CE 3354 Engineering Hydrology
Exercise Set 4

Exercises

1. Use the Oklahoma data you prepared in ES-3 and analyze using the Bulletin 17C procedure (using the PeakFQ software tool - use station skew option).

   If starting from just the data in ES3 you will have to carefully build an input file – the **Beargrass-B17C.txt**[1] file is the correct format.

   Solution

   The **Beargrass-B17C.txt** file is shown below

```
* WCF2.DATA  1/9/89 -- BULLETIN 17 EXAMPLES
*---+----1----+----2----+----3----+----4----+----5----+----6----+----7----+----8

Z                                USGS

*               LAT   LON                          AREA          ELEV
* STATIONID     DDMMSSDDDMMSS                      12345671234567 12345678

H 12345678      3527470973329                      645.55        1202.01
N 12345678      OKLAHOMA FROM ES3
Y 12345678      20.0
2 12345678
3 12345678      19230101 200000
3 12345678      19240101 42000
3 12345678      19250101 11300
3 12345678      19260101 32400
3 12345678      19270101 108000
3 12345678      19280101 73000
3 12345678      19290101 76500
3 12345678      19300101 47800
3 12345678      19310101 28200
3 12345678      19320101 33700
3 12345678      19330101 25700
3 12345678      19340101 11700
3 12345678      19350101 77800
3 12345678      19360101 26600
```

[1] This file is located in same directory as this document

```
3 12345678      19370101 47500
3 12345678      19380101 75600
3 12345678      19390101 19200
3 12345678      19400101 27800
3 12345678      19410101 51000
3 12345678      19420101 94000
3 12345678      19430101 97200
3 12345678      19440101 179000
3 12345678      19450101 124000
3 12345678      19460101 110000
3 12345678      19470101 114000
3 12345678      19480101 70200
3 12345678      19490101 70700
3 12345678      19500101 92800
3 12345678      19510101 135000
3 12345678      19520101 25800
3 12345678      19530101 17500
3 12345678      19540101 18700
3 12345678      19550101 36300
3 12345678      19560101 49200
3 12345678      19570101 120000
3 12345678      19580101 56800
3 12345678      19590101 54800
3 12345678      19600101 158000
3 12345678      19610101 165000
3 12345678      19620101 103000
3 12345678      19630101 19700
3 12345678      19640101 21100
3 12345678      19650101 171000
3 12345678      19660101 10400
3 12345678      19670101 42000
3 12345678      19680101 52800
3 12345678      19690101 77000
3 12345678      19700101 101000
3 12345678      19710101 17100
*
```

Now load this file into PeakFQ, adjust the settings (EMA, and set skew to *station skew*), like below

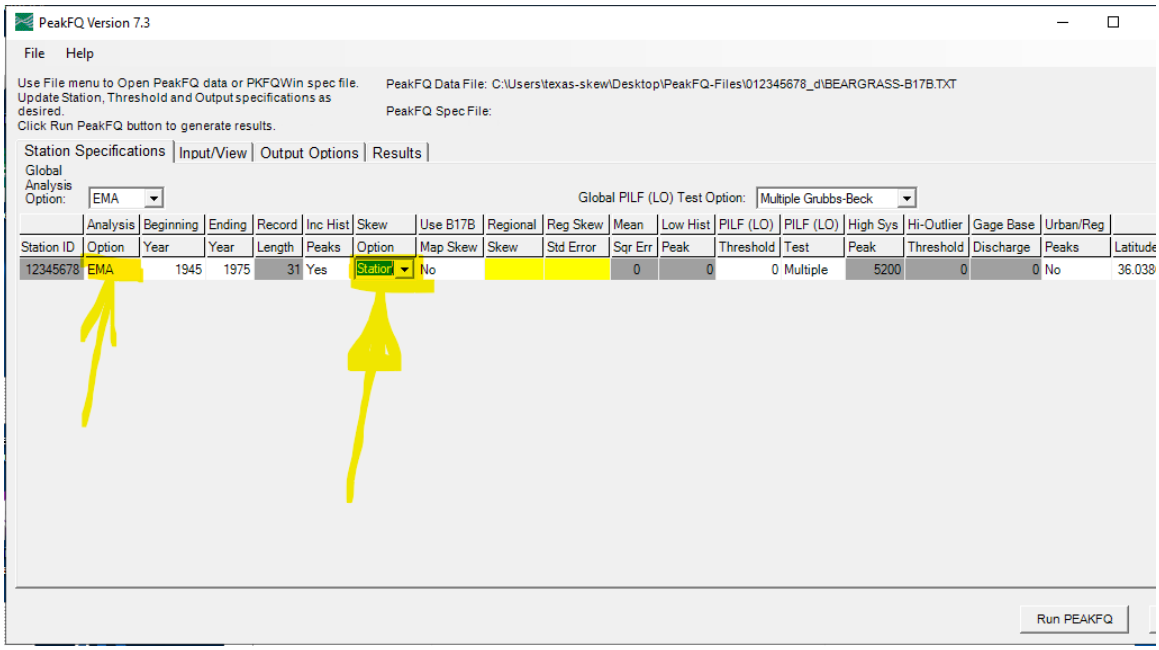


Figure 1: PeakFQ 7.3 Set up screen for Beargrass Creek Data Analysis

Then run the program and extract results (either graphically, or using the output file Table 4)

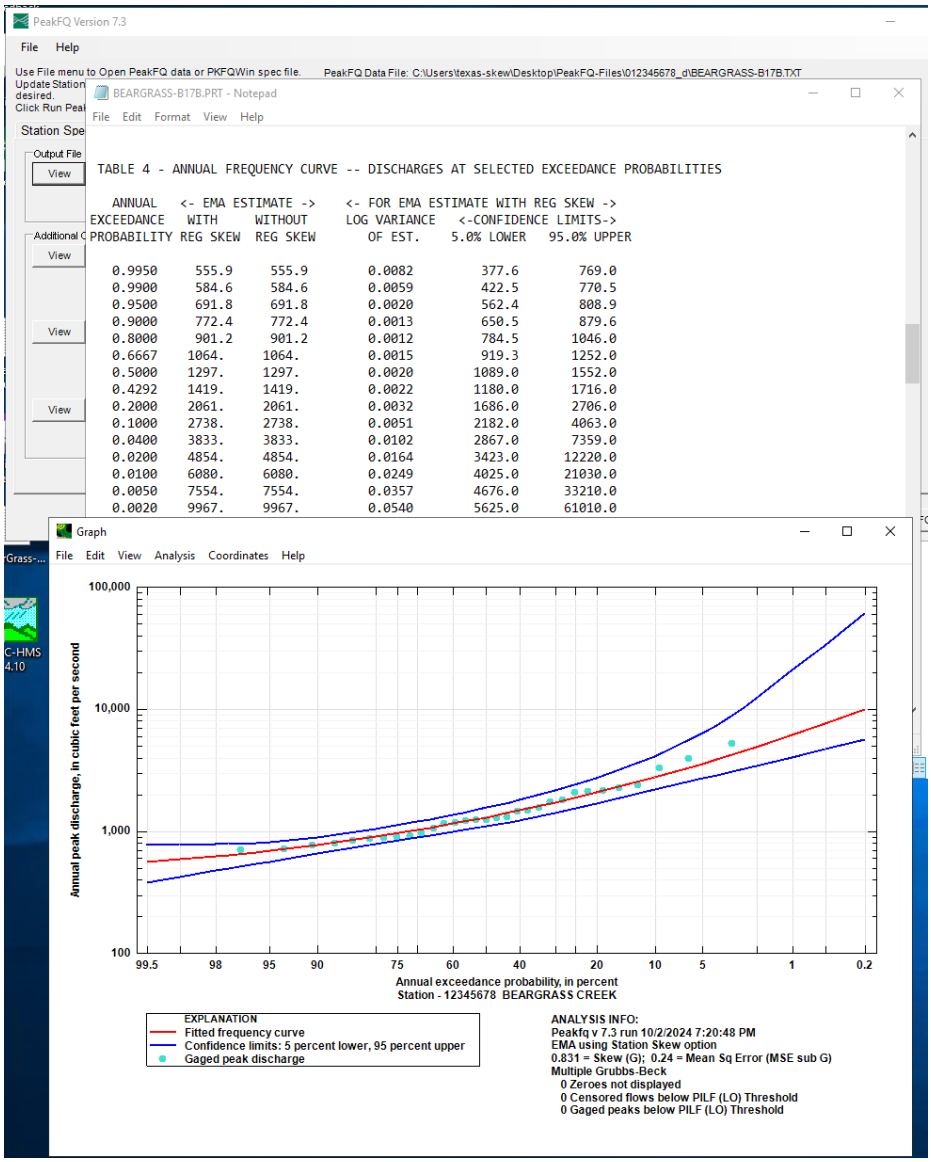


Figure 2: PeakFQ 7.3 results for Beargrass Creek Data Analysis

2. Locate USGS Station 08144800 Brady Creek near Eden, TX. and analyze the historical peaks using the Bulletin 17C procedures (using the PeakFQ software tool use station skew option). Determine the median discharge predicted for this station by PeakFQ. Also determine the discharge per square mile of contributing drainage area.

Solution

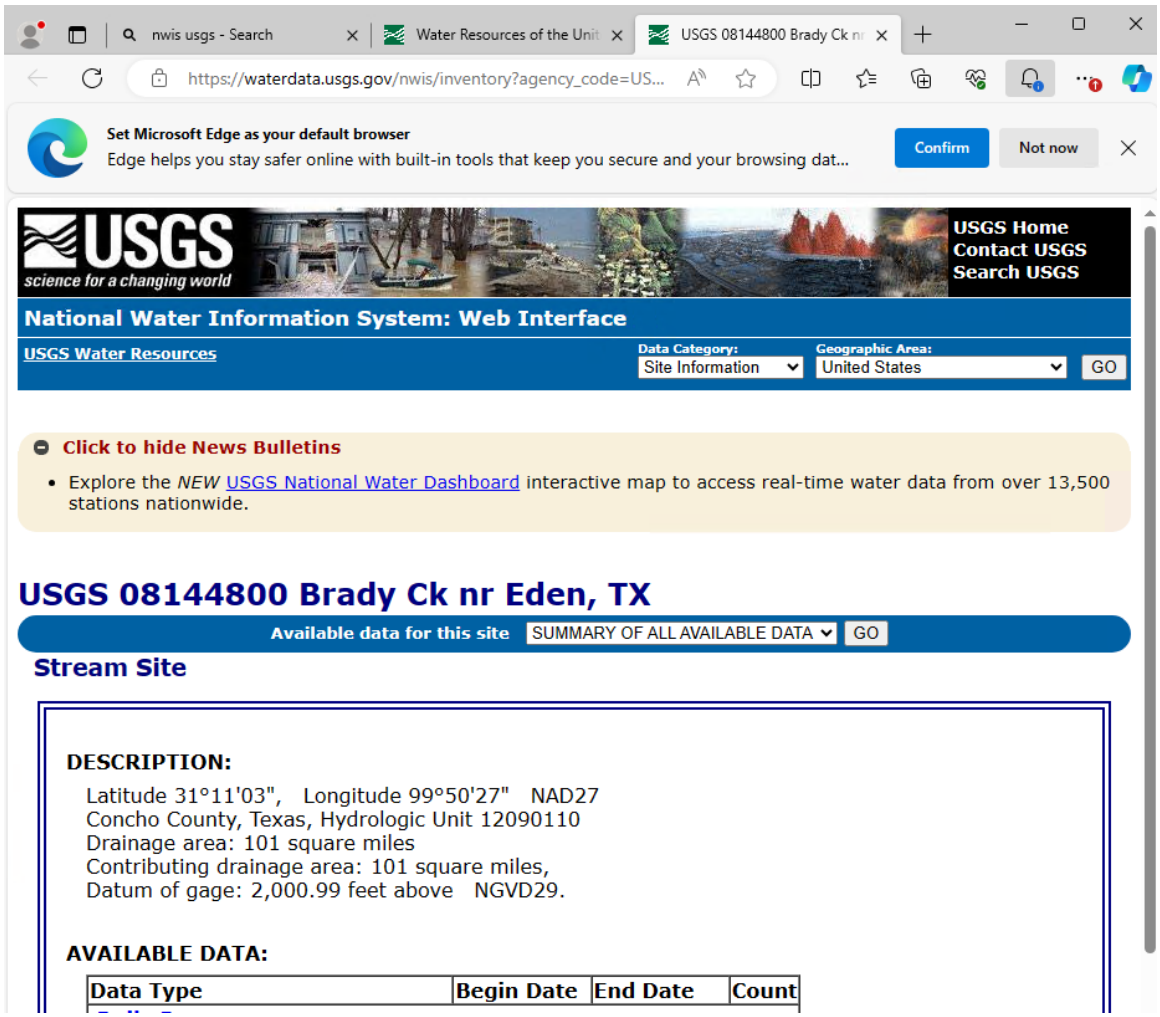


Figure 3: Find NWIS data for Brady Creek Data Analysis

The **Brady Creek STA_08144800.txt** file is shown below

```
Z08144800                          USGS
H08144800       31110309950270048480 95SW12090110101    101      2000.99
N08144800       Brady Ck nr Eden, TX
Y08144800
308144800       19611009    2786                3.18
308144800       19630505   3.006                1.45
308144800       19631001   0.006
308144800       19650518   57.06                2.24
308144800       19660428   51106                7.08
308144800       19670817   45606                6.72
308144800       19680310   11.06                1.78
308144800       19690911    9466                4.37
308144800       19700515   12.06                1.83
308144800       19710530   10206                4.04
308144800       19720615    3756                3.00
308144800       19730603    4106                3.07
308144800       19731012   33206                6.16
308144800       19750511    2446                3.07
308144800       19760711    4736                3.51
308144800       19770624   37206                6.45
308144800       19780528   38.06                1.84
308144800       19790809   10.06                1.51
308144800       19800909   13506                4.58
308144800       19810516   48.06                2.03
308144800       19820505    1776                2.71
308144800       19830606    1356                2.55
308144800       19840812    3336                3.14
308144800       19841231   60.06                2.08
```

Then run the program and extract results (either graphically, or using the output file Table 4)

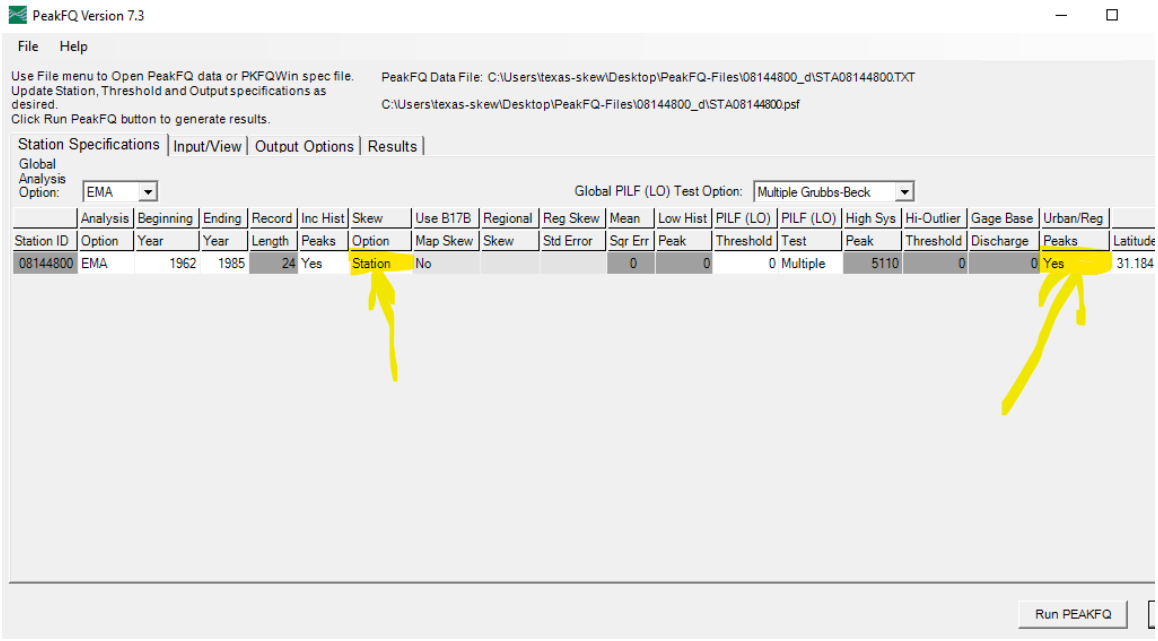


Figure 4: PeakFQ 7.3 setup for Brady Creek Data Analysis

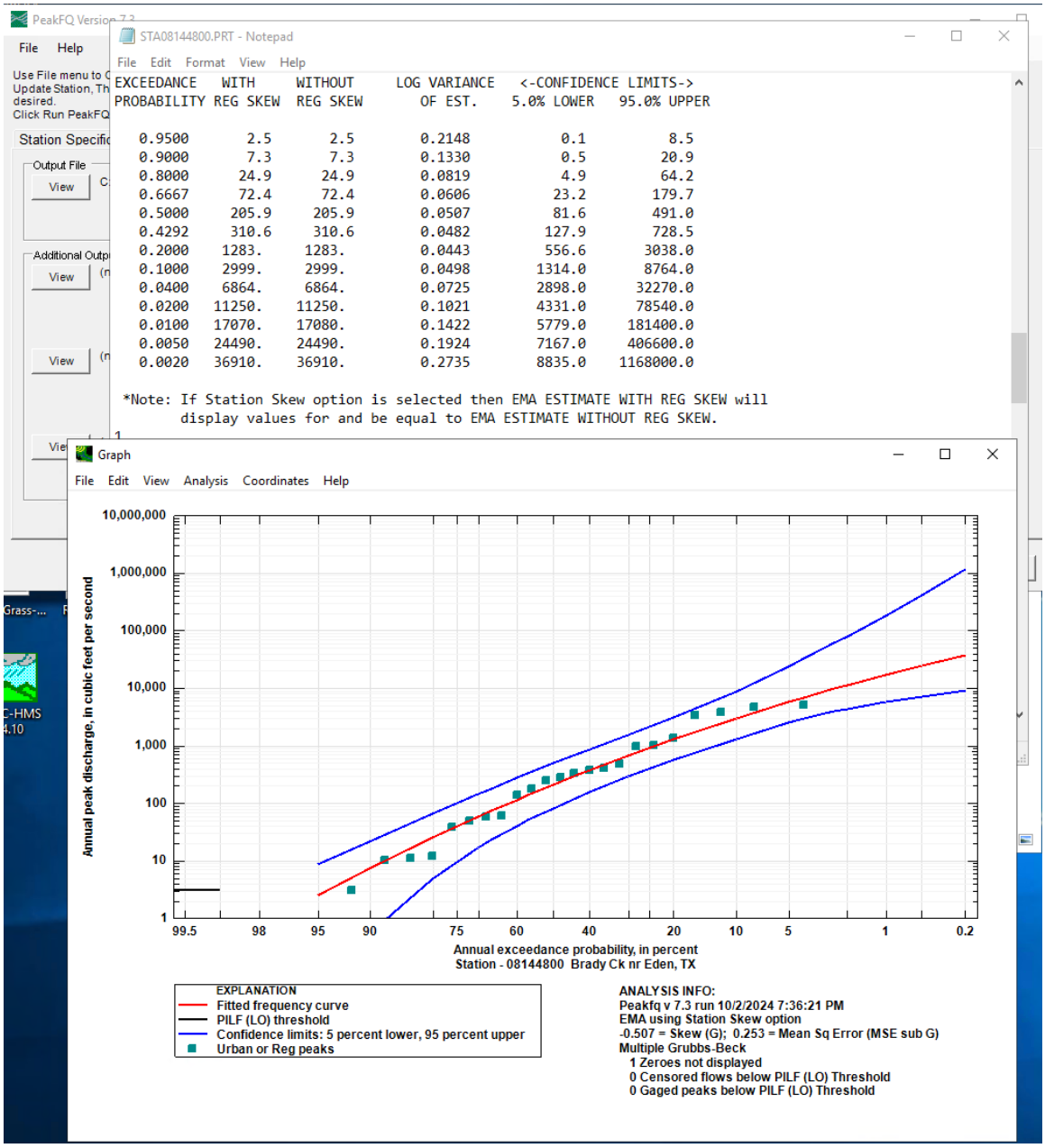


Figure 5: PeakFQ 7.3 results for Brady Creek Data Analysis

Median discharge is 205.9 CFS (Table 4 50% exceedance probability) Median Discharge per square mile is $\frac{205.9\ cfs}{101\ mi^2} = 2.04\ \frac{cfs}{mi^2}$, can also apply to other probabilities. This value is useful to check that the smallish drainage area for the study is producing resonable estimates.

3. Use the NOAA Precipitation Frequency Data Server to prepare Intensity-Duration-Frequency curves for Eden, Texas (Concho County). The desired ARI are 2-yr, 10-yr, 50-yr, and 100-yr (4 curves).

Solution

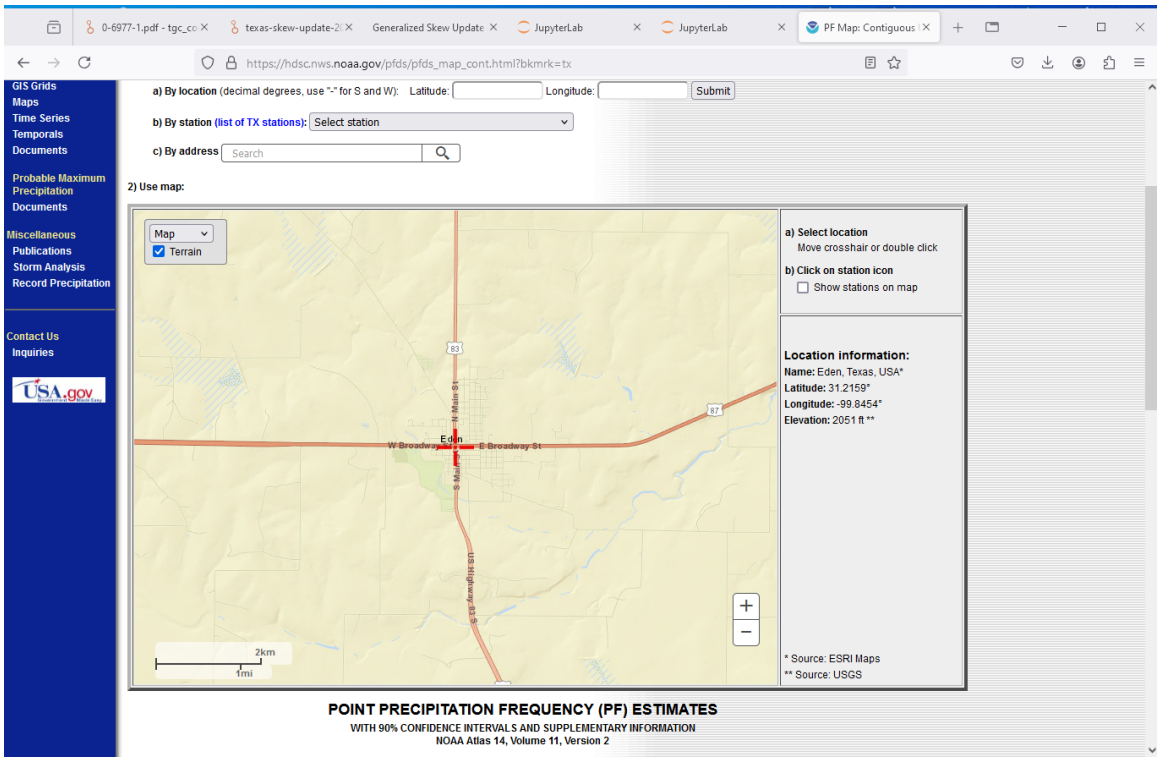
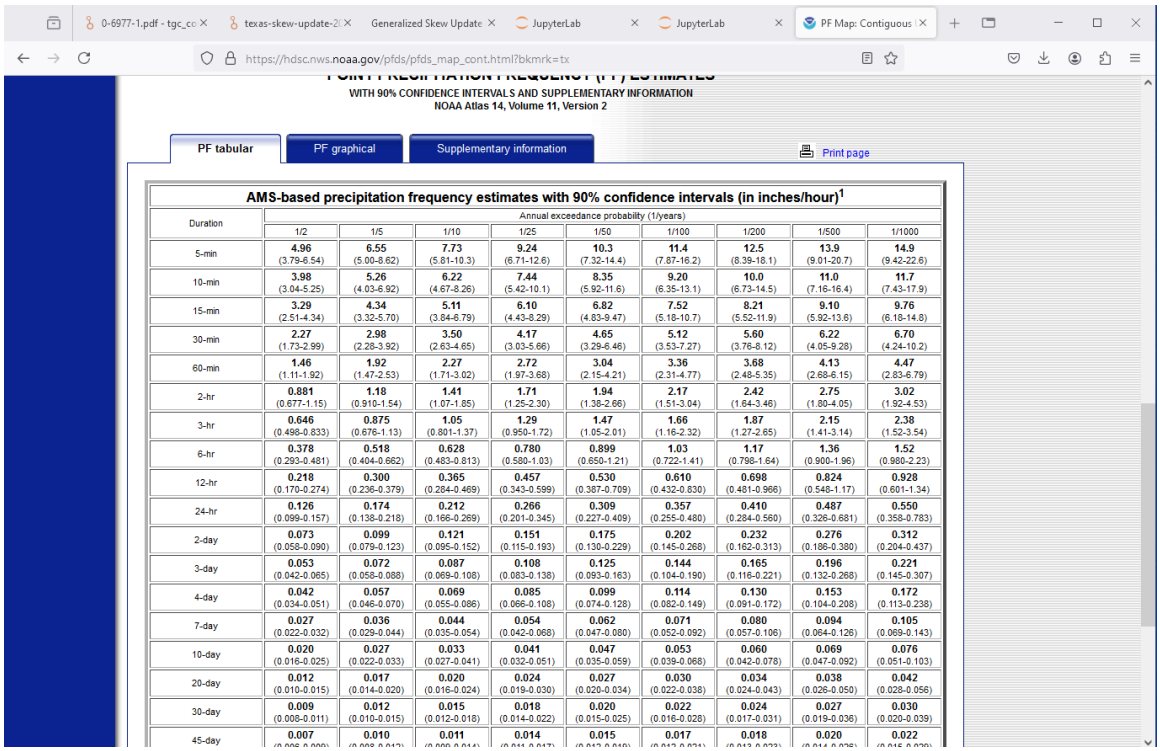


Figure 6: NOAA PFDS landing page for Eden, Tx.

In practice, use the tabular part to build own charts, as the online charts are not useable (except to check your homebrew work)



WITH 90% CONFIDENCE INTERVALS AND SUPPLEMENTARY INFORMATION
NOAA Atlas 14, Volume 11, Version 2

PF tabular | PF graphical | Supplementary information | Print page

AMS-based precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Annual exceedance probability (1/years)								
	1/2	1/5	1/10	1/25	1/50	1/100	1/200	1/500	1/1000
5-min	4.96 (3.79-6.54)	6.55 (5.00-8.62)	7.73 (5.81-10.3)	9.24 (6.71-12.6)	10.3 (7.32-14.4)	11.4 (7.87-16.2)	12.5 (8.39-18.1)	13.9 (9.01-20.7)	14.9 (9.42-22.6)
10-min	3.98 (3.04-5.25)	5.26 (4.03-6.92)	6.22 (4.67-8.26)	7.44 (5.42-10.1)	8.35 (5.92-11.6)	9.20 (6.35-13.1)	10.0 (6.73-14.5)	11.0 (7.16-16.4)	11.7 (7.43-17.9)
15-min	3.29 (2.51-4.34)	4.34 (3.32-5.70)	5.11 (3.84-6.79)	6.10 (4.43-8.29)	6.82 (4.83-9.47)	7.52 (5.18-10.7)	8.21 (5.52-11.9)	9.10 (5.92-13.6)	9.76 (6.18-14.8)
30-min	2.27 (1.73-2.99)	2.98 (2.28-3.92)	3.50 (2.63-4.65)	4.17 (3.03-5.66)	4.65 (3.29-6.46)	5.12 (3.53-7.27)	5.60 (3.76-8.12)	6.22 (4.05-9.28)	6.70 (4.24-10.2)
60-min	1.46 (1.11-1.92)	1.92 (1.47-2.53)	2.27 (1.71-3.02)	2.72 (1.97-3.68)	3.04 (2.15-4.21)	3.36 (2.31-4.77)	3.68 (2.48-5.35)	4.13 (2.68-6.15)	4.47 (2.83-6.79)
2-hr	0.881 (0.677-1.15)	1.18 (0.910-1.54)	1.41 (1.07-1.85)	1.71 (1.25-2.30)	1.94 (1.38-2.66)	2.17 (1.51-3.04)	2.42 (1.64-3.46)	2.75 (1.80-4.05)	3.02 (1.92-4.53)
3-hr	0.646 (0.498-0.833)	0.875 (0.676-1.13)	1.05 (0.801-1.37)	1.29 (0.950-1.72)	1.47 (1.05-2.01)	1.66 (1.16-2.32)	1.87 (1.27-2.65)	2.15 (1.41-3.14)	2.38 (1.52-3.54)
6-hr	0.378 (0.293-0.481)	0.518 (0.404-0.662)	0.628 (0.483-0.813)	0.780 (0.580-1.03)	0.899 (0.650-1.21)	1.03 (0.722-1.41)	1.17 (0.798-1.64)	1.36 (0.900-1.96)	1.52 (0.980-2.23)
12-hr	0.218 (0.170-0.274)	0.300 (0.236-0.379)	0.365 (0.284-0.469)	0.457 (0.343-0.599)	0.530 (0.387-0.709)	0.610 (0.432-0.830)	0.698 (0.481-0.966)	0.824 (0.548-1.17)	0.928 (0.601-1.34)
24-hr	0.126 (0.099-0.157)	0.174 (0.138-0.218)	0.212 (0.166-0.269)	0.266 (0.201-0.345)	0.309 (0.227-0.409)	0.357 (0.255-0.480)	0.410 (0.284-0.560)	0.487 (0.326-0.681)	0.550 (0.358-0.783)
2-day	0.073 (0.058-0.090)	0.099 (0.079-0.123)	0.121 (0.095-0.152)	0.151 (0.115-0.193)	0.175 (0.130-0.229)	0.202 (0.145-0.268)	0.232 (0.162-0.313)	0.276 (0.186-0.380)	0.312 (0.204-0.437)
3-day	0.053 (0.042-0.065)	0.072 (0.058-0.088)	0.087 (0.069-0.108)	0.108 (0.083-0.138)	0.125 (0.093-0.163)	0.144 (0.104-0.190)	0.165 (0.116-0.221)	0.196 (0.132-0.268)	0.221 (0.145-0.307)
4-day	0.042 (0.034-0.051)	0.057 (0.046-0.070)	0.069 (0.055-0.086)	0.085 (0.066-0.108)	0.099 (0.074-0.128)	0.114 (0.082-0.149)	0.130 (0.091-0.172)	0.153 (0.104-0.208)	0.172 (0.113-0.238)
7-day	0.027 (0.022-0.032)	0.036 (0.029-0.044)	0.044 (0.035-0.054)	0.054 (0.042-0.068)	0.062 (0.047-0.080)	0.071 (0.052-0.092)	0.080 (0.057-0.106)	0.094 (0.064-0.126)	0.105 (0.069-0.143)
10-day	0.020 (0.016-0.025)	0.027 (0.022-0.033)	0.033 (0.027-0.041)	0.041 (0.032-0.051)	0.047 (0.035-0.059)	0.053 (0.039-0.068)	0.060 (0.042-0.078)	0.069 (0.047-0.092)	0.076 (0.051-0.103)
20-day	0.012 (0.010-0.015)	0.017 (0.014-0.020)	0.020 (0.016-0.024)	0.024 (0.019-0.030)	0.027 (0.020-0.034)	0.030 (0.022-0.038)	0.034 (0.024-0.043)	0.038 (0.026-0.050)	0.042 (0.028-0.056)
30-day	0.009 (0.008-0.011)	0.012 (0.010-0.015)	0.015 (0.012-0.018)	0.018 (0.014-0.022)	0.020 (0.015-0.025)	0.022 (0.016-0.028)	0.024 (0.017-0.031)	0.027 (0.019-0.036)	0.030 (0.020-0.039)
45-day	0.007	0.010	0.011	0.014	0.015	0.017	0.018	0.020	0.022

Figure 7: NOAA PFDS Tabular Results for Eden, Tx.

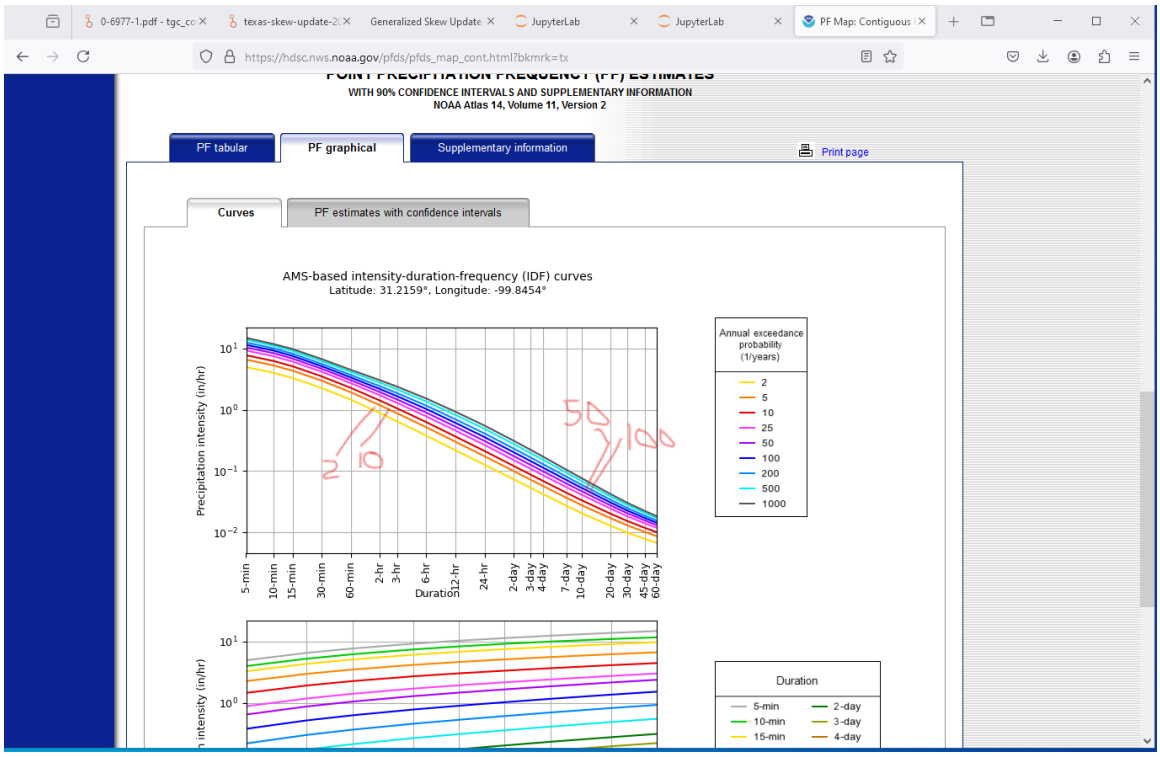


Figure 8: NOAA PFDS Charts for Eden, Tx.

4. Use the NOAA Precipitation Frequency Data Server and the SCS Rainfall Distributions to prepare a 50-yr, 24-hour hyetograph for Eden, Texas.

Solution

Find the 50-yr, 24-hr depth from PFDS, which is 7.44 inches. Then construct SDS distribution using ENGR-1330 methods

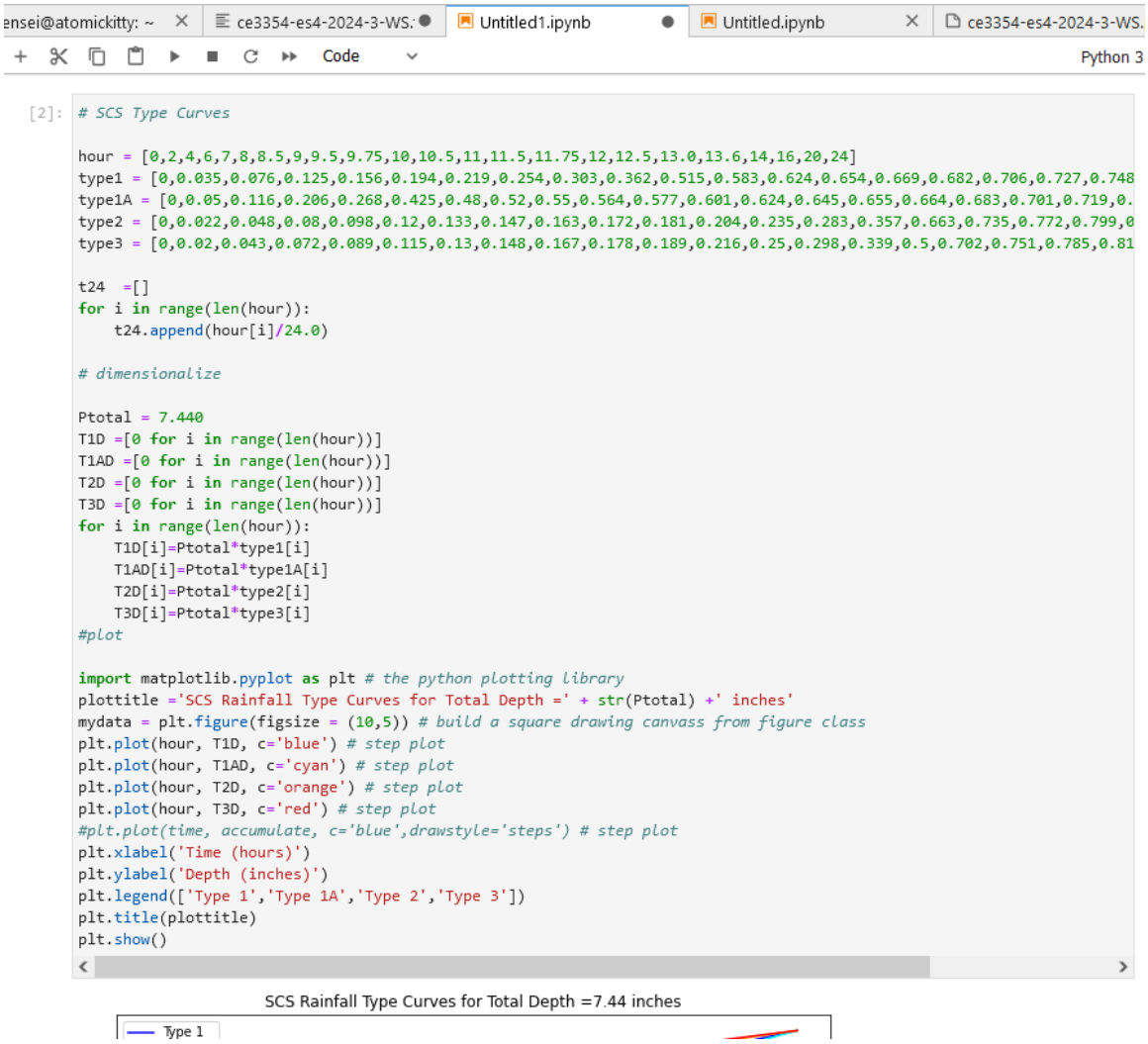
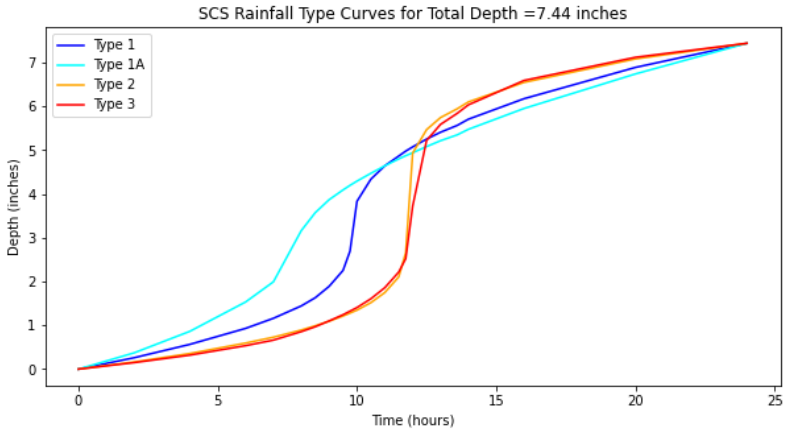


Figure 9: SCS generation script from class notes

```
#plt.plot(time, accumulate, c='blue',drawstyle='steps') # step plot
plt.xlabel('Time (hours)')
plt.ylabel('Depth (inches)')
plt.legend(['Type 1','Type 1A','Type 2','Type 3'])
plt.title(plottitle)
plt.show()
```



[ ]:

Figure 10: SCS Hyetographs

5. Use the NOAA Precipitation Frequency Data Server and the Texas Hyetograph Tool (TxHYETO-2015.xlsx) to prepare a 50-yr, 24-hour hyetograph for Eden, Texas.

Solution

Using the same total depth employ the `TXHYETO-2015.xls` tool:

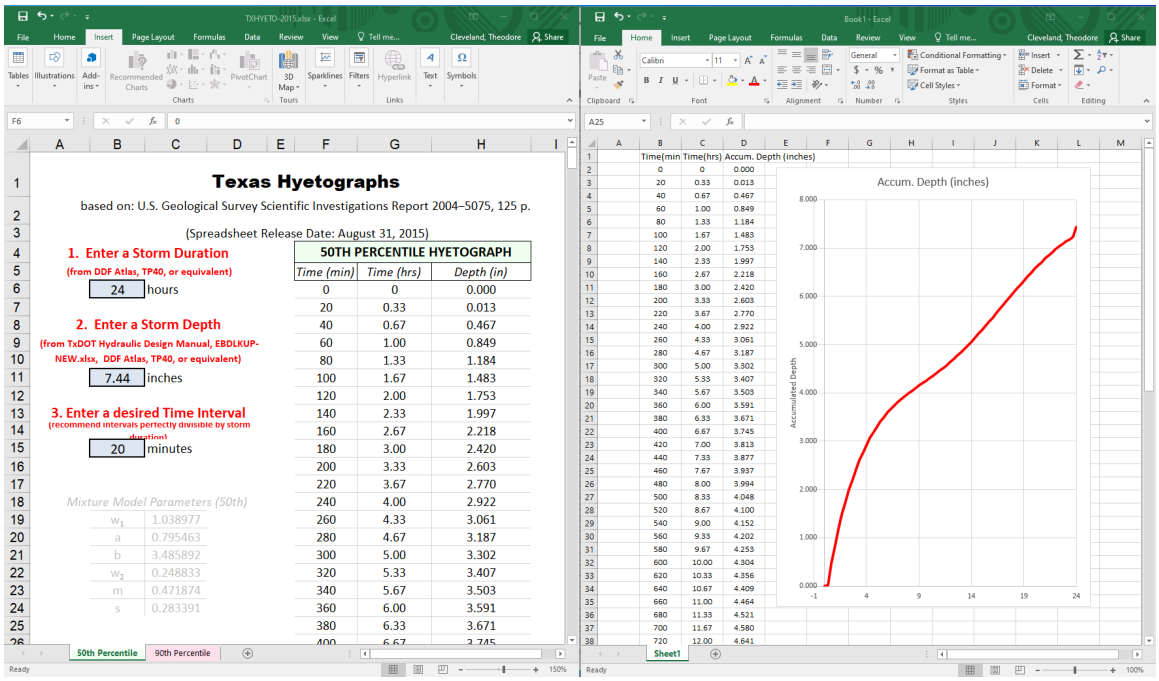


Figure 11: Texas 50% Hyetograph

Save these 50-yr, 24-hour hyetograph for Eden, Texas.; you will reuse them as inputs for the Hardin Branch project.

Beargrass-B17C in PeakFQ format (minor editing may still be needed)

```
* WCF2.DATA  1/9/89 -- BULLETIN 17 EXAMPLES
*---+----1----+----2----+----3----+----4----+----5----+----6----+----7----+----8

Z                              USGS

*               LAT   LON                        AREA          ELEV
* STATIONID     DDMMSSDDDMMSS                    12345671234567 12345678

H 12345678      3527470973329                    645.55        1202.01
N 12345678      OKLAHOMA FROM ES3
Y 12345678      20.0
2 12345678
3 12345678      19230101 200000
3 12345678      19240101 42000
3 12345678      19250101 11300
3 12345678      19260101 32400
3 12345678      19270101 108000
3 12345678      19280101 73000
3 12345678      19290101 76500
3 12345678      19300101 47800
3 12345678      19310101 28200
3 12345678      19320101 33700
3 12345678      19330101 25700
3 12345678      19340101 11700
3 12345678      19350101 77800
3 12345678      19360101 26600
3 12345678      19370101 47500
3 12345678      19380101 75600
3 12345678      19390101 19200
3 12345678      19400101 27800
3 12345678      19410101 51000
3 12345678      19420101 94000
3 12345678      19430101 97200
3 12345678      19440101 179000
3 12345678      19450101 124000
3 12345678      19460101 110000
3 12345678      19470101 114000
3 12345678      19480101 70200
3 12345678      19490101 70700
```

```
3 12345678       19500101 92800
3 12345678       19510101 135000
3 12345678       19520101 25800
3 12345678       19530101 17500
3 12345678       19540101 18700
3 12345678       19550101 36300
3 12345678       19560101 49200
3 12345678       19570101 120000
3 12345678       19580101 56800
3 12345678       19590101 54800
3 12345678       19600101 158000
3 12345678       19610101 165000
3 12345678       19620101 103000
3 12345678       19630101 19700
3 12345678       19640101 21100
3 12345678       19650101 171000
3 12345678       19660101 10400
3 12345678       19670101 42000
3 12345678       19680101 52800
3 12345678       19690101 77000
3 12345678       19700101 101000
3 12345678       19710101 17100
*
```

Station 08144800 in PeakFQ format (minor editing may still be needed)

```
Z08144800                       USGS
H08144800       31110309950270048480 95SW12090110101    101     2000.99
N08144800       Brady Ck nr Eden, TX
Y08144800
308144800       19611009    2786              3.18
308144800       19630505   3.006              1.45
308144800       19631001   0.006
308144800       19650518   57.06              2.24
308144800       19660428   51106              7.08
308144800       19670817   45606              6.72
308144800       19680310   11.06              1.78
308144800       19690911    9466              4.37
308144800       19700515   12.06              1.83
308144800       19710530   10206              4.04
308144800       19720615    3756              3.00
308144800       19730603    4106              3.07
308144800       19731012   33206              6.16
308144800       19750511    2446              3.07
308144800       19760711    4736              3.51
308144800       19770624   37206              6.45
308144800       19780528   38.06              1.84
308144800       19790809   10.06              1.51
308144800       19800909   13506              4.58
308144800       19810516   48.06              2.03
308144800       19820505    1776              2.71
308144800       19830606    1356              2.55
308144800       19840812    3336              3.14
308144800       19841231   60.06              2.08
```