BasinVis 1.0 Guideline for users

This document will introduce you to the user interface of BasinVis 1.0. For detailed descriptions of the functionality of BasinVis 1.0, please check the key paper published in 'Computers & Geosciences'.

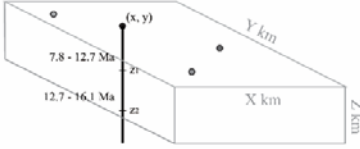*Eun Young Lee, Johannes Novotny, Michael Wagreich, 2016.*

BasinVis 1.0: A MATLAB-based program for sedimentary basin subsidence analysis and visualization. Computers & Geosciences 91, 119-127

http://dx.doi.org/10.1016/j.cageo.2016.03.013

http://www.sciencedirect.com/science/article/pii/S0098300416300899

BasinVis 1.0 is implemented entirely in MATLAB® version 8.4 (R2014b) and requires the 'Symbolic Math' and 'Curve Fitting' Toolboxes (Math, Statistics, and Optimization package). It can be operated under Microsoft Windows (XP or higher), Mac OS X (10.7.4+ or higher), and recent Linux distributions (e.g. Ubuntu 14.04).

To use BasinVis 1.0 completely, you need to have the following data available:

Parameter	Symbol	Description	Example
Study Area Location Depth Geologic Age	X, Y, Z x, y $z_1, z_2, ...$ Ma, ka, yr	a size of mapping and modeling area x, y coordinators top depth of each stratigraphic unit geologic age of each stratigraphic unit	
Initial Porosity Coefficient Densities	$Ø_0$ c ρ_s ρ_m ρ_w	initial porosity of porosity-depth relation (%) coefficient of porosity-depth relation (x 10^{-5}) average density of sediment grain (g/cm^3) average density of mantle (3.3 g/cm^3) average density of water (1.0 g/cm^3)	from Sclater and Christie (1980) $Ø_0$ c ρ_s Shale 63 0.51 2.72 Sand 49 0.27 2.65 Shaly Sand 56 0.39 2.68 Chalk 70 0.71 2.71
Water-depth Sea-level	W_d Δ_{SL}	paleowaterdepth paleosealevel	

Installation Instructions

- Download BasinVis at http://www.geologist-lee.com/basinvis.html
- Extract the ZIP file in a directory of your choice.
- Open Matlab and change the current folder to the BasinVis directory.
- Execute "mainwindow" in the Command Window.

User Instructions

## 1) Main window

The main window acts as central hub to all functions and process stages of BasinVis 1.0. Function buttons are arranged to follow the order of the work flow and are enabled as soon as all required data for the individual operations have been entered and saved. In a new project only the "Study Area" button is enabled.

2) Study Area

Accessed via the "Study Area" Button in Main Window.
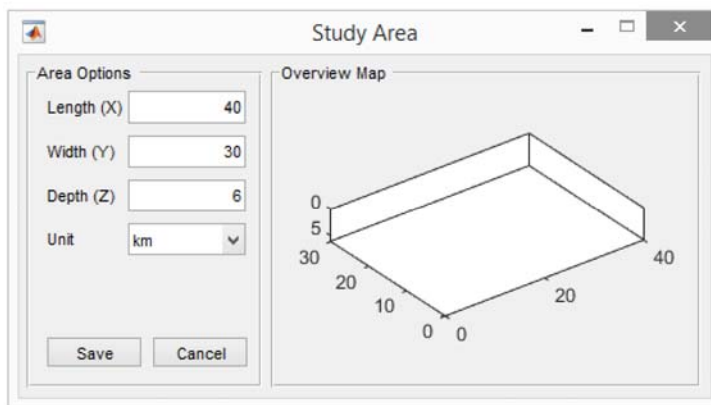
Enter the dimensions of the study area you want to visualize and press save.
The provided area will be the reference frame for your project throughout the rest of the application (e.g. x-y coordinate frame of your well locations, surface plots, etc.).

3) Stratigraphic Units

Accessed via the "Stratigraphic Units" Button in Main Window after the study area has been saved.
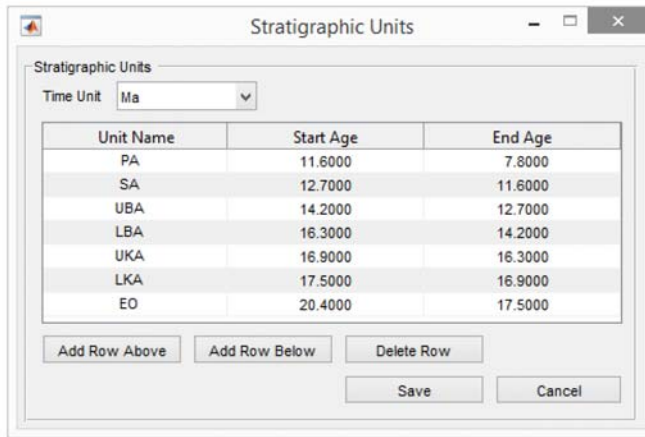

Enter the Unit Names with Start- and End Ages for all stratigraphic units you want to use in your project. Add them by age in ascending order with the youngest unit on top and press save. Attention! Please make sure that the information in this table is complete and correct when you first enter it. Due to some restrictions with the MATLAB data structures, the number of units cannot be changed in subsequent processing stages.

4) Well Data Input

Accessed via the "Well Data Input" Button in Main Window after the stratigraphic units have been saved.
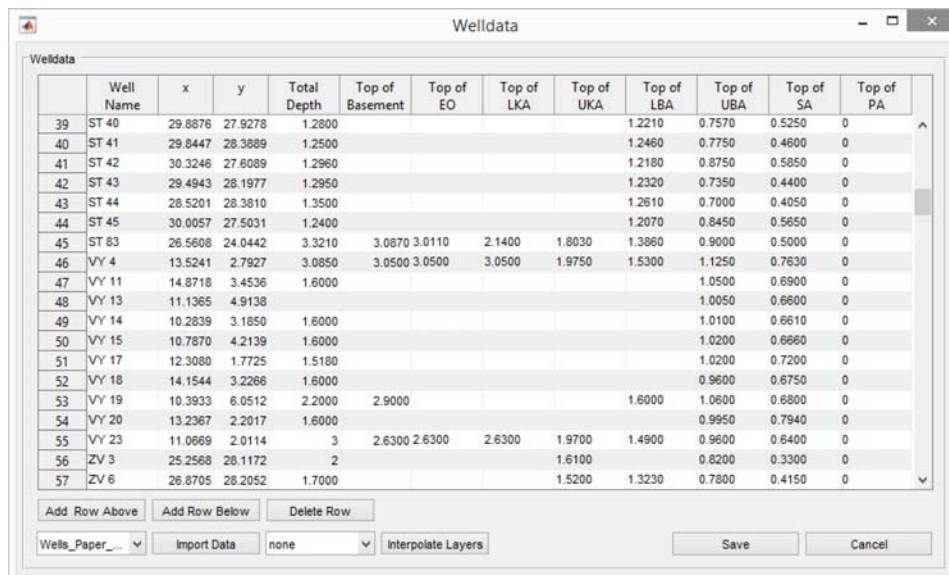
Enter your well data locations within the study area and the depths of stratigraphic units and save them. You can import data from an excel file if it follows the same structure as the table in the "Welldata" window.

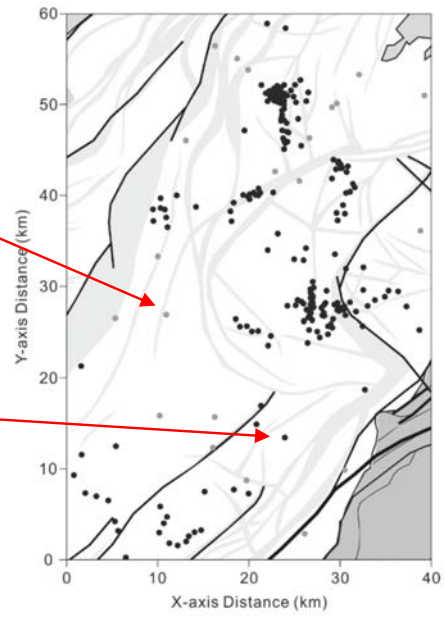Locations (x, y) of wells are relative based on the study area.
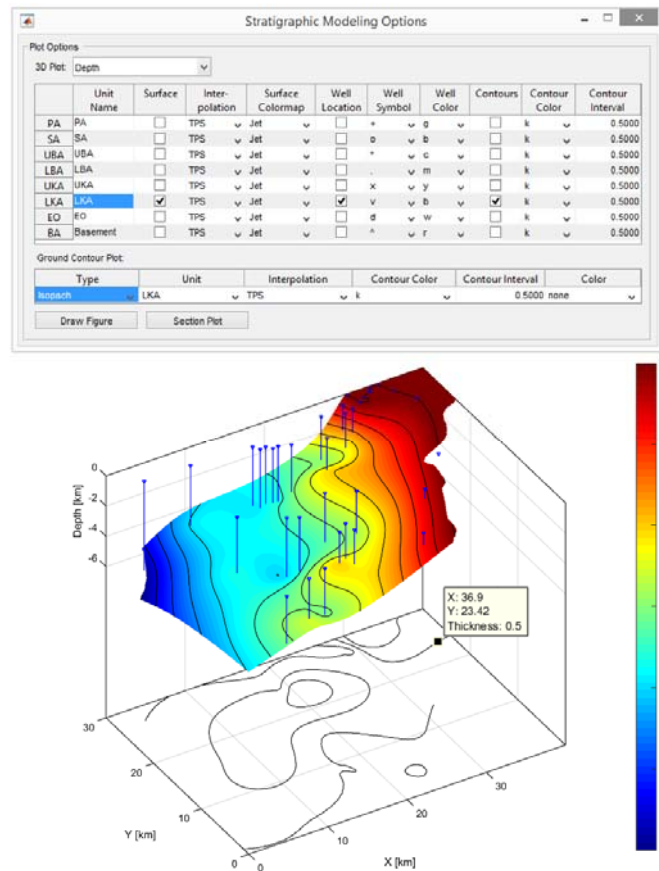
Study area
X: 40 km, Y: 60 km

(11.1, 27.1)

(24.1, 13.6)

5) Stratigraphic Modeling

Accessed via the "Stratigraphic Modeling" Button in Main Window after the well data have been saved

Stratigraphic Modeling Options

Plot Options

3D Plot: Depth

	Unit Name	Surface	Inter-polation	Surface Colormap	Well Location	Well Symbol	Well Color	Contours	Contour Color	Contour Interval
PA	PA	☐	TPS	Jet	☐	+	g	☐	k	0.5000
SA	SA	☐	TPS	Jet	☐	o	b	☐	k	0.5000
UBA	UBA	☐	TPS	Jet	☐	*	c	☐	k	0.5000
LBA	LBA	☐	TPS	Jet	☐	.	m	☐	k	0.5000
UKA	UKA	☐	TPS	Jet	☐	x	y	☐	k	0.5000
LKA	LKA	☑	TPS	Jet	☑	v	b	☑	k	0.5000
EO	EO	☐	TPS	Jet	☐	d	w	☐	k	0.5000
BA	Basement	☐	TPS	Jet	☐	^	r	☐	k	0.5000

Ground Contour Plot:

Type	Unit	Interpolation	Contour Color	Contour Interval	Color
Isopach	LKA	TPS	k	0.5000	none

Draw Figure | Section Plot

X: 36.9
Y: 23.42
Thickness: 0.5

This window offers a variety of options to generate plots based on the available well data. The 3D plot table offers options for 3D surface and contour plots of depth or isopach surface models for stratigraphic units. These options include settings for interpolation type, surface colormap (based on the standard Matlab Colormaps), well indicators (with symbol and color), and 3D contours (color and interval).

The ground contour plot is an optional 2D plot below the 3D surface plot that can be used to show additional information. You can use Matlab's datatip function to determine contour values of the ground contour plot within plot windows.

All visualizations are generated in standard MATLAB plot windows, giving users access to advanced plot options to customize visualization results. Visualizations can be exported to the wide range of image formats supported by MATLAB.

Attention! By default, layer depth maps are interpolated directly from the depth values at well locations. However, it is possible that layer depth surfaces generated in that way intersect each other in areas with insufficient depth data.

6) Parameter Input

Accessed via the "Parameter Input" Button in Main Window after the well data have been saved

Enter parameters for subsidence analysis; Initial porosity, c, Waterdepth, Sealevel, Sediment Density and save them. Initially, every well uses the parameters entered under the Well ID "Default". Parameters can be saved individually for every well by selecting them in the Well ID dropdown menu.

If you do not have initial porosity and coefficient (c) data, you can use standard data from Sclater and Christie (1980) based on sediment's major lithology.

Initial Porosity Coefficient Densities	$\varnothing_0$ c ρ_s ρ_m ρ_w	initial porosity of porosity-depth relation (%) coefficient of porosity-depth relation (x 10^{-5}) average density of sediment grain (g/cm^3) average density of mantle (3.3 g/cm^3) average density of water (1.0 g/cm^3)	from Sclater and Christie (1980)
			$\varnothing_0$ c ρ_s Shale 63 0.51 2.72 Sand 49 0.27 2.65 Shaly Sand 56 0.39 2.68 Chalk 70 0.71 2.71
Water-depth Sea-level	W_d Δ_{SL}	paleowaterdepth paleosealevel	

The uplift field allows you to include corrections for tectonic uplift into subsidence plots (but not the subsidence calculation). An example can be found in the next section.
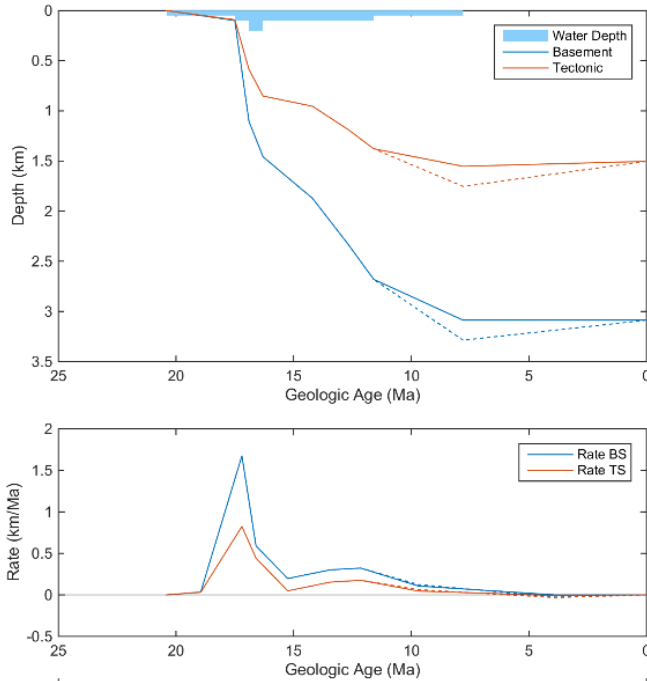
7) Subsidence Analysis

Accessed via the "Subsidence Analysis" Button in Main Window after the subsidence parameters have been saved.

This window shows the numeric backstripping results at a single well location. Wells can be selected in the dropdown menu in the top left corner.
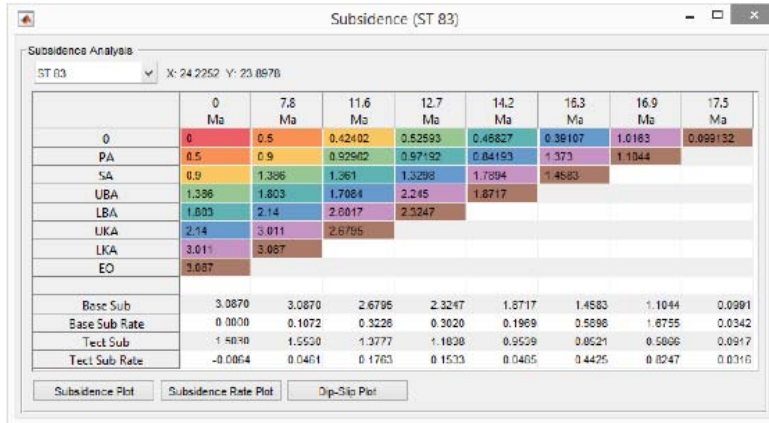
Additionally, the plot buttons allow you to generate several 2D plot representations of the backstripping data.


The plot above show examples of subsidence and subsidence rate plots (BS: Basement Subsidence (Total Subsidence), TS: Tectonic Subsidence). Waterdepth is indicated by the bars on top of the plot while the correction for uplifted is visualized by the dotted line plots.

8) Subsidence Modeling

Accessed via the "Subsidence Modeling" Button in Main Window after the subsidence parameters have been saved.

This window offers plot options similar to those available in the "Stratigraphic Modeling" window. Only wells that reached the basin floor are considered for subsidence modeling. Individual wells can be excluded from the interpolation using the "Well Data" table on the right side of the window.
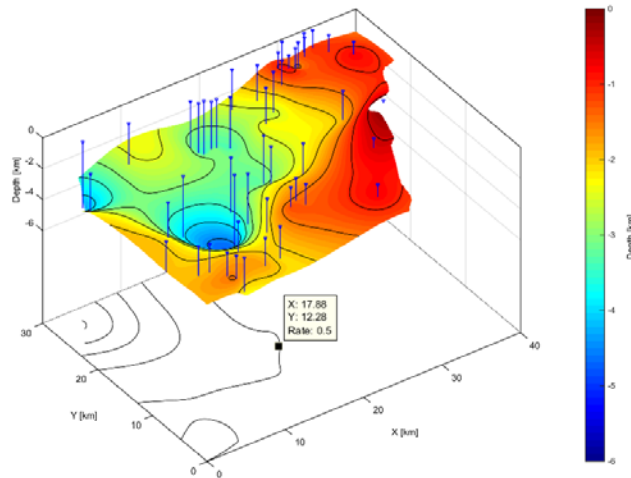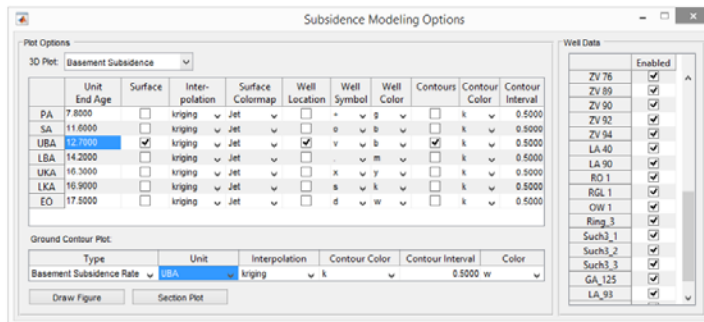
9) Additional functions

- **Cross section**

    Accessed via the "Section Plot" Button in the "Stratigraphic Modeling" and "Subsidence Modeling" windows.

    This window allows you to create 2D Sections plots through the interpolation results for all stratigraphic units. Section locations can be defined as axis-aligned line (parallel to the x or y-axis) by selecting a single point on a 2D map of the study area or as arbitrary line by selecting a point pair.
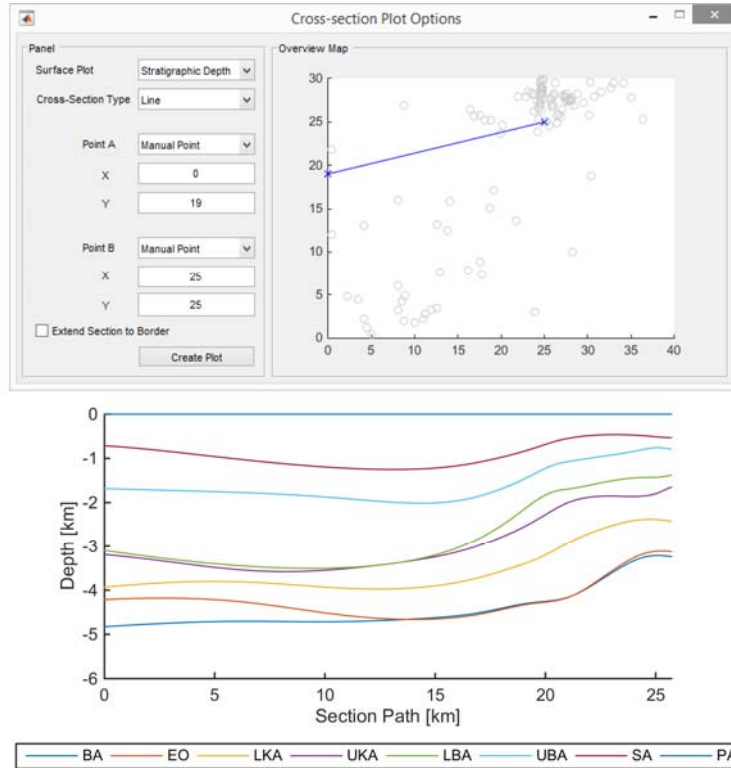
- **Dip-slip Fault Backstripping**

  Accessed via the "Dip-Slip Plot" Button in the "Subsidence Analysis" window.

  Guided by a preview map, users select a pair of well locations eligible for dip-slip backstripping and can generate step or line plots of the vertical fault displacement rates between them.
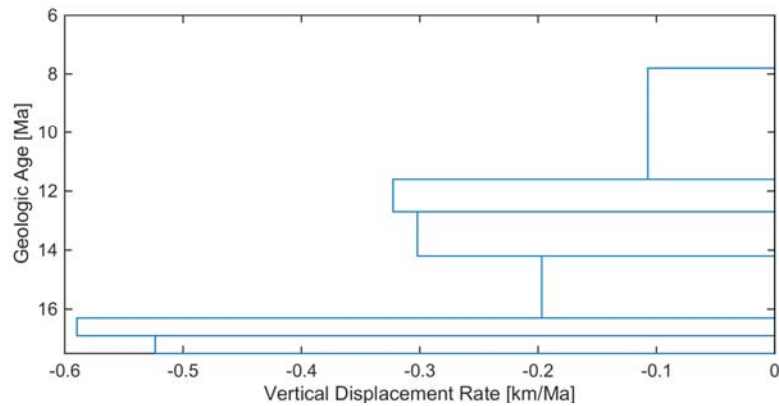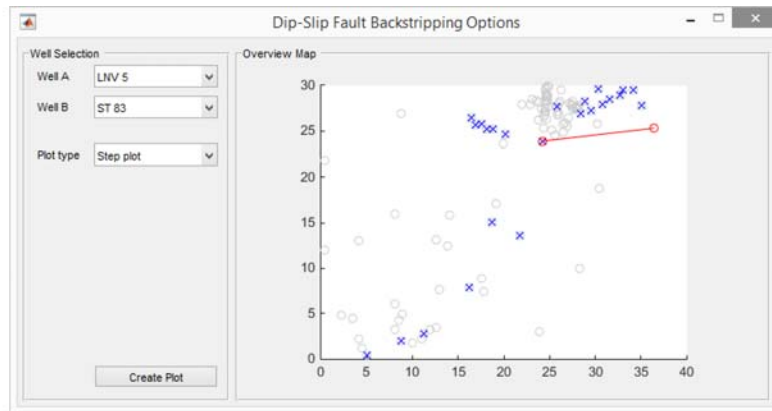
We hope you have good results with BasinVis 1.0.

In your publication, please reference BasinVis 1.0 ! Lee et al. (2016) !

If you have a question, please send it to Eun Young Lee (eun.lee@univie.ac.at)