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Computation of landslides base surfaces using DEM

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Fine mechanical analysis of slope movement by computer is a tedious task, which requires many data. If such methods permit detail assessment of landslides, they cannot be applied to large areas, for which a simplified approach is necessary, even leading to less accurate results. Nevertheless the presented method gives good order of magnitude of phenomenon.
The Slopping Local Base Level method (SLBL) delineates the potential erodible volume by landslide over a short period of time with respect to mountain chain life. These volumes are defined assuming that all undercut rock slopes are unstable because the volumes above the base line of the cut can slide. In the soil slope this surface can be curved. By analogy to the base level, which corresponds to the erosion base level, the surface described above corresponds to a base level for landsliding.

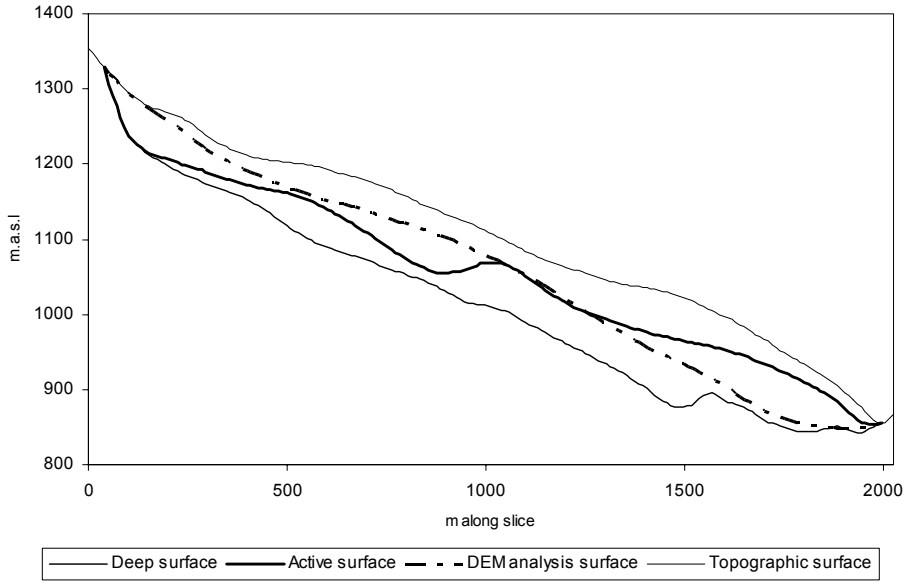

Figure 1: Comparison of the observed surface of failures of the La Frasse landslide with the calculated one on a longitudinal cross-section

This surface can be defined using Digital Elevation Model (DEM) by the following procedure: (1) definition of invariant points such as river, or contour of unstable area; (2) Following an iterative computation, each point of the DEM is replaced by the mean value *m* of its two higher and lower neighbours, if the considered point is higher than *m*; (3) this procedure continues till no variation is observed between to iterations.
In the case of soil, the middle point can be replaced by $m \pm \Delta$ (deviation), which permits to curve the surface.

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The comparison of the results obtained for the La Frasse landslide (Switzerland), with detailed investigation shows that (figure 1):

1. The volume estimation is correct,
2. The reparation of masses is too thick in the zone of accumulation and too thin in the zone of depletion. The detailed geological features are obviously not reproduced by the SLBL,
3. The definition of at least two imbricate landslides can be deduced from the SLBL.

The computation of the LSBL can also be used to define the more sensitive areas to landslides, by looking at the velocities of change of the topography indicated by the SLBL computation. Different landslide levels can be defined in such a way.
This method presents the advantage to quickly obtain a model before detailed field investigations.
The main problem encountered is to define the volume shape accurately. This can be improved by looking at limiting slope angle for sliding and maximum thickness.