Flood hazard in mountain rivers: the key role of geomorphic processes during high magnitude events

(Proposers: Prof. Nicola Surian, Dr. Andrea Brenna)

Floods are one of the major natural hazards that affect highly populated countries and the frequency of extreme events is increasing due to climate change. Although channel dynamics (i.e., bank erosion, intense sediment and wood transport) are commonly the dominant processes in mountain rivers during high-magnitude floods, hazard assessment still mostly focuses on water flooding only. Therefore, there is a need to include river geomorphological hazard to produce reliable flood hazard mapping and define effective mitigation and adaption measures. The proposed project has two main goals: (i) to investigate channel response to floods of different magnitude, and in particular to extreme hydrological events; (ii) to improve hazard assessment, that is our capability of predicting geomorphic effects of floods.

For hazard assessment it is crucial to document the type and magnitude of channel response, to identify controlling factors of such response, and to develop tools enabling channel dynamics predictions. Buraas et al. (2014) pointed out that there is still a general lack in the capability to predict where major geomorphic changes take place during a high magnitude flood event. In this respect, the integrated approach developed by Rinaldi et al. (2016) and studies on recent flood events (e.g. Surian et al., 2016; Scorpio et al., 2018) represent promising contributions for the analysis of channel response to extreme floods and identification of controlling factors on channel responses. For instance, the role of intense sediment transport (i.e., debris floods) seems to be crucial for identifying sites where major channel widening can occur (Brenna et al., 2023) (Figure 1).

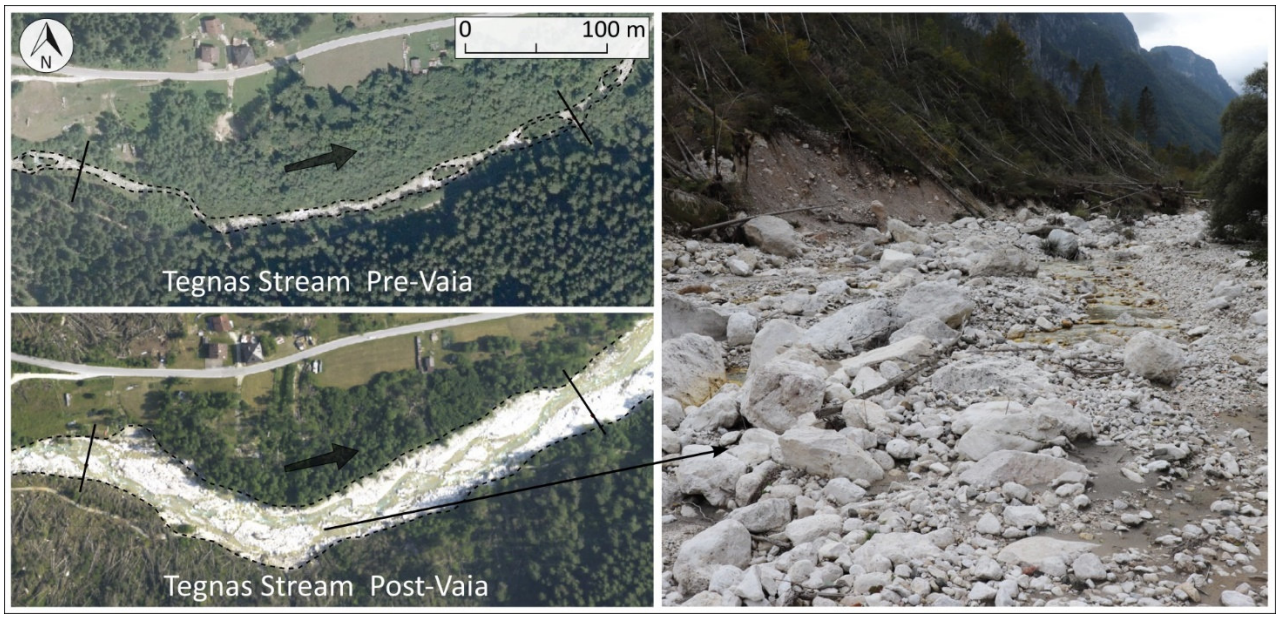

Figure 1. Intense sediment transport and channel widening due to Vaia Storm (October 2018).

Notwithstanding this, there is a need for (i) understanding the spatial variability of geomorphic response to a single flood event; (ii) building a larger dataset, including a wide range of flood magnitude, channel morphologies, environmental conditions; (iii) testing and developing geomorphic tools (e.g., identification of "river morphodynamic corridors") that should improve our capability in forecasting channel response to floods and predisposing effective territorial planning. Although such

forecasting is very challenging, this is crucial since ongoing climate changes are increasing flood frequency, specifically occurrence of extreme floods.

Possible collaborations: University of Bern; Universidad Complutense de Madrid; C.N.R. IRPI; ISPRA

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References:

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Rinaldi et al. (2016), Earth Surf. Process. Landf., 41, 835-846.

Scorpio et al. (2018), Science of the Total Environment, 640-641, 337-351.

Surian et al. (2016), Geomorphology, 272, 78-91.