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Multi-temporal sediment-yield estimates in a steep headwater catchment using UAV and sensor measurements. Challenges and results from the Rebaixader debris-flow monitoring site (Pyrenees).

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Debris flow and related processes strongly affect the morphology of headwater catchments and deliver large amounts of sediments into the drainage network. The Rebaixader monitoring site, which is situated in the Central Pyrenees, is a perfect location to analyse different slope mass-wasting processes and to quantify the sediment yield in this headwater catchment. Two types of data are available: first, yearly photogrammetric surveys by Uncrewed Aerial Vehicle (UAV) have been performed since 2016, and second, an instrumental monitoring system is operational since 2009. Therefore, six years of data can be compared by these two approaches. While the UAV surveys produce point-clouds, Digital Surface Models (DSM) and orthophotos, the monitoring system determines the total volume of each torrential flow by flow-depth sensors, geophones and video cameras. Therefore, the volumes of the torrential flows determined by the instrumental monitoring system were compared and contrasted with those obtained from the DoD (Dem of differences) of photogrammetric reconstructions from UAV flights.

The final values of the sediment yield are between 0.1 and 0.2 m3/m2/y, which shows that this torrential catchment has a very high erosion activity.

The experience from this study shows that the applied monitoring techniques make it possible to i) quantify the sediment yield, ii) identify the different phenomena, and iii) determine the spatial distribution of each process. Regarding the UAV-datasets, the appropriateness of using DoD or advantages of comparing directly the different 3D point clouds are other conclusions derived from this study that will be discussed.