High Mountain Asia 5 Arc-Minute Hydrological Flow Direction for the Headwaters of the Amu Darya and Indus River Basins, Version 1

USER GUIDE

How to Cite These Data

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

Glidden, S. J., R. B. Lammers, & A. A. Prusevich. 2023 *High Mountain Asia 5 Arc-Minute Hydrological Flow Direction for the Headwaters of the Amu Darya and Indus River Basins, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/SE4AJ5NZBWT5. [Date Accessed].

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

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/HMA2_HFD

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1 DATA DESCRIPTION

This High Mountain Asia (HMA) data set contains hydrological flow directions at 5 arc-minute resolution for the headwaters of the Amu Darya and Indus River basins. The domain spans parts of Afghanistan, Tajikistan, Kyrgyzstan, and Pakistan. Flow directions are reported in deterministic eight (D8) format.

The data were developed to support the University of New Hampshire Water Balance Model and the "High Mountain Asia CMIP6 Monthly and Yearly Water Balance Projections, 2016-2099 for Parts of Afghanistan, Tajikistan, Kyrgyzstan, and Pakistan, Version 1" data set.

1.1 Parameters

Flow direction is reported in D8 format, which uses eight powers of two — 1, 2, 4, 8, 16, 32, 64, and 128 — to represent the eight cardinal and intercardinal directions. As depicted in Table 1, a value of 1 represents east, 2 represents southeast, 4 represents south, etc. 0 indicates non-flow and -9999 means missing data.

Table 1. D8 Flow Directions

32	64	128
16	0	1
8	4	2

1.2 File Information

1.2.1 Format

GeoTIFF
ESRI ASCII Grid[1]

1.2.2 Naming Convention

The following data files are available:

HMA2_HFD_20230323_V01.0.tif (GeoTIFF)
HMA2_HFD_20230323_V01.0.asc (ESRI ASCII Grid)

The string “20230323” in the file names references the date the flow model was generated (23 March 2023) using the ISO standard date format YYYYMMDD. V01.0 indicates the data set version: Version 1.0.

In addition, a projection file[2] named “HMA2_HFD_20230323_V01.0.prj” can be downloaded that specifies the geographic coordinate system, datum, spheroid, prime meridian, and units in ESRI Well-Known Text (WKT) format.

1.3 Spatial Information

1.3.1 Coverage

N: 39.83333° N
S: 31.08333° N
E: 81.75° E
W: 65.58333° E

1.3.2 Resolution

5 arcmin (0.0833333°)

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[1] For more information, see Esri ASCII raster format.
[2] Certain tools may require this file to view and properly geolocate the ESRI ASCII Grid file.

1.3.3 Geolocation

The tables below provide information for geolocating this data set:

Table 2. 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
Reference	https://epsg.io/4326

Table 3. Grid Details

Grid cell size (x, y pixel dimensions)	0.0833333° × 0.0833333°
Number of rows	105
Number of columns	194
Geolocated lower left point in grid	31.0833333° N 65.5833333° E
Nominal gridded resolution	0.0833333°
Grid rotation	N/A
ulxmap – x-axis map coordinate of the center of the upper-left pixel (XLLCORNER for ASCII data)	65.625° E
ulymap – y-axis map coordinate of the center of the upper-left pixel (YLLCORNER for ASCII data)	39.7916667° N

1.4 Temporal Information

1.4.1 Coverage

23 March 2023

1.4.2 Resolution

N/A

2 DATA ACQUISITION AND PROCESSING

2.1 Processing

This digital flow direction network was created to support the University of New Hampshire Water Balance Model utilized in the "High Mountain Asia CMIP6 Monthly and Yearly Water Balance Projections, 2016-2099 for Parts of Afghanistan, Tajikistan, Kyrgyzstan, and Pakistan, Version 1" data set (See “Section 4 | Related Data Sets).

It is a High Mountain Asia-specific subset of the global, river network data set developed by Prusevich et al. (2022) to address the issue of erroneously delineated endorheic basins in the MERIT[3] Hydro IHU[4] networks (Eilander et al., 2021). For more information, see “Section 5 | References.”

2.2 Quality, Errors, and Limitations

The network developed in Prusevich et al. (2022) merges many misidentified catchments into other larger endorheic areas, thus significantly reducing the number of endorheic basins while preserving the total land portion of those basins. It also removes erroneous coastal endorheic basins that are in fact connected to the ocean (e.g., the Indus River, which appears in the source MERIT data sets to be endorheic).

3 VERSION HISTORY

Version 1 (initial release)

[3] Multi-Error-Removed Improved-Terrain
[4] Iterative Hydrography Upscaling

4 RELATED DATA SETS

High Mountain Asia CMIP6 Monthly and Yearly Water Balance Projections, 2016-2099 for Parts of Afghanistan, Tajikistan, Kyrgyzstan, and Pakistan, Version 1

5 REFERENCES

Eilander, D., van Verseveld, W., Yamazaki, D., Weerts, A., Winsemius, H. C., and Ward, P. J. (2021). A hydrography upscaling method for scale-invariant parametrization of distributed hydrological models, *Hydrol. Earth Syst. Sci.*, 25(9), 5287-5313. https://doi.org/10.5194/hess-25-5287-2021

Grogan, D.S., D. Wisser, A. Prusevich, R.B. Lammers, and S. Frolking (2017). The use and re-use of unsustainable groundwater for irrigation: A global budget, *Environmental Research Letters*, 12(3), 034017. https://doi.org/10.1088/1748-9326/aa5fb2

Prusevich, A., R. Lammers, and S. Glidden (2022). MERIT-Plus Dataset: Delineation of endorheic basins in 5 and 15 min upscaled river networks (Version v1) [Data set]. MSD-LIVE Data Repository. https://doi.org/10.57931/1904379

6 DOCUMENT INFORMATION

6.1 Publication Date

September 2023

6.2 Date Last Updated

September 2023