Important Wave Height Formulas PDF

Formulas
Examples
with Units

List of 20
Important Wave Height Formulas

1) Maximum Wave Height Formula

Evaluate Formula

Formula

$$H_{max} = 1.86 \cdot H_s$$

Example with Units

$$120.9\,\text{m} = 1.86 \cdot 65\,\text{m}$$

2) Mean Wave Period given Maximum Wave Period Formula

Evaluate Formula

Formula

$$T' = \frac{T_{max}}{\Delta}$$

Example with Units

$$14.6667\,\text{s} = \frac{88\,\text{s}}{6}$$

3) Significant Wave Height given Wave Period for North Sea Formula

Evaluate Formula

Formula

$$H_s = \left(\frac{T_{NS}}{3.94}\right)^{\frac{1}{0.376}}$$

Example with Units

$$64.9996\,\text{m} = \left(\frac{18.93\,\text{s}}{3.94}\right)^{\frac{1}{0.376}}$$

4) Wave Height for Horizontal Component of Local Fluid Velocity Formula

Evaluate Formula

Formula

$$H = u \cdot 2 \cdot \lambda \cdot \frac{\cosh\left(2 \cdot \pi \cdot \frac{d}{\lambda}\right)}{[g] \cdot T_p \cdot \cosh\left(2 \cdot \pi \cdot \frac{D_{Z+d}}{\lambda}\right) \cdot \cos(\theta)}$$

Example with Units

$$3.054\,\text{m} = 50\,\text{m/s} \cdot 2 \cdot 26.8\,\text{m} \cdot \frac{\cosh\left(2 \cdot 3.1416 \cdot \frac{0.9\,\text{m}}{26.8\,\text{m}}\right)}{9.8066\,\text{m/s}^2 \cdot 95\,\text{s} \cdot \cosh\left(2 \cdot 3.1416 \cdot \frac{2\,\text{m}}{26.8\,\text{m}}\right) \cdot \cos(30°)}$$

5) Wave Height for Horizontal Fluid Particle Displacement Formula

Evaluate Formula

Formula

$$H = \varepsilon \cdot \left(4 \cdot \pi \cdot \lambda\right) \cdot \frac{\cosh\left(2 \cdot \pi \cdot \frac{D}{\lambda}\right)}{[g] \cdot T_h^{\,2}} \cdot \left(\left(\cosh\left(2 \cdot \pi \cdot \frac{D_{Z+d}}{\lambda}\right)\right)\right) \cdot \sin\left(\theta\right)$$

Example with Units

$$3.0556\,\text{m} = 1.55\,\text{m} \cdot \left(4 \cdot 3.1416 \cdot 26.8\,\text{m}\right) \cdot \frac{\cosh\left(2 \cdot 3.1416 \cdot \frac{12\,\text{m}}{26.8\,\text{m}}\right)}{9.8066\,\text{m/s}^2 \cdot 9\,\text{s}^{\,2}} \cdot \left(\left(\cosh\left(2 \cdot 3.1416 \cdot \frac{2\,\text{m}}{26.8\,\text{m}}\right)\right)\right) \cdot \sin\left(30°\right)$$

6) Wave Height for Local Fluid Particle Acceleration of Horizontal Component Formula

Evaluate Formula

Formula

$$H = \alpha_{x/y} \cdot \lambda \cdot \frac{\cosh\left(2 \cdot \pi \cdot \frac{D}{\lambda}\right)}{[g] \cdot \pi \cdot \cosh\left(2 \cdot \pi \cdot \frac{D_{Z+d}}{\lambda}\right) \cdot \sin\left(\theta\right)}$$

Example with Units

$$2.7478\,\text{m} = 0.21\,\text{m/s} \cdot 26.8\,\text{m} \cdot \frac{\cosh\left(2 \cdot 3.1416 \cdot \frac{12\,\text{m}}{26.8\,\text{m}}\right)}{9.8066\,\text{m/s}^2 \cdot 3.1416 \cdot \cosh\left(2 \cdot 3.1416 \cdot \frac{2\,\text{m}}{26.8\,\text{m}}\right) \cdot \sin\left(30°\right)}$$

7) Wave Height for Local Fluid Particle Acceleration of Vertical Component Formula

Evaluate Formula

Formula

$$H = \left(\alpha_{x/y} \cdot \lambda \cdot \frac{\cosh\left(2 \cdot \pi \cdot \frac{D}{\lambda}\right)}{[g] \cdot \pi \cdot \sinh\left(2 \cdot \pi \cdot \frac{D_{Z+d}}{\lambda}\right) \cdot \cos\left(\theta\right)}\right)$$

Example with Units

$$3.6278\,\text{m} = \left(0.21\,\text{m/s} \cdot 26.8\,\text{m} \cdot \frac{\cosh\left(2 \cdot 3.1416 \cdot \frac{12\,\text{m}}{26.8\,\text{m}}\right)}{9.8066\,\text{m/s}^2 \cdot 3.1416 \cdot \sinh\left(2 \cdot 3.1416 \cdot \frac{2\,\text{m}}{26.8\,\text{m}}\right) \cdot \cos\left(30°\right)}\right)$$

8) Wave Height for Major Horizontal Semi-Axis given Wavelength Formula

Evaluate Formula

Formula

$$H = A \cdot 2 \cdot \frac{\sinh\left(2 \cdot \pi \cdot \frac{d}{\lambda}\right)}{\cosh\left(2 \cdot \pi \cdot \frac{D_{Z+d}}{\lambda}\right)}$$

Example with Units

$$2.5643\,\text{m} = 6.707 \cdot 2 \cdot \frac{\sinh\left(2 \cdot 3.1416 \cdot \frac{0.9\,\text{m}}{26.8\,\text{m}}\right)}{\cosh\left(2 \cdot 3.1416 \cdot \frac{2\,\text{m}}{26.8\,\text{m}}\right)}$$

9) Wave Height for Minor Vertical Semi-Axis given Wavelength Formula

Evaluate Formula

Formula

$$H = B \cdot 2 \cdot \frac{\sinh\left(2 \cdot \pi \cdot \frac{d}{\lambda}\right)}{\sinh\left(2 \cdot \pi \cdot \frac{D_{Z+d}}{\lambda}\right)}$$

Example with Units

$$2.5617\,\text{m} = 2.93 \cdot 2 \cdot \frac{\sinh\left(2 \cdot 3.1416 \cdot \frac{0.9\,\text{m}}{26.8\,\text{m}}\right)}{\sinh\left(2 \cdot 3.1416 \cdot \frac{2\,\text{m}}{26.8\,\text{m}}\right)}$$

10) Wave Height for Simplified Horizontal Fluid Particle Displacement Formula

Evaluate Formula

Formula

$$H = \varepsilon \cdot 2 \cdot \frac{\sinh\left(2 \cdot \pi \cdot \frac{D}{\lambda_{hp}}\right)}{\cosh\left(2 \cdot \pi \cdot \frac{D_{Z+d}}{\lambda_{hp}}\right)} \cdot \sin(\theta)$$

Example with Units

$$3.0239\,\text{m} = 1.55\,\text{m} \cdot 2 \cdot \frac{\sinh\left(2 \cdot 3.1416 \cdot \frac{12\,\text{m}}{52.1\,\text{m}}\right)}{\cosh\left(2 \cdot 3.1416 \cdot \frac{2\,\text{m}}{52.1\,\text{m}}\right)} \cdot \sin(30°)$$

11) Wave Height for Simplified Vertical Fluid Particle Displacement Formula

Evaluate Formula

Formula

$$H = \varepsilon' \cdot 2 \cdot \frac{\sinh\left(2 \cdot \pi \cdot \frac{D}{\lambda_{vp}}\right)}{\sinh\left(2 \cdot \pi \cdot \frac{D_{Z+d}}{\lambda_{vp}}\right)} \cdot \cos(\theta)$$

Example with Units

$$3.0199\,\text{m} = 0.22\,\text{m} \cdot 2 \cdot \frac{\sinh\left(2 \cdot 3.1416 \cdot \frac{12\,\text{m}}{55.9\,\text{m}}\right)}{\sinh\left(2 \cdot 3.1416 \cdot \frac{2\,\text{m}}{55.9\,\text{m}}\right)} \cdot \cos(30°)$$

12) Wave Height for Vertical Component of Local Fluid Velocity Formula

Evaluate Formula

Formula

$$H = \left(V_v \cdot 2 \cdot \lambda\right) \cdot \frac{\cosh\left(2 \cdot \pi \cdot \frac{D}{\lambda}\right)}{[g] \cdot T_p \cdot \sinh\left(2 \cdot \pi \cdot \frac{D_{Z+d}}{\lambda}\right) \cdot \sin(\theta)}$$

Example with Units

$$3.012\,\text{m} = \left(1.522\,\text{m/s} \cdot 2 \cdot 26.8\,\text{m}\right) \cdot \frac{\cosh\left(2 \cdot 3.1416 \cdot \frac{12\,\text{m}}{26.8\,\text{m}}\right)}{9.8066\,\text{m/s}^2 \cdot 95\,\text{s} \cdot \sinh\left(2 \cdot 3.1416 \cdot \frac{2\,\text{m}}{26.8\,\text{m}}\right) \cdot \sin(30°)}$$

13) Wave Height for Vertical Fluid Particle Displacement Formula

Evaluate Formula

Formula

$$H' = \varepsilon \cdot \left(4 \cdot \pi \cdot \lambda\right) \cdot \frac{\cosh\left(2 \cdot \pi \cdot \frac{D}{\lambda}\right)}{[g] \cdot T_p^{\,2} \cdot \sinh\left(2 \cdot \pi \cdot \frac{D_{Z+d}}{\lambda}\right) \cdot \cos\left(\theta\right)}$$

Example with Units

$$0.1171\,\text{m} = 1.55\,\text{m} \cdot \left(4 \cdot 3.1416 \cdot 26.8\,\text{m}\right) \cdot \frac{\cosh\left(2 \cdot 3.1416 \cdot \frac{12\,\text{m}}{26.8\,\text{m}}\right)}{9.8066\,\text{m/s}^2 \cdot 95\,\text{s}^{\,2} \cdot \sinh\left(2 \cdot 3.1416 \cdot \frac{2\,\text{m}}{26.8\,\text{m}}\right) \cdot \cos\left(30°\right)}$$

14) Wave Height given Wave Amplitude Formula

Evaluate Formula

Formula

$$H = 2 \cdot a$$

Example with Units

$$3.12\,\text{m} = 2 \cdot 1.56\,\text{m}$$

15) Wave Height given Wave Period for Mediterranean Sea Formula

Evaluate Formula

Formula

$$H = \left(\frac{T_{ms} - 4}{2}\right)^{\frac{1}{0.7}}$$

Example with Units

$$3.0844\,\text{m} = \left(\frac{8.40\,\text{s} - 4}{2}\right)^{\frac{1}{0.7}}$$

16) Wave Height given Wave Period for North Atlantic Ocean Formula

Evaluate Formula

Formula

$$H = \frac{T_{NS}}{2.5}$$

Example with Units

$$7.572\,\text{m} = \frac{18.93\,\text{s}}{2.5}$$

17) Wave Height given Wave Steepness Formula

Evaluate Formula

Formula

$$H = \varepsilon_s \cdot \lambda$$

Example with Units

$$3.216\,\text{m} = 0.12 \cdot 26.8\,\text{m}$$

18) Wave Height Represented by Rayleigh Distribution Formula

Evaluate Formula

Formula

$$H_{iw} = \left(\frac{2 \cdot H}{H_{rms}^{\,2}}\right) \cdot \exp\left(-\left(\frac{H^2}{H_{rms}^{\,2}}\right)\right)$$

Example with Units

$$0.2447\,\text{m} = \left(\frac{2 \cdot 3\,\text{m}}{2.9\,\text{m}^{\,2}}\right) \cdot \exp\left(-\left(\frac{3\,\text{m}^{\,2}}{2.9\,\text{m}^{\,2}}\right)\right)$$

19) Wave Height Represented by Rayleigh Distribution under Narrow Band Condition Formula

Evaluate Formula

Formula

$$H_{iw} = -\left(1 - \exp\left(\frac{H^2}{H_{rms}^{\,2}}\right)\right)$$

Example with Units

$$1.9158\,\text{m} = -\left(1 - \exp\left(\frac{3\,\text{m}^{\,2}}{2.9\,\text{m}^{\,2}}\right)\right)$$

20) Wavelength given Wave Steepness Formula

Evaluate Formula

Formula	Example with Units
$\lambda = \frac{H}{\varepsilon_s}$	$25\,\text{m} = \frac{3\,\text{m}}{0.12}$

Variables used in list of Wave Height Formulas above

- **a** Wave Amplitude *(Meter)*
- **A** Horizontal Semi-axis of Water Particle
- **B** Vertical Semi-Axis
- **d** Depth of Water Wave *(Meter)*
- **D** Water Depth *(Meter)*
- D_{Z+d} Distance above Bottom *(Meter)*
- **H** Wave Height *(Meter)*
- **H'** Wave Height for Vertical Fluid Particle *(Meter)*
- H_{iw} Individual Wave Height *(Meter)*
- H_{max} Maximum Wave Height *(Meter)*
- H_{rms} Root Mean Square Wave Height *(Meter)*
- H_s Significant Wave Height *(Meter)*
- **T'** Mean Wave Period *(Second)*
- T_h Wave Period for Horizontal Fluid Particle *(Second)*
- T_{max} Maximum Wave Period *(Second)*
- T_{ms} Wave Period for Mediterranean Sea *(Second)*
- T_{NS} Wave Period for North Sea *(Second)*
- T_p Wave Period *(Second)*
- **u** Water Particle Velocity *(Meter per Second)*
- V_v Vertical Component of Velocity *(Meter per Second)*
- $\alpha_{x/y}$ Local Fluid Particle Acceleration *(Meter per Second)*
- **Δ** Coefficient Eckman
- **ε** Fluid Particle Displacement *(Meter)*
- **ε'** Particle Displacement *(Meter)*
- ε_s Wave Steepness
- **θ** Phase Angle *(Degree)*
- **λ** Wavelength *(Meter)*
- λ_{hp} Wavelength of Horizontal Fluid Particle *(Meter)*
- λ_{vp} Wavelength of Vertical Fluid Particle *(Meter)*

Constants, Functions, Measurements used in list of Wave Height Formulas above

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- constant(s): **[g]**, 9.80665 *Gravitational acceleration on Earth*
- Functions: **cos**, cos(Angle) *Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.*
- Functions: **cosh**, cosh(Number) *The hyperbolic cosine function is a mathematical function that is defined as the ratio of the sum of the exponential functions of x and negative x to 2.*
- Functions: **exp**, exp(Number) *n an exponential function, the value of the function changes by a constant factor for every unit change in the independent variable.*
- Functions: **sin**, sin(Angle) *Sine is a trigonometric function that describes the ratio of the length of the opposite side of a right triangle to the length of the hypotenuse.*
- Functions: **sinh**, sinh(Number) *The hyperbolic sine function, also known as the sinh function, is a mathematical function that is defined as the hyperbolic analogue of the sine function.*
- Measurement: **Length** in Meter (m) *Length Unit Conversion*
- Measurement: **Time** in Second (s) *Time Unit Conversion*
- Measurement: **Speed** in Meter per Second (m/s) *Speed Unit Conversion*
- Measurement: **Angle** in Degree (°) *Angle Unit Conversion*

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