Building Capacity to Use Earth Observations in Addressing Environmental Challenges in Bhutan

Day 2 – Disasters: Floods, Landslides, Fires

Agenda: May 13 – 16, 2024 Thimphu Tech Park

- https://appliedsciences.nasa.gov/sites/default/files/2024-04/Agenda_Bhutan_1.pdf

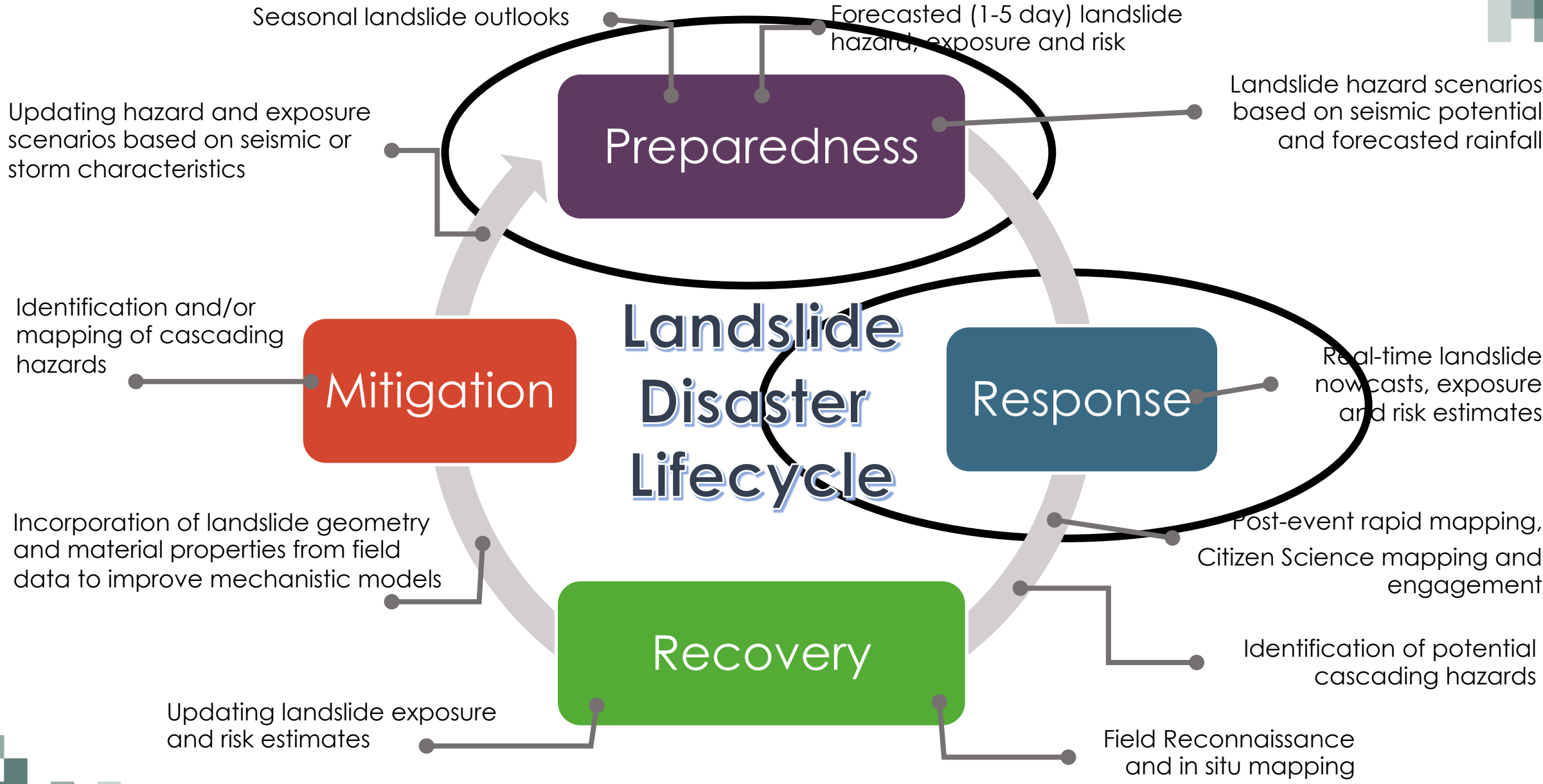
- **Day 2 – Tuesday, May 14 – 8:30am – 5:00pm**
  - Session III: Disasters – Floods, Landslides, Fires
    - Assessing Landslide Hazard Probability
    - Extreme Weather and Flood Monitoring
    - Surface Inundation Monitoring
    - Pre-Fire Risk Assessment
    - Active Fire & Post-Fire Assessment
    - Monitoring Pre- and Post-Fire Conditions

Session 3 Objectives

By the end of Day 2, participants will be able to:

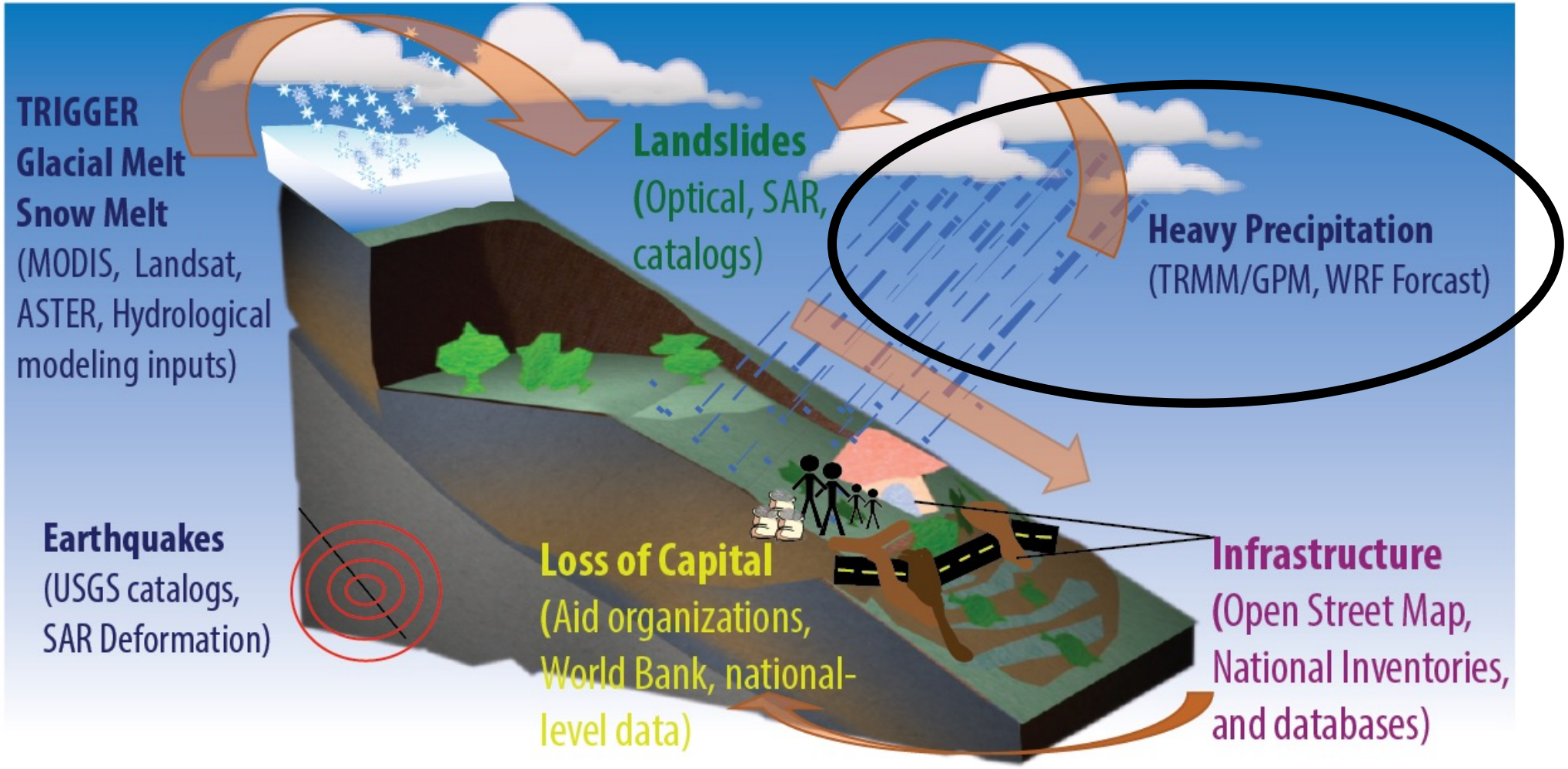
- Identify the different remote sensing (passive [optical] and active [microwave]) data for monitoring disasters (fire, flood, landslide)
- Demonstrate the applications of remote sensing and modeled data for monitoring disasters
- Develop case studies using remote sensing data for disasters in Bhutan

Assessing Landslide Hazards Before and During an Event


Seasonal landslide outlooks
Forecasted (1-5 day) landslide hazard, exposure and risk
Updating hazard and exposure scenarios based on seismic or storm characteristics
Landslide hazard scenarios based on seismic potential and forecasted rainfall
Preparedness
Identification and/or mapping of cascading hazards
Mitigation
Landslide Disaster Lifecycle
Response
Real-time landslide nowcasts, exposure and risk estimates
Incorporation of landslide geometry and material properties from field data to improve mechanistic models
Post-event rapid mapping,
Citizen Science mapping and engagement
Recovery
Identification of potential cascading hazards
Updating landslide exposure and risk estimates
Field Reconnaissance and in situ mapping

Landslides are a major problem…

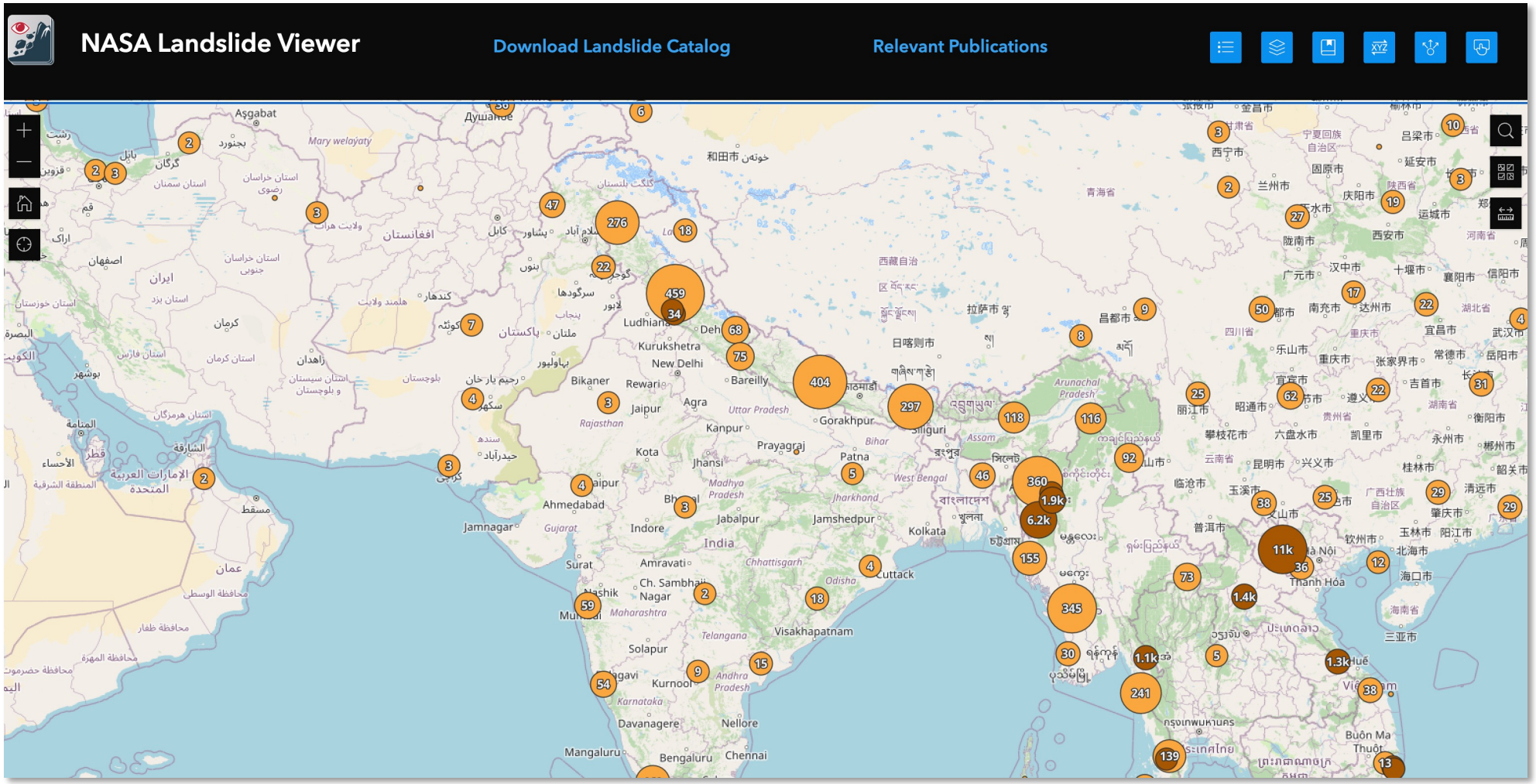
And they have many causes.



Some Resources for Assessing Landslide Hazard Before an Event

Global Landslide Catalog (GLC)

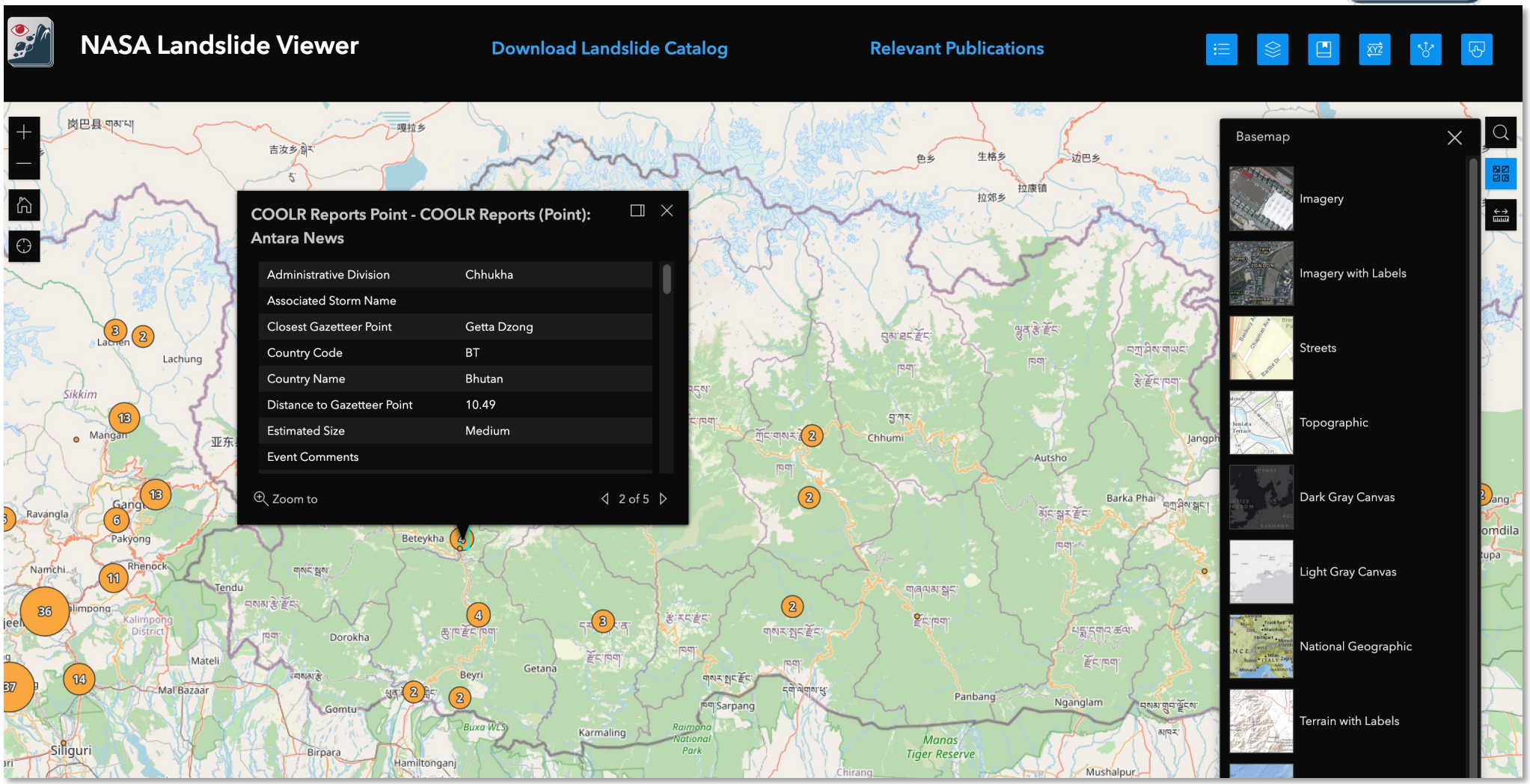
At Landslide Viewer (landslides.nasa.gov/viewer)



http://dx.doi.org/10.1016/j.geomorph.2015.03.016

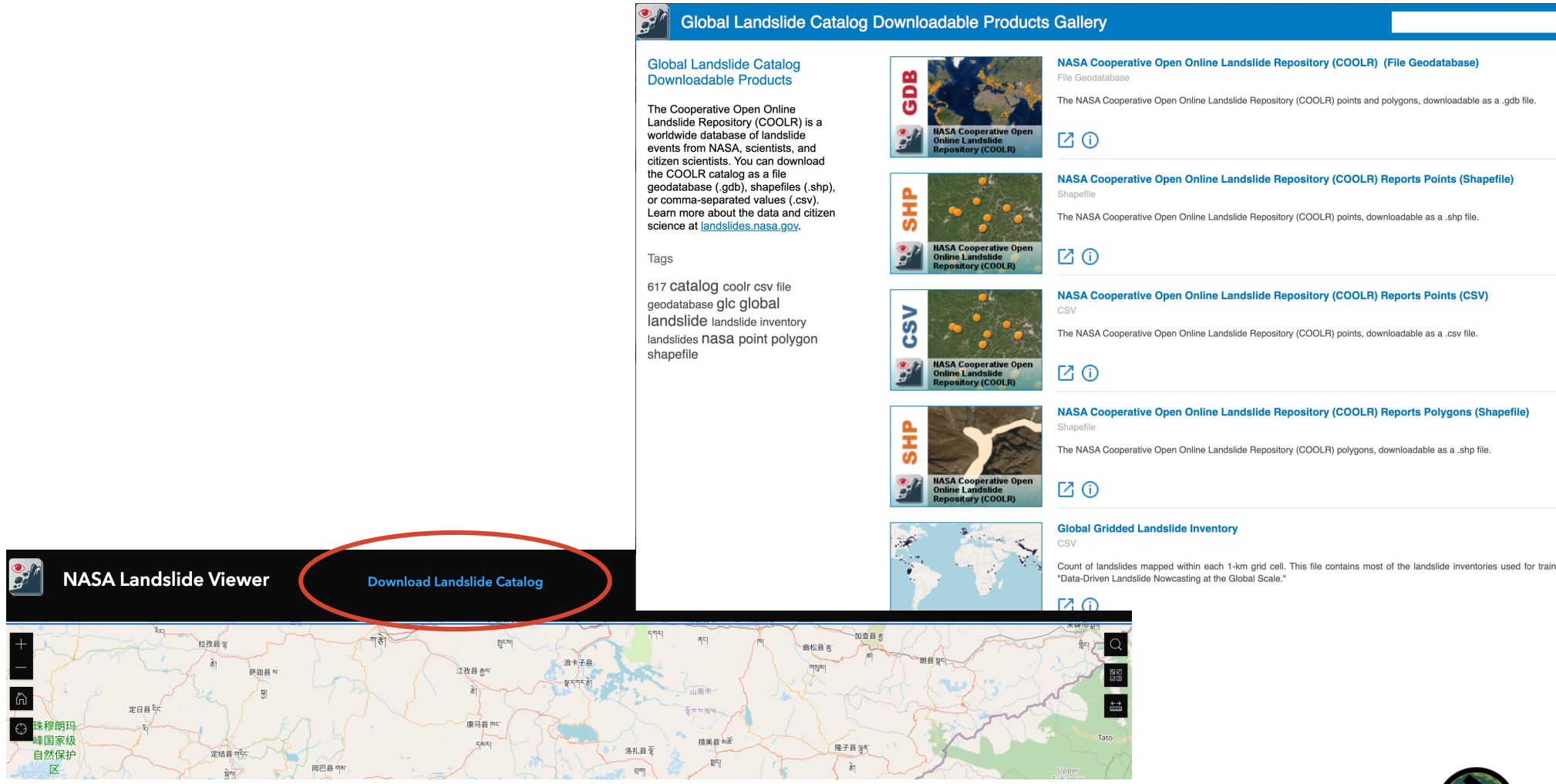
More from the Cooperative Open Online Landslide Repository (COOLR)

At Landslide Viewer (landslides.nasa.gov/viewer)



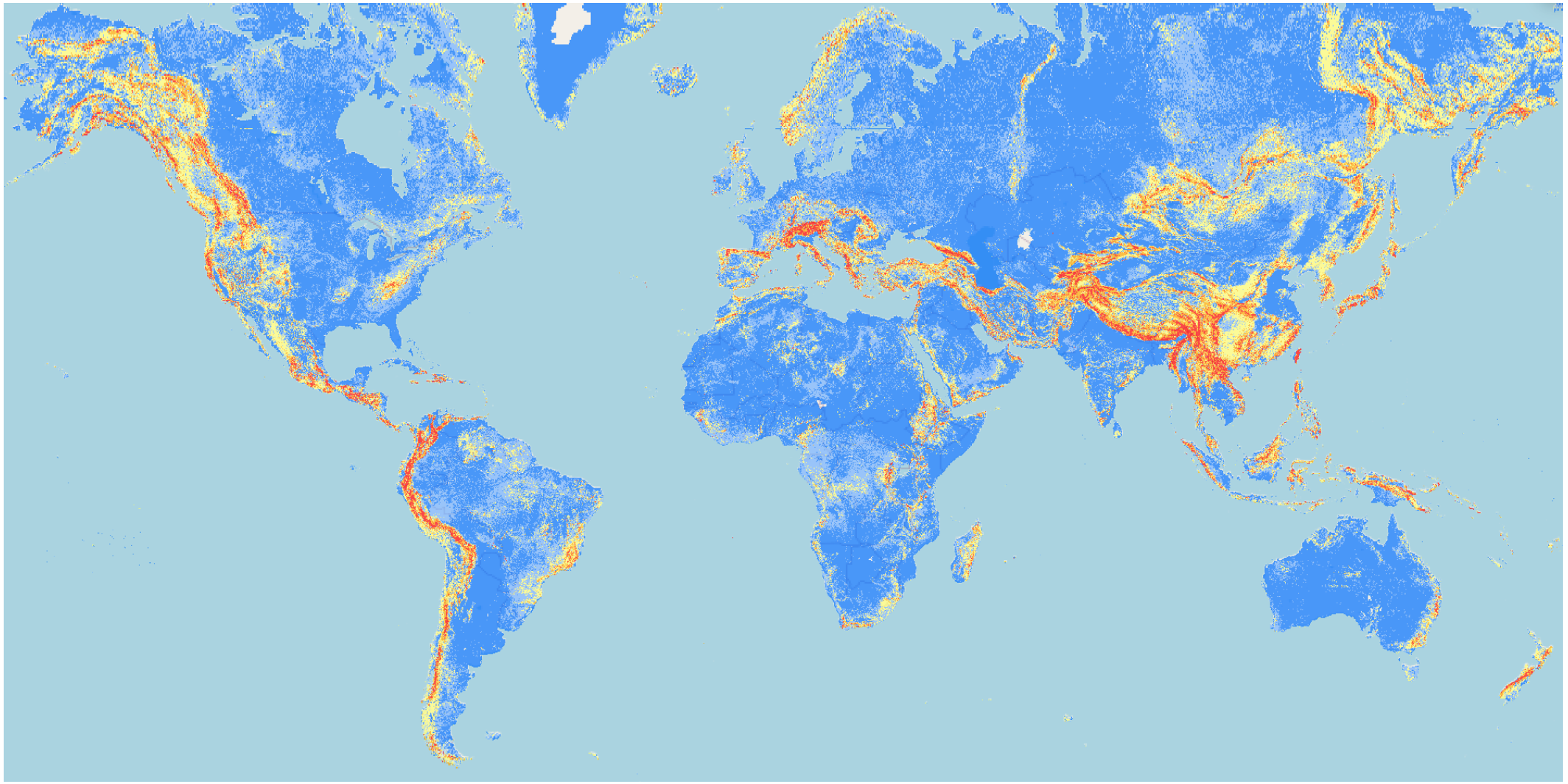
Download All the Data in COOLR

At Landslide Viewer (landslides.nasa.gov/viewer)



Global Landslide Susceptibility Map

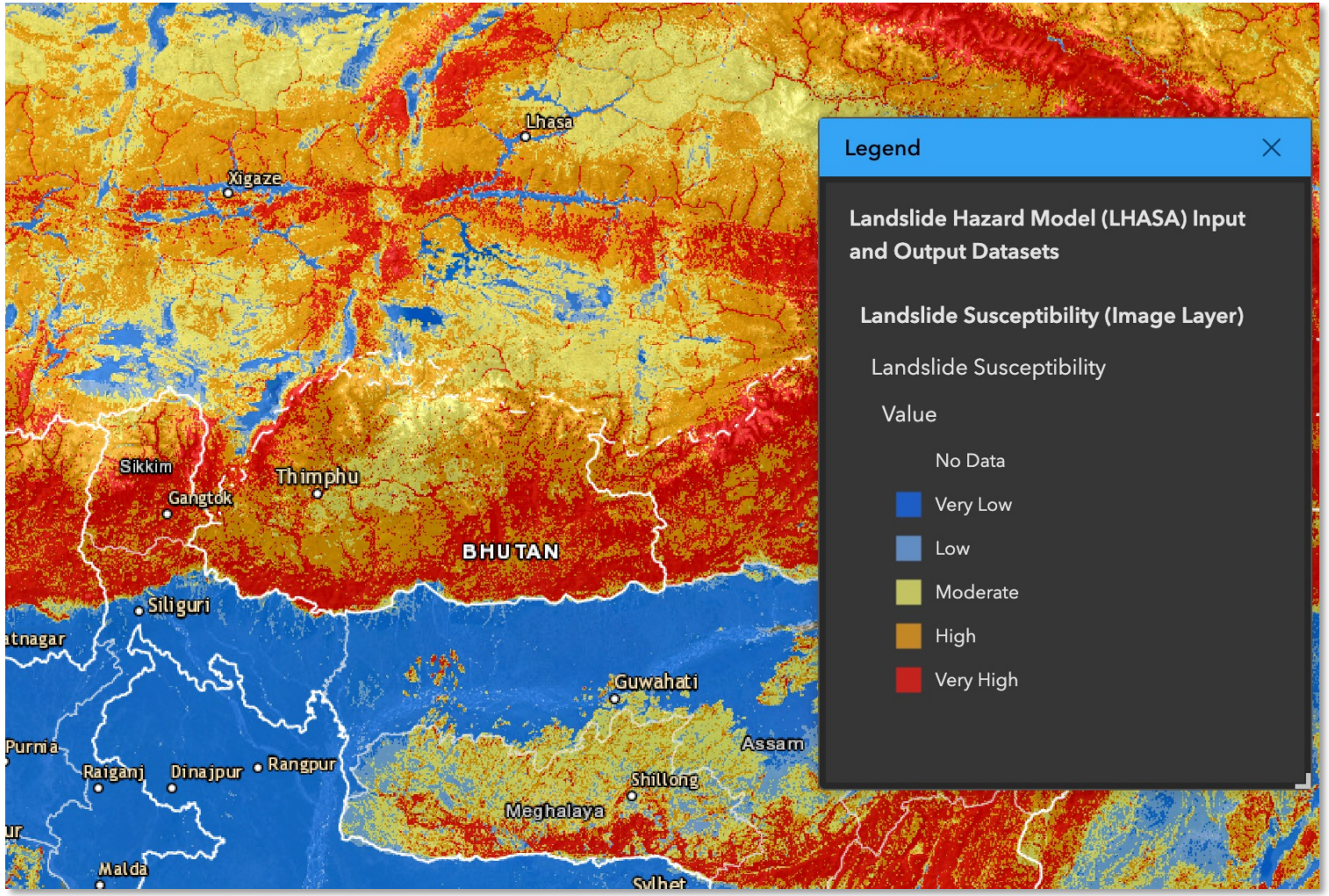
At Landslide Viewer (landslides.nasa.gov/viewer)



http://dx.doi.org/10.1007/s11069-017-2757-y

Global Landslide Susceptibility Map

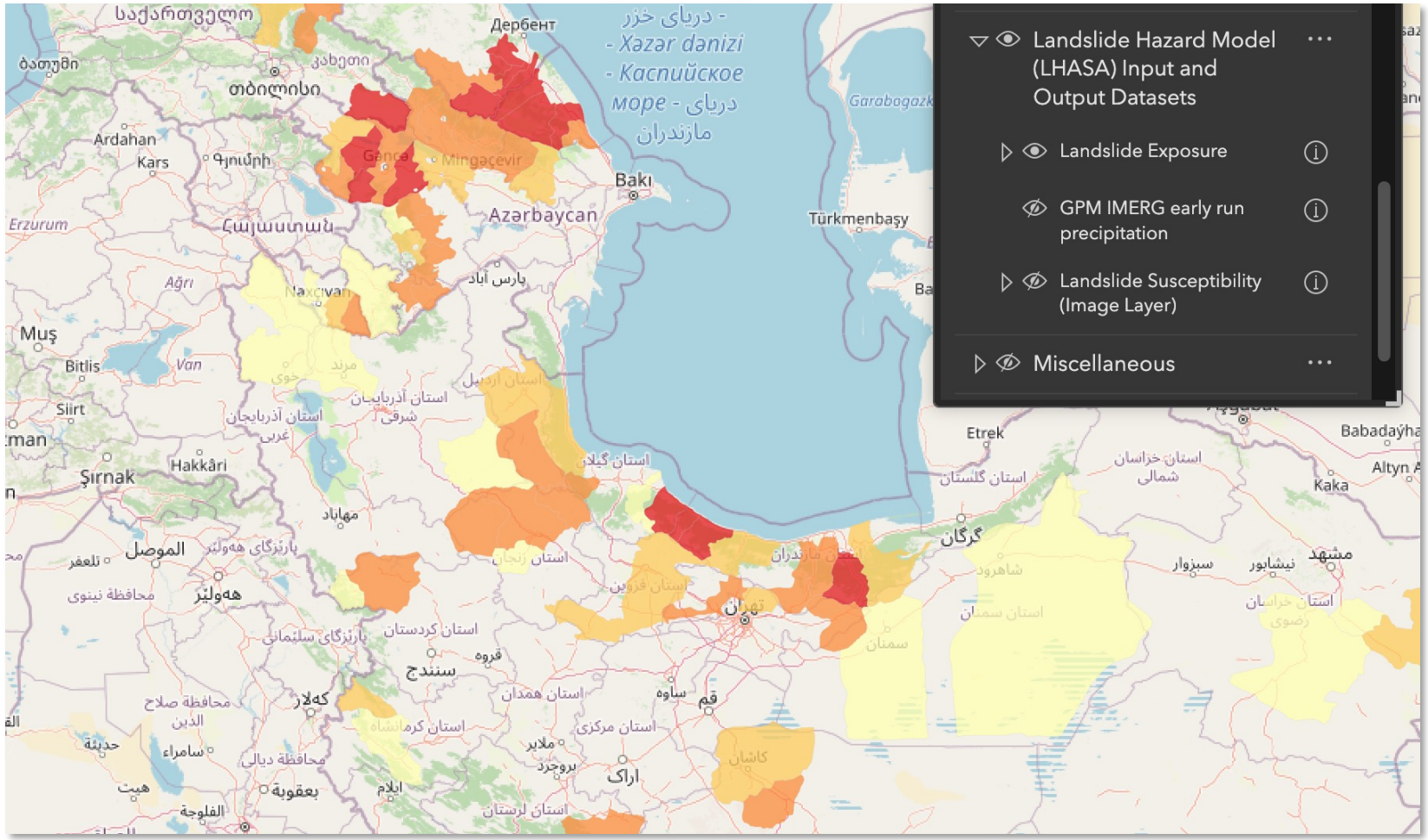
At Landslide Viewer (landslides.nasa.gov/viewer)



Some Resources for Assessing Landslide Hazard During an Event

Global Landslide Exposure

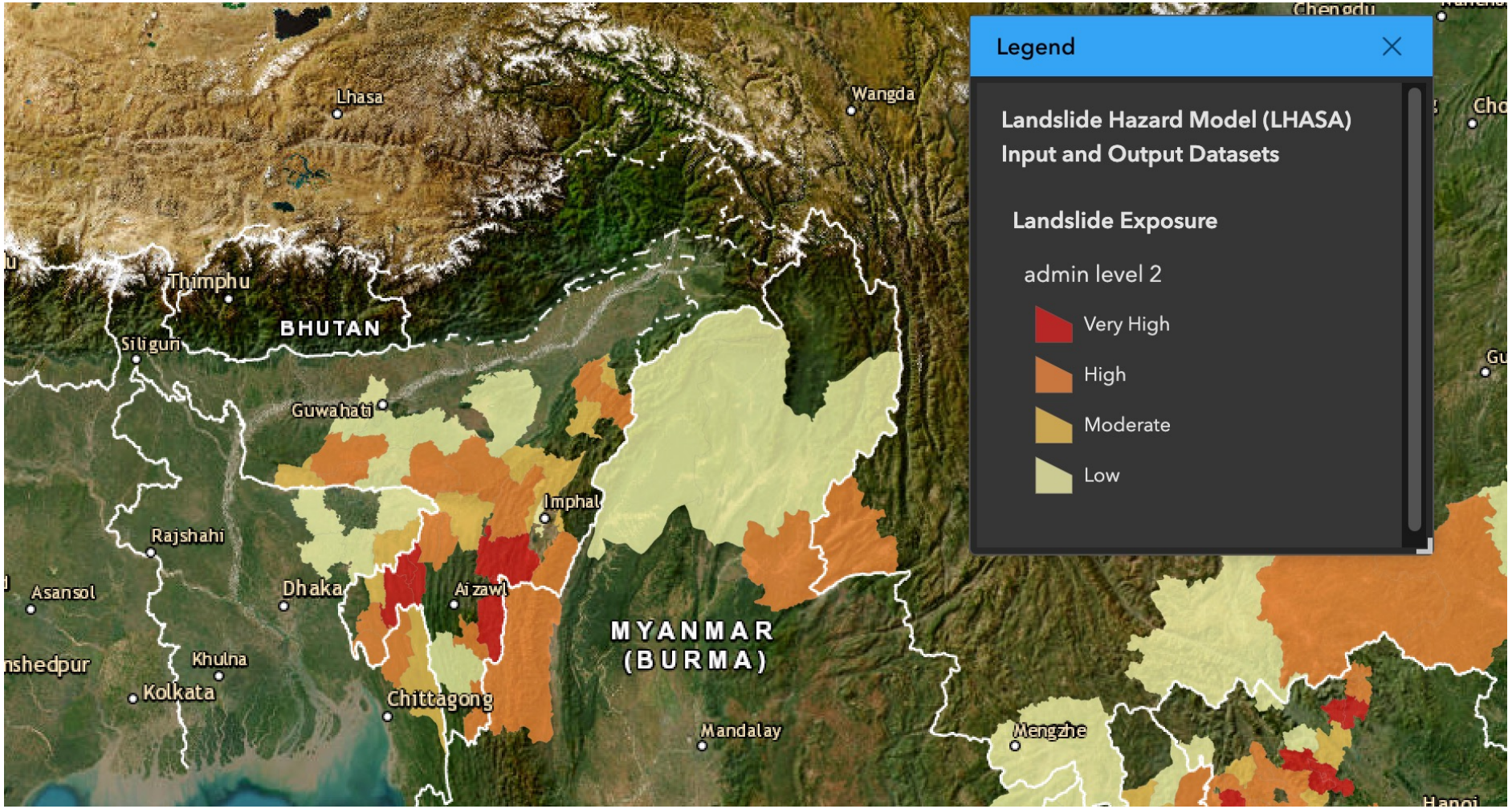
At Landslide Viewer (landslides.nasa.gov/viewer)



https://doi.org/10.3389/feart.2021.640043

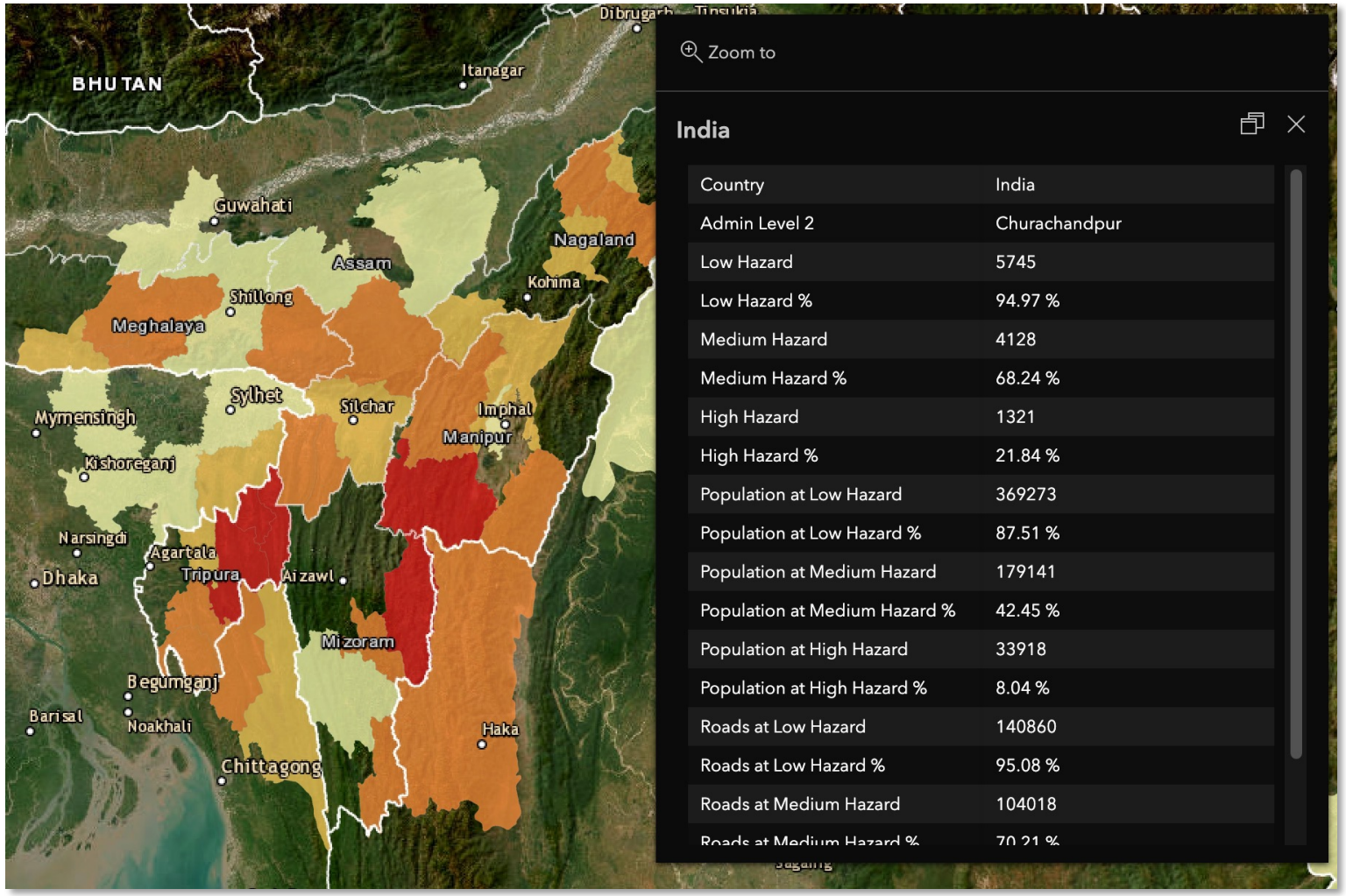
Global Landslide Nowcast

At Landslide Viewer (landslides.nasa.gov/viewer)



Exposed Population and Roads from the Global Landslide Nowcast

At Landslide Viewer (landslides.nasa.gov/viewer)



New Features in the Global Landslide Nowcast (LHASA 2.0)

- Probabilistic, rather than categorical outputs
  - Due to the use of machine learning
  - Incorporates soil moisture and snow mass
- Increased accuracy
- Exposure analysis

- However, version 1.1 is still published at https://pmmpublisher.pps.eosdis.nasa.gov/ and https://gpm.nasa.gov/data/visualizations/precip-apps.
- Both sites allow you to view the "classic" model output:

Pacific Disaster Center

DisasterAWARE (https://www.pdc.org/disasteraware/)

Summary

- Information on landslides can be useful at all stages of the disaster life cycle.
- NASA has several online resources:
  - At Landslide Viewer
  - At Landslide Reporter
- The LHASA model uses IMERG precipitation to produce global landslide nowcasts.
- You can implement LHASA version 2.0 with open-source code and open data.
  - But customizing it for your region is recommended.

Resources

- Global Precipitation Measurement → Landslides
  - https://gpm.nasa.gov/applications/landslides
- GPM Precipitation and Applications Viewer
  - https://gpm.nasa.gov/data/visualizations/precip-apps
- Landslide Hazard Assessment for Situational Awareness (LHASA) Model
  - LHASA 2.0
  - https://gpm.nasa.gov/landslides/projects.html#LHASA

References

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