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Full-depth avalanches and soil erosion: an experimental site in NW Italy

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In the future the combined effect of changes in climate and land use could contribute to the intensification of soil erosion, related to snowpack movements as snow gliding and full-depth avalanches. Often, with particular meteorological conditions, the snow movement along a slope is associated with erosion and transport of the upper soil horizons, with the release of significant amount of material in the runout zone. Moreover the chemical composition of the snow in the deposition zone is usually different from the snow in the starting zone, revealing a potential release of ionic species mainly by the organic debris transported by the avalanche itself. The aim of this work is to characterize the quantity and quality of the material released by full-depth avalanches in the deposition zone. The study area is located in Aosta Valley (NW-Italy), on a SW exposed avalanche path, running from 2000 m a.s.l. of the triggering zone to 1200 m a.s.l. of the deposition zone. At this site, snow gliding and glide cracks, generally followed by full-depth avalanches, have been frequently observed. In the starting area, two plots located at the same elevation, slope and aspect, but with different soil moisture content, are equipped with moisture and temperature sensors, located at different depth in the soil, at the snow-soil interface and in the basal snowpack layer, and with glide shoes. The recorded data are related to the snow physical properties, measured by periodical investigations. In the deposition area, after a full-depth avalanche event occurred in March 2009, the mixed material was collected through snow avalanche coring, and a snow pit was dug in the deposit, in order to evaluate the quantity and the distribution of the material transported by the avalanche. First results show that the average density of the snow in the deposition zone was 624 kg m-3. The solid material was distributed mainly in the upper 5 cm of the avalanche deposit, with a mean concentration of the material equal to 187 kg m-3. The accumulation of sediments in the runout zone was estimated equal to 93 Mg ha-1. The concentration of cations and anions in the avalanche snow was higher on the deposit surface (e.g. NH4+: 85.6 μeq L-1 in the surface and 1.5 μeq L-1 along the profile) and was significantly higher than the mean concentrations observed for alpine snowpacks (e.g. NH4+: $\sim$ 5 μeq L-1). By redistributing snow, avalanches not only redistribute water, but also nutrients, that can be available for plants in the growing season. Moreover avalanche tracks are places where soil accumulates in some areas and erodes in others, contributing to potentially unique pedo-environmental conditions. This project is carried out as part of "DYNAVAL", a EU Interreg Project.