

Feasibility of DESIS Imaging Spectrometer for the Detection of Burned Areas: The Case Study of Arakapas Fire in Cyprus 2021

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KEY WORDS: DESIS, ISS, Imaging Spectrometer, Burned Areas, Fires

This paper presents an assessment of the use of the DESIS sensor, the imaging spectrometer mounted on the International Space Station (ISS), for the detection of burned areas in sensitive areas. Each DESIS acquisition records continuous spectral information over areas of 30 km × 30 km, a suitable size for such applications, in the visible and near infrared ranges across 235 spectral bands. As DESIS is the first hyperspectral sensor allowing rapid revisit of any site of interest excluding extreme high latitudes, pre- and post-event images can be available, where burned areas can be detected with change detection techniques coupled with suitable, narrow-band spectral indices. Such products may help in timely raising awareness on the endangerment of cultural and natural heritage sites and landscapes, emphasising the importance of Earth Observation (EO) data for monitoring, digitizing and documenting valuable cultural heritage sites.

A first assessment for the case of the Arakapas fire in Cyprus is presented. This event started on Saturday, the 3rd of July 2021 in the Limassol district near the village of Arakapas and was controlled after approximately 24 hours. The area affected by the fire is designated as an area of special aesthetic value of the Troodos mountain range to the South West Shores and is included in the Troodos UNESCO global geo-park, which characterizes it as a natural heritage landscape. According to the Department of Antiquities, there are 13 cultural heritage sites in the extended region of the fire. Indeed, several churches of significant cultural value were in danger, being located close to the fire. DESIS acquisitions in cloud-free conditions are available for the pre- and post-event dates of the 10th of June and 31st of July 2021, respectively. The difference of the narrow-band Normalized Differential Vegetation Index (NDVI), using the narrow bands centered around 620 and 700 nm respectively was used to identify the burned area. Results are favourably matched to available coordinates of known burned sites, and the affected area looks overall well identified according to the available information on the event. Short wave infrared (SWIR) information is usually characterized by relevant emissions in presence of fires and widely used for this kind of analysis. Nevertheless, results show that DESIS data yield precise burnt area maps, in spite of the lack of this spectral information.

Also 10 spectral bands of multispectral Sentinel-2 images from the 12th of June and 27th of July, with spatial resolution between 10 m and 20 m and a swath width of 290 km, were used to calculate different indices frequently applied for burned area assessment using EO data, such as the Normalised Burn Ratio (NBR), Burned Area Index (BAI), and dNBR (differential NBR) Results from these broadband indices are accurate, and are subsequently compared to the results of the narrowband outcomes from DESIS.