INTRODUCTION

Harmful Algal Blooms (HABs) have become a major threat to the coastal communities in recent years. In the United States, coastal HAB events have been estimated (conservatively, due to lack of information) to have economic impacts of $82 million/year with the majority of impacts in the public health and commercial fisheries sectors [1].

Approximately 50% of all red tide forming species and 75% of all HAB species are dinoflagellate [2]. Their motility provides a competitive advantage because they can migrate downward at night to acquire nutrients and to the surface during the day for photosynthesis. Their dense aggregations produce strong bio-optical signals that are detectable by satellite and airborne optical sensors.

Detecting HABs in the coastal zone is very challenging due to the complexities of various water types and depths, dissolved and suspended organic and inorganic matters, and bottom reflectance. A hyperspectral imager records a contiguous spectrum from various water types and depths, dissolved and suspended organic and inorganic matters, and bottom reflectance. A hyperspectral imager records a contiguous spectrum from each pixel in the scene image and provides additional spectral information to exploit HABs from other bloom like features.

The Red Band Difference (RBD) Algorithm:

\[ RBD = nLw(\lambda_2) - nLw(\lambda_1) \]

where \( nLw(\lambda) \) is normalized water-leaving radiance; \( \lambda_1 \) represents MODIS band 13 (667 nm), MERIS band 7 (665 nm), and GOCI band 5 (660 nm); \( \lambda_2 \) represents MODIS band 14 (678 nm), MERIS band 8 (681 nm), and GOCI band 6 (680 nm)

CONCLUSION

This study complements previous studies using the RBD technique and shows that the RBD technique is indeed an effective detection tool for dinoflagellate blooms such as \( K. \ brevis \).

This study also shows that blooms can be detected directly from the hyperspectral raw digital counts or radiance at sensor’s attitude. This results in minimal errors from imperfect atmospheric corrections or calibration.

This study also demonstrates the value of including the chlorophyll fluorescence channel in future satellite sensors such as those being planned for the NASA’s hyperspectral Pre-Aerosol-Cloud-Ecosystem (PACE) and Hyperspectral Infrared Imager (HyspIRI) missions.

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REFERENCES