A Note on Return Levels & Return Periods

- Return periods are often incorrectly interpreted in the professional communities as "100-year event is an event which happens only once in 100 years", which may lead to inaccurate assessment of risks.
- A more holistic way of looking at this is to consider a time period within which a risk is evaluated.
- The **Expected number of exceedances in 100 years is 1**.
- For example, however, a 100-year event with probability of exceedance in any given year of 1% would have a probability of ~63.4% to be exceeded at least once within 100 years.

Binomial Prob. Mass Function:

$$b(k; n, p) = \binom{n}{k} p^k (1-p)^{n-k}$$

where p = prob of exceedance,
and n = total # of time periods (years),
and k = # of exceedances (0…n)

If $\mathrm{K} \sim b(k; 100, 0.01)$,
then $\boldsymbol{E(\mathrm{K}) = np = 100(0.01) = 1}$

However,
P(at least 1 exceedance in 100 years)
= 1 – P(no exceedances in 100 years)

$$= 1 - \binom{100}{0} 0.01^0 (1-0.01)^{100-0}$$

$= 1 – (1 – 0.01)^{100} = 63.4\%$