Geophysical Research Abstracts
Vol. 20, EGU2018-13642, 2018
EGU General Assembly 2018


# Orbital grain size mapping from Sentinel 2 images

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A key variable to delineate and characterise river geomorphic units and to better understand fluvial processes is bed material grain size distribution and its pattern of change along rivers and over time. Field based approaches are still dominating in river surveys and their prerequisites limit their application at the network scale and may fail in guaranteeing an objective and repeatable monitoring assessment (Bizzi et al., 2015). In the last two decades, remote sensing (RS) technology has opened up new possibilities for river science, providing continuous data over entire catchments, allowing for a comprehensive river management and monitoring.
Depending on surface characteristics, sunlight re[U+FB02]ected from the soil changes as function of many parameters such as surface roughness, linked to geometry and shape of single grains. Previous studies have shown that there is a correlation between particles and spectral signature of a sediment (Black et al., 2014, Carbonneau et al., 2004). Building on this evidence, this paper investigates the potential of Sentinel 2 multispectral data in discriminating classes of sediment (from fine gravel to coarse cobbles) of exposed river sediment bars. The methodology uses near ground sUAS imagery in order to correlate local grain sizes to Sentinel 2 radiance values.
Results show that the relation between reflectance values registered by Sentinel 2 sensors and surface grain size percentiles is significant. The most sensitive band capable alone to explain around 70% of the variance is in the SWIR region. This methodology has then been applied on about 500 km of the major Italian river, the Po river. The resulting [U+FB01]ning pattern is comparable to others reported in literature and is coherently linked with main tributaries and river infrastructures existing along its course.
This method represents potentially a major advance in our current ability to characterize [U+FB02]uvial habitats and processes along major river systems, thanks to the characteristics of Sentinel 2 data, free available worldwide with a return time frequency of about 5 days. Moreover, the combination of satellite and sUAS remote sensed technologies introduces a new, objective, efficient and repeatable methodology for grain size mapping in large rivers, opening up broad perspectives for future fluvial survey practices. Further studies are required to better understand physical explanations behind observed phenomena by testing the methodology on other large rivers different in geology, lithology and geographic position (i.e. latitude).