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Review

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PII: S2095-9273(18)30300-1
DOI: https://doi.org/10.1016/j.scib.2018.06.015
Reference: SCIB 444

To appear in: *Science Bulletin*

Received Date: 4 May 2018
Revised Date: 19 June 2018
Accepted Date: 20 June 2018

Please cite this article as: Y. Chen, J. Hu, F. Peng, Seismological challenges in earthquake hazard reductions: reflections on the 2008 Wenchuan earthquake, *Science Bulletin* (2018), doi: https://doi.org/10.1016/j.scib.2018.06.015

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ACCEPTED MANUSCRIPT

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Seismological challenges in earthquake hazard reductions:

reflections on the 2008 Wenchuan earthquake

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Received 2018-05-04, received in revised form 2018-06-19, accepted 2018-06-20

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Abstract

The Wenchuan earthquake is a natural disaster. Its occurrence and aftermath have demonstrated the critical roles of seismology and earthquake engineering in reducing seismic hazards and damages. However, their existing limitations should also be underscored. This article summarized and reviewed the current scientific understanding of earthquake ruptures, and new insights gained since the Wenchuan event. This study focused on the related challenges to seismology and earthquake engineering as follows: (1) The under-estimation of earthquake risks before occurrences; (2) The current limited data regarding large earthquakes in continental thrust fault systems; (3) The causal relationship between the Wenchuan earthquake and the reservoir impoundment in its vicinity; (4) The identification of low-velocity zone in the crust and its seismogenical role; and (5) The casualties and economic losses from a cascade of diverse natural hazards triggered by the ruptures, and the excellent earthquake resistance associated with tunnels in mountainous terrain.

Introduction

At 14:27:59 local time, on May 12, 2008, an M_S 8.0 earthquake struck Wenchuan County in Sichuan Province of southwestern China [1, 2]. The Wenchuan earthquake was noted as being one of the most destructive earthquake events to occur in China since 1949, due to its widest recorded region of influence and greatest disaster- triggered losses.

The Wenchuan earthquake also caused major casualties. Estimates from August 25, 2008 show that 69,226 people had been killed, along with 374,643 reported injured, and 17,923 lost. The earthquake caused a total direct economic loss of 845.1 billion yuan. During the earthquake event, numerous urban and rural buildings were devastated. The Ministry of Civil Affairs (June 25, 2008) states that approximately 23 million housing units were broken down duo to the earthquake (one house being equivalent to four housing units on average), with as many as 6,525,000 left completely destroyed. Also, a vast number of villages in the vicinity of the earthquake were razed to the ground.

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