. Three examples – all lidar
2. USGS event response perspective
3. Final thoughts

STV

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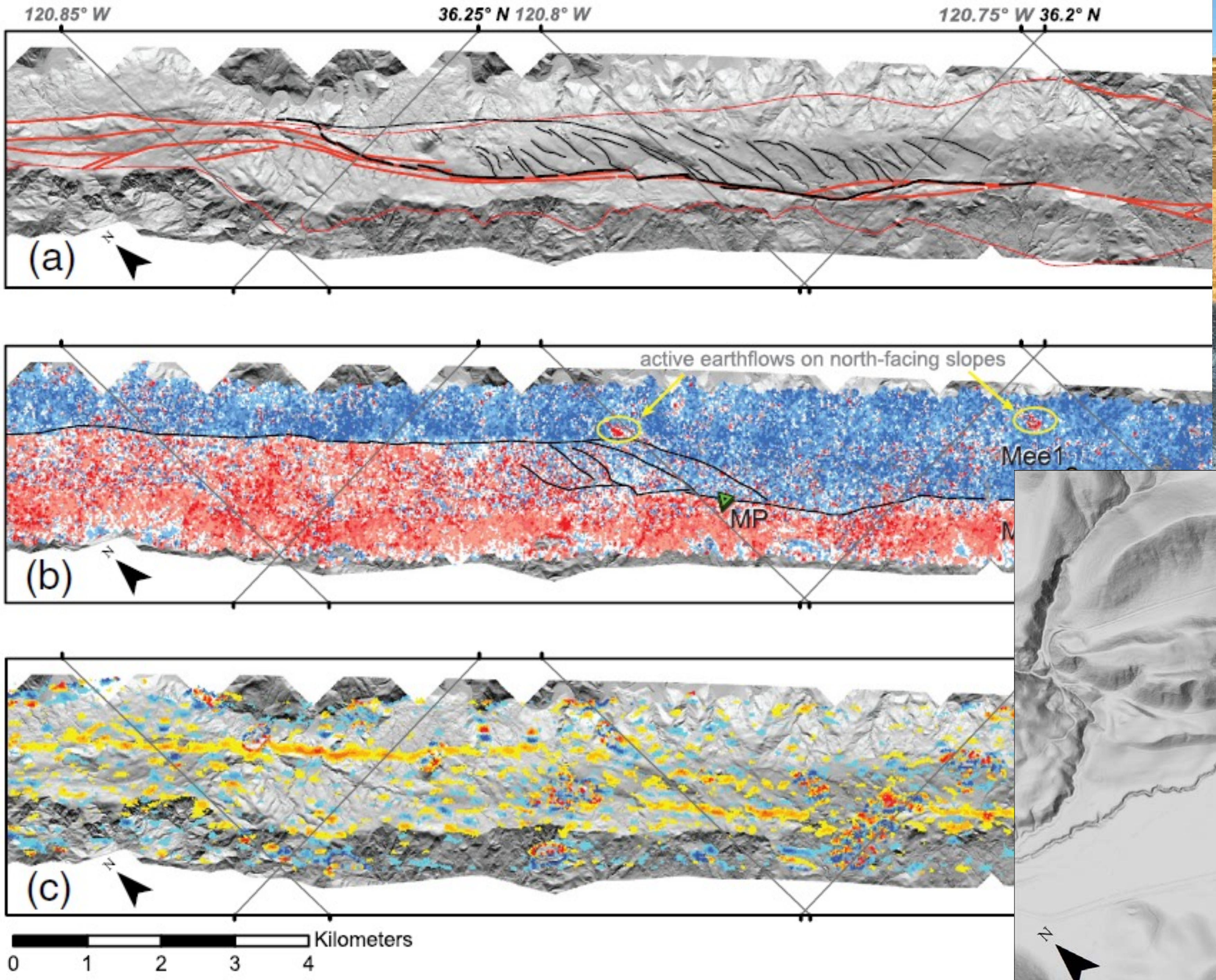
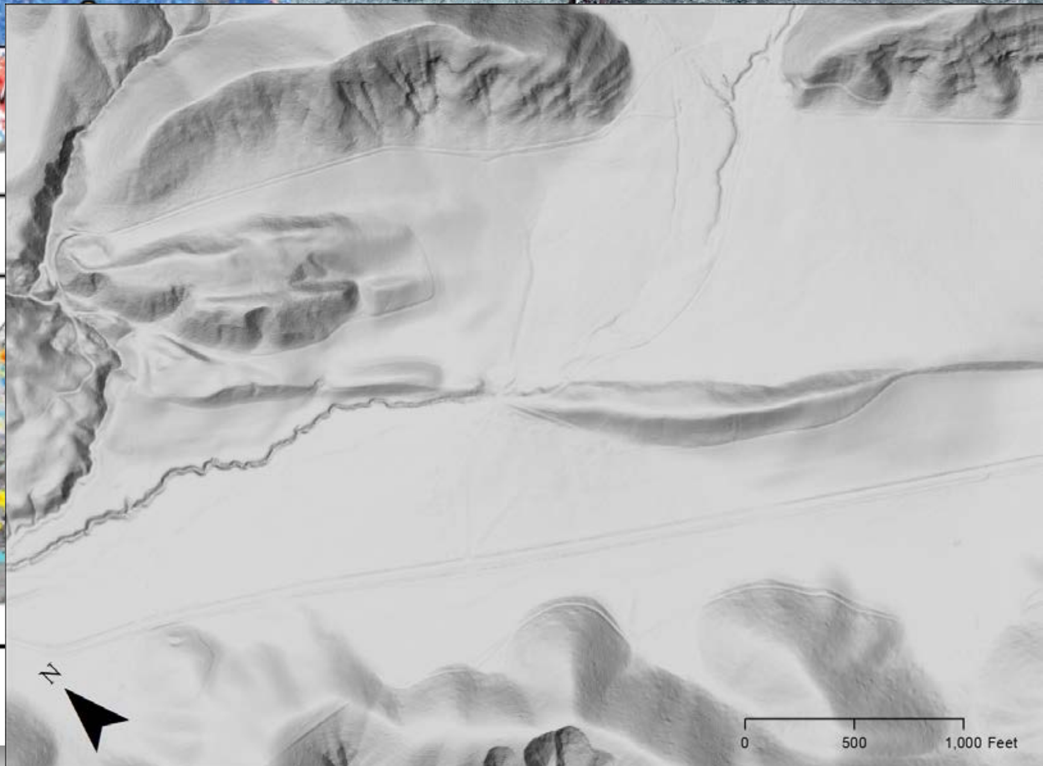


120.85° W
36.25° N
120.8° W
120.75° W
36.2° N
(a)
N
active earthflows on north-facing slopes
Mee1
MP
(b)
N
(c)
N
Kilometers
0
1
2
3
4

N
0
500
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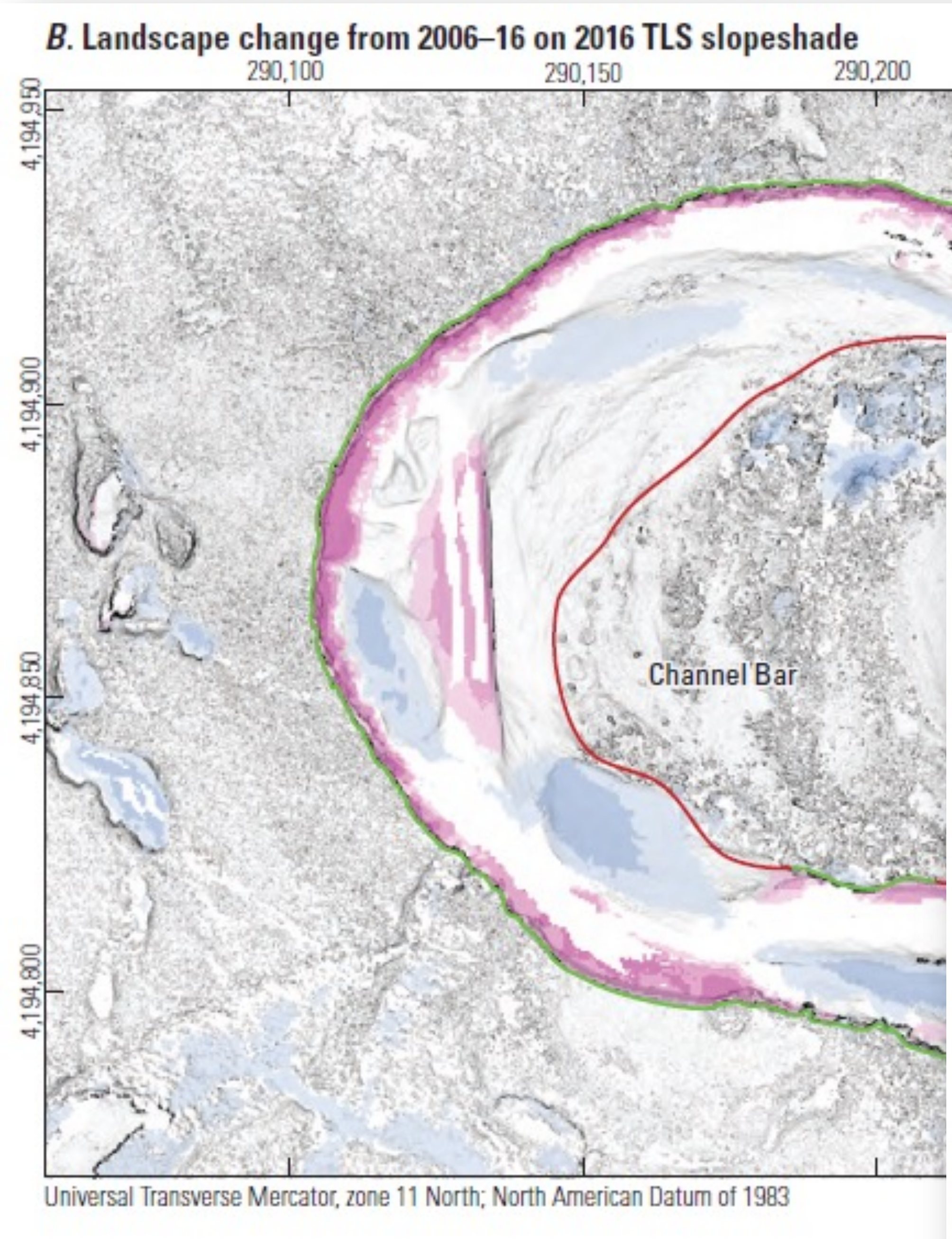
ased

e NP - 2021

g/policy




By Stephen B. DeLong, Alexandra J. Pickering, and Timothy Kuhn

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# USGS hazard event response

## Description of typical USGS Earthquake response – STV perspective

- Evaluate likelihood of surface rupture, if M5.8 or greater (especially domestic), initiate surface rupture – oriented response. Social media, news, local contacts etc provide initial information
- SAR (usually 1-2 days) to confirm rupture, estimate extents, subpixel offset measurement
- Task satellites for image acquisition (need clear views), data sometimes available in hours
- Imagery used for detailed fault rupture mapping. Pre- and post-event imagery used for 2D image correlation for subpixel horizontal slip measurement
- 3D topo from imagery or lidar (*lidar often lags days-weeks, often not collected internationally*) for vertical and horizontal slip measurement
- All this may be iterative with fieldwork by USGS and/or others.
- Afterslip measurement requires high frequency (daily at first, then longer) observations to measure feature offset at cm level.


RESEARCH ARTICLE | NOVEMBER 02, 2023

**Rapid Surface Rupture Mapping from Satellite Data: The 2023 Kahramanmaraş, Turkey (Türkiye), Earthquake Sequence**

Nadine G. Reitman; Richard W. Briggs; William D. Barnhart; Alexandra E. Hatem; Jessica A. Thompson Jobe; Christopher B. DuRoss; Ryan D. Gold; John D. Mejstrik; Camille Collett; Rich D. Koehler; Sinan Akçiz

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# Earth Science STV applications

## A few thoughts on STV needs – agency perspective

- For earthquake scientists and geomorphologists, 1-meter and occasionally finer resolution products may be required to see landscape change at the resolution of the surface processes at work.
- It is becoming more common to look at regional spatial scales – 10s-100s of km across study regions. Storms and wildfires that are two significant drivers with areas of 1000s $km^2$, earthquake surface ruptures can be 100s of km long.
- Accuracies need to be sub-meter, and preferably at the centimeter to decimeter level – especially for post fire erosion, shallow landslides, fluvial system change detection.
- Airborne lidar remain the standard for these types of studies but cost, contracting, and latency remain significant barriers – NSF-NCALM/USGS cooperation has been fruitful.
- SAR is now a routine part of earthquake response studies, and tends to be delivered quickly by scientific community, higher resolution and differing line of sight angles may be useful.
- Commercial optical imagery appears to meet the needs of some return frequency and resolution are getting very good – though issues exist with access and publication of commercial data. QUAKES-I imagery follow-on may be promising with multi-look, deployable photosensor arrays. Finer resolution may be required to reach aspirational objectives.
- Shorter repeat times for STV – hours, days – would allow monitoring of ongoing deformation, landslide activity, cascading hazards (flood/dam breach after seismogenic or other landslides, fire after earthquake, ongoing volcanic activity, etc.)