Special Section Guest Editorial: Unmanned Systems and Satellites: a Synergy for Added-value Possibilities

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Uncrewed aerial systems (UAS) have been gaining in interest, gradually embracing a wide range of applications. Yet, UASs in most monitoring applications cannot be exclusively examined without the consideration of satellite Earth observation (EO). When it comes to UAS and satellite technologies for Earth observation (EO), we often identify similar if not identical methodologies. Remote sensing satellites provide multi/hyper-spectral images for larger regions, yet they cannot deliver an on-demand data acquisition or centimeter level resolution. Nevertheless, new nano-satellite constellations are coming into play to provide better temporal and spatial coverage. The combination of UAS with satellite data implies an abundance of added-value possibilities. Satellite-UAS synergy context expands to applications including data/sensor/temporal fusion, UAS geolocation assistance in GNSS-denied environments, interferometry, radar, multi-hyperspectral data fusion and satellite data calibration.

The main objective of this special section was to showcase combined UAS and satellite studies, yet this disruptive and promising scientific endeavor was not mature enough to support explicit and specialized publications. Nevertheless, most studies included in this section mainly present common methodologies established from satellite remote sensing, adjusted under a UAS perspective, mainly taking advantage of enhanced spatial resolution and on-demand data acquisition.

Tunca and Köksal used an unmanned aerial vehicle (UAV) equipped with multispectral sensors to estimate the yield of bell-pepper crops through a time series study of vegetation indexes, showing a direct correlation to the enhanced vegetation index. In a related study, Tunca et al. used UAV-derived visible and thermal images to estimate daily and seasonal crop evapotranspiration under multiple spatial resolutions, showing potential for small agricultural fields, where satellite data do not suffice.

In a more algorithmic perspective, Faraj et al. modified the YOLO3 algorithm to detect objects on video feeds from UAVs, taking into consideration the flight parameters that affect data collection. Bi et al. implemented and tested a tracking algorithm based on a multiscale antideformation network, achieving high performance in real time and various target scales.

From a remote sensing viewpoint, Apostolopoulos and Nikolakopoulos assessed the ability of CORONA declassified image time series to monitor shoreline evolution. Xie et al. used GaoFen-2 data to detect urban forestry under a deep learning perspective, showing that the proposed Mask-RCNN implementation outperforms SVM, Random Forest and transfer learning.

Most studies included in the current special section showcased various common aspects between UAS and satellite data processing, engaging established approaches including classification, indexes, and deep learning. It was demonstrated that important topics, such as multiscale and multiresolution datasets, time series imagery, moving objects, and video feeds are coming into play more often than static single images commonly anticipated in the past. As such, machine learning is gradually encompassing more sophisticated studies, addressing more complex scenarios that were also absent in historical satellite remote sensing datasets.

We would like to cordially thank the authors and reviewers for their valuable contribution to this issue that attempted to demonstrate and support a fairly new application area. The potential is evident and more scientists should further unravel the added value of UAS and satellite

synergy and also design horizontal methodologies and implement hardware and software components that may combine the remote sensing platforms. This synergy potentially covers applications spanning from civil protection, emergency management, environmental and urban reporting, to health monitoring, atmospheric conditions, agriculture, land administration, etc. We envisage the establishment of the next generation remote sensing ecosystem that combines various forms of data collection, real-time processing, and autonomy.