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Supporting Information for

Thermal Segmentation of Mid-Ocean Ridge Transform Faults

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Introduction

The equation for AU, the seismogenic area for an unsegmented mid-ocean ridge transform fault (Eq. 7 in the paper):

$$A_{\mathrm{U}} = \mathrm{C}_{600} {L_{\mathrm{T}}}^{1.5} V^{-0.5}$$

and the equation for LS, the critical step-over length (Eq. 11 in the paper):

$$\widetilde{L_S} = \mathrm{C_O} \frac{L_1^{1.5} + L_2^{1.5} - 0.1|L_1 - L_2|^{1.5}}{L_1 + L_2} V^{-0.6}$$

have the same exponent on the length terms (L_{T}, L_1 and L_2), but different exponents on the slip rate (V). In order to show the significance of the exponent on the slip rate (Vexp) for A_{U} and $\widetilde{L_S}$, we plot a range of exponent values versus the computed percent error between A_{U} and $\widetilde{L_S}$ derived from the model, and A_{U} and $\widetilde{L_S}$ predicted from the scaling

relation with the given exponent value for the full range of slip rates (2 cm/yr to 14 cm/yr) for a segmented fault system composed of two 50-km long faults (Fig. S1).
In figure S1, panel (a) shows the Vexp versus percent error plot for A_U and panel (b) shows the same plot for $\widetilde{L_S}$. In the case of the scaling relation for A_U, the percent error is minimized at a Vexp value of -0.46 for all slip rates. In the case of the scaling relation for $\widetilde{L_S}$, the percent error is minimized at different Vexp values depending on the slip rate. The spread in the percent error values, however, is minimized for a value of -0.59. The Vexp exponent values are then rounded to two significant digits (-0.5 and -0.6, respectively) for use in the A_U and $\widetilde{L_S}$ equations. The use of a Vexp value of -0.5 in the equation for A_U matches the theoretical value derived from the halfspace cooling model [*Boettcher & Jordan*, 2004]. Rounding this term results in a negligible increase the percent error for both A_U and $\widetilde{L_S}$.

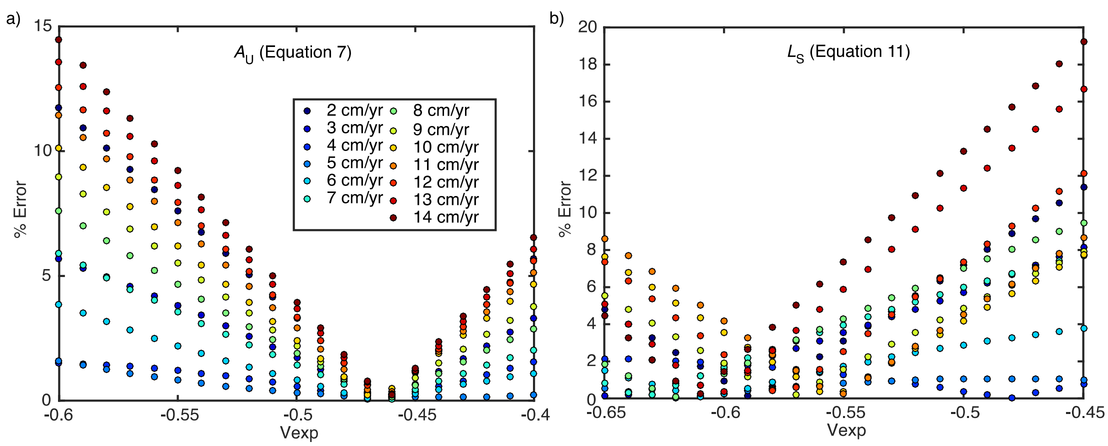

Figure S1. Percent error versus the exponent on the slip rate term (*V*) in the equations for A_U (a) and $\widetilde{L_S}$ (b) for a segmented fault composed of two 50-km long fault segments. Data points are colored by slip rate.

For each value of the slip rate exponent tested in the scaling relations in figure S1, a new constant is computed, C_{600} for A_U and C_O for $\widetilde{L_S}$. In the equation for A_U, a Vexp value of -0.5 corresponds to a C_{600} value of 6.87e-4 $(m/s)^{(1/2)}$. For $\widetilde{L_S}$ with a Vexp value of -0.6, C_O = 1.35e-4 $m^{1.1}s^{-0.6}$. We round these numbers to two significant digits as well (6.9e-4 and 1.4e-4, respectively) to simply the equations and preserve consistency in the significant digits.