Geophysical Research Abstracts,
Vol. 11, EGU2009-11951, 2009
EGU General Assembly 2009

Air circulation and cooling effect through artificial screes : a preliminary case study (Fribourg, Switzerland)

J. Dorthe, D. Abbet, and R. Delaloye
University of Fribourg, Geography, Geosciences, Fribourg, Switzerland (jonathan.dorthe@unifr.ch)

Keywords: Air circulation; sorted gravel heap; thermal regime; temperature measurements; electrical resistivity tomography

Occurrences and thermal impacts of air circulation throughout a natural porous medium have been detected and investigated for the last decade in many talus slopes located in mid-latitude regions (e.g. in the Swiss Alps and Prealps). The process makes sporadic permafrost to occur far below the regional lower limit of discontinuous permafrost. It is commonly accepted that connected systems of large voids facilitates the movement of air. Which void size and structure do prevent the circulation of air and the significant cooling of the ventilated terrain is still a remaining open question. The investigation of artificial gravel heaps consisting each of material of different grain-size could provide key data to solve the problem.

By the end of a 4-week period of cold weather (daily mean temperature often colder than -5°C) in December 2008 / January 2009, with 10-20 cm deep laying snow cover, investigations similar to those performed on natural talus slopes (visual observations, ground surface temperature measurements, 2D electrical resistivity tomography) have been carried out on 8 artificial gravel heaps from 2 to12 m high located in a gravel pit close to Fribourg (620 m a.s.l., Switzerland). The study was aimed to analyse the air circulation and its impact on the thermal regime of the artificial screes depending on the grain-size of the consisting material (>4 mm to 16-32 mm), the volume (10-2000 m3) and the porosity of the heaps. The first results of this ongoing study can be resumed hereafter.

Any evidence of air circulation was not observed on the heaps with a grain-size <4 mm and a volume smaller than 30m3.

Conversely, the three gravel heaps (900-2000 m3) with grain-size larger than 8-11 mm were affected by intense air circulation and showed the same evidences as those observed on natural talus slopes: on the one hand the top of each heap was unfrozen, wet and snowless due to the expelling of warm air from inside the deposit; on the other hand the lower parts of the heaps were strongly frozen with temperature much lower than -5°C. Therefore, an excavation revealed that the material was frozen deep inside the heap. In the frozen section, ice bounds cemented the grains together or was absent (sublimation ?), in both cases leaving the porosity open for air to circulate continuously. The gravel pit holder also mentions that the interior of the large heaps can be sometimes frozen until the beginning of summertime.

At this stage, it can be stated that an open-void debris accumulation consisting of clasts with a grain-size as small as about 1 cm does not prevent an efficient circulation of air throughout the whole of the porous medium and its consecutive overcooling in wintertime.