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_a	a
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}	°
Slab-Tip Horiz. Position	$x_{SlabTip}$	*variable*
Slab-Tip Depth	$z_{SlabTip}$	*variable*
Slab Viscosity	η_{Slab}	$\mathrm{Pa\,s}$
Slab Density	ρ_{Slab}	$\mathrm{kg\,m^{-3}}$
Upper-Mantle Viscosity	η_{UM}	$\mathrm{Pa\,s}$
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	$\eta_{PlateCore}$	$\mathrm{Pa\,s}$
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}	°
Subduction Flow-Rate	d_{UP}	$\mathrm{m^2\,s^{-1}}$

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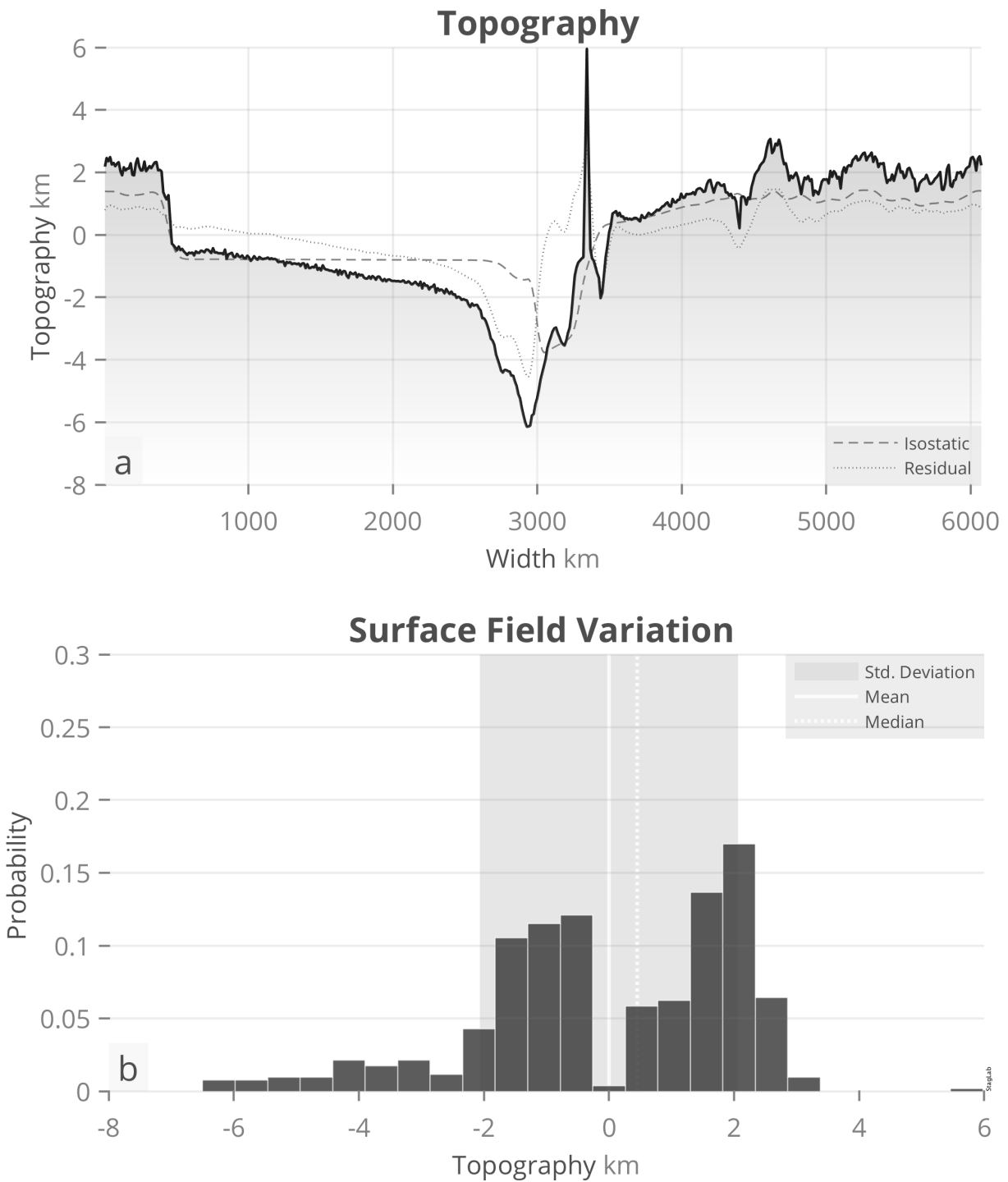
Topography

Surface Field Variation

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.
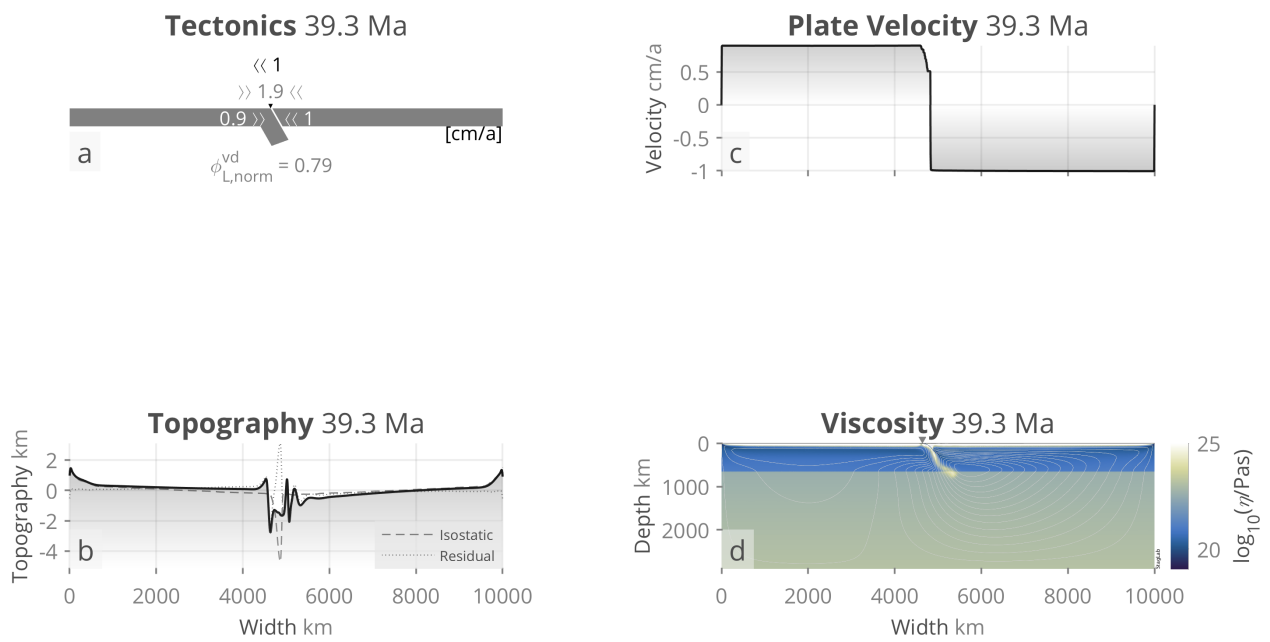
Tectonics 39.3 Ma

⟨⟨ 1
⟩⟩ 1.9 ⟨⟨
0.9 ⟩⟩ ⟨⟨ 1
[cm/a]
a
$\phi^{vd}_{L,norm}$ = 0.79

Plate Velocity 39.3 Ma

Velocity cm/a
0.5
0
-0.5
-1
c

Topography 39.3 Ma

Topography km
2
0
-2
-4
b
- - - Isostatic
········· Residual
0   2000   4000   6000   8000   10000
Width km

Viscosity 39.3 Ma

Depth km
0
1000
2000
d
25
20
$\log_{10}(\eta/\mathrm{Pas})$
0   2000   4000   6000   8000   10000
Width km

Figure S2: STAGLAB diagnostics and visualisation of data from the finite-element code Fluidity (Davies et al., 2011).
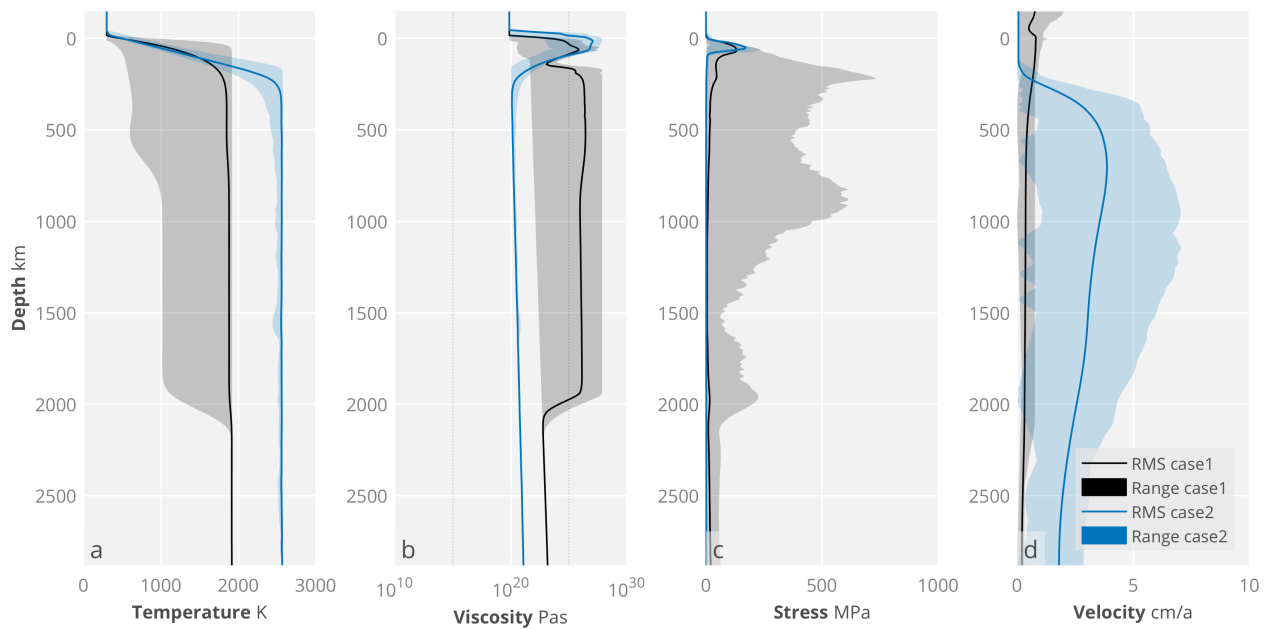
Figure S3: STAGLAB's radial profile graph plots of StagYY's (Tackley 2008) radial root-mean-square data files (*rprof.dat*). Shown are the RMS of the data (solid line) and the corresponding range (transparent area) for two different cases (black and blue).
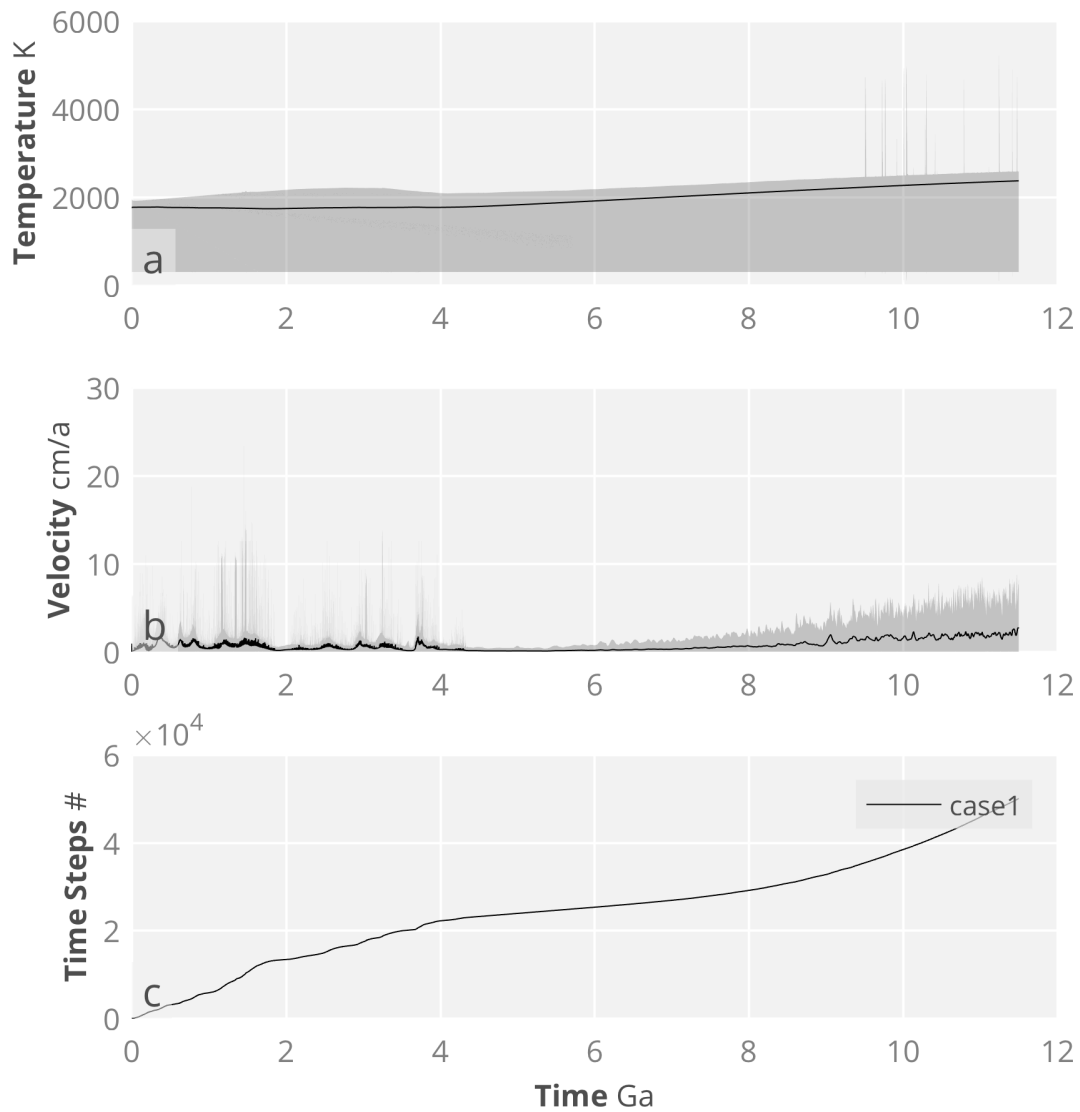
Figure S4: StagLab's temporal graphs plots of StagYY's (Tackley 2008) global root-mean-square (RMS) time-data files (*time.dat*). The black graph indicates the RMS data values and the grey area indicates the data range.