**Design storm calculations:**

What we are going to do is find the 24 hour storm event (precipitation intensity in mm/hr over a span of 24 hours), for different return periods (5 years, 10 years, 15 years and 25 years). This would be like saying something like: a 15 mm/hr storm is likely to occur 1 in 5 years; a 25mm/hr storm is likely to occur 1 in 25 years etc. We want to see how this changes into the future.

**Here are the steps for these calculations from your daily data (eg. historical dataframe dailydatahist)**

You would repeat this for 2040s, 2060s and 2080s time frames

1. Dailydatahist<- read historical daily precip

Our data is already daily (24 hr intervals). So there is NO need to process it further to create 24 hour time series.

1. Find the max 24 hr precip event that happened each year. This would just be the max(precip) for each year.

YearlyMaxof24hrStorm <- max(Dailydatahist) grouped by year

This gives something like below.

|  |  |
| --- | --- |
| year | max 24 hr precip (mm) |
|  |  |
| 1970 | 50 |
| 1971 | 80 |
| 1972 | 25 |
| 1973 | 45 |
| 1974 | 40 |
| 1975 | 35.5 |
| 1976 | 34 |
| 1977 | 50 |

1. Convert it to intensity in mm/hr by dividing by 24

This gives something like below

|  |  |  |
| --- | --- | --- |
|  | max 24 hr precip (mm) | max 24 hr precip intensity (mm/hr) |
|  |  | (1/24) |
| 1970 | 50 | 2.08 |
| 1971 | 80 | 3.33 |
| 1972 | 25 | 1.04 |
| 1973 | 45 | 1.88 |
| 1974 | 40 | 1.67 |
| 1975 | 35.5 | 1.48 |
| 1976 | 34 | 1.42 |
| 1977 | 50 | 2.08 |

1. Calculate mean “m” and std deviation “s” of the intensities (last column above)
2. The design storm events are “extreme” events. So we will fit a Gumbell extreme value distribution to them for the different “return periods”

For a given return period T in years, constant KT corresponding to the Gumbell EV distribution is calculated as

KT = (-1) \* ( sqrt(6)/pi ) \* {0.5772 +ln[ln(T/T-1)]}

|  |  |
| --- | --- |
| T (years) | KT = (-1) \* ( sqrt(6)/pi ) \* {0.5772 +ln[ln(T/T-1)]} |
| 5 | 0.719457416 |
| 10 | 1.304563213 |
| 15 | 1.634674959 |
| 25 | 2.043845939 |

1. Find the 24 hr design storm intensity for each return period as

XT = m + KT\*s; where m is mean and s is std deviation from step 4

You will get something like

|  |  |
| --- | --- |
| Return Period | xt = avg + KT\*stdev (mm/hr) |
| 5 | 2.294506891 |
| 10 | 2.691854113 |
| 15 | 2.916034059 |
| 25 | 3.193903383 |

1. You will do these calculations for the 3 future time series, 2040s, 2060s and 2080s and populate a table like this.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Return Period | 5 | 10 | 15 | 20 | 25 |
| Historical 24 hr design storm (mm/hr) |  |  |  |  |  |
| 2040s 24 hr design storm (mm/hr) |  |  |  |  |  |
| 2060s 24 hr design storm (mm/hr) |  |  |  |  |  |
| 2080s 24 hr design storm (mm/hr) |  |  |  |  |  |

1. You will plot this with the return periods for 5 to 25 on X axis, and design storm values for the 4 groups (hist, 2040s, 2060s and 2080s) on the Y axis.