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A catastrophic debris flow induced by heavy precipitation: June 13, 1995 Senirkent disaster

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On July 13, 1995, a catastrophic debris flow event occured in Senirkent (Isparta, SW Turkey). This debris flow resulted in death of 74 people, destruction of 180 houses completely and 212 houses heavily, and the lifelines and roads of Senirkent completely. The purpose of this study is to describe the mechanism and environmental impacts of the debris flow. Senirkent locates at a debris fan having an average altitude of 1000 m. This fan exists at the northern lower parts of the Beþparmak mountain. The peak altitude of this mountain is about 2400 m. The precipitation begun on July 10, 1995, however the amount and duration of precipitation of July 13, 1995 reached about 28 mm/m2 and 30 min respectively, according to the records of Senirkent Meteorology Station. According to the local eyewitnesses, most of this precipitation falled during the thirty minutes period before the catastrophe and amounted to more than 28 mm/m2 of the precipitation falled with thunder and flash of lightning on the Beþparmak Mountain crest (Karagüzel et al., 1996). Flood channelized in Doðru and Suyolu drainage channels from Beþparmak Mountain to Senirkent and caused the catastrophe. Debris material deposits on slope (50-150) of the Beþparmak Mountain and sediment deposits of Doðru and Suyolu drainage channels were saturated by rainfall before the catastrophe. Debris material consists of a mixture of fine material (average clay+silt ratio of 35%) and course material (gravel and boulders) originated from limestones. The debris flow was triggered by heavy precipitation. Debris material failed because the undrained shear strength was exceed. The failed debris material flowed along Doðru and Suyolu drainage channels because they have highly steep slope having an average of 300 in elevation between 1500-2000 m.

Doðru (2.3 km2) and Suyolu (1.8 km2) watershed areas collect at least 60 000 m3 and 50 000 m3 water, respectvely. Also, the total volume of debris material was esti-

mated 150 000 m3 by Karagüzel et al. (1996). Runout distance and depositional area parameters were calculated using the equation proposed by Legros (2002). The runout distance and deposition area were calculated as 7.5 km and 0.3 km2, respectively. After catastrophe, the runout distance for debris flow is measured as 4 km. Because of the district houses prevented the debris flow, the measured runout distance was obtained lower than the runout distance obtained empirically.

After the catastrophic debris flow event, a series of set were constructed to prevent the catastophic effects of debris flows on northern slope of the Beþparmak Mountain. Also suitable reginal climate trees were planted.

In order to determine of rheological behaviour of Senirkent catastrophe, a numerical runout model BING (Imran et al., 2001) was used. The runout model BING defines the rheological models and flow behaviours (runout distance, thickness of deposit, duration of flow and peak flow velocity). According to the results of the model run, the Herschel-Bulkley model provided the best fit because, it resulted in the shortest runout distance and the shortest duration of flow. A good accordance between the results of Herschel-Bulkley model and the observed debris flow event was found.

References

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