Variations of the seismic *b-value* along the Dead Sea transform

Matty Sharon^{1,2,3}, Ittai Kurzon¹, Nadav Wetzler¹, Amir Sagy¹, Shmuel Marco², Zvi Ben-Avraham²

- 1. Geological Survey of Israel, Jerusalem 9692100, Israel
- 2. Department of Geophysics, Tel Aviv University, Tel Aviv 6997801, Israel
- 3. Institute of Earth Sciences, Hebrew University of Jerusalem, Jerusalem, 9190401, Israel

Supplementary Material

Here we show several tables and figures, providing more details and information, beyond the essential material found in the manuscript. First, we show the statistics of the M_d and M_w regression fits, as calculated for the Network Coverage Area. The results of the NCA shown in Table A1, and in Figure A1, are very similar to the results obtained for the complete Research Area (RA), presented in Figure 3 and Table 2 of the main manuscript.

Regression type and data	a	b	c	RMS	AICc
source (OLS regression)					
Linear	0.90	0.11	-	0.259*	-
(Ataeva et al., 2015)					
Quadratic	0.13	-0.13	2.11	0.470*	-
(Ataeva et al., 2015)					
Linear	0.78	0.53	-	0.149	-2.27e+03
(network coverage)					
Quadratic	0.05	0.53	0.77	0.143	-2.33e+03
(network coverage)					

<u>**Table A1a**</u>: Coefficient correlations (a, b, c) that correspond to linear and quadratic regressions of the forms $M_w = a * M_d + b$ and $M_w = a * M_d^2 + b * M_d + c$, respectively. The regression coefficient of Ataeva et al. (2015) are achieved through Eqs. 1–3 (see Methods section). *when testing in the network coverage area. In addition, the RMS and AICc values for the linear and quadratic fits of our study are also provided.

Regression type	a	b	c	O-RMS	O-AICc
OR Linear	0.78	0.62	-	0.142	-3.18e+03
(network coverage)					
Quadratic	0.05	0.53	0.77	0.21	-3.29e+03
(network coverage)					

Table A1b: Same as *Table A1a*, only that here the linear OR is compared to the quadratic OLS, by measuring the orthogonal distance of each datapoint to the curve fitting the data. The preference for using the quadratic solution remains, even within the NCA polygon.



Figure A1: Linear and quadratic fits within the NCA. Black lines in parts (a) and (c) are linear and quadratic fits achieved in this study within the network coverage area, superimposed on the associated earthquake data. Dashed yellow lines representing 1:1 ratio. Residuals from these fits are scattered for the linear (b) and quadratic (d) fits; where the Black line is the linear fit of these residuals, dashed Yellow line represents 1:1 ratio; Green and Red lines show the detailed RMS in intervals of 25 events in an ascending order of magnitudes and in intervals of a single magnitude, respectively, calculated separately for the negative and positive residuals.



Figure A2: Spatial variations of the b-value (in green) calculated from the entire magnitude range within the DST polygon. The Mc is shown in blue, fluctuating between 1.3-2.1. The use of the upper value, of Mc=2.1, for the generation of the b-value spatial profile in Figure 6, is justified as it removes the Mc to *b-value* possible coupling, stabilizing the resulting profile seen in Figure 6 of the main text.



Figure A3: Spatial variations of the *b-value* in regard to the 75th (blue circles) and 95th (black circles) hypocentre depth percentiles, in tectonic (Table 3; Fig. 4) and seismogenic zones (Fig. A4; Table A2) within or on the edge of NCA (Fig. 2). Black and blue dashed line are OLS fit of the *b-value* to the 75th and 95th depth percentiles, respectively, showing the general trend.

For convenience, we also provide here the reference used for the seismogenic zones, as presented in the Thesis of Sharon (2020), showing their parameters (Table A2), and the associated map (Figure A4)

	a-value	b-value	events	magnitude range	75 th Depth	95 th Depth
					percentile (km)	percentile (km)
Gulf of Elat	5.52 (3.02)	1.25 (0.82)	229 (30)	$3.8 \le M_w \le 7.2$		
East Sinai	1.71 (1.73)	0.73 (0.75)	53 (51)	$2.1 \le M_w \le 4.1$	19.9	27.6
Arava	3.16 (2.85)	1.05 (0.97)	339 (239)	$2.1 \le M_w \le 4.1$	19.0	25.3
Dead Sea Basin	2.93 (2.65)	0.88 (0.83)	448 (314)	$2.1 \le M_w \le 5.1$	19.7	27.4
Carmel-Gilboa-	3.07 (3.02)	0.99 (1.01)	368 (299)	$2.1 \le M_w \le 5.0$		
Tirza						
Kinnarot-	2.73 (2.32)	0.90 (0.84)	257 (136)	$2.1 \le M_w \le 4.4$	10.2	17.0
Korazim-Hula						
Upper Galilee –	3.12 (2.29)	1.02 (0.88)	338 (99)	$2.1 \leq M_w \leq 4.6$	4.9	10.5
Southern Lebanon						
Roum Fault	2.47 (2.95)	1.00 (1.29)	158 (130)	$2.1 \le M_w \le 4.9(4.1)$		
Lebanon	3.39 (3.33)	1.50 (1.49)	58 (57)	$2.1 \le M_w \le 3.2$		
Restraining Bend						

<u>Table A2</u>: Seismicity parameters in seismogenic zones according to Sharon, 2020, and as seen in Figure A4.



Figure A4: Seismogenic zones from Sharon (2020). Black heavy lines and thin lines are the main seismic sources and Quaternary faults (Sharon et al., 2020), respectively.

	σ_1/σ_2	<i>t-test</i> type	<i>t-score</i> value	DOF	Statistical Significance
NCA - > DST	1	Similar Variance	5.51	52	> 2.007
NCA - > CTF	0.4	Similar Variance	2.64	26	> 2.056
NCA - > OFZ(S)	0.35	Welch	1	21	< 2.080
NCA - > OFZ(N)	0.167	Welch	6.86	12	> 2.179
DST - > CTF	0.4	Welch	5.29	26	> 2.056
DST - > OFZ(S)	0.28	Welch	1.81	20	< 2.086
DST - > OFZ(N)	0.167	Welch	7.76	12	> 2.179
CTF - > OFZ(S)	0.714	Similar Variance	1.59	39	< 2.023
CTF - > OFZ(N)	0.41	Welch	5.72	14	> 2.145
OFZ_S - > OFZ(N)	0.58	Similar Variance	6.85	30	> 2.042

In addition we provide here additional tables describing the stages of the Student's t-test method applied in the manuscript in Section 5 and Table 4.

<u>**Table A3:**</u> Applying the Student's t-test calculation for statistical significance. The t-score calculation is done for the b-values between each pair of Tectonic Zones. The type of *t-test* is chosen according to the ratio between the pair's *b-value* standard deviations, σ_1/σ_2 . The statistical significance follows a color scheme defined by the range of *s. l.*, in which the green shades show the *s. l.* \leq 0.05 threshold required for obtaining statistical significance. Our results show that 7 out of 10 pairs are significantly different from each other, with *s. l.* \leq 0.05.

Table A4: Student's t-test distribution Table. This table defines the t-test values according to the s.l. and DOF (degrees of freedom). Only the relevant DOF lines are presented, following their appropriate values provided in Table A3.

	s.l						
DOF	0.2	0.1	0.05	0.02			
12	1.356	1.782	2.179	2.681			
14	1.345	1.761	2.145	2.624			
20	1.325	1.725	2.086	2.528			
21	1.323	1.721	2.08	2.518			
26	1.315	1.706	2.056	2.479			
30	1.31	1.697	2.042	2.457			
39	1.304	1.685	2.023	2.426			
52	1.298	1.675	2.007	2.4			



Figure A5: Temporal variations of the b-value (in green) calculated from the entire magnitude range within the DST polygon. The Mc is shown in blue, fluctuating between 1.3-2.1. The use of the upper value, of Mc=2.1, for the generation of the b-value temporal profile in Figure 7, is justified as it removes Mc to *b-value* possible coupling, stabilizing the resulting profile seen in Figure 7 of the main text.