Getting started with GLDAS data

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NASAaccess package has multiple functions such as `GLDASwat` and `GLDASpolyCentroid` that download, extract, and reformat air temperature data ('Tair_f_inst') of GLDAS from NASA servers for grids within a specified watershed shapefile. The `GLDASpolyCentroid` and `GLDASswat` find the minimum and maximum air temperatures for each day at each grid within the study watershed by searching for minima and maxima over the three hours air temperature data values available for each day and grid. The `GLDASwat` and `GLDASpolyCentroid` functions output gridded air temperature (maximum and minimum) data in degrees 'C'.

Let's explore `GLDASpolyCentroid` and `GLDASswat` functions.

Basic use

Let's use the example watersheds that we introduced with `GPMswat` and `GPMpolyCentroid`. Please visit *NASAaccess* GPM functions for more information.

```
library(NASAaccess)

GLDASwat(Dir = "./GLDASwat/",
                  watershed = shape_path,
                  DEM = dem_path,
                  start = "2020-08-1",
                  end = "2020-08-3")
```

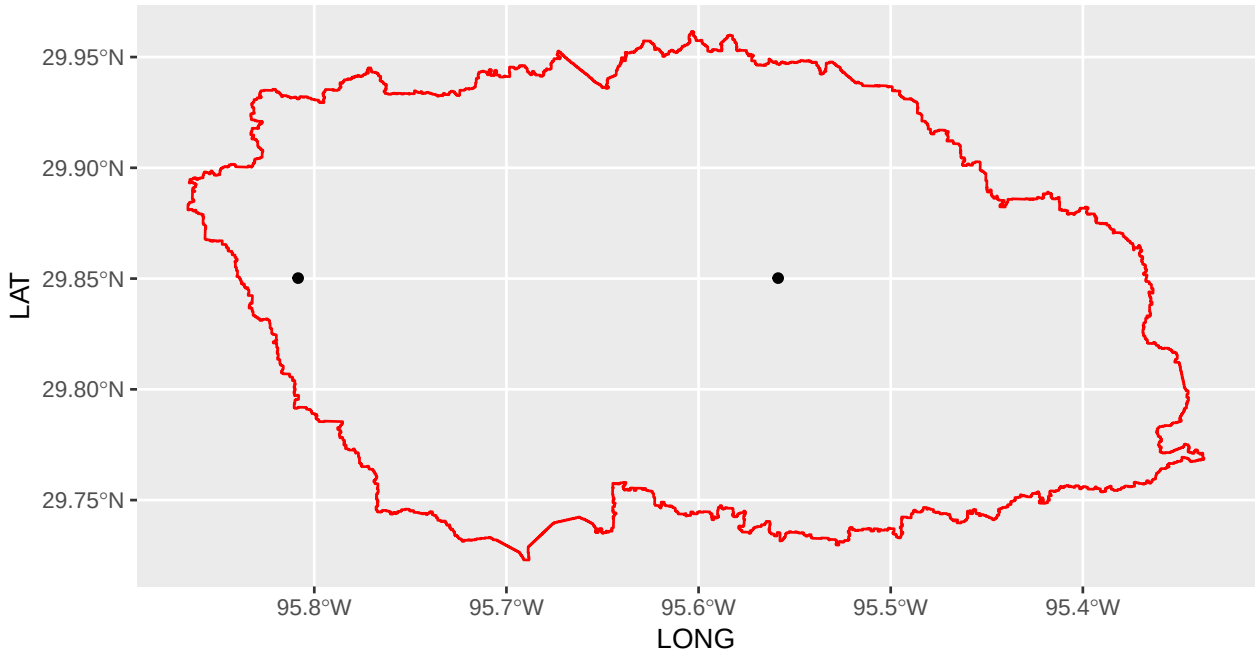
Let's examine the air temperature station file

```
GLDASwat.tempMaster <- system.file('extdata/GLDASwat',
                                          'temp_Master.txt',
                                          package = 'NASAaccess')

GLDASwat.table<-read.csv(GLDASwat.tempMaster)

head(GLDASwat.table)
#>       ID       NAME      LAT      LONG ELEVATION
#> 1 345937 temp345937 29.85021 -95.80842  46.64194
#> 2 345938 temp345938 29.85021 -95.55859  30.55108

dim(GLDASwat.table)
#> [1] 2 5
```

`GLDASwat` generated ascii table for each available grid located within the study watershed. `GLDASwat` also generated the air temperature stations file input shown above *GLDASwat.table* (table with columns: ID, File NAME, LAT, LONG, and ELEVATION) for those selected grids that fall within the specified watershed. The GLDAS dataset used here is the GLDAS Noah Land Surface Model L4 3 hourly 0.25 x 0.25 degree V2.1.

Now, let's see the location of the `GLDASwat` generated grid points

```
ggplot() +
  geom_sf(data = shape,
          fill = NA,
          colour = 'red') +
  geom_point(data=GLDASwat.table,aes(x=LONG,y=LAT))
```



We note here that `GLDASwat` has given us all the GLDAS data grids that fall within the boundaries of the White Oak Bayou study watershed.

The time series air temperature data stored in the data tables (i.e., 2 tables) can be viewed also. looking at air temperature reformatted data from the first grid point as listed in the air temperature station file is by

```
GLDASwat.point.data <- system.file('extdata/GLDASwat',
                                   'temp345937.txt',
                                   package = 'NASAaccess')
#Reading data records
read.csv(GLDASwat.point.data)
#>                   X20200801
#> 32.1672399902343  23.28843
#> 33.0642431640625  22.76880
#> 33.7442358398437  22.91977
```

The time series air temperature data has been written in a format that gives daily maximum and minimum air temperature in degrees 'C'.

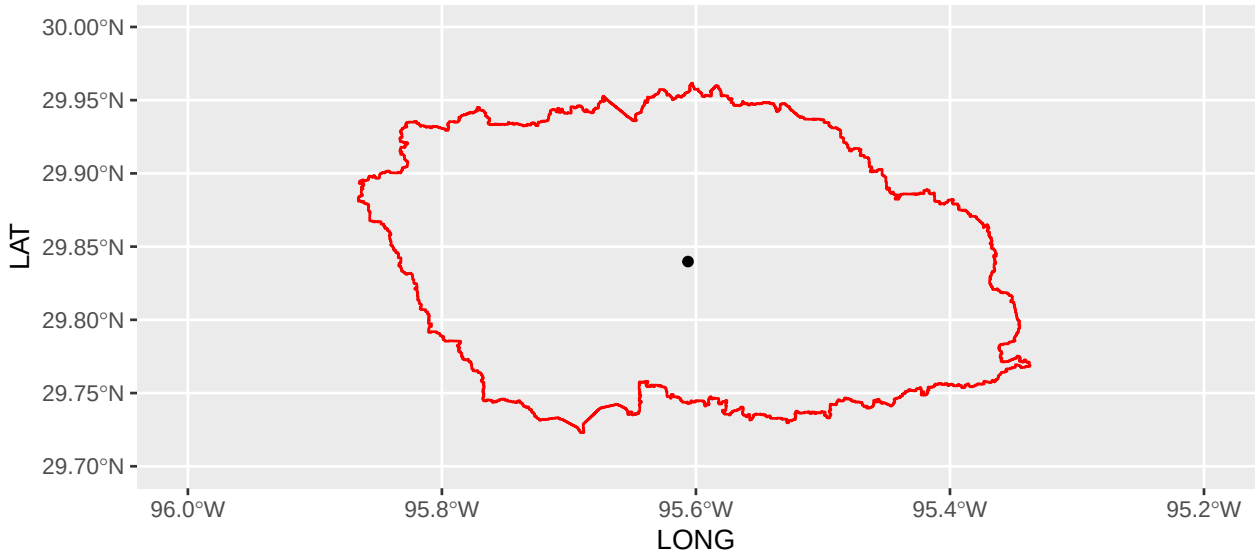
Now, let's examine `GPMpolyCentroid`.

Using the watershed example:

```
GLDASpolyCentroid(Dir = "./GLDASpolyCentroid/",
                  watershed = shape_path,
                  DEM = dem_path,
                  start = "2018-08-1",
                  end = "2018-08-3")
```

Now let's examine the `GLDASpolyCentroid` generated outputs

```
GLDASpolyCentroid.tempMaster <- system.file('extdata/GLDASpolyCentroid',
                                'temp_Master.txt',
                                  package = 'NASAaccess')

GLDASpolyCentroid.table<-read.csv(GLDASpolyCentroid.tempMaster)

#plot
ggplot() +
  geom_sf(data = shape,
          fill = NA,
          colour = 'red') +
  geom_point(data=GLDASpolyCentroid.table,
             aes(x=LONG,y=LAT)) +
  coord_sf(xlim=c(-96,-95.2),ylim=c(29.7,30))
```



We note here that `GLDASpolyCentroid` has given us the GLDAS data grid that fall within our specified watershed and assigns a pseudo air temperature gauge located at the centroid of the watershed a weighted-average daily maximum and minimum air temperature data.

Built with

```
sessionInfo()
#> R version 4.1.2 (2021-11-01)
#> Platform: x86_64-apple-darwin17.0 (64-bit)
#> Running under: macOS Big Sur 10.16
#>
#> Matrix products: default
#> BLAS:   /Library/Frameworks/R.framework/Versions/4.1/Resources/lib/libRblas.0.dylib
#> LAPACK: /Library/Frameworks/R.framework/Versions/4.1/Resources/lib/libRlapack.dylib
#>
#> locale:
#> [1] C/en_US.UTF-8/en_US.UTF-8/C/en_US.UTF-8/en_US.UTF-8
#>
#> attached base packages:
#> [1] stats     graphics  grDevices utils     datasets  methods   base
```

```
#>
#> other attached packages:
#> [1] ggplot2_3.3.6    sf_1.0-7         raster_3.5-15    sp_1.5-0
#> [5] NASAaccess_3.2.0
#>
#> loaded via a namespace (and not attached):
#>  [1] httr_1.4.3          pkgload_1.2.4       tidyr_1.2.0
#>  [4] brio_1.1.3          highr_0.9           yaml_2.3.5
#>  [7] pillar_1.7.0        lattice_0.20-45     glue_1.6.2
#> [10] digest_0.6.29       colorspace_2.0-3    htmltools_0.5.2
#> [13] plyr_1.8.7          XML_3.99-0.10       pkgconfig_2.0.3
#> [16] s2_1.0.7            purrr_0.3.4         scales_1.2.0
#> [19] terra_1.5-21        jpeg_0.1-9          ggmap_3.0.0
#> [22] tibble_3.1.7        proxy_0.4-27        farver_2.1.0
#> [25] generics_0.1.2      ellipsis_0.3.2      withr_2.5.0
#> [28] cli_3.3.0           magrittr_2.0.3      crayon_1.5.1
#> [31] maptools_1.1-4      evaluate_0.15       ncdf4_1.19
#> [34] fansi_1.0.3         xml2_1.3.3          foreign_0.8-81
#> [37] class_7.3-19        tools_4.1.2         shapefiles_0.7
#> [40] RgoogleMaps_1.4.5.3 lifecycle_1.0.1     stringr_1.4.0
#> [43] munsell_0.5.0       compiler_4.1.2      e1071_1.7-11
#> [46] tinytex_0.40        rlang_1.0.2         classInt_0.4-7
#> [49] units_0.8-0         grid_4.1.2          rstudioapi_0.13
#> [52] rjson_0.2.21        bitops_1.0-7        rmarkdown_2.14
#> [55] testthat_3.1.4      wk_0.6.0            gtable_0.3.0
#> [58] codetools_0.2-18    DBI_1.1.3           roxygen2_7.2.0
#> [61] R6_2.5.1            knitr_1.39          dplyr_1.0.9
#> [64] rgdal_1.5-30        fastmap_1.1.0       rgeos_0.5-9
#> [67] utf8_1.2.2          rprojroot_2.0.3     KernSmooth_2.23-20
#> [70] desc_1.4.1          stringi_1.7.6       Rcpp_1.0.8.3
#> [73] vctrs_0.4.1         png_0.1-7           tidyselect_1.1.2
#> [76] xfun_0.31
```