

# Glacier initialization options

## Default initialization

At simulation start (bdate) the area of the glacier class is considered to be completely covered by glacier. The initial glacier volume is calculated based on the area and some coefficients;  $coef = 0.205$  and  $exp = 1.375$ .

$$glac_{vol} = coef \times glac_{area}^{exp}$$

where  $glac_{vol}$  is in  $m^3$  and  $glac_{area}$  in  $m^2$ .

### Changing the default coefficients:

The coefficients may be set to different values by parameters (par.txt; glacvcoef, glacvexp)) and/or glacier input data (GlacierData.txt; column logvolcorr).

$$coef = 0.205 \times e^{logvolcorr}$$

$$coef = glacvcoef$$

$$coef = glacvcoef \times e^{logvolcorr}$$

$$exp = glacvexp$$

## Separation into glacier types

Separation of glaciers into different types can be done in GlacierData.txt. There each glacier can be given the wanted glacier type (column glactype). The glaciers can alternatively be separated into two types based on their class' area and a parameter (par.txt; glac2arlim). Small glaciers are given glactype=0, and large glaciers are given glactype=1. The parameter glac2arlim defines the separating area (in  $m^2$ ). Glaciers of glactype=0 uses the default parameter values for initializing of the glacier volume, while the other uses an alternative set of parameter values. Glaciers of type 0 and 1 have a time varying glacier area, while glaciers of type 2 and 3 have a constant glacier area (equal to the slc area).

### Alternative initialization coefficients:

The alternative initializations coefficients are used for glaciers of other types (glactype>=1). Glaciers of the default type (glactype=0) is initialized as described above, while the other glaciers are initialized with different parameter values. The default values of the alternative coefficients are  $coef = 1.701$  and  $exp = 1.25$ . The coefficients may be set to different values by parameters (par.txt; glacvcoef1, glacvexp1)) and/or glacier input data (GlacierData.txt; logvolcorr) similar to the default glacier.

$$coef = 1.701 \times e^{\log volcorr}$$

$$coef = glacvcoef1$$

$$coef = glacvcoef1 \times e^{\log volcorr}$$

$$exp = glacvexp1$$

## Initialization with glacier volume

Another option to initialize the glaciers is to set the glacier volume ( $m^3$ ) for each glacier in GlacierData.txt directly (column `slcvolume`). Note that to set this input data to zero means zero glacier volume. To turn this option off, leave the column out of GlacierData.txt or set its value to missing value (-9999).

## Valid date adjustment

All of the above methods to initialize the glacier volume can additionally be manipulated using glacier specific data (in GlacierData.txt) on when the initial glacier volume, calculated by `slc` defined glacier area or set by `slcvolume`, is valid. If the initial year is given (GlacierData.txt; `slcdate`) the initial volume is valid for that date. In this case, the average annual change in mass balance (*annmb* in mm/yr) is given as input data (GlacierData.txt; `annualmb`) or as a general parameter (`par.txt`; `glacannmb`). The initial glacier volume is then adjusted according to the difference in years (*yeardiff*) between simulations start and glacier area data. The manipulated initial glacier volume:

$$glac_{vol} = glac_{vol} + yeardiff \times \frac{annmb \times class_{area}}{glacdens \times 1000}$$

For two of the glacier types (`glactype=0` and `1`) the initial glacier area is correspondingly adjusted, but is limited upward by the class area. The relation is:

$$glac_{area} = \left( glac_{vol} \times \frac{1}{coef} \right)^{\frac{1}{exp}}$$

## Initialization and state file

You can force the model to ignore the glacier state from an state file and use the above described calculation to initialize the glaciers at the beginning of the simulation (`info.txt`; `bdate`) by setting a flag in `info.txt`; `modeloption glacierini 1`.