Modelling water quality of lakes from Sentinel-2 satellite data with archive water quality measures

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The aim of this study was suitability testing of remote sensing Sentinel-2 satellite data for water quality modelling with the use of historical water quality observations obtained from Regional Inspectorate for Environmental Protection in Poland. Tha sampling period is 2016-2017 and covers the following parameters: biological oxygen demand, total organic carbon, electroconductivity, total nitrogen, total phosphorous, Secchi Disc Depth and chlorophil-a. The study area are lakes located in Warmia-Masuria Voivodeship in north-eastern part of Poland. Point water quality sampling is often insufficient in this area due to complex shape of the lakes, hard-to-reach areas. Moreover, such a sampling strategy is time and cost demanding.

The Sentinel-2 system of satellites operates in the range of 400-2400 nm in 13 spectral bands with the spatial resolution of 10, 20 and 60 m. This characteristics together with short revisit period makes it applicable for water quality monitoring in relatively small waterbodies. The main limitation of the use of satellite data in this latitude is often occurring cloud cover; which makes difficult to plan simultaneous field campaign.

Formulas from the literature were used to predict and spatially visualize water quality in the study area lakes. Some new empirical formulas for chosen water parameters were derived as well, using the Sentinel reflectance data.

The main outcome of the study is that the free remote sensing Sentinel-2 data together with public available water quality observations can greatly contribute to existing water quality monitoring, especially due to its low cost, possibilities of repeat of the analysis and working on archive data.