



## **Can satellite data be used to monitor chlorophyll a in lakes?**

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Satellites that capture large areas with high spatial and temporal resolution allow extensive analyses of water bodies and thus represent an ideal supplement to existing in situ point measurements. In the joint project WasMon-CT the usability of satellite data for official monitoring of flowing waters and lakes is examined. The subproject at the Institute for Lake Research (ISF) of the LUBW focuses on the satellite-based monitoring of chlorophyll a in lakes. The parameter chlorophyll a is an important indicator in water protection for algae growth, primary production and water quality in lakes. The project partner German Federal Institute of Hydrology (BfG) deals with a satellite-based turbidity monitoring in rivers.

Spatially high-resolution satellites, such as Sentinel-2 (start 2015, data freely available), open up new possibilities for obtaining better information on spatial inhomogeneities of chlorophyll a distributions (patchiness) in Lake Constance and in other large lakes. In addition, the water quality of a larger number of smaller lakes can be monitored. To clarify how well the determination of chlorophyll a concentration works with satellite data, a comprehensive validation study is conducted and presented here. The aim of this validation is to get information about the applicability and potential limitations of remote sensing techniques for different types of lakes.

The satellite data from 2000 to 2017 are compared with the in situ measurement data of about 30 lakes in Baden-Wuerttemberg for water quality parameters, e.g. chlorophyll a and Secchi depth. This lake selection includes Lake Constance and 12 other Water Framework Directive (WFD) lakes. The selected lakes have different extents and limnological properties and have been grouped into different optical lake types by cluster analysis. In addition to the existing database, further measurements were performed at Lake Constance to determine especially horizontal distributions of chlorophyll a.

First results of the validation study show that in general the statistical values of the in situ and remote sensing retrieved chlorophyll a data agree well but small systematic differences occur. Further validation and data interpretation steps take into account methodical differences as well as time differences between in situ and satellite measurements. In addition, tools and application-related derived products (e.g. trophy calculations) are created in close consultation with potential users.