The Vaia event: primary impacts of the storm and subsequent evolution of the Malgonera Stream (Dolomites)

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**Abstract.**

Large Infrequent Disturbances (LIDs), defined as major events that overturn both the morphological setting of the river networks and hillslopes, increasingly affect mountain basins. The subsequent secondary impacts (i.e., wood recruitment after windstorms; mass movements after wildfires; alteration of sediment fluxes after volcanic eruptions) are often disregarded although their understanding would provide important advice to river managers. The following work aims at investigating the primary impacts of the Vaia windstorm event (27th-31st October 2018) and the subsequent evolution of the channel morphology and large wood (LW) load of a small Alpine stream (Malgonera, study area 6,025 m2). To achieve the objectives, remote sensing (LiDAR; UAV) and field data were exploited. Remote sensing products were used to compute two Dem Of Difference (DoD): the first investigated the Vaia impact (pre vs post Vaia; 2010-2019) and the second monitored the evolution of the channel (post vs post-post Vaia, 2020-2021). Field data of LW, combined with the LiDAR and UAVs surveys, were collected to compute both the LW load entailed by Vaia and the subsequent LW fluctuations (2020-2021). The net sediment volume after the event was estimated around -2,025 m3. The area of total erosion was 2,659 m2, while the deposition covered 1,222 m2. Notably, the average depth of surface lowering was deeper than 1 m. On the contrary, the most recent DoD (2020-2021) featured almost irrelevant geomorphic changes and balanced net volume. Concerning the in-channel wood, not present before Vaia, the results showed an input of 58 m3 (96.3 m3/ha) for a total amount of 279 (463 N°/ha) wood elements. Around 50 logs were classified as single elements while the remaining as elements composing wood jams. Between 2020 and 2021 the LW load increased up to a volume of 61.50 m3 (102 m3/ha), increasing the number of elements to 292 (485 N°/ha). This new LW input was caused by cantilever failures of small portions of the unstable forested banks. Therefore, this work underlines the capability of LIDs to affect and rearrange the morphology of mountain streams. Nonetheless, it provides some first evidence on the secondary processes of LW recruitment along an unstable mountain stream affected by a windstorm. Additionally, it interestingly highlights how changes in the LW are detached from limited changes in the channel morphologies. Such information, as well as covering gaps in the literature, provides some useful advice for future river management strategies.