National Aeronautics and Space Administration
Goddard Earth Science Data Information and Services Center (GES DISC)

README Document for The Global Landslide Nowcast from the Landslide Hazard Assessment for Situational Awareness model, version 1.1

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Goddard Earth Sciences Data and Information Services Center (GES DISC)
http://disc.gsfc.nasa.gov
NASA Goddard Space Flight Center
Code 610.2
Greenbelt, MD 20771 USA

Prepared By:

Thomas Stanley

Name	Name

GES DISC

GSFC Code 610.2

01/27/2021

Date

Reviewed By:

Binita KC	02/03/2021
Reviewer Name	Date

GES DISC

GSFC Code 610.2

Goddard Space Flight Center
Greenbelt, Maryland

Revision History

Revision Date	Changes	Author
01/27/2021	Initial Draft	Thomas Stanley
04/01/2022	Update code	Ashley Heath

Table of Contents

1.0 Introduction

This document provides basic information for using the Global Landslide Nowcast.

The global landslide nowcast addresses the need for real-time situational awareness of landslide hazard. The Landslide Hazard Assessment for Situational Awareness model (LHASA) combines satellite rainfall estimates from the Global Precipitation Measurement mission (GPM) with a global landslide susceptibility map to produce a map of locations where rainfall-triggered landslide activity is probable. Although the model could be run every half hour, this archive contains a daily record derived from a retrospective model run.

1.1 Dataset/Mission Instrument Description

LHASA is intended to address most rainfall-triggered landslides. It is intended for situational awareness of landslide hazard over large areas. It does not provide information on landslides initiated by other phenomena such as earthquakes, thermal expansion, freeze-thaw cycles, and human activities. It has 3 levels: high hazard, moderate hazard, and low hazard, represented by integer values: 2, 1, and 0, respectively. The global landslide nowcast is a global grid with a temporal resolution of 1 day and a spatial resolution of 30 arcseconds (approximately 1 km).

1.2 Data Disclaimer

LHASA attempts to identify rainfall-triggered landslide hazard at the global scale. It is not relevant to some common types, including: rock falls, rock topples, riverbank collapses, slope creep events and deep-seated landslides that are triggered by seasonal precipitation and is not suitable for planning construction activities at any specific site or issuing evacuation orders. Although a detailed breakdown of model performance is not possible due to data limitations, LHASA performs better for rapid landslides on steep slopes rather than slow-moving landslides on gradual slopes. Furthermore, global data on precipitation and other at the scale have some uncertainty, which can result in propagation of some errors to the global landslide nowcast. The presence of a nowcast at a specific time and location does not indicate that a landslide has occurred. Rather, it indicates that landslides were more probable at that location than most locations on the same date. Given the rarity of landslide events, it is more probable that no landslide occurred within any given grid cell.

1.2.1 Data Citation and Acknowledgment

Users of these data are encouraged to cite the following articles. The first described the overall modeling approach, and the second describes the changes from version 1.0 to version 1.1:

Dalia B. Kirschbaum, Thomas A. Stanley, NASA GSFC, Global Landslide Nowcasts from LHASA L4 1 day 1 km x 1 km version 1.1 (Global_Landslide_Nowcast) at GES DISC, Edited by Dalia B. Kirschbaum, Thomas A. Stanley, NASA GSFC, Goddard Earth Sciences Data and Information Services Center (GES DISC), Accessed: [Data Access Date], 10.5067/0D23ALHMHHT5.

1.2.2 Contact Information

Goddard Earth Sciences Data Code
617.0, NASA Goddard Space Flight Center
Greenbelt, MD, 20771, USA
thomas.a.stanley@nasa.gov

Dalia B. Kirschbaum
Goddard Earth Sciences Data Code
617.0, NASA Goddard Space Flight Center
Greenbelt, MD, 20771, USA
dalia.b.kirschbaum@nasa.gov

1.3 Version 1.1

Version 1.1 retains without alteration the heuristic decision tree from version 1.0. However, the data inputs were modified slightly to better represent the factors that cause landslides. The most important change is the replacement of total precipitation with liquid precipitation, which was done because snow primarily causes landslides upon melting, not deposition. In addition, the presence or absence of forest loss was replaced by the fraction of forest lost within each grid cell. Finally, road data is now taken from the Global Roads Inventory Project.

2.0 Data Organization

The data are organized into daily files, with a grid resolution of 30 arcseconds (roughly 1 kilometer).

2.1 File Naming Convention

Global_Landslide_Nowcast.yyyy.mm.dd.L4.TIFF

2.2 File Format and Structure

Data set files are in GeoTIFF format.

2.3 Key Science Data Fields

EARTH SCIENCE> HUMAN DIMENSION > NATURAL HAZARDS > LANDSLIDES

3.0 Data Contents

3.1 Data Set Attributes (File Metadata)

The model outputs represent potential for landslide occurrence. The landslide occurrence is a unitless integer with 0, 1, and 2 representing low, moderate and high hazard, respectively.

3.2 Geolocation Fields

A summary of geolocation fields

Global Attribute	Description	Type
Latitude	Latitude of the edge of the cell	32-bit floating point
Longitude	Longitude of the edge of the cell	32-bit floating point
Time	Daily	64-bit floating point

3.3 Dimensions

Provide a description of the variable dimensions associated with the data products.

Global Attribute	Description	Dimensions
Time	Seconds since 2000-06-14 00:00:00Z	
Latitude	Starting at -59.999940, by 30 arcseconds increments	120
Longitude	Starting at -180, by 30 arcseconds increments	360

4.0 Products/Parameters

4.1 Data Fields

The model outputs represent potential for landslide occurrence. The landslide occurrence is a unitless integer with 0, 1, and 2 representing low, moderate and high hazard, respectively.

4.2 Fill Values

Missing data are denoted by values equal to 255.

5.0 Options for Reading the Data

5.1 Tools/Programming

5.1.1 Python

Read the variable using python “rasterio” package

```
import rasterio
import matplotlib.pyplot as plt

src = rasterio.open("filepath\\filename.tif")
array = src.read(1)
array.shape

#Explore metadata

src.meta #all metadata
src.crs #projection
src.transform # how raster is scaled, rotated, skewed, and/or translated
src.height #Dimensions
src.width #Dimensions
src.count # Number of bands
src.bounds # Bounds of the file
src.driver # Driver (data format)
src.nodatavals # No data values for all channels

plt.imshow(array, cmap='RdBu')
plt.colorbar(ticks=range(3),label='Landslide Hazard’)
plt.clim(0, 2)
plt.show()
```

5.1.2 ArcGIS Pro 2.6

1) Drag and drop the GeoTIFF into table of content
2) Add the using add Data Tool from Layer Group in ArcGIS Pro ---> select the data

5.1.3 QGIS

1)Drag and drop the GeoTIFF into table of content

6.0 GES DISC Data Services

If you need assistance or wish to report a problem:
Email: gsfc-dl-help-disc@mail.nasa.gov
Voice: 301-614-5224
Fax: 301-614-5268
Address:
Goddard Earth Sciences Data and Information Services Center NASA Goddard Space Flight Center Code 610.2 Greenbelt, MD 20771 USA

6.1 How To Articles

The GESDISC web site contains many informative articles under the "How To Section", "FAQ" (frequently asked questions), "News", "Glossary", and "Help" . A sample of these articles includes:

Earthdata Login for Data Access

7.0 More Information

https://gpm.nasa.gov/landslides/index.html contains descriptions of other landslide research conducted at NASA, especially the citizen science portal, Landslide Reporter.

The most recent global landslide nowcast will continue to be available at NASA Landslide Viewer. This application enables users to interact with the nowcast, search for specific locations, and view related information, such as historical landslides and current rainfall.

Home | NASA Global Precipitation Measurement Mission provides a wide variety of information on GPM, including visualizations, sensor descriptions, and links to downloadable precipitation data.

8.0 Acknowledgments

This project was funded by the NASA Precipitation Measurement Mission (PMM), with continuing support from the NASA Disasters Program (grant no. 18-DISASTER18-0022). The PMM team has also provided the server and web portal necessary for the routine publication of the global landslide nowcast.

9.0 References

Kirschbaum, D., and T. Stanley. 2018. "Satellite-Based Assessment of Rainfall-Triggered Landslide Hazard for Situational Awareness." Earth's Future, 6 (3): 505-523 doi:10.1002/2017ef000715

Emberson, R., D. Kirschbaum, and T. Stanley. 2020. "New global characterisation of landslide exposure." Natural Hazards and Earth System Sciences, 20 (12): 3413-3424 doi:10.5194/nhess 20-3413-2020