RBR

Welcome, the RBR Webinar will begin shortly…

RBR

rbr-global.com

RSKtools: A free toolbox for CTD post-processing and data visualization

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June 03, 2020

What is RSKtools?

- Free and open source tool box written in MATLAB
- Provides access to Ruskin RSK data files
  - Ruskin RSK files are SQLite databases
  - SQLite most widely deployed database engine
- Read, post-process, and visualize RBR data
- Current version: v3.4.1
- Compatible with Matlab R2013b and later
- Does not require additional paid toolboxes

RBR

Ruskin and RSKtools

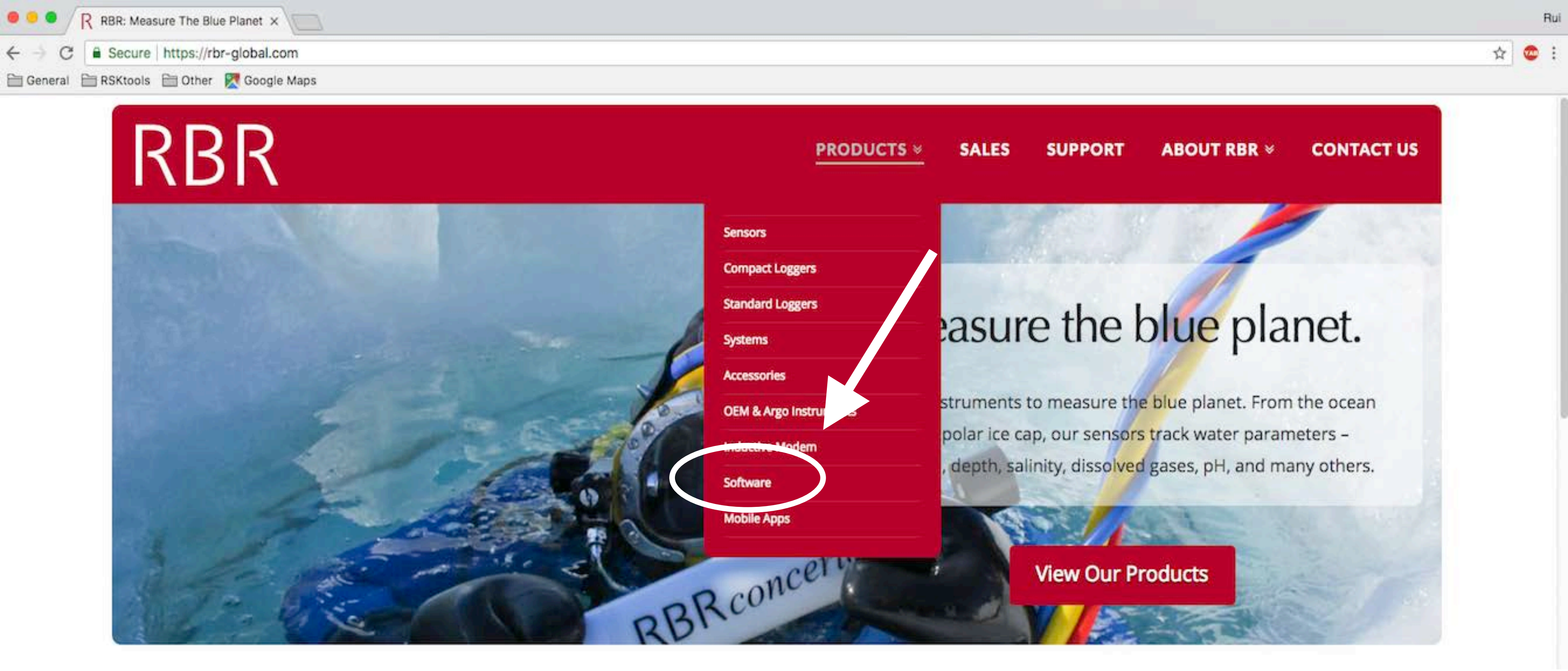
1. Ruskin: configure, simulate, and calibrate instruments; and download, view, annotate, and export data
2. RSKtools is not a replacement for Ruskin
3. Most important distinctions of RSKtools: data post-processing
4. RSKtools provides a direct link between RSK files and Matlab

Outline

- **Download and installation**
- Help and support
- Review the most important functions
    - ➢ Read
    - ➢ View
    - ➢ Process
    - ➢ Export

RBR

Download: `rbr-global.com` → PRODUCTS → Software



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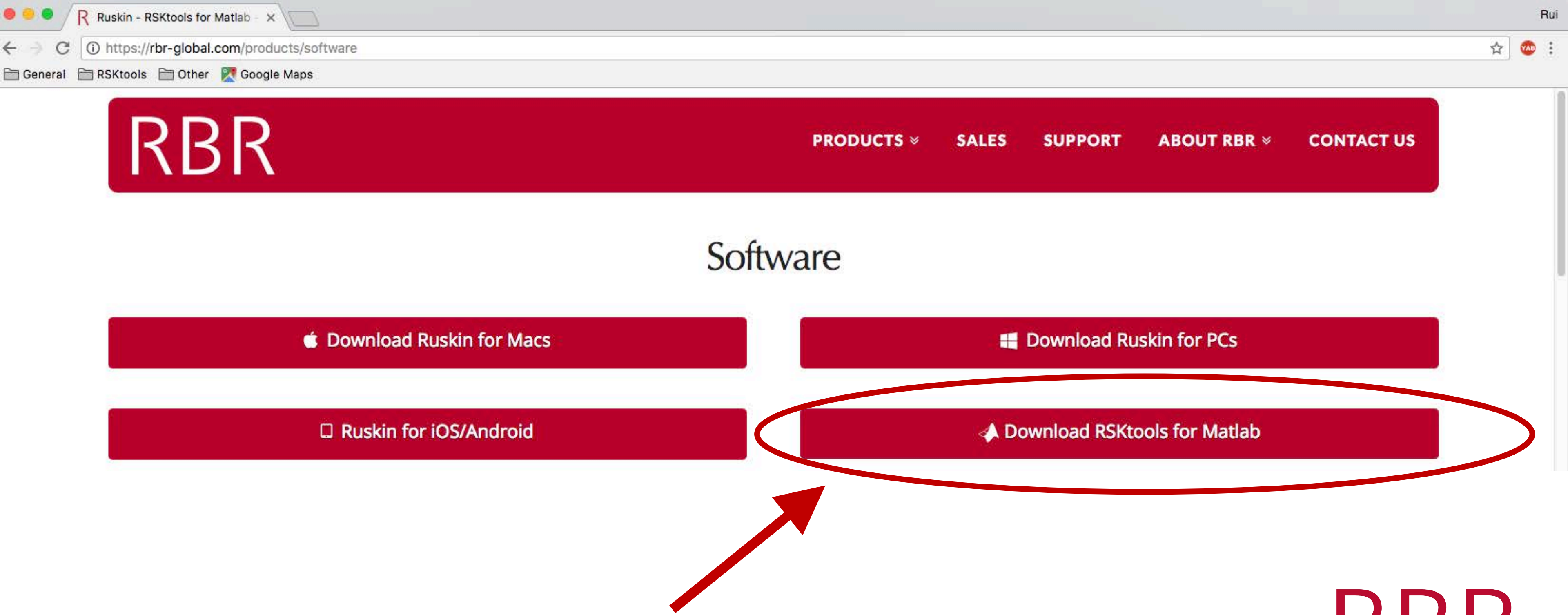
Ruskin - RSKtools for Matlab
Rui
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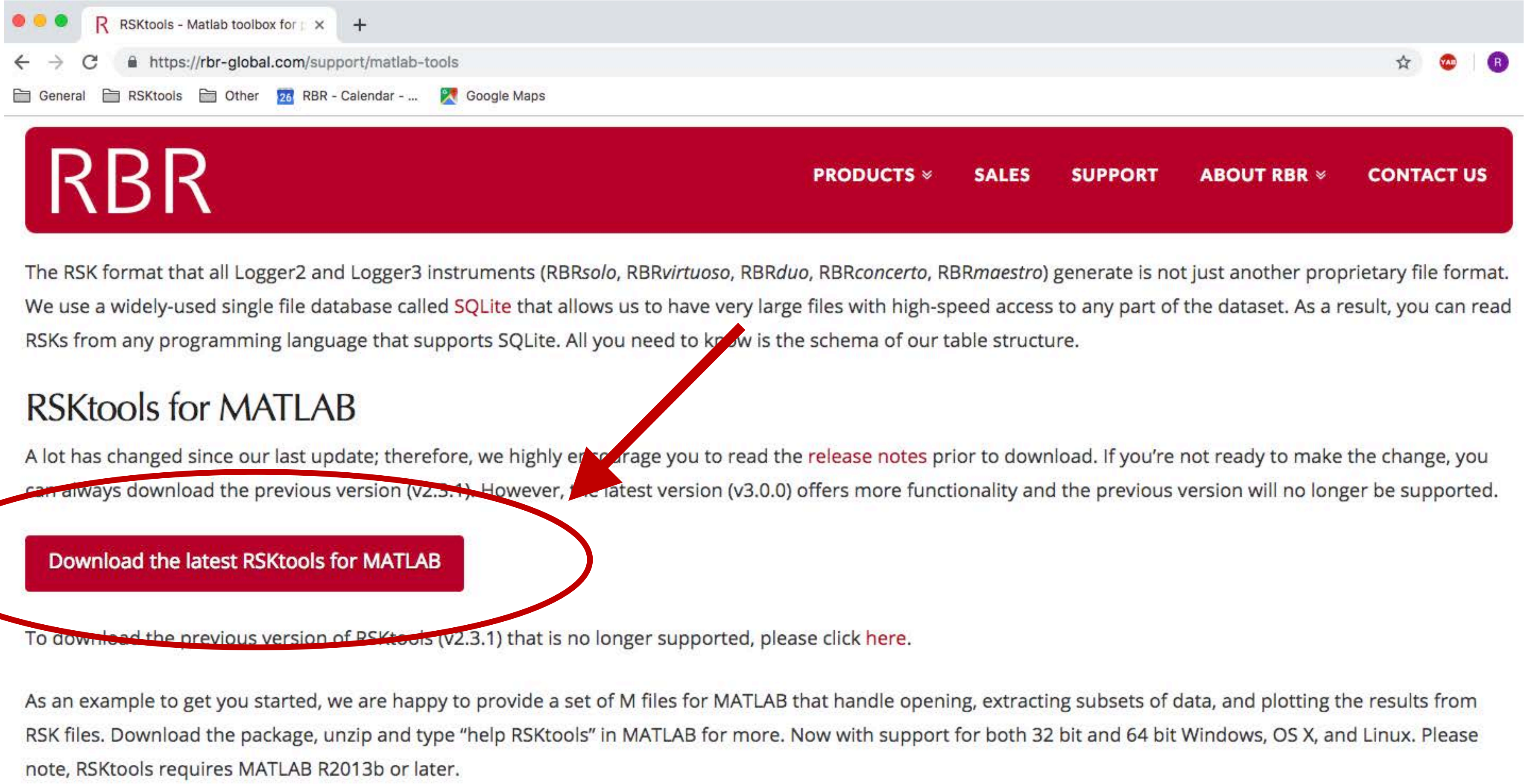


The RSK format that all Logger2 and Logger3 instruments (RBR*solo*, RBR*virtuoso*, RBR*duo*, RBR*concerto*, RBR*maestro*) generate is not just another proprietary file format. We use a widely-used single file database called SQLite that allows us to have very large files with high-speed access to any part of the dataset. As a result, you can read RSKs from any programming language that supports SQLite. All you need to know is the schema of our table structure.

RSKtools for MATLAB

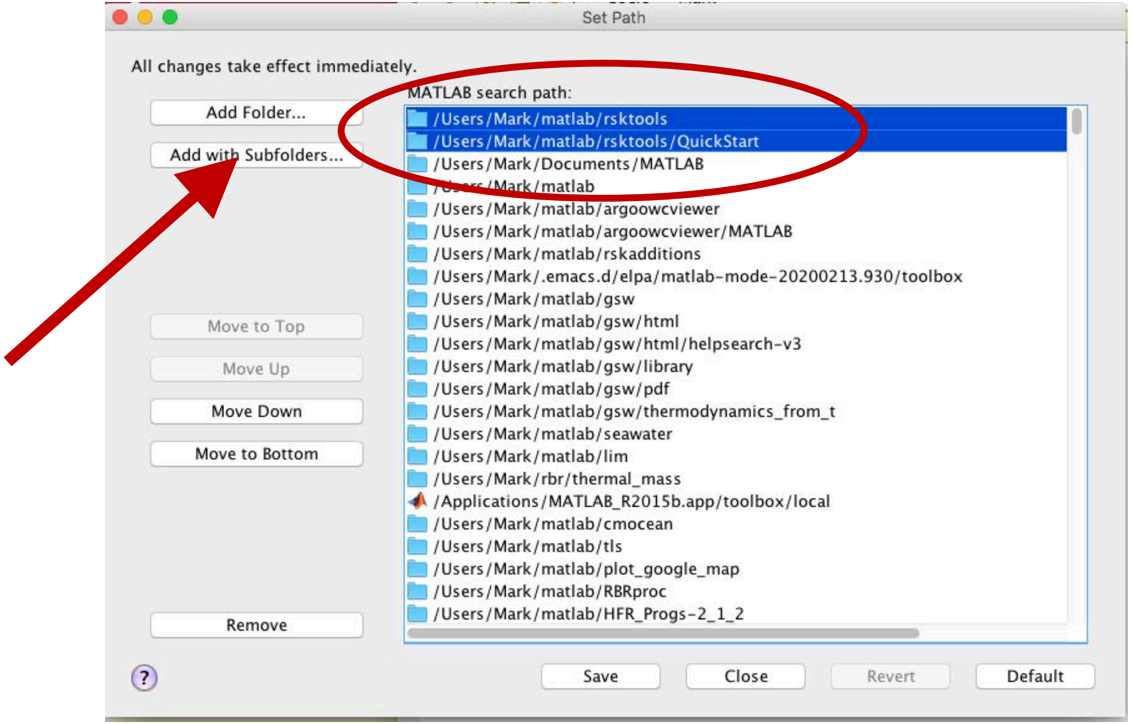
A lot has changed since our last update; therefore, we highly encourage you to read the release notes prior to download. If you're not ready to make the change, you can always download the previous version (v2.3.1). However, the latest version (v3.0.0) offers more functionality and the previous version will no longer be supported.

To download the previous version of RSKtools (v2.3.1) that is no longer supported, please click here.

As an example to get you started, we are happy to provide a set of M files for MATLAB that handle opening, extracting subsets of data, and plotting the results from RSK files. Download the package, unzip and type "help RSKtools" in MATLAB for more. Now with support for both 32 bit and 64 bit Windows, OS X, and Linux. Please note, RSKtools requires MATLAB R2013b or later.

Installation

- Unzip the file
- Matlab → Set Path → Add with Subfolders



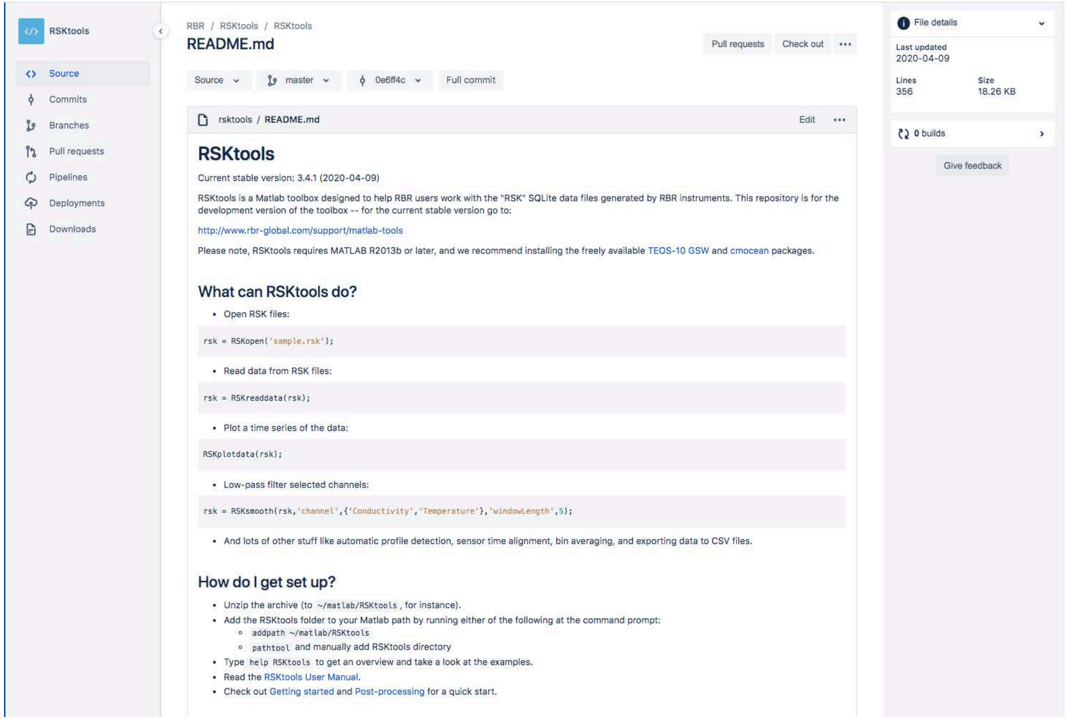
All changes take effect immediately.

MATLAB search path:

/Users/Mark/matlab/rsktools
/Users/Mark/matlab/rsktools/QuickStart
/Users/Mark/Documents/MATLAB
/Users/Mark/matlab
/Users/Mark/matlab/argoowcviewer
/Users/Mark/matlab/argoowcviewer/MATLAB
/Users/Mark/matlab/rskadditions
/Users/Mark/.emacs.d/elpa/matlab-mode-20200213.930/toolbox
/Users/Mark/matlab/gsw
/Users/Mark/matlab/gsw/html
/Users/Mark/matlab/gsw/html/helpsearch-v3
/Users/Mark/matlab/gsw/library
/Users/Mark/matlab/gsw/pdf
/Users/Mark/matlab/gsw/thermodynamics_from_t
/Users/Mark/matlab/seawater
/Users/Mark/matlab/lim
/Users/Mark/rbr/thermal_mass
/Applications/MATLAB_R2015b.app/toolbox/local
/Users/Mark/matlab/cmocean
/Users/Mark/matlab/tls
/Users/Mark/matlab/plot_google_map
/Users/Mark/matlab/RBRproc
/Users/Mark/matlab/HFR_Progs-2_1_2

Bitbucket repository

- Stay on top of the most recent developments
- Anyone can contribute



README.md

Last updated 2020-04-09

Lines 356

Size 18.26 KB

RSKtools

Current stable version: 3.4.1 (2020-04-09)

RSKtools is a Matlab toolbox designed to help RBR users work with the "RSK" SQLite data files generated by RBR instruments. This repository is for the development version of the toolbox -- for the current stable version go to:

http://www.rbr-global.com/support/matlab-tools

Please note, RSKtools requires MATLAB R2013b or later, and we recommend installing the freely available TEOS-10 GSW and cmocean packages.

What can RSKtools do?

- Open RSK files:

```
rsk = RSKopen('sample.rsk');
```

- Read data from RSK files:

```
rsk = RSKreaddata(rsk);
```

- Plot a time series of the data:

```
RSKplotdata(rsk);
```

- Low-pass filter selected channels:

```
rsk = RSKsmooth(rsk,'channel',{'Conductivity','Temperature'},'windowLength',5);
```

- And lots of other stuff like automatic profile detection, sensor time alignment, bin averaging, and exporting data to CSV files.

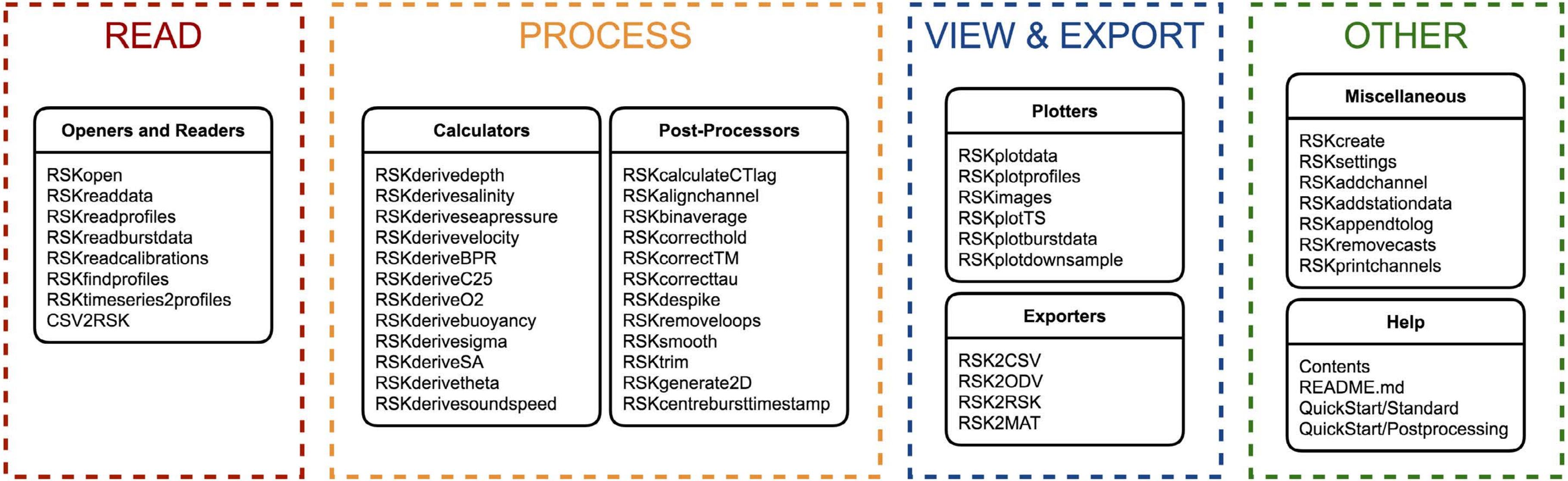
How do I get set up?

- Unzip the archive (to `~/matlab/RSKtools`, for instance).
- Add the RSKtools folder to your Matlab path by running either of the following at the command prompt:
  - `addpath ~/matlab/RSKtools`
  - `pathtool` and manually add RSKtools directory
- Type `help RSKtools` to get an overview and take a look at the examples.
- Read the RSKtools User Manual.
- Check out Getting started and Post-processing for a quick start.

https://bitbucket.org/rbr/rsktools/src/master/

RBR

49 user-faced functions in v3.4.1



READ

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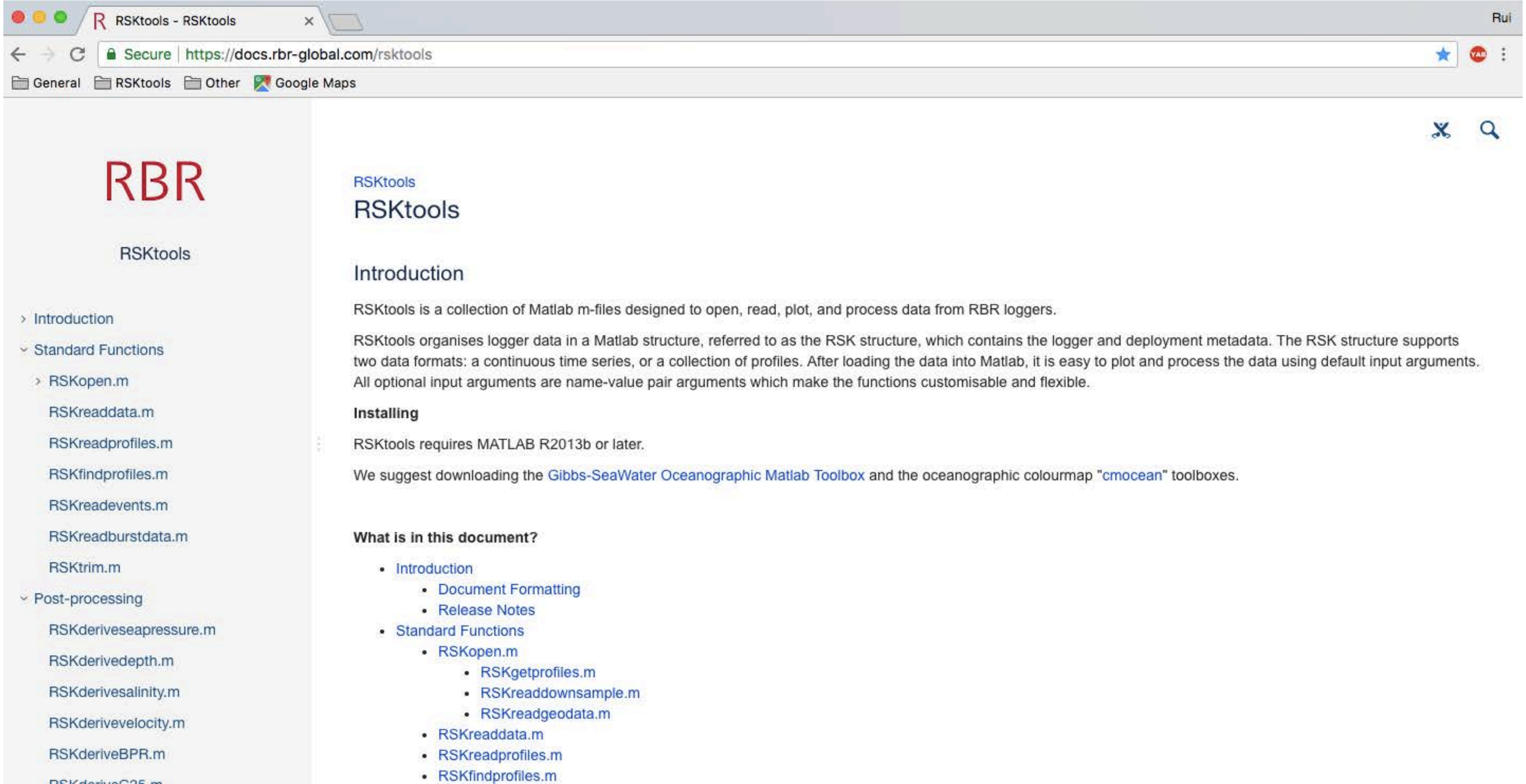
Help

Contents
README.md
QuickStart/Standard
QuickStart/Postprocessing

Help and Support

- QuickStart demo
  - Getting started with RSKTOOLS (pdf)
  - Post-processing RBR data with RSKtools (pdf)
- Online manuals
  - docs.rbr-global.com/rsktools
- type `help RSKtools` in the MATLAB command window
- Bugs: support@rbr-global.com

Online manuals - https://docs.rbr-global.com/rsktools



RSKtools

RSKtools

Introduction

RSKtools is a collection of Matlab m-files designed to open, read, plot, and process data from RBR loggers.

RSKtools organises logger data in a Matlab structure, referred to as the RSK structure, which contains the logger and deployment metadata. The RSK structure supports two data formats: a continuous time series, or a collection of profiles. After loading the data into Matlab, it is easy to plot and process the data using default input arguments. All optional input arguments are name-value pair arguments which make the functions customisable and flexible.

Installing

RSKtools requires MATLAB R2013b or later.

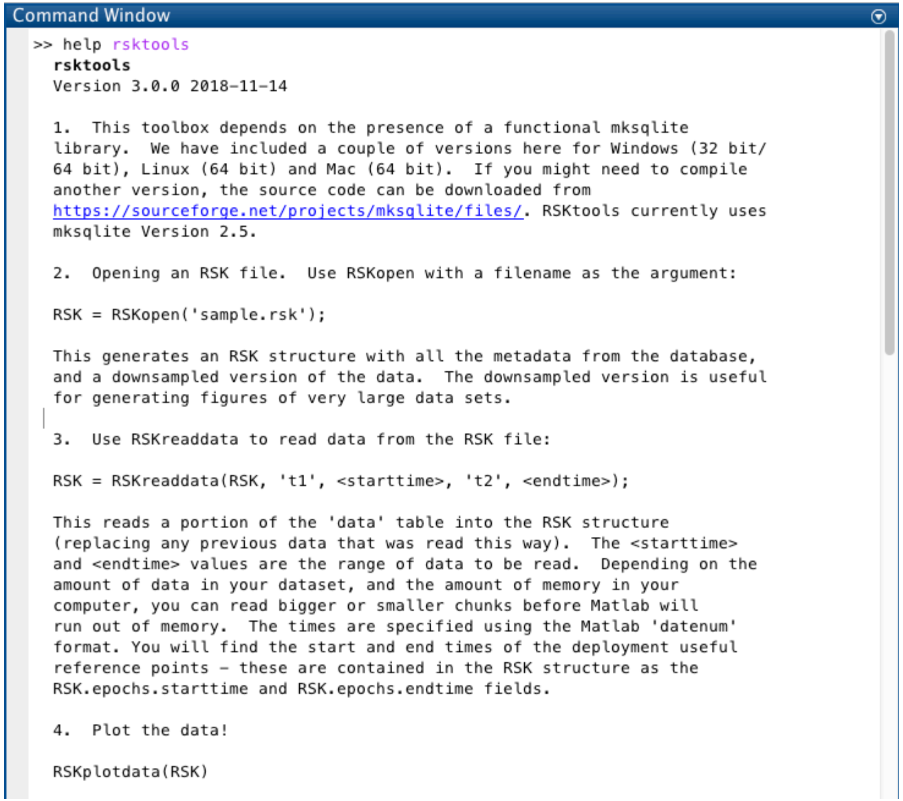
We suggest downloading the Gibbs-SeaWater Oceanographic Matlab Toolbox and the oceanographic colourmap "cmocean" toolboxes.

What is in this document?

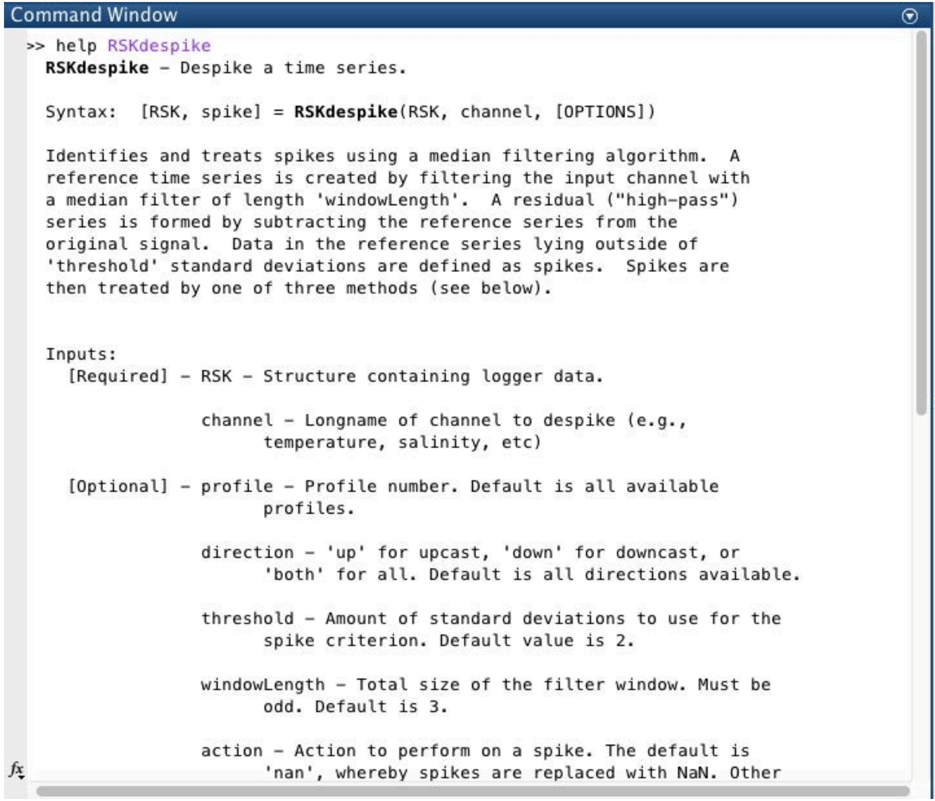
Help from the Matlab command window

help rsktools

help RSKdespike



```
>> help rsktools
  rsktools
  Version 3.0.0 2018-11-14

  1.  This toolbox depends on the presence of a functional mksqlite
  library.  We have included a couple of versions here for Windows (32 bit/
  64 bit), Linux (64 bit) and Mac (64 bit).  If you might need to compile
  another version, the source code can be downloaded from
  https://sourceforge.net/projects/mksqlite/files/. RSKtools currently uses
  mksqlite Version 2.5.

  2.  Opening an RSK file.  Use RSKopen with a filename as the argument:

  RSK = RSKopen('sample.rsk');

  This generates an RSK structure with all the metadata from the database,
  and a downsampled version of the data.  The downsampled version is useful
  for generating figures of very large data sets.

  3.  Use RSKreaddata to read data from the RSK file:

  RSK = RSKreaddata(RSK, 't1', <starttime>, 't2', <endtime>);

  This reads a portion of the 'data' table into the RSK structure
  (replacing any previous data that was read this way).  The <starttime>
  and <endtime> values are the range of data to be read.  Depending on the
  amount of data in your dataset, and the amount of memory in your
  computer, you can read bigger or smaller chunks before Matlab will
  run out of memory.  The times are specified using the Matlab 'datenum'
  format. You will find the start and end times of the deployment useful
  reference points - these are contained in the RSK structure as the
  RSK.epochs.starttime and RSK.epochs.endtime fields.

  4.  Plot the data!

  RSKplotdata(RSK)
```



```
>> help RSKdespike
  RSKdespike - Despike a time series.

  Syntax:  [RSK, spike] = RSKdespike(RSK, channel, [OPTIONS])

  Identifies and treats spikes using a median filtering algorithm.  A
  reference time series is created by filtering the input channel with
  a median filter of length 'windowLength'.  A residual ("high-pass")
  series is formed by subtracting the reference series from the
  original signal.  Data in the reference series lying outside of
  'threshold' standard deviations are defined as spikes.  Spikes are
  then treated by one of three methods (see below).


  Inputs:
    [Required] - RSK - Structure containing logger data.

                 channel - Longname of channel to despike (e.g.,
                       temperature, salinity, etc)

    [Optional] - profile - Profile number. Default is all available
                       profiles.

                 direction - 'up' for upcast, 'down' for downcast, or
                       'both' for all. Default is all directions available.

                 threshold - Amount of standard deviations to use for the
                       spike criterion. Default value is 2.

                 windowLength - Total size of the filter window. Must be
                       odd. Default is 3.

                 action - Action to perform on a spike. The default is
                       'nan', whereby spikes are replaced with NaN. Other
```

Introduction to RSKtools functions

CTD data post-processing example

Simplified CTD data post-processing pipeline:

	Step	RSKtools functions	See also
1	Open RSK file and read data	RSKopen, RSKreadprofiles, RSKreaddata, RSKprintchannels	RSKtimeseries2profiles, RSKreadburstdata
2	Visualize raw data	RSKplotprofiles	RSKplotdownsample, RSKplotdata
3	Add station metadata	RSKaddstationdata	
4	Calculate sea pressure and depth	RSKderiveseapressure, RSKderivedepth	
5	Low pass filter C & T	RSKsmooth	
6	Align temperature to conductivity	RSKalignchannel	RSKcalculateCTlag, RSKcorrecttau
7	Remove ship heave (“loops”)	RSKderivevelocity, RSKremoveloops	RSKdespike
8	Derive variables	RSKderivesalinity, RSKderivetheta, RSKderivesigma	RSKderiveC25, RSKderivesoundspeed, RSKderiveO2, RSKderiveSA
9	Bin average by depth	RSKremovecasts, RSKbinaverage	
10	Visualize processed data	RSKplotprofiles	RSKplotdata, RSKimages, RSKplotTS
11	Export	RSK2CSV, RSK2RSK, RSK2ODV	RSK2MAT

- Read
- View
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RSKopen

```
rsk = RSKopen(‘sample.rsk’);
```

- Extract metadata such as channel information, profile start and end times, serial number, sampling rate, etc.

RSKreaddata

```
rsk = RSKreaddata(rsk, 't1’, tstart, 't2’, tend);
```

- Read data from all channels as a *time series*. Optionally specify start and end times to read select periods.

RSKreadprofiles

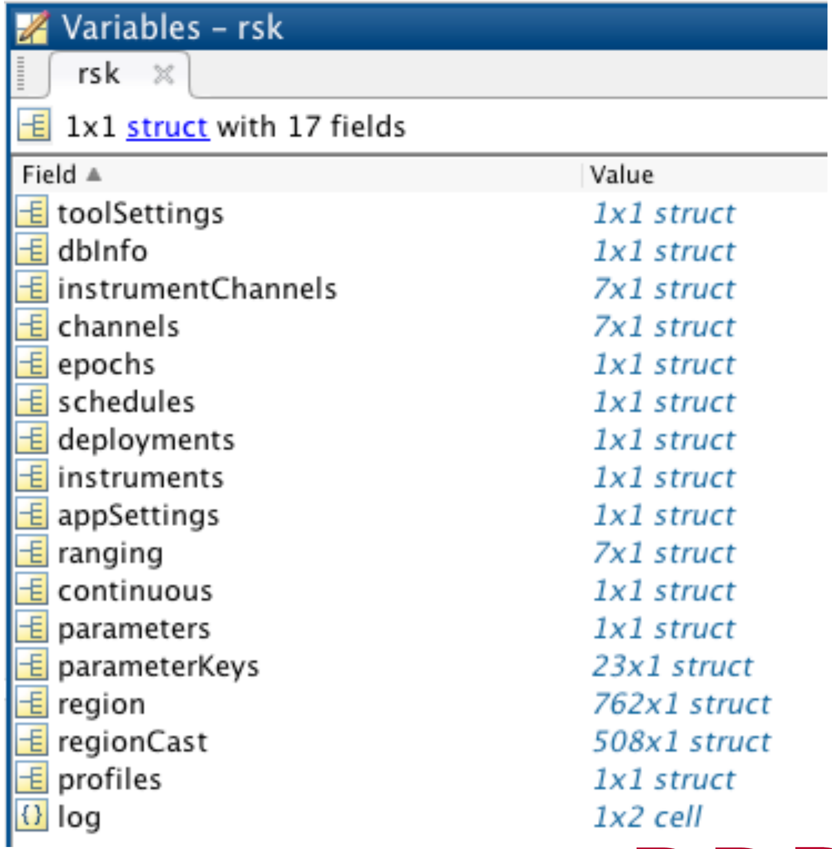
```
rsk = RSKreadprofiles(rsk,‘profile’,1:4,‘direction’,‘down’);
```

- Uses profile “events” from Ruskin to read the data and store as profiles

RSKopen

```
rsk = RSKopen(‘sample.rsk’);
```

- *dbInfo*
  - version, format, file and path
- *channels*
  - channel name, unit
- *continuous*
  - sampling rate
- *profiles*
  - profile start and end times
- *instruments*
  - instrument name
  - instrument serial number
- *log*
  - data processing log



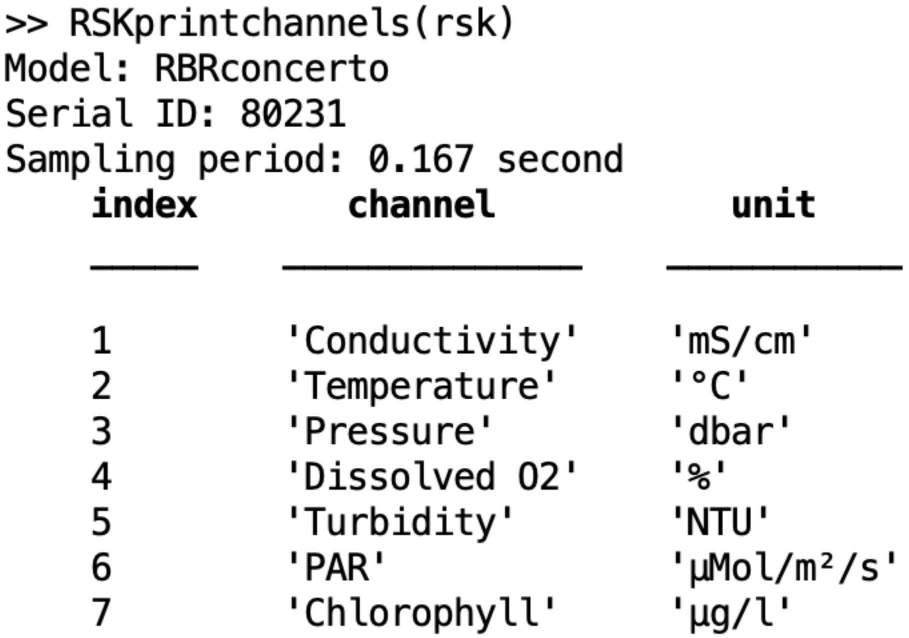
1x1 struct with 17 fields

Field ▲	Value
toolSettings	1x1 struct
dbInfo	1x1 struct
instrumentChannels	7x1 struct
channels	7x1 struct
epochs	1x1 struct
schedules	1x1 struct
deployments	1x1 struct
instruments	1x1 struct
appSettings	1x1 struct
ranging	7x1 struct
continuous	1x1 struct
parameters	1x1 struct
parameterKeys	23x1 struct
region	762x1 struct
regionCast	508x1 struct
profiles	1x1 struct
log	1x2 cell

RSKprintchannels

```
RSKprintchannels(rsk)
```

Display important information about the instrument and dataset



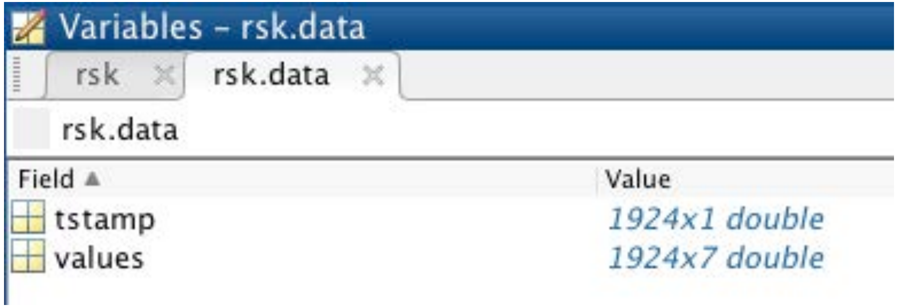
```
>> RSKprintchannels(rsk)
Model: RBRconcerto
Serial ID: 80231
Sampling period: 0.167 second
    index         channel              unit
    _____    ______________    ___________

    1        'Conductivity'    'mS/cm'
    2        'Temperature'     '°C'
    3        'Pressure'        'dbar'
    4        'Dissolved O2'    '%'
    5        'Turbidity'       'NTU'
    6        'PAR'             'µMol/m²/s'
    7        'Chlorophyll'     'µg/l'
```

RSKreaddata

```
rsk = RSKreaddata(rsk);
```

Or

```
tstart = datenum(2014, 05, 03);
tend = datenum(2014, 05, 04);
rsk = RSKreaddata(rsk, 't1’, tstart, 't2’, tend);
```

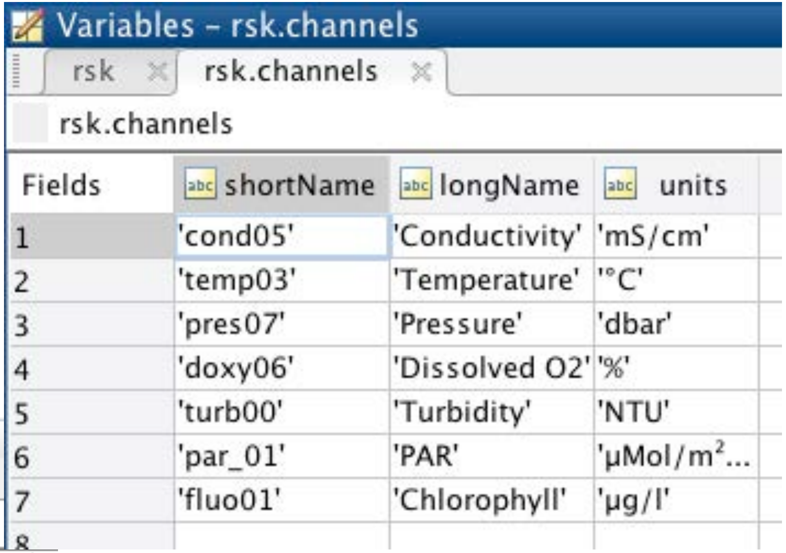


Field ▲	Value
tstamp	*1924x1 double*
values	*1924x7 double*

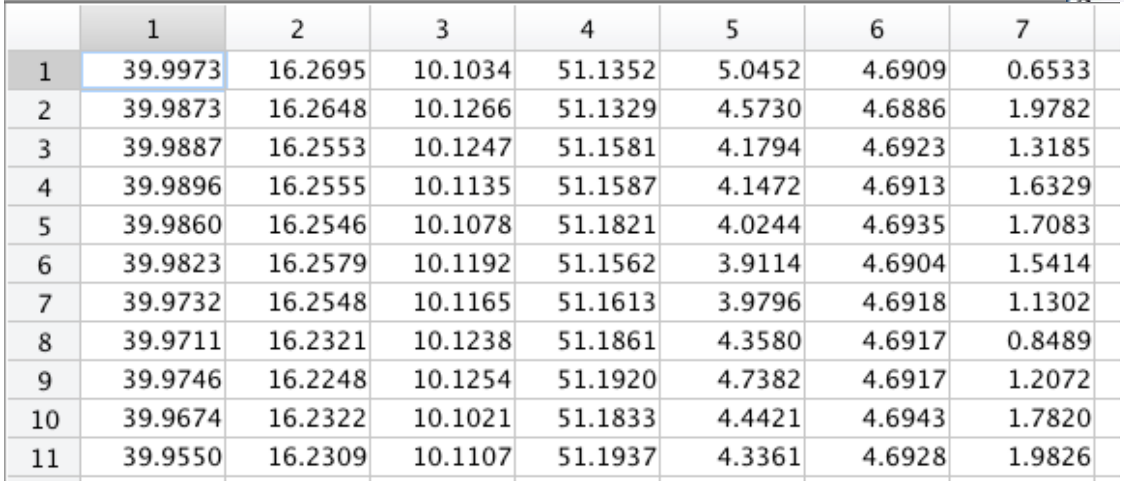
- Data subset specified by start time `t1` and end time `t2`.

rsk.data

- Row: number of data samples
- Column: number of channels



Fields	shortName	longName	units
1	'cond05'	'Conductivity'	'mS/cm'
2	'temp03'	'Temperature'	'°C'
3	'pres07'	'Pressure'	'dbar'
4	'doxy06'	'Dissolved O2'	'%'
5	'turb00'	'Turbidity'	'NTU'
6	'par_01'	'PAR'	'µMol/m^2...
7	'fluo01'	'Chlorophyll'	'µg/l'
8			



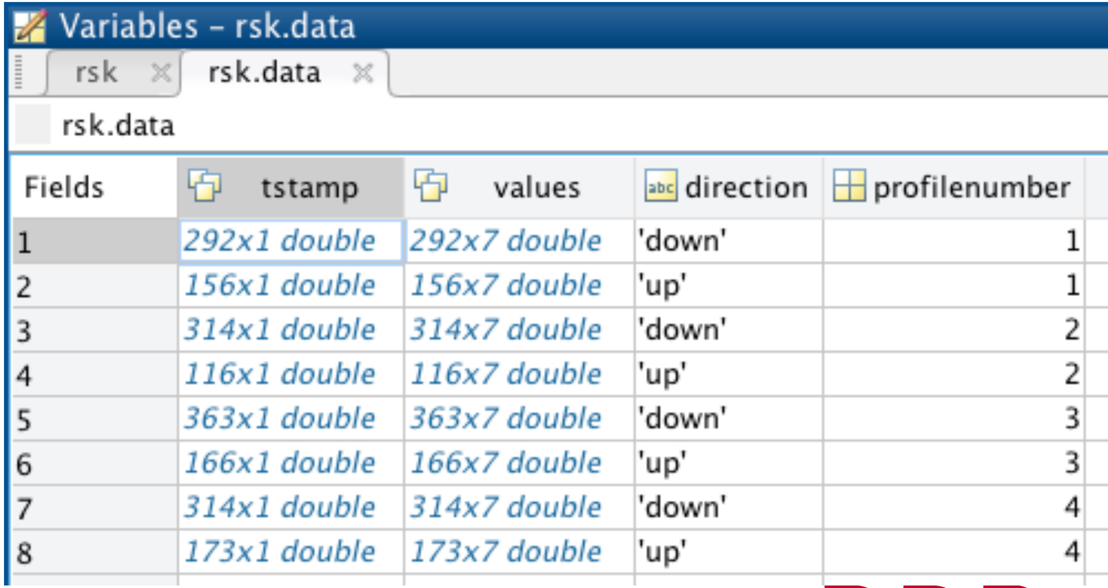
	1	2	3	4	5	6	7
1	39.9973	16.2695	10.1034	51.1352	5.0452	4.6909	0.6533
2	39.9873	16.2648	10.1266	51.1329	4.5730	4.6886	1.9782
3	39.9887	16.2553	10.1247	51.1581	4.1794	4.6923	1.3185
4	39.9896	16.2555	10.1135	51.1587	4.1472	4.6913	1.6329
5	39.9860	16.2546	10.1078	51.1821	4.0244	4.6935	1.7083
6	39.9823	16.2579	10.1192	51.1562	3.9114	4.6904	1.5414
7	39.9732	16.2548	10.1165	51.1613	3.9796	4.6918	1.1302
8	39.9711	16.2321	10.1238	51.1861	4.3580	4.6917	0.8489
9	39.9746	16.2248	10.1254	51.1920	4.7382	4.6917	1.2072
10	39.9674	16.2322	10.1021	51.1833	4.4421	4.6943	1.7820
11	39.9550	16.2309	10.1107	51.1937	4.3361	4.6928	1.9826

RBR

RSKreadprofiles

```
rsk = RSKreadprofiles(rsk,‘profile’,[1:4],‘direction’,‘both’);
```

- Either logger or Ruskin detects profiles and stores start and end time of each cast
- RSKreadprofiles uses that information to directly read data into profiles

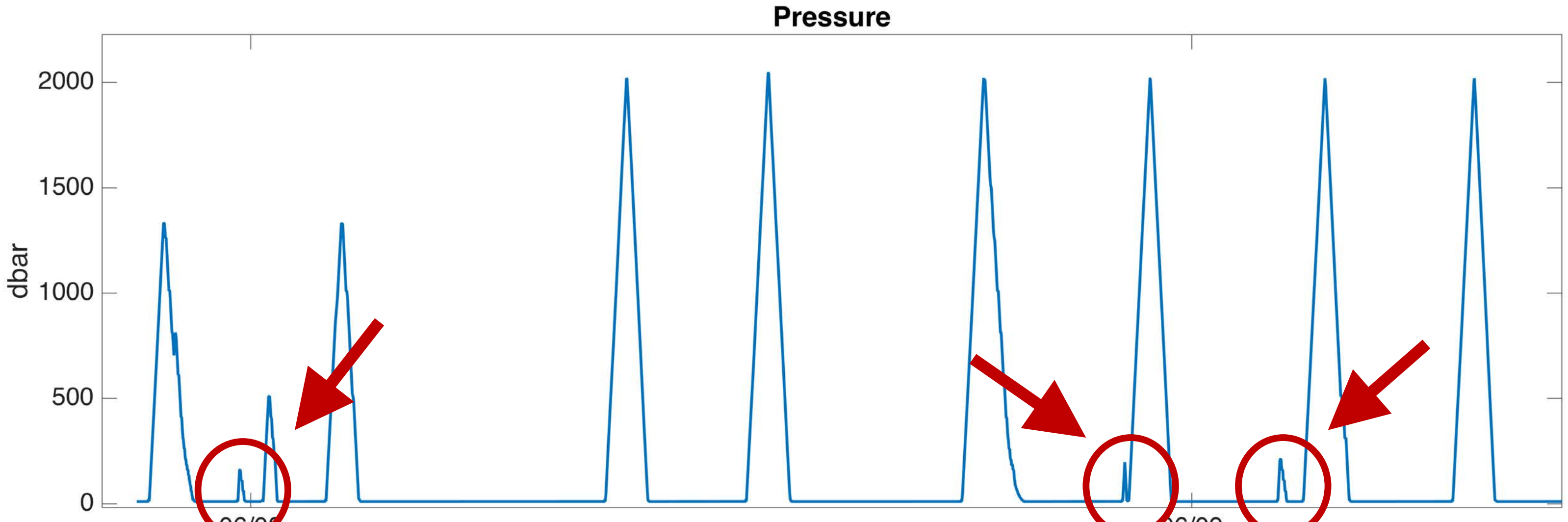


Fields	tstamp	values	direction	profilenumber
1	292x1 double	292x7 double	'down'	1
2	156x1 double	156x7 double	'up'	1
3	314x1 double	314x7 double	'down'	2
4	116x1 double	116x7 double	'up'	2
5	363x1 double	363x7 double	'down'	3
6	166x1 double	166x7 double	'up'	3
7	314x1 double	314x7 double	'down'	4
8	173x1 double	173x7 double	'up'	4

RSKtimeseries2profiles

```
rsk = RSKtimeseries2profiles(rsk, 'pressureThreshold', 200);
```

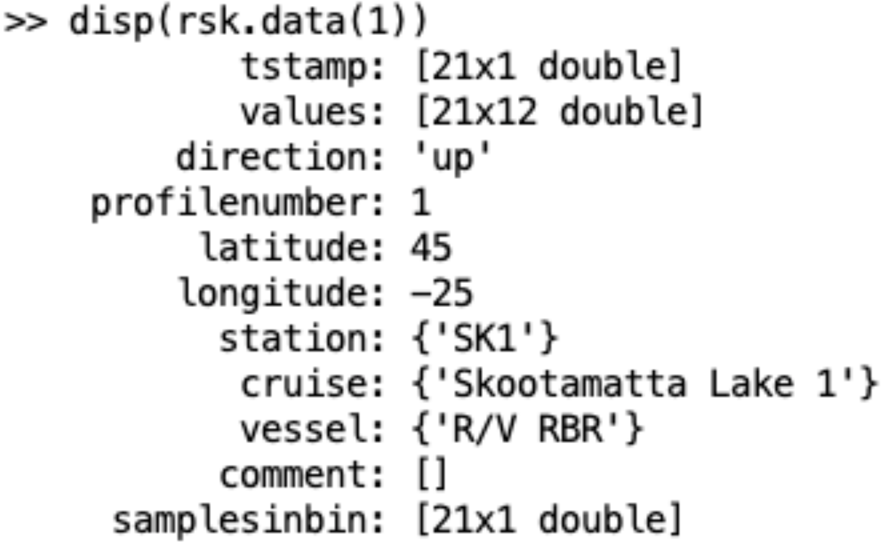
- Reorganize time series created by `RSKreaddata` into profiles
- Useful when profile events were not correctly detected by logger/Ruskin
- Cast detection parameters can be tuned to for specific data sets



RSKaddstationdata

```
stations = {‘S1’,’S2’,’S3’,’S4’};
rsk = RSKaddstationdata(rsk,’cruise’,{’Repeat
line’},‘Station’,stations,‘latitude’,lat_vec,’longitude’,lon_ve
c);
```

- Note this data is exported into the header by RSK2CSV.



```
>> disp(rsk.data(1))
          tstamp: [21x1 double]
          values: [21x12 double]
       direction: 'up'
   profilenumber: 1
        latitude: 45
       longitude: -25
         station: {'SK1'}
          cruise: {'Skootamatta Lake 1'}
          vessel: {'R/V RBR'}
         comment: []
    samplesinbin: [21x1 double]
```

- Read
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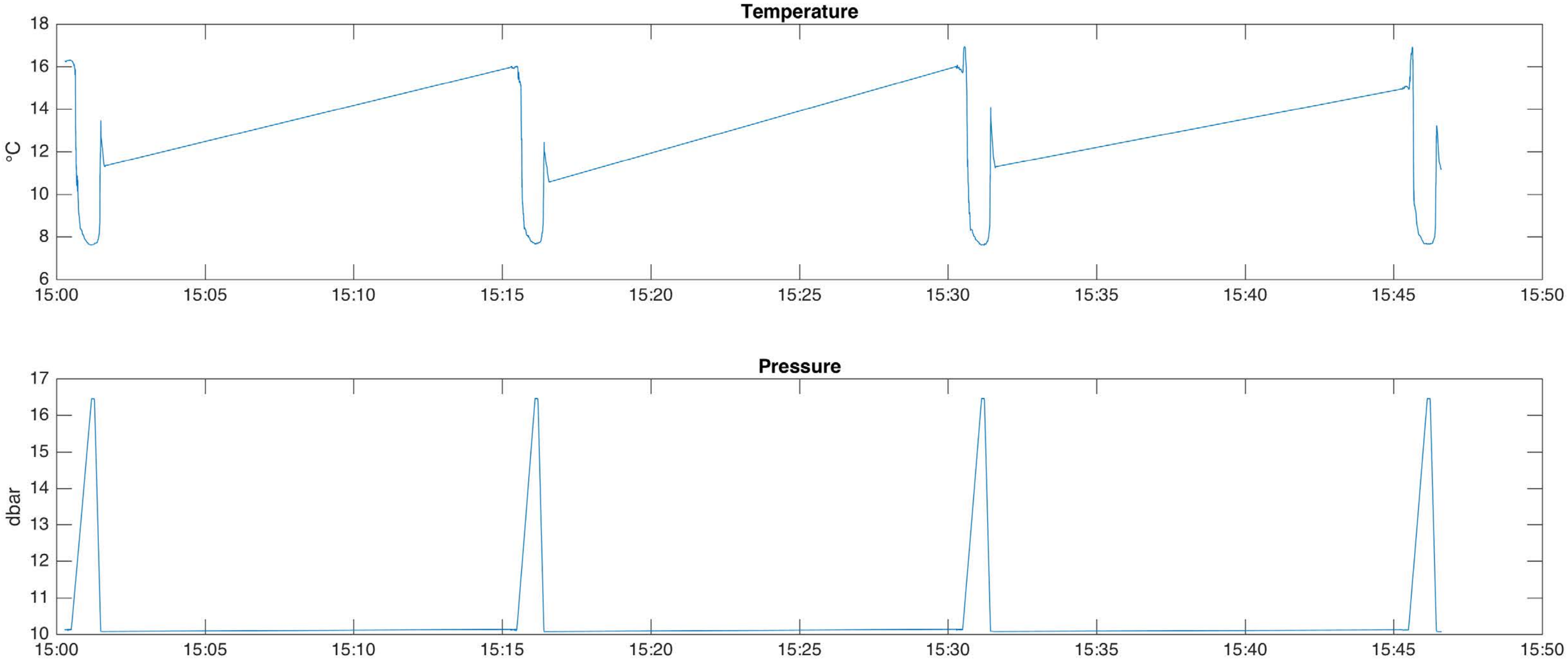
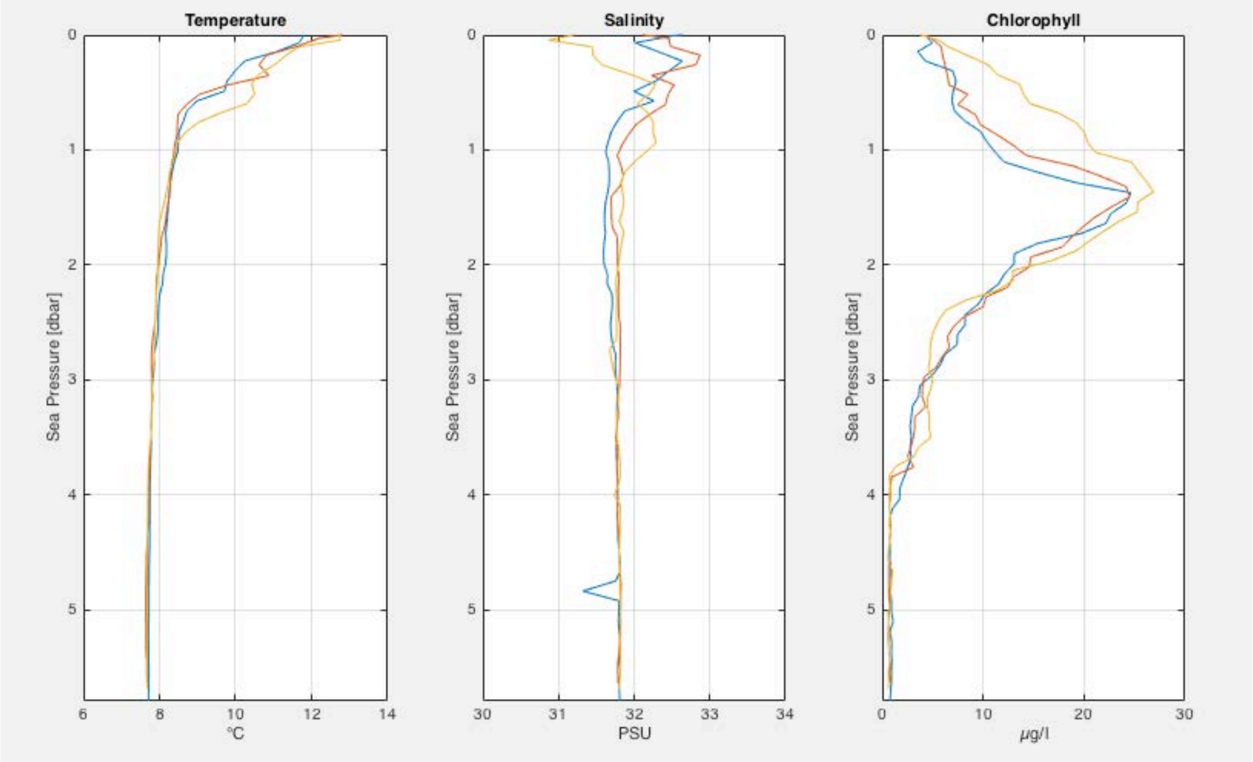
RSKplotdata

```
RSKplotdata(rsk,'channel',{‘temperature’, ‘pressure'});
```



RSKplotprofiles

```
RSKplotprofiles(rsk,'channel',{‘temperature’, ‘salinity',
‘chlorophyll'},'profile’, [1 5 10],'direction','down');
```



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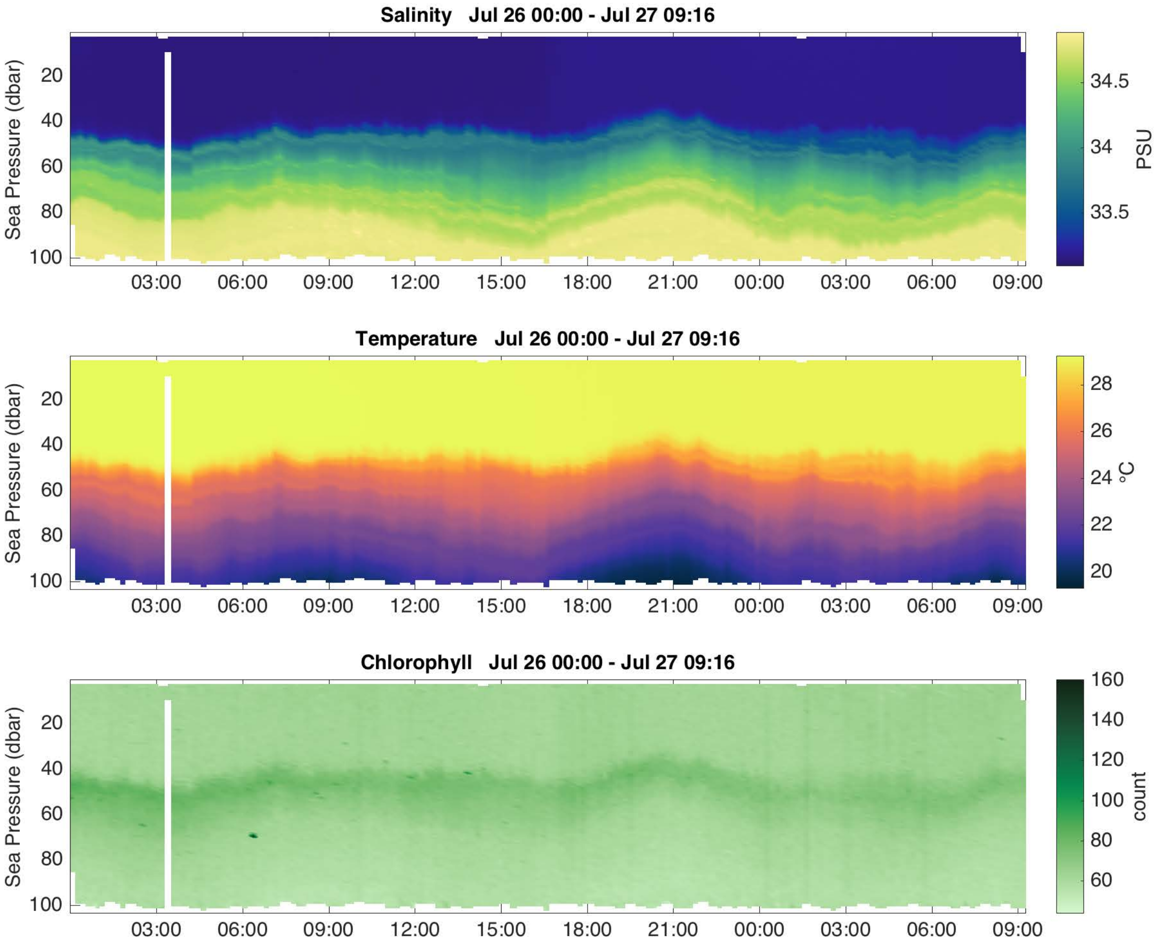
RSKimages

```
RSKimages(rsk,
'direction','up’)
```

- Requires bin averaging the profiles (`RSKbinaverage`)

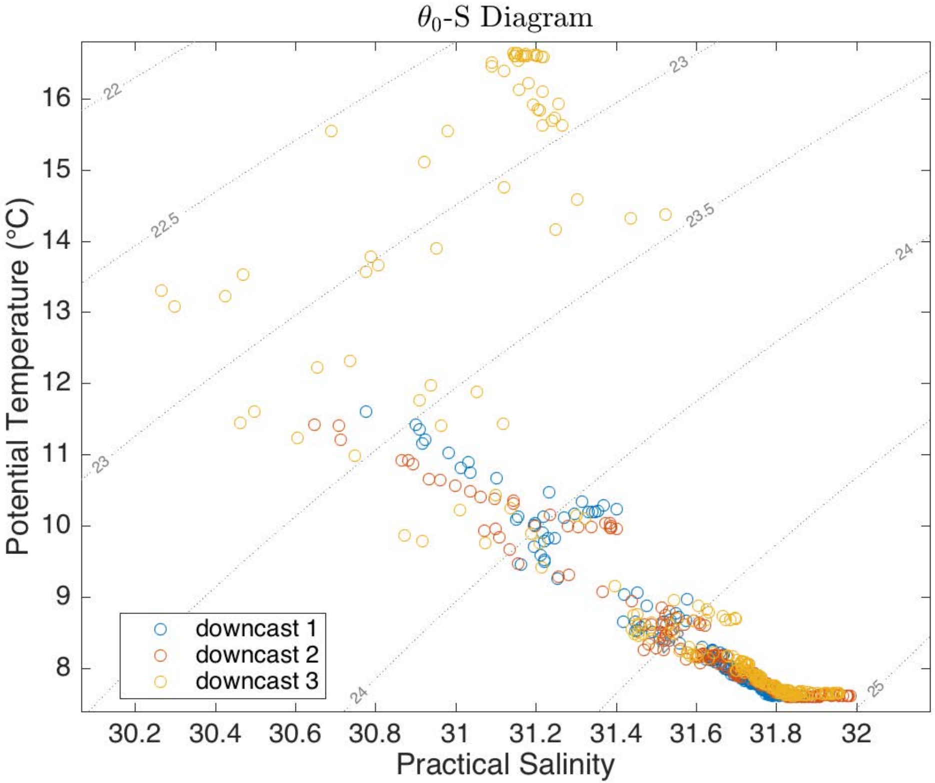


RSKplotTS

```
RSKplotTS(rsk,'profile',1:3,'direction','down');
```

```
handles = RSKplotTS(rsk,…);
```

- outputs line handles to for customization



- Read
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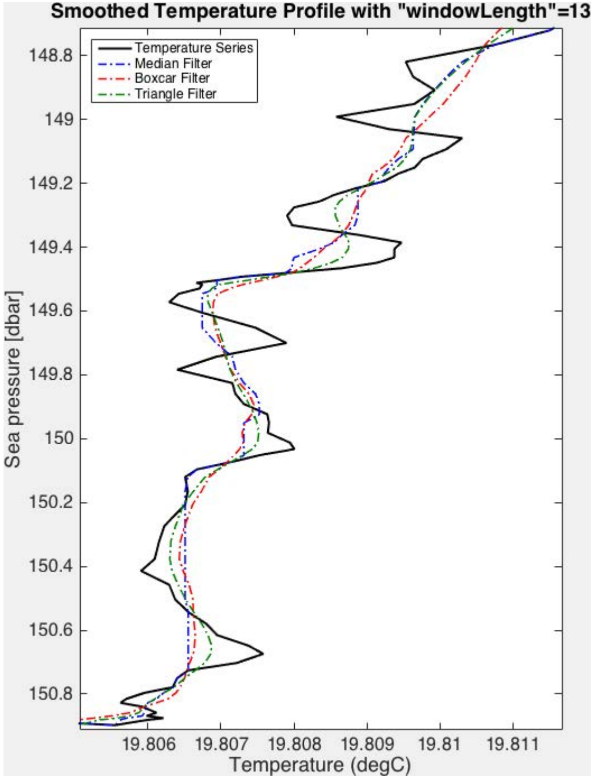
RSKsmooth

```
rsk = RSKsmooth(rsk,’temperature’,'windowLength’,5,
‘filter’,’boxcar’,’profile’,1,’direction’,’down’);
```

- Low-pass filter data with a running average or median
- Boxcar or triangular weighting windows
- User specified window length, profile number and cast direction

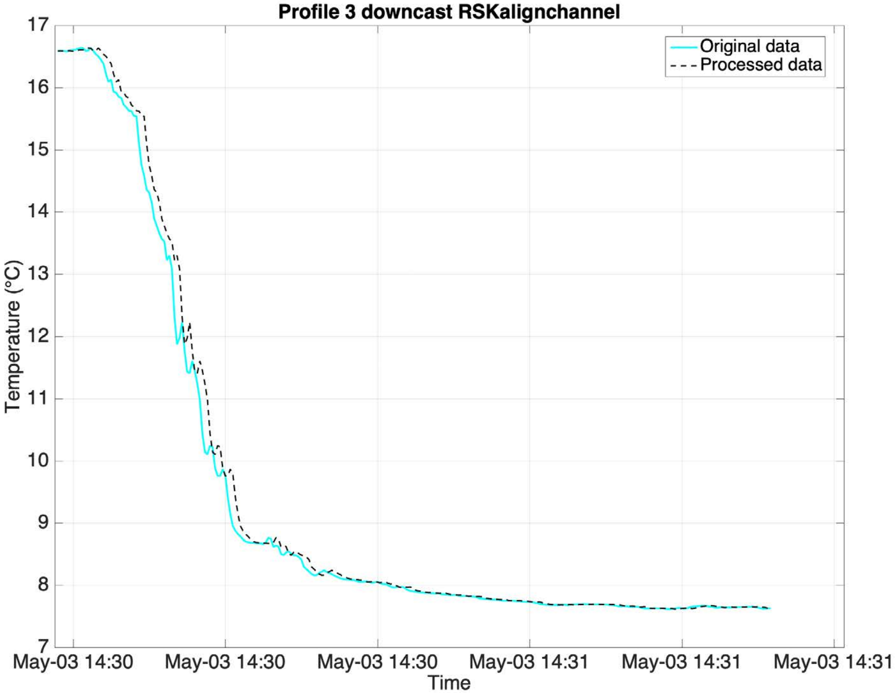


RBR

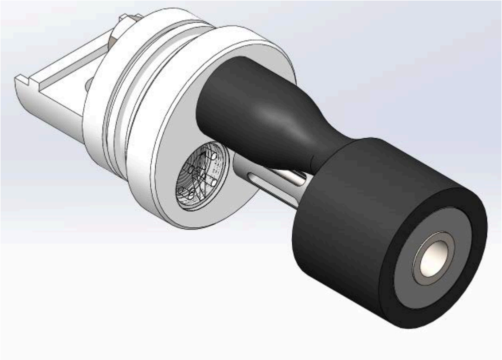
RSKalignchannel

```
rsk = RSKalignchannel(rsk, 'channel','temperature','lag',2);
```

- Shifts a channel in time
- Can specify lag as a number of samples or a time in seconds (requires interpolation)



Time misalignment of conductivity and temperature



- In some instruments, conductivity and temperature are separated vertically in space
- Sensors may have different time constants

→ Both factors cause errors in derived salinity (e.g., spikes)

- For details on dynamic corrections for RBR CTDs, please see: Webinar recording and PDF slides

RBR

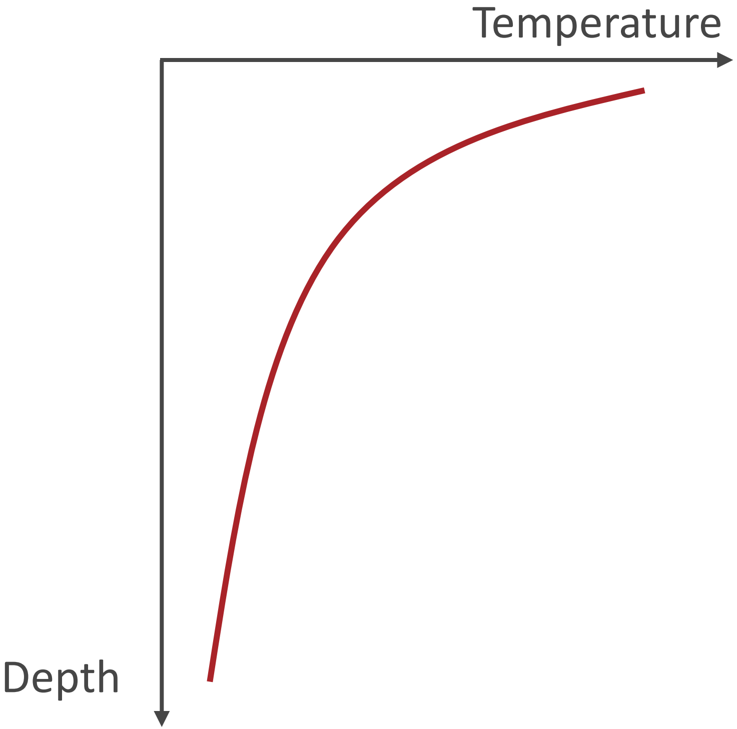
What is the optimal lag? Try RSKcalculateCTlag

```
lag = RSKcalculateCTlag(rsk);
```

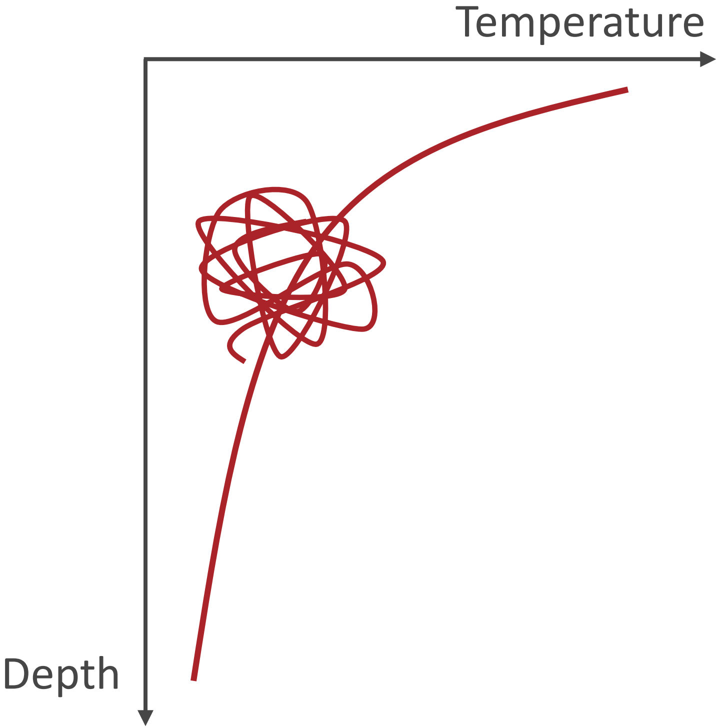
- Derive salinity with a range of lags, from -20 to 20 samples
- High-pass filter salinity, and calculate the standard deviation of the result
- optimal lag is the one with the smallest standard deviation (i.e., the least “spiky”)

RSKremoveloops – improve data affected by ship heave

Ideal

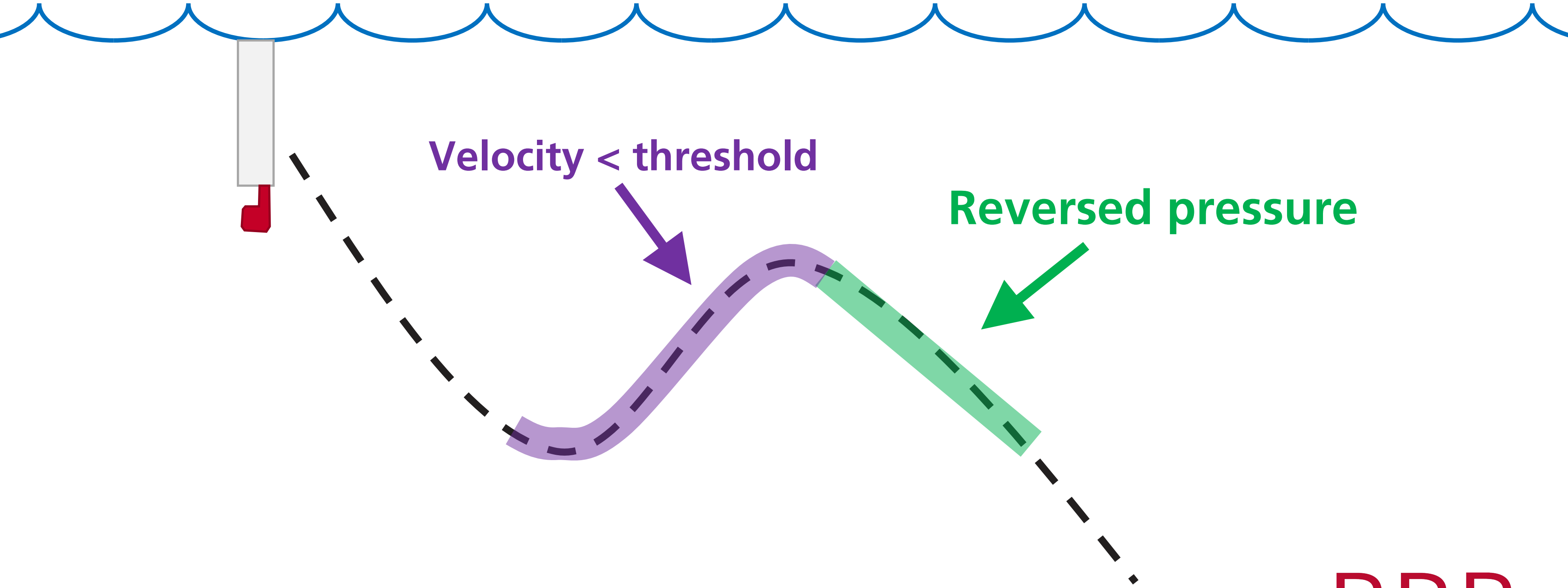


Reality



RBR

RSKremoveloops

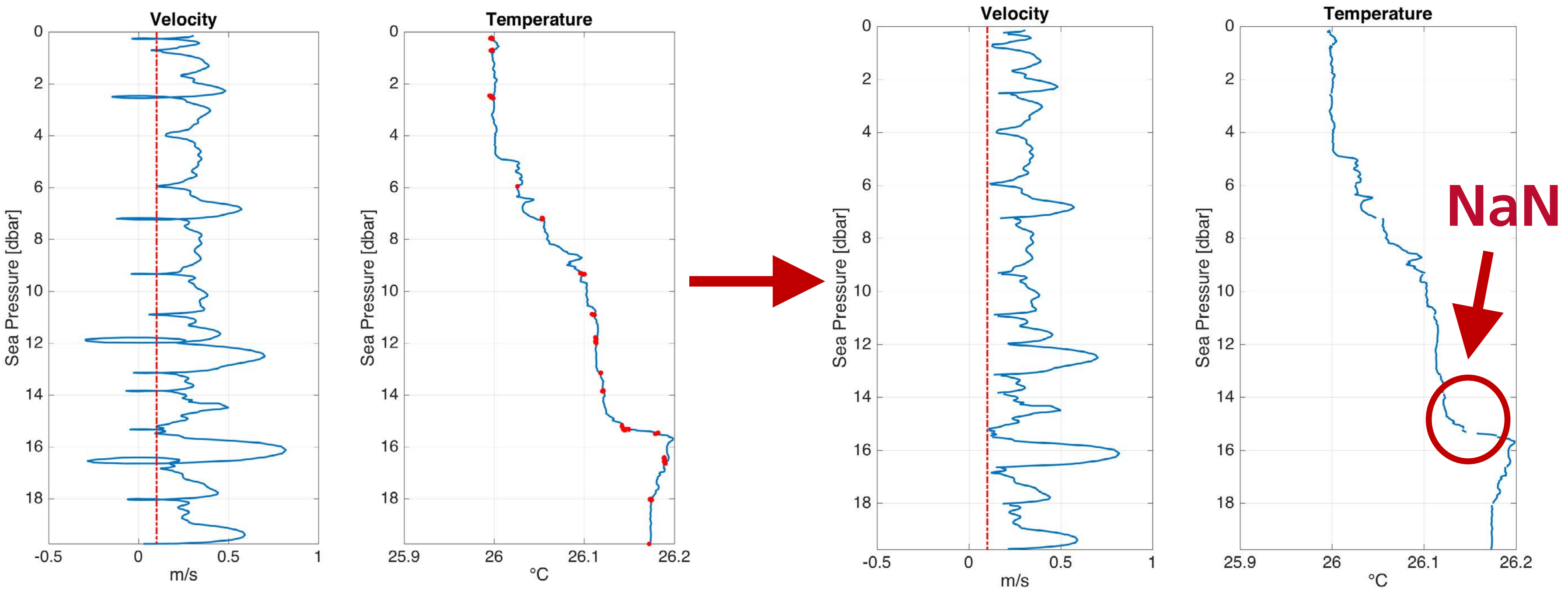


Velocity < threshold

Reversed pressure

RSKremoveloops

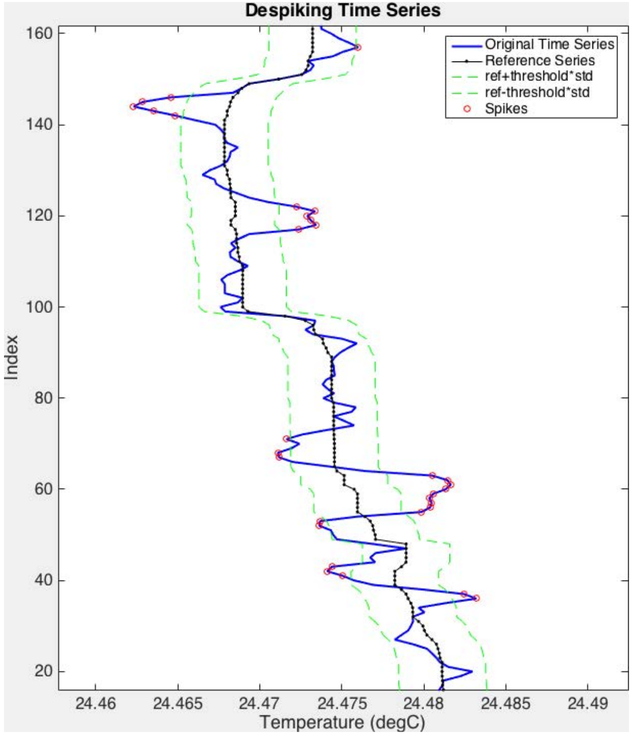
```
rsk = RSKremoveloops(rsk,'threshold',0.1);
```



RSKdespike

```
rsk = RSKdespike(rsk,’temperature',’threshold’,4,
'windowLength',11,'action’,’nan’);
```

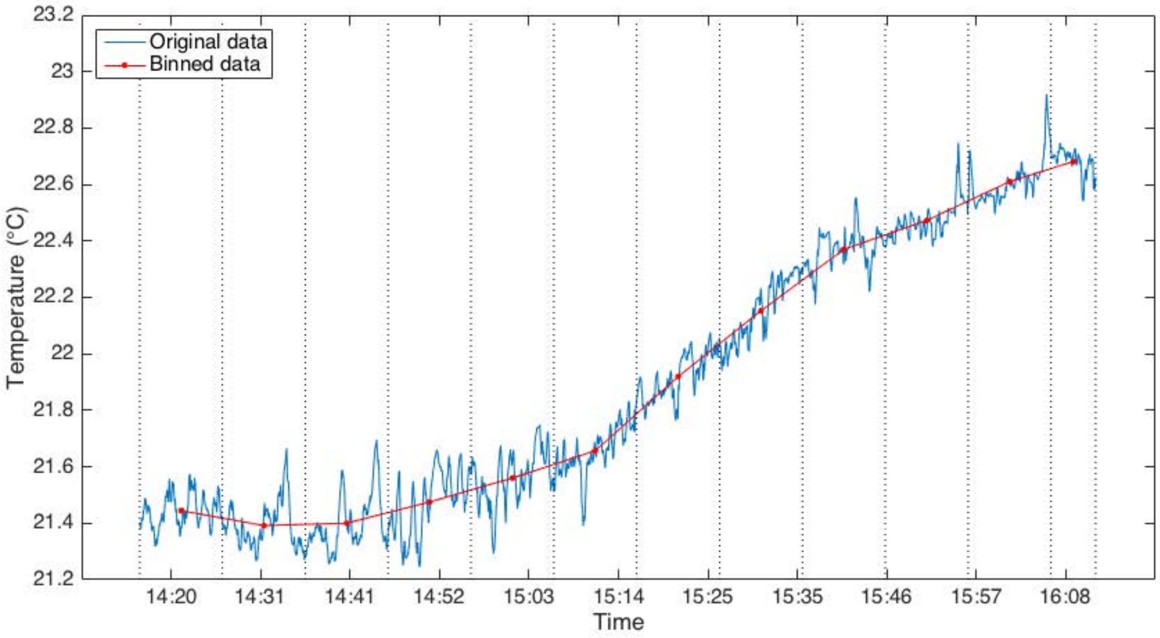
- Low-pass filter data to calculate a reference time series and standard deviation of the residuals.
- Data lying outside of 'threshold’ times of standard deviations are defined as spikes.
- Three methods to deal with spikes
  - NaN
  - replace
  - interp



RSKbinaverage

```
rsk = RSKbinaverage(rsk, 'binBy', ‘time', 'binSize’, 600);
```

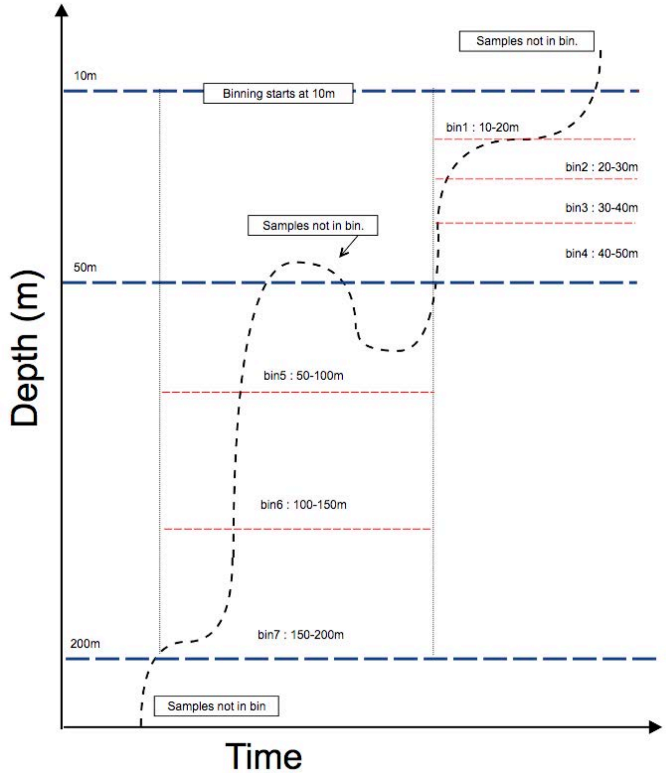
- Bin - average data within an interval
- Bin by sea pressure, depth, or time



RSKbinaverage

```
rsk = RSKbinaverage(rsk, 'direction', 'down', 'binBy', ‘depth', 
'binSize', 1, 'boundary', 1);
```

- RSKbinaverage supports regime binning (variable bin widths)
- Bin average according to pressure, depth, time, or any channel

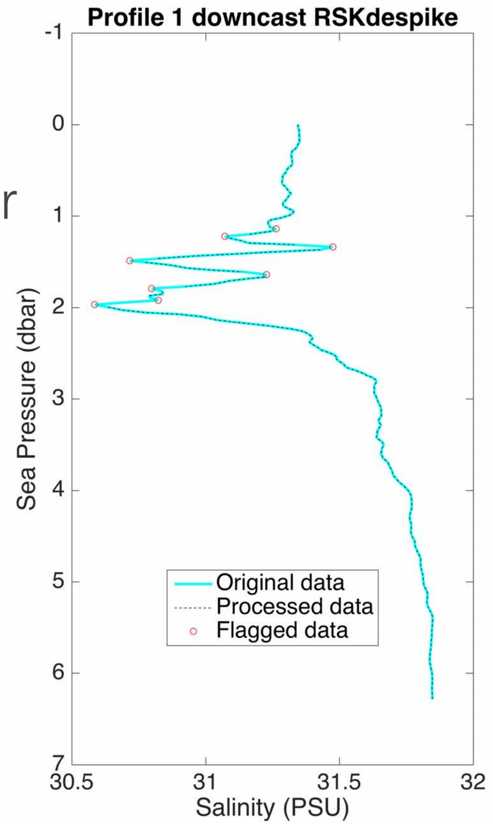


Visualization mode for post-process functions

```
rsk = RSKdespike(rsk,'salinity',
'threshold',1,'visualize',1);
```

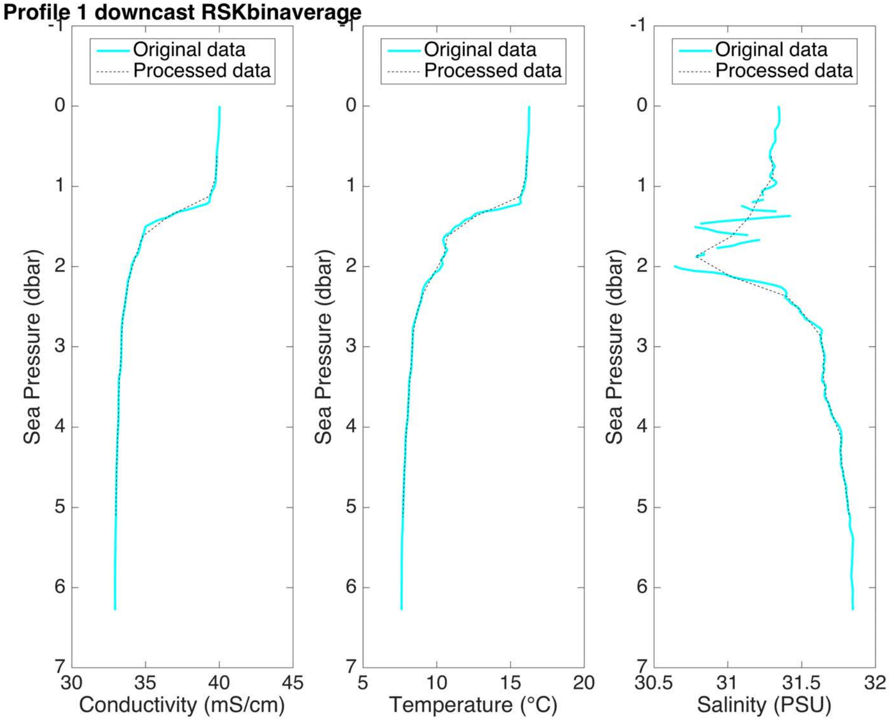
Profile number to visualize

- Optional input ‘visualize’ paired with profile number
- Display original, processed and flagged data.



Visualization mode for post-process functions

```
rsk = RSKbinaverage(rsk, 'binBy', ‘sea pressure',
'direction', 'down', 'visualize', 1);
```


Profile 1 downcast RSKbinaverage

RBR

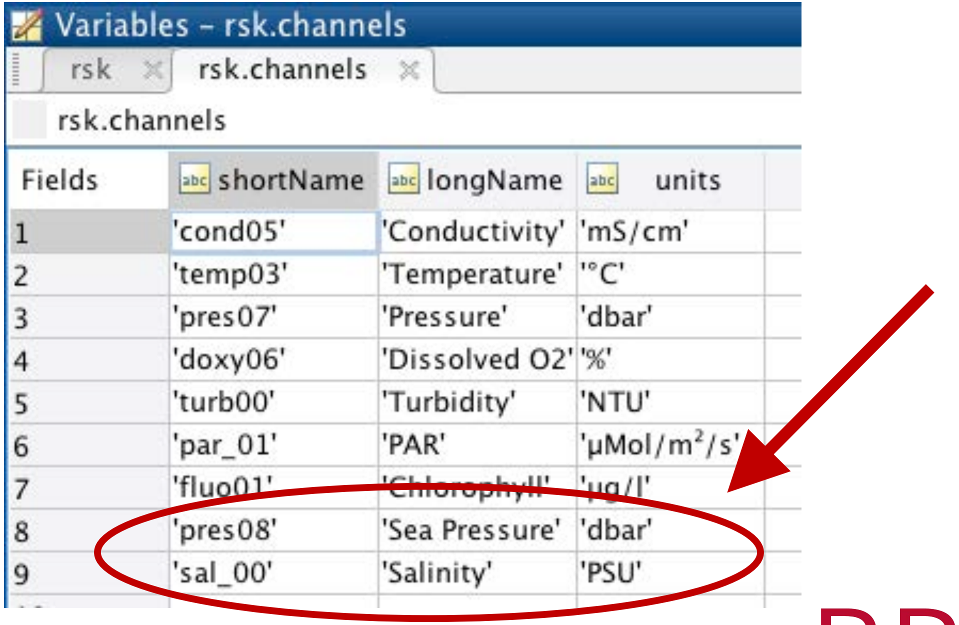
RSKderive

- sea pressure
- profiling velocity
- Sound speed
- Specific conductivity
- O2 concentration
- O2 saturation

TEOS-10 wrappers:

- depth
- Practical and Absolute Salinity
- Potential temperature and density
- buoyancy frequency
- …

```
rsk = RSKderiveseapressure(rsk);
rsk = RSKderivesalinity(rsk);
```



Fields	shortName	longName	units
1	'cond05'	'Conductivity'	'mS/cm'
2	'temp03'	'Temperature'	'°C'
3	'pres07'	'Pressure'	'dbar'
4	'doxy06'	'Dissolved O2'	'%'
5	'turb00'	'Turbidity'	'NTU'
6	'par_01'	'PAR'	'μMol/m^2/s'
7	'fluo01'	'Chlorophyll'	'μg/l'
8	'pres08'	'Sea Pressure'	'dbar'
9	'sal_00'	'Salinity'	'PSU'

Functions: Advanced post-processing

- RSKcorrecttau
- RSKcorrectTM

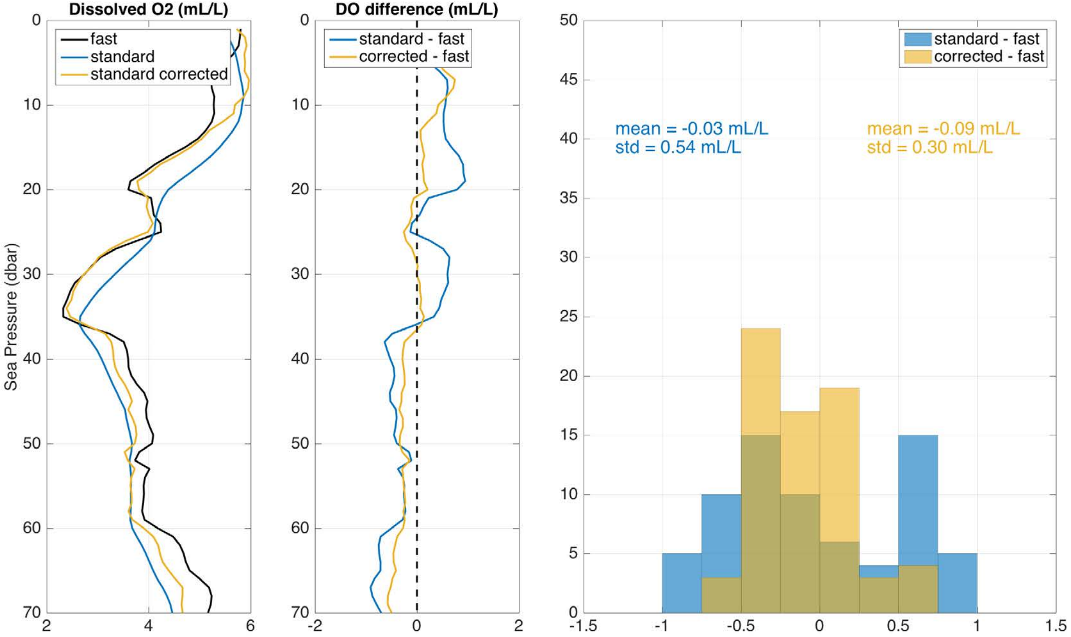
RSKcorrecttau

- Apply Fozdar et al. (1985) algorithm to correct the phase and amplitude response of measured signals.
- Known as signal reconstruction or “sharpening”
- Suitable for sensors with a relatively large time constant
    - Profiling with a dissolved oxygen sensor with $\tau = 8$ s
    - And/or fast profiling through large gradients

RSKcorrecttau

```
rsk = RSKcorrecttau(rsk,'channel','Dissolved O2','tauResponse',8)
```

- Application on RBR*coda* T.ODO (τ = 8s) in a profiling practice
- T.ODO|fast (τ = 1s) serve as a reference



RSKcorrectTM

```
rsk = RSKcorrecttau(rsk,’alpha’,0.08,’beta’,1/8);
```

- Applies the Lueck and Picklo (1990) algorithm to correct measured conductivity for thermal inertia

$$C_T(n) = -bC_T(n-1) + \gamma a[T(n) - T(n-1)]$$

$$a = 4f_N\alpha\beta^{-1}(1 + 4f_N\beta^{-1})^{-1}$$

$$b = 1 - 2a\alpha^{-1}$$

$$C_{cor}(n) = C(n) + C_T(n)$$

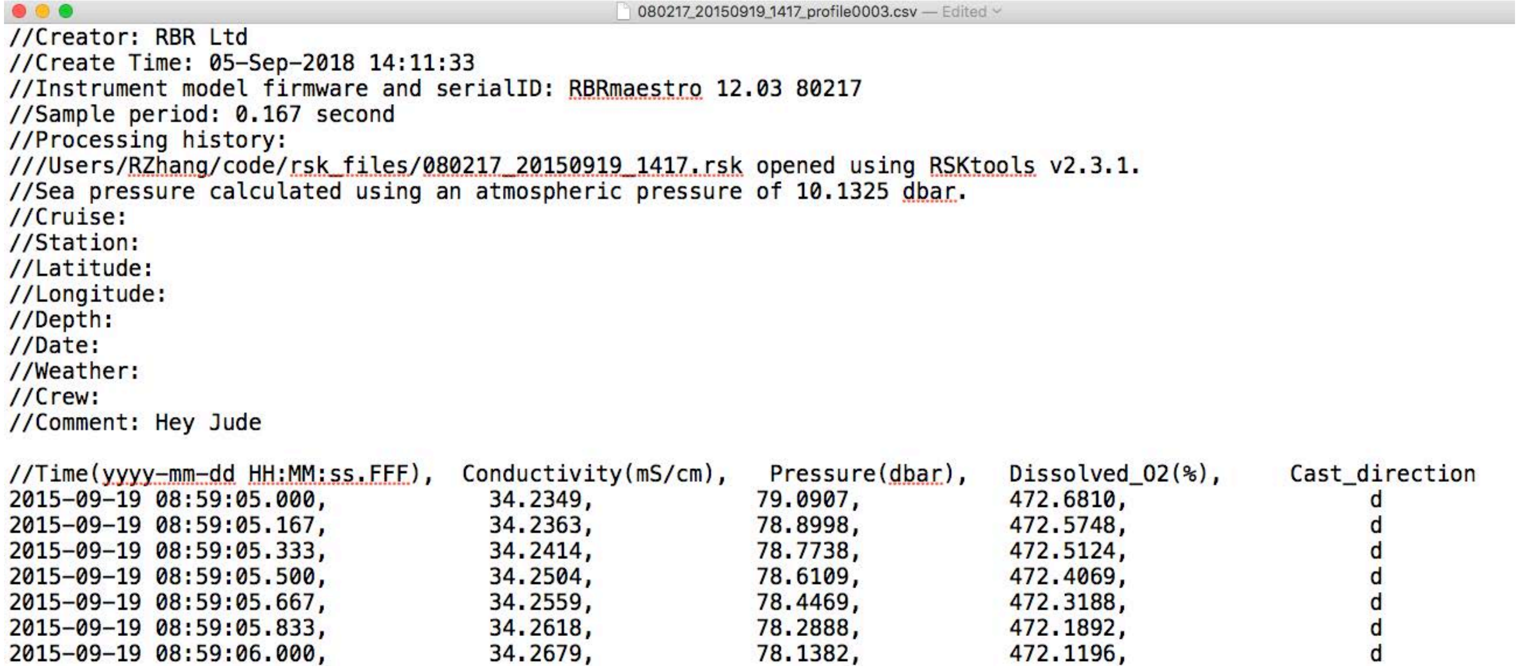
Lueck, R. G. and J. J. Picklo, 1990: Thermal inertia of conductivity cells: Observations with a Sea-Bird cell. J. Atmos. Oceanic Technol., 7, pp. 756 - 768. https://doi.org/10.1175/1520-0426(1990)007<0756:TIOCCO>2.0.CO;2

- Read
- View
- Process
- Export

RBR

RSK2CSV

```
RSK2CSV(rsk,'channel’,{‘conductivity’,’pressure’,’dissolved O2'},'outputdir','/Users/folder','comment','Hey Jude');
```

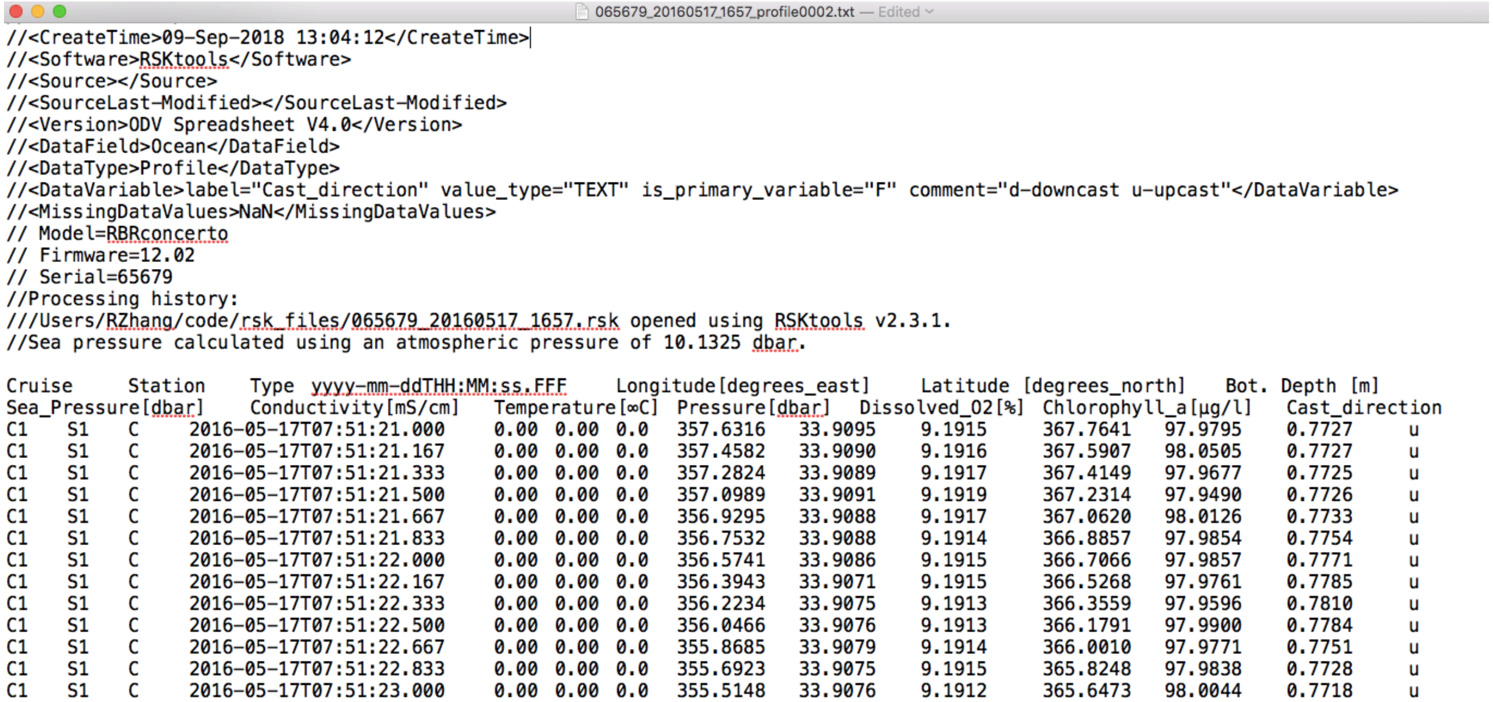


```
//Creator: RBR Ltd
//Create Time: 05-Sep-2018 14:11:33
//Instrument model firmware and serialID: RBRmaestro 12.03 80217
//Sample period: 0.167 second
//Processing history:
///Users/RZhang/code/rsk_files/080217_20150919_1417.rsk opened using RSKtools v2.3.1.
//Sea pressure calculated using an atmospheric pressure of 10.1325 dbar.
//Cruise:
//Station:
//Latitude:
//Longitude:
//Depth:
//Date:
//Weather:
//Crew:
//Comment: Hey Jude

//Time(yyyy-mm-dd HH:MM:ss.FFF),  Conductivity(mS/cm),  Pressure(dbar),  Dissolved_O2(%),    Cast_direction
2015-09-19 08:59:05.000,            34.2349,            79.0907,         472.6810,                 d
2015-09-19 08:59:05.167,            34.2363,            78.8998,         472.5748,                 d
2015-09-19 08:59:05.333,            34.2414,            78.7738,         472.5124,                 d
2015-09-19 08:59:05.500,            34.2504,            78.6109,         472.4069,                 d
2015-09-19 08:59:05.667,            34.2559,            78.4469,         472.3188,                 d
2015-09-19 08:59:05.833,            34.2618,            78.2888,         472.1892,                 d
2015-09-19 08:59:06.000,            34.2679,            78.1382,         472.1196,                 d
```

RSK2ODV

```
RSK2ODV(rsk)
```



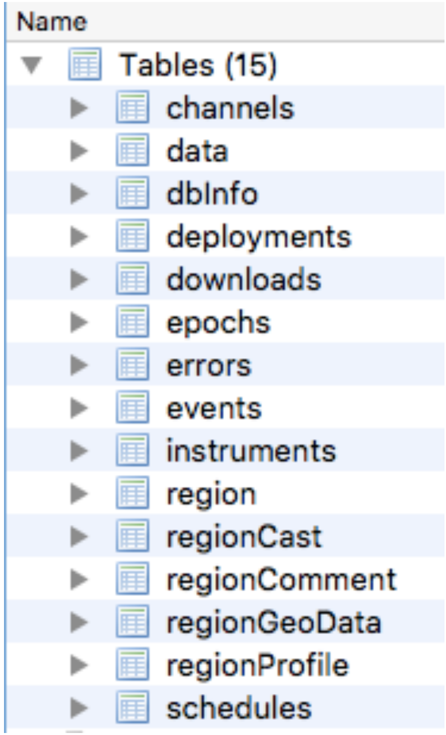
```
//<CreateTime>09-Sep-2018 13:04:12</CreateTime>
//<Software>RSKtools</Software>
//<Source></Source>
//<SourceLast-Modified></SourceLast-Modified>
//<Version>ODV Spreadsheet V4.0</Version>
//<DataField>Ocean</DataField>
//<DataType>Profile</DataType>
//<DataVariable>label="Cast_direction" value_type="TEXT" is_primary_variable="F" comment="d-downcast u-upcast"</DataVariable>
//<MissingDataValues>NaN</MissingDataValues>
// Model=RBRconcerto
// Firmware=12.02
// Serial=65679
//Processing history:
///Users/RZhang/code/rsk_files/065679_20160517_1657.rsk opened using RSKtools v2.3.1.
//Sea pressure calculated using an atmospheric pressure of 10.1325 dbar.

Cruise     Station     Type  yyyy-mm-ddTHH:MM:ss.FFF     Longitude[degrees_east]     Latitude [degrees_north]    Bot. Depth [m]
Sea_Pressure[dbar]     Conductivity[mS/cm]     Temperature[∞C]  Pressure[dbar]   Dissolved_O2[%]  Chlorophyll_a[µg/l]    Cast_direction
C1    S1    C     2016-05-17T07:51:21.000    0.00  0.00  0.0   357.6316    33.9095     9.1915     367.7641    97.9795    0.7727      u
C1    S1    C     2016-05-17T07:51:21.167    0.00  0.00  0.0   357.4582    33.9090     9.1916     367.5907    98.0505    0.7727      u
C1    S1    C     2016-05-17T07:51:21.333    0.00  0.00  0.0   357.2824    33.9089     9.1917     367.4149    97.9677    0.7725      u
C1    S1    C     2016-05-17T07:51:21.500    0.00  0.00  0.0   357.0989    33.9091     9.1919     367.2314    97.9490    0.7726      u
C1    S1    C     2016-05-17T07:51:21.667    0.00  0.00  0.0   356.9295    33.9088     9.1917     367.0620    98.0126    0.7733      u
C1    S1    C     2016-05-17T07:51:21.833    0.00  0.00  0.0   356.7532    33.9088     9.1914     366.8857    97.9854    0.7754      u
C1    S1    C     2016-05-17T07:51:22.000    0.00  0.00  0.0   356.5741    33.9086     9.1915     366.7066    97.9857    0.7771      u
C1    S1    C     2016-05-17T07:51:22.167    0.00  0.00  0.0   356.3943    33.9071     9.1915     366.5268    97.9761    0.7785      u
C1    S1    C     2016-05-17T07:51:22.333    0.00  0.00  0.0   356.2234    33.9075     9.1913     366.3559    97.9596    0.7810      u
C1    S1    C     2016-05-17T07:51:22.500    0.00  0.00  0.0   356.0466    33.9076     9.1913     366.1791    97.9900    0.7784      u
C1    S1    C     2016-05-17T07:51:22.667    0.00  0.00  0.0   355.8685    33.9079     9.1914     366.0010    97.9771    0.7751      u
C1    S1    C     2016-05-17T07:51:22.833    0.00  0.00  0.0   355.6923    33.9075     9.1915     365.8248    97.9838    0.7728      u
C1    S1    C     2016-05-17T07:51:23.000    0.00  0.00  0.0   355.5148    33.9076     9.1912     365.6473    98.0044    0.7718      u
```

RSK2RSK

```
newfile = RSK2RSK(rsk)
```

- Write rsk file using simplest schema
- Write post-processed RBR data in an RSK file
- Readable with Ruskin
- Independent from original RSK file



Name

Tables (15)

- channels
- data
- dbInfo
- deployments
- downloads
- epochs
- errors
- events
- instruments
- region
- regionCast
- regionComment
- regionGeoData
- regionProfile
- schedules

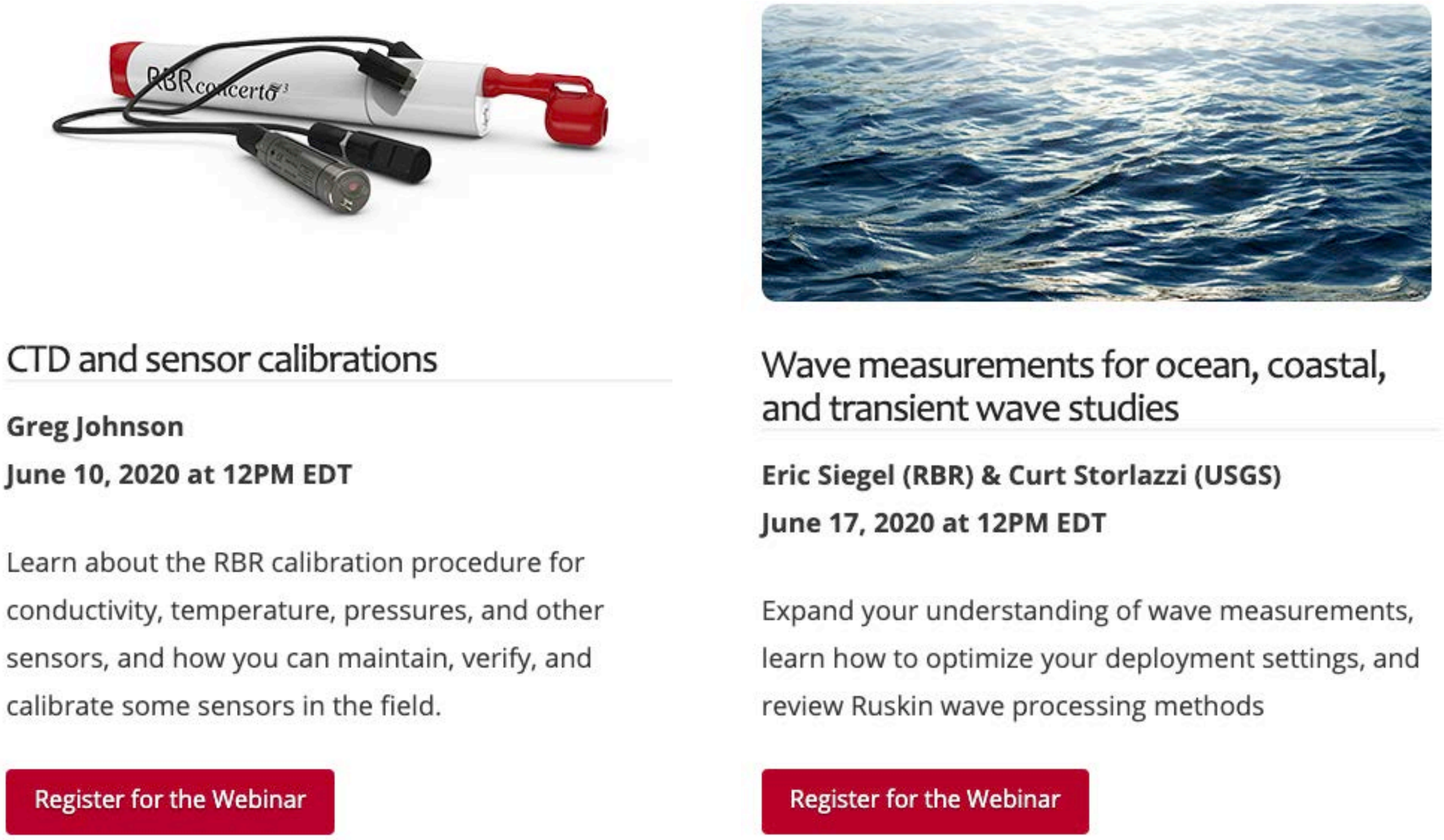
RSKcreate – convert ANY data into the rsk structure

- Any data source: other CTDs, float, gilder, etc
- Legacy RBR instruments
- Apply RSKtools function to any dataset!

```
tstamp = [735722.625196759;
          735722.625198692;
          735722.625200613];
values =  [39.9973,   16.2695,   10.1034;
           39.9873,   16.2648,   10.1266;
           39.9887,   16.2553,   10.1247];
channel = {'Conductivity','Temperature','Pressure'};
unit = {'mS/cm','°C','dbar’};
rsk = RSKcreate('tstamp',tstamp,'values',values,
'channel',channel,'unit',unit);
```

Upcoming Webinars

Future Webinars



CTD and sensor calibrations

Greg Johnson

June 10, 2020 at 12PM EDT

Learn about the RBR calibration procedure for conductivity, temperature, pressures, and other sensors, and how you can maintain, verify, and calibrate some sensors in the field.

Wave measurements for ocean, coastal, and transient wave studies

Eric Siegel (RBR) & Curt Storlazzi (USGS)

June 17, 2020 at 12PM EDT

Expand your understanding of wave measurements, learn how to optimize your deployment settings, and review Ruskin wave processing methods

Thank You

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