The Kashmir Earthquake: a Confluence of Unfortunate Events

Neil Edelman

1 December, 2006

Abstract

The 8 October, 2005 earthquake that shook war-torn Kashmir killed approximately eighty-thousand people; even for a magnitude 7.6 earthquake, this number is astronomical. Many more people died from hypothermia, starvation, and disease. We look at why the casualties are so high. The mountainous terrain had many roads collapsed by landslides; large areas became inaccessible after the earthquake. Providing shelter was the main challenge as camps became overcrowded. Most casualties are accounted for by building collapse; the construction standards are poor. The government was completely caught off guard and international aid was slow and lacking. Helicopters were taken up by the war on Iraq and funding greatly diminished due to the Indian Ocean Tsunami of 2004

1 Introduction

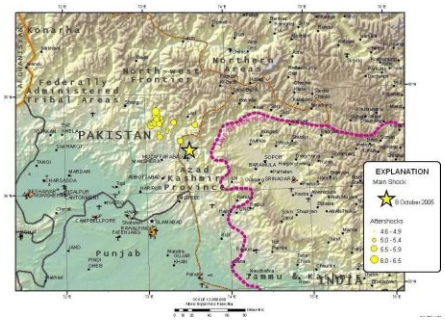

Figure 1: The area of the earthquake with the Line of Control clearly visible [1].

The 8 October, 2005, at 03:50:40 UTC [12][11], nearly nine o'clock local time, an earthquake shock close to Muzaffarabad, the capital of the Pakistani controlled part of Kashmir. It destroyed parts of Pakistan, Jammu, and Kashmir [8]. This is the worse natural disaster to hit the region in recent history. Failure of either India or Pakistan to address their earthquake vulnerabilities led to the local government that was totally unprepared [3]. Limited action and problems of coordination were felt at the national and international level.

2 Politics

The state of Kashmir and Jammu is a war-torn region [8]. Tourism used to be the main source of income, but that has been quashed by the ongoing insurgency; now agriculture and construction are the main areas of the economy. This area is characterised by human rights abuses, corruption, a stagnant economy and unemployment. It is under control of three countries: Pakistan in the northwest, India in the south-centre, and China in the northeast. The cæsefire line is known as the Line-of- Control (LOC.) In the aftermath of the disaster Pakistani parties called a truce, but this was short lived, as the government's handling of the disaster was too attractive to the opposition. Anisotropy of aid due to politics was a serious concern; politicians made their way to a weakly hit village to have their picture taken, handing out supplies to happy, uninjured people. Some residents of Pakistan favoured letting the Indian army over the border, mere miles away, to help them. The Friendship Bridge across the LOC, which was opened six months prior as a means of providing bus service, was destroyed. As it was, Pakistan-Indian relations softened following the disaster. India lifted restrictions on the use of cellular phones over the LOC. On 18 October, Pakistan proposed greater movement to help each other with the reconstruction. This occurred the 7 November, allowing humanitarian assistance to pass.

3 Tectonics

The Indian Plate and Eurasian Plate meet in a convergent plate boundary, colliding at $40mma^{-1}$; it is this that is responsible for Himalayan Mountains [10]. The plate is under extreme seismic stress, and undergoes infrequent earthquakes of great magnitude [11]. It was here that gen-

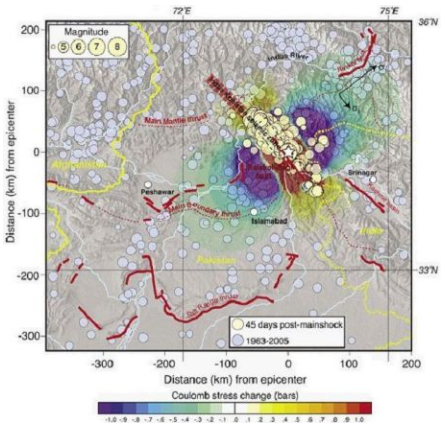

Figure 2: "Coulomb stress change on optimally oriented fault planes at 10 km depth from the 8 October, 2005 M = 7.6 Kashmir earthquake (epicentre shown by star,)" [9].

erated a 450-year earthquake, latitude $34°29'35''N$, longitude $73°37'44''E$, with a focal depth of $26km$ along a NNE fault axis [12]. It lasted about thirty seconds, along a fault plane of $50km$, magnitude 7.6. The earthquake was followed by aftershocks clustered $50km$ to the NW; about 978 above magnitude 4.0 in 19 days and 110 above magnitude 5.0 in 27 days [7][12].

Several researchers over the past two centuries warn that the Himalayas are overdue for several magnitude eight earthquakes [12]. Only small portions of the mountain range, mostly in Nepal, have been studied using Global Navigation Satellite Systems (GNSS.) This is due to the political situation; India and Pakistan are worried about ceding an advantage, so geologists bearing GNSS receivers are banned from entry [2]. Nevertheless, the studies agree with what has been predicted. Especially disturbing is the increasingly populated mega-cities which lie in the fertile Indo-Gangetic plains, where an earthquake would possibly strike [12].

4 Loses

According to the United Nations' (UN) Office for the Coordination of Humanitarian Affairs (OCHA,) the "number of confirmed dead as of 20 November was 73 320 and the number of injured was 69 392," [8]. The actual number of casualties is not known, but it could range from 75 000 to over 86 000, with the number of injured 96 000 to 200 000 [11][12][8][6][7][2]. Most of these are in Pakistan, while approximately 1500 people are dead along the Indian border [11]. The earthquake destroyed 50% of houses, 25% of buildings were completely collapsed [7]. It destroyed 291 hospitals and 12 000 schools. Saturday is a school day, and it killed 17 000 children [4][8]. "It will be remembered as the disaster that wiped out a generation of children," [8].

The earthquake was in mountainous terrain of the Himalayas [11][8]. Already lacking in communications, the area is extremely difficult to reach, even in normal conditions. It was made worse by landslides following the earthquake [10]. This contrasts to the Indian Ocean Tsunami of 2004, which affected coastal areas that are much easier to reach; and in fact the adverse effects were worse then the tsunami [5][7]. Large parts of the affected area were inaccessible because of blocked or damaged roads and bridge collapse, preventing food and medicine from reaching the survivors [8]. Pipelines for drinking water were broken at several places [10]. It was weeks before some villages received aid.

The area most hit is not home to any major infrastructure so the economic effects are limited [8]. Most of the people hit are poor, subsistence farmers, and this disaster is likely to increase their economic vulnerability. There is concern about nuclear facilities, but that is classified [11].

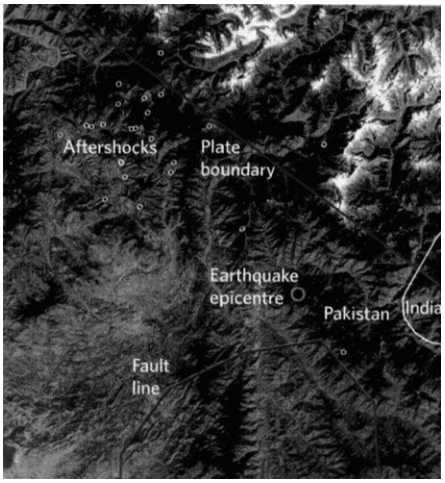

Figure 3: "Massive land sliding occurred north of Muzaffarabad," [7].

At least 2.5 million people, probably closer to 4 million, were homeless [8][7]. In camps, sustenance of displaced population for long times was a problem. The region was entering the harsh Himalayan winter. Up to one million people were sleeping out in the open. In November, 200 000 were cut off due to fresh snow, and probably suffered hypothermia. Kofi Annan warned people of a "second massive wave of death," and that we have

"the power to stop the next wave: the deaths and despair caused by freezing temperatures and disease, by lack of shelter, food and water;" but that is exactly what happened [8]. Many more people got hypothermia, starved, and got deadly illness than were killed in the earthquake itself.

5 Relief

The provision of shelter was the main shortcoming after the earthquake [8]. A month after the earthquake, 58 tent-villages were up, providing shelter for 36 000 people. In the long run, it is estimated that 150 000 people will settle in camps. This creates problems feeding them. Overpopulation is also a problem in tent-villages; a single tent might hold five families. The tents are often not suited for cold weather, providing problems for the often two meters of snow in the winter. Many people, though they had shelter, were scared to live indoors; this placed an enormous burden on the limited tents. Human fæces lined the camps; diarrhoea was an epidemic.

During the first three weeks of the Red Cross Field Hospital, a study was done on the patients [4]. There were 316 patients, 246 were women and children and 145 were fourteen and under; the mean age was 22.7. The majority had infected wounds, and the most reported disease was acute respiratory infection. Out of 564 healthcare facilities, 291 were completely destroyed and 74 were partially damaged. In Muzaffarabad, there was one 50-bed hospital operating immediately after the earthquake [5]. Two weeks later, 8 hospitals and 700 beds were operating. Four weeks later, an additional 16 field hospitals and 44 basic healthcare units were operational all over the disaster-affected area [4]. On 25 October, the US set up a mobile hospital outside Muzaffarabad [5]. Many people, once treated, refused to leave the hospitals; it was cold and they had nowhere to go.

6 Imagery

Pakistan government appealed for high-resolution satellite imagery, but forced the International Charter on Space and Major Disasters to remove the images from their web site; that would compromise security in the Kashmir region, a region that is long under dispute [3]. Internet users worldwide were busy almost instantaneously plotting the disaster despite limited data. Publicly available satellite images are used to see what roads are open and to locate isolated settlements.

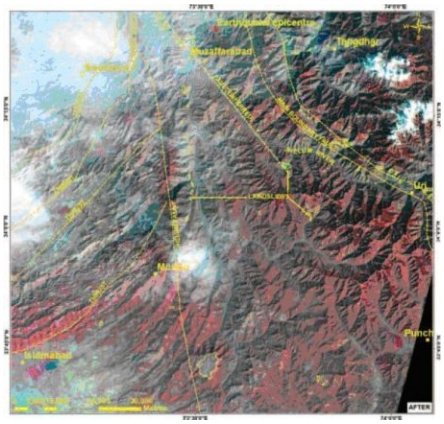

Figure 4: "Images of the devastation in Kashmir caused by the earthquake," [3].

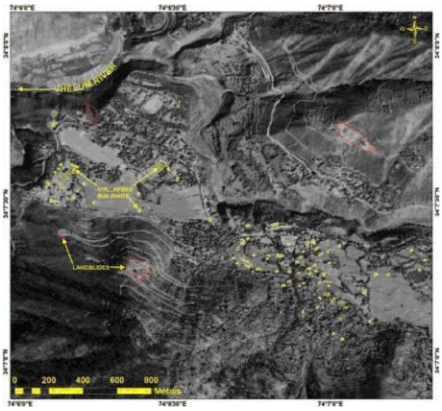

Figure 5: "Tectonic framework of the area," [6].

7 Construction

For a magnitude 7.6 earthquake, 80 000 dead is very high [12]. The leading cause of casualties was collapsed buildings [11]. Engineering practices are different in the US or Japan where they have few building collapses. In the affected area, there are no strict codes referring to earthquakes. Construction standards were poor [12]. Safety norms were largely ignored. Lots of apartment buildings in the city collapsed. Engineers in major cities often do not have the expertise to build earthquake resistance into buildings. Microzonation maps (earthquake hazard maps,) are sorely lacking in major cities; where they are, scientists' recommendations have never been realised [11]. Many areas with buildings are built on inappropriate soil [8]. Rural buildings made of locally available stones and

Figure 6: “9 October 2005 (post-earthquake) showing damaged buildings and landslides in Uri region of Jammu and Kashmir, India,” [6].

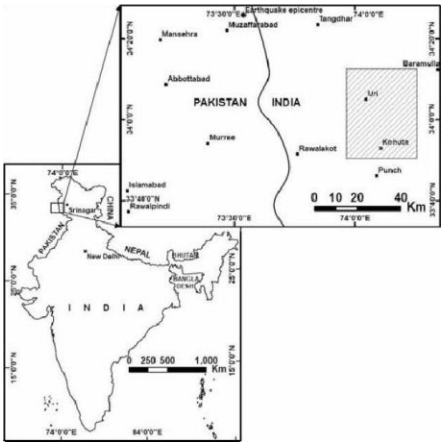

Figure 7: A drawing showing the earthquake and Figure 6’s location [6].

mud [11]. The people are often poor; houses with quake-resistant structure are three times more prevalent in urban areas. Retrofitting and providing lots of open space to public buildings such as schools is important. They could be rebuilt at relatively low-cost with earthquakes in mind, and could provide a centre for disaster relief [2].

Almost all buildings collapsed close to the epicentre [7]. Twenty-five kilometres away, 25% of buildings collapsed, with 50% being severely damaged. The region has a number of bridges which were extremely vulnerable due to lack of restrainers to prevent unseating [10]. The houses were mainly un-reinforced stone laid in cement-sand mortar [7]. These buildings with random rubble and poor mortars are common in the villages, where there is a poor economic situation [10][7]. The collapse of these structures was responsible for a vast majority of casualties

Figure 8: “Collapse of unreinforced concrete block masonry houses in Kamsar near Muzaffarabad,” [7].

[11][7]. The poor people of Kashmir cannot afford reinforced concrete, but they can make simple modifications such as integrating the roof on the houses’ frame that will increase the structures’ resistance [2]. Un-reinforced masonry laced with timber performed noticeably better [10]. Traditional timber-brick masonry is called dhajji-dewari, meaning ‘patch quilt wall;’ this withstood with little damage. Many government buildings have reinforced concrete frames in colonial-style, but collapsed because they were not designed well [10][7].

8 Helicopters

Figure 9: “BALIKOT, Pakistan - Pakistani Soldiers carry tents away from a U.S. Army CH-47 Chinook helicopter,” 18 October [13].

Search and Rescue (SAR) teams from various countries responded to the disaster quickly, but they had trouble reaching many parts of the disaster-affected area [8]. Helicopters were the only means of reaching most of the villages to carry wounded, transport SAR, and deliver relief. Not only had roads been blocked, but often times they

have been washed away and no longer exist. Pakistan's fifteen helicopters were not enough, but an Indian offer of helicopters was turned down. The international help on additional relief helicopters was limited and delayed, in large part because the war in Iraq. Three days after the earthquake, the US released eight helicopters which had been serving there. People waved clothes to get the attention of helicopters, but even with helicopters, sometimes there is nowhere to land in the rugged terrain [5].

9 Aid

The UN (OCHA) was quick to respond, but money was an issue. The UN appealed for $550 million USD, but the member countries promised $1.3 billion and the government of Pakistan was promised $2 billion; a month after the UN had only received $133 million and the government of Pakistan only received $9.5 million [8]. International aid fatigue after a series of natural disasters in the prior months exhausted the supply of money, most notably the Indian Ocean Tsunami of 2004. Supplies had been donated from all over the world, the bottleneck is transporting them. The army was leading relief effort, but was unwilling to coordinate with civilian authorities. Most of the soldiers did not have any training to handle disasters. With the landlines, radio, and mobile phone systems badly damaged, the troops were waiting for orders that never came. This area was not ready for such a devastating disaster, having not been affected for several decades. The emergency assistance was total chaos. Fed up, people have loaded up their vehicles with assistance and trekked to the disaster area. The poor and young have helped out, for example volunteering at local hospitals. Guerrillas have put aside arms and helped carry out the injured from remote villages. Civic action was impressive. The earthquake hit during the holy month of Ramadan, and Muslims are expected to help the poor and be generous. The aid was chaotic, so a National Volunteers Movement was set up on 19 November to organize large number of volunteers.

10 Conclusion

The Kashmir Earthquake of 2005 struck the Himalayan mountains and the results were devastating. Relief workers could not access large parts of the affected area because of landslides. Eighty-thousand people died, most by collapsed buildings due to poor construction standards and the poor economic situation of the people. Still more people were killed by hypothermia, starvation, and disease. The government was largely unprepared for the disaster to strike the war-torn region of Kashmir and the aftermath is a human disaster. International response was slow and lacking. This should be remembered as a major tragedy to which the World sent insufficient aid.

References

[1] Anonymous. United states national earthquake information center. http://quake.usgs.gov/, 2005.

[2] Anonymous. Everybody's fault. *Nature*, 440(7080):1, 2006.

[3] Declan Butler. Quake aid hampered by ban on web shots. *Nature*, 437(7062):1072–1073, 2005.

[4] M. Helminen, E. Saarela, and J. Salmela. Characterisation of patients treated at the red cross field hospital in kashmir during the first three weeks of operation. *Emerg. Med. J.*, 23:654–656, 2006.

[5] Joy Jacobson. Kashmir's earthquake victims. *AJN*, 105(12):21, 2005.

[6] K. Vinod Kumar, T.R. Martha, and P.S. Roy. Mapping damage in the jammu and kashmir caused by 8 october 2005 mw 7.3 earthquake from the cartosat-1 and resourcesat-1 imagery. *International Journal of Remote Sensing*, 27(20):4449–4459, 2006.

[7] Dr. A. Naeem, Dr. Qaisar Ali, Muhammad Javed, Zakir Hussain, Amjad Naseer, Syed Muhammad Ali, Irshad Ahmed, and Muhammad Ashraf. A summary report on muzaffarabad earthquake, pakistan. *University of Engineering and Technology, Peshawar, Pakistan*, pages 1–7, 2005.

[8] Alpaslan Özerdem. The mountain tsunami: afterthoughts on the kashmir earthquake. *Third World Quarterly*, 27(3):397–419, 2006.

[9] Tom Parsons, Robert S. Yeats, Yuji Yagi, and Ahmad Hussain. Static stress change from the 8 october, 2005 m = 7.6 kashmir earthquake. *Geophysical Research Letters*, 33:1–4, 2006.

[10] IIT Kanpur press release. North kashmir earthquake - reconnaissance survey. *The Indian Concrete Journal*, 79(11):17–18, 2005.

[11] B.P. Radhakrishna. The quake that shook kashmir: Has it any lessons to teach us? *Journal of the Geological Society of India*, 67(1):1–10, 2005.

[12] N. Purnachandra Rao, P. Kumar, Kalpna, T. Tsukuda, and D.S. Ramesh. The devastating muzaffarabad earthquake of 8 october 2005: New insights into himalayan seismicity and tectonics. *Gondwana Research*, 9(4):365–378, 2005.

[13] Timothy Smith. Air force link. http://www.af.mil/-photos/index.asp?galleryID=281&page=2, 2005.