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Nearshore Currents Formulas

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List of 13 Nearshore Currents Formulas

Nearshore Currents

1) Oscillatory Flow due to Infragravity Waves

Open Calculator

fx $u_i = u - u_w - u_t - u_o - u_a$

ex $8\text{m/s} = 45\text{m/s} - 16\text{m/s} - 12\text{m/s} - 3\text{m/s} - 6\text{m/s}$

2) Oscillatory Flow due to Wind Waves

Open Calculator

fx $u_o = u - u_t - u_w - u_i - u_a$

ex $3\text{m/s} = 45\text{m/s} - 12\text{m/s} - 16\text{m/s} - 8\text{m/s} - 6\text{m/s}$

3) Steady Current driven by Breaking Waves

Open Calculator

fx $u_w = u - u_t - u_i - u_o - u_a$

ex $16\text{m/s} = 45\text{m/s} - 12\text{m/s} - 8\text{m/s} - 3\text{m/s} - 6\text{m/s}$

4) Tidal Current given Total Current in Surf Zone

Open Calculator

fx $u_t = u - (u_w + u_a + u_i + u_o)$

ex $12\text{m/s} = 45\text{m/s} - (16\text{m/s} + 6\text{m/s} + 8\text{m/s} + 3\text{m/s})$

5) Total Current in Surf Zone

Open Calculator

fx $u = u_a + u_i + u_o + u_t + u_w$

ex $45\text{m/s} = 6\text{m/s} + 8\text{m/s} + 3\text{m/s} + 12\text{m/s} + 16\text{m/s}$

6) Wind Driven Current given Total Current in Surf Zone

Open Calculator

fx $u_a = u - u_w - u_t - u_o - u_i$

ex $6\text{m/s} = 45\text{m/s} - 16\text{m/s} - 12\text{m/s} - 3\text{m/s} - 8\text{m/s}$

Longshore Current

7) Beach Slope Modified for Wave Setup

Open Calculator

fx $\beta^* = a\tan\left(\frac{\tan(\beta)}{1+\left(3\cdot\frac{\gamma_b^2}{8}\right)}\right)$

ex $0.144531 = a\tan\left(\frac{\tan(0.15)}{1+\left(3\cdot\frac{(0.32)^2}{8}\right)}\right)$

8) Longshore Current at Mid-Surf Zone

Open Calculator

fx $V_{mid} = 1.17\cdot\sqrt{[g]\cdot H_{rms}}\cdot\sin(\alpha)\cdot\cos(\alpha)$

ex $1.098031\text{m/s} = 1.17\cdot\sqrt{[g]\cdot 0.479\text{m}}\cdot\sin(60^\circ)\cdot\cos(60^\circ)$

9) Longshore Current Speed

Open Calculator

$$V = \left(5 \cdot \frac{\pi}{16}\right) \cdot \tan\left(\beta^*\right) \cdot \gamma_b \cdot \sqrt{[g] \cdot D} \cdot \sin(\alpha) \cdot \frac{\cos(\alpha)}{C_f}$$

ex

$$41.57468\text{m/s} = \left(5 \cdot \frac{\pi}{16}\right) \cdot \tan(0.14) \cdot 0.32 \cdot \sqrt{[g] \cdot 11.99\text{m}} \cdot \sin(60^\circ) \cdot \frac{\cos(60^\circ)}{0.005}$$

10) Radiation Stress Component

Open Calculator

$$S_{xy} = \left(\frac{n}{8}\right) \cdot \rho \cdot [g] \cdot \left(H^2\right) \cdot \cos(\alpha) \cdot \sin(\alpha)$$

ex

$$13.48941 = \left(\frac{0.05}{8}\right) \cdot 997\text{kg/m}^3 \cdot [g] \cdot \left((0.714\text{m})^2\right) \cdot \cos(60^\circ) \cdot \sin(60^\circ)$$

11) Ratio of Wave Group Speed and Phase Speed

Open Calculator

$$n = \frac{S_{xy} \cdot 8}{\rho \cdot [g] \cdot H^2 \cdot \cos(\alpha) \cdot \sin(\alpha)}$$

ex

$$0.055599 = \frac{15 \cdot 8}{997\text{kg/m}^3 \cdot [g] \cdot (0.714\text{m})^2 \cdot \cos(60^\circ) \cdot \sin(60^\circ)}$$

12) Root Mean Square Wave Height at Breaking given Longshore Current at Mid-Surf Zone

Open Calculator

fx $$H_{rms} = \frac{\left(\frac{V_{mid}}{1.17 \cdot \sin(\alpha) \cdot \cos(\alpha)}\right)^{0.5}}{[g]}$$

ex $$0.149572\text{m} = \frac{\left(\frac{1.09\text{m/s}}{1.17 \cdot \sin(60^\circ) \cdot \cos(60^\circ)}\right)^{0.5}}{[g]}$$

13) Wave Height given Radiation Stress Component

Open Calculator

fx $$H = \sqrt{\frac{S_{xy} \cdot 8}{\rho} \cdot [g] \cdot \cos(\alpha) \cdot \sin(\alpha)}$$

ex $$0.714914\text{m} = \sqrt{\frac{15 \cdot 8}{997\text{kg/m}^3} \cdot [g] \cdot \cos(60^\circ) \cdot \sin(60^\circ)}$$

Variables Used

- C_f Bottom Friction Coefficient
- **D** Water Depth *(Meter)*
- **H** Wave Height *(Meter)*
- H_{rms} Root Mean Square Wave Height *(Meter)*
- **n** Ratio of Wave Group Speed and Phase Speed
- S_{xy} Radiation Stress Component
- **u** Total Current in the Surf Zone *(Meter per Second)*
- u_a Wind Driven Current *(Meter per Second)*
- u_i Oscillatory Flow due to Infragravity Waves *(Meter per Second)*
- u_o Oscillatory Flow due to Wind Waves *(Meter per Second)*
- u_t Tidal Current *(Meter per Second)*
- u_w Steady Current driven by Breaking Waves *(Meter per Second)*
- **V** Longshore Current Speed *(Meter per Second)*
- V_{mid} Longshore Current at the Mid-Surf Zone *(Meter per Second)*
- **α** Wave Crest Angle *(Degree)*
- **β** Beach Slope
- β^* Modified Beach Slope
- γ_b Breaker Depth Index
- **ρ** Mass Density *(Kilogram per Cubic Meter)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Constant: **[g]**, 9.80665
  Gravitational acceleration on Earth
- Function: **atan**, atan(Number)
  Inverse tan is used to calculate the angle by applying the tangent ratio of the angle, which is the opposite side divided by the adjacent side of the right triangle.
- Function: **cos**, cos(Angle)
  Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.
- Function: **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.
- Function: **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.
- Function: **tan**, tan(Angle)
  The tangent of an angle is a trigonometric ratio of the length of the side opposite an angle to the length of the side adjacent to an angle in a right triangle.
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion
- Measurement: **Mass Concentration** in Kilogram per Cubic Meter (kg/m³)
  Mass Concentration Unit Conversion

Check other formula lists

- **Nearshore Currents Formulas**

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