Review of: "Algal bloom monitoring in Koka Reservoir, Ethiopia: Application of satellite remote sensing algorithms"

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Potential competing interests: No potential competing interests to declare.

This paper explores the possibility of using satellite imagery with the remote aim of understanding and predicting phytoplankton dynamics in the Koka Reservoir, Ethiopia.

Indeed, remote Earth observation systems are indispensable in global-scale assessment of our environment. The relationships between satellite-based indices and the ground truth are empirical. Extrapolating relationships verified in a few systems (e.g. lakes) to a large sample of lakes that may or may not be similar to the verified sample, inevitably bears a high uncertainty. Still the approach is valuable, because there are no other means to monitor thousands of globally distributed lakes and weight global significance of various environmental problems. When, however, the aim is to use remote sensing for understanding and managing a given lake (e.g. the Koka reservoir), the uncertainty should be reduced as much as possible. This needs a ground truth library of considerable size and may need the development of case-specific algorithms. Unfortunately, in this paper the ground truth sample was small (n=27) and did not show any relationship with the satellite-based index (Fig. 5b). Since only the month (and not the day) of water sampling was known, and algae may double their biomass in 3-5 days, the lack of a relationship was not surprising. Thus, the only acceptable result of this study was the cross-validation of the floating algal index (FAI) derived from Sentinel-2 MSI and Landsat-8 OLI imagery. However, without knowing, how FAI is related to the concentration of chlorophyll, suspended solids and colored dissolved organic carbon in the Koka Reservoir, this (and any other) index remains unsuitable for monitoring and managing the reservoir. Suggesting the opposite misleads managers and may lead to harmful consequences.

The authors claim that "*Financial and institutional constraints hinder in situ water quality data availability in lakes in remote areas such as Koka Reservoir*". The reservoir is a touristic area, 2 hours' drive (100 km) from the capital city, Addis Ababa. Nevertheless, financial, institutional or other constraints may easily exist. This means that for the moment, the conditions are not given to exploit a freely available large dataset, the satellite imagery. What scientists could do is as follows: i) demonstrate to managers and decisionmakers credible cases where satellite-based indices were successfully verified against ground truth data in systems not very different from the Koka Reservoir using literature sources, ii) demonstrate success stories where interpreted satellite imagery contributed to lake management, iii) show that the existing ground truth data are insufficient to improve planning and management practices in the the Koka Reservoir, and iv) make managers and decisionmakers aware of the need to invest into targeted collection of traditional water quality data and into development of proper data processing techniques before management can rely on free satellite data.

The Introduction provides a useful overview of satelite-based phytoplankton indices. The rest of the paper contains a number of inaccuracies. Just a few examples: i) After defining that the Normalized Difference Chlorophyll Index derived from Sentinel-2 MultiSpectral Instrument imagery will be abbreviated as $NDCI_{MSI}$, $NDCI_{Sen2A}$ and "satelite derived NDCI" (Fig. 5b) also occur. Ii) Contrary to the text below Fig. 5, Fig. 5a does not show an error analysis. Iii) Contrary to the text below Fig. 5, no equations are presented in Figs. 2 and 3.

The Methods section is incomplete. Describing the study area, additional details are needed, including some morphometric data (area, depth, volume), the position of the main inflows and that of the dam, general regional climatic features, etc. Consulting the Google Maps, it seems likely that the southern area of the reservoir is so shallow because huge amounts of eroded soils transported by the Awash River into the reservoir during heavy rains filled up this area (?). Important information is also missing from the data collection subsection. Why, for example "…*400 out of 480 pairs of FAI and NDCI values were retrieved and used to establish the correlation*" and "…*192 out of 200 pairs were retrieved and displayed*"? (The latter information is missing from the methods, it is indicated only in the legend of Fig. 2.)

The Results section is just a description of the figures. The text and the figure legends are often contradicting each other. Figs. 2 to 4 suggest a plateauing relationship between FAI_{MSI} and $NDCI_{MSI}$, while the authors claim a linear relationship. A non-linear relationships is more realistic than a linear one, because the formation of surface scums (particularly characteristic when *Microcystis* is the dominant cyanobacterium) differentially influences the two indices.

The Discussion does not focus on the subject of the paper (application of satellite remote sensing algorithms), instead it provides an (incomplete) overview on the nutrient load – in-lake nutrient cycling – algal bloom relationships in the Koka Reservoir on the basis of literature sources. Surprizingly, sewage load is not mentioned at all, diffuse nutrient loads from agricultural areas and from the atmosphere are blamed for eutrophication.

Finally, the paper needs a thorough language revision.