ハイパースペクトル放射観測と海洋の植物プランクトン分類
Hyperspectral Radiometry towards Classification of Marine Phytoplankton Groups

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Marine phytoplankton plays an essential role in marine ecosystems as a primary producer. Generally, a trophic transfer food chain via large-sized phytoplankton can be found in the oceans at higher latitudes and/or in coastal waters. On the other hand, a trophic transfer via middle- and/or small-sized phytoplankton can be found in the oceans at lower latitudes. As a first approximation, a cell size of phytoplankton is associated with taxonomic groups (e.g. diatoms are often large in size whereas cyanobacteria are usually small). In addition, phytoplankton in a taxonomic group often possesses a characteristic photosynthetic and/or photoprotective pigment(s) (e.g. diatoms contain fucoxanthin while cyanobacteria zeaxanthin). As a result, a taxonomic group are linked as a first approximation to a specific size class and a pigment(s), so that the groups may be inferred from the size and pigments. Both of the cell size distribution and the pigments affects optical, or spectral signature of phytoplankton. Hence, once the spectral signature of phytoplankton is obtained, their taxonomic detection/classification may be possible. In the present technology, a radiometric observation, either in situ or from space, enables the detection of the signature. Currently, it is an open question what, and how many, spectral bands are required for the accurate detection/classification of the phytoplankton, especially when phytoplankton taxonomic composition is complex and when other optically-active components interplay in the radiometric measurements. In this presentation, a preliminary result towards answering the question is presented using in situ hyperspectral radiometric measurements obtained in the Atlantic Ocean. Our result shows that radiometric measurements at many spectral bands are correlated with each other. While the correlation strength differs among spectral bands in question, radiometric measurements at these bands are correlated to the concentration of chlorophyll-a, a pigment commonly found in phytoplankton groups. The correlation with chlorophyll-a was even found at spectral bands where chlorophyll-a little absorbs the light. This may be due to another correlation between the chlorophyll-a concentration and other phytoplankton pigments, the latter of which absorb the light at the spectral band where chlorophyll-a does not. The pigment co-variation implies that a correlation between the radiometric measurements and any pigment concentration does not guarantee the optical detection of the pigment signature, and a more careful analysis is required when the radiometric measurements are analyzed.

キーワード：ハイパースペクトル、リモートセンシング 、植物プランクトン
Keywords: hyperspectral, remote sensing, phytoplankton

