Hydrology Analysis

Installation

Only necessary to run this cell once to set up local machine

```
install.packages('tidyverse', repos='http://cran.us.r-project.org')
```

```
##
## The downloaded binary packages are in
##  /var/folders/r_/4w9b5lnx7n542qjy74wfz0hr0000gn/T//Rtmp0CVwcq/downloaded_packages
```

Set up Environment

Loads the Tidyverse and imports necessary functions

```
library(tidyverse)
```

```
## Warning: replacing previous import 'lifecycle::last_warnings' by
## 'rlang::last_warnings' when loading 'tibble'

## Warning: replacing previous import 'lifecycle::last_warnings' by
## 'rlang::last_warnings' when loading 'pillar'

## -- Attaching packages --------------------------------------- tidyverse 1.3.1 --

## v ggplot2 3.3.3     v purrr   0.3.4
## v tibble  3.1.1     v dplyr   1.0.5
## v tidyr   1.1.3     v stringr 1.4.0
## v readr   2.1.2     v forcats 0.5.1

## Warning: package 'readr' was built under R version 4.0.5

## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```
source('./Rcode/utils.R')
```

```
##
## Attaching package: 'lubridate'

## The following objects are masked from 'package:base':
##
##     date, intersect, setdiff, union
```

Read Data

To run the programs on your desired file, set `inputFile` to the appropriate file path

```
inputFile <- './Data_Raw/MercedHI_Q_T_2022023.txt' # Set to appropriate file
data <- readUsgsData(inputFile)
```

```
## Rows: 38755 Columns: 2-- Column specification --------------------------------------------------------
## Delimiter: "\t"
## dbl  (1): X12
## date (1): X3
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

Generate and Analyze Output

There are two cells each R program: the first will generate output and store it in the `./Output/` folder, and the second gives space to produce visualizations of the output

surfwtr.R Generate output

```
source('./Rcode/surfwtr.R')
surfwtrOutput <- surfwtr(data)
head(surfwtrOutput)
```

```
## # A tibble: 6 x 5
##   waterYear   dur   mdq   cmt frsmq
##       <dbl> <int> <dbl> <dbl> <dbl>
## 1      1915    38  56.8  13.5 0
## 2      1916   366 460.  235.  0.860
## 3      1917   365 405.  235.  0.853
## 4      1918   365 334.  243.  0.897
## 5      1919   365 308.  205.  0.824
## 6      1920   366 255.  235.  0.896
```

```
# Space to visualize surfwtrOutput
```

snwpulse.R Generate output

```
source('./Rcode/snwpulse.R')
snwpulseOutput <- snwpulse(data)
head(snwpulseOutput)
```

```
## # A tibble: 6 x 4
##   waterYear   mdq snwpulse dypulse
##       <dbl> <dbl>    <dbl>   <dbl>
## 1      1916  691.  -42860.      97
## 2      1917  574.  -46141.     112
## 3      1918  483.  -37868.     106
## 4      1919  414.  -29451.     104
## 5      1920  377.  -29746.     116
## 6      1921  565.  -34475.     109
```

```
# Space to visualize snwpulseOutput
```

lwflow.R Generate output

```
source('./Rcode/lwflow.R')
lwflowOutputs <- lwflow(data) # Returns list of tables
lapply(lwflowOutputs, head)
```

```
## [[1]]
## # A tibble: 6 x 2
##   waterYear   amQ
##       <dbl> <dbl>
## 1      1915  56.8
## 2      1916 460.
## 3      1917 405.
## 4      1918 334.
## 5      1919 308.
## 6      1920 255.
##
## [[2]]
## # A tibble: 6 x 9
##   waterYear   m3w   m7w  m14w   m3s   m7s  m14s  m7dw  m7ds
##       <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>
## 1      1916   9    8.74  8.87  18   20.6  28.4     61   356
## 2      1917  26   27    28.2   27.7 31.6  36.4    105   364
## 3      1918  10.7 11.7  12.2   26   27.6  36.4    103   347
## 4      1919  34   34.9  35.3    7    7.29  7.96   126   361
## 5      1920  13.3 11.2  10.8   23.3 23.4  24.5     61   357
## 6      1921  67.3 69.3  70.6   13   14.4  16       69   364
##
## [[3]]
## # A tibble: 6 x 7
##       exp   m3w   m7w  m14w   m3s   m7s  m14s
##     <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>
## 1 0.00935  2.90  3     3.14  1.19  1.24  1.38
## 2 0.0187   4.13  4.40  4.86  1.57  1.90  2.58
## 3 0.0280   4.23  4.94  4.91  1.77  2.03  2.59
## 4 0.0374   4.88  5.10  5     2.33  2.63  2.98
## 5 0.0467   4.93  5.14  5.36  2.47  2.71  3.08
## 6 0.0561   5     5.33  5.50  2.60  2.72  3.22
##
## [[4]]
## # A tibble: 6 x 7
##     xxp   m3w   m7w  m14w   m3s   m7s  m14s
##   <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>
## 1  0.95 102.  115.  134.  62.3   71.2  83.0
## 2  0.9   71.4  74.6  80.4 44.5   51.9  65.1
## 3  0.8   52.9  54.9  57.4 25.3   26.7  30.7
## 4  0.7   42.2  41.7  40.1 17     19.5  22.4
## 5  0.6   30.7  32    34.6 12.3   13.1  15.1
## 6  0.5   21.2  21.5  21.4  9.43  10.3  12.2
```

```
# Space to visualize lwflowOutputs
```

hiflow.R Generate output

```
source('./Rcode/hiflow.R')
hiflowOutputs <- hiflow(data) # Returns list of tables
lapply(hiflowOutputs, head)
```

```
## [[1]]
## # A tibble: 6 x 7
##   waterYear     m3     m7    m10    m14   m3d  m14d
##       <dbl>  <dbl>  <dbl>  <dbl>  <dbl> <int> <int>
## 1      1915   25.7   23.9   23.9   30.6    36    31
## 2      1916 2247.  2180   2130   2088.    256   262
## 3      1917 2797.  2511.  2444   2446.    253   263
## 4      1918 2787.  2670   2586   2409.    256   261
## 5      1919 2660.  2440.  2361.  2133.    241   242
## 6      1920 2330   2039.  1817   1791.    234   243
##
## [[2]]
## # A tibble: 6 x 5
##     exp    m3    m7   m10   m14
##   <dbl> <dbl> <dbl> <dbl> <dbl>
## 1 0.991  25.7  23.9  23.9  30.6
## 2 0.981 501.  470.  466.  437.
## 3 0.972 835   697.  686.  644.
## 4 0.963 900.  788.  728.  726
## 5 0.954 917.  812.  760.  743.
## 6 0.944 947   821   763.  761.
##
## [[3]]
## # A tibble: 6 x 5
##     xxp    m3    m7   m10   m14
##   <dbl> <dbl> <dbl> <dbl> <dbl>
## 1  0.95  929.  816.  761.  750.
## 2  0.9  1084   969.  951.  866.
## 3  0.8  1418  1263. 1200. 1141.
## 4  0.7  1761. 1550. 1509. 1407.
## 5  0.6  1989. 1825. 1754  1669.
## 6  0.5  2247. 2084. 1897  1777.
```

```
# Space to visualize hiflowOutputs
```

fldur.R Generate output

```
source('./Rcode/fldur.R')
fldurOutput <- fldur(data)
head(fldurOutput)
```

```
## # A tibble: 6 x 3
```

```
## # Rowwise:
##     pbs   qfd  dqfd
##   <dbl> <dbl> <dbl>
## 1  0.01 6326. 17.9
## 2  0.03 4475. 12.7
## 3  0.05 4206. 11.9
## 4  0.1  3872. 11.0
## 5  0.5  3120   8.84
## 6  1    2720   7.71
```

```
# Space to visualize fldurOutput
```