dbhydroR: An R package to access the DBHYDRO Environmental Database

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1 Introduction

This document introduces the `dbhydroR` package and its associated functions. These functions are aimed at improving programmatic workflows that query the DBHYDRO Environmental Database. HTTP requests are faciliated by the httr (Wickham 2015) and RCurl (Lang 2015) packages.

2 Package installation

The `R` package `dbhydroR` is distributed via a `.tar.gz` (analagous to `.zip`) package archive file. This package contains the source code for package functions. In RStudio, it can be installed by navigating to `Tools -> Install Packages... -> Install from: -> Package Archive File`. Computers running the Windows operating system can only install binary `.zip` package archive files unless they have additional compiler software installed. The `dbhydroR` binary package can be installed by running the following commands from the `R` console:

```
install.packages(c("httr","RCurl","reshape2","XML"))
install.packages(paste("\\\\ad.sfwmd.gov\\DFSRoot\\data\\restoration_sciences",
"\\projects\\joe_stachelek\\R\\dbhydroR_0.1-3.zip",sep="")
,type="win.binary",repos=NULL)
```

Once installed, the package can be loaded using the following command:

```
> library(dbhydroR)
```

3 Composing database queries

3.1 Water quality data

The workhorse `dbhydroR` functions are `getwq` and `gethydro`. The `getwq` function takes four required arguments. The user must specify a station ID, a test name, and a date range. Station IDs can be located on the SFWMD Google Earth portal. A list of available test names can be found in the Appendix to this document. Dates must be specified in YYYY-MM-DD format (e.g. 2015-02-26). The following set of examples retrieve measurements between March 2011 and May 2012. They can be run from the R console by issuing the command:

```
> example(getwq)
```

- One variable at one station

```
> getwq(station_id="FLAB08", date_min="2011-03-01",
+             date_max="2012-05-01",test_name="CHLOROPHYLLA-SALINE")
```

- One variable at multiple stations

```
> getwq(station_id=c("FLAB08","FLAB09"), date_min="2011-03-01",
+             date_max="2012-05-01",test_name="CHLOROPHYLLA-SALINE")
```

- One variable at a wildcard station

```
> getwq(station_id=c("FLAB0%"), date_min="2011-03-01",
+             date_max="2012-05-01",test_name="CHLOROPHYLLA-SALINE")
```

- Multiple variables at multiple stations

```
> getwq(station_id=c("FLAB08","FLAB09"), date_min="2011-03-01",
+             date_max="2012-05-01",test_name=c("CHLOROPHYLLA-SALINE",
+                                               "SALINITY"))
```

By default, `getwq` returns a "cleaned output". First, the cleaning function `cleanwq` converts the raw output from native DBHYDRO "long" format (each piece of data on its own row) to "wide" format (each site x variable combination in its own column) using the reshape2 package (Wickham 2007). Next, the QA blanks/flags and DBHydro database identifiers are stripped. Setting the `raw` flag to `TRUE` will force `getwq` to retain this information. An example query that retains this information is shown below.

```
> getwq(station_id="FLAB08", date_min="2011-03-01",
+             date_max="2011-05-01",test_name="CHLOROPHYLLA-SALINE",
+             raw=TRUE)
```

3.2 Hydrologic data

Hydrologic time series data can be retrieved using the `gethydro` function either by specifying a set of known `dbkeys` or by retrieving `dbkeys` on-the-fly with entries in the Station ID (stationid), data category (category), and parameter (param) fields.

Complex stationid/category/parameter combinations can easily cause errors or return unexpected results. If dbkeys are not known ahead of time (or manually retrieved from the DBHYDRO Browser, it is good practice to plug in your stationid/category/parameter combination to the `getdbkey` function to ensure that the listing looks reasonable. The following set of examples can be run from the R console by issuing the command:

```
> example(getdbkey)
```

- Complete specification of the Station ID, Category, and Parameter flags

```
> getdbkey(stationid="JBTS",category="WEATHER",param="WNDS")
```

- Wildcard Station ID with no parameter specification

```
> getdbkey(stationid="C111%",category="SW")
> getdbkey(stationid="C111%",category="GW")
> getdbkey(stationid="C111%",category="WQ")
```

- Returning only dbkeys with the blind flag

```
> getdbkey(stationid="JBTS",category="WEATHER",param="WNDS", blind=TRUE)
```

In addition to a dbkey, users must specify a date range. Dates must be entered in YYYY-MM-DD format (e.g. 2015-02-26). The following set of examples retrieve wind speed measurements between January and February 2013. They can be run from the R console by issuing the command:

```
> example(gethydro)
```

- One variable/station time series

```
> gethydro(dbkey="15081",
+          date_min="2013-01-01",date_max="2013-02-02")
```

- Multiple variable/station time series

```
> gethydro(dbkey=c("15081","15069"),
+          date_min="2013-01-01",date_max="2013-02-02")
```

- Retreiving unknown `dbkeys` on-the-fly

```
> gethydro(stationid="JBTS",category="WEATHER",
+          param="WNDS",date_min="2013-01-01",date_max="2013-02-02")
```

4 Appendix

4.1 Test names

There are many test names available in DBHYDRO. These are detailed in the following table.

Code
AMMONIA-N
CARBON, TOTAL ORGANIC
CHLOROPHYLL-A(LC)
CHLOROPHYLL-B(LC)
CHLOROPHYLLA-SALINE
DISSOLVED OXYGEN
KJELDAHL NITROGEN,TOTAL
NITRATE+NITRITE-N
NITRITE-N
PHEOPHYTIN-A(LC)
PHOSPHATE,ORTHO AS P
PHOSPHATE,TOTAL AS P
SALINITY
SILICA
SP CONDUCTIVITY, FIELD
TEMP
TOTAL NITROGEN
TURBIDITY

4.2 Further reading

See section on URL-based data access in the DBHYDRO Browser User's Guide

References

Duncan Temple Lang. *RCurl: General network (HTTP/FTP/...) client interface for R*, 2015. URL http://CRAN.R-project.org/package=RCurl. R package version

1.95-4.6.

Hadley Wickham. Reshaping data with the reshape package. *Journal of Statistical Software*, 21(12):1–20, 2007. URL http://www.jstatsoft.org/v21/i12/.

Hadley Wickham. *httr: Tools for Working with URLs and HTTP*, 2015. URL http://CRAN.R-project.org/package=httr. R package version 0.6.1.