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Inventory of shallow landslides in regard with their frequency in the Canton of Vaud (Switzerland).

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The study consists in making a new inventory of shallow landslides in the Canton of Vaud in Switzerland, including volumes and occurrences. The Canton of Vaud has been very active in developing approaches for natural hazard mapping over the last years (VD, 2017). It includes gravitational hazards such as: permanent landslides (deep), spontaneous landslides (shallow), rockfalls, subsidence or collapse. Although shallow landslides are typically small in volume, they are frequently located close to populated areas, have often high velocities and impact energies, and then can be very damaging for persons and infrastructures.

In 2015, the whole Canton of Vaud territory was covered by a new airborne LiDAR acquisition with an unprecedented density of points (up to 80 points / m2). This new dataset offers an excellent opportunity to make a new inventory of shallow landslides including volumes estimations.
Main datasets used for this project are: 1) a digital elevation model (DEM) at 0.5 m grid cell size. The full LiDAR point clouds datasets are available too; 2) a former inventory including more than 610 events from years 1889 to 2013, 3) present hazard maps, 4) basic documents such as geological and topographical maps, air photos.

Main part of the work is to identify and map shallow landslides on hillshaded representations of the new DEM for 7 pilot zones representing various geological, soils and site conditions. Estimation of the sliding surfaces and volumes was done with 3 different methods: the half-ellipsoid method, the elliptic paraboloid method and the "Sloping Local Base Level" (SLBL) method (Jaboyedoff & Derron, 2005). In order to test the method, shallow landslides whose volumes are known from independent technical reports or inventories are used. Results are showing that there are no significant differences of the volumes estimated with the half-ellipsoid method and with the SLBL method. The volume ratio of the elliptic paraboloid method and the half-ellipsoid is 0.75. Data are showing a more significant different pattern depending if it is a landslide situated on a mountain slope or on a riverbank slope.

Volumes vs frequencies graphs indicates that the volumes follows power law like distributions which depends primarily on the type of slope (mountain slope vs riverbank slope) and secondary on the site conditions like geology, presence of quaternary layers.
In addition, in several cases, the reach angle can be estimated, allowing first to assess the probability of propagation. All these results will improve significantly hazard and risk assessment maps for shallow landslides.

REFERENCES

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