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Insight study of the bio-optical algorithms for chlorophyll-a and cyanobacteria with sensitivity analysis and multi-objective algorithm

JongCheol Pyo (1), SangSoo Baek (1), SangHun Park (1), YongSung Kwon (1), MinJeong Kim (1), Mayzonee Ligaray (1), SeongHyun Yoon (2), Jihun Sin (2), Yongeun Park (1), YoonKyung Cha (2), and KyungHwa Cho (1)

(1) Ulsan National Institute of Science and Technology, Ulsan, Korea, Republic Of (puiguu@gmail.com), (2) University of Seoul, Seoul, Korea, Republic Of

In recent years, severe degradation of drinking water quality has been observed more frequently due to severe eutrophication. This kind of environmental issue is mainly caused by anthropogenic activities like rapid growths of agricultures and industries. Therefore, the water degradation will be observed which could significantly affect humans and the aquatic ecosystem. Based on these environmental situations, the efficient management of drinking water system is necessary. To address this issue, many researches have implemented the monitoring of algae to predict their concentration or the development of new technology for the elimination of algae. The representative one is a remote sensing technique.

In remote sensing research area, a lot of bio-optical algorithms has been developed to estimate the chlorophyll-a or phycocyanin concentration in the fresh water system. These bio-optical algorithms have many parameters and wavelengths to evaluate the algae concentration. However, the understanding of the specific parameters and the wavelengths is not enough since the bio-optical properties are not universal in terms of the different water environment. Thus, this study implemented that the major bio-optical algorithms (i.e. Gons, Gilerson, Ritchie, Simis, Duan, and Li algorithms) were tested their performances for the estimation of the chlorophyll-a and phycocyanin concentration with the observation data. And, the parameters and wavelengths were analyzed their sensitivity which could reveal the relationship and effectiveness between these parameters. Then, the optimization process was implemented to find out the optimal parameters and wavelengths for Korea water system. Finally, these results were compared to the other researches which used same major bio-optical algorithms but had different study site to identify the insight meaning of the parameters and wavelengths in Korea water system. Therefore, the knowledges from this research could be the foundation to understand the bio-optical algorithm properties and to guide the establishment of the new bio-optical algorithm for Korea water system.