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Editors

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Introduction

The global urbanization constitutes an epochal transformation of the Earth. Since 2007, for the first time in human history more people have lived in cities than in the countryside. According to the United Nations in 2050, around 75% of the worldwide population will be living in cities. The population density, traffic and infrastructure, environmental and energy problems, climate change, migration, demographic change, aspects of vulnerability and sustainability, new forms of mobility and sharing - unprecedented challenges and opportunities are continuously arising. In any case, the urban environment plays a major role in the development of humanity and the quality of life of the individual citizen.

In respond to this high-interest topic, the conference on Remote Sensing Technologies and Applications for Urban Environments was launched within the SPIE Remote Sensing Symposium held in Edinburgh from 26-29 September 2016. It comprises papers related to advanced remote sensing technologies, applications and information that push beyond the state-of-the-art with respect to urban air quality and climate, urban land cover and biodiversity as well as urban morphology and infrastructures. In 31 oral presentations and 8 posters it was demonstrated that remote sensing offers a wealth of possibilities and opportunities to monitor the urban environment, to support planning processes, to enhance the availability of relevant information, to shape the sustainable city and to improve the quality of life of citizens. The outcome of the conference is documented by the volume of proceedings at hand.

Remote sensing has become a viable technology to monitor and analyze urban air quality and climate, either by space-borne, airborne or ground-based instruments. As an example of the better exploitation of existing instruments, Levitan and Gross present an improved MODIS aerosol retrieval over urban areas, while Mukai et al. show an enhanced algorithm for severe aerosol pollution events. Van der Wal et al. outline a new concept for modular, compact spectrometers and SmallSats designed to monitor urban air pollution at a high spatial resolution. In order to track unburned hydrocarbon emissions from aircraft engine exhaust plumes, Berkson and Messinger propose a multispectral imaging system, while Beu et al. highlight the use of a wind doppler LiDAR to measure the turbulence kinetic energy of low-level jets in Sao Paulo, Brazil. The suitability of Earth Observation data to link air pollution and climate change is shown for East Asian cities (Nakata et al.) and Bucharest, Romania (Savastru et al.). Finally, the need for space-based air pollution data is formulated to better enable epidemiological studies (Oliviera et al.).

The capabilities of remote sensing technologies to make cities smarter and healthier are demonstrated for energy efficiency of buildings (Mandanici and Conte), gas detection (Baskurt et al.), human fall detection (Alzubi et al.) and

solar energy resource potential (Teves et al.). Boyd et al. present results of measuring carbon dioxide levels in the street canyons and public transport in Edinburgh. The high three-dimensional variability of the gas demonstrates the need for complementary information on air pollution levels in hot spots using mobile devices, micro sensor networks and crowd sourcing. With respect to urban climate, Earth Observation enables a better estimation of the anthropogenic heat flux (Chrysoulakis et al.), the quantification of the urban heat island effect (Xu et al.; Berwal et al.) and the analysis of the impact of urban growth on heat weaves in cities (Zoran et al.).

Advanced urban planning for sustainable and resilient cities relies on information on urban land cover and biodiversity. Latest advances on vegetation mapping in cities are presented by Levebre et al. using Pleiades multi-angular imagery and Nabucet et al. evaluating a bisprectral lidar. The importance of spectral unmixing and the related generic spectral libraries of the endmembers for urban land cover mapping are emphasized in the three papers of Jilge et al., Priem et al. and Degerickx et al.. A neural network is developed for the segmentation of hyperspectral images acquired by drones (Bruno et al.). The relation of land cover change and light pollution is investigated by Rohman et al..

A large number of applications are presented regarding latest results on urban morphology and infrastructures. Remote sensing enables an improved delineation of urban flooded areas (Zhang, Y. et al.), the three-dimensional mapping of buildings and infrastructures by circular synthetic aperture radar (Palm et al.), the mapping of informal and temporal dwellings (Jenerowicz and Kemper), the identification and correction of road courses (Wang et al.; Bulatov et al.) and the detection of asphalt pavement cracks (Mettas et al.). The benefits of synergistic data use are demonstrated by Ceamanos et al. for atmospheric correction of airborne hyperspectral information using a digital surface model and by Bratsolis et al. for building block classification combining aerial imagery and lidar data. While the latter use Markov random fields, attribute belief propagation is used by Wang et al. to detect vehicles in very-high-resolution aerial imagery. A deep learning technique is applied to improve the quality of infrared imagery (Zhang, H. et al.). For the automatic pole-like object modeling a 3D part-based analysis is introduced by He et al. Considering latest developments in remote sensing technology, a sensor for monitoring large civil infrastructures is presented (Barone and Giordano) as well as a new state-of-the-art airborne lidar sytem (Hartsell et al.).

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