Important Energy Flux Method Formulas PDF

Formulas
Examples
with Units

List of 13
Important Energy Flux Method Formulas

1) Energy Dissipation Rate by Battjes and Janssen Formula

Evaluate Formula

Formula

$$\delta = 0.25 \cdot \rho_{water} \cdot [g] \cdot Q_B \cdot f_m \cdot \left(H_{max}^{2} \right)$$

Example with Units

$$19221.034 = 0.25 \cdot 1000\,\text{kg/m}^3 \cdot 9.8066\,\text{m/s}^2 \cdot 2 \cdot 8\,\text{Hz} \cdot \left(0.7\,\text{m}^{2} \right)$$

2) Energy Dissipation Rate per unit Surface Area due to Wave Breaking Formula

Evaluate Formula

Formula

$$\delta = \left(\frac{K_d}{d} \right) \cdot \left(\left(E'' \cdot C_g \right) - \left(E_f \right) \right)$$

Example with Units

$$18376.3333 = \left(\frac{10.15}{1.05\,\text{m}} \right) \cdot \left(\left(20.00\,\text{J/m}^2 \cdot 100\,\text{m/s} \right) - \left(99.00 \right) \right)$$

3) Energy Flux associated with Stable Wave Height Formula

Evaluate Formula

Formula

$$E_{f'} = E'' \cdot C_g$$

Example with Units

$$2000 = 20.00\,\text{J/m}^2 \cdot 100\,\text{m/s}$$

4) Maximum Wave Height given Energy Dissipation Rate Formula

Evaluate Formula

Formula

$$H_{max} = \sqrt{\frac{\delta}{0.25 \cdot \rho_{water} \cdot [g] \cdot Q_B \cdot f_m}}$$

Example with Units

$$0.7\,\text{m} = \sqrt{\frac{19221}{0.25 \cdot 1000\,\text{kg/m}^3 \cdot 9.8066\,\text{m/s}^2 \cdot 2 \cdot 8\,\text{Hz}}}$$

5) Maximum Wave Height using Miche Criterion Formula

Evaluate Formula

Formula

$$H_{max} = 0.14 \cdot \lambda \cdot \tanh\left(d \cdot k \right)$$

Example with Units

$$0.7765\,\text{m} = 0.14 \cdot 26.8\,\text{m} \cdot \tanh\left(1.05\,\text{m} \cdot 0.2 \right)$$

6) Mean Wave Frequency given Energy Dissipation Rate Formula

Evaluate Formula

Formula

$$f_m = \frac{\delta}{0.25 \cdot \rho_{water} \cdot [g] \cdot Q_B \cdot H_{max}^2}$$

Example with Units

$$8\,\text{Hz} = \frac{19221}{0.25 \cdot 1000\,\text{kg/m}^3 \cdot 9.8066\,\text{m/s}^2 \cdot 2 \cdot 0.7\,\text{m}^2}$$

7) Percentage of Waves Breaking given Energy Dissipation Rate Formula

Evaluate Formula

Formula

$$Q_B = \frac{\delta}{0.25 \cdot \rho_{water} \cdot [g] \cdot f_m \cdot \left(H_{max}^2\right)}$$

Example with Units

$$2 = \frac{19221}{0.25 \cdot 1000\,\text{kg/m}^3 \cdot 9.8066\,\text{m/s}^2 \cdot 8\,\text{Hz} \cdot \left(0.7\,\text{m}^2\right)}$$

8) Stable Wave Height Formula

Evaluate Formula

Formula

$$H_{stable} = 0.4 \cdot d$$

Example with Units

$$0.42\,\text{m} = 0.4 \cdot 1.05\,\text{m}$$

9) Water Depth given Energy Dissipation Rate per unit Surface Area due to Wave Breaking Formula

Evaluate Formula

Formula

$$d = K_d \cdot \frac{E'' \cdot C_g - \left(E_f\right)}{\delta}$$

Example with Units

$$1.0039\,\text{m} = 10.15 \cdot \frac{20.00\,\text{J/m}^2 \cdot 100\,\text{m/s} - \left(99.00\right)}{19221}$$

10) Water Depth given Maximum Wave Height by Miche Criterion Formula

Evaluate Formula

Formula

$$d = \left(\frac{a\tanh\left(\frac{H_{max}}{0.14 \cdot \lambda}\right)}{k}\right)$$

Example with Units

$$0.9439\,\text{m} = \left(\frac{a\tanh\left(\frac{0.7\,\text{m}}{0.14 \cdot 26.8\,\text{m}}\right)}{0.2}\right)$$

11) Water Depth given Stable Wave Height Formula

Evaluate Formula

Formula

$$d = \frac{H_{stable}}{0.4}$$

Example with Units

$$1.05\,\text{m} = \frac{0.42\,\text{m}}{0.4}$$

12) Wave Number given Maximum Wave Height by Miche Criterion Formula

Evaluate Formula

Formula

$$k = a\frac{\tanh\left(\frac{H_{max}}{0.14 \cdot \lambda}\right)}{d}$$

Example with Units

$$0.1798 = a\frac{\tanh\left(\frac{0.7\,\text{m}}{0.14 \cdot 26.8\,\text{m}}\right)}{1.05\,\text{m}}$$

13) Wavelength given Maximum Wave Height by Miche Criterion Formula

Evaluate Formula

Formula

$$\lambda = \frac{H_{max}}{0.14 \cdot \tanh\left(k \cdot d\right)}$$

Example with Units

$$24.1585\,\text{m} = \frac{0.7\,\text{m}}{0.14 \cdot \tanh\left(0.2 \cdot 1.05\,\text{m}\right)}$$

Variables used in list of Energy Flux Method Formulas above

- C_g Wave Group Speed *(Meter per Second)*
- **d** Water Depth *(Meter)*
- E_f Energy Flux associated with Stable Wave Height
- $E_{f'}$ Energy Flux
- E'' Wave Energy *(Joule per Square Meter)*
- f_m Mean Wave Frequency *(Hertz)*
- H_{max} Maximum Wave Height *(Meter)*
- H_{stable} Stable Wave Height *(Meter)*
- **k** Wave Number for Waves in Coast
- K_d Decay Coefficient
- Q_B Percentage of Waves Breaking
- **δ** Energy Dissipation Rate per unit Surface Area
- **λ** Wavelength of Coast *(Meter)*
- ρ_{water} Water Density *(Kilogram per Cubic Meter)*

Constants, Functions, Measurements used in list of Energy Flux Method Formulas above

- constant(s): **[g]**, 9.80665
  Gravitational acceleration on Earth
- Functions: **atanh**, atanh(Number)
  The inverse hyperbolic tangent function returns the value whose hyperbolic tangent is a number.
- Functions: **sqrt**, sqrt(Number)
  A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.
- Functions: **tanh**, tanh(Number)
  The hyperbolic tangent function (tanh) is a function that is defined as the ratio of the hyperbolic sine function (sinh) to the hyperbolic cosine function (cosh).
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Frequency** in Hertz (Hz)
  Frequency Unit Conversion
- Measurement: **Heat Density** in Joule per Square Meter (J/m²)
  Heat Density Unit Conversion
- Measurement: **Density** in Kilogram per Cubic Meter (kg/m³)
  Density Unit Conversion

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