High Mountain Asia 30m and 8m Flood Geomorphic Potential, Version 1

USER GUIDE

How to Cite These Data

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

Sofia, G., M. Khanam, E. I. Nikolopoulos, and E. N. Anagnostou. 2024. *High Mountain Asia 30m and 8m Flood Geomorphic Potential, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/WS83XMWHGEM9. [Date Accessed].

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

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/HMA2_FGP

National Snow and Ice Data Center

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1 DATA DESCRIPTION

This data set contains Flood Geomorphic Potential (FGP) at 30 m resolution for the High Mountain Asia (HMA) region and 8 m resolution over Nepal. FGP is a DEM-derived geomorphic index that provides high-resolution flood mapping based on bankfull elevations, defined in terms of river widths, and elevation differences between the point under examination and the closest bankfull elevation in the river network.

1.1 Parameters

Flood Geomorphic Potential (FGP)

1.2 File Information

1.2.1 Format

ESRI Shapefile[1], GeoTIFF

1.2.2 Contents

Shapefiles specify river widths in meters at either 30 m or 8 m intervals. Each Shapefile has a corresponding GeoTIFF (.tif) that contains FGP values.

Each Shapefile in this data set consists of the following files:

Table 1. Shapefile File Extensions and Descriptions

File Extension	Description
.shp	Main file with shape and vertices for each record
.dbf	dBASE table of attributes for each record
.shx	Index file
.prj	Coordinate system information

[1] An ESRI Shapefile is a geospatial, vector data storage format consisting of multiple, related files.

1.2.3 Naming Convention

30 m resolution

Convention

HMA2_FGP_30m_HUC407[XXXXXXX]_v01.0.ext

Examples

HMA2_FGP_30m_HUC4071348160_v01.0.tif

HMA2_FGP_30m_HUC4071348160_v01.0.shp

HMA2_FGP_30m_HUC4071348160_v01.0.shx

HMA2_FGP_30m_HUC4071348160_v01.0.prj

HMA2_FGP_30m_HUC4071348160_v01.0.dbf

"HUC[XXXXXXXXXX]" refers to the Hydrologic Unit Code (HUC) utilized by HydroBASINS[2]. HydroBASINS HUCs follow the Pfafstetter concept (Verdin and Verdin, 1999) with a few modifications to allow for global coverage.

For this data set, the first three digits ("407") indicate the continent, i.e., Asia ("4"), and the Pfafstetter Level: "07" = Level 7. The next seven digits represent a unique, six-digit identifier within the HydroSHEDS network, plus a final digit that indicates the side of a sub-basin in relation to the river network (all files in this data set end in "0" or "no side.").

For more information about HydroBASINS and its HUC naming convention, see HydroSHEDS | HydroBASINS.

8 m Resolution

Convention

HMA2_FGP_8m_tile[XXX]_v01.0.ext

[2]HydroBASINS comprises a global series of vectorized polygon layers that depict consistently sized and hierarchically nested hydrological sub-basins at different scales.

Examples

HMA2_FGP_8m_tile624_v01.0.tif

HMA2_FGP_8m_tile624_v01.0.shp

HMA2_FGP_8m_tile624_v01.0.shx

HMA2_FGP_8m_tile624_v01.0.dbf

HMA2_FGP_8m_tile624_v01.0.prj

“Tile[XXX]” in file names refers to 3-digit tile number used by the High Mountain Asia 8-meter DEM Mosaics Derived from Optical Imagery, Version 1 data set (the DEM used to generate the 8 m FGPs). A PDF map of DEM tile numbers is available from “What is the spatial extent of individual HMA DEMs?”

1.3 Spatial Information

1.3.1 Coverage

N: 49.7° N

S: 9.5 N°

E: 121.6° E

W: 58.1° E

1.3.2 Resolution

30 m

8 m (Nepal only)

1.3.3 Geolocation

The 30 m data are provided in a custom Albers Equal-Area projection (see Table 2), with standard parallels at 25° N and 47° N, a central longitude of 85° E, and the origin at 85° E, 36° N. Elevations are specified in meters above the WGS 84 ellipsoid.

Table 2. Geolocation Details for Albers Equal-Area Conical Projection (30 m Data)

Geographic coordinate system	World Geodetic System 1984
Projected coordinate system	Albers Equal-Area Conical
Standard Parallels	25° N, 47° N
Central Meridian	85° E
Latitude of Origin	36° N
Datum	WGS 84
Ellipsoid/spheroid	WGS 84
Units	meters
EPSG code	None
PROJ4 string	+proj=aea +lat_1=25 +lat_2=47 +lat_0=36 +lon_0=85 +x_0=0 +y_0=0 +datum=WGS84 +units=m +no_defs

The 8 m data are provided in the WGS 84/Universal Transverse Mercator (UTM) projection. The following table contains details about the WGS 84 geographic coordinate system:

Table 3. WGS 84 Geolocation Details

Geographic coordinate system	World Geodetic System 1984
Projected coordinate system	N/A
Longitude of true origin	Prime Meridian, Greenwich
Latitude of true origin	N/A
Scale factor at longitude of true origin	N/A
Datum	WGS 84
Ellipsoid/spheroid	WGS 84
Units	degree
False easting	N/A
False northing	N/A
EPSG code	EPSG: 4326
PROJ4 string	+proj=longlat +datum=WGS84 +no_defs +type=crs
Reference	https://epsg.org/crs_4326/WGS-84.html

The 8 m data are distributed across 12 UTM zones. Each zone spans 6° of longitude (see Table 4) between the equator and 84° N.

Table 4. UTM Zones/EPSG Codes for 8 M Data

Zone	Coverage	EPSG Code	Zone	Coverage	EPSG Code
40N	54° E - 60° E	32640	46N	90° E - 96° E	32646
41N	60° E - 66° E	32641	47N	96° E – 102° E	32647
42N	66° E - 72° E	32642	48N	102° E - 108° E	32648
43N	72° E - 78° E	32643	49N	108° E - 114° E	32649
44N	78° E - 84° E	32644	50N	114° E - 120° E	32650
45N	84° E - 90° E	32645	51N	120° E - 126° E	32651

1.4 Temporal Information

1.4.1 Coverage

The DEMs used to generate this data set were created from satellite imagery spanning multiple years (See “2.2 | Acquisition“). The following temporal coverages refer to the publication date of the DEM used to generate the corresponding 30 m or 8 m resolution FGP indices.

22 April 2021 (30 m resolution)
16 July 2017 (8 m resolution)

2 DATA ACQUISITION AND PROCESSING

2.1 Background

Hydroclimatic variation driven by climate change will heighten the disaster risk for millions of people living in the High Mountain Asia region. As such, understanding how the landscape will respond to annual increases in precipitation extremes, over long time scales, will be crucial to mitigating human suffering and damage to crops and infrastructure caused by floods and debris flows.

2.2 Acquisition

The following DEMs were used to create this data set:

- Copernicus GLO-30 Digital Elevation Model
- High Mountain Asia 8-meter DEM Mosaics Derived from Optical Imagery, Version 1

The imagery used to construct the GLO-30 DEM were obtained by the German Aerospace Center TanDEM-X satellite between 2011 through mid-2015. The High Mountain Asia 8-meter DEM was constructed from imagery acquired between 2008 and 2017 by the GeoEye-1, QuickBird-2, and WorldView-1, -2, and -3 satellites flown by Maxar Technologies Inc. (formerly DigitalGlobe).

2.3 Processing

The shapefiles in this data set comprise stream networks automatically derived from the corresponding 30 m or 8 m DEM, using a geomorphologic approach that in turn provides the river widths (Sofia et al 2011) used to calculate the FGP values.

FGP is defined as the natural logarithm of the ratio between:

- The bankfull elevation at the point in the river network nearest the point under examination
- The difference in elevation between the two points.

FGP values range (in theory) from -infinity to infinity, with higher values corresponding to higher flood potential.

Improving on the Geomorphic Flood Index (GFI) defined in Samela et al. 2017, which requires estimating river depths in elements of the basin based on the contributing area, FGP utilizes bankfull elevations estimated with a hydraulic scaling function defined in terms of river widths, because determining river widths via remote sensing is relatively straightforward. The benefit of this approach is that the FGP can be retrieved from the landscape via a fully automated process that

does not require any additional information other than terrain data (Sofia, et al., 2015; 2017a; 2017b; and Sofia and Nikolopoulos, 2020).

2.4 Quality, Errors, and Limitations

River widths were retrieved from DEMs via a fully automated process and have not been cross-referenced with field data.

3 VERSION HISTORY

Version 1 (initial release)

4 RELATED DATA SETS

High Mountain Asia 8-meter DEM Mosaics Derived from Optical Imagery, Version 1

5 RELATED WEBSITES

NASA's High Mountain Asia Team

6 REFERENCES

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7 DOCUMENT INFORMATION

7.1 Publication Date

April 2024

7.2 Date Last Updated

April 2024