Geophysical Research Abstracts
Vol. 16, EGU2014-9188-1, 2014
EGU General Assembly 2014
© Author(s) 2014. CC Attribution 3.0 License.

Erosion processes in molassic cliffs: the role of the rock surface temperature and atmospheric conditions

Dario Carrea, Antonio Abellán, Antoine Guerin, Michel Jaboyedoff, and Jérémie Voumard
University of Lausanne, ISTE - Institut des Sciences de la Terre, Lausanne, Switzerland (dario.carrea@unil.ch)

The morphology of the Swiss Plateau is modeled by numerous steep cliffs of Molasse. These cliffs are mainly composed of sub-horizontal alternated layers of sandstone, shale and conglomerates deposed in the Alps foreland basin during the Tertiary period. These Molasse cliffs are affected by erosion processes inducing numerous rockfall events. Thus, it is relevant to understand how different external factors influence Molasse erosion rates. In this study, we focus on analyzing temperature variation during a winter season.

As pilot study area we selected a cliff which is formed by a sub-horizontal alternation of outcropping sandstone and shale. The westward facing test site (La Cornalle, Vaud, Switzerland), which is a lateral scarp of a slow moving landslide area, is currently affected by intense erosion.

Regarding data acquisition, we monitored both in-situ rock and air temperatures at 15 minutes time-step since October 2013: (1) on the one hand we measured Ground Surface Temperature (GST) at near-surface (0.1 meter depth) using a GST mini-datalogger M-Log5W-Rock model; (2) On the other hand we monitored atmospheric conditions using a weather station (Davis Vantage pro2 plus) collecting numerous parameters (i.e. temperature, irradiation, rain, wind speed, etc.). Furthermore, the area was also seasonally monitored by Ground-Based (GB) LiDAR since 2010 and monthly monitored since September 2013.

In order to understand how atmospheric conditions (such as freeze and thaw effect) influence the erosion of the cliff, we modeled the temperature diffusion through the rock mass. To this end, we applied heat diffusion and radiation equation using a 1D temperature profile, obtaining as a result both temperature variations at different depths together with the location of the 0°C isotherm. Our model was calibrated during a given training set using both in-situ rock temperatures and atmospheric conditions.

We then carried out a comparison with the rockfall events derived from the 3D GB-LiDAR datasets in order to quantify the erosion rates and to correlate it with atmospheric conditions, aiming to analyze which parameters influence Molasse erosion process.