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Gumbel's Method for Prediction of Flood's Peak Formulas

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List of 22 Gumbel's Method for Prediction of Flood's Peak Formulas

Gumbel's Method for Prediction of Flood's Peak

1) Frequency Factor as applicable to Infinite Sample Size

$$\text{fx } K_z = \frac{y_T - 0.577}{1.2825}$$

[Open Calculator !\[\]\(a870788d6ed9b8fd294b7654a8c8526b_img.jpg\)](#)

$$\text{ex } 2.731384 = \frac{4.08 - 0.577}{1.2825}$$

2) Frequency Factor given Variate 'x' concerning Return Period

$$\text{fx } K_z = \frac{x_T - x_m}{\sigma}$$

[Open Calculator !\[\]\(c50c8b7b2cc2cf9ff925edec0ee94c0d_img.jpg\)](#)

$$\text{ex } 7.0816 = \frac{9.43 - 0.578}{1.25}$$

3) Frequency Factor in Gumbel's Equation for Practical Use

$$\text{fx } K_z = \frac{y_T - y_n}{S_n}$$

[Open Calculator !\[\]\(f60b7a900783ac3fd531bfd9c111be6d_img.jpg\)](#)

$$\text{ex } 7.006 = \frac{4.08 - 0.577}{0.50}$$



4) General Equation of Hydrologic Frequency Analysis

$$fx \quad x_T = x_m + K_z \cdot \sigma$$

[Open Calculator !\[\]\(cbe80b694ebd74fcfe136a095b608235_img.jpg\)](#)

$$ex \quad 9.328 = 0.578 + 7 \cdot 1.25$$

5) Gumbel's Variate 'x' with Recurrence Interval for Practical Use

$$fx \quad x_T = x_m + K_z \cdot \sigma_{n-1}$$

[Open Calculator !\[\]\(3e2231b1ad3ca8da8658228c00dd08e0_img.jpg\)](#)

$$ex \quad 9.538 = 0.578 + 7 \cdot 1.28$$

6) Mean of Variate in Flood Frequency Studies

$$fx \quad x_m = x_T - K_z \cdot \sigma$$

[Open Calculator !\[\]\(0d5ec72f61334709c3fc9450209b754f_img.jpg\)](#)

$$ex \quad 0.68 = 9.43 - 7 \cdot 1.25$$

7) Mean Variate given Variate 'x' with Recurrence Interval for Practical Use



$$fx \quad x_m = x_T - (K_z \cdot \sigma_{n-1})$$

[Open Calculator !\[\]\(84f47badaad7772cd95667a7c387a639_img.jpg\)](#)

$$ex \quad 0.47 = 9.43 - (7 \cdot 1.28)$$

8) Reduced Mean when Frequency Factor and Standard Deviation are Considered

$$fx \quad y_n = y_T - (K_z \cdot S_n)$$

[Open Calculator !\[\]\(c15650232aa6660c9deb34f3b82dcb72_img.jpg\)](#)

$$ex \quad 0.58 = 4.08 - (7 \cdot 0.50)$$



9) Reduced Standard Deviation when Variate and Reduced Mean is Considered

$$fx \quad S_n = \frac{y_T - y_n}{K_z}$$

[Open Calculator !\[\]\(e78f798d4ea5c530c9db49e7d26e6b95_img.jpg\)](#)

$$ex \quad 0.500429 = \frac{4.08 - 0.577}{7}$$

10) Reduced Variate concerning Return Period

$$fx \quad y_T = - \left(\ln \left(\ln \left(\frac{T_r}{T_r - 1} \right) \right) \right)$$

[Open Calculator !\[\]\(05be7c7a8995decd503647c99211f7c2_img.jpg\)](#)

$$ex \quad 5.007293 = - \left(\ln \left(\ln \left(\frac{150}{150 - 1} \right) \right) \right)$$

11) Reduced Variate for Return Period when Frequency Factor is Considered

$$fx \quad y_{tf} = (K_z \cdot 1.2825) + 0.577$$

[Open Calculator !\[\]\(fe3aebe81acea8d45108cd2768939da7_img.jpg\)](#)

$$ex \quad 9.5545 = (7 \cdot 1.2825) + 0.577$$

12) Reduced Variate when Frequency Factor and Standard Deviation is Considered

$$fx \quad y_{tf} = K_z \cdot \sigma_{n-1} + y_n$$

[Open Calculator !\[\]\(899d8b7697d64725bf017d3296cfcf1b_img.jpg\)](#)

$$ex \quad 9.537 = 7 \cdot 1.28 + 0.577$$



13) Reduced Variate 'Y' for given Return Period

fx

Open Calculator 

$$y_T = - \left(0.834 + 2.303 \cdot \log_{10} \left(\log_{10} \left(\frac{T_r}{T_r - 1} \right) \right) \right)$$

$$\text{ex } 5.008378 = - \left(0.834 + 2.303 \cdot \log_{10} \left(\log_{10} \left(\frac{150}{150 - 1} \right) \right) \right)$$

14) Reduced Variate 'Y' in Gumbel's Method

fx

Open Calculator 

$$y = \left(\frac{1.285 \cdot (x_T - x_m)}{\sigma} \right) + 0.577$$

$$\text{ex } 9.676856 = \left(\frac{1.285 \cdot (9.43 - 0.578)}{1.25} \right) + 0.577$$

Confidence Limits

15) Confidence Interval of Variate

fx

Open Calculator 

$$x_1 = x_T + f_c \cdot S_e$$

$$\text{ex } 12.43 = 9.43 + 15 \cdot 0.2$$

16) Confidence Interval of Variate Bounded by X2


fx

Open Calculator 

$$x_2 = x_T + f_c \cdot S_e$$

$$\text{ex } 12.43 = 9.43 + 15 \cdot 0.2$$



17) Equation for Confidence Interval of Variate 

$$fx \quad x_1 = x_T - f_c \cdot S_e$$

[Open Calculator !\[\]\(d3fb9f94af8b26d1c844efa9a98805b0_img.jpg\)](#)


$$ex \quad 6.43 = 9.43 - 15 \cdot 0.2$$

18) Equation for Confidence Interval of Variate Bounded by x_2 

$$fx \quad x_2 = x_T - f_c \cdot S_e$$

[Open Calculator !\[\]\(e1d6102fe77919492c04879c8450f1f5_img.jpg\)](#)


$$ex \quad 6.43 = 9.43 - 15 \cdot 0.2$$

19) Equation for Variate 'b' using Frequency Factor 

$$fx \quad b = \sqrt{1 + (1.3 \cdot K_z) + (1.1 \cdot K_z^2)}$$

[Open Calculator !\[\]\(ab4e2b3fc7e7887b7a72f548aa6f5e60_img.jpg\)](#)

$$ex \quad 8 = \sqrt{1 + (1.3 \cdot 7) + (1.1 \cdot (7)^2)}$$

20) Probable Error 

$$fx \quad S_e = b \cdot \left(\frac{\sigma_{n-1}}{\sqrt{N}} \right)$$

[Open Calculator !\[\]\(5abce1a84a655b073239ab33e1199487_img.jpg\)](#)

$$ex \quad 0.200017 = 8 \cdot \left(\frac{1.28}{\sqrt{2621}} \right)$$



21) Sample Size when Probable Error is Considered

[Open Calculator !\[\]\(feabb98897b440bc8695a03336a6e2df_img.jpg\)](#)

$$\text{fx } N = \left(\frac{b \cdot \sigma_{n-1}}{S_e} \right)^2$$

$$\text{ex } 2621.44 = \left(\frac{8 \cdot 1.28}{0.2} \right)^2$$

22) Variate 'b' given Probable Error

[Open Calculator !\[\]\(642aa997563f9a325b310230bb5078b7_img.jpg\)](#)

$$\text{fx } b = S_e \cdot \frac{\sqrt{N}}{\sigma_{n-1}}$$

$$\text{ex } 7.999329 = 0.2 \cdot \frac{\sqrt{2621}}{1.28}$$



Variables Used

- **b** Variable 'b' in Probable Error
- **f_c** Function of Confidence Probability
- **K_Z** Frequency Factor
- **N** Sample Size
- **S_e** Probable Error
- **S_n** Reduced Standard Deviation
- **T_r** Return Period
- **x₁** Value of 'x1' Bounded to Variate 'Xt'
- **x₂** Value of 'x2' Bounded to Variate 'Xt'
- **x_m** Mean of the Variate X
- **x_T** Variate 'X' with a Recurrence Interval
- **y** Reduced Variate 'Y'
- **y_n** Reduced Mean
- **y_T** Reduced Variate 'Y' for Return Period
- **y_{tf}** Reduced Variate 'Y' with Respect to Frequency
- **σ** Standard Deviation of the Z Variate Sample
- **σ_{n-1}** Standard Deviation of the Sample of Size N



Constants, Functions, Measurements used

- **Function:** **ln**, $\ln(\text{Number})$
Natural logarithm function (base e)
- **Function:** **log10**, $\log_{10}(\text{Number})$
Common logarithm function (base 10)
- **Function:** **sqrt**, $\sqrt{\text{Number}}$
Square root function



Check other formula lists

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- [Gumbel's Method for Prediction of Flood's Peak Formulas](#) 
- [Rational Method to Estimate the Flood Peak Formulas](#) 

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