# MCS Visualizer Manual (v1.1.x)

## Purpose of the application and requirements

MCS Visualizer (MCSV) is a tool for visualization of Magma Chamber Simulator (MCS) output data. Output data are read from the RunSummary-worksheet of an MCS output file (an MS Excel .XLSX file generated by the MCS software). MCSV is easy-to-use, intuitive and fast method to inspect and share MCS model runs. MCSV is *FREE* to use and redistribute in binary form. See ‘Information’ tab in the program for additional license & legal information.

**Requirements:**

(Windows) 64-bit Windows 7/8/10 with an OpenGL 3.3 compliant GPU (integrated or dedicated). MCSV uses (and requires) the font ‘Arial’, which should be found in X:\Windows\Fonts\Arial.ttf

(Mac) Tested on macOS 10.12.5 and newer. Requires OpenGL 3.3 compliant GPU (e.g. all Macbooks). MCSV searches the following paths for fonts (Arial is recommended):

/Library/Fonts/Microsoft/Arial.ttf

/System/Library/Fonts/Supplemental/Arial.ttf (macOS 10.15)

/Library/Fonts/Arial.ttf

~/Library/Fonts/Arial.ttf

/System/Library/Fonts/SFNSDisplay.ttf (macOS 10.12-14)

/System/Library/Fonts/SFCompactDisplay.ttf (macOS 10.15)

## Running instructions

IMPORTANT! Only run a copy of this software obtained from a distributor you trust, such as the MCS website or another MCS user!

(Windows) Place your MCS output file(s) in the folder where the MCSV executable is located and run ‘MCSV (Win64).exe’.

(Mac) Run the software (MCSV or MCSV.app) and follow instructions on screen. If you attempt to run the .app-version of the software and encounter an error, see troubleshooting section below for instructions on how to open an app from an unidentified developer.

***If problems are encountered: Check Troubleshooting-section on page 4.***

## Using the software

The program comprises 5 main tabs: ‘Load’, ‘MCS Model’, ‘Simple’, ‘Plot data’, and ‘Information’.

**Typical usage steps are simple:**

1. Go to ‘Load’ tab and load your MCS output .XLSX file.
2. Go to ‘MCS Model’ or ‘Simple’ tab and use the ‘Step’ slider to go through your model; data are shown on the right side of the screen. ‘Plot data’ tab can be used to show magma chamber melt composition/cumulate composition as a line plot.
3. (If you want to save the model to images: *i*. Resize the screen to fit all information you need and use ‘Setup/Save’ button to select labels and axes and to save model to images, or use ‘Setup/Save’ button to set animation timestep and ‘Run’ button to run animation, during which screen can be captured with some third-party tool.)
4. Go to ‘Load’ tab and load another file or press Esc to close the program.

### Detailed instructions

‘**Options**’ is used to load files and set some options

* Place your MCS output files to the folder indicated on the top of the application window. To refresh the file menu, press ‘**Update Folder**’. Select output file from the file menu and press ‘**Load selected**’to load your output. Data is read only from the RunSummary-worksheet of your output file. Negative values of cumulate phases (i.e. ‘seed crystals’) are corrected away in the software.
* ‘**Show labels and axes on visualization**’ can be used to disable all labels and axes that appear on top of the model visualization in ‘MCS Model’ and ‘Simple’ tabs.
* ‘**Background color**’ can be used to change the color of the background. Useful if some phases in your model are difficult to distinguish from the blue background. Press the blue square to open a color selector popup.
* Window dimensions shows current window resolution, and ‘**Return default**’-button can be used to reset the resolution back to default (1366x768).

‘**MCS model**’ and ‘**Simple**’ contain the visualization of the MCS model state and differ only by amount of information shown on the right side of the application window.

‘**MCS model**’ and ‘**Simple**’ controls and visualization on the left side of the application screen:

* ‘**Step**’ slider can be used to go through the steps in the MCS model.
* ‘**Run**’ runs the animation, ‘**Stop**’ stops the animation, and ‘**Reset**’ returns to first model step. Third-party screen capture tools can be used to capture video of the screen as the animation is running (tested with OBS Studio).
* ‘**Block**’ and ‘**Pixel**’ are selected to show different styles of cumulation, as pixels or vertical columns. In ‘Block’-mode, the height of the cumulate column is equal to its mass, and the width of a cumulate block is equal to its wt% for each step. ‘**Grid**’ can be used to show the mass of an individual pixel in ‘Pixel’ mode.
* ‘**Show initial wallrock outline**’ shows/hides the outline (mass) of the original wallrock in models containing assimilation steps.
* ‘**Setup/Save**’ opens a popup window that allows user to:
  + 1. Select animation timestep (i.e. amount of time a step is shown when animation is running)
  + 2. Select which Labels and Axes you want to show on the visualization. Note that if you disabled all axes and labels in the ‘Load’ tab, these settings do nothing.
  + 3. Save the model as series of PNG images. During saving the screen will be blank and the program will not respond for several seconds (depending on the number of steps to save and your CPU). **Do not press anything until the program responds again**. The images will be saved in the folder where the MCSV executable is located (Windows) or /Documents/MCS Visualizer/ (macOS). These images are screenshots of the application window (and have the resolution of the window) and can, for example, be loaded in MS PowerPoint presentations (In PowerPoint: Insert->Photo Album).

(Windows) !NOTICE! The PNG images contain transparency and don’t look good in Windows 10 Photo Preview! Don’t be alarmed! They look good in all other applications!

‘**MCS Model**’ data display

Data in the center: ‘Magma chamber state’ shows information about the magma chamber at the current step, including temperature, mass of the system, mass of each phase during the current step and in cumulative total.

Tabs on the right show in formation about assimilation and recharge:

* ‘**AFC/RFC**’ shows current state of the wallrock (if it exists) and information about the last recharge step (if it exists).
* ‘**Last AFC**’ is only shown if assimilation occurs during the model run; it displays the state of the wallrock during the last assimilation step
* ‘**Last RFC**’ is only shown if recharge occurs during the model run; it displays the last recharge step, including recharge melt composition and mass.
* ‘**WR at FmZero**’ shows the information of wallrock approximately at the point assimilation starts. Only shown if wallrock exists, and if wallrock data are printed in the the RunSummary worksheet

‘**Simple**’ data display shows only the temperatures and amounts of all phases in the wallrock and magma chamber subsystems.

‘**Plot data**’ shows line plots of cumulative cumulate and melt composition in the magma chamber. Double-click on the chart to fit data (required after loading new model). Pan and zoom using the mouse.

‘**Information**’ tab includes short instructions, the Freeware license of MCSV and information about the C/C++ libraries used and their licenses.

## Troubleshooting

**If the visualization is not visible or data does not seem to be correctly loaded**:

* The Log on ‘Load’ tab should give a warning if your data was not correctly loaded. If the log says that your data was correctly loaded, but the visual or data does not seem right, your MCS output file may be malformed in an unexpected way. This may happen if MCS crashes during modeling.

**If your MCS output file does not load**:

* Some special characters (e.g. umlauts) in filenames are not read correctly. Rename your output file, press ‘Update folder’ and try again.
* Did MCS crash during modeling? Output XLSX-file may be malformed in two ways: If the RunSummary-worksheet ends in two AFC rows (WallrockEquilibrate and WallrockChangeBulk), remove these two lines. If RunSummary ends in one RFC row, remove that row.

**If the MCS Visualizer does not start**:

* Check that your antivirus software does not block the software from running.
* Check if you need administrator privileges to run executables.
* Check that the necessary fonts are installed in your system (see Running instructions).
* (Windows) Check your Windows computer meets the requirements (64-bit Windows/OpenGL 3.3 -capable GPU and drivers).
* (Mac) Are you running the ‘MCSV.app’ file (or other Mac .app file) and getting and error message (saying file is corrupt and should be moved to trash)? See the following link (**but only open an app obtained from a trusted source**) <https://support.apple.com/guide/mac-help/open-a-mac-app-from-an-unidentified-developer-mh40616/mac>

## Contact

Did you encounter a bug or have other comments or requests? Send an e-mail to the author at einari.suikkanen[at]gmail.com or ask the MCS team for up-to-date contact information.

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# Example files

AFC: Assimilation only

FC: Fractional crystallization only

R2AFC: Two hot recharges, and assimilation

S2FC: Two COLD recharges, no assimilation

R2FC Two hot recharges, no assimilation