



Study of the dynamic behavior of earthflows through the analysis of shear wave velocity in the landslide's body

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Over the first year of my PhD, I carried out a literature search about earthflows features and dynamics and conducted periodic ReMi-MASW campaigns to assess the temporal variation of shear velocity for several landslides that were recently reactivated. Literature search was conducted to review recent works related to shear wave velocity as an indicator for rheological changes in clay materials (Mainsant et al., 2012). From January to August 2014 I carried out numerous ReMi-MASW surveys to characterize several active earthflows in the Emilia-Romagna Apennines. I did these measures both inside and outside the landslide's bodies, usually during the first ten days after the reactivation. At first, these measures indicate low shear waves velocity inside the landslide and high velocity outside. This is due to the different consistence of the materials, to the different water content and to the void index. Then I repeated the measures over time in the same places on the same landslide, in order to detect the variability of Vs over time in correlations with the landslide's movements.

Periodic ReMi-MASW survey were conducted on the following landslides:

- The Montevecchio (FC) earthflow was reactivated the 1th of February 2014 (estimated volume of 240.000 m³) and increased the movement's velocity around the 7th of February 2014, after intense precipitations. Analyzing the data collected inside the landslide's body, I observed an increase of Vs over time, due to the decrease of landslide velocity;
- The Silla (BO) complex landslide reactivated the 10th of February 2014 (estimated volume of 900.000 m³), and moved downslope with a maximum velocity in the order of several m/hour. Studying the data, it is possible to notice how the Vs increase over time only in the lower portion of the landslide. In fact the upper portion is still active, so the Vs remained unchanged over time.
- the Puzzola-Grizzana Morandi (BO) complex landslide. This landslide was reactivated the 10th of February 2014 involving about 5000 m³ of materials. Analyzing the data collected inside the landslide's body, I observed an increase of Vs over time, due to the decrease of landslide velocity and, probably, to the remedial works carried out after the reactivation;
- The Mozuno (BO) rotational landslide. This landslide was reactivated around the first day of March 2014. The data collected show a decrease of Vs variability, due to an increase of fractures near the main scarp;
- The Borgo Val di Taro (PR) complex landslide. This landslide was reactivated during the night between the 9th and the 10th of February 2014 with a maximum velocity around 40m/d. The data collected show an increase of Vs, due to the slowing of the movements and the consolidation of landslide material;
- The Camugnano (BO) transitional landslide. The reactivation of this landslide was around the 15th of March 2014. Analyzing the data collected inside the landslide's body, I noted an increase of Vs over time, due to the slowing of the movements;
- The Zattaglia-Poggio Zampiroli (BO) transitional landslide. The reactivation of the landslide occurred on the 9th of February 2014. The data show really different values of Vs in relation to the landslide's portion investigated and show an increase of Vs over time.

In all these cases, the measures taken outside the landslide's body do not show a significant Vs variability, because the material are not involved in the landslide's movements.

Preliminary results from field data clearly show that the variation of the shear wave velocity with time is related to the movements of the landslides and to the different consistence of the materials.