Crustal deformation in the Kunlun Fault region from long-term GPS measurements

Gang Zheng[1], Jianghui Geng[1], Hua Wang[2]

[1] *GNSS Research Center, Wuhan University, China*

[2] *Department of Surveying Engineering, Guangdong University of Technology, China*

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- 4. A comparison between geological and geodetic slip rates
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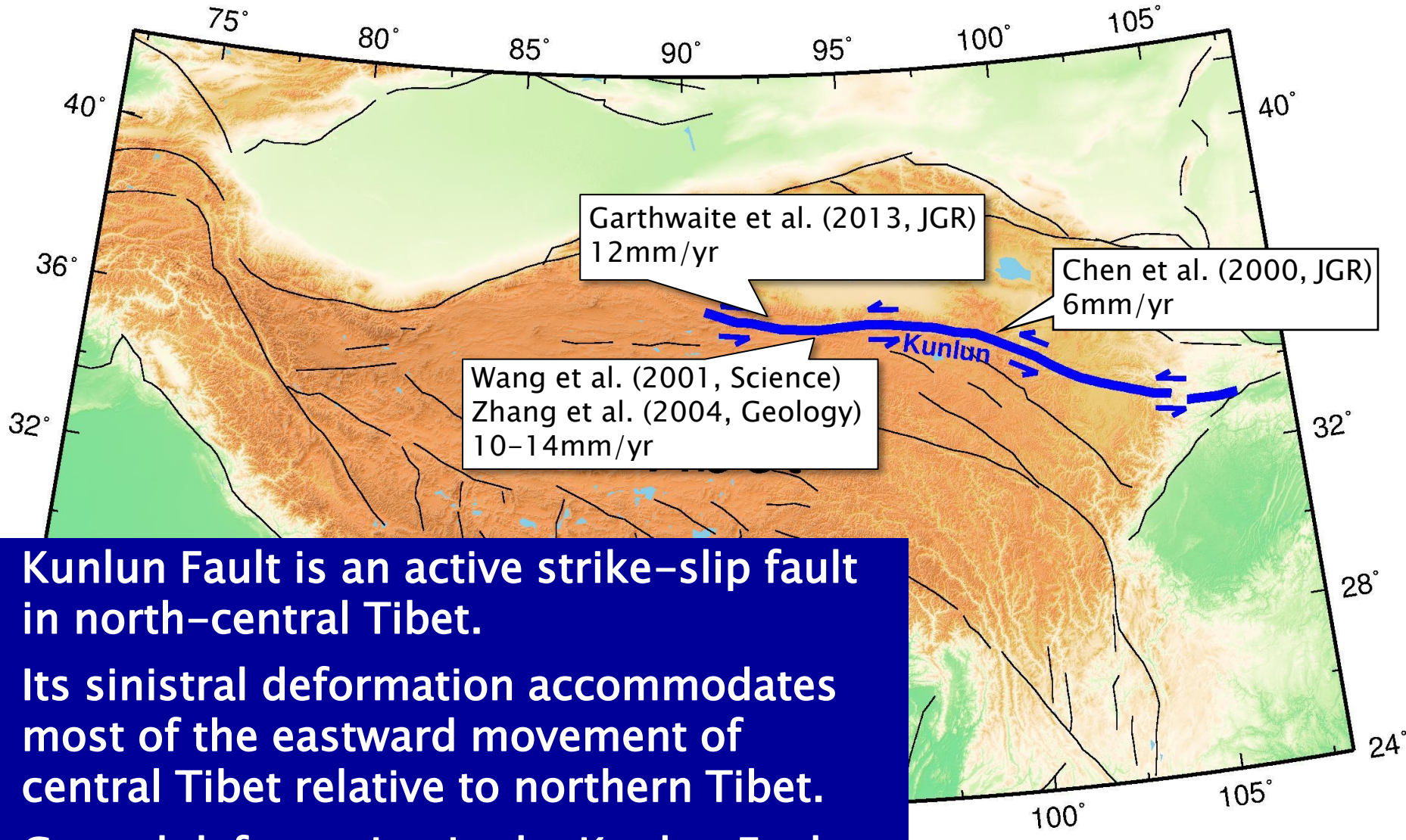
- 6. Strain distribution
- 7. Conclusions

1 Introduction



- Kunlun Fault is an active strike-slip fault in north-central Tibet.
- Its sinistral deformation accommodates most of the eastward movement of central Tibet relative to northern Tibet.
- Crustal deformation in the Kunlun Fault region is a hot topic in geoscience.

1 Introduction

- We derive a regional GPS velocity field
  - Process GPS data from CMONOC during 1998-2015
  - Incorporate GPS data from GSRM

- We use the velocity field to study crustal deformation in the Kunlun Fault region
  - Estimate present-day slip rates and locking depths of the Kunlun Fault
  - Compare geodetic slip rates against available geological estimates
  - Discuss the change of the slip rates along the eastern Kunlun Fault
  - Calculate the strain distribution

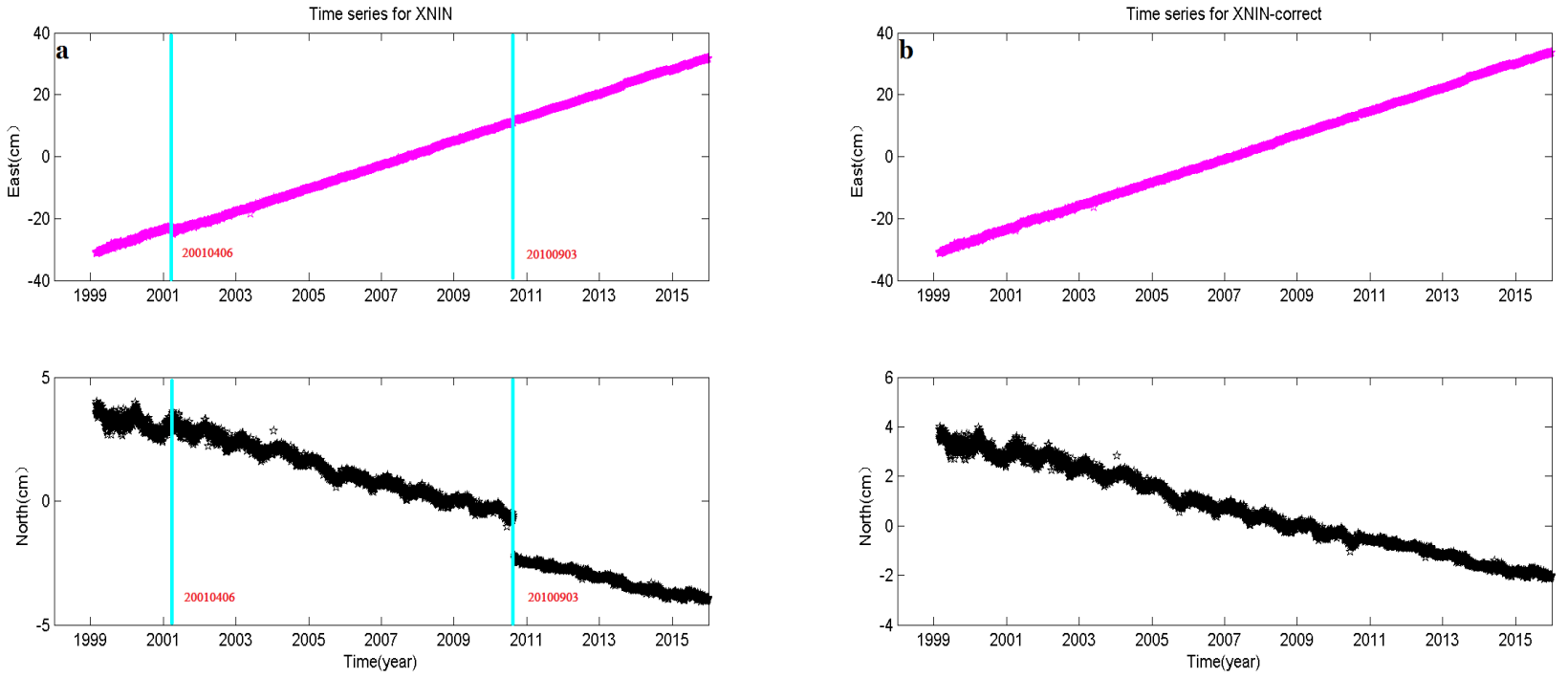
2 GPS data processing

- We use the PANDA software developed at Wuhan University to process CMONOC GPS data in single-day solutions with the PPP mode

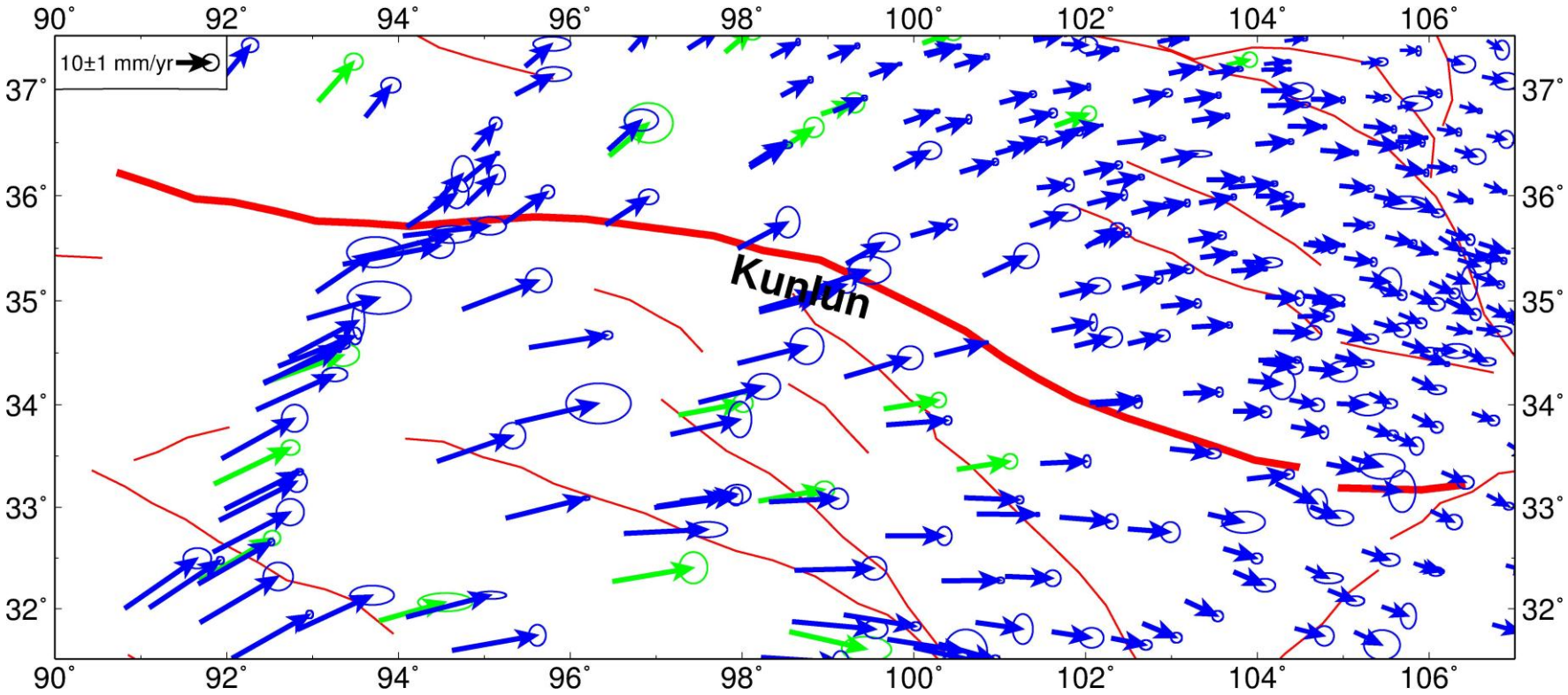
	Strategies
Supporting inputs	Use earth rotation parameters, precise ephemeris in IGS08 reference frame and 30s satellite clock products from MIT
Troposphere	GMF projection function, Saastamoinen model and GPT model
Ionosphere	Ionosphere-free linear combination
Tidal corrections	Use FES2004 model to correct ocean tide Use IERS2003 model to correct solid tide and pole tide
Other corrections	Absolute antenna phase-center correction, phase wind-up correction and relativistic effect
Cut-off elevation angle	15°, use an elevation-dependent weighting strategy at low elevations (e>30°, p=1; e≤30°, p=sin2e)

2 GPS data processing

- Deal with instrument issues and contrived events according to the Station Memorabilia
  - Replacement, update and failure of GPS instruments
  - Blasting by human



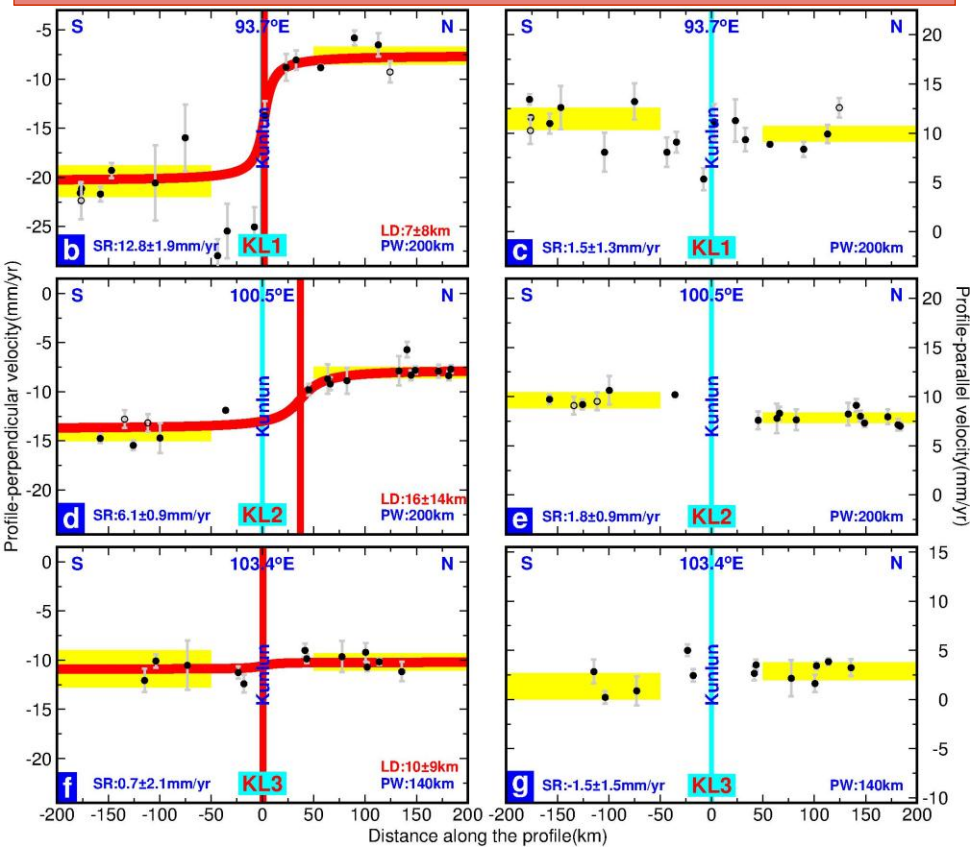
2 GPS data processing

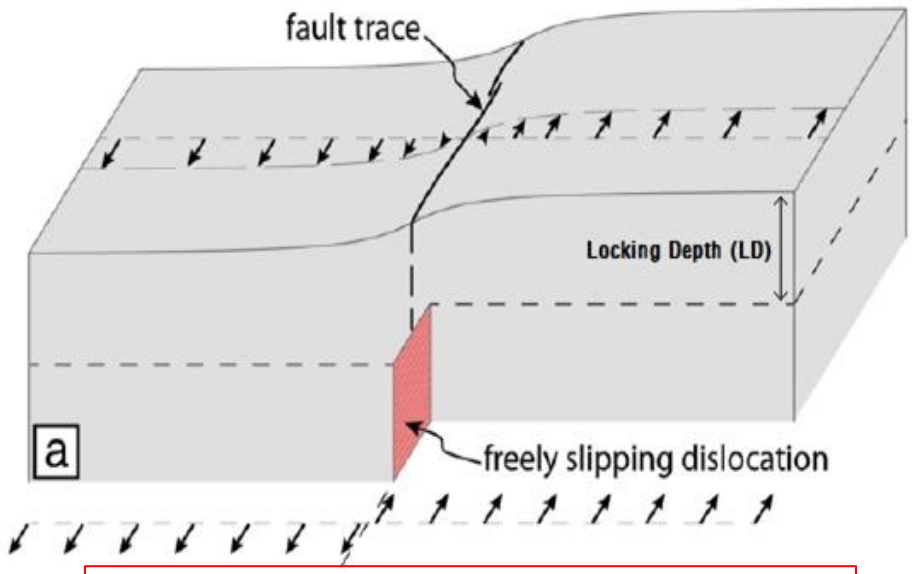


Incorporate GPS data from GSRM to obtain our resultant GPS velocity field

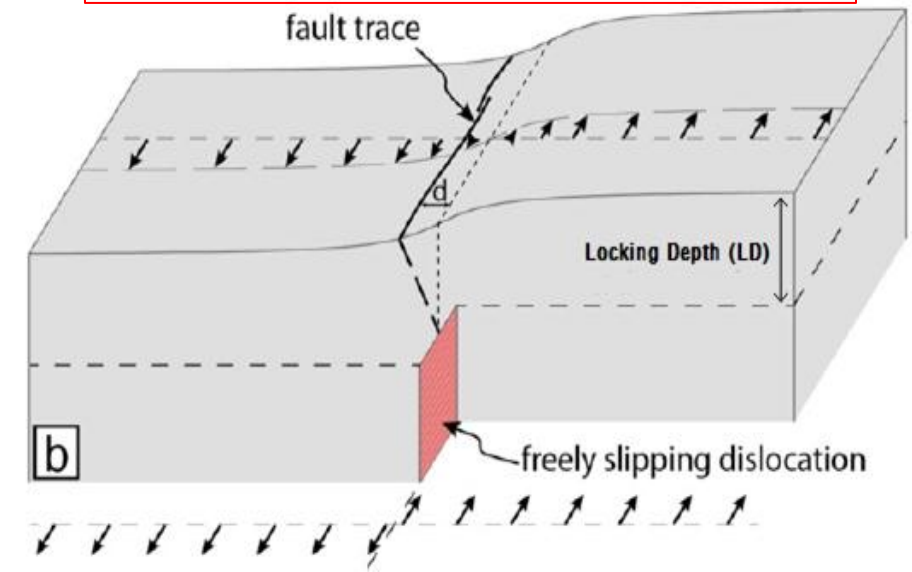
3 Present-day slip rates and locking depths of the Kunlun Fault

- The locking depths near 94°E, 101°E and 103°E are 7 km, 16 km and 10 km respectively.

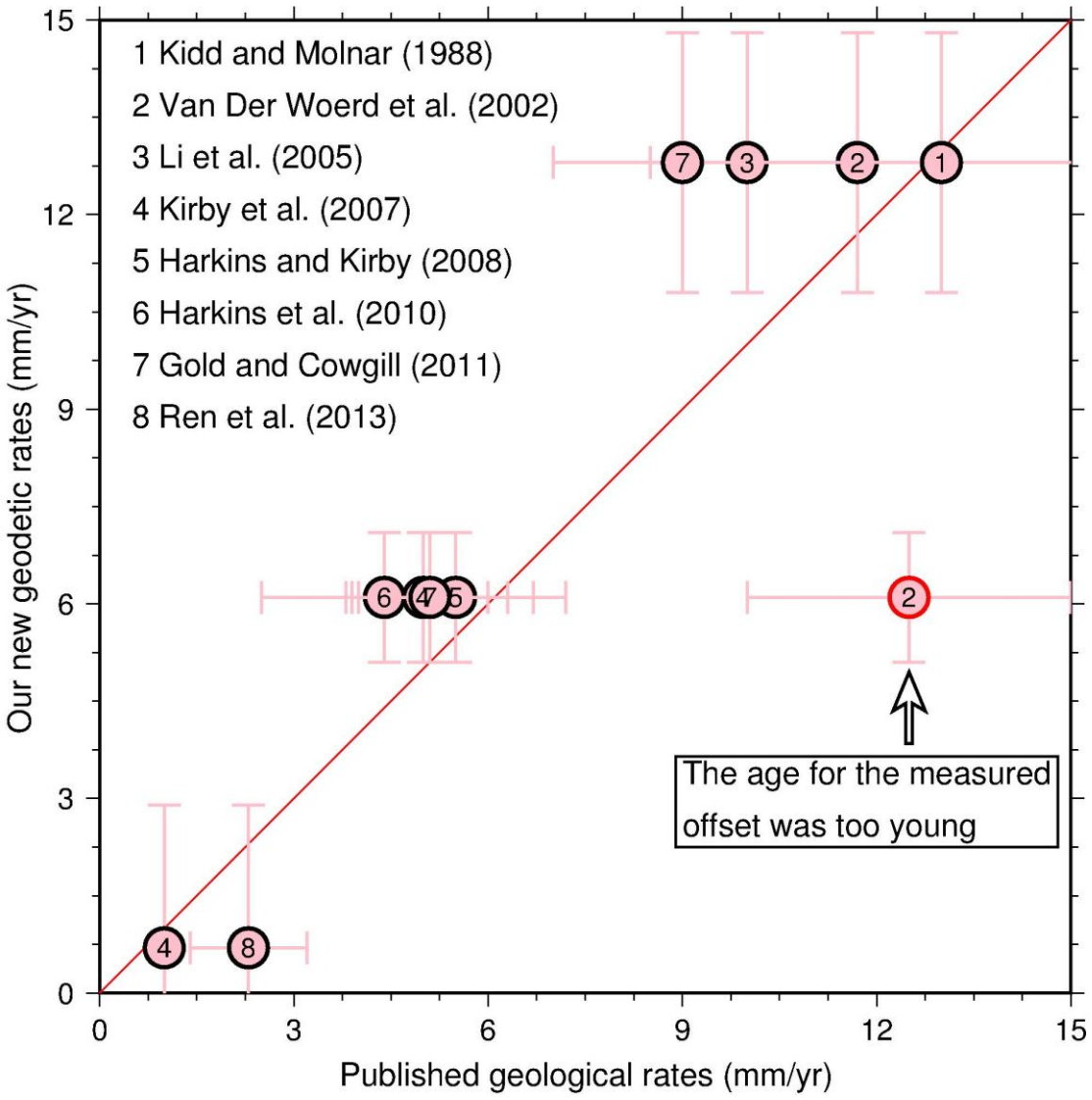




$$(a)v = \frac{SR}{\pi} \cdot \arctan\frac{x}{LD} \qquad (b)v = \frac{SR}{\pi} \cdot \arctan\frac{x-d}{LD}$$



4 A comparison between geological and geodetic slip rates



- No robust evidence for discrepancy between geological and geodetic slip rates
- Geodetic strain rates can be a useful input data set for seismic hazard assessment

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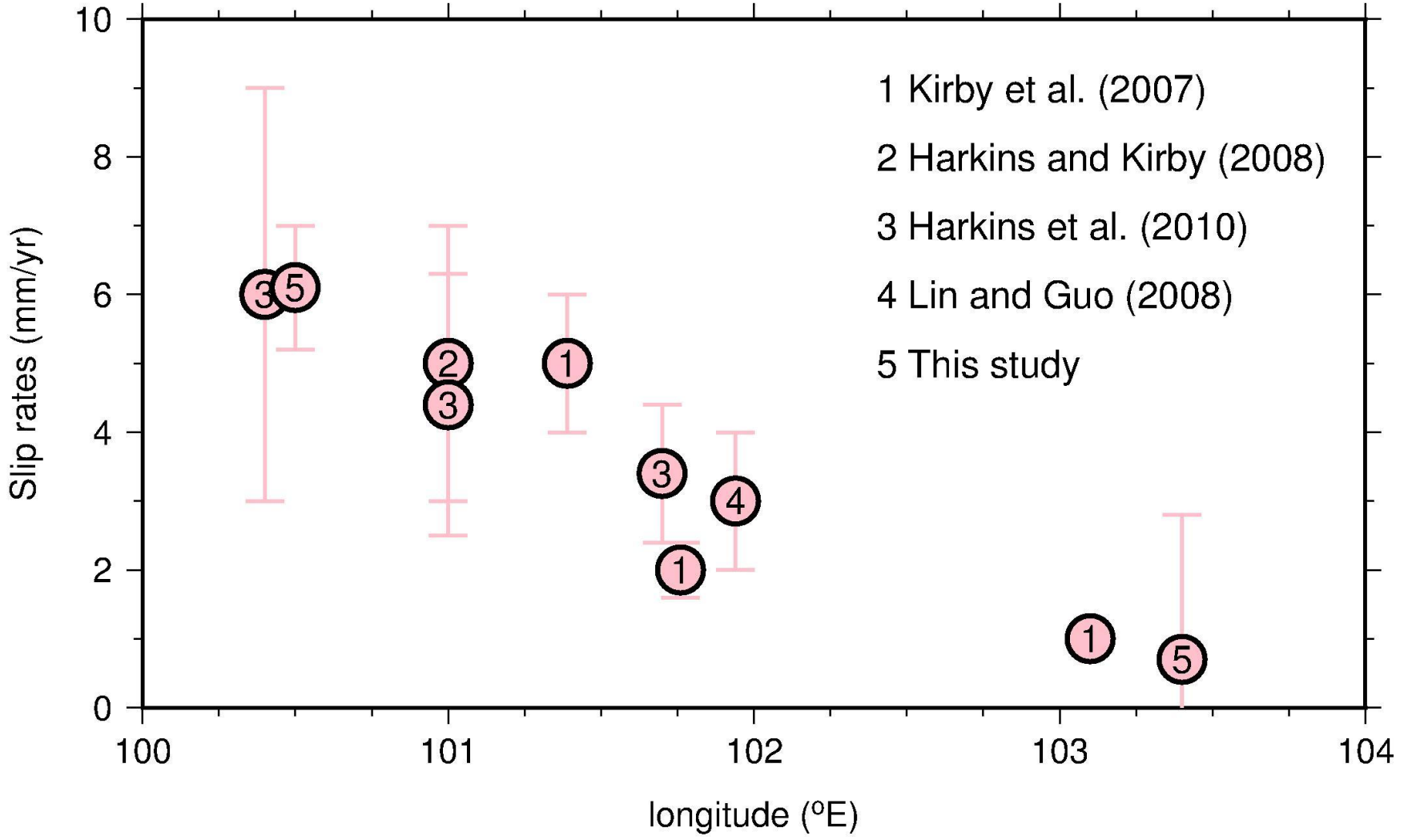
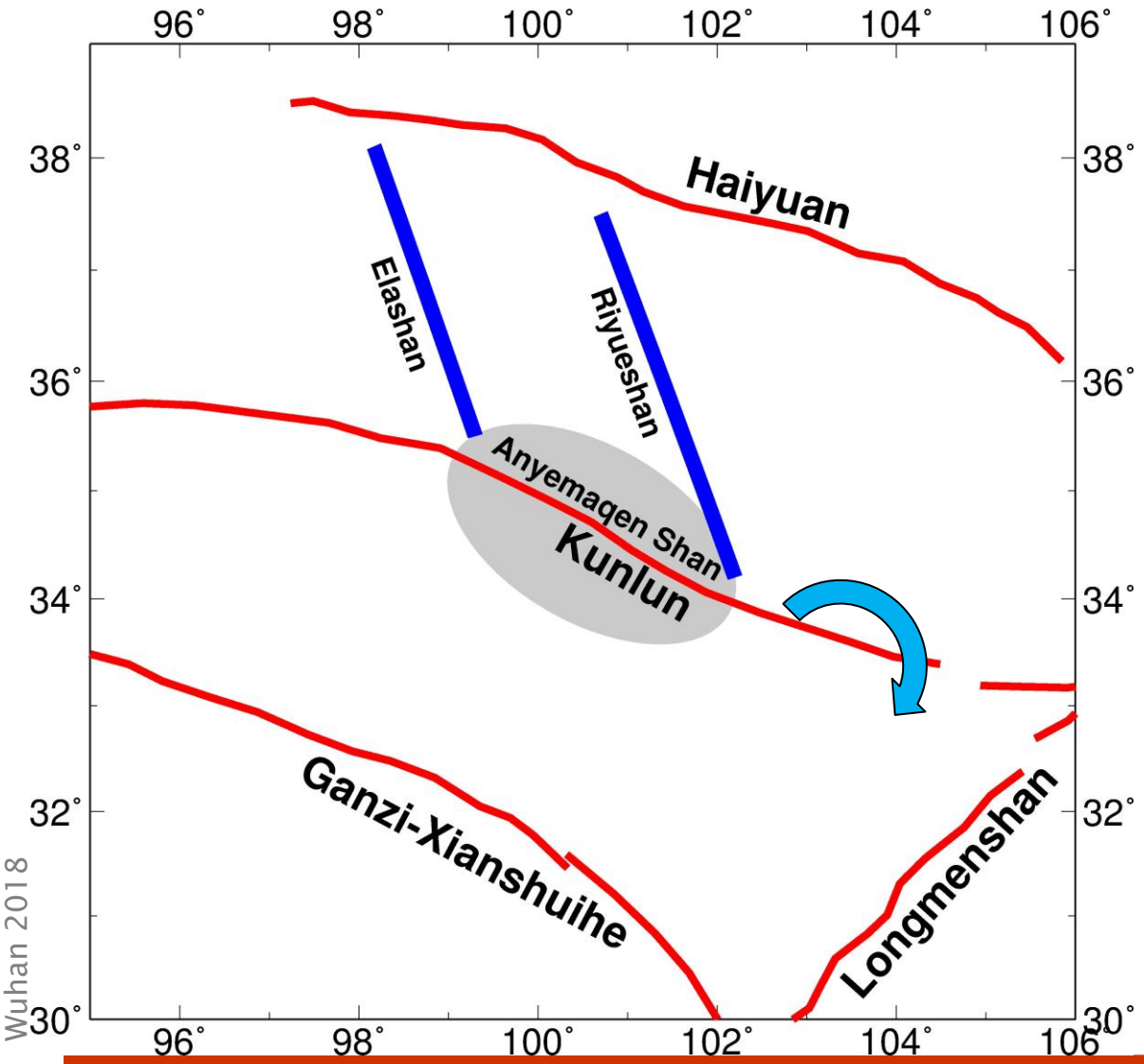
5 The change of the slip rates along the eastern Kunlun Fault



The eastern Kunlun Fault has an eastward-decreasing slip rate

5 The change of the slip rates along the eastern Kunlun Fault



- Loveless and Meade (2011) indicated that the Elashan and Riyueshan faults each transfer slip of ~5 mm/yr away.
- These two faults were shown to slip with a low rate of ~1 mm/yr by Yuan et al. (2011).
- Kirby and Harkins (2013) indicated that crustal thickening across Anyemaqen Shan and clockwise rotation of the eastern Kunlun fault accommodate most of the decrease in the slip rate.

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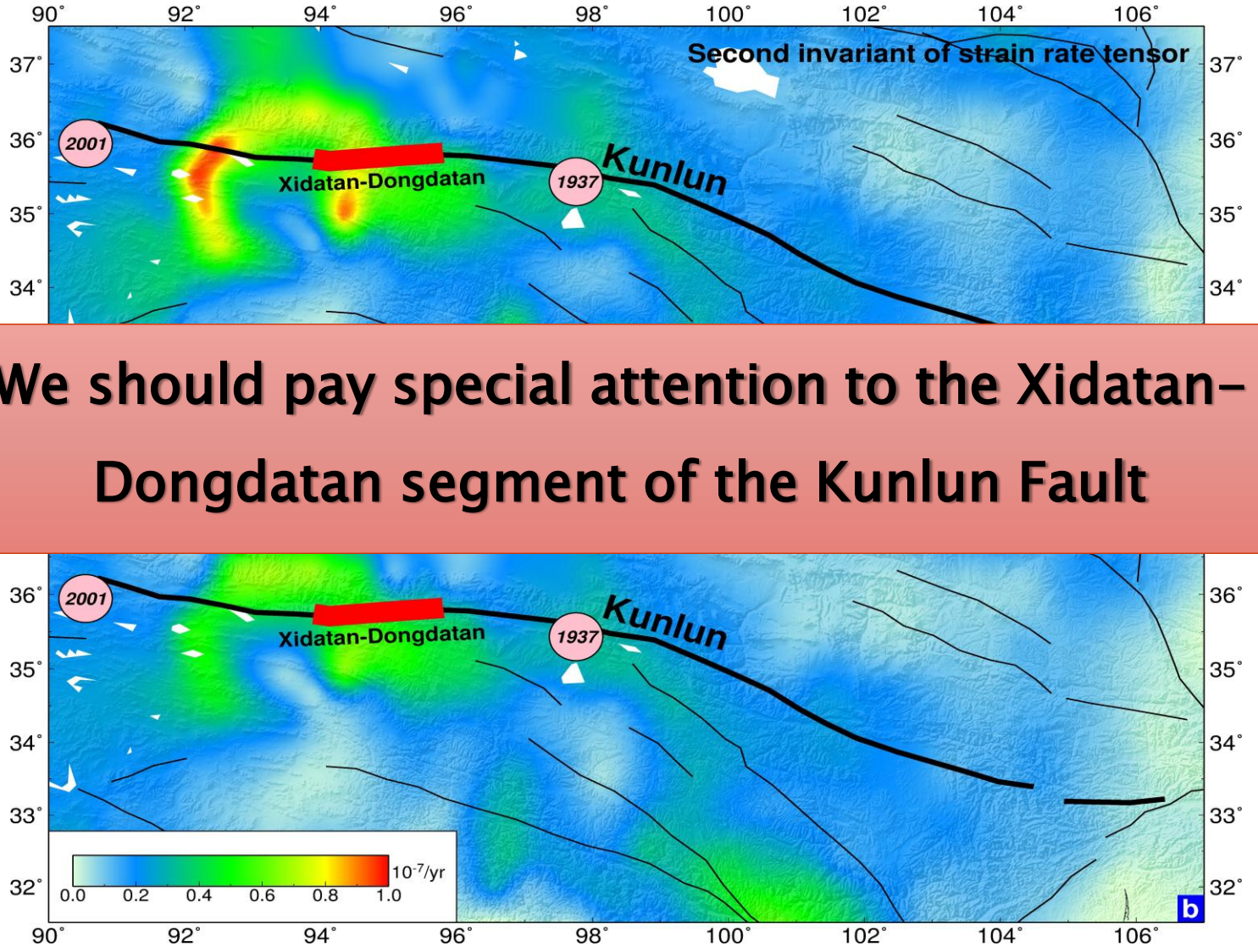
6 Strain distribution



We should pay special attention to the Xidatan-Dongdatan segment of the Kunlun Fault

We use the method of Wang and Wright (2012, GRL) to calculate strain rates

7 Conclusions

- GPS velocity profiles across the Kunlun Fault show sinistral rates of 12.8, 6.1 and 0.7 mm/yr near 94°E, 101°E and 103°E, respectively.
- The locking depths of the Kunlun Fault near 94°E, 101°E and 103°E are 7 km, 16 km and 10 km, respectively.
- There is no robust evidence for discrepancy between geological and geodetic slip rates of the Kunlun Fault.
- The eastern Kunlun Fault has an eastward-decreasing slip rate, which may be mainly due to clockwise rotation of the fault and crustal thickening across Anyemaqen Shan.
- The Xidatan-Dongdatan segment of the Kunlun Fault calls for special attention.

Thank you

- Email: gzheng@whu.edu.cn

- Research Interests
  - The method of high-precision GNSS data processing and GNSS time series analysis
  - The application of GNSS geodesy to understanding crustal deformation, earthquakes and dynamical processes