

The report for the third AIWaReN webiner held on June 21, 2023

Presentation by Professor Sagawa

Professor Sagawa talked about (i) the overview of the remote sensing technology, (ii) important characteristics to be considered in the remote sensing (e.g., spectral, spatial and radiometric resolutions), and (iii) fundamentals about data retrieval for constituents in a water body such as photoplankton, non-algal particles, and colored dissolved organic matter. The reader is referred to the pdf file of his presentation slide for the detail that has been shared already. In this document, mainly described are questions from the audience, answers by Professor Sagawa, and discussions made among participants.

Professor Kipkemboi asked about how to overcome cloud-covered situations, which are often seen in tropical regions. Also, Professor Kipkemboi inquired about to what extent we can accurately infer the eutrophication status/algal bloom occurrence, based on data retrieved from satellite images. Professor Sagawa first responded to the second question, and stressed the difficulty for inland waters in terms of application of a certain algorithm, compared with ocean waters [*note: a reference review paper for this point was attached as the additional information*]. For the first question, Professor Sagawa stated that in the cloudy situation, an active sensor can be used, but microwave cannot penetrate water and only the surface information is available. However, in the future, we may have a possibility to retrieve optical data from a LiDAR even in a cloudy weather. Professor Sagawa also noted that as the frequency of observations increases, the chance of obtaining relatively cloudless images increases, and that many small satellites have been launched recently so that we may be able to use data from those satellites for data augmentation.

Dr. Obubu was impressed with the level of resolution that current satellites such as WorldView realizes (i.e., 0.3 m), and asked about the cost of such a high-resolution satellite image. Professor Sagawa responded that WorldView satellite images are not free and expensive. Professor Sagawa introduced PlanetScope, of which the resolution is 3 m and not as expensive as those of WorldView (even free for research purposes), and also mentioned free Sentinel-2 images, of which the resolution is up to 10 m.

[*Note on the price of commercial satellite images*]

- WorldView3 price per square kilo-meter: \$22.50 (ref: <https://apollomapping.com/worldview-3-satellite-imagery>)
- PlanetScope price per square kilo-meter: \$2.25 (ref: <https://apollomapping.com/planetscope-satellite-imagery>)

In relation to Dr. Obubu's question, Dr. Inagaki first asked about the resolution of Google Satellite images that are available in Google Maps. Dr. Sagawa let us know that Google provides a combination of spaceborne (Landsat) and airborne images. Dr. Inagaki additionally asked about how to analyze shallow water lakes. Dr. Sagawa responded that the algorithms for shallow waters are complicated, compared with those for deep waters, as there are many parameters involved and information such as bottom types is required. We concluded that we can still try to investigate shallow lakes, developing some feasible algorithms.

Professor Sakakibara commented on the usefulness of the remote sensing technology, especially for water resource management in African and South Asia, when it comes to achieving the Sustainable Development Goal Target 6, of which the progress is not as smooth as expected

Updates of our initiatives

Our group name was determined as “African Inland Water Research Network”, AIWaReN for short. The test website was already launched at: <https://gakkykun.github.io/jupyter-books-demo/intro.html>. There are pages for the mission statements, research themes, projects, tools and etc. The website will be updated frequently, as our project makes progress. This can serve as an information platform sharing our research activities and also attracting funding agencies and potential collaborators outside our group.

Research topics to be pursued within our group

Dr. Inagaki presented four potential research topics that can be pursued within our group based on preliminary discussions with Drs. Makwinja, Obubu and Ramkat: (i) nutrient and pesticide inputs to Lake Victoria from riparian and basin countries (Uganda, Kenya, Tanzania, Rwanda and Burundi), (ii) the interrelation between Lake Victoria – Lake Kyoga – Lake Albert in terms of trophic state, (iii) deep-dive into four lakes in Malawi that have been investigated under the Dr. Makwinja’s initiatives, (iv) lake comparison/categorization for management priority, particularly targeting shallow lakes in Uganda and lakes in Kenya. Also, Dr. Inagaki introduced a recently published paper studying cyanotoxins risk across Africa, and previous studies about lake classification techniques based on optical properties retrieved from water bodies. He also emphasized the importance of combination of a satellite-derived index for a water body with landscape variables extracted from surrounding lands.

Professor Kipkemboi suggested to include the aspect of climate change, and then introduced to us that there was a World Bank-funded project for Lake Victoria consisting of many aspects including municipal and industrial waste management; however, the project did not seem to make a difference very well. Professor Kipkemboi stated that it would be a good idea to look at the detail of the project, and also stressed the importance of understanding the current situation to clarify what interventions can be done in the catchment and what waste/wastewater treatment technologies are feasible.

Dr. Obubu noted that our study should include Rwanda, where one of active rivers flowing into Lake Victoria exists. Dr. Obubu commented on the inclusion of wastewater treatment technology development as a solution to reduce pollutant loads into Lake Victoria. This makes people realize that there are alternatives to reduce pollution loads. Dr. Obubu let us know that there is currently no big project going on in Lake Victoria.

Professor Sakakibara proposed that we consider the nutrient recycle with the application of technology for nutrient recovery from solid wastes and municipal wastewater, in addition to the evaluation of nutrients loads into rivers and Lake Victoria. The idea of constructing a sustainable/circular society is appealing to funding agencies. Professor Sakakibara suggested to invite people from World Bank Group, who preferably are in charge of big projects in Africa, to our webinar, and to ask them about what challenges exist, how a project is selected, and how our ideas are different from theirs.

Mr. Habineza stated that the pollution pattern in East Africa are more or less similar and showed his aspiration to contribute to a study covering an area in Rwanda in the future. Ms. Haaziyu showed her willingness to share the information about the status of lakes in Zambia with our group.

Toward the next online meeting in August

Based on the suggestion from Professor Sakakibara, Dr. Inagaki will prepare a 1-page conceptual note with graphics that summarizes our potential research topics—pictures of Lake Victoria and other lakes, and conceptual images for nutrient and pesticide discharged from point and non-point sources, the establishment of a nutrient recycle loop, an effective monitoring strategy using satellite images, as well as relevant technology development. Members of our group will give their inputs into the document, so that we can keep polishing the idea. Through this opportunity, members can get a deep understanding

of how the collaborative research goes. This document will serve as a base for a proposal for research fund applications.