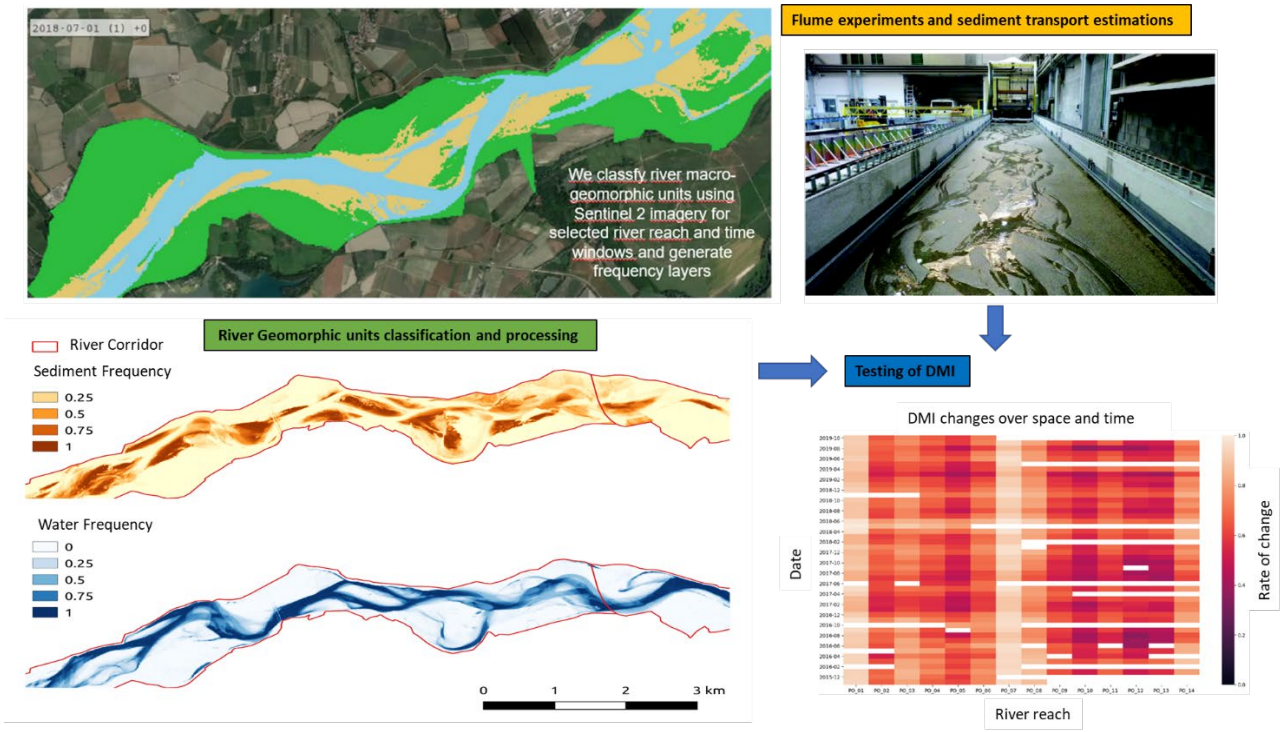
River Mapping From Space

(Proposer: Dr. Simone Bizzi)

Nowadays, it is possible to fully characterize at the basin scale using trained algorithms and toolboxes: riparian corridor features, floodplain patterns, active channel (i.e. the part of the channel re-worked frequently by yearly floods) and its channel forms, and channel confinement. These procedures are flourishing in the literature and, although they are first attempts, they are paving the way toward a more quantitative and objective characterization of river systems at a resolution not available in the past. The information generated by these pioneering applications are a precious basis for river geomorphic interpretation at regional scale but they are still based on once in time mapping. In other words, they present a picture of spatially distributed information acquired in a single specific date, it is not a time varying information. At the most few specific dates acquired in different years have been compared but without information of what happen in between these dates. This is a major limitation when trying to interpret geomorphological processes, which are dynamic by their own nature.



Recently (since 2016), the availability of multispectral satellite images of Sentinel 2 (S2) opens to new possibility in this respect since river multispectral orthoimages are available weekly and globally at 10m (Vis and NIR) or 20m (SWIR) spatial resolution. This means that medium-large rivers (e.g., with channel width larger than 50m) can be mapped globally and weekly in absence of clouds. Landsat satellite acquire global multispectral imagery since late seventies at 30 m meter resolution with two weeks, on average, reacquisition time. Although some research experiences have been proposed to exploit these rich datasets, the value of such dynamic information for river geomorphic interpretation have been limited to date.

This project aims to test opportunities offered by satellite imagery to develop novel river geomorphic indicators capable to integrate spatial and temporal information globally and to provide new and meaningful description of channel forms and processes. These indicators aim to be the foundation of new approaches to quantitatively characterize river types and their dynamic. Specifically, this project objectives are:

1. To develop a few novel indicators of the dynamics of river alluvial morphology (Dynamic Morphological Indexes, DMI) capable to exploit spatial and temporal information generated by satellite imagery. These indicators will be calculated on a global selection of alluvial rivers.
2. Linking DMI changes with variations in sediment transport to assess the sensitiveness of alluvial morphology to variations in sediment load and water fluxes.
3. Assess the ability of the proposed DMI indexes to characterize and distinguish river types in terms of morphological units and their associated dynamic.

The project will adopt Python and Google Engine as software interfaces to develop this research.
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