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The Disaster of May 12th Wenchuan Earthquake and Its Influence on Debris Flows

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Abstract

On May 12th, 2008, a rare major earthquake with magnitude 8.0 occurred in Wenchuan, Sichuan province of China, which caused considerable damage. Considering mud-rock flows in the quake-hit areas caused and influenced by the major earthquake, the essay analyzes the formed conditions and the influential factors for mud-rock flows disaster in the quake-hit areas. Meanwhile, it presents preventive measures for the post-disaster mud-rock flows.

Keywords: Earthquake, Debris flow, Disaster, Influence

1. Introduction

On May 12th, 2008, a rare major earthquake occurred at noon in Wenchuan, Sichuan province of China, which is the second major earthquake since the foundation of the PRC. The seismic magnitude, influence scope and relevant loss are rare for the same period of the history. The mud-rock flow which belongs to a non-land area of earthquake debris burst ferociously and rushed violently with lots of silt. There are many kinds of direct and secondary disasters caused by the earthquake. The mud-rock flow is one of the serious secondary disasters and the damages can not be more.

2. The overview of the earthquake disaster

On May 12th, 2008, a rare major earthquake with magnitude 8.0 occurred in Wenchuan, Sichuan province of China, whose largest earthquake intensity reached 11 degrees. More than 100,000 square kms became the particularly serious quake-hit areas including Sichuan, Gansu, Shanxi, Chongqing, Yunnan and so on. Sichuan province, such as Beichuan, Shifang, Dujiangyan, Mianzhu, Wenchuan, Pengzhou, etc. is the most severely affected area. The quake-hit areas. The casualties of the earthquake were 87,000 people including 69,000 deaths and more than 18,000 disappearances . The direct economic loss amounted to 845.14 billion yuan, and indirect loss was numerous.

<Figure 1>

3. Brief statement for the debris flows in the quake-hit areas

Longmen Mountains were largely changed the crust because of the earthquake. An on-site survey showed in some places that the crust had gone up or down to a few meters vertically. Some rocks and soil were loose, broken and easy to cause a large number of debris flows, post-disaster debris, collapses and other geological disasters. The earthquake disaster was the most severe geological disaster of all China's one-time catastrophic events in the history. Preliminarily judging, about 1/3 of the whole Wenchuan earthquake losses were not by the direct result of the earthquake, but by the secondary geological disasters. Among these secondary disasters the debris flow hazards can not be ignored. The distribution of landslides that may occur is shown in Figure1. After the earthquake, many mountains' terrains have been damaged and the southwest part of China is mountainous, so the mountains are easy to seriously slide during the rainy season which is from May to September.

The following examples are mud-rock flows occurred in the disaster areas: On May 17th, 2008, a heavy rainfall in WenXian accompanied by strong winds, lasting 40 minutes and reaching 12.7 mm, triggered a large mud-rock flow in Guanjiagou, Wen County with 15 cubic meters per second. The flow buried several cars parked on the roadsides. On May 12th, 2008, a certain part of Baoji-Chengdu Railway was blocked. About 2.7 million ton mud-rock flew into the tunnel, destroyed over 4300 ton roadbeds. 11 trains were forced to stop or to change their lines. On September 25th, 2008, torrents with a mud-rock flow happened in the old town of Beichuan. It damaged the town and the only road to the town was blocked. According to an on-site survey and relevant information, we learn that an earthquake can easily cause mud-rock flows. Such examples as mentioned above do exist in many other places.

4. The impact of the debris flow after the earthquake disaster

After the earthquake a debris flow is a common geological disaster. When a debris flow happens, the mixture of water, soil, rocks with a high speed will cause huge casualties and property losses.

Debris flows destroy transport facilities. It damages the buildings, silts lines, and disrupts traffic. After the earthquake, according to the survey from the transport sector, when the rainy season comes, debris flows often damage the railways and roads especially the roadbeds and buried buildings, causing traffic disruption.

Debris flows causes river courses to block. As the mud-rock flow carries a lot of solid substances, the frequency of the flow is far greater than that of the flow of water. What's more, it flows with the rapid erosion, transport and stacking. As a result, in a very short time, it can cause drastic changes of the original valleys. The debris accumulates a lot in the lower valley to form "Landslide Lake", Such as Tangjiashan "Landslide Lake". If it isn't well managed, huge potential hazards will exist in its lower reaches.

Mud-rock flows' damage to the regional environment is enormous. The flow carries large amounts of loose sand, which silts so widely that farmland can not be cultivated. The flow changes the original mountains' terrains, causes soil erosion and vegetation damage, and fails to regulate climate and conserve soil and water. Climate changes will exacerbate.

5. The formed conditions and factors of mud-rock flows in the quake-hit areas

Generally speaking, the following three conditions can form a mud-rock flow: the topography and geomorphology with steep catchments areas which are easy to accumulate water and other substances; there is a wealth of loose substances; a lot of water gets together in a short time. (Fei, Xiangjun, 2004) The mud-rock flow caused by Wenchuan earthquake equally satisfies these conditions, while it also has its own characteristics.

5.1 The topography and geomorphology conditions of mud-rock flows formed in the quake-hit areas

The earthquake occurred at the main fault of Longmen Mountains, located in the middle part of China's north-south seismic belt. There are many high mountains, deep valleys, steep terrains and steep gully beds where water can be easy to flow together. The slope of the broken soil surface affected by the earthquake infiltrated when a rainstorm hit. The soil was loose to slide down, mixed with water, and finally formed debris flows along the steep slope after erosion.

5.2 The source of loose substances for mud-rock flows in the quake-hit area.

Usually mud-rock flows happen in the areas with complicated topography, the folding faults, the active newly-formed terrains and high seismic intensity. Bad geological phenomena such as rock breaking, the surface splitting and collapsing after the earthquake provides many loose solid substances. In addition, the areas with a layer of soft and hard rocks are easily damaged by the earthquake, which provides rich debris. The debris from rock collapsing, the soil slipping in the rainstorms and the loose debris from valley beds form a mud-rock flow.

5.3 Water conditions of mud-rock flows in the quake-hit areas

The main earthquake zone this time is in Sichuan, and the rainfall is much more during the rainy season. A debris flow is closely related to the 10 mm rainfall. (Qi, Xiaojun, 2003) Water is not only an important component and condition of the mud-rock flows but also the media to carry debris. Usually the water sources of mud-rock flows are from heavy rains, and melt snow and water from reservoirs. (Pan, Mao, 2002) The main water sources of debris flows in the quake-hit areas are rainstorms, continuous rain for a long time and so on. The earth surface water caused by strong storms in the mid and upper valley erodes the broken mountains. With the increasing intensity of erosion, some rocks in the valleys begin to loose. Being heavily lift, swept, the rocks mix with water and form a mud-rock flow.

5.4 The factors of debris flows caused by earthquake

The factors of debris flows caused by earthquake are complicated, which include the crustal rock construct, topography, soil vegetation, hydrology, climate, rainfall and so on. Collapse and landslides because of the earthquake cause even more serious mud-rock flows. More other factors need seriously analyzing.

6. Prevention measures for mud-rock flows after the quake

The significant earthquake activated the potential disasters of mud-rock flows before the earthquake. In particular, mud-rock flows often occur in main flood seasons. Heavy rainfall and frequent aftershocks may cause more mud-rock flows at any time. Considering the characteristics of the debris flows in the mountain areas, I come up with the following prevention measures for the quake-hit areas.

6.1 Administrative measures

By post-disaster planning team's requirements, the quake-hit areas must establish the monitoring and forecasting systems, classify the districts in danger and teach relevant knowledge to local residents. Mud-rock flows' early warning system and emergency evacuation mechanism must be established necessarily. Before or when mud-rock flows occur, the affected units and individuals should take corresponding measures. By preventing and mitigating disasters, we should do lots of things such as rescuing the wounded, evacuating the residents, detecting disasters, organizing self-help, stabilizing social orders and so on.

*6.2 Engineering and biological measure*s

In order to prevent even greater damages caused by debris flows, it is necessary to build gravity dams, masonry dams, concrete stone arch dams, soil dams, grille dams, drainage troughs, silt basins and so on in

proper places. (Wang Shige, 2002) Reasonably planting trees and grass in the areas which are prone to occur mud-rock flows can conserve water and soil and reduce the volume of solid substance sources of debris flows.

6.3 Measures on self-examination

As for the characteristics of the main shock and the aftershock, with the influence of aftershocks, the mountain body is instable enough to cause mud-rock flows when rainstorms come. Therefore, we should investigate the geological environment and the distribution of the mud-rock flows in quake-hit areas and seriously do a good job about weather forecasting records.

7. Conclusion

As a member from quake-hit areas, I witnessed the earthquake and disasters, which touched my heart deeply. "5.12" earthquake has gradually been away from us. However, all kinds of disasters have impressed us at the bottom of our hearts. We should analyze and sum up the disasters caused by mud-rock flows and work out the characteristics of mud-rock flows caused by the quake-hit areas. In this case, we can better predict and prevent the geological disasters. I believe that by scientific means of management, we will overcome the natural disaster and reconstruct our beautiful homeland.

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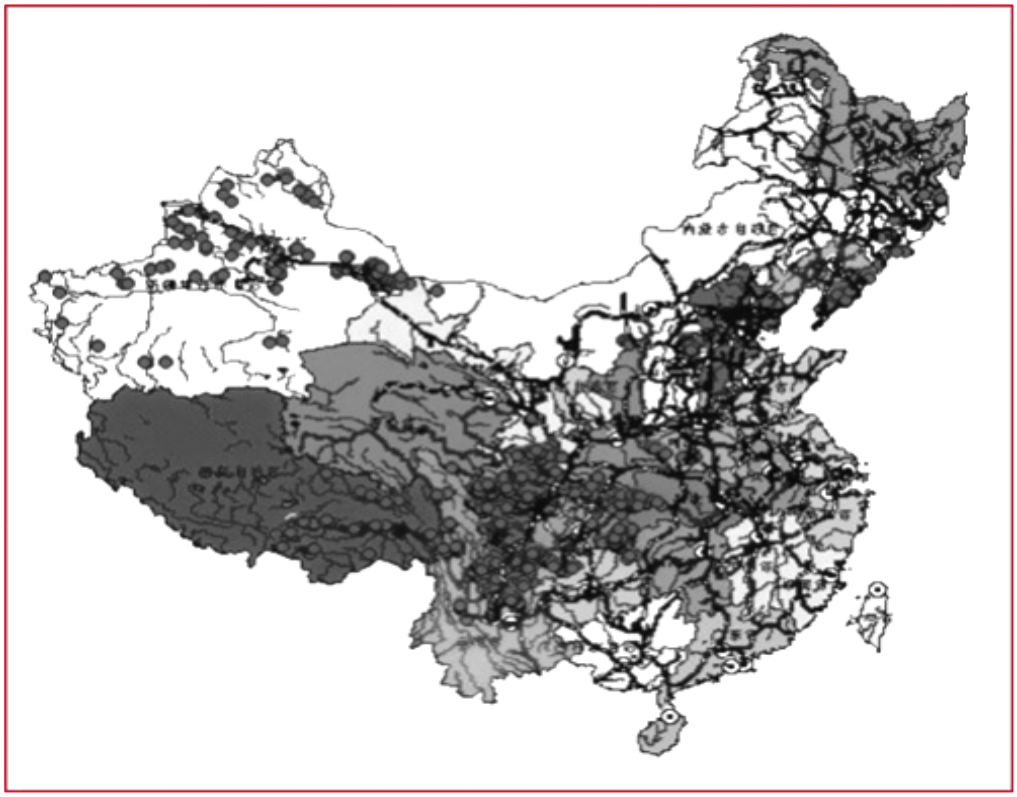

Figure 1. Distribution of post-disaster debris from MA Dongtao