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Preface: Earth surveillance and space-based monitoring of the environment: integrated approaches

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This Special Issue hosts mostly papers that were presented at a session entitled “Earth surveillance and space-based monitoring of the environment: integrated approaches” which was organized within the framework of the European Geosciences Union (EGU) General Assembly, held in Vienna, Austria, from 8 to 13 April 2018. The contributors to this session were encouraged by the Guest Editors to submit a short but self-contained paper summarizing their presentation for publication in this volume. All the papers submitted were reviewed by at least two independent anonymous reviewers from the international community.

As the Guest Editors of this Special Issue, we hope that this collection of papers will comprise a source of inspiration for current and future related research. We wish to stress our appreciation to the authors of the papers included in the present volume for their co-operation. We also extend our sincere thanks to the scientists who offered their valuable services as reviewers of the paper submitted. Thanks also are due to the staff at Copernicus Publications Production Office for their guidance, assistance and prompt response to inquiries.

Seven papers were accepted and are published in this volume. The topics reported in this volume cover distinct integrated approaches adopted in Earth surveillance and space-based monitoring of the environment. A summary of each paper is given in the following.

Gomes and Almeida (2019) employed Apatite fission-track (AFT) analyses to Southern Brazil and Uruguay samples, aiming to understand the low temperature history of the Dom Feliciano Belt Segment. Twenty-four samples were

dated, and confined track lengths of twenty samples were measured. The spatial distribution of ages shows three domains with different evolution cut by shear zones and, or suture zones in the Dom Feliciano Belt. The Western Domain exhibits AFT ages >250 Ma (Permian to Devonian) while the Eastern Domain shows AFT ages <230 Ma (Paleogene to Triassic). In the Central Domain, the AFT ages range from ~ 196 to 130 Ma (Jurassic to Early Cretaceous). The thermal modeling in the domains revealed a complex evolution, with cooling and reheating phases, and a denudation of ~ 2600 m. The AFT ages clearly postdate the Gondwanide, Paraná-Etendeka and Rio Grande Cone exhumation history of the Dom Feliciano Belt.

In the paper by Alverti et al. (2018), the scientific objective is to find a simple understandable model linking human smart characteristics to a group of socio-demographic and urban environment indices, applied to the case of Limassol (Cyprus) Urban Complex, the southernmost European city, with a total population of 208 980. The data set of the analysis contains 25 variables in 3 thematic domains using as spatial analysis level, the 126 postal code areas of the most urbanized part of the city. The study results obtained through multivariate statistical analysis and thematic cartography using GIS technology. The results reveal that the human smart characteristics consist of the use of high-speed internet and broad band telephony, recycling activities, employment in creative industry, high educational attainment and open-mindedness (i.e. participation in EU elections), are significantly correlated with demographic dynamics and built infrastructure characteristics.

Melillos et al. (2018) aim at exploring the importance of monitoring military landscapes in Cyprus using Earth Observation. The rising availability of remote sensing data provides adequate opportunities for monitoring military landscapes and detecting underground military man-made structures. In order to study possible differences in the spectral signatures of vegetation so as to be used for the systematic monitoring of military landscapes that comprise underground military structures, field spectroscopy has been used. In this paper, underground

military structures over vegetated areas were monitored, using both ground and satellite remote sensing data. The results show that Vegetation Indices such as NDVI, SR, OS-AVI, DVI and MSR are useful for determining areas where military underground structures are present.

The main objective of the paper by Oikonomou et al. (2018) is to evaluate the tropospheric delay performance for Global Navigation Satellite Systems (GNSS) integrated water vapor estimation by using GPT2w model, ECMWF's IFS (European Centre for Medium-Range Weather Forecasts) reanalysis model and ground meteorological data from two stations of the permanent network of Cyprus and Greece. The period from 27 May to 3 June 2018 is characterized by two different synoptic conditions: high pressure with fair weather in central Mediterranean (Greece), on the one hand, and high instability over the upper levels of the atmosphere that resulted in thunderstorms inland and mountainous areas during midday over the Eastern Mediterranean (Cyprus), on the other hand. In general, the results show that both the empirical blind model GPT2w and the ECMWF (IFS) operational model perform well in particular over Nicosia when used for the retrieval of Integrated Water Vapor (IWV) from GNSS measurements, although appreciable deviations were observed between ECMWF (IFS)-retrieved IWV and the one retrieved from GNSS observations by using meteorological measurements.

Dimopoulos et al. (2018) performed a comparative study of the prediction performance of the Random Forests method has been accomplished, with respect to the corresponding results of the Linear Multivariate Regression. A variety of regression models were scrutinized, apropos the independent variables involved, for both methods. The database regards actual transactions of the Cyprus Department of Lands and Surveys. A significant part of this work involved the data preparation and cleaning, the identification of the significant database features, as well as the handling of the missing values and the skewed input distributions. Furthermore, authors make suggestions for the mass appraisal system in Nicosia, examine the dependent variable (Accepted Price), its differences from the Declared Price (by the buyer and seller) and its dependency on the property's characteristics (independent variables).

The paper by Cuca and Barazzetti (2018) illustrates an approach to evaluate damages after extreme flooding, with special attention to cultural heritage conservation. The pa-

per mainly focuses on the use of Sentinel-2 (optical) satellite images with medium geometric resolution, which are available at specific epochs without purchasing high resolution images on the selected area. The idea behind this paper is to consider damage identification as a change detection problem, which starts from the satellite level and reaches the local level using data acquired from drones and terrestrial images, i.e. through a multi-scale approach, as illustrated in the previous section. The work carried out is mainly related to processing of satellite images, which can be used to plan the acquisition of on-site data (UAV and close-range photogrammetry). Change detection was carried out with both (i) traditional algorithms based on image differencing, and (ii) a novel approach that tries to focus on water body mapping using NDVI and NDWI. Results reveal that image difference is a valid tool for rapid analysis, which however provides an overall change detection for the entire area.

Based on timeseries analysis of multispectral Sentinel-2 datasets, Evagorou et al. (2019) obtained bathymetric data for shallow waters, (up to 30 m below sea level), using freely and open distributed optical satellite images. The ratio transform algorithm was implemented for twelve (12) monthly images covering thus a whole year. The different generated Digital Terrain Models (DTMs) were compared with high resolution LIDAR measurements. The results showed that bathymetry can be obtained from satellite data within a Root Mean Square Error ranging from 1.39 to 2.56 m while more accurate results were generated during the summer period.

References

- Alverti, M. N., Themistocleous, K., Kyriakidis, P. C., and Hadjimitsis, D. G.: A Human Centric Approach on the Analysis of the Smart City Concept: the case study of the Limassol city in Cyprus, *Adv. Geosci.*, 45, 305–320, <https://doi.org/10.5194/adgeo-45-305-2018>, 2018.
- Cuca, B. and Barazzetti, L.: Damages from extreme flooding events to cultural heritage and landscapes: water component estimation for Centa River (Albenga, Italy), *Adv. Geosci.*, 45, 389–395, <https://doi.org/10.5194/adgeo-45-389-2018>, 2018.
- Dimopoulos, T., Tyralis, H., Bakas, N. P., and Hadjimitsis, D.: Accuracy measurement of Random Forests and Linear Regression for mass appraisal models that estimate the prices of residential apartments in Nicosia, Cyprus, *Adv. Geosci.*, 45, 377–382, <https://doi.org/10.5194/adgeo-45-377-2018>, 2018.
- Evagorou, E., Mettas, C., Agapiou, A., Themistocleous, K., and Hadjimitsis, D.: Bathymetric maps from multi-temporal analysis of Sentinel-2 data: the case study of Limassol, Cyprus, *Adv. Geosci.*, 45, 397–407, <https://doi.org/10.5194/adgeo-45-397-2019>, 2019.
- Gomes, C. H. and Almeida, D.: New insights into the Gondwana breakup at the Southern South America by apatite fission-track analyses, *Adv. Geosci.*, 47, 1–15, <https://doi.org/10.5194/adgeo-47-1-2019>, 2019.
- Melillos, G., Agapiou, A., Michaelides, S., and Hadjimitsis, D. G.: Monitoring military landscapes and detection of underground

man-made critical infrastructures in Cyprus using Earth Observation, *Adv. Geosci.*, 45, 335–342, <https://doi.org/10.5194/adgeo-45-335-2018>, 2018.

Oikonomou, C., Tymvios, F., Pikridas, C., Bitharis, S., Balidakis, K., Michaelides, S., Haralambous, H., and Charalambous, D.: Tropospheric delay performance for GNSS integrated water vapor estimation by using GPT2w model, ECMWF's IFS operational model and in situ meteorological data, *Adv. Geosci.*, 45, 363–375, <https://doi.org/10.5194/adgeo-45-363-2018>, 2018.