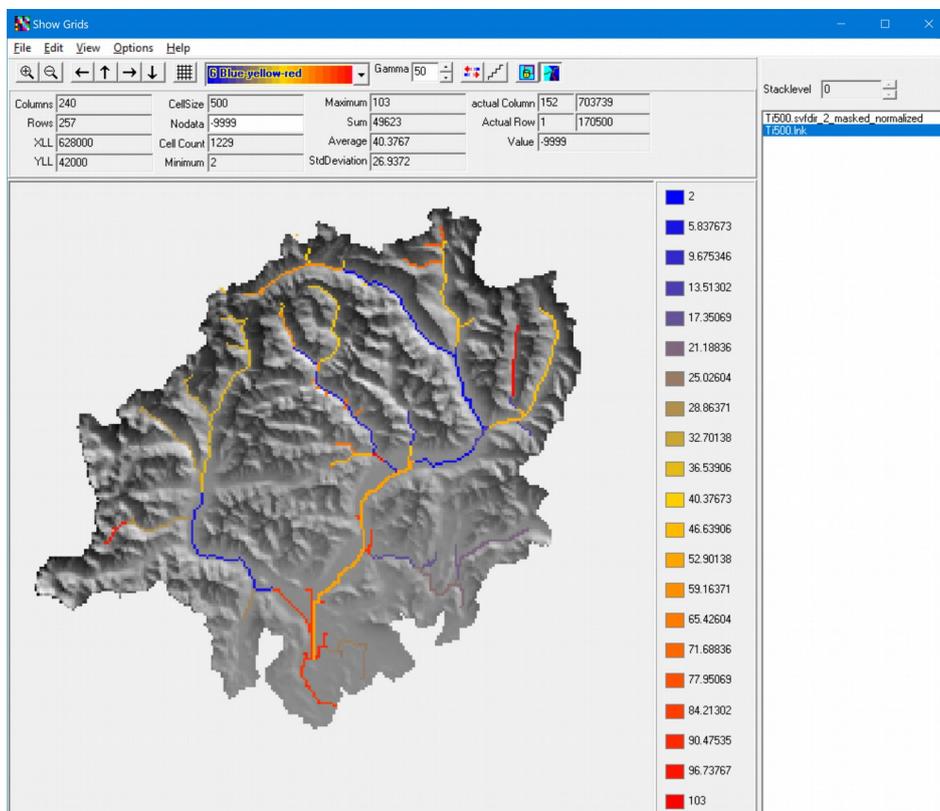


ShowGrid Documentation Version 1.4

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1 Introduction

ShowGrid, short: SG, is a help tool for the hydrologic model WaSiM-ETH. It can be used to display grids and stacks with multiple layers, like those from the soil model or layered snow model.

The main features are:

- processable grids can be in WaSiM binary format (single or double precision) or in ASCII format (ESRI-ASCII)
- the maximum number and size of grids is limited by the 32-bit addressable memory range only, which is around 1.5 GB under Windows
- any number of grids can be loaded into the selection list, either by adding the grids to the command line as parameters or by using the Load command from the file menu. Since SG doesn't keep grids in memory when navigating to another grid, the number of grids in this selection list can be quite large (no caching is used as well)
- zooming in and out is possible
- stacks can be displayed per layer only, scrolling through the layers is possible with the stack-level control above the file name list
- grid lines can be shown optionally
- 6 standard color palettes are provided (smooth color gradients between 3 base colors) with 21 legend positions each
- user defined color palettes can be defined and stored with up to 21 colors (SG interpolates between these colors depending on the actual value)
- Display of colors can be continuous or discontinuous (color steps, e.g. for elevation belts),
- all color palettes can be inverted
- the gamma distribution of default color palettes can be changed continuously over a wide range (not available for custom palettes)
- All statistic data as well as the actual cell below the mouse pointer are displayed in the data panel on the upper part of the application window
- when loading a grid, statistics is always re-calculated (since ASCII grids so not contain statistics yet; for stacks, statistics are computed for each layer when this layer is displayed)
- single stack layers can be saved as separate grid
- the actual displayed grid can be copied to the clipboard and can be processed with other applications like any other bitmap graphic
- cells can be selected with the mouse or by defining a value range and let SG select all cells within that range
- The values of all selected cells can be changed to the same new value by a simple dialog
- the mouse can be used to select any number of cells, connected or unconnected
- all selected cells can be copied to the clipboard (in ASCII format) and pasted to other locations in the same grid or even to other grids using several different merge options (replace, add, multipl, subtract, divide, simply copy the selection markers)
- A profile along the marked cells can be displayed as line chart and can be copied to the clipboard (using Ctrl+Shift+C)

- The value range of the actual palette can be either automatically be calculated or set manually, when using automatic mode, the optimal range and distribution is calculated by SG
- gradient arrows can optionally be added to the displayed grid (using F2)
- if grids for x- and y-components of a vector field are available, the arrows can be constructed from these grids (like for groundwater flow fields, using groundwater fluxes in x and y directions)
- if the selected clipping should be used for multiple grids, the clipping extend can be fixed
- with a few restrictions, grid can be overlayed on each other (no zoom, no new clipping possible). This can be used e.g. for drawing the river network on the elevation model (see title page)
- showgrid must be activated by a license file, without license no grids can be loaded, but the module can be started to generate an ID-file for a license request
- Demo licenses are available on request. A standard license can be issued user and/or hardware dependent (the ID file contains necessary informations)

2 GUI-Elements

Figure 1 shows the general layout of the application, here with an additional window that shows the values along a line drawn free naded with the mouse (green cells in the main window). The panel on the right side of the main window contains the list of all „loaded“ grids (they are not physically loaded, only the names are loaded in this list). Each time, an entry of this list is marked with the mouse or keyboard, the respective grid is read from disk and displayed with the actual palette settings (either with fix value range or automatically adjusted). The left part of the main window displays the grid. By using either the buttons in the button bar or short cuts or menu commands, the view can be zoomed and scrolled and the color palette can be changed.

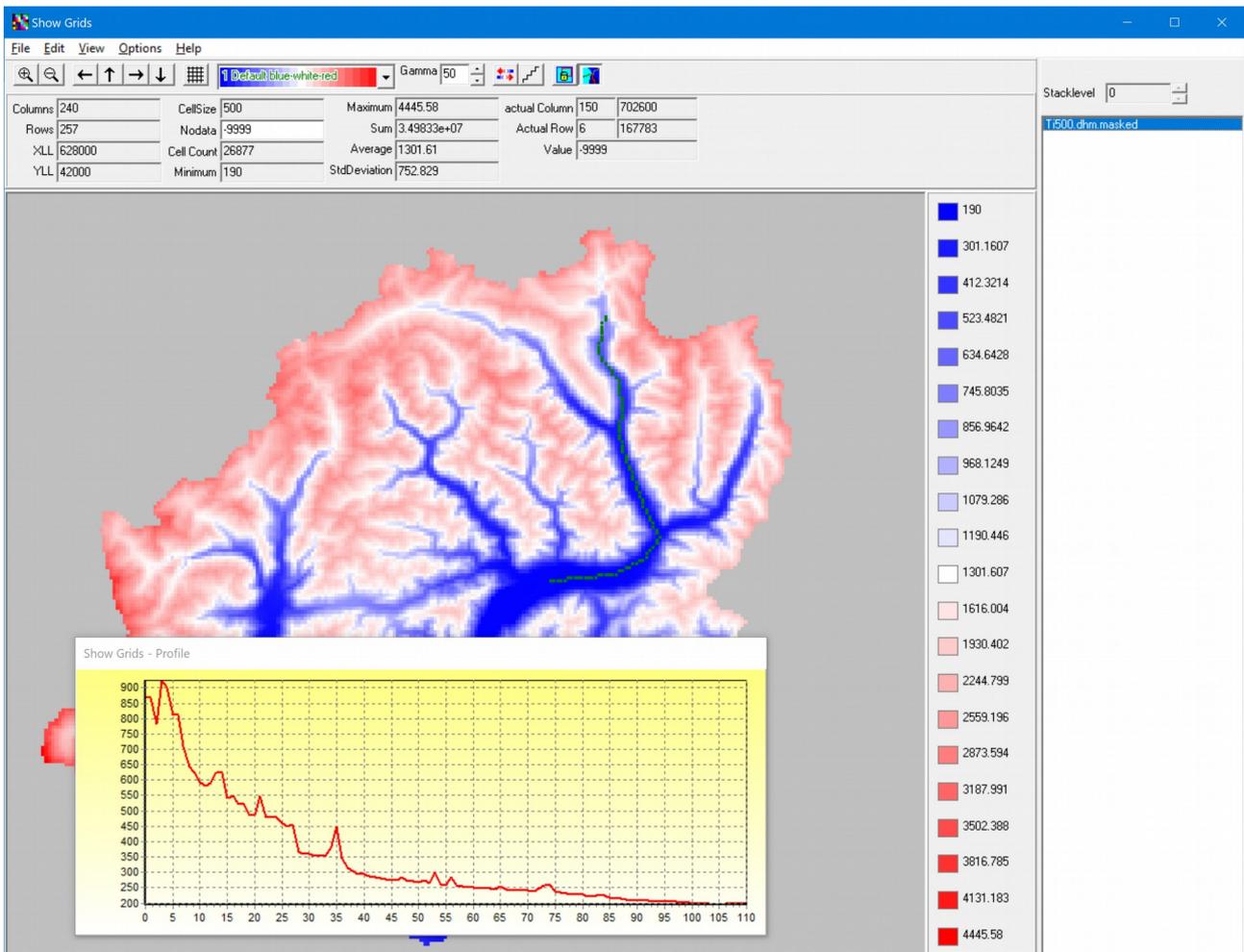


figure 1: Main window with additional profile chart, here the elevations along the green line

The profile chart window can be switched on and off with Ctrl+F oder by using the respective menu commands.

Above the displayed grid, the grids metadata and statistics are shown. These values are calculated each time a grid is changed or when a new stack level is choosen. Statistics will be saved together with the grid when using the save grid command.

The value from the cell below the mouse pointer is displayed in the cells on the right side of the

statistics panel. The position is displayed in rows/columns as well as in geographic coordinates (with respect to the xll and yll and cell size data from the grid header). The value of the cell below the mouse pointer is also displayed. Rows are counted from top to bottom, columns from left to right.

Marked cells can be edited together by pressing F5 and changing the value in a simple dialog. When the active grid is changed and there are some cells still selected, a dialog appears that will allow to save the changed values before changing the grid effectively.

3 Menu Structure

3.1 The main Menu

3.1.1 File

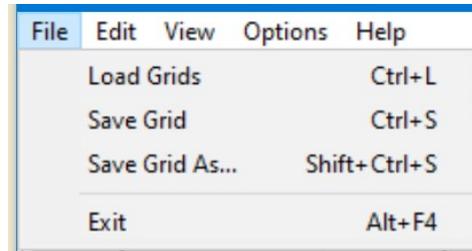


figure 2: Main Menu → File (Alt+F)

- Load Grids, Ctrl+L:

Loading grids with the standard Windows file dialog

Note: you can load grids also by adding the grids as parameters to the command line (e.g. when using a tool like TotalCommander)

However, this doesn't work with a demo license

- Save Grid, Ctrl+S:
- Save Grid as, Ctrl+Shift+S:
- Exit, Alt+F4:

The active grid can be saved with the actual name

The active grid can be saved with a new name. Layers of stacks can be saved using this option.

closes the application

„Save Grid“ and „Save Grid As“ write the grids in the original format. ASCII grids will be saved in ASCII format, binary grids in binary format (single or double precision, depending on the input).

3.1.2 Edit

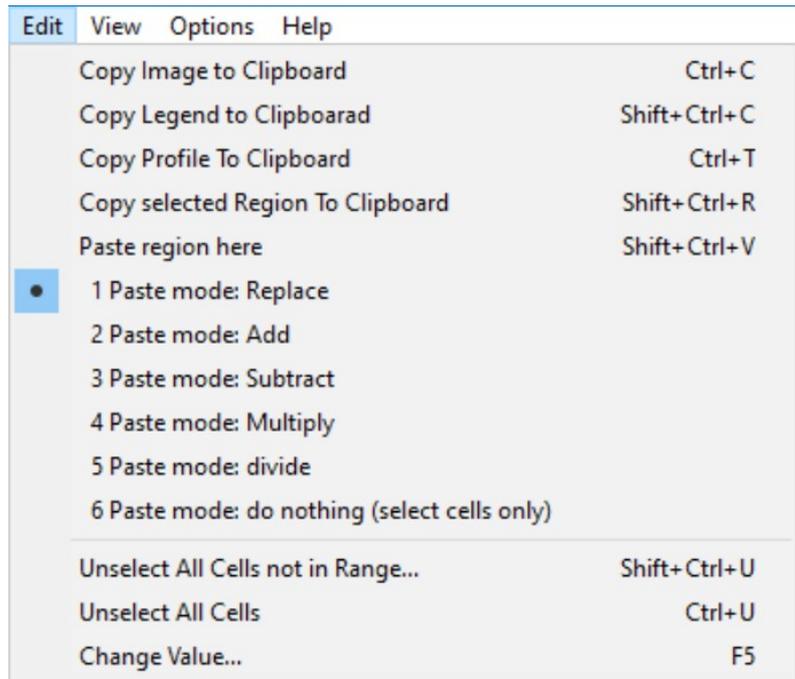
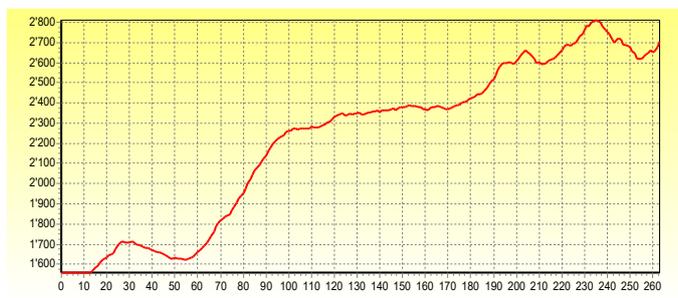


Figure 3: Menu → Edit (Alt+E)

- Copy Image to Clipboard, Ctrl+C: copying of the entire image to the system clipboard. The image can be used in any other application by pasting it into documents, presentations etc.
- Copy Legend to Clipboard, Ctrl+shift+C copies the legend to the clipboard. Since image and legend may require different scaling, they can be copied separately
- Copy Profile to Clipboard, Ctrl+T: copies the actual profile (activated with Ctrl+F) to the clipboard. This sample image was copied using this command for writing this documentation

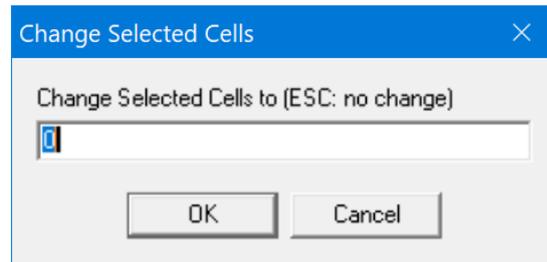


- Copy selected region to clipboard, Shift+Ctrl+R: If a region of cells was selected either manually or automatically by defining a range and unselecting all cells not in range (see below), the selection can be copied to the clipboard. The format is in ASCII, so it is even possible to manipulate the values in a text editor and paste the selection back to the same grid or to another grid – or to another position in the same or

- any other grid.
 - pastes the selected region according to the selected option of the list below.
 - Note: if no cell is selected, the paste locations are the same cells where the selection was copied from. If one or more cells are selected, the first cell (coming from the top and left row by row down the grid) is taken to paste the selection into the actual grid
- Paste Region here, Shift+Ctrl+V
 - Paste mode: Replace, 1 the section replaces the actual cells
 - Paste mode: Add, 2 the values from the selection from the clipboard will be added to the values of the cells of the active grid
 - Paste mode: Subtract, 3 the values from the selection from the clipboard will be subtracted from the values of the cells of the active grid
 - Paste mode: Multiply, 4 the values from the selection from the clipboard will be multiplied with the values of the cells of the active grid
 - Paste mode: Divide, 5 the values from the cells of the active grid will be divided by the values of the selection from the clipboard
 - Paste mode: do nothing, 6 only the selection is copied to the active grid. This can be used to define a region in a grid depending on properties of another grid, like marking the location of lakes in the DEM by copying the selection from a grid containing lakes only
- Unselect all cells not in range, Shift+Ctrl+U When a selection was made with the mouse by selecting a rectangle (using Shift+mouse button), this function will de-select all cells that do not fall within the pre-defined value range. To use this function, three steps are required:
 1. Select a rectangle using the mouse to select on edge of the rectangle and then Shift+mouse button to select the opposite edge – all cells in the defined rectangle will be selected
 2. define a value range by using the Ctrl+R-command (or Menu→Options→Set Range...)
 3. using this command to unselect all cells outside the defined range.
- Unselect all Cells, Shift+U: unselects all selected cells (can also be achieved by selecting a single unselected cell and clicking on the same cell again with the control key pressed down)

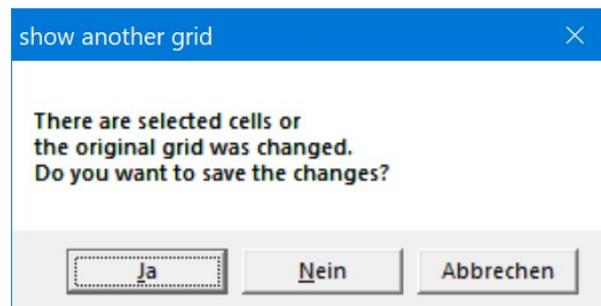
- Change Value, F5:

The values of all selected cells can be changed simultaneously with this dialog. After pressing F5, an input dialog appears and the new value can be keyed in there.



Pressing OK changes the values of all selected cells simultaneously.

Escape or cancel cancels this operation.



If a new grid is selected while there are still some cells selected, a warning dialog opens up. Yes/Ja means that the active grid should be saved before switching to the next grid, No/Nein means that the changes made to any cells will be discarded and the grid is not saved before switching to the next grid, cancel/Abbrechen means that the active grid is not switched at all.

3.1.3 View

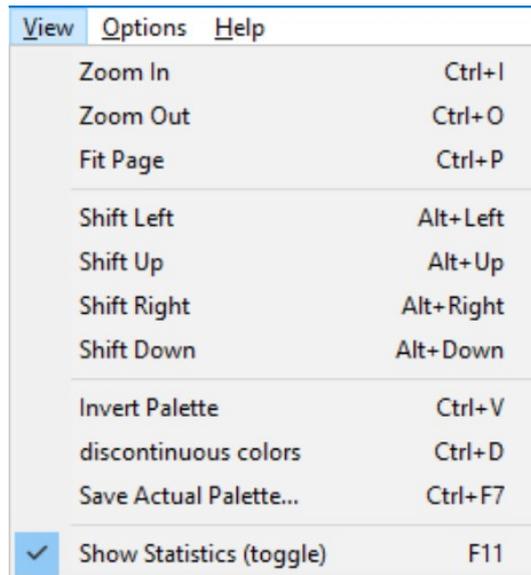


Figure 4: Menu → View (Alt+V)

- Zoom In, Ctrl+I: Zoom in; Button  has the same Effekt.
- Zoom Out, Ctrl+O: Zoom out, as long as the grid is not already completely shown. Button  has the same effect.
- Fit Page, Ctrl+P: Fit to page, default when starting ShowGrid.
- Shift Left, Alt+← (Left arrow): Scrolls the visible clipping window to the left (if zoomed). Button  has the same effect
- Shift Up, Alt+↑ (up-Arrow): scrolls the visible clipping window up (if zoomed). Button  has the same effect
- Shift Right, Alt+→ (right arrow): Scrolls the visible clipping window to the right (if zoomed). Button  has the same effect
- Shift Down, Alt+↓ (down arrow): scrolls the visible clipping window down (if zoomed). Button  has the same effect
- Invert Palette, Ctrl+V: Inverts the color palette. All settings like Gamma and continuous/steps are kept. Button  has the same effect. Example:
original:

after inverting:

- discontinuous colors, Ctrl+D: Button  has the same effect. Pixel colors are per default interpolated between the 21 legend

values. Thus, continuous color gradients can be displayed. However, sometimes a discontinuous display is more appropriate, e.g. for showing elevation belts or ranges of snow water equivalent etc.

Example: Figure 5 shows the digital elevation model of an alpine catchment. On the left, where the colors are interpolated, some more details like small side valleys can be seen, whilst on the right the elevation ranges are much better recognizable.

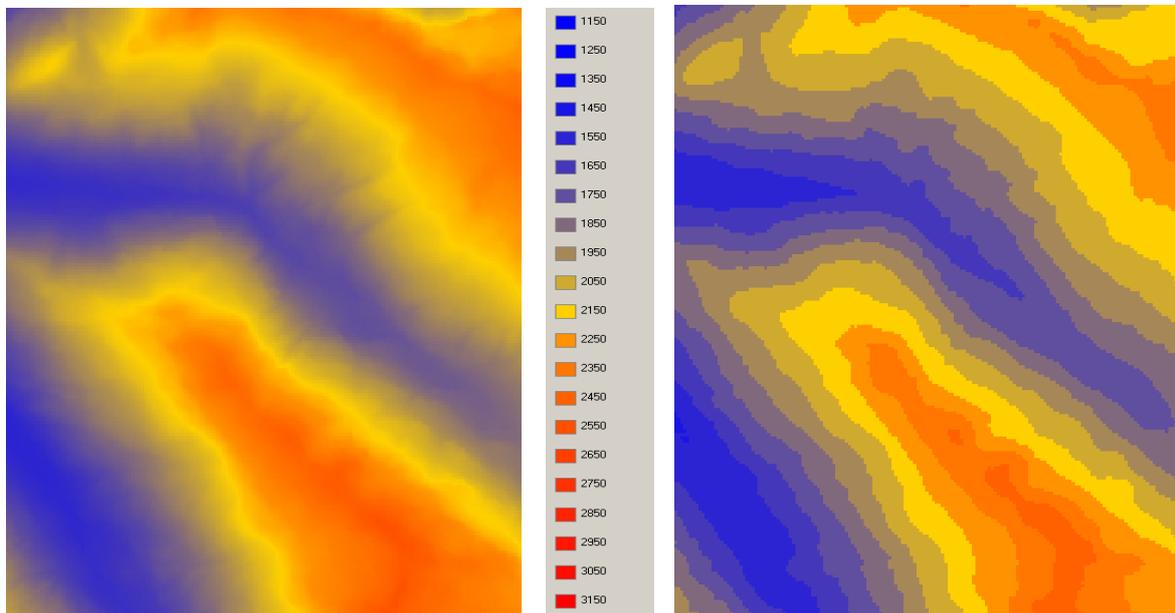


Figure 5: Comparison between continuous and discontinuous color representations

- Save Actual Palette, Ctrl+F7:

Saves the actual palette as *.spg file (Show Grid Palette). This file should be placed under the users document folder, so it can be loaded again when restarting SG.exe. Custom palettes can be defined by clicking on the color bars in the legend and choose a color in the Windows color dialog. It is possible to define specific color by even type in RGB-Values. The numeric value of the legend position can also be changed by double-clicking on the numeric label in the legend. The actual grid will immediately be updated after closing the dialog. The format of the palette file is described in chapter 6

3.1.1 Options

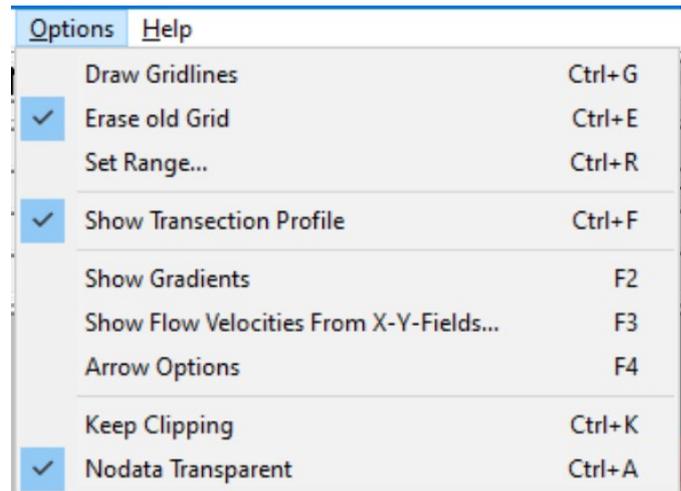


Figure 6: Menu → Options (Alt+O)

- Draw Gridlines, Ctrl+G:
- Erase old Grid, Ctrl+E:
- Set Range, Ctrl+R:

optional display of grid lines. Also available by button  (Switch).

Erasing the old grid from the display before drawing the new grid. If multiple grids with the same geometry are drawn, it can be much faster to draw grids without erasing the old grid. There is no speed button for this functionality.

Allows definition of a minimum and maximum value for the corresponding color palette. Multiple grids can such be displayed using the same color palette for better comparability. Automatic scaling can be achieved again by choosing identical values for minimum and maximum, usually 0 for both values.

By choosing appropriate values, the numbers in the legend can be made to match integer values (e.g. minimum=1, maximum=21 → Values in legend will range from 1 to 21 in integer steps).

- Show Transection Profile, Ctrl+F:

If cells are selected with the mouse, Ctrl+F opens the profile chart. The profile is drawn along the selected cells, using the order of selection. Straight lines can be selected by first clicking on the first cell of the cross section and then clicking on the endpoint cell with Ctrl+Shift pressed down. If inly the Shift key is pressed, then a rectangle between first and second cell is selected and drawn as profile row by row

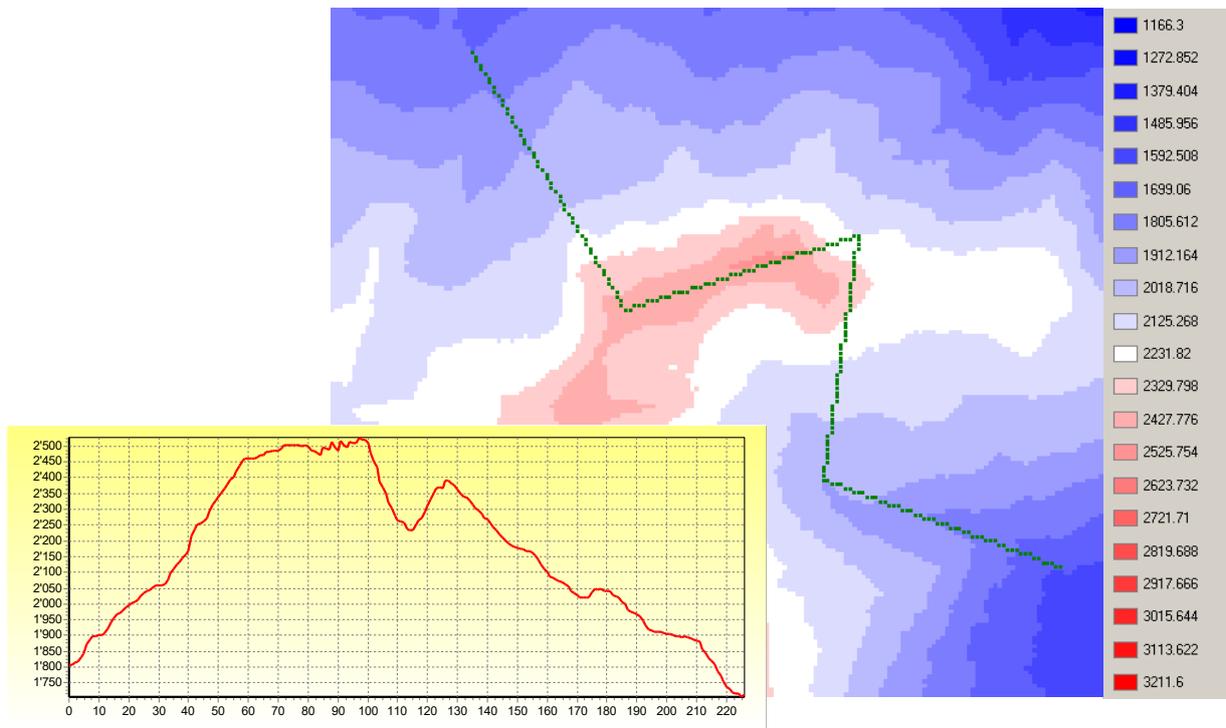
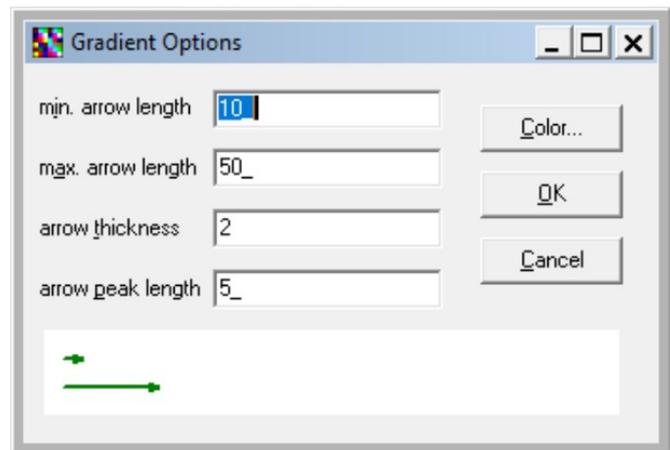


figure 7: elevation cross section along the selected lines

- Show Gradients, F2:

Displays arrows (in the direction of the steepest gradient) for each cell. The length of the arrows and the color changes with the gradient value



Pressing F4 opens a dialog to define gradient options.

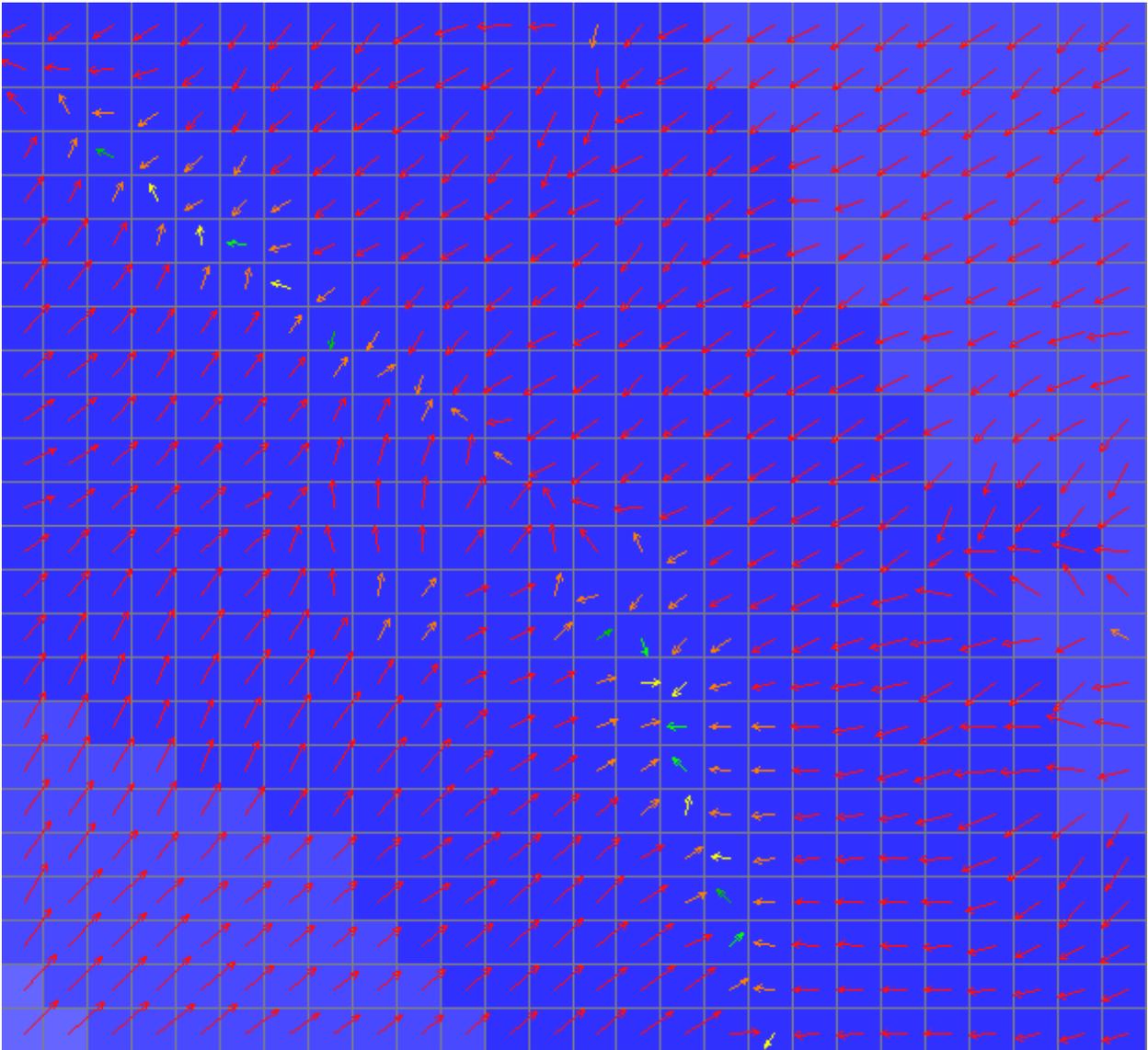


Figure 8: Example with overlaid gradient arrows over a grid (here: a digital elevation model)

- Show Flow Velocities From X-Y-Fields, F3: For e.g. groundwater fluxes, x- and y-components are provided by WaSiM separately as grids. Combined, both grids can be used to construct a vector field which can be represented by arrows plotted on top of another grid, e.g. the digital elevation model or the groundwater pressure heads. When choosing this function from the menu, two grids must be selected from the file system: first the grid containing the x-component, second the y-component. Figure 9 shows a comparison of such a vector field (right) with the gradients (left). Although both figures look very similar, there are some differences, in particular the arrows color (which is an indicator for the flow velocity) and also in the direction of some arrows. Also, for gradient arrows, the starting points of the arrows are always in the center of a cell while arrows for flux fields always start at the cells

edges. This is because of cell values are always valid for the lower left corner of a cell (WaSiM-grids works with YLL-CORNER and XLL-CORNER-coordinates). When computing the gradient, the center of a cell is taken and the slope to all 8 neighbors evaluated.

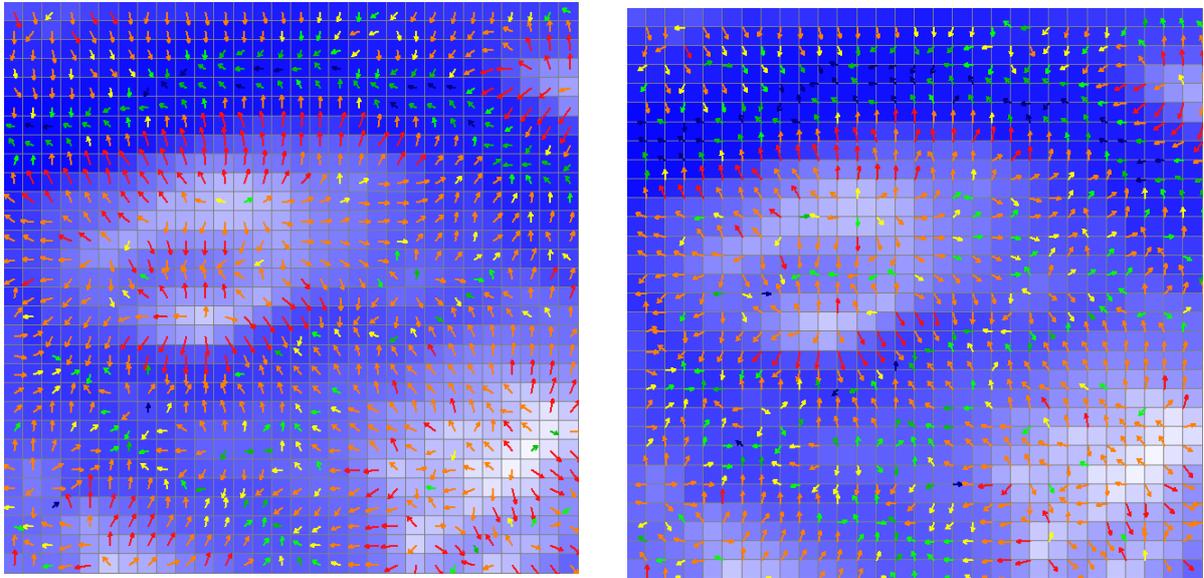
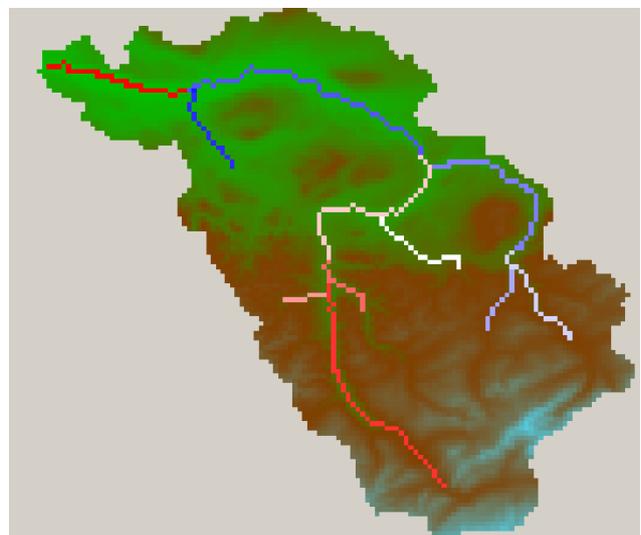


figure 9: comparison of gradients (left) and flow velocity vectors (right)

- Arrow Options, F4: same as for gradient options
- Keep Clipping, Ctrl+K
The visible rectangle of the actual zoomed in grid will be kept for other grids.
- Nodata Transparent, Ctrl+A
Allows overlaying of multiple grids. Nodata values are not painted with the background color but simple jumped over, so the underlying grid remains visible. After drawing the overlaying grid, another color palette can be chosen to improve contrasts for the overlaying grid.



Example for overlaying the river link grid over the DEM

Note: This function automatically switches off the

function/flag „Erase old Grid“. Since the background layer is not re-painted, it is not possible to zoom or shift the combined image. So the exact clipping must be defined on the underlying grid before painting any overlay.

3.1.2 Help

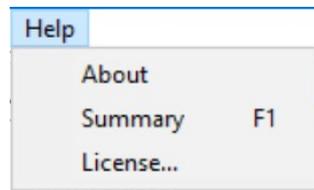


Figure 10: Menu → Help (Alt+H)

- About: Shows a message box with version and copyright information



Figure 11: About-Box

- Summary: If the PDF-file SG_Help.pdf is located in the installation directory of sg.exe and if a PDF viewer is registered on the computer (like Acrobat-Reader), then this file is opened. There is no other help implemented.
- License: When choosing this command, a dialog for managing licenses is opened. Here, licenses for Showgrid and Graphlines can be managed.

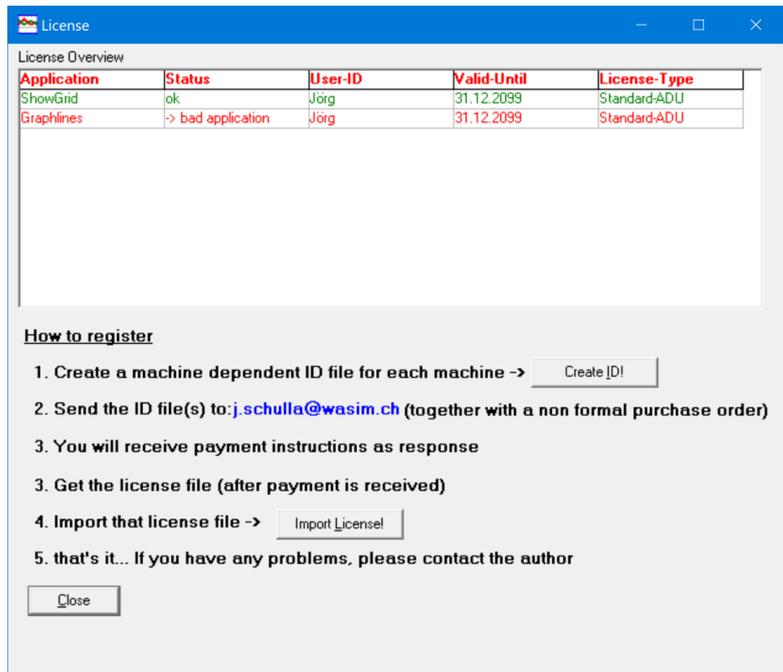


Figure 12: License window

This dialog contains a step-by-step checklist, how to order and install a license. The following steps are required:

- Create an ID file. Use the button . This command collects some hardware specific properties of the computer and saves the data as an ID file. Depending on the license agreement, the license can be issued for specific hardware, specific users and a specific time period or a combination thereof. Therefore it is important to create the ID file on the same computer where the tools should run and with the same user who will use the tools.
- Send the ID file(s) to the e-mail address given in step 2 and order the required licenses (please add billing information like your name, address, name of the organisation, zip-code, city etc.)
- The license will then be generated based on the ID file(s). You will receive the license via e-mail. The invoice will usually follow either by e-mail or on paper.
- The license file can then be imported by clicking on and choosing the provided lic-file. The license window will then show all licenses and their validity.

Note: When starting Showgrid for the first time, the command „Load Grid“ is not available. A valid license (either a demo license or a standard license) is required. After installing the license, the program must be restarted.

3.2. The Speed-Button Bar



Figure 13: Speed button bar

The button bar allows fast access to almost all of the functions described above like zooming, scrolling, showing grid lines, inverting palettes, switching between smooth color gradients and color steps, fix clipping rectangles and overlaying techniques. Two functions are provided by the button bar only (no menu equivalents):

- choose color palette

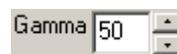
The following palettes are implemented by default:



- Default Blue-White-Red
- Altitude Green-Brown
- Evaporation (Green-Yellow-Red)
- Black-Gray-White
- Brown-White-Ice
- Blue-Yellow-Red

- In addition, some custom palettes are shown here
 more info on palette files: see chapter 4

- Gamma of the actual color palette



This up-down-chooser allows to change the contrast of the integrated color palettes in a wide range. This is achieved by interpolating no longer linearly between the lowest, the central and the highest pallet values but rather using non-linear weighing functions:



4 Creating custom palettes

New color palettes can be created from any existing palette and then saved under a new name to be available after every restart.

The value range is always dynamic, so a non-linear custom scaling of the palette values across the value range of the grid to be drawn must always be defined manually.

Individual colors could be defined for each palette entry by double-clicking on the palette color entry. A Windows standard color dialog opens and the required color can be chosen from either the pre-defined colors or by defining RGB or HSV values by clicking on the „define colors“ button.

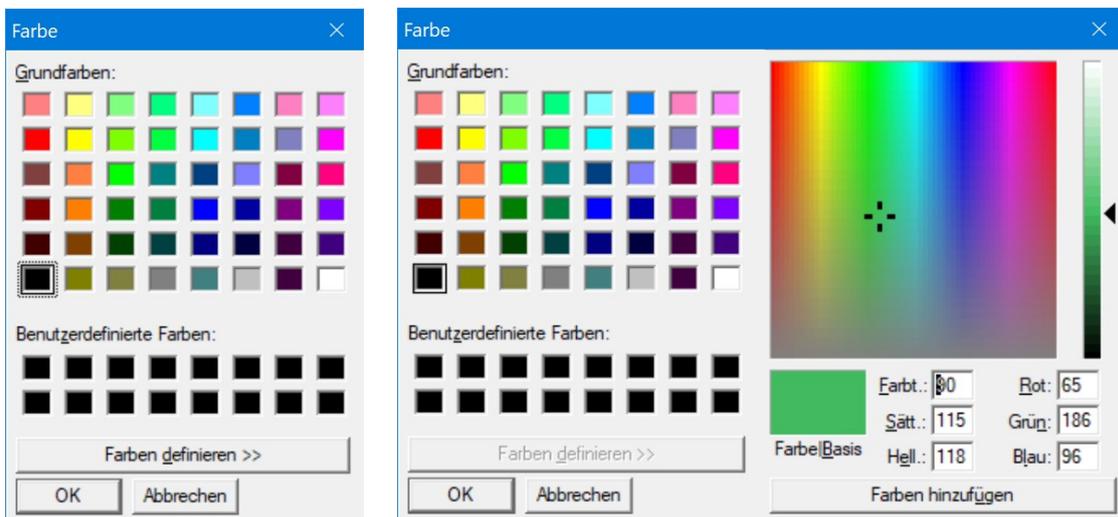


Figure 14: Color Dialog. Simple (left) and extended (right)

Figure 14 shows this color dialog in a simple and in an extended version. The values for red, green and blue that are visible in the extended mode will be stored in the palette file as hexadecimal values

An example for the palett „elevation steps“ (Höhenstufen) looks like this:

```
Höhenstufen 004000 008A00 00D200 0DC698 1D91E7 1476BE 0F588E  
666C66 757B75 919791 B6BAB6 C9C4A7 D6B887 E1A97B DA955C CC762F  
A45F26 C90160 FE2E91 FE76B7 FFB9DA
```

This palette creates the following picture of Switzerland:

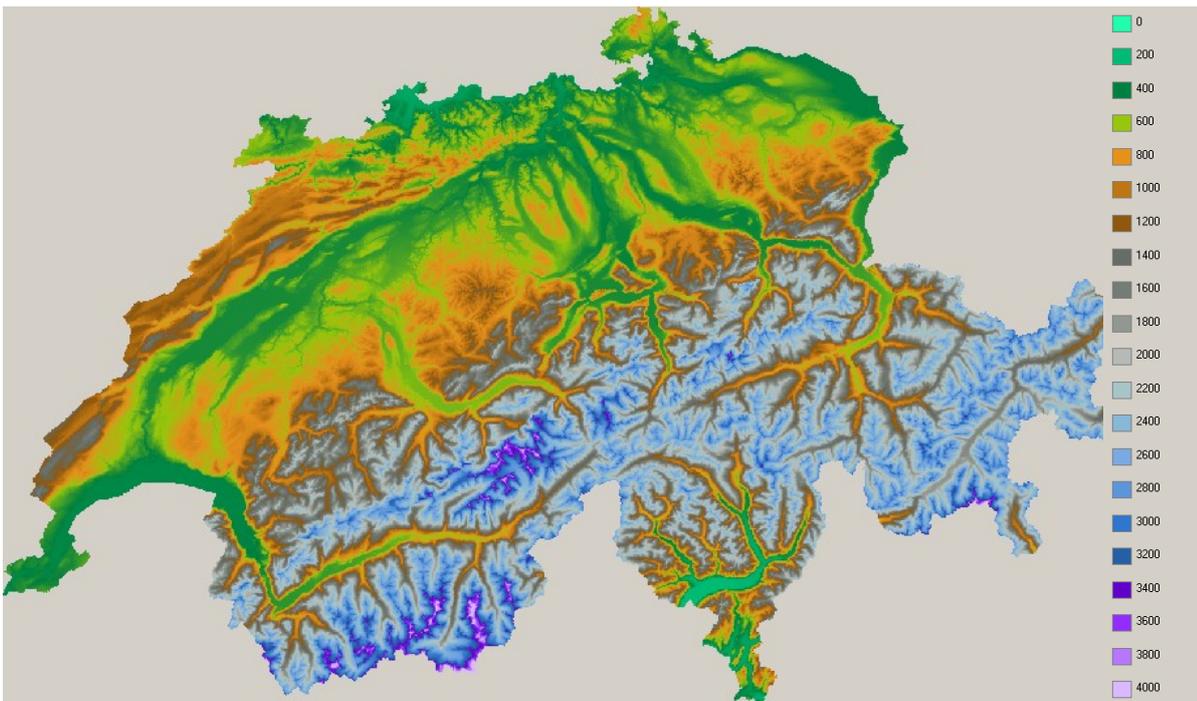


Figure 15: Sample picture created with the custom palette „Höhenstufen“ (elevation steps)

If the values of the grid should NOT be distributed evenly (by number) over all palette values, the numerical values that match each palette entry can be defined manually. By double-clicking on the numerical value next to the legend color boxes (not on the color box itself), an input box opens, see figure 16.

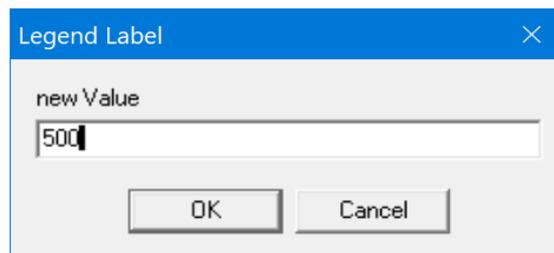


Figure 16: Defining specific values for the legend entry

Those specific values cannot be stored and will be lost after closing the program or after choosing a new grid or palette.

5 Technical information

5.1 DLLs and othe rbinaries

The following dlls (files with extension dll are „dynamic link libraries“, i.e. files that contain executable code, which can be used by several programs simultaneously and which are loaded at runtime) and othe rlibraries are used by SG.exe:

- borlndmm.dll
- cc3260mt.dll
- vcl60.bpl
- vcl60.bpl
- tee60.bpl
- rtl60.de

These files will be copied by the setup tool to the installation directory.

5.2 Operating system environment

SG was developed on Windows XP, Windows 7 and Windows 10 and should be able to run on Windows 10 now. If installed with an Admin account, the program should be accessible by all normal users. For installing the module and for installing the license file, Admin permissions are required. The license file will be written to the registry, on Windows 10 it will be copied to c:\ProgramData\WaSiM-Tools\licence.txt

If licenses are not correctly recognized by the module, it may help to delete the key HASH under Computer\HKEY_LOCAL_MACHINE\SOFTWARE\WOW6432Node\Wasim-Tools\License

5.3 Custom palette files

A custom palette file contains a name for the palette (without spaces) which is displayed as name in the color palette combobox. The name is followed by 21 6-digit hexadecimal values, each defining one color as a combination of blue (first two digits), green (center two digits) and red (last two digits). The minimal value is 00, maximum is FF. If all color channels are defined as FF, i.e. the code is FFFFFFFF, the resulting color is white (additive color mixing). Black corresponds to 000000 etc.

5.4 Notes for using the module with Windows 7 and Windows 10

Color palette files should be saved to the users document folder, e.g. c:\users\moritz\documents\mypalette.sgp.

5.5 Notes for using SG under Linux

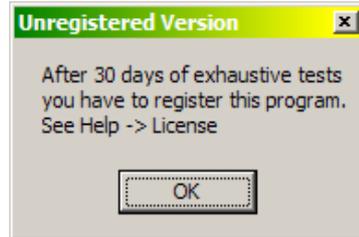
If a package like wine is installed, ShowGrid can also be used under Linux. Call the program like this:

```
wine sg.exe <grid> [<grid> [...]]
```

The required license may different from a windows license, even if running on the same computer. Please contact the author in such cases.

6 Licensing

SG is offered as shareware. The user may download and install the software and request a demo license that is valid for a test period of usually 30 days. After this testing period, a registration and licensing is required. The demo/Shareware-Version shows a splash-screen on startup, identifying the version as unlicensed gtest version:



In Demo mode, some functions are not available:

- no command line parameters can be passed to the program
- On start-up as well as after each five grids, the above shown message appears on the screen.

A fully licensed version is usually licensed per machine or per user. A machine specific license can be used by any user on that machine, while a user specific license can be used by that user on different machines, as long as only one copy is used at a time.

If multiple licenses are purchased, then no more users than the number of licensed copies may work at the same time with the module.

License types are:

- Demo license: A short term license with the above mentioned restrictions, usually for a 30-day testing period
- Standard license: License with a valid-until-date of 31st of December 2099. This type of license is always restricted to a specific hardware and/or to a specific user (login name). For specific scenarios, other options are possible (e.g. no hardware and user limitations but a runtime limitation for one year for pool licenses)
- Example: Standard-ADHU
 - A = Application (valid for showgrid or graphlines)
 - D = date (valid-until-date as dd.mm.jjjj or mm/dd/yyyy, depending on the language settings)
 - H = hardware dependend (a hardware specific key will be checked on startup)
 - U = user specific license

The features can be mixed in any combination. Usual license types are: Demo-AD oder Standard-AH oder Standard-AD.

To order a license, please send the ID file together with your order to j.schulla@wasim.ch

The prices are subject to change. Prices in Swiss Francs are listed in the following table (for other currencies than Swiss Francs these are guiding values only, the effective prices depend on the daily exchange rates and additional transfer fees):

<i>1st license</i>	<i>2nd -10th . License</i>	<i>11th license and more</i>
80 CHF	65 CHF per license	50 CHF per license