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In situ measurement of chlorophyll *a* specific absorption coefficient in the sea

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Abstract

The total absorption coefficient is important in determining the magnitude and the spectral shape of the light field in an aquatic medium. Furthermore, accurate estimates of phytoplankton absorption are necessary to determine the chlorophyll *a* specific absorption coefficient, which is central to the bio-optical model for primary production. However, the presence of detrital and dissolved matter in seawater complicates the direct measurement of phytoplankton absorption coefficient in the sea.

The most widely used method for determining absorption coefficient is the quantitative filter technique (QFT). It can be used to determine the chlorophyll *a* specific absorption coefficient. However, these provide the information at discrete depths only. In recent years, reflective-tube absorption and attenuation meter (ac-9: Wetlabs) and fluorometer (WETStar: Wetlabs) have been developed and provide the continuous vertical profiles of *in situ* absorption, attenuation, and fluorescence.

The present study is aimed to estimate the vertical profile of chlorophyll *a* specific

absorption coefficient using an *in situ* method that was tested against QFT method.

Data were collected in Sagami Bay from April to July 1999. The particulate absorption coefficient using *in situ* method were obtained by subtracting the absorption of dissolved organic matter determined with a 0.2μm filter placed at the intake port of ac-9 from the total absorption coefficient using *in situ* method. In the present study we chose to use absorption at 676nm to estimate phytoplankton absorption *in situ* due to negligible contribution by detrital absorption to particulate absorption at 676nm. *In vivo* bottle samples were taken from Niskin bottle casts at discrete depths. Seawater samples were filtered through Whatman GF/F glass-fiber filters for analysis of chlorophyll *a* concentrations with fluorometric method after extraction in DMF. The continuous profile of chlorophyll *a*, matched well with those collected at discrete depths, provided information on the fine structure of the vertical pigment profile.

There was a good agreement between absorption coefficients at 676nm measured by QFT and ac-9 at the subsurface depths. The significant relationship between specific absorption coefficient at 676nm and the average absorption coefficient from 400 to 700nm was obtained for the QFT method. Estimation of the specific absorption coefficient at 676nm using *in situ* method and *in situ* chlorophyll *a* concentration is able to give continuous information on the vertical variation of chlorophyll *a* specific absorption coefficient for PAR region of the spectrum.

In conclusion, *in situ* method for measuring chlorophyll *a* specific absorption coefficient at 676nm developed can be used to continuously determine vertical profile of the chlorophyll *a* specific absorption coefficient in the spectral region from 400 to 700nm for depths below 10m.