Thompson and Meade

Comments (numbers annotated on text)

1) Include references attributing Wenchuan earthquake to Beischuan fault rupture:

Lin, A., Z. K. Ren, D. Jia, and X. J.Wu (2009). Co-seismic thrusting rupture and slip distribution produced by the 2008 Mw 7.9 Wenchuan earthquake, China, Tectonophysics 417, 203–215.

Xiwei X., X. Wen, G. Yu, G. Chen, Y. Klinger, J. Hubbard, and J. Shaw, 2009, Coseismic reverse- and oblique-slip surface faulting generated 2008 Mw 7.9 Wenchuan earthquake, China, *Geology*, v. 37; no. 6; p. 515–518.

Hubbard, J., and J. H. Shaw, 2009, Uplift of the Longmen Shan and Tibetan Plateau, and the 2008 Wenchuan (M 7.9) earthquake, *Nature*, Vol. 458, 12 March 2009, doi:10.1038/ nature07837.

2) But, these models do not provide a mechanism for accumulating the elastic strain released coseismically during the Wenchuan earthquake, nor do they explain the significant crustal shortening and active geologic structures along the range front (Hubbard et al., 2010; Li et al., 2010; Wang et al., 2013; Wang et al., 2014).

Wang, M., D. Jia, A. Lin, J. H. Shaw, Y. Li, L. Shen, 2013, Active fault-related folding beneath the alluvial terrace in the south Longmen Shan range front, Sichuan basin, China: Implications for seismic hazard, *Bulletin of the Seismological Society of America,* 103.4, p. 2369-2385.

Wang,M., Dong Jia, J. Hubbard,A. Plesch, J. H. Shaw, A. Lin, Y. Li, B. Liu, 2014, The 2013 Lushan (M 6.6), China blind thrust earthquake: Implications for seismic hazards in the Chengdu Plain, *Geology,* v. 42, p. 915-918.

3) Consider reordering and slight rephrasing:

This fault system geometry is consistent with structural observations (Hubbard et al., 2010; Li et al., 2010) and the inference of 2-6 m of slip of a 20 km deep detachment that extends 90 km northwest using InSAR measurements and post-Wenchuan GPS observations (Qi et al., 2011; Fielding et al., 2013).

4) Consider somewhere include brief description of structural constraints:

a) Beichuan fault has listric shape, with surface dips of ≥ 60°NW shallowing to a moderate dip (≈ 35°NW) at seismogenic depths (based on focal mechanisms).

b) The Beichuan fault is part of an imbricate system, with fault dips that steepen toward the hinterland. Structural imbrication is typically produced by stacked listric faults that sole to detachments.

c) The presence of a large synclinorium that lies west of, and is parallel to, the Beichuan fault trace. This synclinorium is consistent with a shallowing of the Beichuan fault to a detachment based on fault-bend folding theory (Hubbard et al., 2010; Suppe, 1983).

5) Describe why you use 1.5° dip for detachment. This is the regional dip of the western Sichuan basin as it extends beneath the Longmenshan range front (Hubbard et al., 2010; Guo et al., 2013).

6) This section reads as if the specific listic geometry you note (60° to 10°) is required to yield a near zero shortening rate deficit. My understanding is that planar and various listic faults without a detachment would all yield this result. If so, restate. Also, you may want to note again that near zero slip rate deficits are also inconsistent with geologic and seismologic (in addition to geodetic) observations (see note 2).

7) How sensitive are derived rates to detachment dip? As the dip is poorly constrained, this would be a natural parameter to assess sensitivity for.

8) You state that “This northwestern-most observation is adjacent to the Longriba fault, suggesting that it should not be included.” But I gather you do include it, based on other considerations. If this is the case, consider rephrasing ““This northwestern-most observation is adjacent to the Longriba fault, and thus may be impacted by interseismic strain accumulation on this structure.”

9) eliminate second “the”

10) Treatment of sensitivity to topography seems out of place. Perhaps this can be in section 3.

11) State (at least initially) full range in RI for Wenchuan-like events based on slip rates range that you calculate.

12) “… such as the Range Front blind thrust (Hubbard et al., 2010; Wang et al., 2014).”