

Introduction to the dataRetrieval package

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1 Introduction to dataRetrieval

The dataRetrieval package was created to simplify the process of getting hydrologic data in the R environment. It has been specifically designed to work seamlessly with the EGRET package: Exploration and Graphics for RivEr Trends (EGRET)

1.1 What is dataRetrieval?

The dataRetrieval package was created to simplify hydrologic data retrieval. The options are web or user-produced files.....

1.2 What is EGRET?

Exploration and Graphics for RivEr Trends (EGRET): An R-package for the analysis of long-term changes in water quality and streamflow, including the water-quality method Weighted Regressions on Time, Discharge, and Season (WRTDS)...

2 Getting Started

This section describes the options for downloading and installing the dataRetrieval package.

2.1 Installing dataRetrieval from gitHub:

One can easily install the latest version of dataRetrieval directly from gitHub using the devtools package. devtools is available on CRAN. Simply type the following commands into R to install the latest version of dataRetrieval available on github.

```
> library(devtools)
> install_github("dataRetrieval", "USGS-CIDA")
```

To then open the library, simply type:

```
> library(dataRetrieval)
```

2.2 Installing dataRetrieval from downloaded binary:

Alternatively, the dataRetrieval package is available for download at <https://github.com/USGS-CIDA/WRTDS/downloads>. If the package's tar.gz file is saved in R's working directory, then the following commands will fully install the package:

```
> install.packages("dataRetrieval_1.2.0.tar.gz",
+                  repos=NULL, type="source")
```

If the downloaded file is stored in an alternative location, include the path in the install command. A Windows example looks like this (notice the direction of the slashes, they are in the opposite direction that Windows normally creates paths):

```
> install.packages(
+   "C:/RPackages/Statistics/dataRetrieval_1.2.0.tar.gz",
+   repos=NULL, type="source")
```

A Mac example looks like this:

```
> install.packages(
+   "/Users/userA/RPackages/Statistic/dataRetrieval_1.2.0.tar.gz",
+   repos=NULL, type="source")
```

Some users have found it necessary to delete the package folders before installing newer versions of either dataRetrieval or EGRET. If you are experiencing an issue after updating a package, trying deleting the package folder, the default location for Windows is something like this: C:/Users/ldecicco/Documents/R/win-library/2.15/dataRetrieval the default for a Mac: /Users/ldecicco/Library/R/2.15/library/dataRetrieval Then, re-install the package using the directions above. Moving to CRAN should solve this problem.

2.3 A Simple Web Retrieval Example

In this example, we use 3 dataRetrieval functions to get daily streamflow data and inorganic nitrogen sample results, and site information for a USGS gaging station with the ID 06934500. The station is Missouri River at Hermann, MO (which is discovered in the INFO dataset).

```
> Daily <- getDVDData("06934500", "00060", "1970-10-01", "2011-09-30")
```

There are 14975 data points, and 14975 days.

There are 0 zero flow days

If there are any zero discharge days, all days had 0 cubic meters per second added to the c

```
> head(Daily)
```

	Date	Q	Julian	Month	Day	DecYear	MonthSeq	Qualifier	i	LogQ
1	1970-10-01	3879.408	44102	10	274	1970.747	1450	A 1	8.263438	
2	1970-10-02	3454.655	44103	10	275	1970.750	1450	A 2	8.147478	
3	1970-10-03	3029.903	44104	10	276	1970.753	1450	A 3	8.016286	
4	1970-10-04	2644.793	44105	10	277	1970.755	1450	A 4	7.880348	
5	1970-10-05	2293.665	44106	10	278	1970.758	1450	A 5	7.737906	
6	1970-10-06	2072.793	44107	10	279	1970.761	1450	A 6	7.636652	

Q7 Q30

1	NA	NA
2	NA	NA
3	NA	NA
4	NA	NA
5	NA	NA
6	NA	NA

```
> Sample <- getSampleData("06934500", "00631", "1970-10-01", "2011-09-30")
> head(Sample)
```

	Date	ConcLow	ConcHigh	Uncen	ConcAve	Julian	Month	Day	DecYear	MonthSeq
1	1979-09-26	1.10	1.10	1	1.10	47384	9	269	1979.734	1557

2	1979-10-16	0.42	0.42	1	0.42	47404	10	289	1979.788	1558
3	1979-11-27	2.00	2.00	1	2.00	47446	11	331	1979.903	1559
4	1979-12-18	1.70	1.70	1	1.70	47467	12	352	1979.960	1560
5	1980-01-29	1.30	1.30	1	1.30	47509	1	29	1980.078	1561
6	1980-02-21	1.10	1.10	1	1.10	47532	2	52	1980.141	1562

	SinDY	CosDY
1	-0.9946999	-0.1028210
2	-0.9712570	0.2380333
3	-0.5724040	0.8199718
4	-0.2463613	0.9691781
5	0.4699767	0.8826788
6	0.7733507	0.6339785

```
> INFO <-getMetaData("06934500","00631", interactive=FALSE)
> colnames(INFO)
```

[1] "agency.cd"	"site.no"	"station.nm"
[4] "site.tp.cd"	"lat.va"	"long.va"
[7] "dec.lat.va"	"dec.long.va"	"coord.meth.cd"
[10] "coord.acy.cd"	"coord.datum.cd"	"dec.coord.datum.cd"
[13] "district.cd"	"state.cd"	"county.cd"
[16] "country.cd"	"map.nm"	"map.scale.fc"
[19] "alt.va"	"alt.meth.cd"	"alt.acy.va"
[22] "alt.datum.cd"	"huc.cd"	"basin.cd"
[25] "topo.cd"	"construction.dt"	"inventory.dt"
[28] "drain.area.va"	"contrib.drain.area.va"	"tz.cd"
[31] "local.time.fg"	"reliability.cd"	"project.no"
[34] "queryTime"	"drainSqKm"	"staAbbrev"
[37] "param.nm"	"param.units"	"paramShortName"
[40] "paramNumber"	"constitAbbrev"	

```
> INFO$station.nm
```

```
[1] "Missouri River at Hermann, MO"
```

```
> Sample <- mergeReport()
```

Discharge Record is 14975 days long, which is 41 years
 First day of the discharge record is 1970-10-01 and last day is 2011-09-30
 The water quality record has 437 samples
 The first sample is from 1979-09-26 and the last sample is from 2011-09-29
 Discharge: Minimum, mean and maximum 394 2660 20900
 Concentration: Minimum, mean and maximum 0.02 1.3 4.2
 Percentage of the sample values that are censored is 1.4 %

In the next section, we will go into detail the available functions in `dataRetrieval`, their required input and generated output.

3 Function Details

3.1 Daily Value Retrievals

3.2 Water Quality Retrievals

3.3 Site Information Retrievals

References

- [1] Helsel, D.R. and R. M. Hirsch, 2002. Statistical Methods in Water Resources Techniques of Water Resources Investigations, Book 4, chapter A3. U.S. Geological Survey. 522 pages. <http://pubs.usgs.gov/twri/twri4a3/>
- [2] Hirsch, R. M., Moyer, D. L. and Archfield, S. A. (2010), Weighted Regressions on Time, Discharge, and Season (WRTDS), with an Application to Chesapeake Bay River Inputs. JAWRA Journal of the American Water Resources Association, 46: 857-880. doi: 10.1111/j.1752-1688.2010.00482.x <http://onlinelibrary.wiley.com/doi/10.1111/j.1752-1688.2010.00482.x/full>
- [3] Sprague, L. A., Hirsch, R. M., and Aulenbach, B. T. (2011), Nitrate in the Mississippi River and Its Tributaries, 1980 to 2008: Are We Making Progress? Environmental Science & Technology, 45 (17): 7209-7216. doi: 10.1021/es201221s <http://pubs.acs.org/doi/abs/10.1021/es201221s>