Supporting the study of expansion and retraction dynamics of flowing streams with aerial photogrammetry from UAV (Unmanned Aerial Vehicle)

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River networks expand and retract, periodically changing their drainage network density, depending on several climatic and geomorphic controls. The ERC funded project DyNET (Dynamical River Networks: climatic controls and biogeochemical function), undertaken by University of Padua (Italy) in collaboration with University of Calabria (Italy), University of Tuscia (Italy) and the Eawag Institute of Zurich (Switzerland), aims to provide, for the first time, a systematic and quantitative description of such dynamics, contributing to the objective identification of temporary stream segments. This topic is recognized by the European Union itself as a key point, given the different ecological dynamics and resulting different protocols needed for the observation and management of temporary streams. The project examines a group of catchments in Italy and Switzerland along a climatic gradient and, among other instruments and tools, uses images from UAVs (Unmanned Aerial Vehicle) and satellites. The employ of UAVs is given by the need to acquire data in inaccessible areas, thus being able to return a high resolution mapping for the study of river networks dynamical processes, as well as for the effective repeatability of flights and the consequent analytical multi-temporal approach.

This study specifically refers to the observation of the expansion and retraction dynamics of the Turbolo Creek catchment, located in Calabria (southern Italy). The catchment area is very heterogeneous concerning geology, since it is characterized by three distinct geo-lithological facies, determining different permeability of surface soils, therefore deeply influencing river network dynamics. The test area is 7 km2 wide, covering the upstream area of the catchment, where a tributary (the San Nicola Creek) significantly contributes to river discharge. River network is being monitored since October 2018, through both visual surveys on site and photogrammetric surveys with UAVs, aimed at controlling the presence/absence of active surface flow. From February 2019 also images from thermographic cameras will be available, useful to support surveys in the case of dense vegetation with hidden river bed. The data collected is organized in a GIS project expressly designed to highlight temporal dynamics of the river network. Furthermore, the considerable difference in spatial resolution between satellite and UAV images, especially for the assessment of the presence/absence of water, is highlighted.