

# Supplementary Material for the paper entitled “A remarkable change of the entropy of seismicity in natural time under time reversal before the super-giant M9 Tohoku earthquake on 11 March 2011”

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## Contents of this file

1. Figures S1 to S21

**Introduction** This supplementary material is focused on the investigation concerning the robustness of the results of the main text in respect to the maximum depth of

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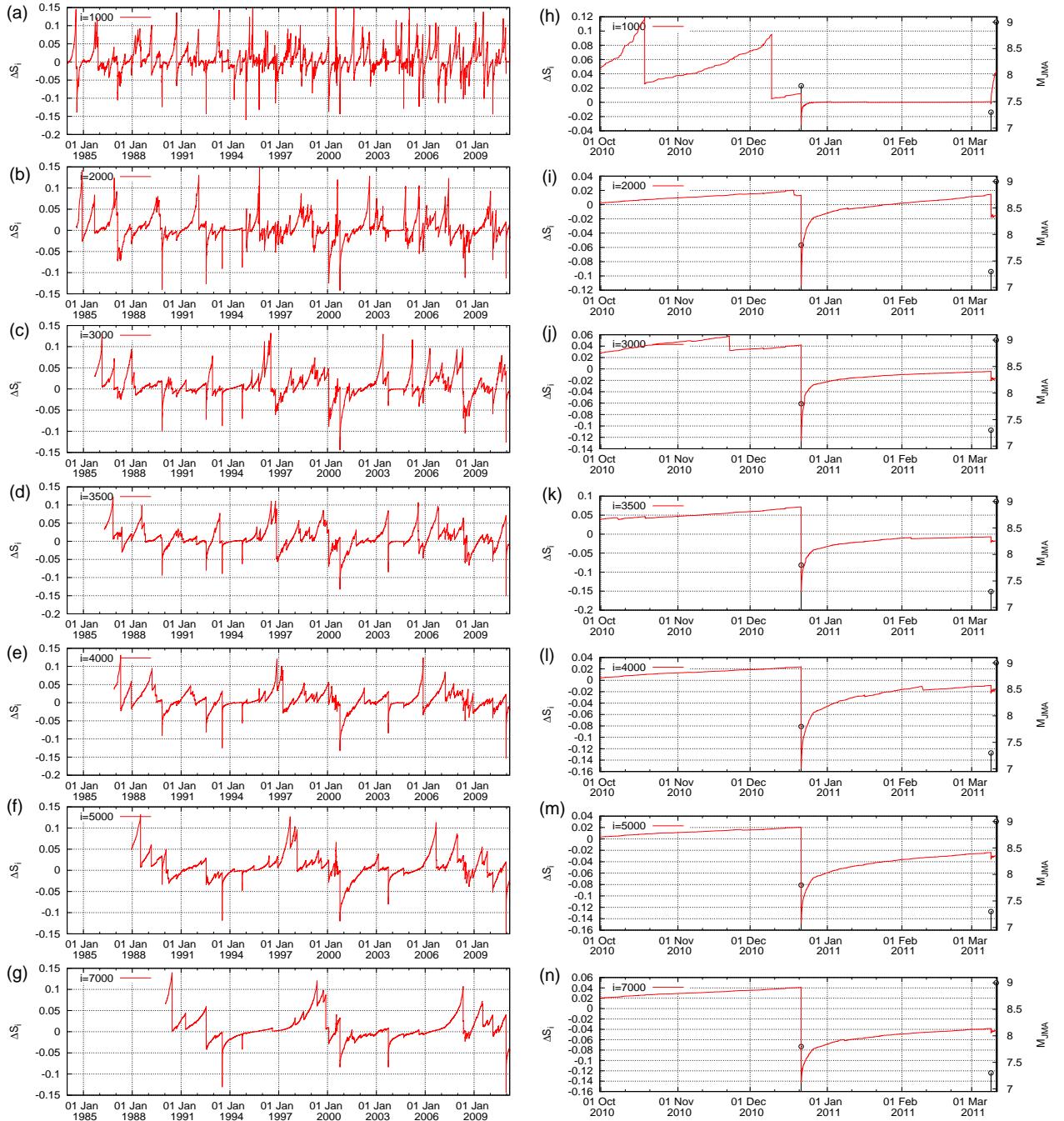
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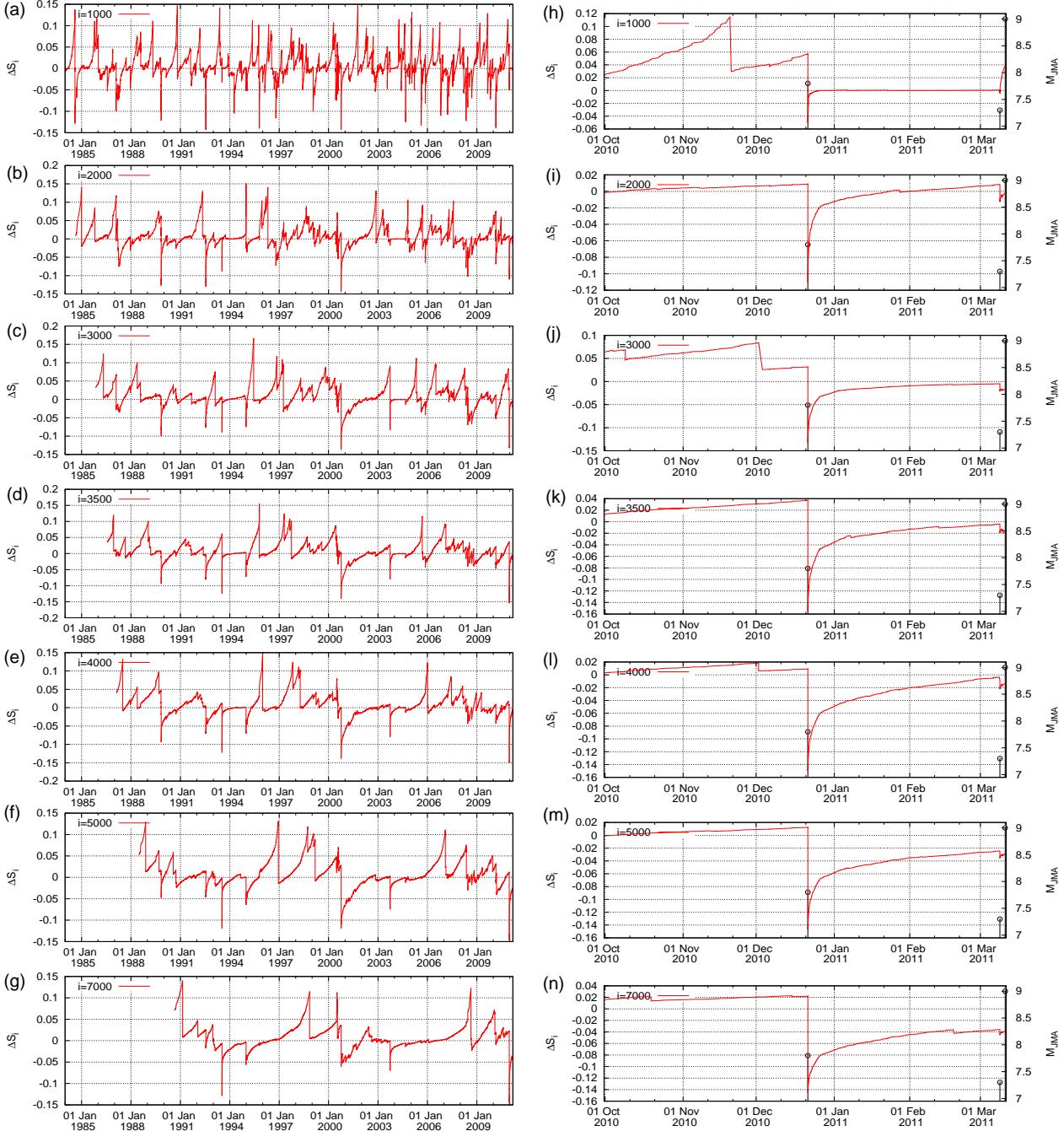
the EQs considered (Figs S1 to S4), the magnitude threshold  $M_{thres}$  (Figs S5 to S8), and the size of the studied area (Figs S9 to S21). Concerning the size of the studied area, Figs S9-S12 refer to  $20^\circ \times 20^\circ$  areas, and Figs S13-S21 to  $19^\circ \times 19^\circ$  areas.



**Figure S1.** (color online)  $\Delta S_i$  values versus the conventional time for the larger area as Fig 2 of the main text a to g but only for the shallow EQs of depth  $h \leq 70\text{km}$  (see [https://earthquake.usgs.gov/learn/topics/determining\\_depth.php](https://earthquake.usgs.gov/learn/topics/determining_depth.php)). Their corresponding  $\sim 5\frac{1}{2}$  month excerpts from 1 October 2010 until the M9 Tohoku EQ occurrence on 11 March 2011 are shown (as in Fig 3) in h to n, respectively.

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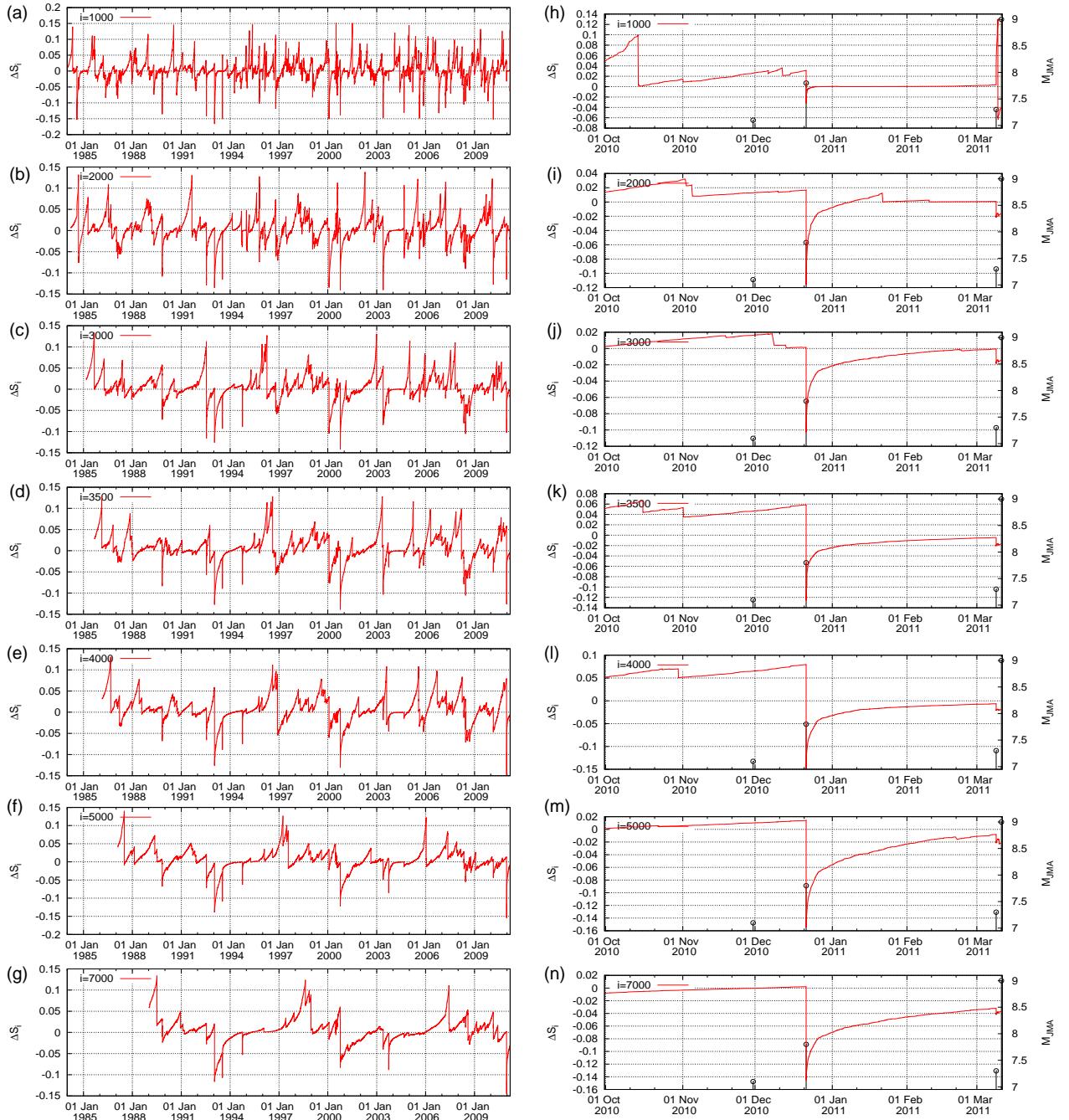
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**Figure S2.** (color online)  $\Delta S_i$  values versus the conventional time for the smaller area as Fig 4 of the main text a to g but only for the shallow EQs of depth  $h \leq 70\text{km}$  (see [https://earthquake.usgs.gov/learn/topics/determining\\_depth.php](https://earthquake.usgs.gov/learn/topics/determining_depth.php)). Their corresponding  $\sim 5\frac{1}{2}$  month excerpts from 1 October 2010 until the M9 Tohoku EQ occurrence on 11 March 2011 are shown (as in Fig 5) in h to n, respectively.

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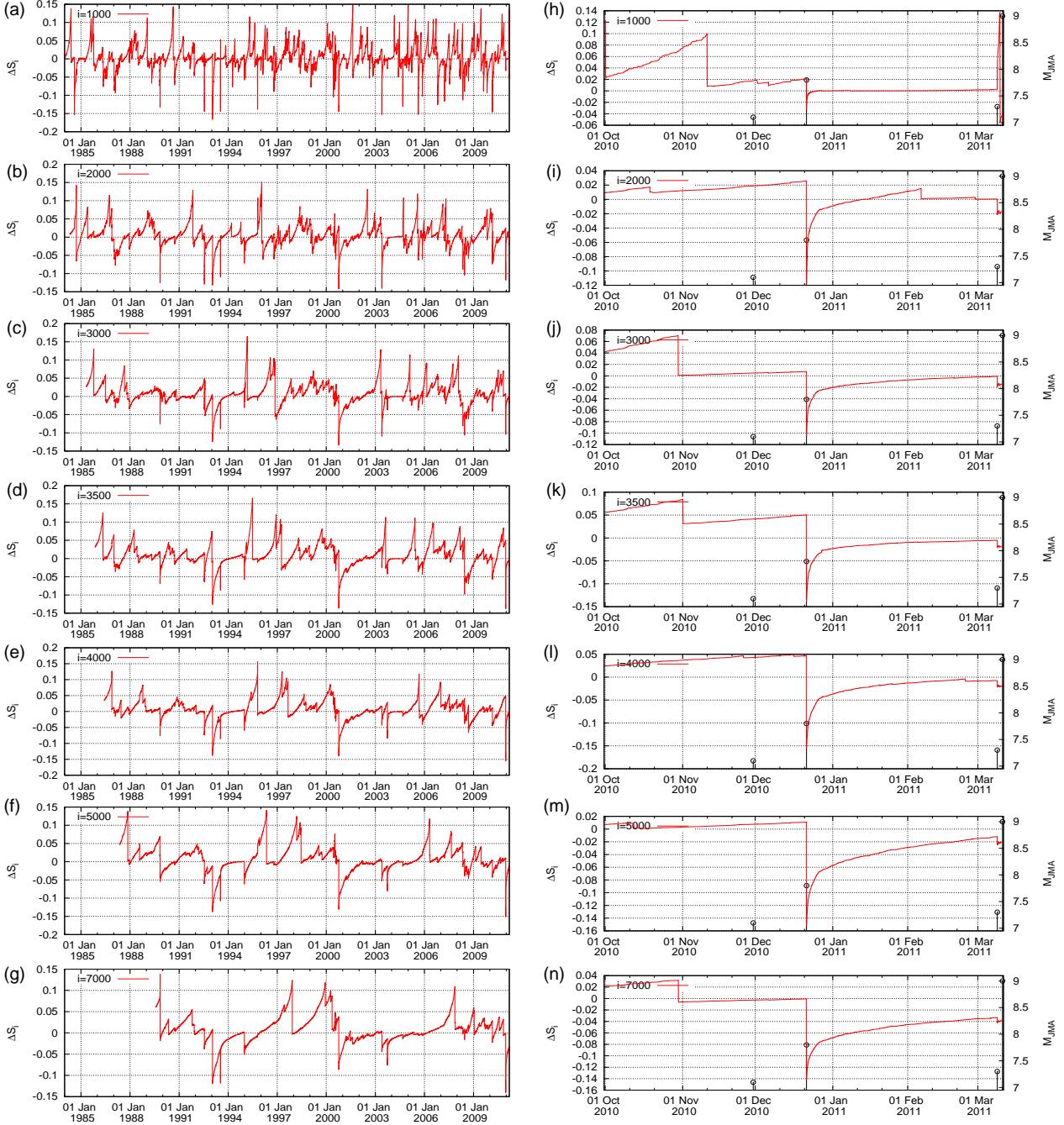


**Figure S3.** (color online)  $\Delta S_i$  values versus the conventional time for the larger area

as Fig 2 of the main text a to g but only for both shallow and intermediate depth EQs with depth  $h \leq 300\text{km}$  (see [https://earthquake.usgs.gov/learn/topics/determining\\_depth.php](https://earthquake.usgs.gov/learn/topics/determining_depth.php)). Their corresponding  $\sim 5\frac{1}{2}$  month excerpts from 1 October 2010 until the M9 Tohoku EQ occurrence on 11 March 2011 are shown (as in Fig 3) in h to n, respectively.

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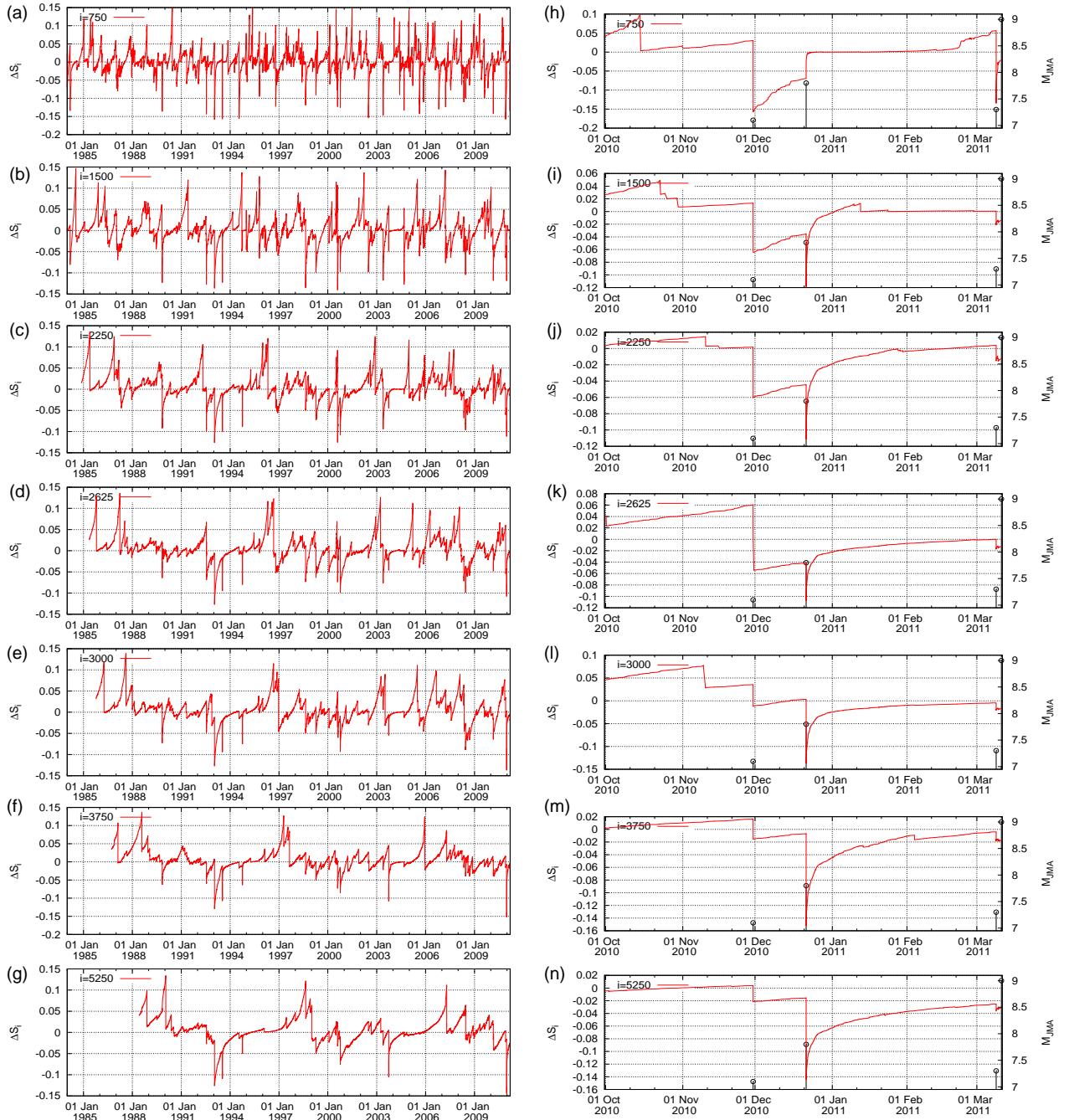
**Figure S4.** (color online)  $\Delta S_i$  values versus the conventional time for the smaller area

as Fig 4 of the main text a to g but only for both shallow and intermediate depth EQs with depth  $h \leq 300\text{km}$  (see <https://earthquake.usgs.gov/learn/topics/determining-depth.php>). Their corresponding  $\sim 5\frac{1}{2}$  month excerpts from 1 October 2010 until the M9 Tohoku EQ occurrence on 11 March 2011 are shown (as in Fig 5) in h to n, respectively.

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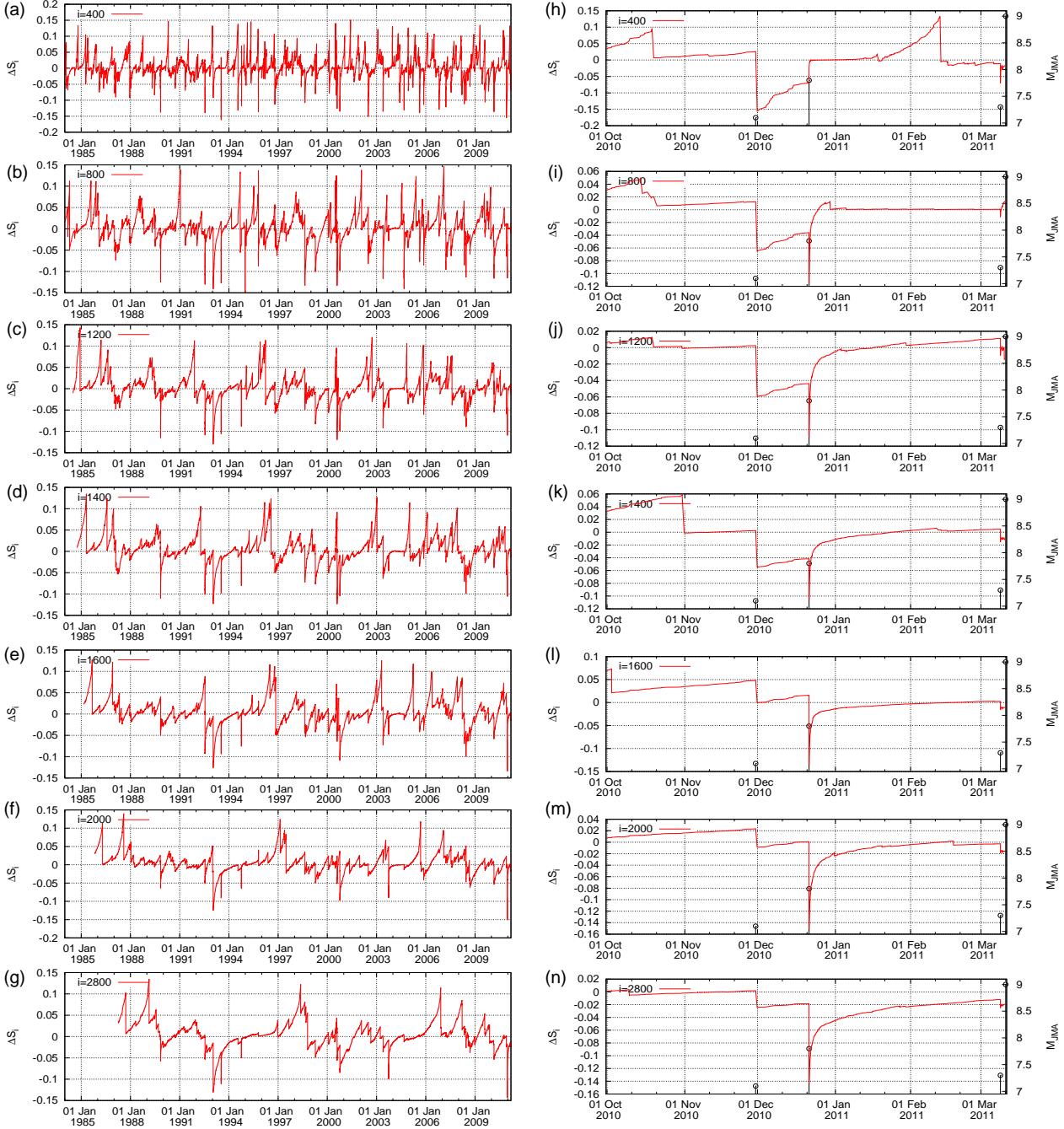


**Figure S5.** (color online)  $\Delta S_i$  values versus the conventional time for the larger ( $25^\circ - 46^\circ\text{N}$ ,  $125^\circ - 148^\circ\text{E}$ ) area as Figs 2 and 3 of the main text but only for EQs with  $M \geq 3.7$ .

Since the number of EQs with  $M \geq 3.5$  is approximately one and a half times larger than that for  $M \geq 3.7$ , the scales  $i$  presented here are smaller by a factor of 1.5 compared to Figs 2 and 3, and hence panels a to g (as well as h to n) correspond to the scales  $i = 750, 1500, 2250, 2625, 3000, 3750$ , and  $5250$ , respectively.

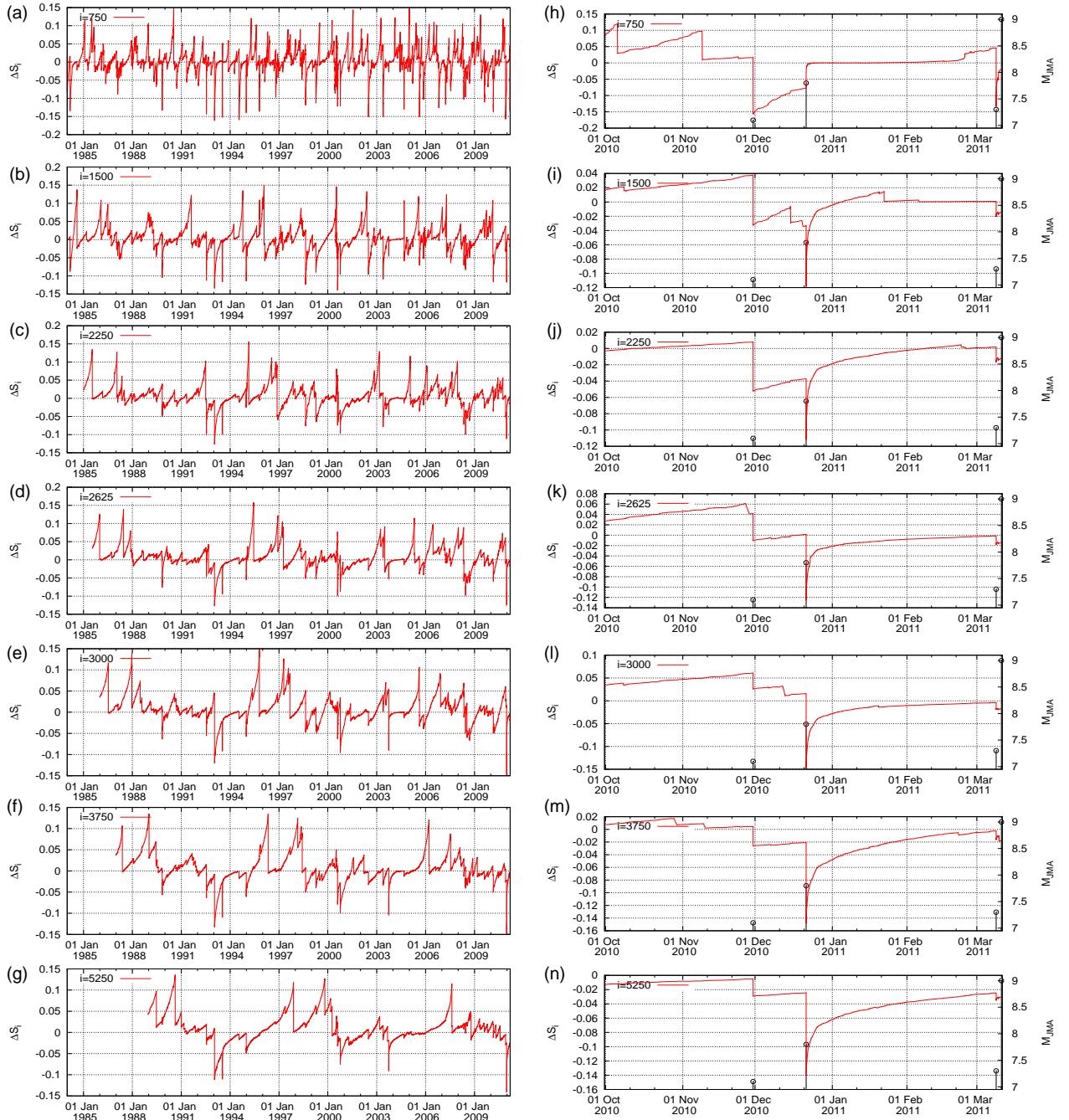
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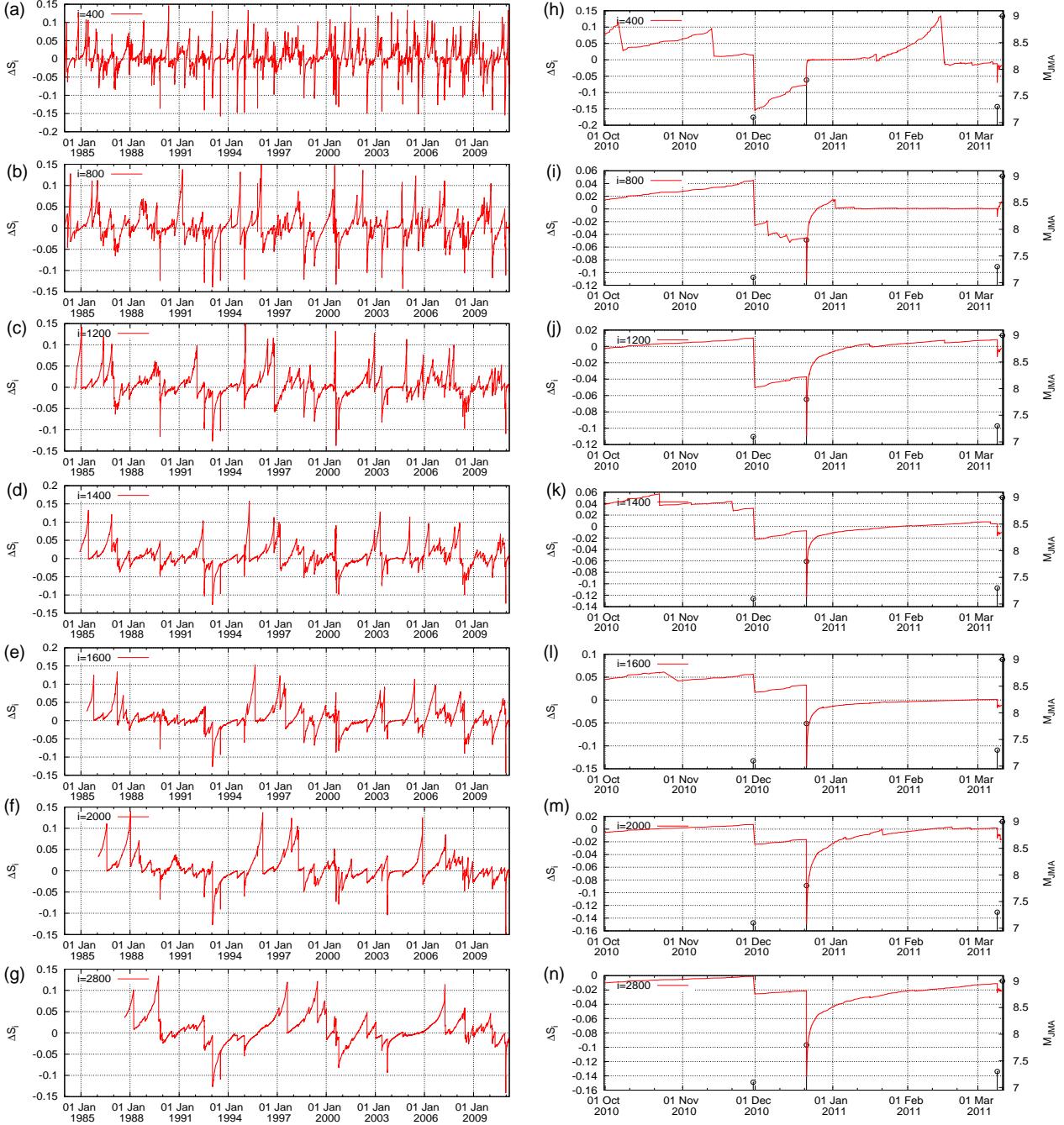
**Figure S6.** (color online)  $\Delta S_i$  values versus the conventional time for the larger ( $25^\circ - 46^\circ\text{N}$ ,  $125^\circ - 148^\circ\text{E}$ ) area as Figs 2 and 3 of the main text but only for EQs with  $M \geq 4.0$ .

Since the number of EQs with  $M \geq 3.5$  is approximately two and a half times larger than that for  $M \geq 4.0$ , the scales  $i$  presented here are smaller by a factor of 2.5 compared to Figs 2 and 3, and hence panels a to g (as well as h to n) correspond to the scales  $i = 400, 800, 1200, 1400, 1600, 2000$ , and  $2800$ , respectively.



**Figure S7.** (color online)  $\Delta S_i$  values versus the conventional time for the smaller ( $25^\circ - 46^\circ\text{N}$ ,  $125^\circ - 146^\circ\text{E}$ ) area as Figs 4 and 5 of the main text but only for EQs with  $M \geq 3.7$ .

Since the number of EQs with  $M \geq 3.5$  is approximately one and a half times larger than that for  $M \geq 3.7$ , the scales  $i$  presented here are smaller by a factor of 1.5 compared to Figs 4 and 5, and hence panels a to g (as well as h to n) correspond to the scales  $i = 750, 1500, 2250, 2625, 3000, 3750$ , and 5250, respectively.

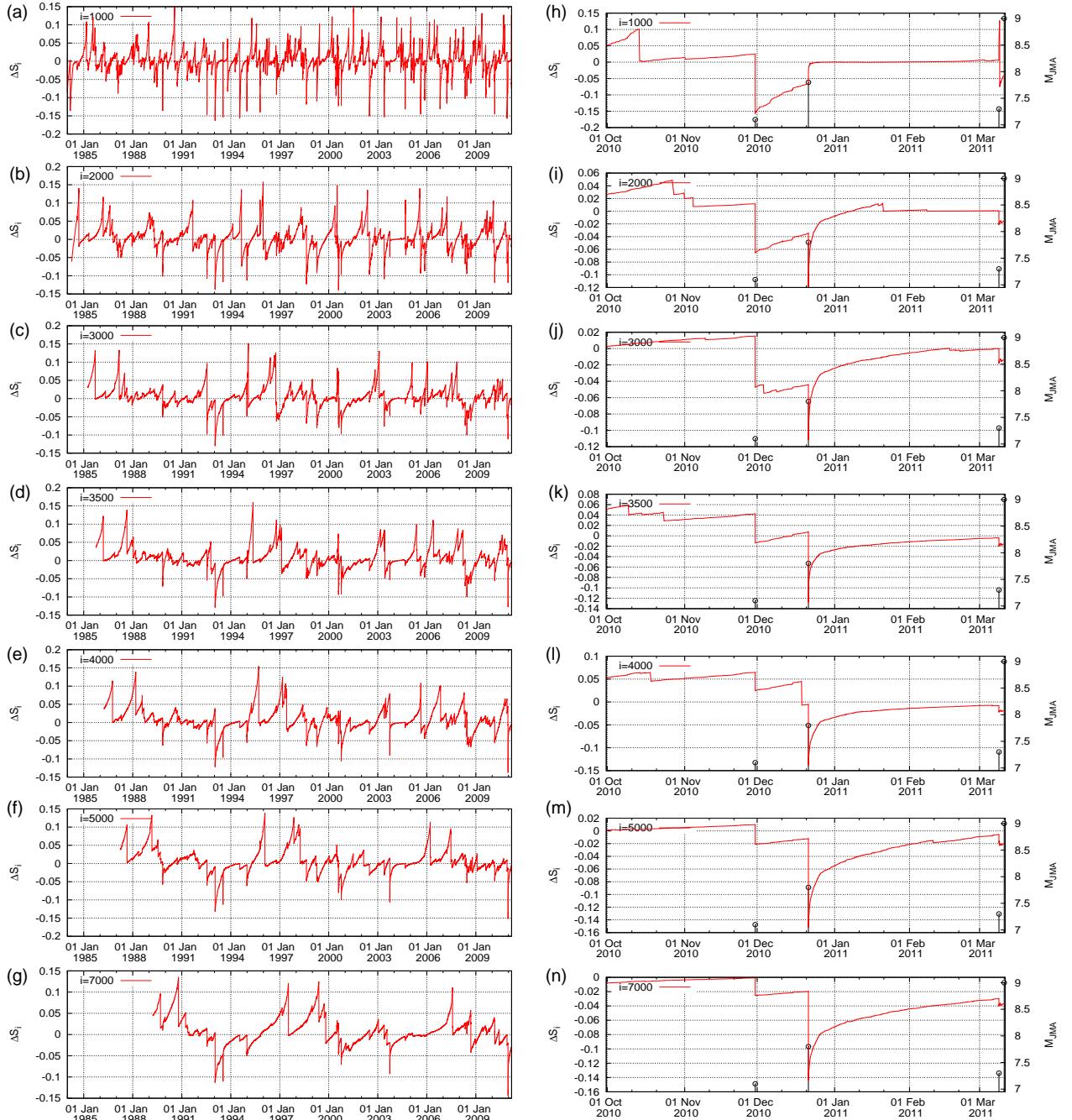


**Figure S8.** (color online)  $\Delta S_i$  values versus the conventional time for the smaller ( $25^\circ - 46^\circ\text{N}$ ,  $125^\circ - 146^\circ\text{E}$ ) area as Figs 4 and 5 of the main text but only for EQs with  $M \geq 4.0$ .

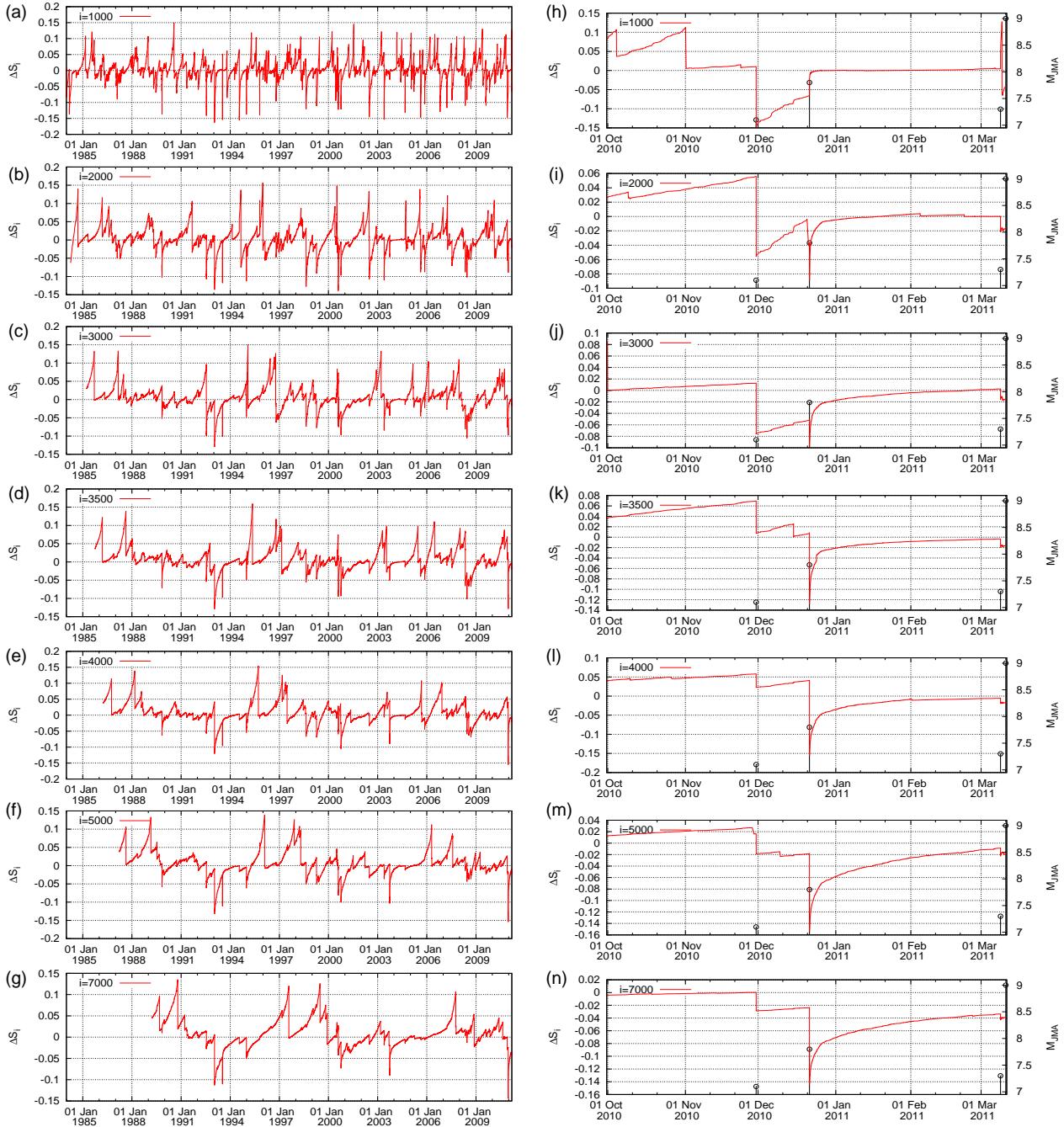
Since the number of EQs with  $M \geq 3.5$  is approximately two and a half times larger than that for  $M \geq 4.0$ , the scales  $i$  presented here are smaller by a factor of 2.5 compared to Figs 2 and 3, and hence panels a to g (as well as h to n) correspond to the scales  $i = 400, 800, 1200, 1400, 1600, 2000$ , and  $2800$ , respectively.

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**Figure S9.** (color online)  $\Delta S_i$  values versus the conventional time for the  $20^\circ \times 20^\circ$  area  $25^\circ - 45^\circ\text{N}$ ,  $125^\circ - 145^\circ\text{E}$ .



**Figure S10.** (color online)  $\Delta S_i$  values versus the conventional time for the  $20^\circ \times 20^\circ$  area

$26^\circ - 46^\circ\text{N}$ ,  $125^\circ - 145^\circ\text{E}$ .