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Monitoring and surveying the catastrophic landslide of Jwaya-Lebanon

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Among the various natural hazards, landslides are probably the most damaging to the natural and human environment in the Mediterranean countries, including Lebanon which represents a good case study of mountainous landscape. Winter 2010 will be on records for years to come after, the high precipitation and flood caused structural destruction across vast areas in Lebanon. In Jwaya, a town located in southern Lebanon east to Tyr city; a three story house collapsed after the retaining fill slope failed under the house foundations. The entire slope slumped down word and kept on creeping forward over a period of time. To measure the direction, amount of movement and the difference in altitude a network of ten monitoring stations (points) was spread within and around the sliding surface using TOPOCON total station. The established traverse was tied with a reference (stable point) and a local coordinate system with arbitrary coordinates was utilized. Four campaigns were raised to monitor evolution of this movement on a period of two months: 14/2, 15/3, 19,3, 23/4 2010 respectively.
The field reconnaissance and the survey measurement showed that an area of 20 000 m2 occupying around 15 house units indicated the presence of two geological phenomena: creeping and slumping. A nearby improper excavation along with the torrential rainfall suggested the triggering of this failure. The main crown of the escarpment showed a vertical displacement of 120 cm. Other escarpments varied between 20 and 60 cm while the horizontal displacement ranged between a 200cm and 40 cm all over the sliding area. Moreover the monitored points showed an obvious displacement of the land, each in a different manner. The overall rate of movement in all points was measured to be 4.8 cm per month. With the increase of time discrepancies it was obvious that the displacement increases, but it is realized from the dates of monitoring that the temperature (rainy) affects movements more than time gaps. This is proved by the displacement between first visit and second visit is greater than displacement between second and third although the time gap is greater in the second. The greatest displacements are on the points in the green area where the scarp of the slump is.