High Mountain Asia Near-Global Multi-Decadal Glacial Lake Inventory, Version 1

USER GUIDE

How to Cite These Data

As a condition of using these data, you must include a citation:

Shugar, D., A. Burr, U. K. Haritashya, J. Kargel, C. S. Watson, M. C. Kennedy, A. R. Bevington, R. A. Betts, S. Harrison, and K. Strattman. 2020. *High Mountain Asia Near-Global Multi-Decadal Glacial Lake Inventory, Version 1.* [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/UO20NYM3YQB4. [Date Accessed].

We also request that you acknowledge the author(s) of this data set by referencing the following peer-reviewed publication:

Shugar, D., A. Burr, U. K. Haritashya, J. Kargel, C. S. Watson, M. C. Kennedy, A. R. Bevington, R. A. Betts, S. Harrison, and K. Strattman. 2020. *Rapid worldwide growth of glacial lakes since 1990*, Nature Climate Change. https://doi.org/10.1038/s41558-020-0855-4.

FOR QUESTIONS ABOUT THESE DATA, CONTACT NSIDC@NSIDC.ORG

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/HMA_GLI

National Snow and Ice Data Center

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1 DATA DESCRIPTION

1.1 Parameters

The main parameter in this data set is glacial lake extent in m^2 (Area_m2). The data files also contain a set of additional attributes, such as Lat, Lon, Year_Start, and Country. Figure 1 is a screenshot of the QGIS user interface displaying the contents of the file HMA_GLI_glacial_lakes_LatLonWGS84_1990_99.shp.

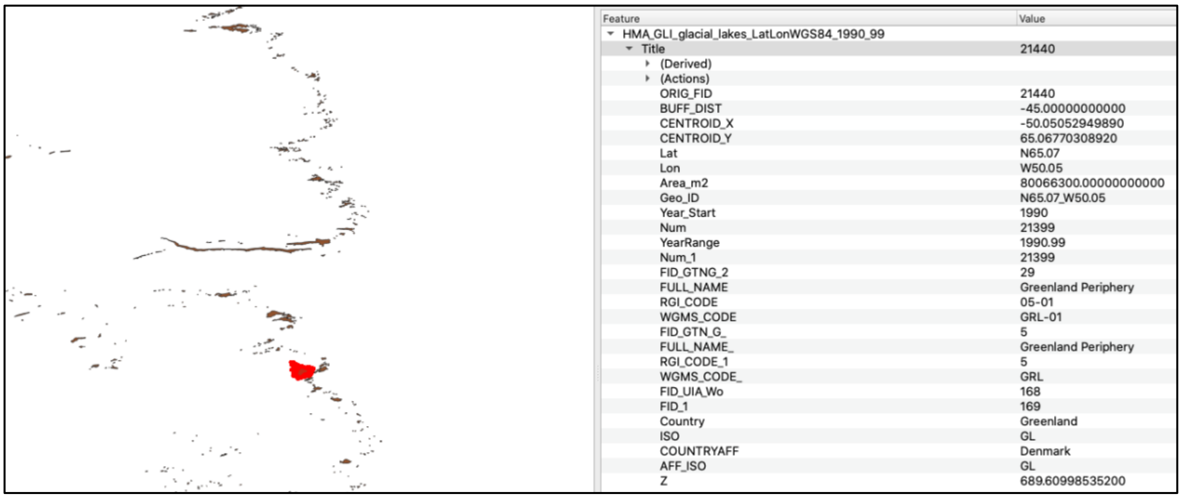

Figure 1. Left: locations of various glacial lake polygons. Right: parameters for the red-highlighted polygon.

1.2 File Information

1.2.1 Format

The data files are provided as ESRI Shapefiles (.shp, .shx, .dbf, .prj, .sbx, .sbn, .cpg).

1.2.2 Naming Convention

Example file name:

HMA_GLI_glacial_lakes_LatLonWGS84_1990_99.shp

The files are named according to the following convention, which is described in Table 1:

HMA_GLI_glacial_lakes_LatLonWGS84_YYYY_yy.ext

Table 1. File Naming Convention

Variable	Description
HMA_GLI	Data set ID
glacial_lakes	Indicates the focus on glacial lakes
LatLonWGS84	Indicates the use of the WGS 84 coordinate reference system
YYYY_yy	Years included in the data file. E.g.: 1990_99 means that the data include the years 1990 to 1999.
.ext	Indicates ESRI shapefiles: .shp, .shx, .dbf, .prj, .sbx, .sbn, .cpg

1.3 Spatial Information

1.3.1 Coverage

The spatial coverage is nearly global, but does not include Antarctica and various smaller, high-latitude islands.

Northernmost latitude: 82.6° N
Southernmost latitude 55.4° S
Easternmost longitude: 180.0° E
Westernmost longitude: 180.0° E

1.3.2 Resolution

Individual polygons with varying spatial extents and distances from each other.

1.3.3 Geolocation

Table 2 provides geolocation information for this data set.

Table 2. Geolocation Details

Geographic coordinate system	WGS 84
EPSG code	4326
PROJ4 string	+proj=longlat +datum=WGS84 +no_defs
Reference	https://epsg.io/4326

1.4 Temporal Information

1.4.1 Coverage

01 January 1990 to 31 December 2018

1.4.2 Resolution

The polygons represent glacial lake extents averaged over five multi-year periods: 1990-1999, 2000-2004, 2005-2009, 2010-2014, and 2015-2018.

2 DATA ACQUISITION AND PROCESSING

2.1 Background

The size of glacial lakes has been rapidly changing due to climate change and the associated retreat of glaciers. The implications of continued glacial melt for glacial lake outburst floods and local and regional water resources are important both from societal and ecological standpoints. This data set can be used to explore the changes in glacial lake extents on a near-global scale by contrasting five different time periods between 1990 and 2018. For more background information, see Shugar et al. (2020).

2.2 Acquisition and Processing

Using optical imagery from Landsat missions 4, 5, 7, and 8 available in Google Earth Engine (254,795 individual scenes), an initial mapping of water pixels on a near-global scale was performed. To this end, the calibrated surface reflectance data from the 254,795 scenes were stacked to produce a multi-sensor data cube. The cube was restricted to only include relatively (typically <20%) cloud-free scenes from the ablation season, in order to minimize the likelihood of capturing snow and frozen lake surfaces. Using a Normalized Difference Water Index-based model implemented in Google Earth Engine, surface water was identified and outlined and subsequently filtered by a set of variables to retain only glacial lakes (i.e., supraglacial, proglacial, and ice-marginal lakes). The images were then aggregated by epoch and verified for complete coverage of glacier proximal areas in order to avoid biases related to differing spatiotemporal image densities.

For more information on the data acquisition and processing steps, see the Methods section in Shugar et al. (2020).

2.3 Quality, Errors, and Limitations

The largest error sources arise from varying water and adjacent terrain properties, such as the color of the glacial lakes, frozen lake conditions, and shadows cast by terrain or clouds. Errors due to omissions or inaccuracies in the source data also affect the quality of this data set. For more information on the error assessments performed on this data set, see Shugar et al. (2020).

3 SOFTWARE AND TOOLS

The data files can be opened using software that recognizes the ESRI Shapefile file format, such as QGIS, command-line tools from the GDAL project, and ArcMap.

4 RELATED DATA SETS

High Mountain Asia at NSIDC | Data Sets

5 RELATED WEBSITES

High Mountain Asia at NSIDC | Overview
NASA High Mountain Asia Project
NASA Research Announcement: Understanding Changes in High Mountain Asia
GLIMS: Global Land Ice Measurements from Space

6 CONTACTS

Dr. Dan H. Shugar
University of Calgary

7 ACKNOWLEDGMENTS

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8 REFERENCES

Shugar, D. H., Burr, A., Haritashya, U. K., Kargel, J. S., Watson, C. S., Kennedy, M. C., Bevington, A. R., Betts, R. A., Harrison, S., & Strattman, K. (2020). Rapid worldwide growth of glacial lakes since 1990. Nature Climate Change. https://doi.org/10.1038/s41558-020-0855-4

9 DOCUMENT INFORMATION

9.1 Publication Date

16 January 2019

9.2 Date Last Updated

03 September 2020