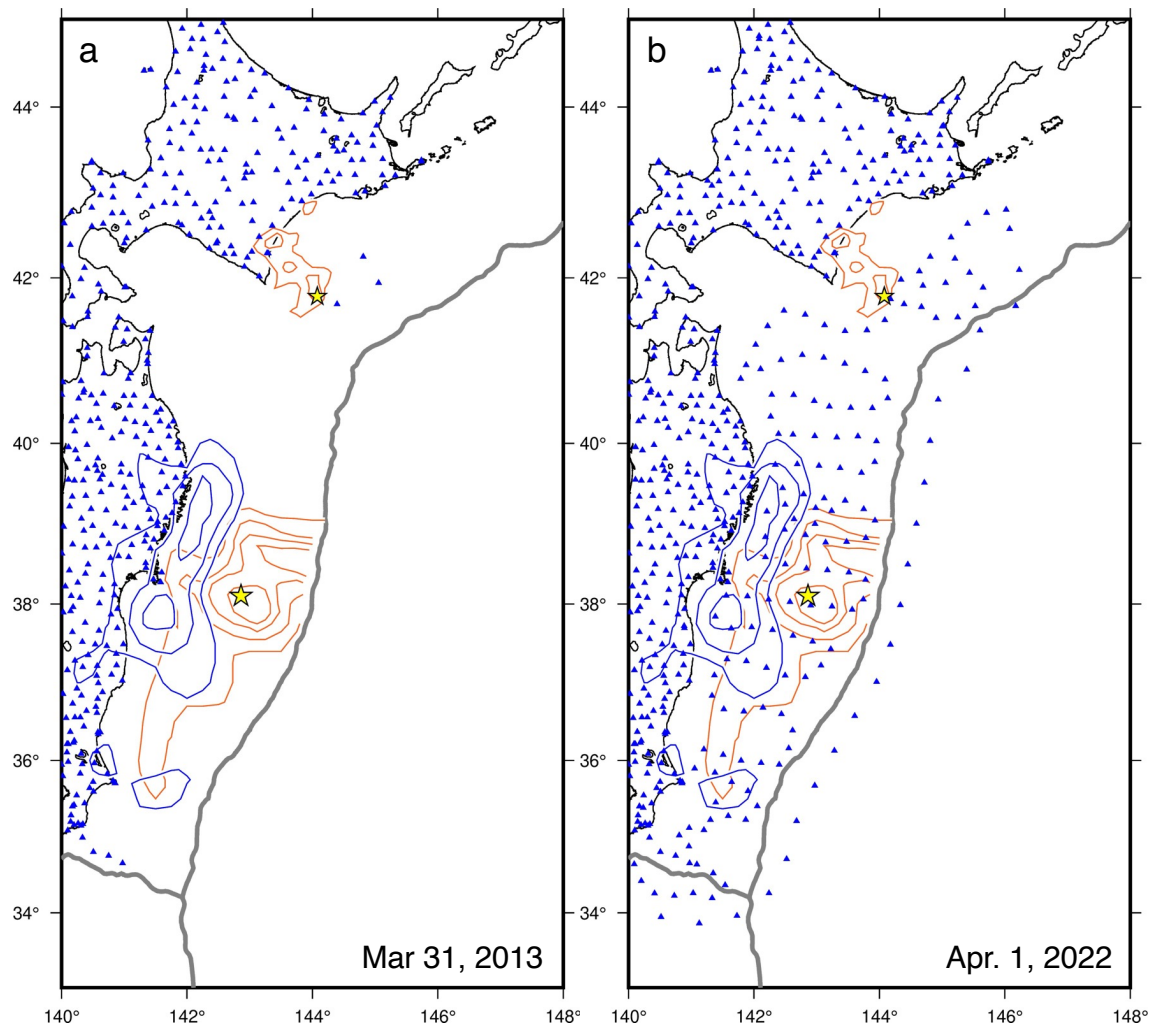


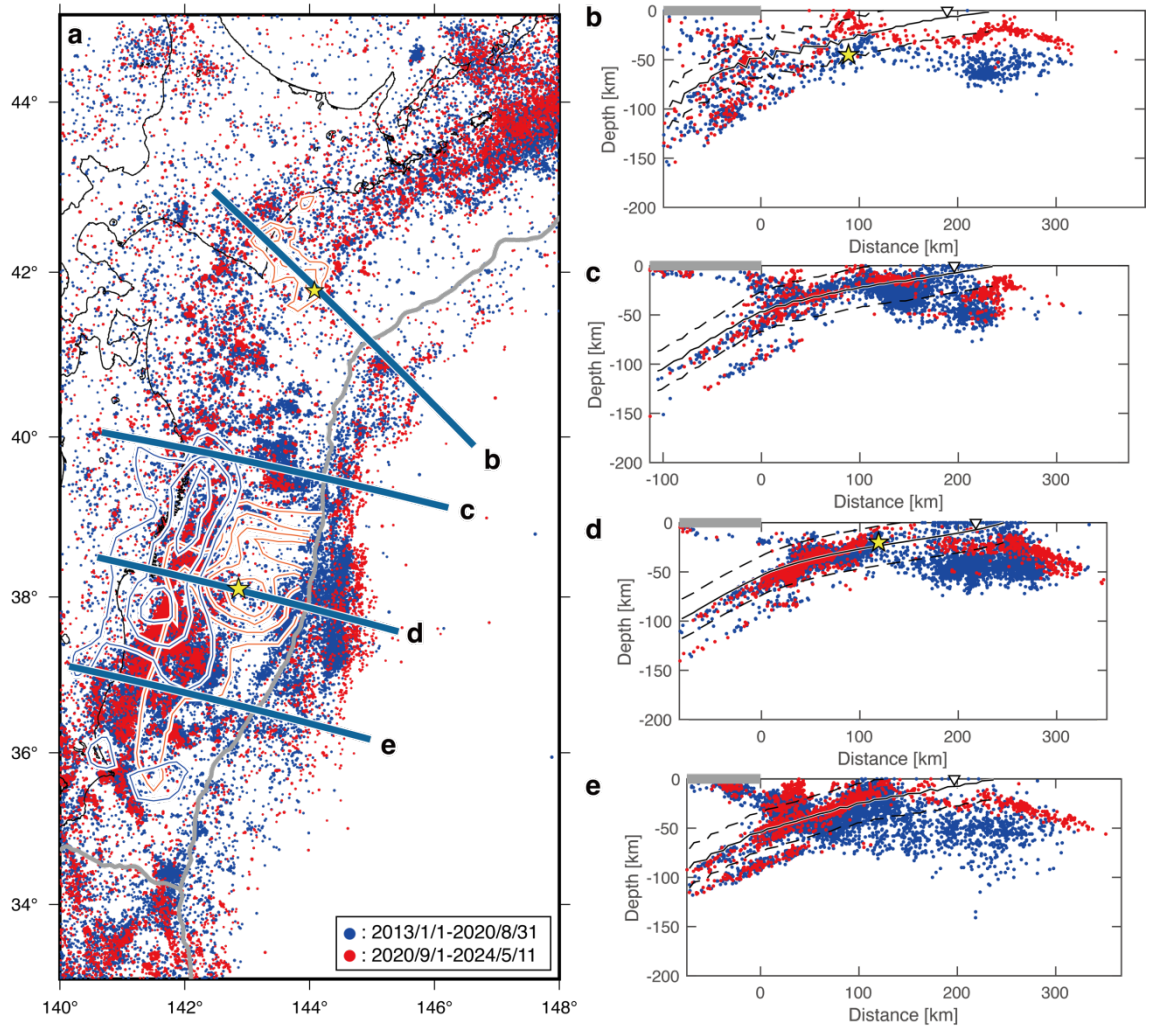
Supplementary Information

Likelihood and unlikelihood of megaquake recurrence
implied by frequency-magnitude distribution of Japanese
seismicity

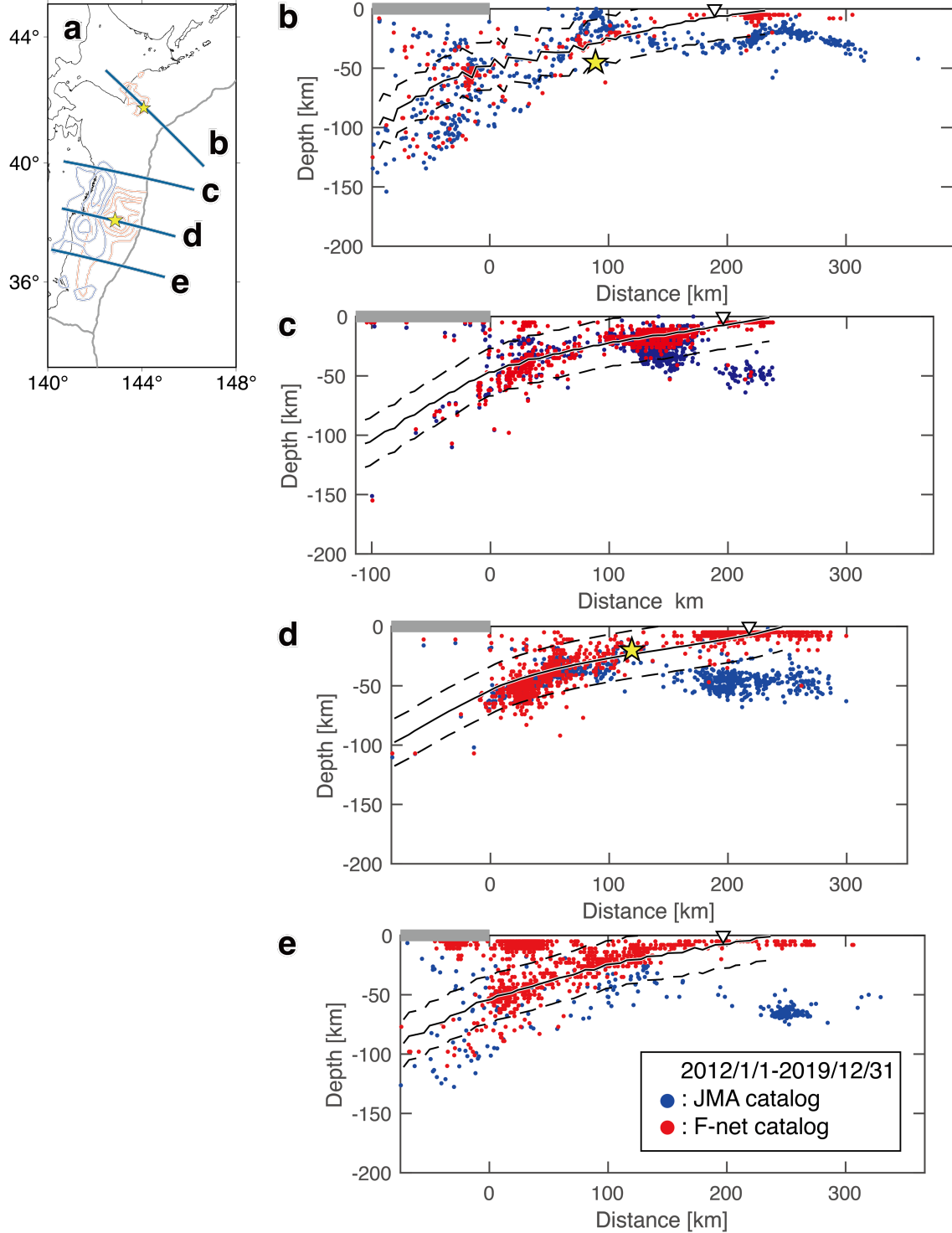
K. Z. Nanjo and T. Hori



Supplementary Fig. 1. Distribution of stations in operation on Mar. 31, 2013 in **a** and Apr. 1, 2022 in **b** (see Data availability). For an explanation of stars, contour lines, and grey curves, see the caption of Fig. 1.

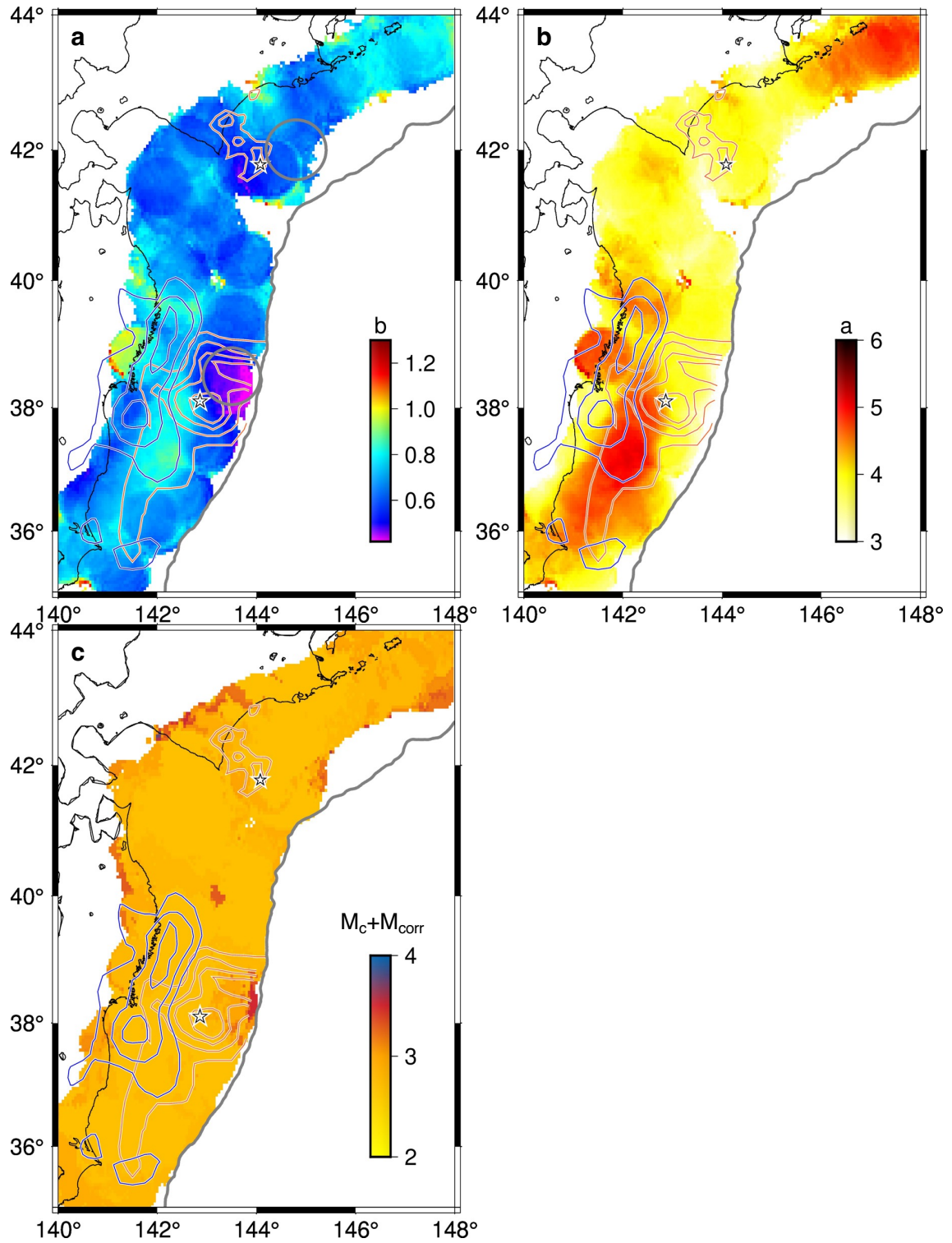


Supplementary Fig. 2. Spatial distribution of earthquakes before and after adding the S-net data. **(a)** Red and blue dots indicate $M \geq 2.5$ earthquakes (depth ≤ 200 km) during the periods Jan. 1, 2013-Aug. 31, 2020 and Sep. 1, 2020-May 11, 2024, respectively. Cross-sectional views along the line segments, indicated by **b-e**, are shown in **b-e**. For an explanation of stars, contour lines, and grey curve, see the caption of Fig. 1. **(b-e)** Plot of depths of earthquakes along the line segments, indicated by **b-e**, with a width of 100 km as a function of distance from the coast, where the right end of the grey bar at depth of 0 km indicates the coast. Black curve indicates the upper surface of the Pacific plate^{54,55}. Dashed curves indicate 20 km above and below this surface. Triangle indicates the trench axis.

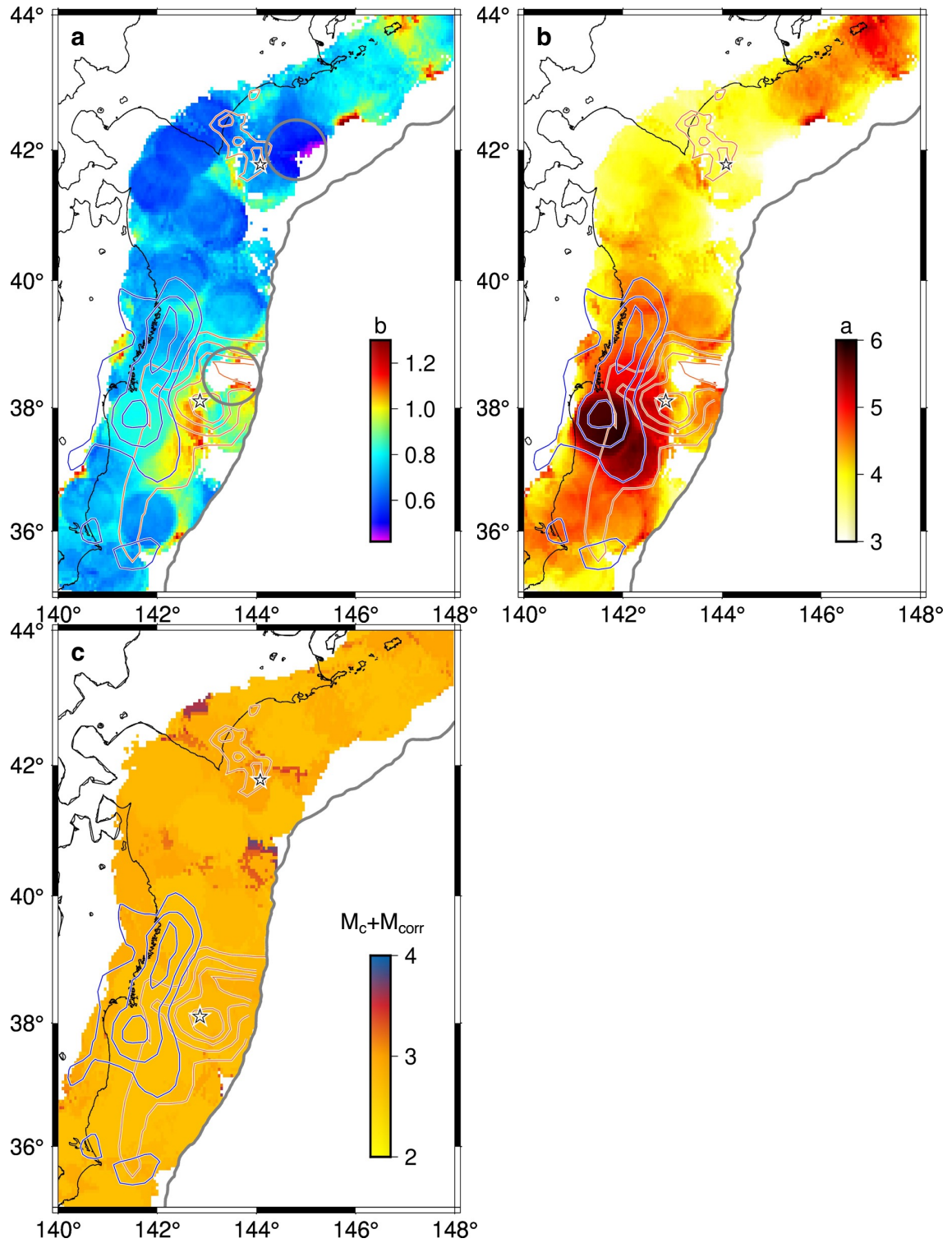


Supplementary Fig. 3. Spatial distribution of earthquakes obtained from the F-net catalog (red dots) and the JMA catalog (blue dots). An earthquake in the F-net catalog was paired with that in the JMA catalog if the time difference between them was within 2 seconds and the epicentral distance between them was less than 30 km, while ignoring one-to-multiple cases. Paired earthquakes during the period from Jan. 1, 2012 to Dec. 31,

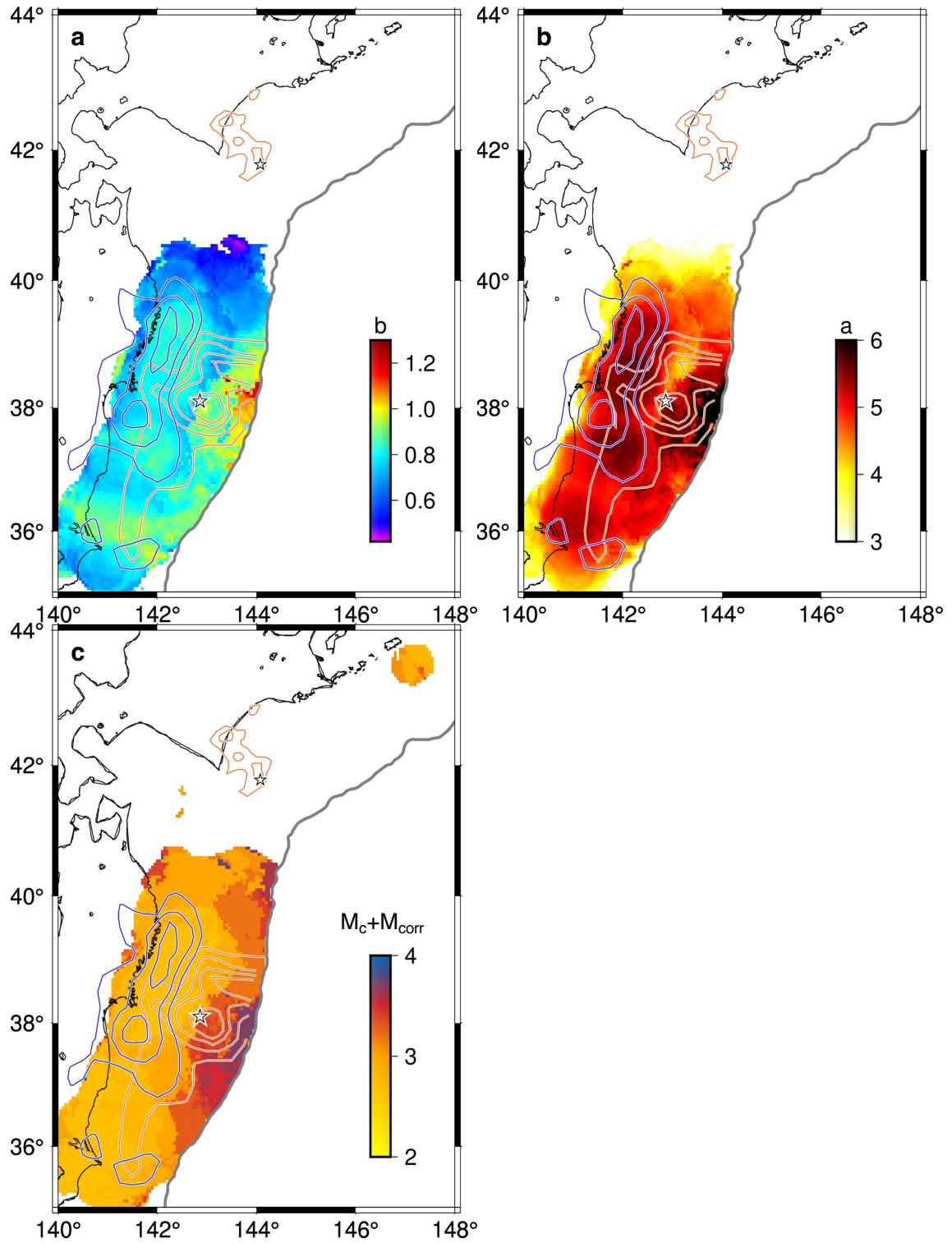
2019 ($\text{depth} \leq 200 \text{ km}$) were used to create graphs in **b-e**. **(a)** Spatial map of line segments, indicated by **b-e**. For the explanation of stars, contour lines, and grey curves, see the caption of Fig. 1. **(b-e)** Plot of depths of earthquakes along the line segments with a width of 100 km as a function of distance from the coast, where the right end of the grey bar at a depth of 0 km indicates the coast. For an explanation of black curve, dashed curves, and triangle, see the caption of Supplementary Fig. 2.



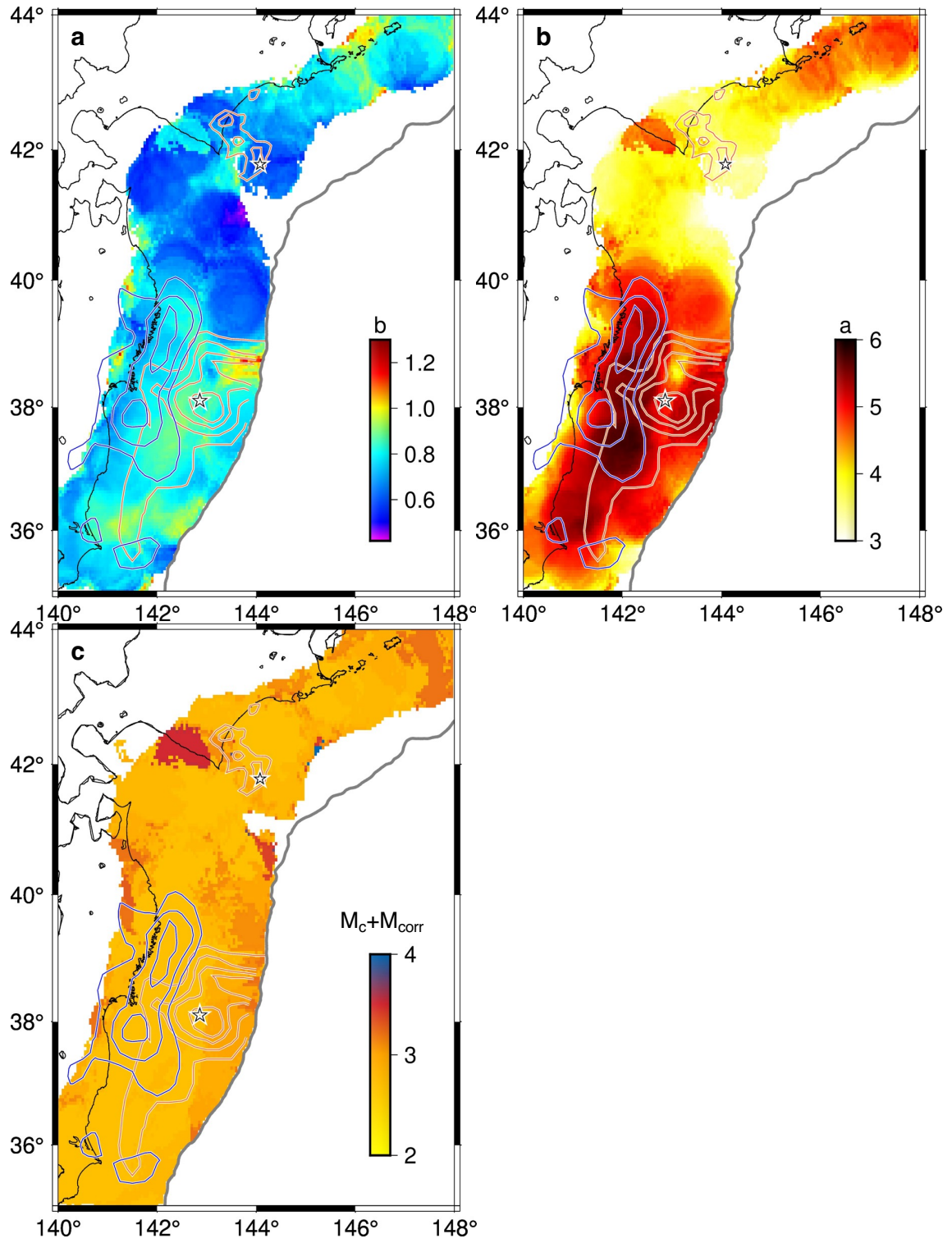
Supplementary Fig. 4. Distributions of b , a , and M_c for the period from 2007 to immediately before the Tohoku earthquake. (a) Same as Fig. 1a. (b) Same as a for a . (c) Same as a for $M_c + M_{\text{corr}}$.



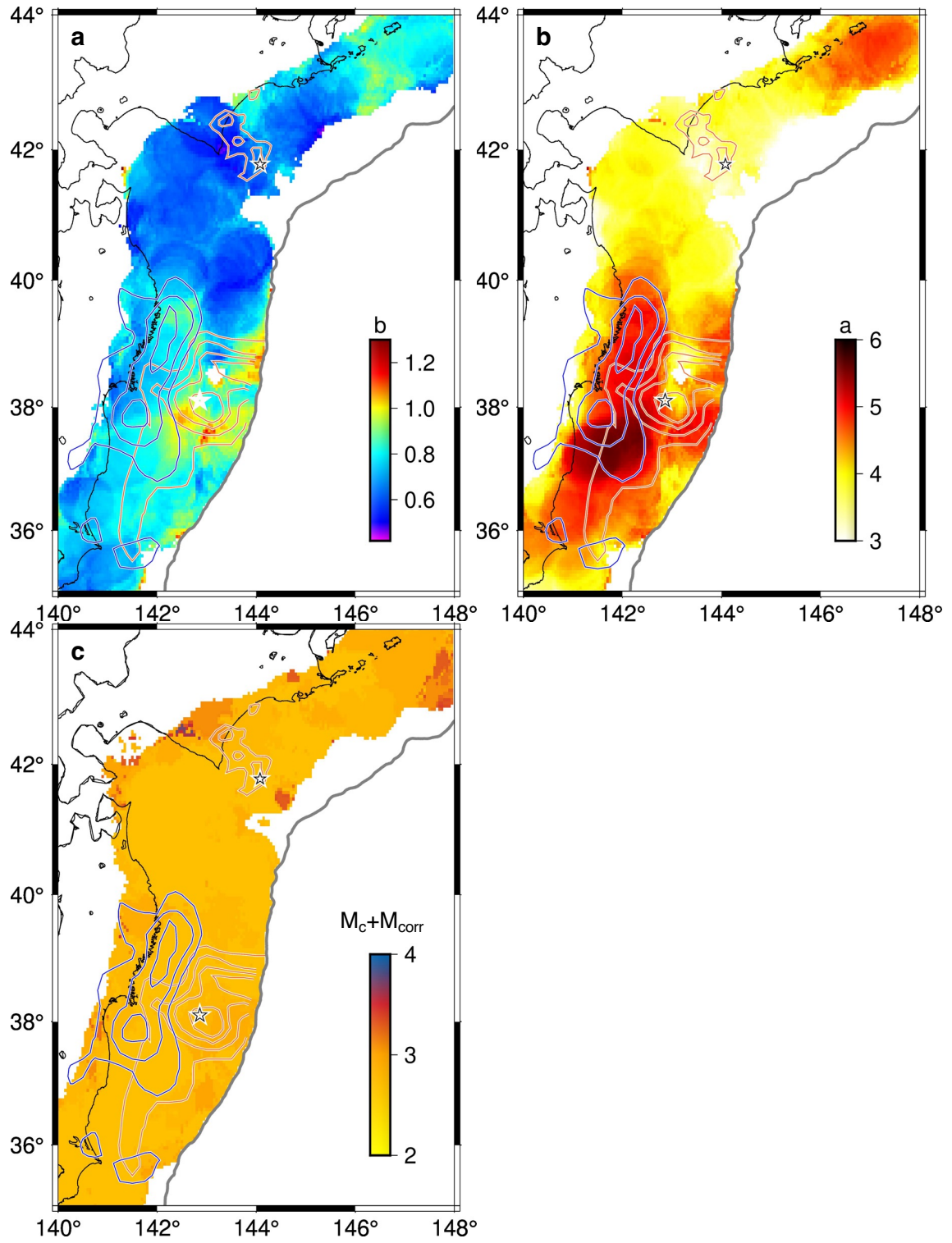
Supplementary Fig. 5. Same as Supplementary Fig. 4 for the period from 2020 to the present (as of May 11, 2024). **a** is the same as Fig. 1b.



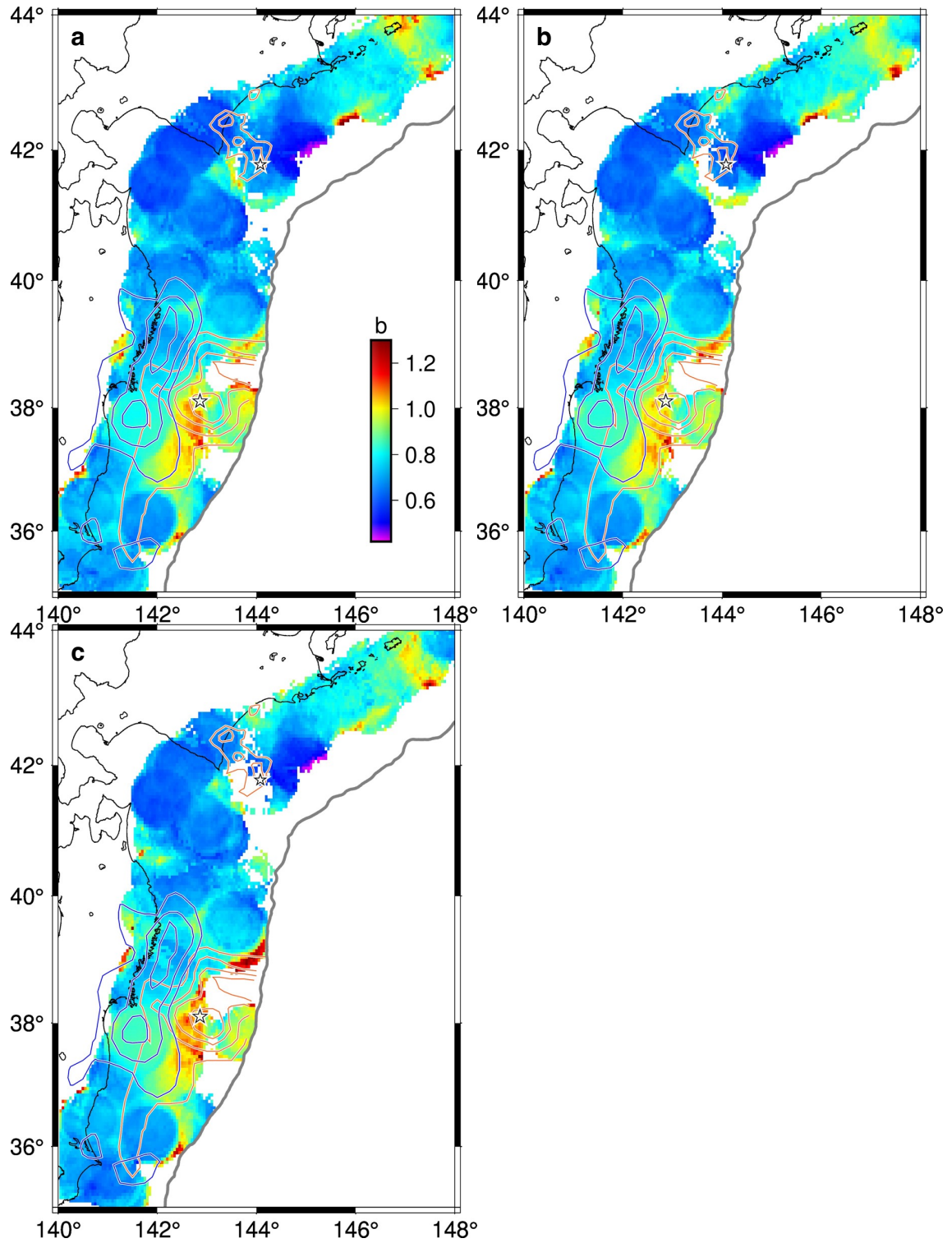
Supplementary Fig. 6. Same as Supplementary Fig. 4 for the period from Mar. 26, 2011 to Jun. 30, 2011. This period is the same as that used by previous study⁹ to show 3 months after the Tohoku aftershocks.



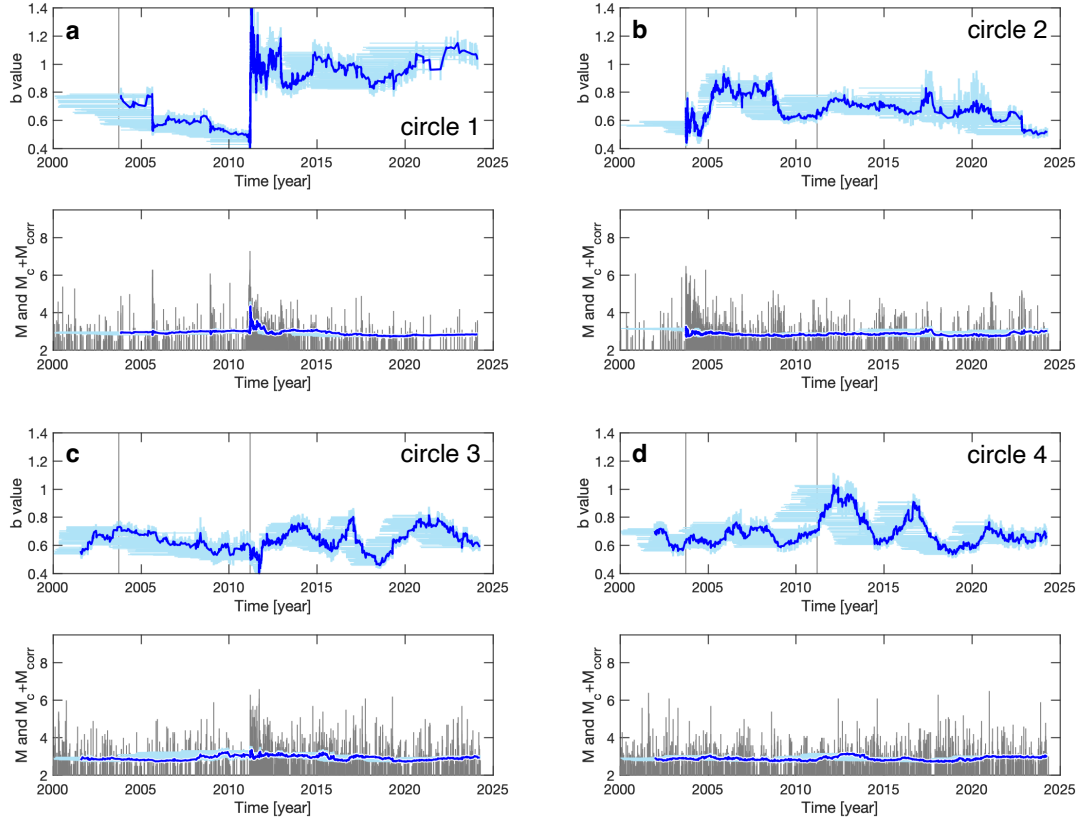
Supplementary Fig. 7. Same as Supplementary Fig. 4 for the period from 2012 to 2015.



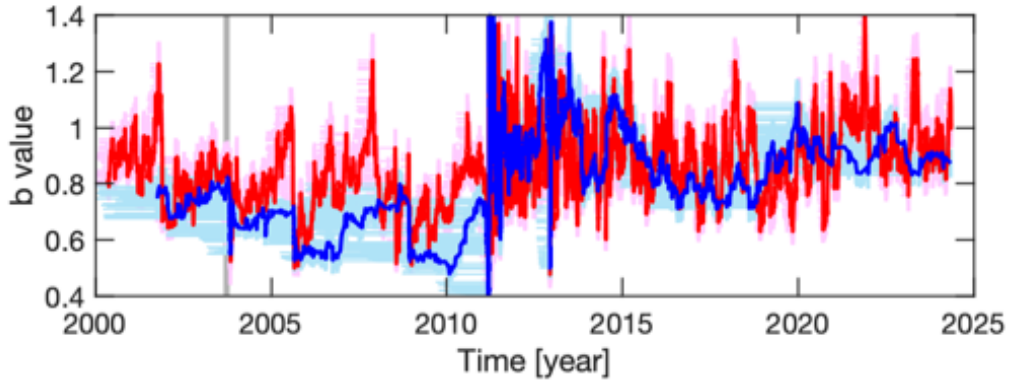
Supplementary Fig. 8. Same as Supplementary Fig. 4 for the period from 2016 to 2019.



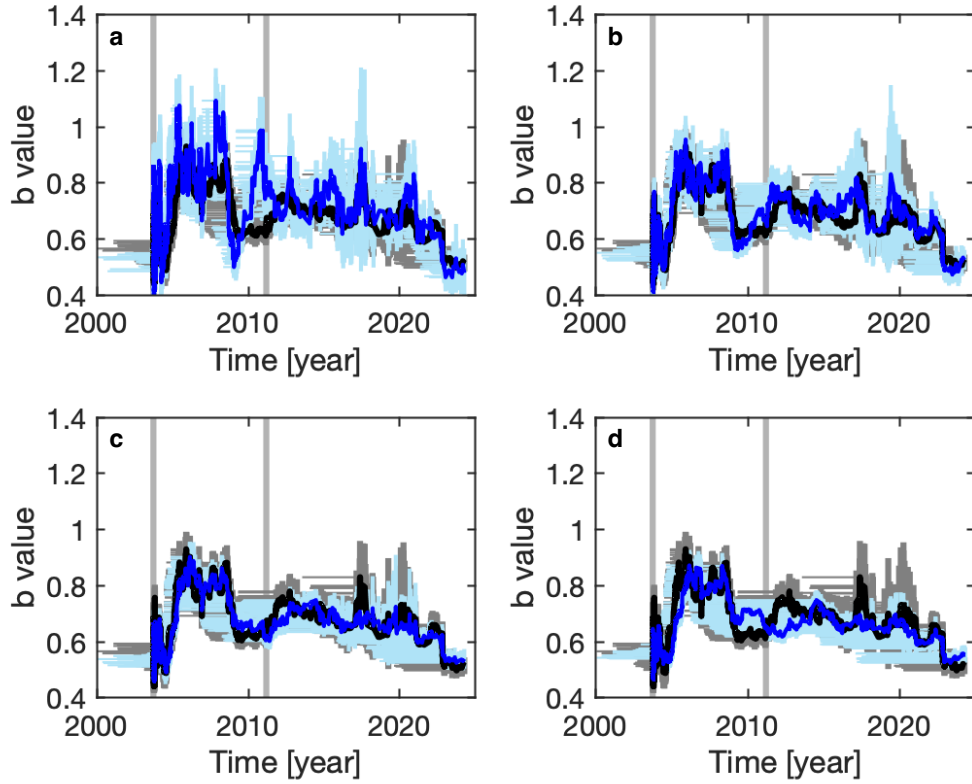
Supplementary Fig. 9. Map view of b -values for different values for M_{corr} : 0.2 in **a**, 0.3 in **b**, and 0.4 in **c**. b -values in **a** are the same as those in Fig. 1b.



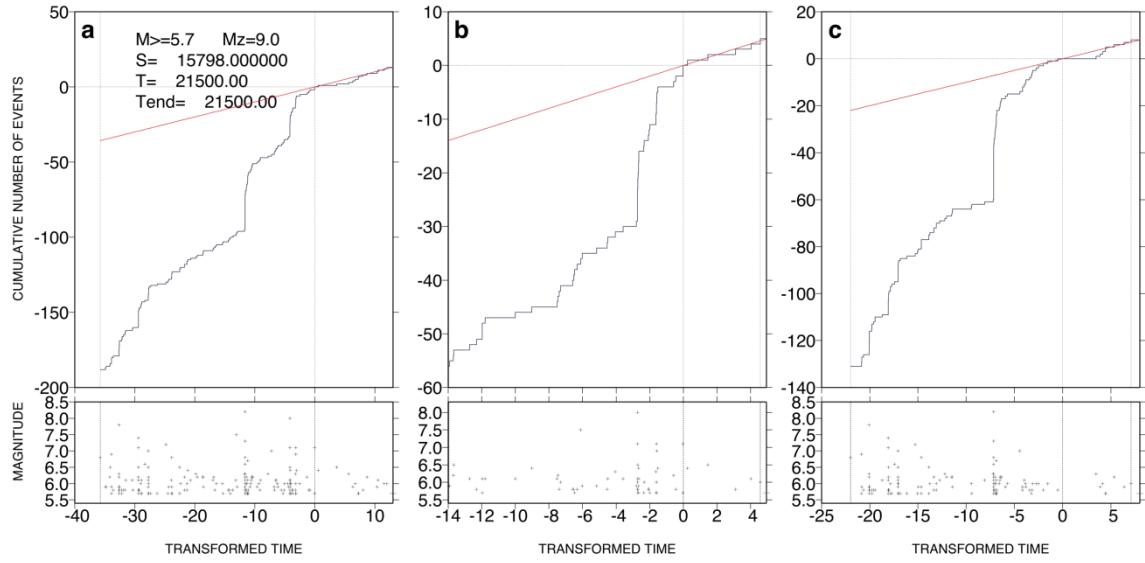
Supplementary Fig. 10. Plot of b values as a function of time. **(a)** Top panel: same as Fig. 2a except that the result obtained for circle 1 is only shown. We plotted b -values from temporal analysis were plotted at the end of the moving window (horizontal bar) that they represent. Bottom panel: M -time diagram. Also included is the time dependence of $M_c + M_{corr}$ ($M_{corr}=0.2$). **(b-d)** Same as **a** except that the result obtained for circles 2-4 is shown.



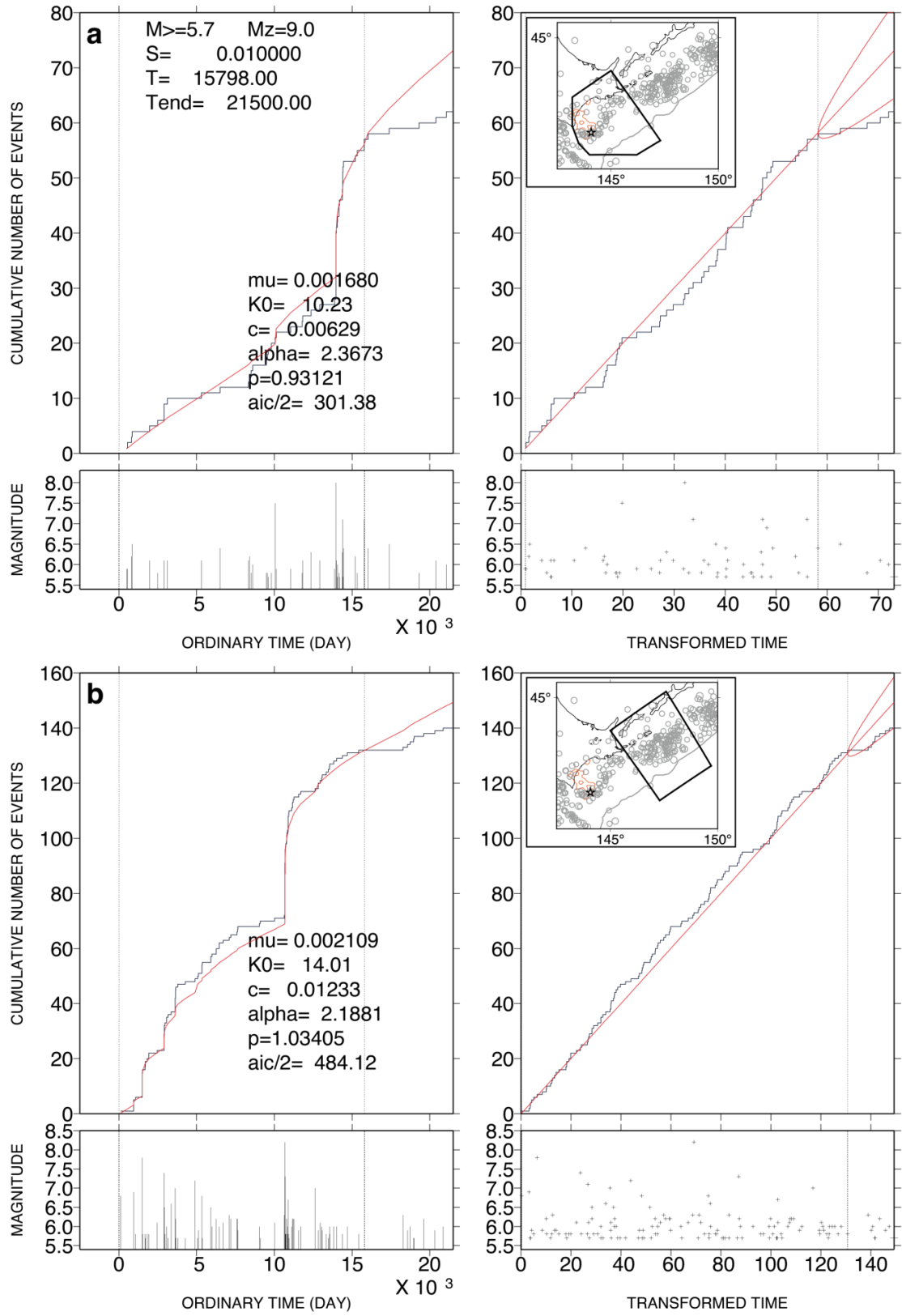
Supplementary Fig. 11. Plot of b values as a function of time (blue curve) for seismicity ($M \geq 2.5$) in the rectangular region shown in Fig. 2a of Nanjo et al.²⁰. We employed the same moving window procedure as for Fig. 2. Red curve: same as the blue curve except for seismicity ($M \geq 2.5$) inside the Tohoku 10-m-slip contour obtained by a previous study⁶⁹. This region was used for computing the b -value timeseries shown in Fig. 3 of Tormann et al.⁹. Again, the same moving window procedure used in Fig. 2 was employed. Thick vertical lines indicate moments of the 2003 Tokachi earthquake. Thick vertical line showing the moment of the 2011 Tohoku earthquake (2011.19 years) was overlapped by blue and red curves.



Supplementary Fig. 12. Comparison of b -value timeseries for different sampling windows. **(a)** Black curve is the same as the blue curve in Fig. 2a. Blue curve is the same as that in Fig. 2a except for a smaller window (50 events). Also included is a black curve, which is same as the blue curve in Fig. 2a. For a description of the vertical grey lines, see the caption of Fig. 2. **(b-d)** Same as **a** for 80, 120, 150 events.



Supplementary Fig. 13. (a) Same as the right panel of Fig. 3a except that the target interval is from Oct. 1, 2008 to May 11, 2024. (b,c) Same as the left and right panels of Fig. 3b, respectively, except that the target interval is from Oct. 1, 2008 to May 11, 2024.



Supplementary Fig. 14. (a) Left panel: same as the left panel of Fig. 3b except that ordinary time was used. Right panel: same as the left panel of Fig. 3b. (b) Left panel:

same as the right panel of Fig. 3**b** except that ordinary time was used. Right panel: same as the right panel of Fig. 3**b**.