

The comparison of usage of satellite SAR and optical data in the process of urban growth monitoring

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The aim of this project was to monitor the temporal growth of the urban areas, on the example of the Krakow city (Poland). In recent years more frequent use of satellite data in environmental monitoring can be observed. Definitely the optical data are the most popular type of it. This kind of data are commonly used in many applications like land cover change detection, biomass study and in the map preparation process. Despite their many advantages they are very sensitive on the weather conditions. Thus they cannot be gathered in cloudy or rainy day. This case doesn't occur when the satellite SAR (Synthetic Aperture Radar) system are used. The ability of SAR and optical systems in monitoring the temporal growth of the urban areas were presented in the past (Al Rawashdeh & Saleh 2006, Opido & Leśniak 2015). In these projects SAR and optical satellite systems were compared.

The study presented here was performed on fifty archival SAR and optical images acquired between years 1992 and 2010. The images were grouped into five two-year time intervals. Each interval contains data stack of eight SAR and 2 Landsat images. For each group the analysis of land cover was performed. Each optical image was classified into three following classes: water, urban and green areas. The study of the SAR data was based on the analysis of coherent scatterers (Porzycka-Strzelczyk & Strzelczyk 2015). The most commonly used methods of coherent scatterer's identification were tested: dispersion of amplitude, Log-Cumulant (Nicolas et al. 2004),

Signal-to-cluter ratio (Ulander et al. 2010) and coherency method (Touzi 1999).

The growth of the urban area was calculated by studying changes in the numbers of coherent scatterers on the SAR images. For the Landsat images changes in the area of the urban class were analyzed. Furthermore, regions of most and least intensive urban growth were detected. The next step of the project is to compare the presented results with those provided by new ESA (European Space Agency) satellites. Sentinel-1 provides SAR images with a much better spatial resolution than ERS-1, ERS-2 and Envisat satellites. Sentinel-2 has better spatial resolution and more spectral bands than Landsat-8 (Masek 2015). This will allow to achieve more precise maps of coherent scatterers.

REFERENCES

- Al Rawashdeh S. & Saleh B., 2006. Satellite Monitoring of Urban Spatial Growth in the Amman Area, Jordan. *Journal of Urban Planning and Development*, 132, 211–216.
- Masek J., 2015. HysPIRI Workshop, GSFC. [on-line:] https://hyspiri.jpl.nasa.gov/downloads/2015_Symposium/day1/10_Landsat8_Sentential2_Masek.pdf [access: 15 February 2016].
- Nicolas J.M., Bujor F. & Trouve E., 2004. Application of Log-Cumulants to the Detection of Spatiotemporal Discontinuities in Multitemporal SAR Images. *IEEE Transactions on Geoscience and Remote Sensing*, 42, 10, 2073–2084.
- Opido P. & Leśniak A., 2015. Analysis of possibilities and constrains of using ERS-1, ERS-2 and Envisat radar data in the process of urban areas growth monitoring.

- [in:] *SGEM 2015: informatics, geoinformatics and remote sensing: 15th International Multidisciplinary Scientific Geoconference: 18–24, June, 2015. Albena, Bulgaria: conference proceedings*, 1, 973–980.
- Porzycka-Srzelczyk S. & Strzelczyk J., 2014. Identification of coherent scatterers in SAR images based on the analysis of polarimetric signatures. *IEEE Geoscience and Remote Sensing Letters*, 11, 4, 783–787.
- Touzi R., 1999. Coherence estimation for SAR imagery. *IEEE Transactions on Geoscience and Remote Sensing*, 37, 1, 135–149.
- Ulander L.M.H., Barmettler A. & Flood B., 2010. Signal-to-clutter ratio enhancement in bistatic very high frequency (VHF)-band SAR images of truck vehicles in forested and urban terrain. *IET Radar, Sonar & Navigation*, 4, 3, 438–448.