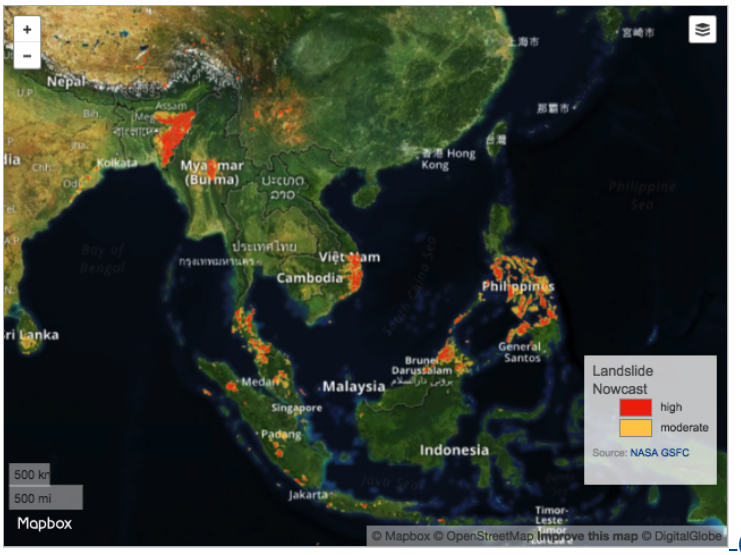
Global Landslide Model

The global Landslide Hazard Assessment for Situational Awareness (LHASA) model is developed to provide situational awareness of landslide hazards for a wide range of users. Precipitation is a common trigger of landslides. The GPM (/GPM) Integrated Multi-satellitE Retrievals for GPM (IMERG) data shows recent precipitation, updated every thirty minutes. A LHASA landslide "nowcast" is created by comparing GPM data from the last seven days to the long-term precipitation record provided by the Tropical Rainfall Measuring Mission (TRMM) Multi-satellite Precipitation Analysis (TMPA). Because IMERG data is only available starting in 2014, the record of historical rainfall was established by TMPA, comparing 2001-present. The TMPA rainfall probability distributions were then compared to that of IMERG and the rainfall thresholds were adjusted so that the IMERG data more closely mapped to those of the TMPA archive. The past 7 days of rainfall are considered, with each day is weighted according to their date before present, with the last twenty-four hours having the most impact.

In places where precipitation is unusually high, the susceptibility of the terrain is evaluated, which includes quantitative information on if:

- roads (https://www.openstreetmap.org/about) have been built;
- trees (http://earthenginepartners.appspot.com/science-2013-global-forest) have been cut down or burned;
- a major tectonic fault is nearby;
- the local bedrock (http://ccgm.org/en/) is weak;
- the hillsides are steep (http://viewfinderpanoramas.org/).



(/precip-apps)

Example landslide nowcast map from the GPM Precipitation & Applications Viewer. (/precip-apps)

Click Here to Download the Global Landslide Susceptibility Map (/sites/default/files/downloads/global-landslide-susceptibility-map-3-10-17.zip) (.zip / .tiff 27 MB)

Please cite the following publications when using this information:

For susceptibility map:

Stanley, T., and D. B. Kirschbaum (2017), A heuristic approach to global landslide susceptibility mapping, Nat. Hazards, 1–20, doi:10.1007/s11069-017-2757-y. Link to article:

QUICK LINKS

L (http://landslides.nasa.gov/viewer)**andslide Viewer** (http://landslides.nasa.gov/viewer)

Landslide Reporter (http://landslides.nasa.gov/reporter)

View LHASA Data in the GPM Precipitation & Applications Viewer (/precip-apps)

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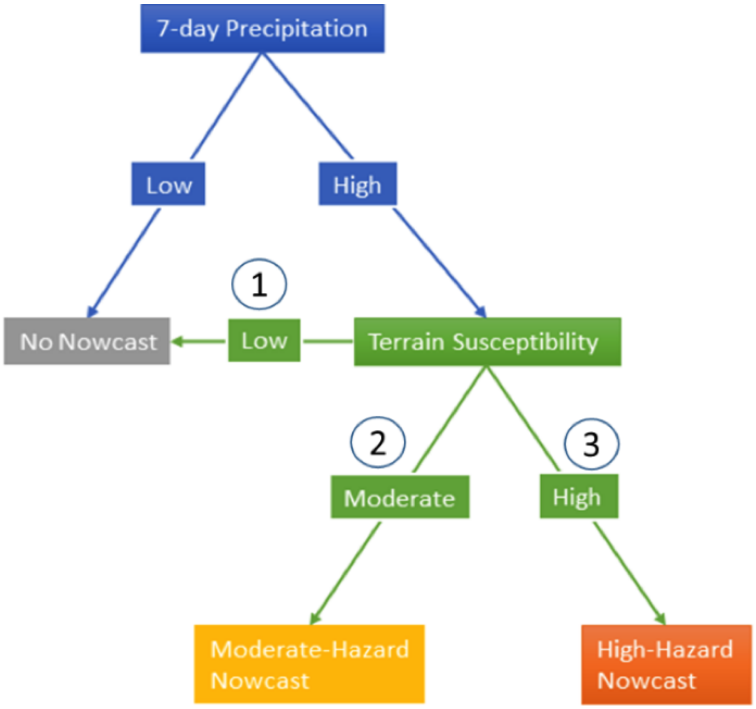
http://link.springer.com/article/10.1007%2Fs11069-017-2757-y (http://link.springer.com/article/10.1007%2Fs11069-017-2757-y)

For global model:

Kirschbaum, D. and Stanley, T. (2018), Satellite-Based Assessment of Rainfall-Triggered Landslide Hazard for Situational Awareness. Earth's Future. . doi:10.1002/2017EF000715 (https://doi.org/10.1002/2017EF000715)

Depending on the susceptibility, one of three things happens:

1. If the terrain is not very susceptible to landslides (e.g. it's very flat), no nowcast will be issued;
2. If the terrain is moderately susceptible, a "moderate-hazard" nowcast will be issued. This area is shown as yellow on the map;
3. If the terrain is highly susceptible (e.g. it's very steep, and the forest has burned down), a "high-hazard" nowcast will be issued. This area is shown as red on the map.



(/sites/default/files/imce/landslide-model-diagram.png)

This system was evaluated by comparing the nowcasts to each of 3,989 landslide events in the Global Landslide Catalog (http://landslides.nasa.gov/viewer). Since most landslides occur in places with no observations, it was not possible to verify that the global LHASA nowcast is accurate in all locations. However, it does provide a near real-time global summary of landslide hazard that may be useful for disaster response agencies, international aid organizations, and others who would benefit from situational awareness of potential landslides in near real-time.

In future evaluations, the LHASA model will be evaluated using the Cooperatve Open Online Landslide Repository (https://landslides.nasa.gov) (COOLR), which combines data from the Global Landslide Catalog and data from citizen scientists in an effort to reduce inconsistencies in how landslides are reported in different regions. Anyone can view landslides as well as report a landslide event using the Landslide Viewer (https://landslides.nasa.gov/viewer) and Landslide Reporter (https://landslides.nasa.gov/reporter) web applications. Growing this global landslide database will help validate and improve LHASA, as well as enable the landslide community to advance landslide research and understanding of where and when landslides are occurring.

This information is provided with two versions: the "Global Landslide Nowcast 30 mn", and the "Global Landslide Nowcast". The 30 minute product is updated every 30 minutes with a latency of 4 hours from the time the data was acquired from the GPM constellation of satellites. This product uses the 30 minute IMERG Early product to obtain the last day of rainfall and then draws on the IMERG Late data from the previous 7 days. The "Global Landslide Nowcast" is updated daily and uses the IMERG Late 1-day rainfall accumulation data.

Further reading on this methodology and the validation data include:

Kirschbaum, D. B., T. Stanley, and J. Simmons (2015), A dynamic landslide hazard assessment system for Central America and Hispaniola, Nat. Hazards Earth Syst. Sci., 15(10), 2257–2272, doi:10.5194/nhess-15-2257-2015.

Kirschbaum, D. B., T. Stanley, and Y. Zhou (2015), Spatial and temporal analysis of a global landslide catalog, Geomorphology, 249 (Geohazard Databases: Concepts, Development, Applications), 4–15, doi:10.1016/j.geomorph.2015.03.016.

Kirschbaum, D., T. Stanley, and S. Yatheendradas, 2016: Modeling landslide susceptibility over large regions with fuzzy overlay. Landslides, 13, 485–496, doi:10.1007/s10346-015-0577-2. http://dx.doi.org/10.1007/s10346-015-0577-2.

A manuscript is currently in development for this model. Please contact dalia.b.kirschbaum@nasa.gov (mailto:dalia.b.kirsdchbaum@nasa.gov) with any questions.