$Y =$ flood, yes/no, $Y \sim Bernoulli(p)$. $X =$ the amount,

$$X = \begin{cases} 0, & \text{if } Y = 0 \\ Exp(\lambda), & \text{if } Y = 1 \end{cases}$$

$$\begin{aligned} F_X(x) &= P(X \leq x) \\ &= P(X \leq x|Y = 0)P(Y = 0) + P(X \leq x|Y = 1)P(Y = 1) = \\ &= (1 - p) + (1 - e^{\lambda x})p \end{aligned}$$

Here, first split the $X \leq x$ event with Y using the definition for conditional probability and then note that if there is no flood then the amount is always 0, that is the probability that it is less than x is 1 (x always greater than 0).

$$P(X \leq t + h|X > t) = \frac{P(t < X \leq t + h)}{P(X > t)} = \frac{F_X(t + h) - F_X(t)}{1 - F_X(t)} = 1 - e^{\lambda h}$$

You can get that last one from throwing the expression in Mathematica and using Full-Simplify on it or simply remembering that the exponential distribution possesses the "memorylessness" property. Meaning that the expected value of X is simply $t+\lambda$, if you parametrize the exponential distribution with its expected value ($1 + \frac{1}{\lambda}$ otherwise).