RSKtools for Matlab access to RBR data (v1.4)

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December 2, 2015

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1 Introduction

RBR instruments output data in an open database format known as SQLite[1]. To facilitate direct access to the data in Matlab[TM], we created the `RSKtools` toolbox. `RSKtools` facilitates direct access to the data stored in `RSK` files by using the included `mksqlite` library, for which we have provided versions compiled for Windows (32/64bit), Linux (64bit) and Mac OSX (64bit). It may be necessary to compile your own version, using the source code provided at `http://sourceforge.net/projects/mksqlite/`.

`RSKtools` also provides some convenience functions for common data extraction (e.g. extracting profiles from a continuous dataset) and visualization (plotting individual profiles). For plans for future additions, see the Future plans section.

2 Installing

The latest stable version of `RSKtools` can be found at `http://www.rbr-global.com/support/matlab-tools`.

- Unzip the archive (to `~/matlab/RSKtools`, for instance)
- Add the folder to your path inside matlab (`addpath ~/matlab/RSKtools` or some nifty GUI thing)
- type `help RSKtools` to get an overview and take a look at the examples.

[1] `http://www.sqlite.org/famous.html`

3 Examples of use

3.1 Loading files

To work with an RSK file using `RSKtools`, a connection to the database must be made. This is done using the `RSKopen()` function. Note that `RSKopen` doesn't actually read the data, but reads a *thumbnail* of the data which is typically about 4000 points long. The structure returned after opening an RSK looks something like:

```
file = '../testfiles/065583_20140612_0739.rsk';
rsk = RSKopen(file)
```

```
                          < M A T L A B (R) >
                Copyright 1984-2015 The MathWorks, Inc.
                 R2015a (8.5.0.197613) 64-bit (maci64)
                           February 12, 2015


To get started, type one of these: helpwin, helpdesk, or demo.
For product information, visit www.mathworks.com.

>> >> mksqlite Version 1.12 build:34, an interface from MATLAB to SQLite
(c) 2008-2011 by Martin Kortmann <mail@kortmann.de>
based on SQLite Version 3.7.11 - http://www.sqlite.org
UTF-8 extension: A.Martin, 2012-02-10, Volkswagen AG


rsk =

               dbInfo: [1x1 struct]
             datasets: [1x1 struct]
    datasetDeployments: [1x1 struct]
          calibrations: [5x1 struct]
           instruments: [1x1 struct]
    instrumentChannels: [5x1 struct]
     instrumentSensors: []
              channels: [3x1 struct]
                epochs: [1x1 struct]
             schedules: [1x1 struct]
           appSettings: [1x1 struct]
           deployments: [1x1 struct]
         thumbnailData: [1x1 struct]
              profiles: [1x1 struct]
```

Note the structure element called `thumbnailData`. In order to read the actual data, we use the `RSKreaddata()` function, which if given with one argument (the variable name of the RSK object) will read the entire data set. Because RSK files can store a large amount of data, it may be preferable to read a subset of the data, specified using a start and end time (in Matlab `datenum`

format[2]).

```
t1 = rsk.thumbnailData.tstamp(1) + 0.5; % half a day after start
t2 = rsk.thumbnailData.tstamp(1) + 1.5; % 1.5 days after start
rsk = RSKreaddata(rsk, t1, t2);
```

Note that the data structure can be found in the object at

```
>> rsk.data
ans =
      tstamp: [442293x1 double]
      values: [442293x4 double]
    longName: {'Conductivity'  'Temperature'  'Pressure'  'Salinity'}
       units: {'mS/cm'  '?C'  'dbar'  'PSU'}
```

In this example, because the instrument was determined to be a "CTD"-type instrument, a new channel was created called `Salinity` (using the Practical Salinity Scale). The salinity calculation is performed by the TEOS-10 package, which can be obtained from `http://teos-10.org/software.htm`.

3.2 Working with profiles

Profiling loggers with recent versions of firmware contain the ability to automatically detect and log profile "events". These are denoted as "downcasts" and "upcasts", and the function `RSKreadprofiles()` can be used to extract individual profiles from the raw data, based on the previously identified events. Following this, quick plots of the profiles can be made using the `RSKplotprofiles()` function.

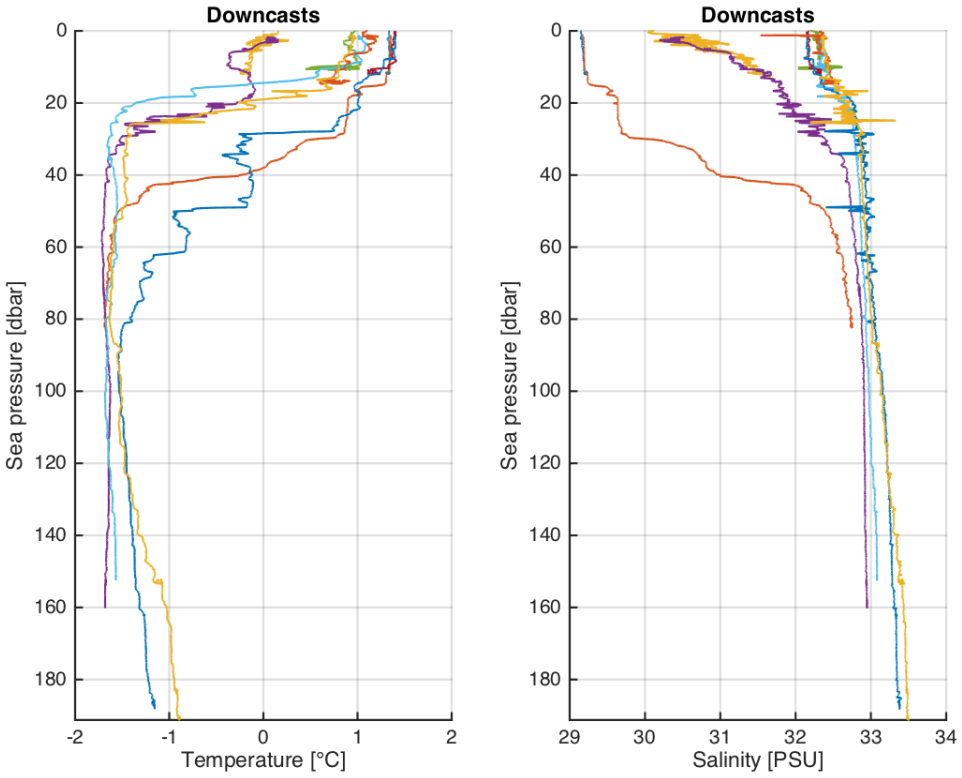
```
file = '../testfiles/065583_20140612_0739.rsk';
rsk = RSKopen(file);

%% load the first 10 profiles
rsk = RSKreadprofiles(rsk, 1:10);

%% plot the downcasts
subplot(121)
RSKplotprofiles(rsk, [], 'temperature', 'down')
subplot(122)
RSKplotprofiles(rsk, [], 'salinity', 'down')

print -dpng profiles.png;
ans = 'profiles.png';
```

[2]The Matlab datenum is defined as the number of days since January 0, 0000.



4 Future plans

- Cast detection for datasets without profile events
- Wave processing functions
- Improved data processing functions (e.g. for CTD data)

5 About this document

This document was created using `org-mode` for GNU Emacs, utilizing the org-babel functionality to include and execute code blocks as part of the document.