



ICG2022-236

<https://doi.org/10.5194/icg2022-236>

10th International Conference on Geomorphology

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Channel change during catastrophic flood: example of the Alex storm in the Vésubie valley

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Documenting and interpreting channel responses to catastrophic floods help understanding how rapid fluvial metamorphosis can propagate in a catchment under sediment cascading effects. The recent example of the October 2020 Alex storm in SE France (~500 mm of rain in 24 h) provides a unique opportunity to investigate the sudden formation of a braided channel along 35 km of a confined alpine valley (Vésubie) and to link the morphological response with sediment wave initiation and propagation. GIS-based analysis of remote sensing data (high-resolution ortho-imagery and airborne LiDAR data) acquired before and after the flood allowed combining channel changes with sediment erosion and deposition along a 35-km reach of the Vésubie, including the most impacted portions of the valley. Archives of aerial imagery and old pictures were also used to integrate the storm impact in the historical trajectory of the river. Comparison of the Alex storm effect with past major floods that occurred in the valley shows that active channel widening after the storm was one order of magnitude higher than during the 100-yr flood of November 1997. Dramatic channel aggradation was observed, with net bed-level change exceeding 10 m in some proximal reaches. This case study allows us to discuss the critical role of floodplain and terrace erosion in the formation of the post-flood braided channel, and to compare the geomorphic impact of the storm with similar reported cases in the literature.