# *StagLab 4*

*Geodynamic diagnostics and scientific visualisation for geodynamic models*

*Crameri (2018, GMD)*

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## Author


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> Various contributors to this project are mentioned below.

## Prerequisites

StagLab necessitates a working version of **MatLab 2014b or later**.

> StagLab works best with the latest version of MatLab as earlier versions might disable multiple StagLab features and might cause problems as compatibility is not maintained carefully any longer.

## Installing

- To install StagLab, simply execute the included ***f_INSTALL***. This can be done in the MatLab terminal by typing:

```
cd <yourPath>/StagLab3
f_INSTALL
```

> Alternatively, add all StagLab files manually to the MatLab search path (in MatLab go to: *HOME > Set Path > Add With Subfolders*).

- It is best practise to delete old StagLab versions.

> StagLab removes, however, file dublicates from the MatLab search path and so prevents confusion with old files.

## Testing

- To test StagLab on your system, simply execute the included ***f_TEST***. This can be done in the MatLab

terminal by typing:

```
cd <yourPath>/StagLab3
f_TEST
```

> This automated test performs various core tasks of StagLab and produces a suite of test figures that are saved to *StagLab > Examples > ExampleFigures*.

# Running

- StagLab is run through parfiles (see folder *Parfiles*). Use one of the parfiles included (e.g., ***ParStagLab2D***) to set your parameters and to run one of the main StagLab Apps (*STAGplot* for parameter fields, *STAGrprof* for radial profiles, *STAGtimedat* for time evolutions). See ***f_Defaults***, ***f_DefaultsRprof***, or ***f_DefaultsTimedat*** for all available options available with the corresponding parfile.

| | **Parameter Fields** | **Radial Profiles** | **Temporal Graphs** |
|---|---|---|---|
| **Execution File** | *ParStagLab2D ParStagLab3D ParStagLabYY* | *ParStagLabRprof* | *ParStagLabTimedat* |
| **Defaults** | f_Defaults | f_DefaultsRprof | f_DefaultsTimedat |
| **Routine** | STAGplot | STAGrprof | STAGtimedat |

> You can run your parfile from any directory you like.
>
> You will always be able to re-use your old parfiles to run newer versions of StagLab.

- Adjust file name, number and directory with:

```
IN.Name                 =   {'test'};
IN.Number               =   [1];
IN.Folder               =   {'/work/stagyy/'};
```

> TIP: Given the above *IN.Folder*, StagLab checks automatically also for the following folder-structures to read:
>
> ```
> /work/stagyy/+op/<fileToRead>
> /work/stagyy/+op/<filename>/<fileToRead>
> ```
>
> and write:

```
/work/stagyy/+im/<fileToSave>
/work/stagyy/+im/<filename>/<fileToSave>
```

TIP: It is possible to plot or compare multiple files in the same figure by simply adding another file name. *IN.Name* controls which and how many files are plotted. To plot three different files all for the first output number:

```
IN.Name                     =   { 'test1' 'test2' 'test3'};
IN.Number                   =   [   1   ];
IN.Folder                   =   {'/folder1/' '/folder2/' '/folder3/'};
```

To plot multiple time steps of one single model:

```
IN.Name                     =   { 'test1' ‘test1' 'test1'};
IN.Number                   =   [   1   2   3 ];
IN.Folder                   =   { '/folder_test1/‘ };
```

If there is just one entry for either *IN.Number* or *IN.Folder*, it will take the same entry for all files specified in *IN.Name*.

- Adjust the dimensional parameters in the parfile for correct dimensionalisation according to ***f_Dimensions***.

```
IN.Parameter            =   [ 11 ];
```

StagLab saves the publication-ready figures and movies, if:

```
SAVE.Figure             =   logical(1);
SAVE.Movie              =   logical(1);
```

To specify a certain write directory change the default:

```
SAVE.writeDirectory     =   'auto';
```

to e.g.:

```
SAVE.writeDirectory     =   '/work/stagyy/';
```

## NOTE: Preparing Fluidity output

To make readable by StagLab, the original Fluidity output needs to be converted to a .csv file using e.g., Paraview. Adjust StagLab's ***f_readFluidity*** to the specific details of the .csv file.

# More detailed information

See *Crameri (2018, GMD)*.

# Acknowledging StagLab

- Please acknowledge the free use of the StagLab or any of its routines.

> Use for example:
>
> "The geodynamic diagnostics and scientific visualisation software StagLab (Crameri 2017; Crameri 2018) is used in this study."
>
> *Crameri, F. (2017), StagLab 3.0, Zenodo, http://doi.org/10.5281/zenodo.1199037*
>
> *Crameri, F. (2018), Geodynamic diagnostics, scientific visualisation and StagLab 3.0, Geosci. Model Dev., 11, 2541-2562, doi:10.5194/gmd-11-2541-2018.*

# Published studies using StagLab

- Crameri and Lithgow-Bertelloni (2018), Tectonophysics, doi:10.1016/j.tecto.2017.09.013.
- Crameri et al. (2017), Gcubed, doi:10.1002/2017GC006821.
- Crameri and Tackley (2016), PEPS, doi:10.1186/s40645-016-0103-8.
- Crameri and Tackley (2015), JGR, doi:10.1002/2014JB011664.
- Crameri and Tackley (2014), JGR, doi:10.1002/2014JB010939.
- Crameri et al. (2012), GRL, doi:10.1029/2011GL050046.

# Contributing

- Direct contributions, bug reports, requests and general questions to Fabio Crameri.

# Contributors

## External routines

- *f_readStagYY* originally by ***Boris Kaus*** to read StagYY's binary output directly into MatLab.
- *f_readStagYYhdf5* originally by ***Kiran Chotalia*** to read StagYY's HDF5 output into MatLab.
- *f_readFluidity* originally by ***Fanny Garel*** to read Fluidity's CSV output into MatLab.
- *f_YYtoMap* originally by ***Paul Tackley*** to produce horizontal maps of fully spherical yinyang data.
- *export_fig* originally by ***Oliver Woodford*** to add more flexibility to figure saving.
- *flowfun* and *cumsimp* by ***Kirill K. Pankratov*** to derive the stream function and to perform the Simpson-

rule column-wise cumulative summation, respectively.
- *MinVolEllipse* by ***Nima Moshtagh*** to fit a minimum-volume ellipse around a point cloud.
- *hatchfill2* originally by ***Neil Tandon*** to fill areas with a specific texture.
- *plotboxpos* by ***Kelly Kearney*** to return the position of the plot more accurately and reliably.
- a few functions including *equalisecolourmap.m* and *sineramp2.m* by ***Peter Kovesi*** were used to provide the scientific colour-map diagnostics.

### Thanks to...


- ***Kiran Chotalia*** for her help with debugging the code and additions to STAGrprof.
- ***Antoniette Grima*** for her help with debugging the code.
- ***Enrico Marzotto*** for his help with debugging the code.
- ***Fanny Garel*** for her help with adding compatibility with Fluidity output.
- ***Robert Petersen*** for his help with deriving an appropriate radius of curvature for the plate bending.
- ***Tobias Rolf*** for his help with the surface variation histogram plot.
- ***Marcel Thielmann*** for his help with StagLab's compatibility across different MatLab versions
- ***Paul Tackley*** for his helpful comments throughout the development of StagLab.


# Versioning

### StagLab 4

- re-introducing multi-subduction-zone tracking
- introducing plume-mobility diagnostics
- improved Windows compatibility
- improved compatibility with latest StagYY version
- improved handling of 3-D spherical models
- additional parameter fields
- extended suite of scientific colour-maps
- analysis mode for STAGrprof and STAGtimedat
- flexibility extensions to STAGrprof and STAGtimedat
- automatic fixing of corrupt time.dat files
- stability improvements
- bug fixes

### StagLab 3

- introducing automated installation and testing
- introducing 2-D mode for 3-D
- introducing analysis mode
- introducing tracer plot

- introducing surface-variation histogram plot
- introducing topography diagnostics
- introducing perceptually-uniform colour schemes
- option to discretize colour maps
- option to set default figure position on screen
- option to shift or flip data horizontally
- support for partial cylindrical geometry
- magnifier support for cylindrical geometry
- additional parameter fields
- additional plate diagnostics
- major improvements to STAGrprof and STAGtimedat
- compatibility with Fluidity output
- refined visual design
- improved file finder
- improved code design
- improved speed
- bug fixes

## StagLab 2

- introducing mantle-dynamics diagnostics
- introducing tectonic diagnostics
- introducing topography components (isostatic,residual)
- introducing plot for up- and downwelling
- introducing parameter table
- introducing plot-in-plot mode
- introducing movies
- introducing fAIo
- more parameter fields added
- automatic detection of side-boundary v-condition
- less-disruptive error handling
- cleaner plot design and layout
- improved colormaps
- improved filefinder
- improved display output
- improved stability of design-routines
- improved saving and plotting of tectonic data
- improvements towards convertibility to other geodynamic codes
- bug fixes

## StagLab 1

- Combining Apps to StagLab
- supports all available StagYY model geometries
- supports all available StagYY output, including rprof.dat and time.dat
- option added for YinYang horizontal maps
- hot and cold plume tracking added
- first test version of 3-D Cartesian plate boundary tracking implemented
- code speed optimisations: deriving lithosphere thickness
- option added to plot horizontal residual temperature
- option added to plot heat flux
- option added to plot temporal evolution of tectonic parameters
- option added to save figure to specific directory
- improved code design
- improved user friendliness
- bug fixed that led to empty plate sketch plot
- bug fixes and updates to the dimensionalisation

# Reference


- *Crameri, F. (2018), Geodynamic diagnostics, scientific visualisation and StagLab 3.0, Geosci. Model Dev., 11, 2541-2562, doi:10.5194/gmd-11-2541-2018.*


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