

EGU2020-13262

<https://doi.org/10.5194/egusphere-egu2020-13262>

EGU General Assembly 2020

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Multifractality in Humanitarian Applications

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Every year the total number of people who had been forcibly displaced (refugees, asylum seekers, and internally displaced persons) is constantly rising, a fact that is directly reflected in the area covered by IDP/refugee camps. Long-term humanitarian relief requires reliable and comprehensive information that is constantly delivered during a crisis. Very High Resolution (VHR) optical satellite data have been shown to be useful in monitoring IDP/refugee camps as it can provide an overview of the affected areas with a spatial resolution of up to 0.3 m within a matter of days.

The aim of our research is to verify the usefulness of multifractal parameters as descriptors of IDP/refugee camps area, both in the context of their applicability and usability in the humanitarian related issues. In particular, we perform studies devoted to: (I) the complex terrain situation description with the division into compact and dispersed structures; and (II) the identification of IDP/refugee camps area extent aiming at distinguishing residential areas from other land use/land cover types. The analysis performed in two IDP/refugee camps, i.e. Ifo and Ifo 2 (Daadab) in Kenya and Al Geneina in Sudan, based on GeoEye-1 and Pléiades-1A VHR satellite data, gives a promising aspect of limited calculation time needed for the initial stage of image classification in respect to the spatial complexity of analysed terrain. Our results show that the degree of multifractality calculated for the selected images increases for compact areas with high-contrast structures (e.g., functional buildings and dwellings). Consequently, the extraction of the IDP/refugee camps extent by using only one feature, i.e., the degree of multifractality, proved to be an efficient way for initial image classification.

We hope that our studies supplemented by further research, i.e. pre- and post-processing, the inclusion of multispectral bands, analyzing other areas of interest, and examining the added value of other multifractal measures, will help to develop an unsupervised classification approach providing results more quickly, with more frequent updates.

Research supported by the National Science Centre, Poland, under Grant 2016/23/B/ST10/01151.