SICOPOLIS V2.9
– Quick Start Manual –

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1 Installation on a UNIX/LINUX system

1. Download the gzipped tar archive sicopolis_v29.tgz.

2. Unpacking with the following commands:

```
gunzip sicopolis_v29.tgz
tar -x -v -f sicopolis_v29.tar
```

3. You should then have a new folder "sicopolis_v29", which contains the entire program package.

2 Files and directories in "sicopolis_v29"

- **runs**:

  Shell script (tcsh) sico.job for running a single simulation under UNIX/LINUX.

  Shell script (tcsh) multi_sico.job for running multiple simulations by repeated calls of sico.job.

  Subdirectory **headers**: specification files sico_specs_*run_name*.h (*run_name*: name of run).

  – Files included for runs grl40_test_wre1000, grl20_test_wre1000 and grl10_test_wre1000
    ⟶ Greenland ice sheet, resolution 40 / 20 / 10 km, $t = 1990\,\mathrm{CE} \ldots 2350\,\mathrm{CE}$
    [similar to the WRE1000 run by Greve (2004)
    and run #11 by Greve and Otsu (2007)].

  – File included for run emtp2sge_expA
    ⟶ EISMINT Phase 2 Simplified Geometry Experiment A,
    resolution 25 km, $t = 0\,\mathrm{ka} \ldots 200\,\mathrm{ka}$ (Payne et al. 2000).

  – Files included for runs ant80_paleo04_init, ant80_paleo04, ant40_paleo04_init and ant40_paleo04
    ⟶ Antarctic ice sheet, resolution 80 km for ant80..., 40 km for ant40...,
    $t = -522\,\mathrm{ka} \ldots -422\,\mathrm{ka}$ for the spin-up runs (..._init), $t = -422\,\mathrm{ka} \ldots 0\,\mathrm{ka}$
    for the main runs [see Greve (2006) and Greve (2005)].

  – Files included for runs grl40_paleo01_init, grl40_paleo01, grl20_paleo01_init and grl20_paleo01
    ⟶ Greenland ice sheet, resolution 40 km for grl40..., 20 km for grl20...,

$t = -422\,\text{ka} \ldots -250\,\text{ka}$ for the spin-up runs (..._init), $t = -250\,\text{ka} \ldots 0\,\text{ka}$ for the main runs [similar to run hf_pmod2 by Greve (2005)].

- File included for run nhem80_nt012_new
  $\longrightarrow$ northern hemisphere, resolution 80 km, $t = -250\,\text{ka} \ldots 0\,\text{ka}$
  [similar to run nt012 by Greve et al. (1999)].

- **src**:

  Directory which contains the main program file sicopolis.F90.

  - Subdirectory **subroutines/general**: general subroutines, for any modelled domain.
  - Subdirectory **subroutines/ant**: subroutines specific for the Antarctic ice sheet.
  - Subdirectory **subroutines/emtp2sge**: subroutines specific for the EISMINT Phase 2 Simplified Geometry Experiments.
  - Subdirectory **subroutines/grl**: subroutines specific for the Greenland ice sheet.
  - Subdirectory **subroutines/nhem**: subroutines specific for the northern hemisphere.
  - Accordingly for Scandinavia, Tibet, ISMIP HEINO, and the north and south polar caps of Mars.

- **sico_in**:

  Directory which contains input data files for SICOPOLIS.

  - Subdirectory **general**: general input files, for any modelled domain.
  - Subdirectory **ant**: input files specific for the Antarctic ice sheet.
  - Subdirectory **emtp2sge**: input files specific for the EISMINT Phase 2 Simplified Geometry Experiments.
  - Subdirectory **grl**: input files specific for the Greenland ice sheet.
  - Subdirectory **nhem**: input files specific for the northern hemisphere.
  - Accordingly for Scandinavia, Tibet, ISMIP HEINO, and the north and south polar caps of Mars.

- **sico_out**:

  Empty directory into which output files of SICOPOLIS simulations are written.

3 How to run a simulation

1. In the script sico.job (subdirectory runs/), search for "greve", and replace the path names for RUN_DIR and SRC_DIR with your own ones.

   Also, search for "Compiler", and replace the variables F90 and F90FLAGS according to the syntax of your own Fortran compiler (F90FLAGS should do).

2. In the specification files (subdirectory runs/headers/), search for "greve", and replace the path names for INPATH, OUTPATH and ANFDATPATH (unless set to "none") with your own ones.

3. The rest is quite simple:

   - In order to run simulation grl40_test_wre1000, use the script sico.job. The command is

     ```
     (./sico.job grl40_test_wre1000) >&! out_job.dat &
     ```

     (from subdirectory runs/, tcsh required). Accordingly for the other simulations.

   - Alternatively, if you prefer to run all simulations consecutively, you may use the script multi_sico.job:

     ```
     (./multi_sico.job) >&! out_mjob.dat &
     ```

The computing times for the simulations, run with the Intel Fortran Compiler for Linux 9.1 on an Intel P4 (3.8 GHz) PC under openSUSE 10.3 (32 bit), are as follows:

Run	Time
grl40_test_wre1000	2.6 sec
grl20_test_wre1000	19.3 sec
grl10_test_wre1000	6.5 min
emtp2sge_expA	9.2 min
ant80_paleo04_init	3.9 min
ant80_paleo04	12.8 min
ant40_paleo04_init	1.8 hrs
ant40_paleo04	6.3 hrs
grl40_paleo01_init	28.2 min
grl40_paleo01	41.4 min
grl20_paleo01_init	3.8 hrs
grl20_paleo01	5.6 hrs
nhem80_nt012_new	5.0 hrs

4 Output files

Output files of simulations are written to directory sico_out. Four types are produced:

- **run_name.log**:

  Lists the main specifications of simulation *run_name*.

- **run_name.ser**:

  Time-series file which contains global parameters:

  - Time, t
  - Surface-temperature anomaly, D_Ts, or glacial index, glac_ind (forcing)
  - Sea level, z_sl (forcing)
  - Maximum ice thickness, H_max
  - Maximum ice elevation, zs_max
  - Ice volume, V_g
  - Volume of the temperate ice, V_t
  - Freshwater production due to melting and calving, V_fw
  - Sea-level equivalent of ice volume, z_sle
  - Ice area, Aib
  - Area covered by temperate ice, Atb
  - Water drainage due to basal melting, V_bm
  - Water drainage from the temperate layer, V_tld
  - Maximum thickness of the temperate layer, H_t_max
  - Maximum surface velocity, vs_max

- **run_name.core**:

  Time-series file which contains for selected locations xxx:

  - Time, t
  - Surface-temperature anomaly, D_Ts, or glacial index, glac_ind (forcing)
  - Sea level, z_sl (forcing)
  - Thickness, H_xxx
  - Surface velocity, v_xxx

- Basal temperature, T_xxx
- Basal frictional heating, Rb_xxx

For the Greenland ice sheet, these data are written for six locations:
GRIP (xxx=GR), GISP2 (xxx=G2), Dye 3 (xxx=D3), Camp Century (xxx=CC), NorthGRIP (xxx=NG), NEEM (xxx=NE).

For the Antarctic ice sheet, these data are written for six locations:
Vostok (xxx=Vo), Dome A (xxx=DA), Dome C (xxx=DC), Dome F (xxx=DF), Kohnen (xxx=Ko), Byrd (xxx=By).

For the northern hemisphere and the EISMINT Phase 2 Simplified Geometry Experiments, no such data are written.

- **run_name01.erg**, **run_name02.erg**, ...:

  Complete set of fields (topography, velocity, temperature etc., written in binary format; see subroutine output1) for selected time slices defined in specifications file. For example, simulation grl40_test_wre1000 produces two files grl40_test_wre100001.erg, grl40_test_wre100002.erg, which correspond to 2000 CE and 2350 CE, respectively.

5 Plotting with SICOGRAPH

The output described in Sect. 4 can be visualized with any plotting tool at the user's preference. One possibility is to use SICOGRAPH, which is part of the SICOPOLIS package and based on the Generic Mapping Tools GMT (http://gmt.soest.hawaii.edu/).

5.1 Installation

1. If you do not have an installation of GMT version 4.x yet, download and install the latest version according to the instructions on the GMT web site.
2. Download the gzipped tar archive sicograph_*date*.tgz.
3. Unpacking with the following commands:

   ```
   gunzip sicograph_date.tgz
   tar -x -v -f sicograph_date.tar
   ```

4. You should then have a new folder "sicograph" which contains the program sicograph.F90 and all required auxiliary files.

5.2 Customization

1. In the program sicograph.F90, search for "Compiler", and define the corresponding variable as either INTEL, NAG, GFORTRAN or G95, depending on which Fortran compiler you use.

2. In the script sicograph.job, search for "greve", and replace the path name for RUN_DIR with your own one.

   Also, search for "Compiler", and replace the variables F90 and F90FLAGS according to the syntax of your own Fortran compiler (F90FLAGS should do).

3. In the scripts plan_view.gmt, plan_view_lonlat.gmt, time_series.gmt and scatter.gmt (subdirectory gmt_scripts/), search for "greve", and replace the path name for GMT_SCRIPT_PATH with your own one.

5.3 Producing plots

In order to plot the output of simulation grl40_test_wre1000, use the script sicograph.job interactively:

```
./sicograph.job grl40_test_wre1000
```

(tcsh required; accordingly for the other simulations). You'll then get a menu which allows you to choose the type of plot you wish to produce. For example, try the option

(1) Ice-surface topography

and enter

Number of time-slice file (with leading zeros) > `02`

Plot (1) with or (2) without colour bar? > `1`

Plot (1) with or (2) without contour labels? > `1`

You will find the plot in the subdirectory gmt_scripts/plots/ as file grl40_test_wre100002_zs.eps (in EPS format). As a second example, try

(41) Time series

and in the following sub-menu choose

(5) Total ice volume

This produces the file grl40_test_wre1000_V_tot.eps in the subdirectory gmt_scripts/plots/.

5.4 Manipulating plot appearance

For all types of plots, the files in the subdirectory parameter_files/ control the limits and labels of the x- and y-axes. In addition, for the plan-view plots, the files in the subdirectory gmt_scripts/cpt/ control the colour scales (*.cpt) and contour levels (*.zzz). If a file is missing, the corresponding parameters are computed automatically.

References

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