

9 Calculation Of Ocean Color

9.1 Calculation Of Chlorophyll-a Concentration, Pigment Concentration And Diffuse Attenuation Coefficients

Using observation data consisting of different light absorption characteristics for different wavelengths, the content of chlorophyll in the ocean is calculated.

The calculation method for Chlorophyll-a concentration, Pigment concentration and Diffuse attenuation coefficients are stated hereunder.

Chlorophyll-a concentration, Pigment concentration and Diffuse attenuation coefficients (490nm) are calculated by the following equations respectively.

$$Ch1 = 0.2818 * ((L_4 + L_5) / L_3)^{3.497} \quad (9.1-1)$$

$$Pig = 1.568 * (L_2 / L_4)^{-2.079} * (L_3 / L_4)^{-3.497} \quad (9.1-2)$$

$$K(490) = 0.0391 * ((L_4 + L_5) / L_2)^{1.691} \quad (9.1-3)$$

where,

$Ch1$: Chlorophyll a concentration ($\mu\text{g}/1$)

Pig : Pigment concentration ($\mu\text{g}/1$)

$(i=0-409)$: Diffuse attenuation coefficients at 490 nm (1/m)

L_n : Atmospheric corrected normalized water-leaving radiation
brightness

$$\left[mW \cdot sr^{-1} \cdot cm^{-2} \cdot \mu m^{-1} \right]$$

These coefficients calculated are stored in data base.

These calculations are applied pixel by pixel, therefore $Ch1$, Pig and $K(490)$ for every pixel is calculated.

9.2 Calculation Of Level 2QF

For calculation of ocean color, QF of the following items is calculated by each pixel.

- Cocolithopher
- Turbid Case 2

These pieces of information are calculated as follows.

(1) Cocolithopher

"Cocolithopher" flag is placed for items that satisfy all the following conditions.

$$\begin{aligned}
 1.10 < nLw(443) &< 2.55 \\
 0.80 < nLw(565) &< 2.55 \\
 0.95 < r24 &< 1.50 \\
 1.00 < r25 &< 2.00 \\
 1.00 < R45 &< 1.60
 \end{aligned}$$

Where

$$\begin{aligned}
 r25 &= nLw(443) / nLw(565) \\
 r45 &= nLw(520) / nLw(565) \\
 r24 &= nLw(443) / nLw(520)
 \end{aligned}$$

(2) Turbid Case 2

"Turbid Case 2" flag is placed for items that satisfy the following conditions.

$$\begin{aligned}
 Rrs(565) &> (1 - \rho) \cdot Rlim(565) / (Q \cdot n^2) && (9.2-1) \\
 Q &= 3.42 \\
 n &= 1.34
 \end{aligned}$$

Where

$$\begin{aligned}
 Rrs(565) &= nLw(565) / Es(565) \\
 Es(565) &= E_0(565) \cdot t(565) \cdot \cos \theta_0 \\
 E_0(565) &: \text{Extraterrestrial solar irradiance} \\
 t(565) &: \text{Atmospheric transmittance of 565 nm at zenith angle of the sun } \theta_0 \\
 \theta_0 &: \text{Zenith angle of the sun} \\
 Rlim(565) &= \left\{ (1 - 2.5B) - \left((2.5B - 1)^2 - 4.44B \right) \right\} / 2 && (9.2-2) \\
 B &= 0.33b / Kd \\
 b &= 0.00075 + (0.063 - 0.00263 \cdot \log(C)) \cdot C^{0.62} \\
 Kd &= 0.0717 + 0.039 \cdot C^{0.64} \\
 C &= \text{Chlorophyll-a concentration } [\mu g / l]
 \end{aligned}$$