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Applicability of cloud radar observations for an intra-event analysis of runoff on a steep vineyard

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Studying runoff on steep vineyards is an important topic in the agricultural science. Steep vineyards are especially susceptible to soil erosion due to the force of water runoff. Runoff can also carry sediment, pesticides, and fertilizers thus affecting nutrient efficiency and water quality. Understanding of how runoff depends on properties of rain and state of soil can help to improve soil management practices.

There is a number of studies investigating how runoff depends on properties of rain and soil. Typically, the amount of runoff is related to maximum rain intensity, total precipitation, soil water content, etc. Based on a large number of runoff events, often collected over multiple years of observations, the runoff can be represented as a linear regression of the abovementioned variables. However, these linear regressions are highly variable from time period to time period and also among different sites. In order to better understand possible reasons of such variability, a more detailed analysis of single events is required.

In this study we make an attempt to characterize the water budget within a single rain event. From summer 2023 we have run a measurement campaign at an operational site in the Alto Monferrato vine-growing area (Piedmont, NW Italy). For the campaign the site, which is already well equipped with state-of-the art soil and runoff sampling tools, was complemented by a polarimetric cloud radar. The cloud radar can obtain range-resolved profiles of drop-size distribution with high spatial and temporal resolution. The radar observations can be used to characterize rain and to check how variable rain properties are over the field. The main advantages of cloud radars over conventional in-situ rain sampling devices are much larger sampling volume and range profiling of rain properties.

During the summer and autumn seasons we have already collected more than 10 runoff events with different duration and intensity. The collected dataset allows us to relate runoff to rain and soil properties on intra-event scale. The rain intensity is characterized based on cloud radar observations. The water content is measured by moisture sensors located at three different depth levels. Finally, the amount of runoff is measured using 12 L tipping buckets. The site is split into plots with different soil management in the inter-row. This makes it possible to also investigate

how different cover affects the water budget.