Supporting Information for:

Assessing earthquake rates and b-value given spatiotemporal variation in catalog completeness: Application to Atlantic Canada

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This file contains alternative versions of Figures 2, 4, and 5, produced using the power-law $M_c(d)$ function from Figure 3, rather than the “smooth-increasing" model:

Figure S1: alternative version of Figure 4.
Figure S2: alternative version of Figure 5.
Figure S3: alternative version of Figure 2 (only panel d differs).

An additional Figure S4 compares the predicted event rate maps produces by the two $M_c(d)$ models.

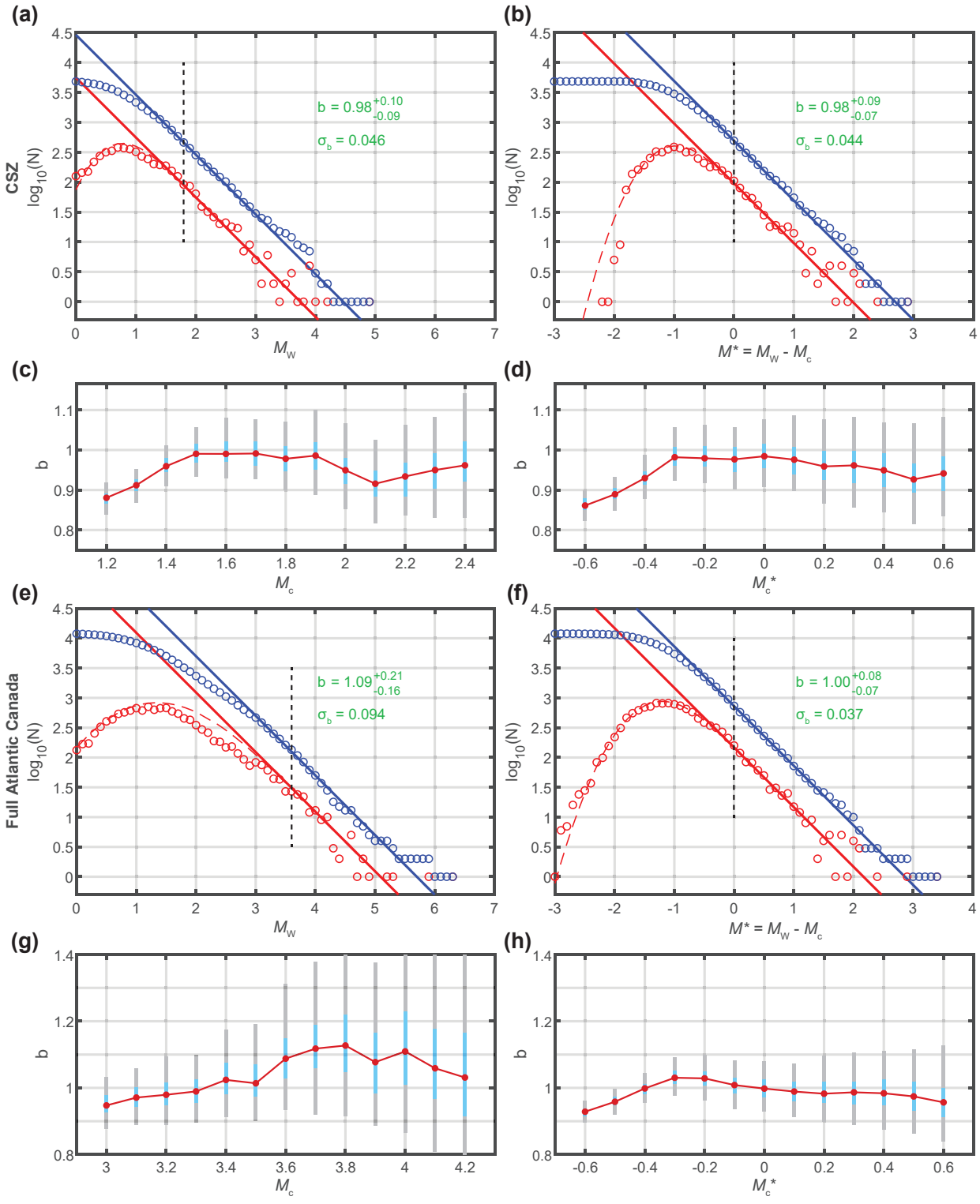

Figure S1. (a) Standard GR plot for the CSZ. Red and blue markers show the non-cumulative and cumulative MFDs, respectively. MLE-derived b is printed with 95% confidence intervals from 500 bootstrap iterations, as well as the standard error σ_b, which depends directly on the number of events with $M \geq M_c$ (N): $\sigma_b = b/\sqrt{N}$. The M_c used is shown with the dashed black line. (b) CSZ GR plot using M^* to account for variable $M_c(x,t)$. (c) b vs. M_c for the CSZ, using raw M_W, cyan and grey error bars show the 50% and 95% intervals from 500 bootstrap iterations. (d) b vs. M_c^* for the CSZ, using M^*, (e–h) like a–d except for the full map region of Figure 1. The **?** model fits in panels a, b, e, and f, were computed with b and M_c fixed to be consistent with the MLE fit and resulted in thinning widths σ of 0.39, 0.38, 0.65, and 0.44, respectively.

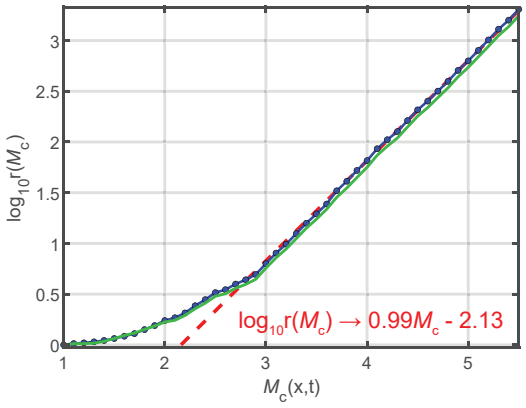

Figure S2. The predicted ratio of total/detected $M_W \geq 1$ earthquakes r, as a function of M_c, computed using Equation 6 for $1.0 \leq M_c \geq 5.2$ using increments of 0.1. The ratio approaches the log-linear relationship $\log_{10} r = 0.99 M_c - 2.13$ (computed using least-squares over the range $3.9 \geq M_c \leq 5.2$). The green curve is an alternative $r(M_c)$ model computed by extrapolating the GR model (without the thinning function), as described in the text.

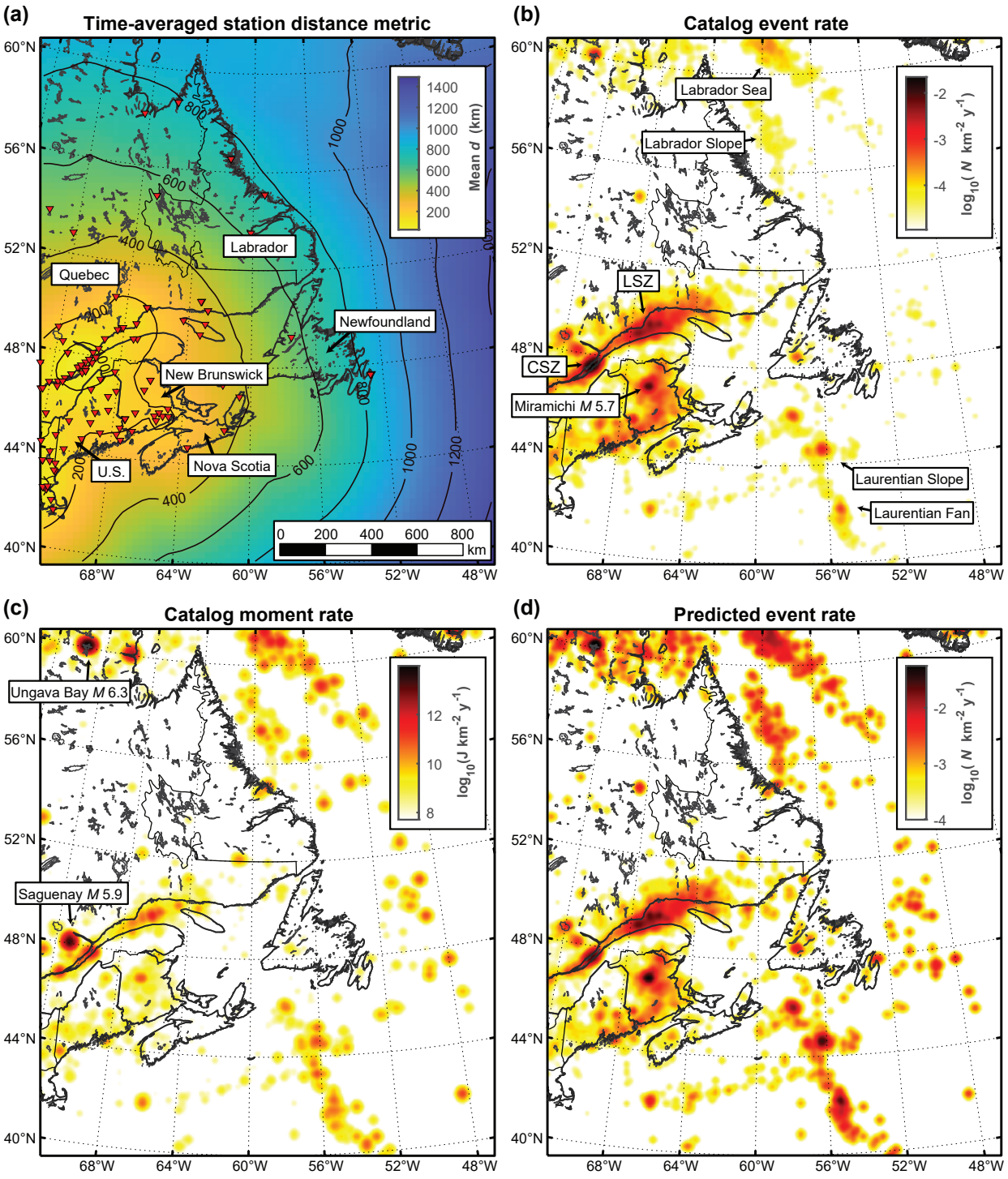

Figure S3. (a) Time-averaged weighted station-distance metric d over the study period of 1985–2022. Contours indicate distance in kilometres. Red triangles indicate locations of seismometers active for $\geq$3 years of the study period. Canadian provinces/regions and the United States (U.S.) are labeled. (b) Uncorrected yearly $M>1$ earthquake density (N km^{-2} y^{-1}) from the CNSN catalog. (c) Moment density (J km^{-2} y^{-1}) for the same catalog. (d) The main result of this study (Section 3): Predicted yearly earthquake density based on the CNSN catalog and the magnitude-of-completeness analysis of this study. All maps were first computed on a coarse grid ($\sim$15 km spacing), then converted to a finer grid and smoothed with a 2D Gaussian filter.

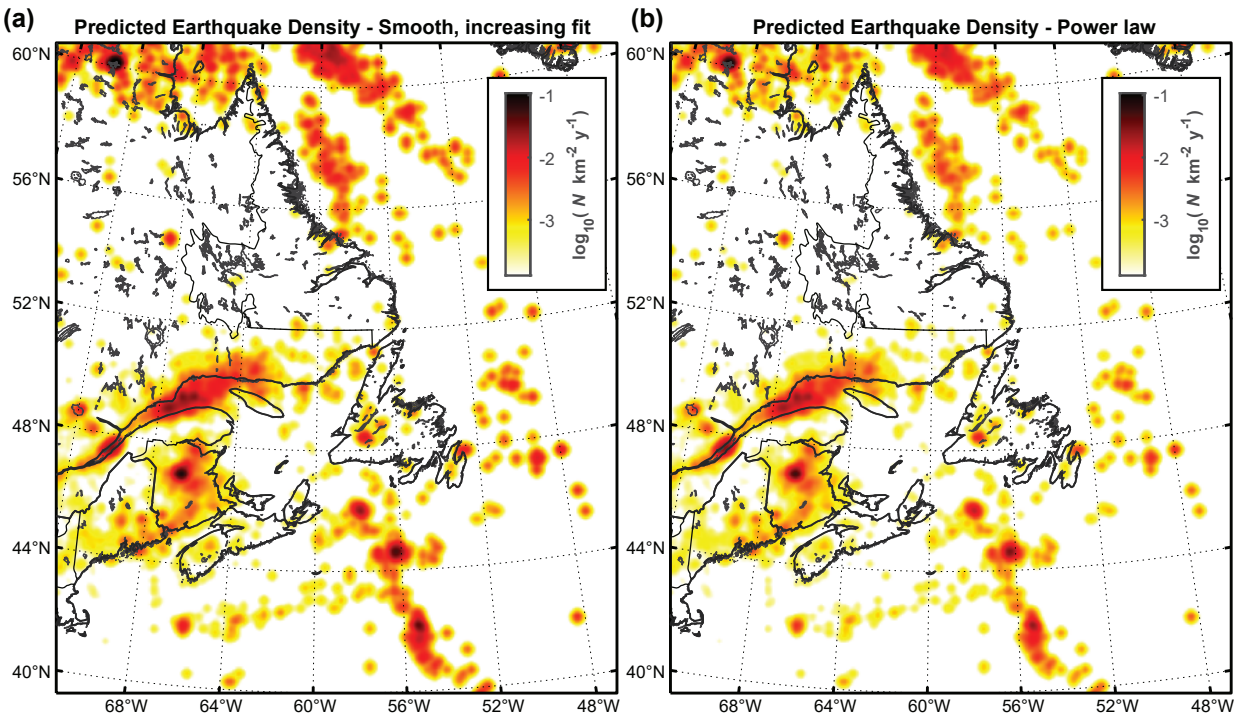

Figure S4. Predicted event rate maps using the two $M_c(d)$ functions. (a) is equivalent to Figure 2d and (b) is equivalent to Figure S3d, except they are plotted using the same colorbar to facilitate direct comparison.