

Supplementary Materials:**Multi-hazard Risk Assessment for Planning with Climate in the Dosso Region, Niger**

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Equations S1.

Gumbel method

The probability density function of the Gumbel (maximum) distribution is:

$$f(x) = \frac{1}{\beta} e^{-\frac{x-\mu}{\beta}} e^{-e^{-\frac{x-\mu}{\beta}}}$$

The formula for the cumulative distribution function of the Gumbel distribution (maximum) is:

$$F(x) = e^{-e^{-x}}$$

The method of moments estimators of the Gumbel (maximum) distribution are:

$$\tilde{\beta} = \frac{s\sqrt{6}}{\pi}$$

$$\tilde{\mu} = \bar{X} - 0.5772\tilde{\beta}$$

where \bar{X} and s are the sample mean and standard deviation,

The formula for the inverse survival function of the Gumbel distribution (maximum) is:

$$Z(p) = -\ln \left[\ln \left(\frac{1}{1-p} \right) \right]$$

considering a Time return T then:

$$p = \frac{1}{T}$$

and

$$W(T) = -\ln \left[\ln \left(\frac{T}{T-1} \right) \right]$$

So the critical value for the T return is:

$$X_T = \beta + \mu W(T)$$