MAIC-2
– Quick Start Manual –

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1 Requirements

- UNIX/LINUX system.
- Fortran 90/95 compiler.

2 Installation

1. Download the zip archive maic2_v2.zip from Zenodo (https://doi.org/10.5281/zenodo.3700623).
2. Unzip the archive: `unzip maic2_v2.zip`
   $\longrightarrow$ folder "maic2" that contains the entire program package.

3 Files and directories in "maic2"

- **runs**:

  Shell script (bash) maic2.job for running a single simulation under UNIX/LINUX.

  Shell script (bash) multi_maic2.job for running multiple simulations by repeated calls of maic2.job.

  Subdirectory **headers**: specification files maic2_specs_*run_name*.h
  (*run_name*: name of run).

Name of Run	Description
run_c01a	Simulation #2 by Greve et al. (2010), only over 1 Martian year with more detailed output
run_c01	Simulation #2 by Greve et al. (2010)
run_c02	Simulation #1 by Greve et al. (2010)
run_c03	Simulation #3 by Greve et al. (2010)
run_c04	Simulation #4 by Greve et al. (2010)
run_t06	Simulation #6 by Greve et al. (2010)
run_t07	Simulation #7 by Greve et al. (2010)
run_t08	Simulation #8 by Greve et al. (2010)
run_t12	Simulation #5 by Greve et al. (2010)
run_t14	Simulation #6 by Greve et al. (2010), but from 20 Ma ago until 10 Ma into the future
run_t39	Simulation by Greve et al. (2012) (pp. 14-15)
run_t40	Simulation by Greve et al. (2012) (pp. 14-15)

- **src**:

  Main program file maic2.F90.

  Subdirectory **subroutines**: subroutines for MAIC-2.

- **maic2_in**:

  Input data files (orbital forcing) for MAIC-2.

- **docu/doxygen**:

  Directory that contains the documentation created by Doxygen.

  - html/index.html $\longrightarrow$ Source code browser.
  - latex/refman.pdf (must be built with make) $\longrightarrow$ Reference manual.

- **license**:

  Directory that contains a copy of the GNU General Public License (version 3).

4 How to run a simulation

1. In the script maic2.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 and OUTPATH with your own ones.

3. The rest is quite simple:

   - In order to run simulation run_t06, use the script maic2.job. The command is

     ```
     (./maic2.job run_t06) >out_job.dat 2>&1 &
     ```

     (from subdirectory runs/, bash required). Accordingly for the other simulations.
   - Alternatively, if you prefer to run all simulations consecutively, you may use the script multi_maic2.job:

     ```
     (./multi_maic2.job) >out_mjob.dat 2>&1 &
     ```

The computing times for the simulations, run with the Intel Fortran Compiler for Linux 11.1 (optimization option –fast) on an Intel Xeon X5570 (2.93 GHz) PC under openSUSE 11.0 (64 bit), are as follows:

Run	Time	Run	Time	Run	Time
run_c01a	0.1 sec	run_t06	7.0 hrs	run_t39	7.0 hrs
run_c01	7.0 hrs	run_t07	7.0 hrs	run_t40	14.0 hrs
run_c02	7.0 hrs	run_t08	7.0 hrs		
run_c03	7.0 hrs	run_t12	7.0 hrs		
run_c04	7.0 hrs	run_t14	21.0 hrs		

5 Output files

Output files of simulations are written to a directory specified by the user (OUTPATH in specification files, see above). Each simulation produces an output file **run_name.out** in ASCII format that contains the following data:

Column 1: Time t [a]
Column 2: Solar longitude L_s [deg]
Column 3: Latitude φ [deg]
Column 4: Surface temperature $T(\varphi, t)$ [K]
Column 5: Evaporation rate $E(\varphi, t)$ [$\mathrm{kg\,m^{-2}\,a^{-1}}$]
Column 6: Condensation rate $C(\varphi, t)$ [$\mathrm{kg\,m^{-2}\,a^{-1}}$]
Column 7: Water content $\omega(\varphi, t)$ [$\mathrm{kg\,m^{-2}}$]
Column 8: Net mass balance $a_\mathrm{net}(\varphi, t)$ [$\mathrm{mm\,a^{-1}}$ ice equivalent]
Column 9: Ice thickness $H(\varphi, t)$ [m]

References

Greve, R., B. Grieger and O. J. Stenzel. 2010. MAIC-2, a latitudinal model for the Martian surface temperature, atmospheric water transport and surface glaciation. *Planet. Space Sci.*, **58** (6), 931–940. doi:10.1016/j.pss.2010.03.002.

Greve, R., B. Grieger and O. J. Stenzel. 2012. Glaciation of Mars from 10 million years ago until 10 million years into the future simulated with the model MAIC-2. Presentation No. PPS03-06, JpGU Meeting, Makuhari, Chiba, Japan, 24 May 2012. doi:10.5281/zenodo.3698542.