GEOFIZIKA VOL. 34 2017

Preface to special issue

"GeoMLA Conference – Geostatistics and Machine Learning Applications in Climate and Environmental Sciences"

This special issue of Geofizika presents a selection of papers that evolved from the GeoMLA Conference – Geostatistics and Machine Learning Applications in Climate and Environmental Sciences", held from 21 to 24 June 2016 in Belgrade, Serbia. It was an interdisciplinary meeting of experts from different scientific fields including geoinformatics, meteorology, geodesy, geology and landslides monitoring. The focus of the conference was on new approaches in geostatistics and machine learning for modelling of different phenomena by using spatio-temporal Earth observations. The invited speakers introduced the session's topics. Prof. Mikhail Kanevski presented the topic "Advanced Analysis of Environmental Data Using Machine Learning". Tomislav Hengl talked about "Automated global soil mapping: discovering spatial soil patterns using machine learning". Prof. Wolfgang Wagner presented "Time series analysis of Sentinel-1 backscatter data on a high performance computing platform". Prof. Mirko Orlić gave a talk about "Stjepan Mohorovičić, an early advocate of Milutin Milanković's theory of climate change", notably presented in the original Milutin Milankovich lecture hall. Milutin Milanković, one of the pioneers of climate science and a popularizer of science, has been ranked among the top fifteen minds of all time in the field of earth sciences by NASA (edition of "On the Shoulders of Giants"). Second talk from prof. Orlić was climate change related: "Exploring the relationship between global temperatures and global sea levels". Final invited speaker, Ole Einar Tveito, presented "Observation based gridded climate data in Norway".

In spatio-temporal analysis of the meteorological parameters two main challenges are going toward finer spatial and smaller temporal resolutions. First goal highly depends on the spatial density of the measured data, while second one is mainly governed by the physics of the phenomena. Long term climatological spatio-temporal fields are shaped by climate factors like elevation, distance to water bodies, solar cycles or prevailing air masses, whereas meteorological fields on monthly, daily or hourly temporal scales depend on current weather situation and only partially on constant climate factors. This presents a challenge for spatio-temporal analysis, leading to the development of new methods or adopting existing ones from other research domains. New types of data can be introduced to improve the analysis, e.g. remote sensed land surface temperature can be used as a predictor together with the observed 2-m air temperature from the meteorological stations to produce temperature maps. An additional challenge is the

quantity of the data, that goes to millions of records just in analyzing daily data available for one county during few decades, while an advantage is that the quality of the data is improving.

This is illustrated in a paper for Croatia presenting the method for the creation of complete and homogenised monthly climatological data, together with the estimates of the quality of the 1981–2010 climate normal. Hierarchical clustering is applied to group the stations into homogeneous regions, data are homogenized and monthly fields completed, making this procedure a basis for climate atlas and climate monitoring products generation.

Different gridding methods are examined for developing a Romanian daily high-resolution gridded data set of snow depth. Four interpolation methods were tested using a cross-validation procedure: Multiquadratic, Ordinary Kriging (separated and pooled variograms) and 3d Kriging among, of which the last one proved to be the most accurate.

From the field of geodesy, a paper related to modelling extreme Total Electron Content (TEC) values over the territory of Republic of Serbia is presented. TEC represents an integral of electron density per unit of volume along the signal path between the satellite and the Global Navigation Satellite System receiver. Data analysis and modelling of pure temporal and spatio-temporal data were applied, in order to model and predict TEC values using Neural Networks and Support Vector Machines. The reported results showed similar prediction quality at unobserved locations using both methods.

Finally, Landslide Susceptibility Assessment (LSA) was examined over the territory of Ljubovija Municipality in western Serbia using three different approaches, including expert-driven (Analytical Hierarchy Process), deterministic (Stability Index modelling) and Machine Learning method (Random Forest). The characteristics of the individual methods of LSA modelling have been discussed in details, mostly giving preference to Random Forest model.

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