Source Geometry and Causes of the 2019 Ms6.0 Changning Earthquake in Sichuan, China Based on InSAR

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Introduction

This document contains text and figures that are not the core of the research but can play a supporting role or are not easy to put into the main manuscript. There are 1 text and 7 figures in total.

Text 1 describes the details of the Monte Carlo analysis of FMS

Figure S1 shows the wrapped co-seismic deformation and coherence of the Changning event.

Figure S2 shows the sampling results of the coseismic defomation.

Figure S3 shows the Monte Carlo analysis result of FMS

Figure S4 shows the slip model of P2.

Figure S5 shows the accumulated water loss of salt mines。

Figure S6 shows the deformation of two aftershocks observed by Sentinel-1.

Figure S7 shows the forward results of P1 and P2.

Text S1. the Monte Carlo analysis of FMS

We conduct the Monte Carlo analysis of FMS. Based on the model, we first forward the surface deformation, and then add a random error with the mean of 0 and the standard deviation of 5 mm to each point of deformation, resulting in 200 sets of simulated deformations. Then the 200 sets of deformation are used for linear inversion. Finally, the standard deviation of 200 inversion results on each patch is calculated (Fig. S3). The results can reflect the robustness of the model. The smaller the overall standard deviation is, the more robust the model is and the more reliable the results are. The result shows that the model is stable and the maximum standard deviation is 1.0 cm.

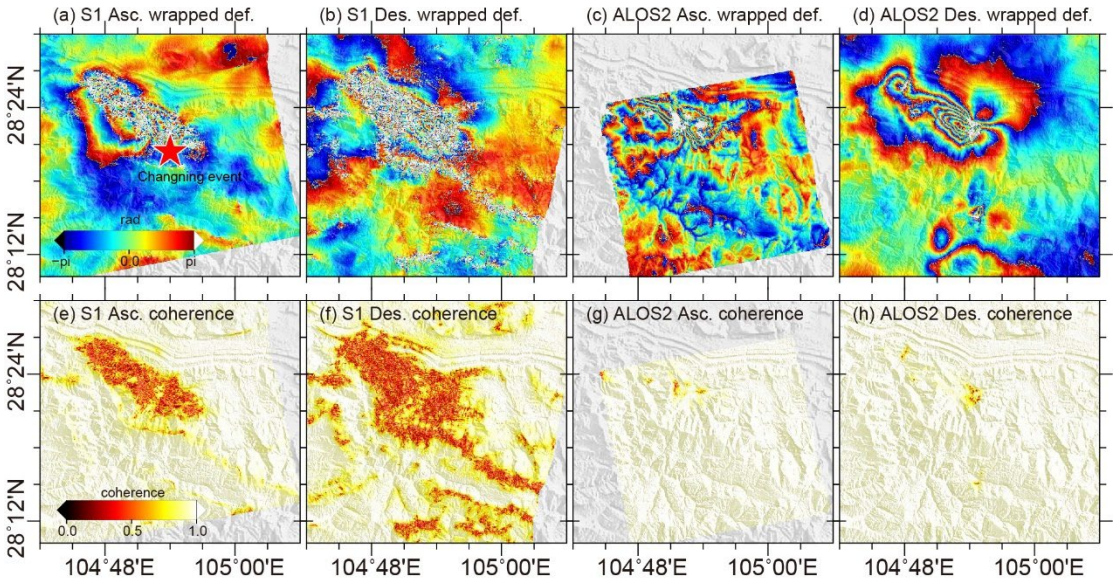

Figure S1. The co-seismic deformation (wrapped by 2.8 cm per cycle) and coherence of the Changning event observed by Sentinel-1 and ALOS2.

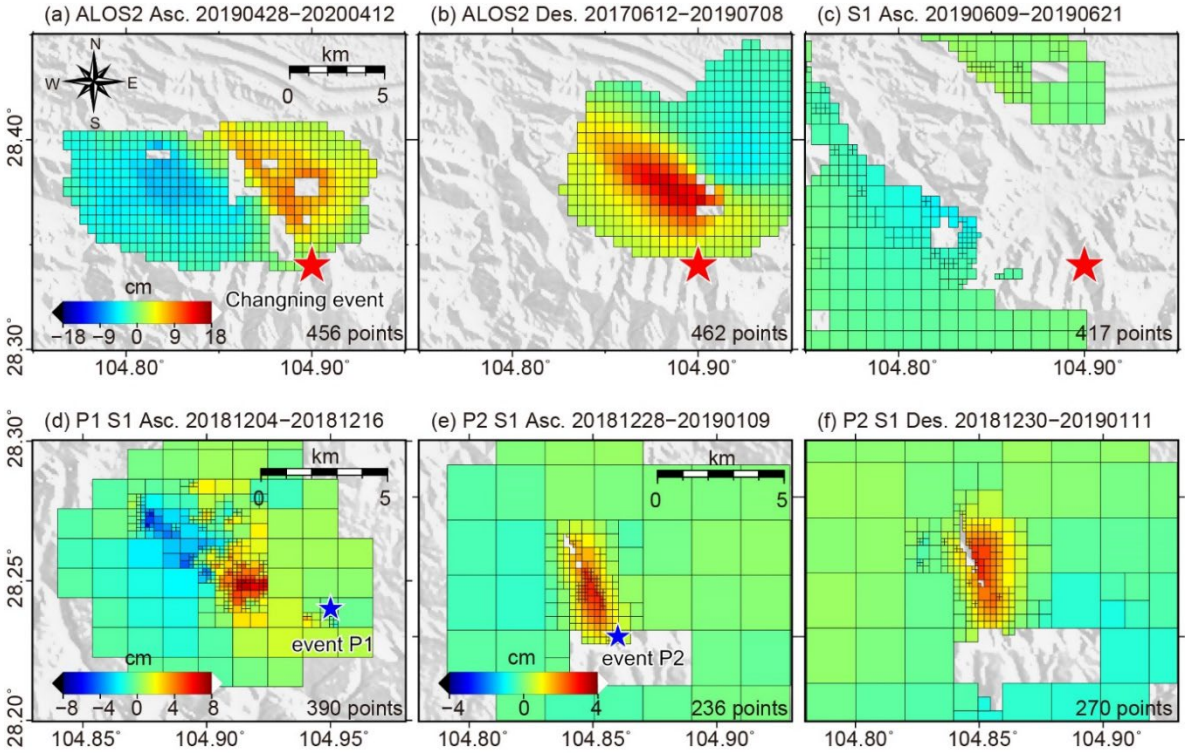

Figure S2. The deformation points participating in inversion after quadtree sampling. (**a**–**c**) the Changning event. (**d**) P1. (**e**,**f**) P2.

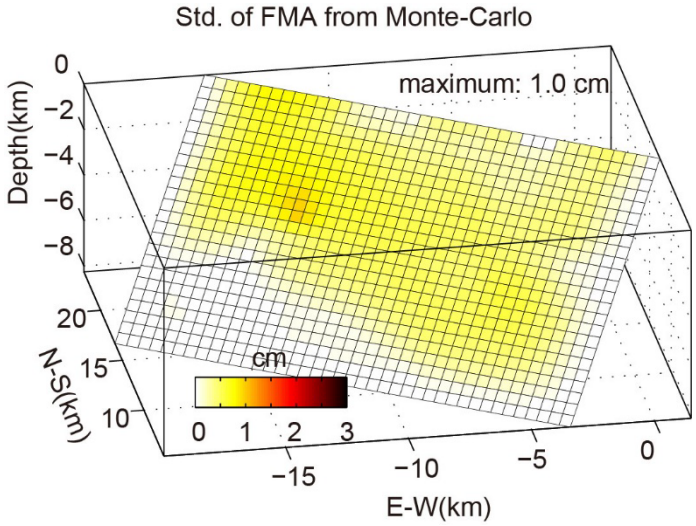

Figure S3. The Monte Carlo analysis result of FMS. The color in the figure represents the standard deviation (Std.) of 200 inversion results on each patch. The maximum is 1.0 cm.

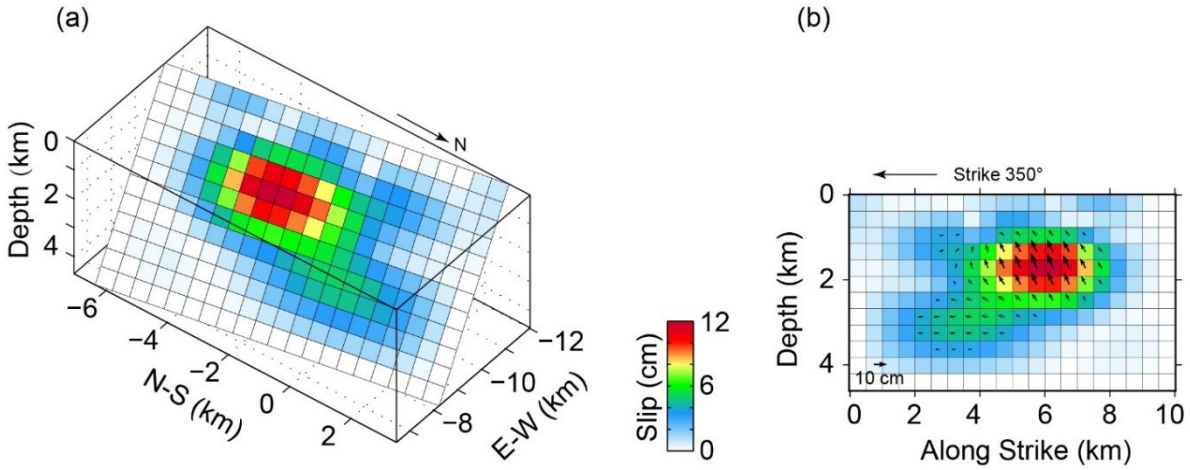

Figure S4. Three-dimensional (**a**) and two-dimensional (**b**) slip models of P2. Each small rectangle in the figures represents a slip unit. The color of the unit represents the slip value and the arrow represents the slip direction. The results of P2 are solved by the non-negative least squares algorithm and added the Laplace smoothing constraint and edge constraint.

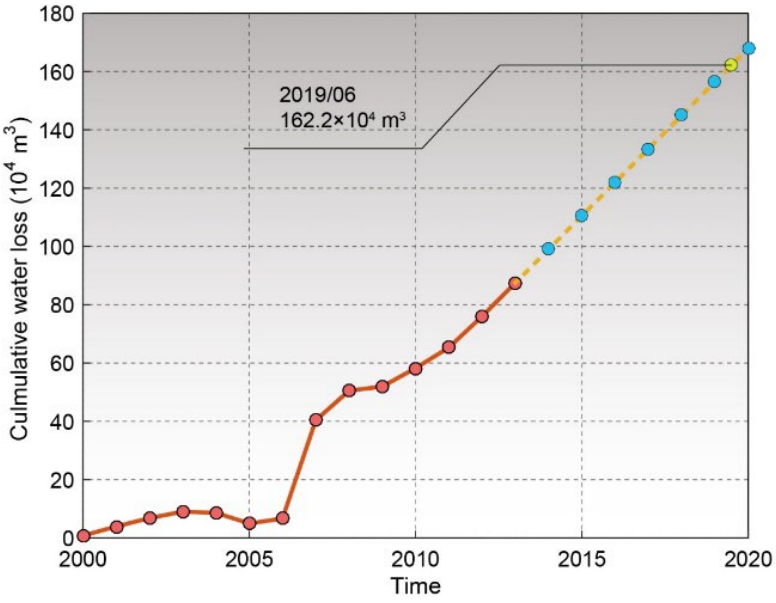

Figure S5. The accumulated water loss of salt mines in 2000–2013 [1] and the expected loss in 2014–2020. The loss volume in 2014 and later is calculated according to the loss rate in 2013.

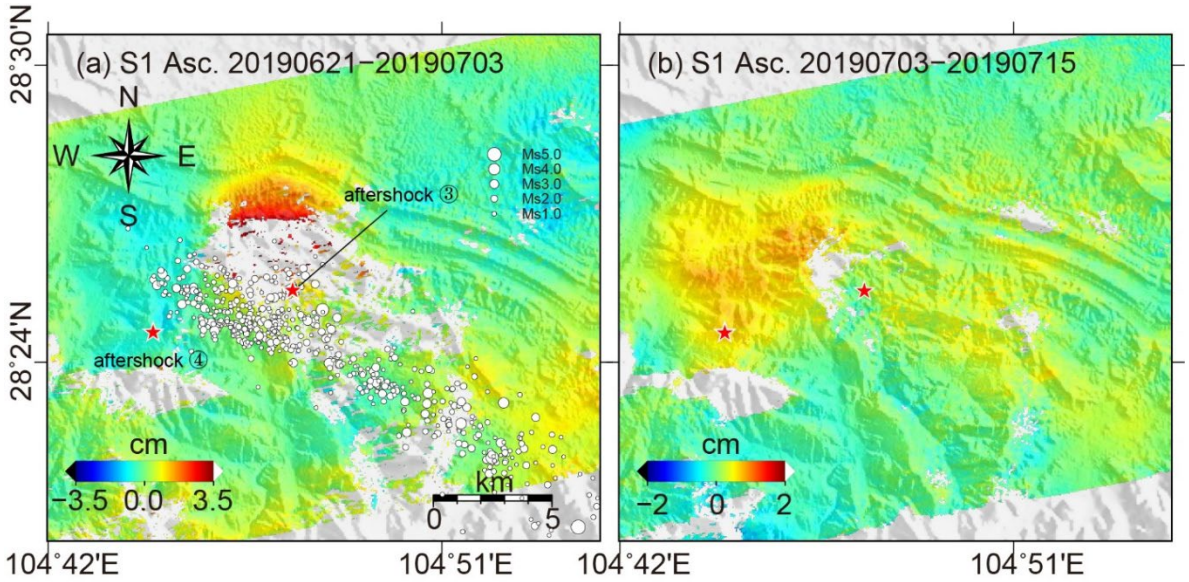

Figure S6. The deformation caused by (**a**) 2019/6/22 Ms 5.4 event (aftershock ③) and (**b**) 2019/7/4Ms 5.6 event (aftershock ④). The white dots are aftershocks from Yi et al. [2].

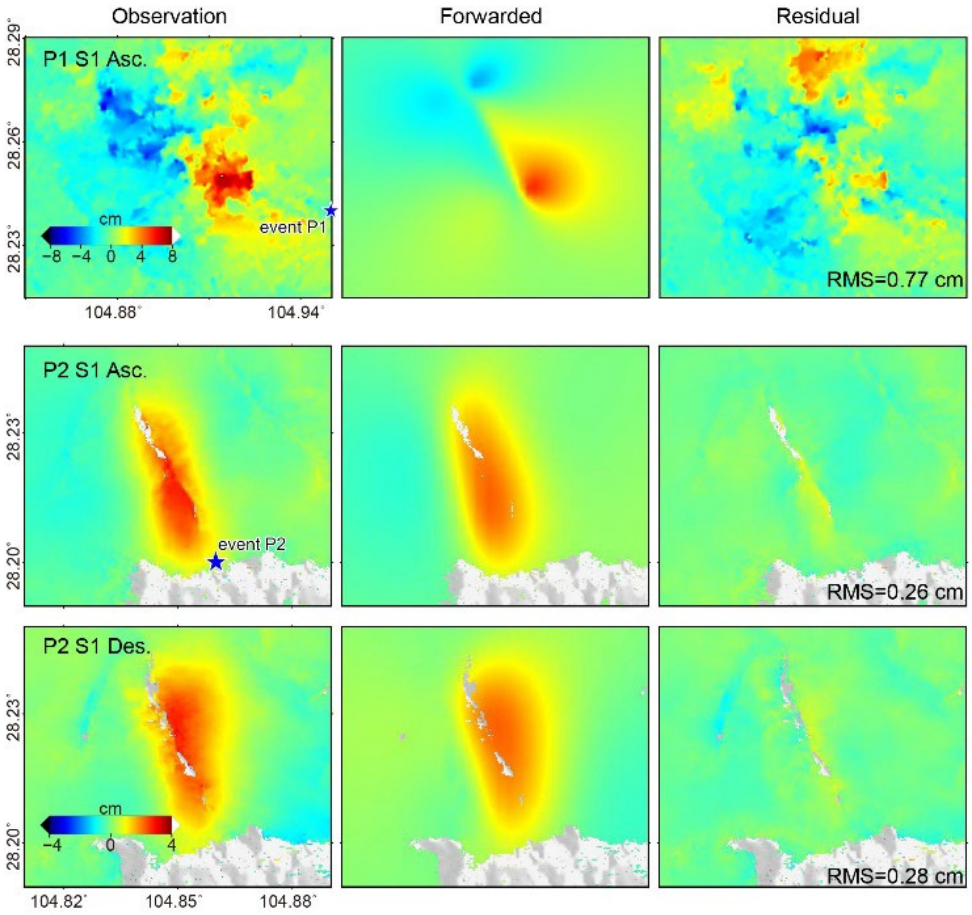

Figure S7. The observed deformation, forward deformation, and residuals of P1 and P2.

References

1. Sun, X.; Yang, P.; Zhang, Z. A study of earthquakes induced by water injection in the Changning salt mine area, SW China. *J. Asian Earth Sci.* **2017**, *136*, 102–109. http://dx.doi.org/10.1016/j.jseaes.2017.01.030
2. Yi, G.X.; Long, F.; Liang, M.J.; Zhao, M.; Wang, S.W.; Gong, Y.; Qiao, H.Z.; Su, J.R. Focal mechanism solutions and seisogenic structure of the 17 June 2019 Ms6.0 Sichuan Changning earthquake sequence. *Chin. J. Geophys.* **2019**, *62*, 3432–3447. https://doi.org/10.6038/cjg2019N0297