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Title of Doctoral Dissertation

Determination of Water Contaminant Concentration using Spectro-polarimetric Bidirectional Reflectance Factor

(水域の分光及び偏光双方向反射係数を用いた汚染物質濃度の決定)

A study is carried out utilizing spectro-polarimetric bidirectional reflectance factor for determination of water surface contaminant concentration. A spectral distribution of controlled contaminated water sample with soil and chlorophyll as the contaminant materials is measured. The measurement is done using a Liquid Crystal Tunable Filter (LCTF) camera with a rotating polarizer attached to a goniophotometer. The water sample is filled in a black covered tank and wave generator is placed on the surface of the water to simulate waves on waterbody. On top of that, a field-measurement is done at Lake Kasumigaura in Ibaraki, Japan by measuring the water reflectance using portable spectrophotometer called SpectrumCatcher and collecting water samples. The collected water sample is then measured its Turbidity level and Chlorophyll concentration by measuring its inherent optical properties (IOPs). The field-measurement is then replicated in the laboratory by filling the water tank with the collected water sample and camera configuration. The replicated experiment reflectance result is then compared with the controlled water sample and used Spectral Mixture Analysis (SMA) to determine soil and chlorophyll contributions. Later, the result is compared with the collected water samples result. The research has shown that the Lake Kasumigaura water has low turbidity level but high chlorophyll comparing with previous study. It is revealed that the estimated concentrations are different from the collected water samples. This different is because there is a difference in environment conditions such as the waves generated, condition of the sky during field-measurement, and other factors. Nevertheless, the research shows the possibility of determining the water surface contaminant concentration through the measurement of apparent optical properties (AOPs) which can be used for in-situ water quality measurement.