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Geoscientific Model Development
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Supplement of

Geodynamic diagnostics, scientific visualisation and StagLab 3.0

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Table S1: StagLab's diagnostic output parameters for 2-D model data[a]

Parameter	Symbol	Unit[b]
Time	t	*variable*
Time Seconds	t_s	s
Time Years	t_{yr}	yr
Mantle-Transit Time	t_{MT}	#MT
Trench Position	x_{Trench}	*variable*
Subduction Polarity	Pol_{Sub}	'-1': left, '1': right, '0': unknown
Trench Velocity	v_{Trench}	$\mathrm{cm\,a^{-1}}$
Theoretic Trench Velocity	$v_{TrenchTheoretic}$	$\mathrm{cm\,a^{-1}}$
Upper-Plate Velocity	v_{UP}	$\mathrm{cm\,a^{-1}}$
Lower-Plate Velocity	v_{LP}	$\mathrm{cm\,a^{-1}}$
Convergence Velocity	$v_{Convergence}$	$\mathrm{cm\,a^{-1}}$
Slab Sinking Velocity	$v_{SlabSinking}$	$\mathrm{cm\,a^{-1}}$
Max. Plate Velocity	$v_{PlateMax}$	$\mathrm{cm\,a^{-1}}$
RMS Plate Velocity	$v_{PlateRMS}$	$\mathrm{cm\,a^{-1}}$
Slab Angle	θ_{Slab}	$^\circ$
Slab-Tip Horiz. Position	$x_{SlabTip}$	*variable*
Slab-Tip Depth	$z_{SlabTip}$	*variable*
Slab Viscosity	η_{Slab}	Pa s
Slab Density	ρ_{Slab}	$\mathrm{kg\,m^{-3}}$
Upper-Mantle Viscosity	η_{UM}	Pa s
Upper-Mantle Density	ρ_{UM}	$\mathrm{kg\,m^{-3}}$
Max. Upper-Mantle Velocity	$v_{UM,Max}$	$\mathrm{cm\,a^{-1}}$
Slab-Mantle Visc.Contrast	$\Delta\eta_{Slab-Mantle}$	-
Left-Plate Thickness	d_{leftP}	*variable*
Right-Plate Thickness	d_{rightP}	*variable*
Lower-Plate Thickness	d_{LP}	*variable*
Upper-Plate Thickness	d_{UP}	*variable*
Plate Bending Radius	R_B	*variable*
Bending Dissipation	ϕ_L^{vd}	$\mathrm{N\,s^{-1}}$
Rel. Bending Dissipation	$\phi_{L,norm}^{vd}$	-
Viscous Plate Dissipation	ϕ_{Plate}^{vd}	$\mathrm{N\,s^{-1}}$
Max. Plate-Core Viscosity	$\eta_{PlateCore}$	Pa s
Min. Plate-Core Strainrate	$\dot{\epsilon}_{PlateCore,Min}$	$\mathrm{s^{-1}}$
Max. Plate-Core Strainrate	$\dot{\epsilon}_{PlateCore,Max}$	$\mathrm{s^{-1}}$
Max. Plate-Core Stress	$\sigma_{PlateCore,Max}$	MPa
Max. Plate Stress	$\sigma_{Plate,Max}$	MPa
LAB Depth	z_{LAB}	*variable*
Max. Yield Depth	$z_{yield,max}$	*variable*
Max. Yield Depth Fraction	$z_{yield,max,frac}$	fraction of mean plate thickness
Trench Depth	z_{Trench}	*variable*
Upper-Plate Tilt	θ_{UP}	$^\circ$
Subduction Flow-Rate	d_{UP}	$\mathrm{m^2\,s^{-1}}$

[a]At time of submission. [b]In StagLab's dimensional mode.

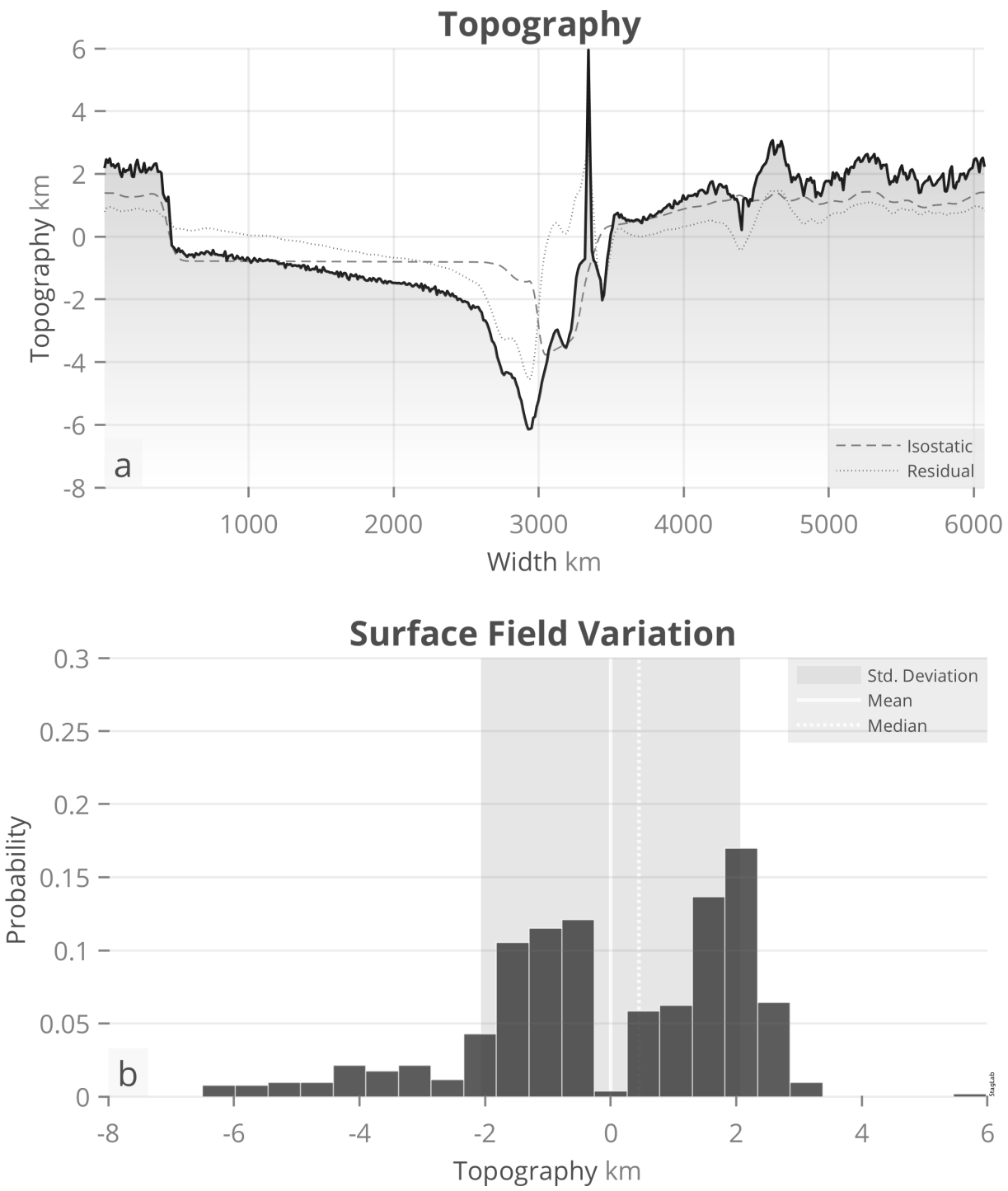

Figure S1: (a) StagLab's surface-topography plot with isostatic and residual components and (b) the resulting surface-field variation plot with indicators for the standard deviation, mean and median.

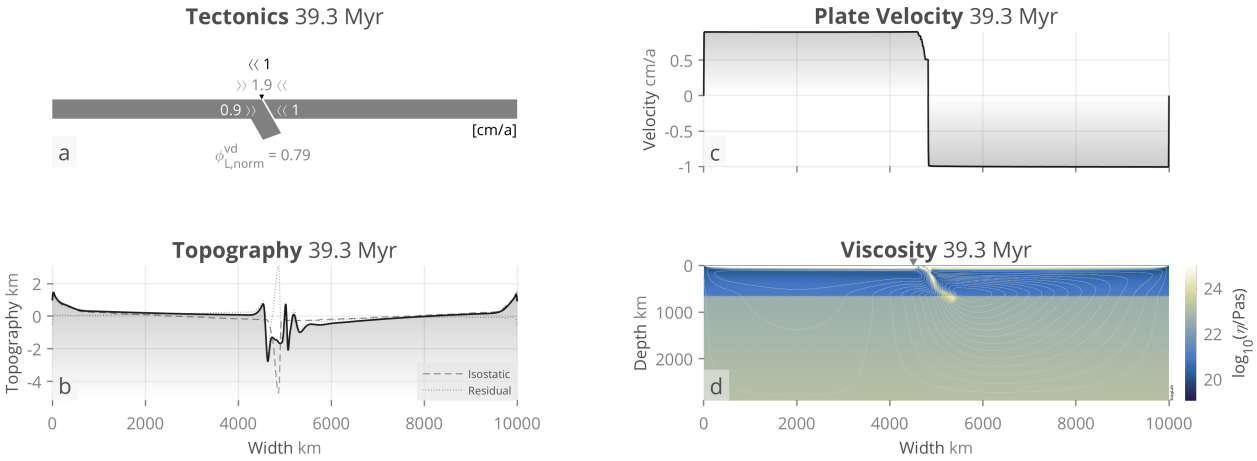

Figure S2: StagLab diagnostics and visualisation of data from the finite-element code Fluidity (Davies et al., 2011).

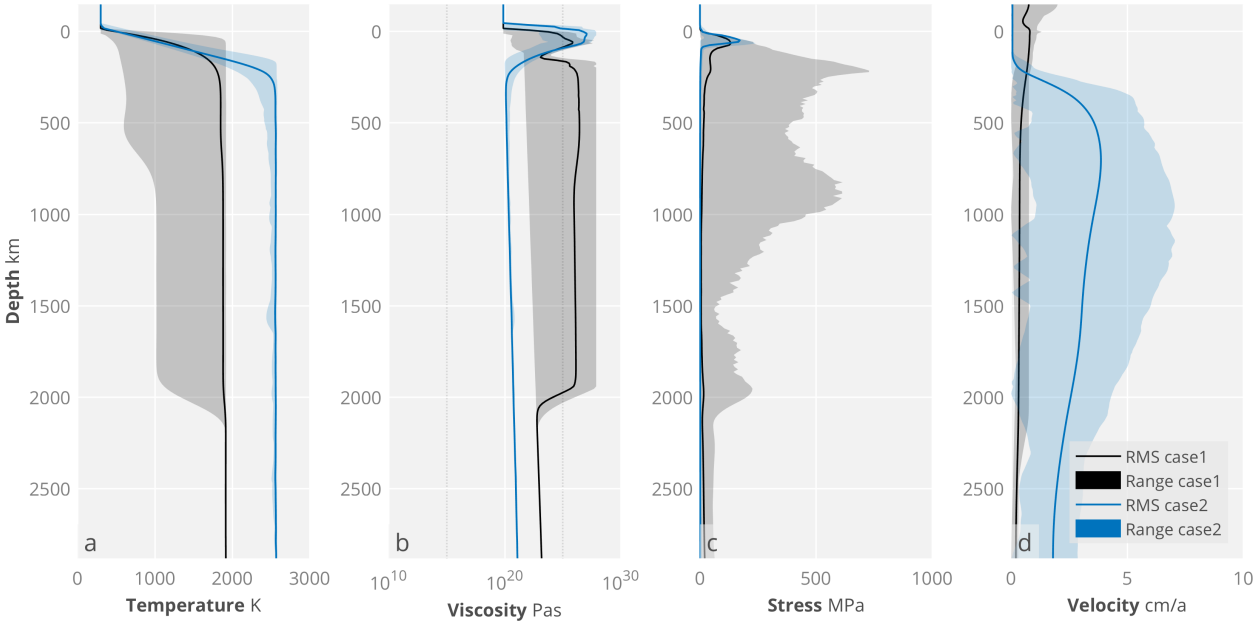

Figure S3: StagLab's radial profile graph plots of StagYY's (Tackley 2008) radial root-mean-square data files (*rprof.dat*). Shown are the RMS of the data (solid line) and the corresponding range (transparent area) for two different cases (black and blue).

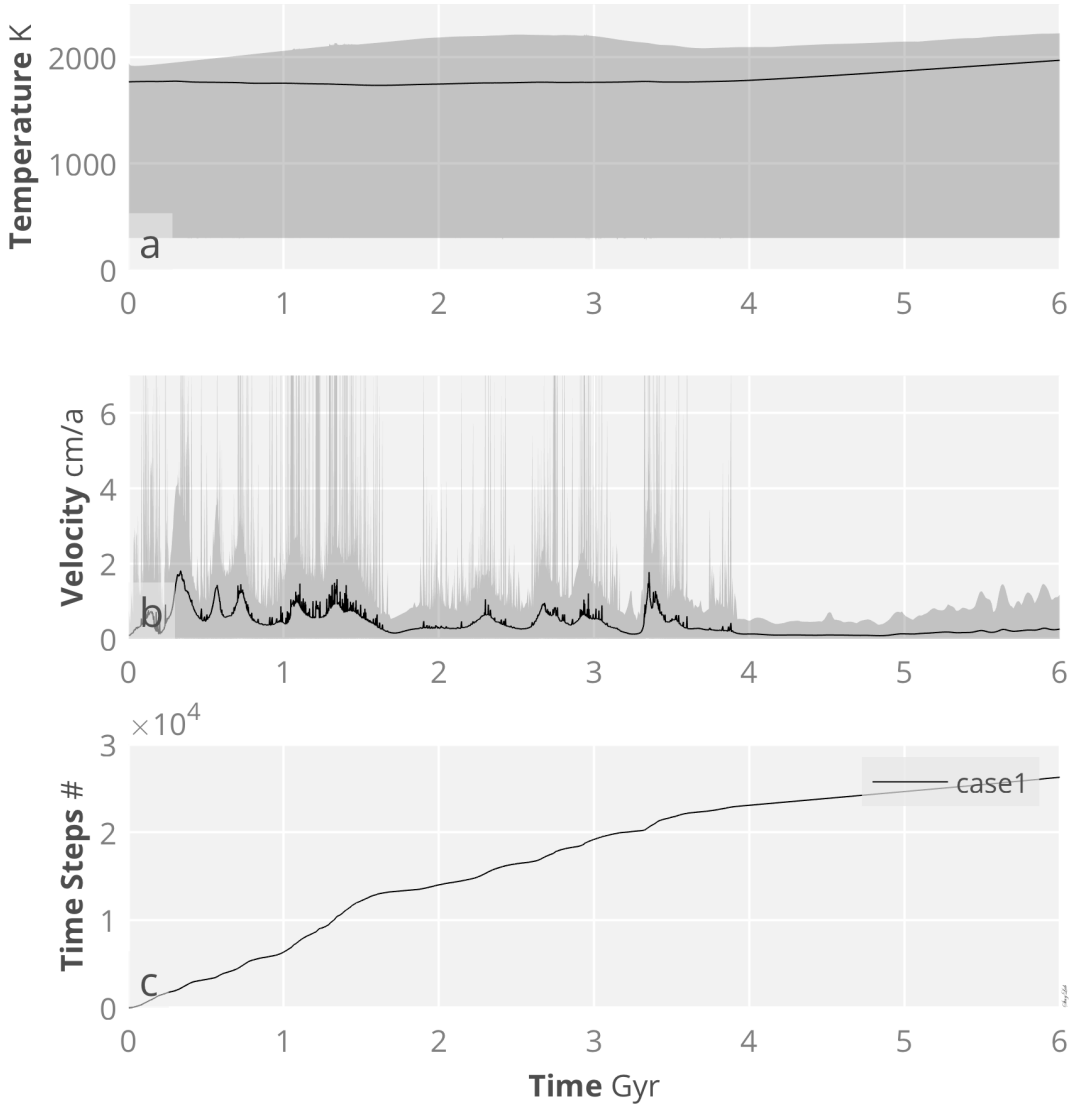

Figure S4: StagLab's temporal graphs plots of StagYY's (Tackley 2008) global root-mean-square (RMS) time-data files (*time.dat*). The black graph indicates the RMS data values and the grey area indicates the data range.

StagLab 3 - User Guide

Geodynamic Diagnostics and Scientific Visualisation for Geodynamic Models

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by **Fabio Crameri** - contact

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.

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.1199038*
>
> *Crameri, F. (2018), Geodynamic diagnostics, scientific visualisation and StagLab 3.0, Geosci. Model Dev. Discuss., doi:10.5194/gmd-2017-328*

Reference

- *Crameri, F. (2018), Geodynamic diagnostics, scientific visualisation and StagLab 3.0, Geosci. Model Dev. Discuss., doi:10.5194/gmd-2017-328*

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