Five years of the Landsat 8 mission – an analysis of data availability for the lakes surface thermal state monitoring

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The main aim of the work was to asses a five-year Landsat 8 imagery data set in terms of its suitability for the spatiotemporal analysis of the surface temperature on the example of three Polish lakes: Sławskie lake (SLA; 51.885°N, 16.021°E; area of 8.2 km^2, mean and maximum depth of 5.2 m and 12.3 m; volume of 42.7 million m^3), Charzykowskie lake (CHA; 53.784°N, 17.507°E; area of 13.6 km^2, mean and maximum depth of 9.8 m and 30.5 m; volume of 134.5 million m^3) and Mikołajskie (MIK; 53.771°N, 21.603°E; area of 4.2 km^2, mean and maximum depth of 11.2 m and 25.9 m; volume of 55.7 million m^3). Both, SLA and MIK lakes are located within single WRS-2 acquisition paths (191 and 188, respectively) while the CHA lake is located in the area where two paths (190 and 191) overlap. That fact significantly differentiates the potential availability of images for each lake.

In the first part of the work, all of the available scenes for spring (March, April, May), summer (June, July, August) and autumn (September, October, November) seasons of 2013-2017 years were inventoried. Subsequently, all of the 327 images (80, 163 and 84 for SLA, CHA and MIK, respectively) have been reviewed in terms of cloudiness and lake visibility. Only 66 (21%) of them were assessed as suitable for further temperature calculations: 17 for SLA, 29 for CHA and 20 for MIK. More detailed analysis of the data availability was drawn in the study, concerning annual, seasonal and monthly patterns.

Second part of the work was devoted to the calculations of the lake surface temperatures at selected dates. Both, Operational Land Imager (OLI) and Thermal Infrared Sensor (TIRS) data were used. Firstly, for each scene the water mask was extracted by combination of the selected OLI bands (green light – B3 and near infrared spectrum – B5; 30 m resolution) to prevent relevant area in further TIRS data processing. Secondly, thermal bands B10 and B11 (100 m resolution resampled to 30 m) were converted to the temperature values. The results were used to analyze spatiotemporal dynamics of the temperature field for each of the specified lakes. Moreover, the comparison between lakes was drawn for the similar dates. OLI and TIRS data processing to the temperature values have been automated using a simple GUI application written in Matlab.