

Guidelines on how to access the mountain glacier database from Barndon and Lima et al. (in review)

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Reference: Barndon and Lima, et al. (ESSD, in review) Mountain glacier evolution since the last interglacial.

1 Introduction

The shapefiles of the continuous extent of mountain glaciers for each study area (i.e. mountain ranges), for the full simulation period, are available through the Sigma2 NIRD data archive [1]. The mountain glacier database consist of individual glacier extents (shapefiles) and ice thicknesses (TIFF), one for each time step in each of the simulations. The database also contains averaged extent files (shapefiles) for each study area, based on the best-performing simulations in the ensemble [2]. The database does not include an averaged ice thickness product. In addition to the main files, some statistic files and plots are found in the individual simulation folders. The database is very large, and therefore some preparation is necessary before accessing the desired data.

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2 Data file structure

2.1 Full set of simulations

The shapefiles of the simulated extent of the mountain glaciers are grouped in ensembles named after each study area (i.e. mountain range). Each of the ensemble folders contains the full set of simulations (~ 50 simulation) for the study area.

```

full_ensemble_results/
├── ahmar_mountains_expanded_500m_full_calibration_ensemble/
│   ├── ahmar_mountains_expanded_500m_full_calibration_1/
│   │   ├── results/
│   │   │   ├── output.tif/
│   │   │   │   ├── thk--00100.tif
│   │   │   │   ├── thk--00200.tif
│   │   │   │   └── [...]
│   │   │   └── ice_extent_shape_files/
│   │   │       ├── ICE00000.shp
│   │   │       ├── ICE00010.shp
│   │   │       └── [...]
│   │   └── [...]
│   └── [...]
├── alps_500m_full_calibration_ensemble/
├── bale_mountains_500m_full_calibration_ensemble/
├── caucasus_500m_full_calibration_ensemble/
├── centre_central_andes_500m_v3_full_calibration_ensemble/
├── eastern_cord_and_merida_500m_full_calibration_ensemble/
├── ecuadorian_cordilleras_500m_full_calibration_ensemble/
├── median_extent_ensembles_top16/
├── median_extent_ensembles_top8/
├── mount_elgon_500m_full_calibration_ensemble/
├── mount_kenya_and_kilimanjaro_500m_full_calibration_ensemble/
├── north_central_andes_500m_v2_full_calibration_ensemble/
├── pyrenees_500m_full_calibration_ensemble/
├── ruwenzori_500m_full_calibration_ensemble/
├── santa_marta_500m_full_calibration_ensemble/
├── semien_mountains_500m_full_calibration_ensemble/
├── sierra_nevada_500m_full_calibration_ensemble/
├── south_central_andes_500m_v3_full_calibration_ensemble/
└── west_central_cordilleras_500m_full_calibration_ensemble/

```

2.2 Ensemble simulations

For most users, the "median extent ensembles" would be the most useful data, as they best represent the glacier extent of the mountain range in question. These averaged glacier extents are based on the best performing 16 or 8 simulations from the ensemble.

The shapefiles of the median extents of the glaciers can be found in the main directory under `median_extent_ensembles_top8` and `median_extent_ensembles_top16/`. Here are the medians of the eight best performing simulations of each ensemble:

```
median_extent_ensembles_top8/
├── alps_500m_full_calibration_ensemble_threshold_0.50/
│   ├── ICE00000.shp
│   ├── ICE00010.shp
│   ├── ICE00020.shp
│   └── [...]
├── caucasus_500m_full_calibration_ensemble_threshold_0.50/
├── centre_central_andes_500m_v3_full_calibration_ensemble_threshold_0.50/
├── eastern_cord_and_merida_500m_full_calibration_ensemble_threshold_0.50/
├── ecuadorian_cordilleras_500m_full_calibration_ensemble_threshold_0.50/
├── full_arsi_mountains_500_full_calibration_ensemble_threshold_0.50/
├── full_bale_mountains_500_full_calibration_ensemble_threshold_0.50/
├── mount_elgon_500m_full_calibration_ensemble_threshold_0.50/
├── mount_kenya_and_kilimanjaro_500m_full_calibration_ensemble_threshold_0.50/
├── north_central_andes_500m_v2_full_calibration_ensemble_threshold_0.50/
├── pyrenees_500m_full_calibration_ensemble_threshold_0.50/
├── ruwenzori_500m_full_calibration_ensemble_threshold_0.50/
├── santa_marta_500m_full_calibration_ensemble_threshold_0.50/
├── semien_mountains_500m_full_calibration_ensemble_threshold_0.50/
├── sierra_nevada_500m_full_calibration_ensemble_threshold_0.50/
├── south_central_andes_500m_v3_full_calibration_ensemble_threshold_0.50/
└── west_central_cordilleras_500m_full_calibration_ensemble_threshold_0.50/
```

Note that some directory names have versioning and variations, this is also true for the `...top16/`. These folders also contain the `.cpg`, `.dbf`, and other part shape files.

2.3 Naming convention per time step

The shapefiles (glacier extent) and tiff-files (ice thickness) are all named after the time step of the simulation (Table 1). Ice-thickness files have a direct name-by-year scheme, while the shapefiles are named by the difference to the present year (the year 2000). Since single year time-steps are not included in the dataset, the last digit were removed from these file names for brevity.

Year (CE & BCE)	Ice thickness file name (tiff)	Difference to Our Present (year 2000)	Shape-file name (.shp etc)
2000	thk-002000.tif	0	ICE00000.shp
1900	thk-001900.tif	-100	ICE00010.shp
1500	thk-001500.tif	-500	ICE00050.shp
1000	thk-001000.tif	-1000	ICE00100.shp
0	thk-000000.tif	-2000	ICE00200.shp
-100	thk--00100.tif	-2100	ICE00210.shp
-1000	thk--01000.tif	-3000	ICE00300.shp
-20000	thk--20000.tif	-22000	ICE02200.shp
-21000	thk--21000.tif	-23000	ICE02300.shp
-130000	thk--130000.tif	-132000	ICE13200.shp

Table 1: Time step naming convention across file types. Ice thickness files use the direct year (CE or BCE) as the numeral in their file name. The ice extent files are numbered by the difference to the year 2000. Note that all other partial shape files have the same time-step-name as the .shp files.

2.4 Additional files

Example from the European Alps simulation run 9:

```
alps_500m_full_calibration.9/
├─ params.json
├─ results/
│   ├── ice_extent_shape_files/
│   ├── output_tif/
│   ├── alps_500m_full_calibration.9_result.log
│   ├── alps_500m_full_calibration.9_result_metrics.log
│   ├── climate_output.csv
│   ├── computational-pie.png
│   ├── computational-statistics.txt
│   └─ glacier_extent_and_volume.csv
```

These additional files can also be found in each simulation. `params.json` is the specific simulation input parameters, as used in the IGM simulation run.

The log files are from the same IGM simulation run, as is the computational graph and statistics. The `climate_output.csv` collects runtime updated climate parameters, and `glacier_extent_and_volume.csv` logs the ice parameters.

3 Ways to access the data

For larger *sets* of data, there are several methods to download from our mountain glacier database. The first, **Method A**, uses a command line interface tool called Rclone. This is the recommended approach for accessing the glacier extent data. A few other methods are mentioned but not explained in detail. **Method B** involves manually extracting the desired links from a summary CSV-file. This can be useful for a *single* (or very few) file (e.g. if only a single time step of a glacier extent is required).

Database access links:

- archive.sigma2.no/dataset/evolution-of-mountain-glaciers-since-the-last-interglacial
- doi.org/10.11582/2026.juu0pnt4

3.1 Method A: Command line client

Sigma2 recommends two separate tools [3] to chose from when downloading sets of data from our mountain glacier database. We have chosen to explain Rclone here, see NIRD documentation [4] for AWS CLI and other approaches.

3.1.1 Installing Rclone

The installation steps mentioned here are for Linux, macOS or BDS systems. To install on **Windows** please see: rclone.org/downloads/ or rclone.org/install/.

To be able to access the dataset with Rclone, you need to first [download this configuration file](#) (`rda-s3-rclone.conf`), which simply looks like this:

```
[s3]
type = s3
provider = IBMCOS
endpoint = https://s3.nird.sigma2.no/
location_constraint = us-east-1
cal = private
```

Then, to install Rclone run:

```
sudo -v ; curl https://rclone.org/install.sh | sudo bash
```

After the installation is complete, move the downloaded Sigma2/NIRD configuration file to `.config/rclone/rclone.conf`, for example:

```
mv Downloads/rda-s3-rclone.conf .config/rclone/rclone.conf
```

If you now run the `rcloneconfig` command, the config file should be detected and show the name/type: `s3`. Instead of the above setup it is also possible to just run all `rclone` commands with the `--config<path-to-config-file>` flag. Rclone is now successfully installed and ready to access the NIRD archive.

3.1.2 Accessing and downloading with Rclone

The `<dataset-identifier>` for the glacier extent database is: `7d98e89f-c213-4239-bc27-9e7775c55110`

To list the content directories, run:

```
rclone lsd
↳ s3:/archive-ro/7d98e89f-c213-4239-bc27-9e7775c55110/full_ensemble_results/
```

To download a directory:

```
rclone copy s3:/archive-ro/7d98e89f-c213-4239-bc27-9e7775c55110/full_ensemble_r
↳ esults/<path-to-desired-directory> ./<some-local-destination-folder>
```

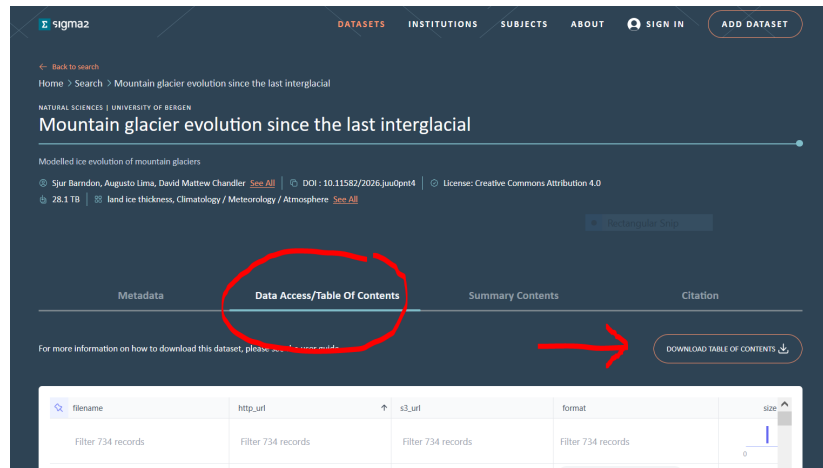
For example, if you want to download the shape files of all the time steps of the alps ‘top 8’ median extent shape files:

```
rclone copy s3:/archive-ro/7d98e89f-c213-4239-bc27-9e7775c55110/full_ensemble_r
↳ esults/median_extent_ensembles_top8/alps_500m_full_calibration_ensemble_thr
↳ eshold_0.50 ./<some-local-destination-folder>
```

For more `rclone` commands, see rclone.org/docs/#basic-syntax.

3.2 Method B: Extracting links from the CSV-file

By downloading the CSV-file and manually extracting all the links, it is possible to download files. First download the table of contents CSV file from the database access:



In this large CSV file, all the download links are accessible on a line-by-line basis. This method of extracting the data could be useful for single files.

4 References

1. Sigma2 and NIRD: archive.sigma2.no/ Documentation: documentation.sigma2.no/
2. Preprint publication: <https://doi.org/10.5281/zenodo.18195704>
3. documentation.sigma2.no/nird_archive/user-guide.html#searching-and-accessing-datasets
4. documentation.sigma2.no/nird_archive/downloading-datasets.html