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Corresponding author: Francesco Tufano
e-mail of corresponding author: f.tufano@cira.it
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Title

Repeatable and scalable Image Acquisition from Drone equipped with Multispectral and Thermal Sensor for proximal sensing processing of Nature Based Solutions

Authors
Francesco Tufano, *Cesario Vincenzo Angelino*, *Edoardo Bucchignani*

** Corresponding author*
[1] Italian Aerospace Research Center, *Via Maiorise snc*, *81043 Capua*, *Italy*, *f.tufano@cira.it*

Abstract
Hydro-meteorological hazards, such as floods and storm surges, are responsible for severe socio-economic disruptions and the risks associated are expected to increase due to the climate changes, whilst traditional measures (*e.g.*, dykes, seawalls) could not be able to cope with the expected intensifications of these events. For this reason, Nature Based Solutions (NBS) represent measures encouraged by global summits in order to address environmental problems caused by climate change [1]. The concept of Open-Air Laboratory (OAL) has been recently implemented by the H2020 project OPERANDUM, in order to demonstrate the applicability of the NBS for this kind of hazards. Monitoring of the impacts of OALs is generally done by using a combination of remote sensing at multiple scale and in situ data, including socio – economic variables aimed at acquiring new insights on the bio – geophysical processes determining the impacts and vulnerability of NBS.

In this work, we present a repeatable and scalable process for the image acquisition over an artificial dune, which is aimed at reducing storm surge and consequent coastal erosion [2]. To this purpose, a suitably drone equipped with a multispectral camera and an advanced drone autopilot is used. High resolution spatial image sequences have been acquired in visible (RGB), red edge, near infrared and thermal infrared (LWIR) bands. Image processing allows to evaluate the surface of NBS, vegetation status and terrain temperature. Based on these acquisitions, several indicators have been computed, *e.g.*, NDVI (Normalized Difference Vegetation Index), GNDVI (Green Normalized Difference Vegetation Index), NIRE (Normalized Index Red Edge) in order to evaluate the NBS effectiveness based on the fact that the reflectance changes significantly between stressed and healthy vegetation. Furthermore, we introduce a methodology to use these indicators in other NBS of the same type, but with different size and in different locations. In particular, using a customized Foxtech Hover 1, equipped with a multispectral Micasense Altum, has been defined a repeatable and scalable data acquisition.
In order to ensure the follow up of NBS, an image reflectance calibration phase needed. In this way it is possible to correctly use the image analysis tools enabling the comparison amoung acquisitions made in different times. Repeatability and comparison are simplified thanks to the definition of a specific done flight plan for each NBS. To process the images a particular workflow is defined by NBS type, in order to generate geolocated orthomosaics, three-dimensional reconstructions and volumetric measurements. Vegetation indexes can be applied on them and some considerations on the NBS structure can be made. The state of health of the vegetation is strictly related to the functionality of the NBS.

References

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