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Eroded riverbank assessing in a gravel bed reach of the Piave River by processing LiDAR and TLS data

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The fluvial systems, can be classified in different morphological units according to the characteristics of the surrounding lands. In the wide alpine valleys and foothill regions, the rivers usually assume a dominant braided or wandering morphology. Such configurations are characterized by high complexity of evolutionary dynamics. Availability of sediment, transport capacity and human impacts, directly affect the erosive and depositional processes that are the basis of morphological changes. These processes can create lateral erosions to the river that possibly could trigger bank erosion. This process can be described in a quantitative way, but it can be difficult or impossible if the topographic data collected have too low resolution or too high uncertainty in relation to the spatial and temporal scale evaluated.
The present study, assess the dynamic of a significant erosion occurred in a lateral bank of the Piave River (North-East of Italy), with a good equilibrium between time-consuming and results at low uncertainty. The evaluation was performed by using LiDAR data of 2003, 2010 and 2011 and two TLS surveys carried out in 2013 and 2014. TLS data were filtered from vegetation with a new tool developed and called vegeFILTER (Vegetation Filter - Matlab® script). Volumetric changes over 11 years of analysis (2003-2014) were estimated and subsequently assessed with a second new tool developed: PrEDA (Principal Erosion Deposition Analyzer - Matlab® script). PrEDA is able to extract and automatically analyse continuum layers of erosion and deposition over a difference of DEM (DoD). From 2003 to 2014 the riverbank was subjected to around 3250 m3 of erosion and 4250 m3 of deposition, probably due to the joined action of floods and the upstream longitudinal bank protection. VegeFILTER and PrEDA have been proved to represent useful tools for optimizing time consuming and to follow a more objective way when we are working with TLS clouds and DoDs.
The proposed work represents a valuable support for river topography description, river management, ecology and restoration purposes.

Keywords: Fluvial processes; gravel bed river; riverbank erosion; LiDAR data; TLS data; vegetation filtering; erosion-deposition analysis.