# : A Software System for Oceanographic Work at the Interface


Clark Richards[1] Dan Kelley[2]

RBR

[1]RBR Ltd.
Ottawa, ON
clarkrichards.org

[2]Dalhousie University
Halifax, NS


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# Data analysis tools are as important to our work as the instruments that collect the data

Increasingly scientists need to consider:

- code sharing (i.e. “collaboration”)
- public access
- long-term access and reproducibility

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# What is R?

www.r-project.org

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R is a free software environment for statistical computing and graphics. R is available as Free Software under the terms of the Free Software Foundation's GNU General Public License in source code form. It compiles and runs on a wide variety of UNIX platforms and similar systems (including FreeBSD and Linux), Windows and MacOS.

# Why R?

Community:

- Free ("as in beer" and "as in speech")
- Large (and growing), diverse user base (including non-geoscience)
- Organized (R Core Team, R Foundation, R Consortium)

Technical:

- packages and the CRAN package repository
- object orientation
- reproducible research tools

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# Package system

## What is a “package”?

A rigorous and precise system for collecting functions and data that ensures:

- working code
- accurate documentation
- correct results (tests)
- cross-platform

# Comprehensive R Archive Network (CRAN)

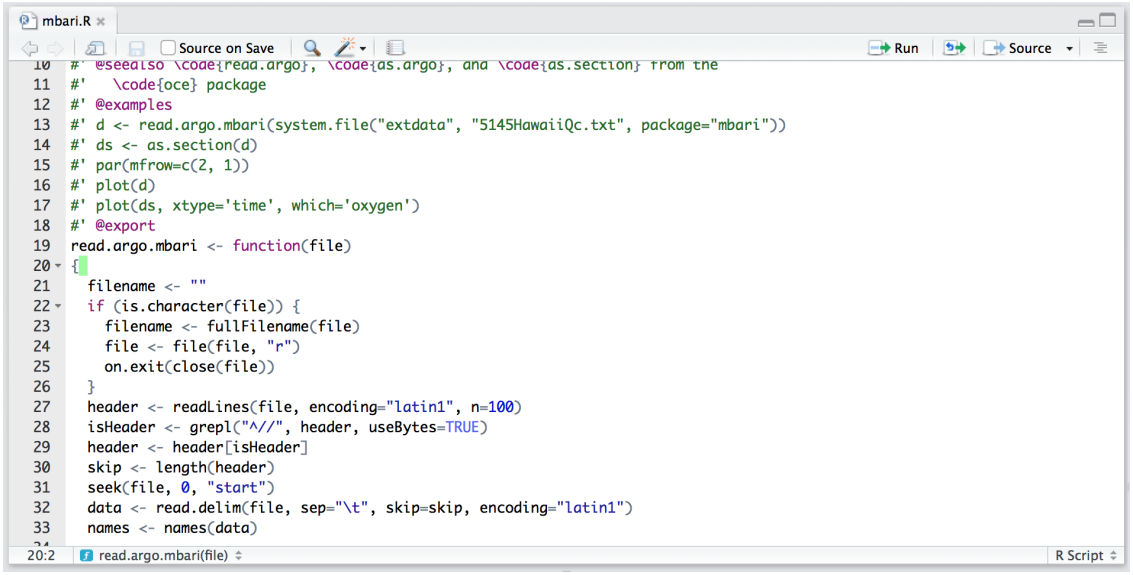
## CRAN

A ***curated*** repository for packages

- ensures dependency installation
- archived versions
- frequently updated and maintained
- unambiguous copyright and license requirements (i.e. FOSS)
- currently over 6000 packages available

# What's in a package?

- code (functions)
- data
- documentation
- tests/examples/vignettes
- dependency information (and other metadata)



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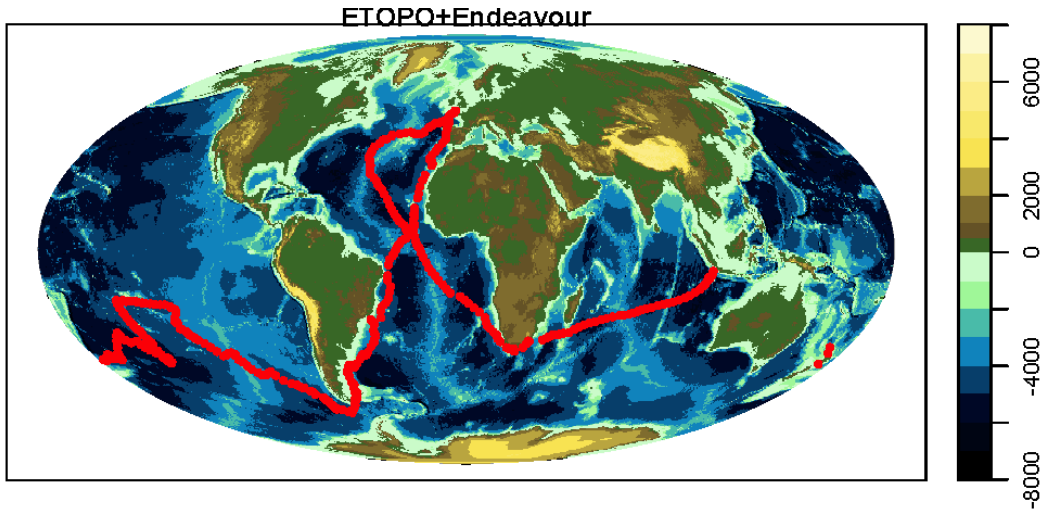

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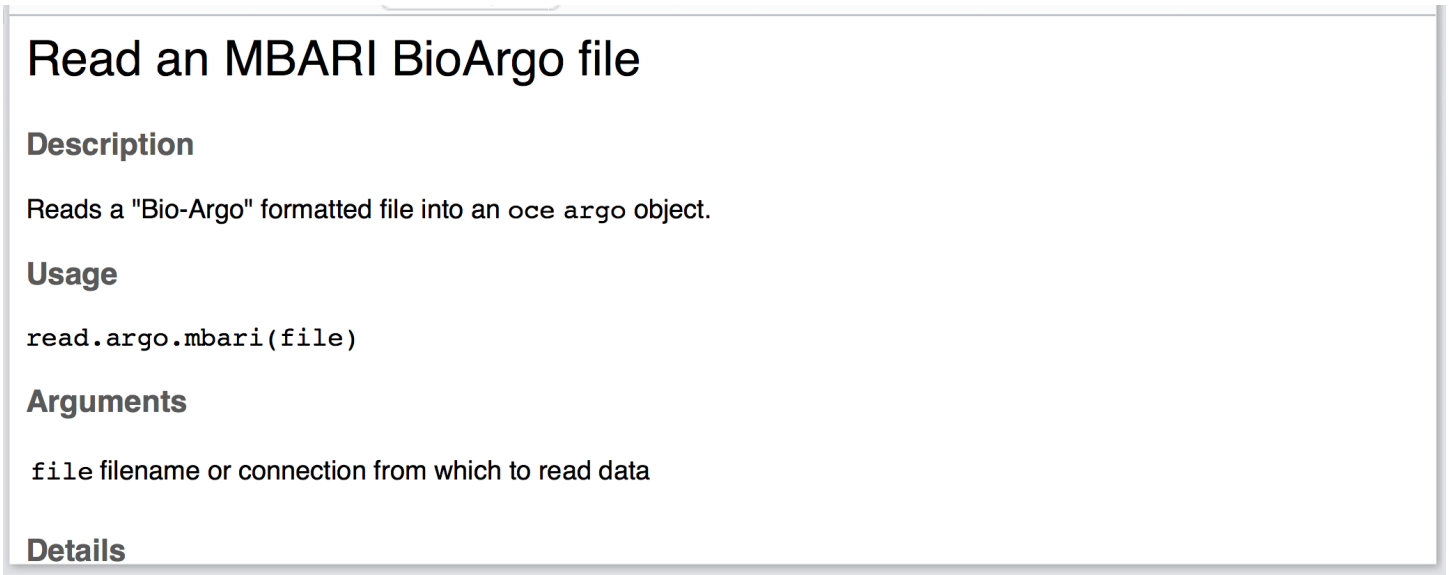

## Read an MBARI BioArgo file

**Description**

Reads a "Bio-Argo" formatted file into an `oce` `argo` object.

**Usage**

```
read.argo.mbari(file)
```

**Arguments**

`file` filename or connection from which to read data

**Details**

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Clark Richards, Dan Kelley, Cara Wilson

**See Also**

`read.argo`, `as.argo`, and `as.section` from the `oce` package

**Examples**

```
d <- read.argo.mbari(system.file("extdata", "5145HawaiiQc.txt", package="mbari"))
ds <- as.section(d)
par(mfrow=c(2, 1))
plot(d)
plot(ds, xtype='time', which='oxygen')
```

[Package *mbari* version 0.1.0 Index]

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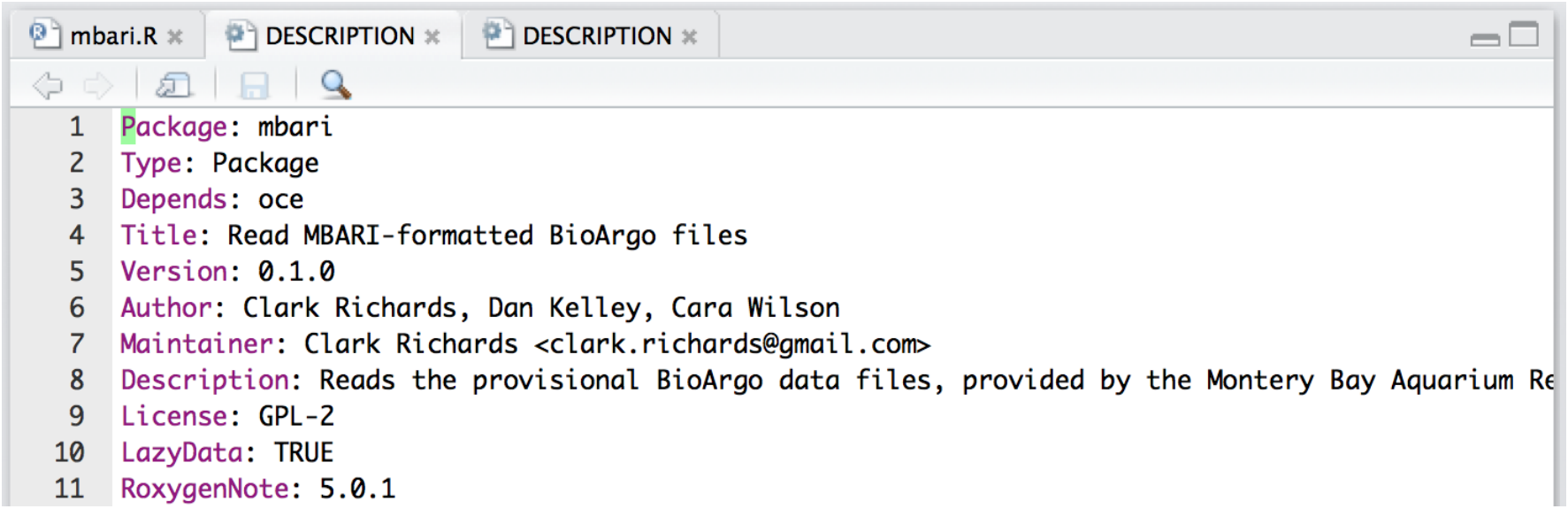


# The **oce** package

## What is **oce**?

**Oce** is a package that helps Oceanographers by providing functions to read Oceanographic data files, to process the data in instrument-specific ways, and to represent the results with plots that follow Oceanographic convention.

`dankelley.github.io/oce`


Overview

Installation

Examples

Documentation

Datasets

Bugs

## Overview

Oce is a package for the R statistical language that helps Oceanographers do their work by providing functions to read Oceanographic data files, to process the data in instrument-specific ways, and to represent the results with plots that follow Oceanographic convention.

Developed in university and research settings, Oce is simple enough for novices but powerful enough for experts.

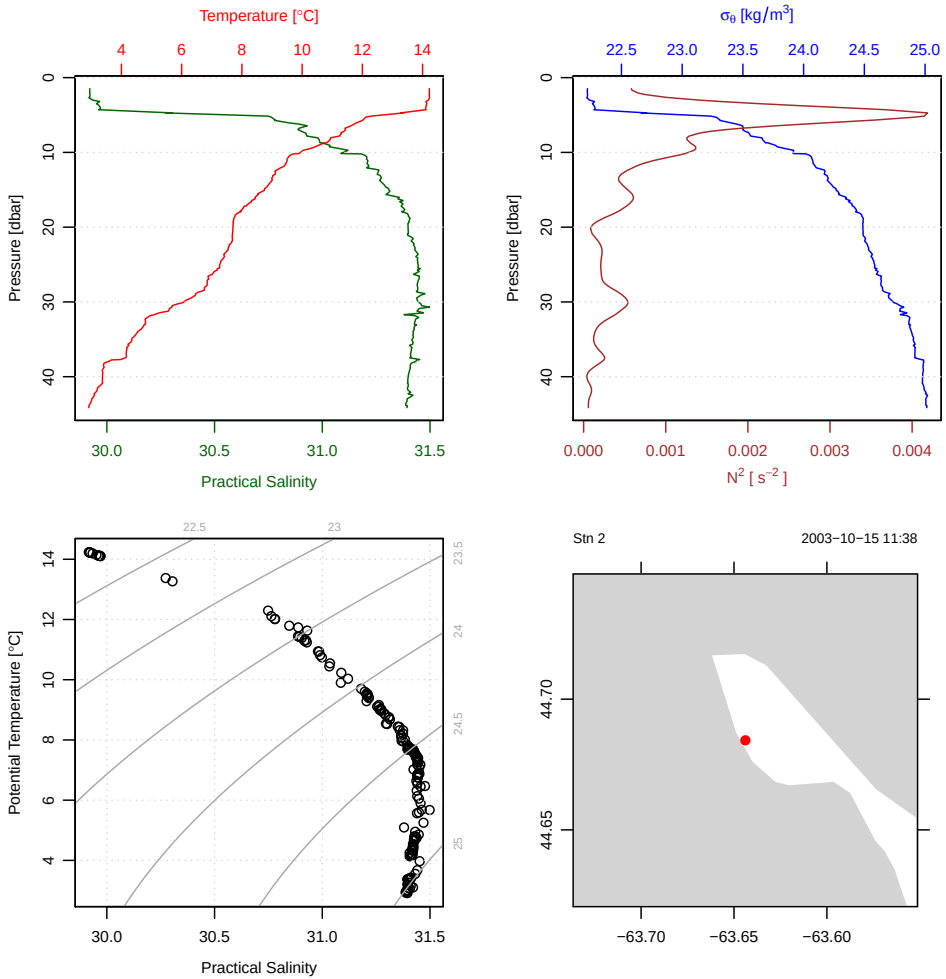
Oce makes heavy use of the R notion of *generic functions*, so that a single function call works across a wide range of data types. For example,

```
library(oce)
d <- read.oce("file")
plot(d)
```

will produce a useful plot that is tailored to the type of data stored in the file named `file`. For example, if `file`

# **oce** example

```
## install.packages('oce')          # install from CRAN
library(oce)                        # load the package
data(ctd)                           # an example dataset
plot(ctd)                           # default ctd plot
```



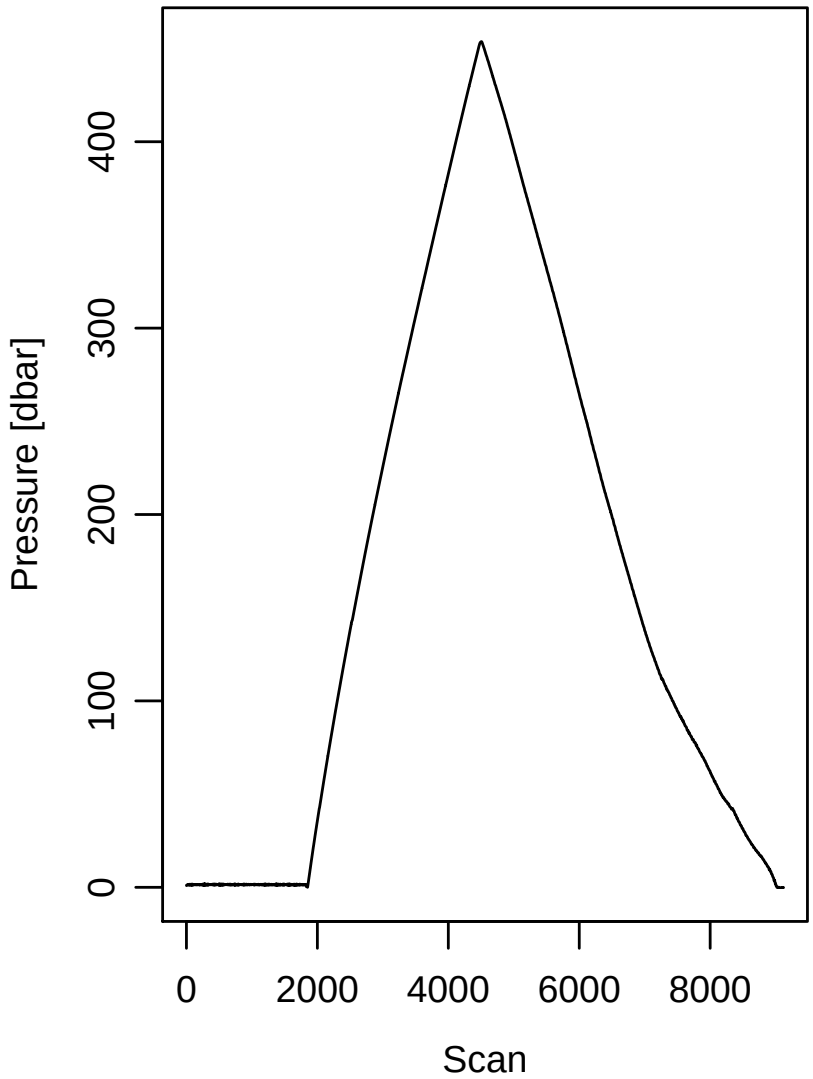
# Working with CTD data

## Data collected in Northwest Greenland by OceanResearchProject.org

```
library(oce)
rsk <- read.oce('data/ORP.rsk')
ctd <- as.ctd(rsk)
plotScan(ctd)
```

```
## trim the cast
ctd <- ctdTrim(ctd,
  parameters=list(pmin=3))
plotScan(ctd)
```

```
## Plot some profiles
plotProfile(ctd)
```



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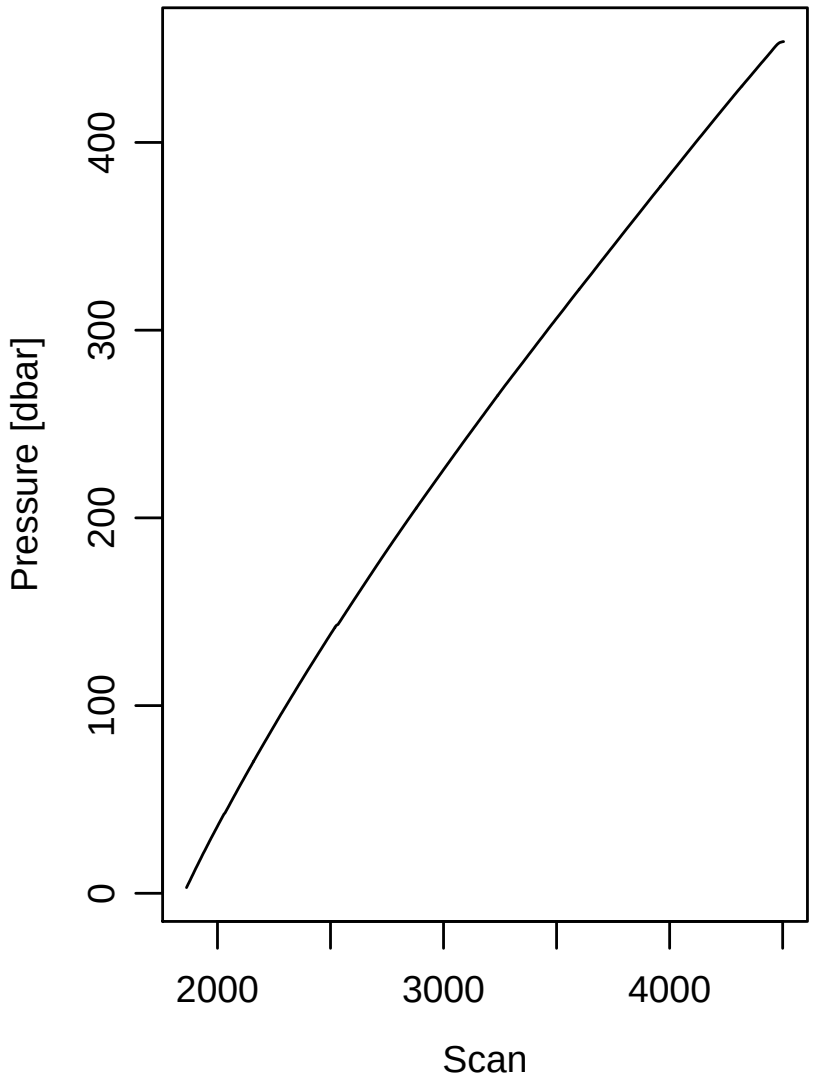

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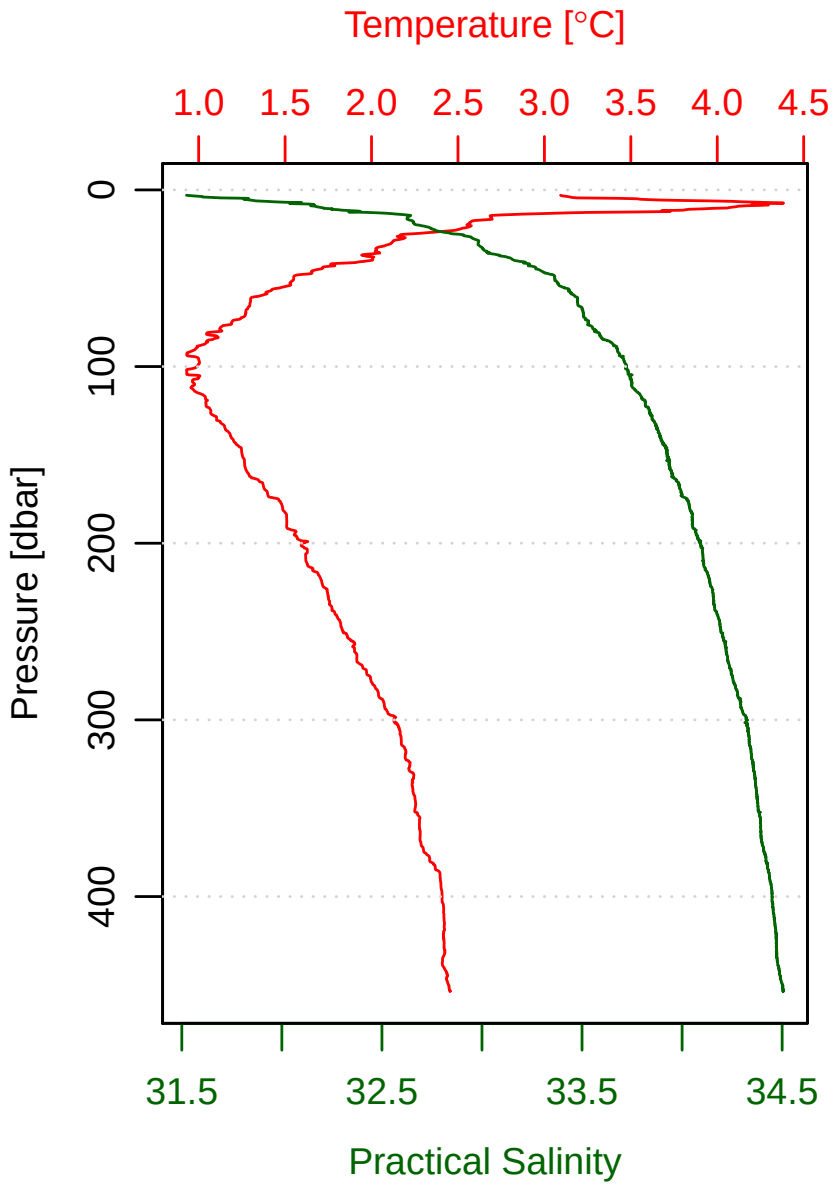
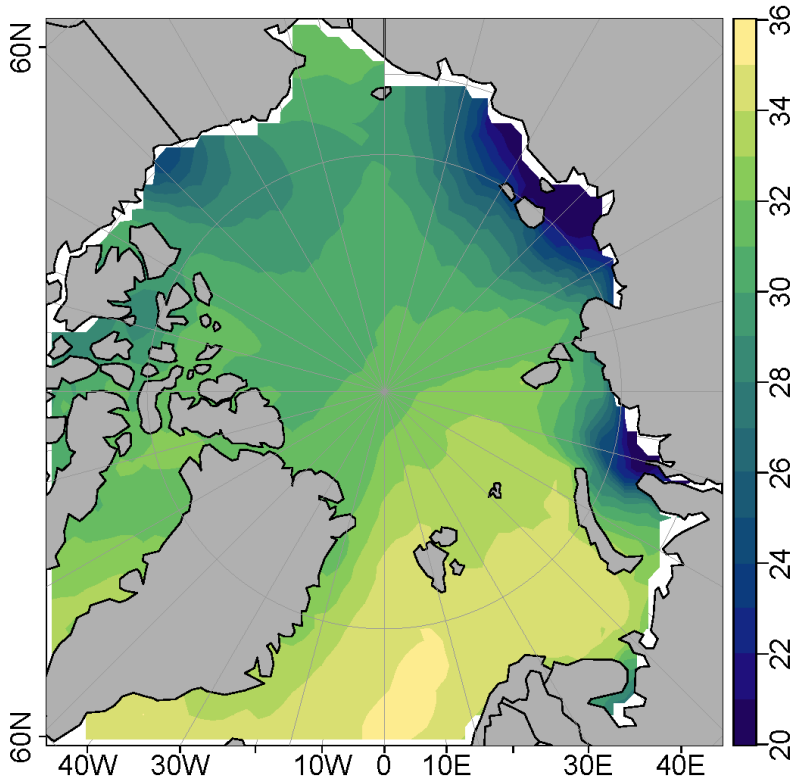


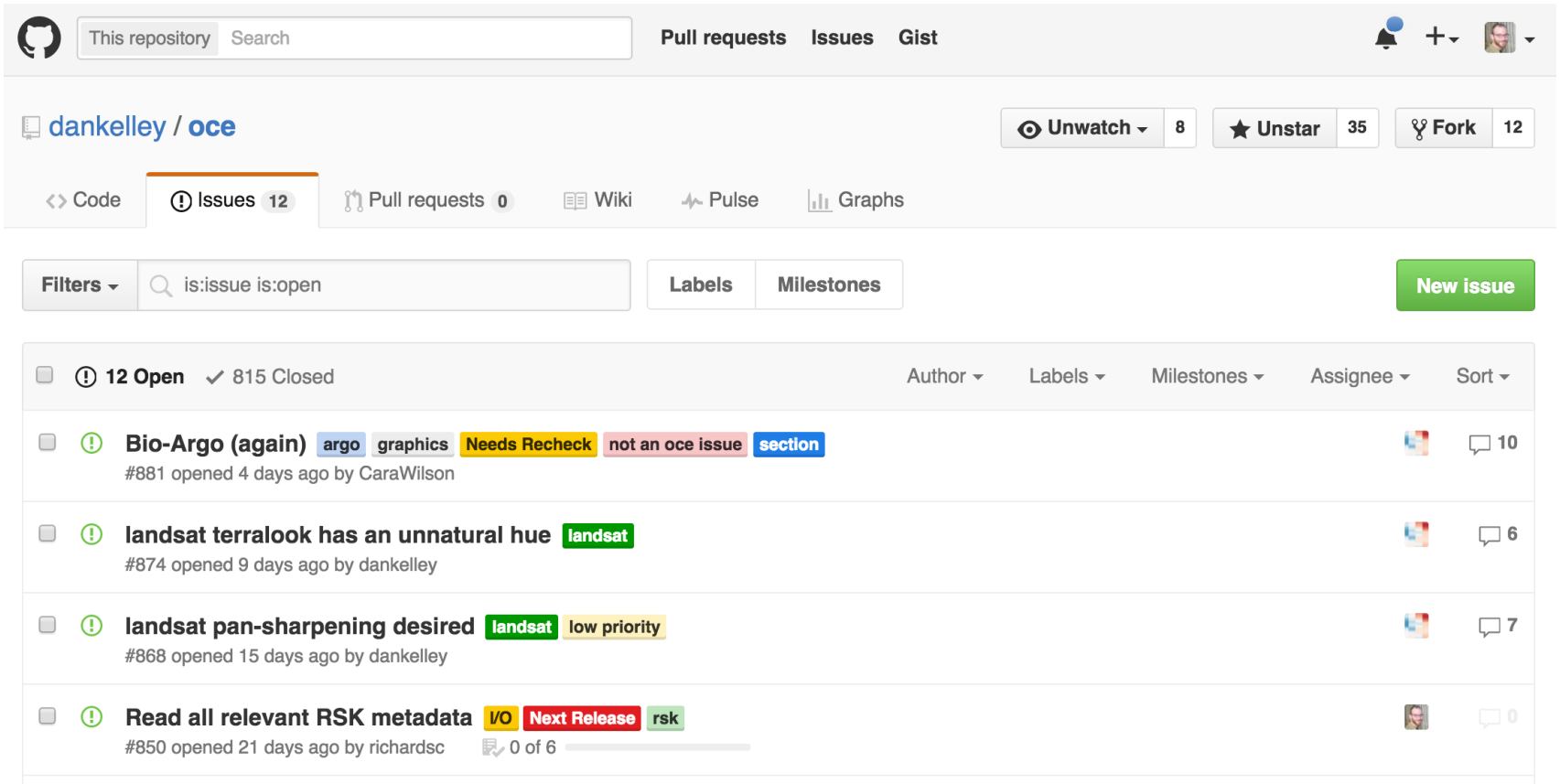
```
data(levitus)
SSScmap <- colormap(levitus$SSS, breaks=seq(20, 36, 1),
                    col=oceColorsSalinity, missingColor = NA)
drawPalette(colormap=SSScmap)
mapPlot(coastlineWorld, projection='+proj=stere +lat_0=90',
        longitudelim = c(-180, 180), latitudelim = c(70, 90))
mapImage(levitus$longitude, levitus$latitude,
         levitus$SSS, colormap=SSScmap, filledContour = TRUE)
mapPolygon(coastlineWorld, col='grey'); mapGrid()
```



# R and oce are user driven

- Development on Github
  - Issues/bugs/requests
  - Pull Requests

`https://github.com/dankelley/oce`



# Other useful ocean packages

- **ocedata** (extra data sets for oce)
- **ncdf4** (read/write netcdf files)
- **gsw** (TEOS-10 routines)
- **rerddap** (Connect to the NOAA ERDDAP server)
- **OceanView** (3D data/model visualization)
- **marmap** (bathymetry data and mapping)
- **seacarb** (seawater carbonate chemistry)
- **signal** (time series tools, e.g. filters)
- **fields** (spatial gridding/interpolation)
- **deSolve** (differential equations)
- **rpy2** (connect R and python)
- ...

# More resources

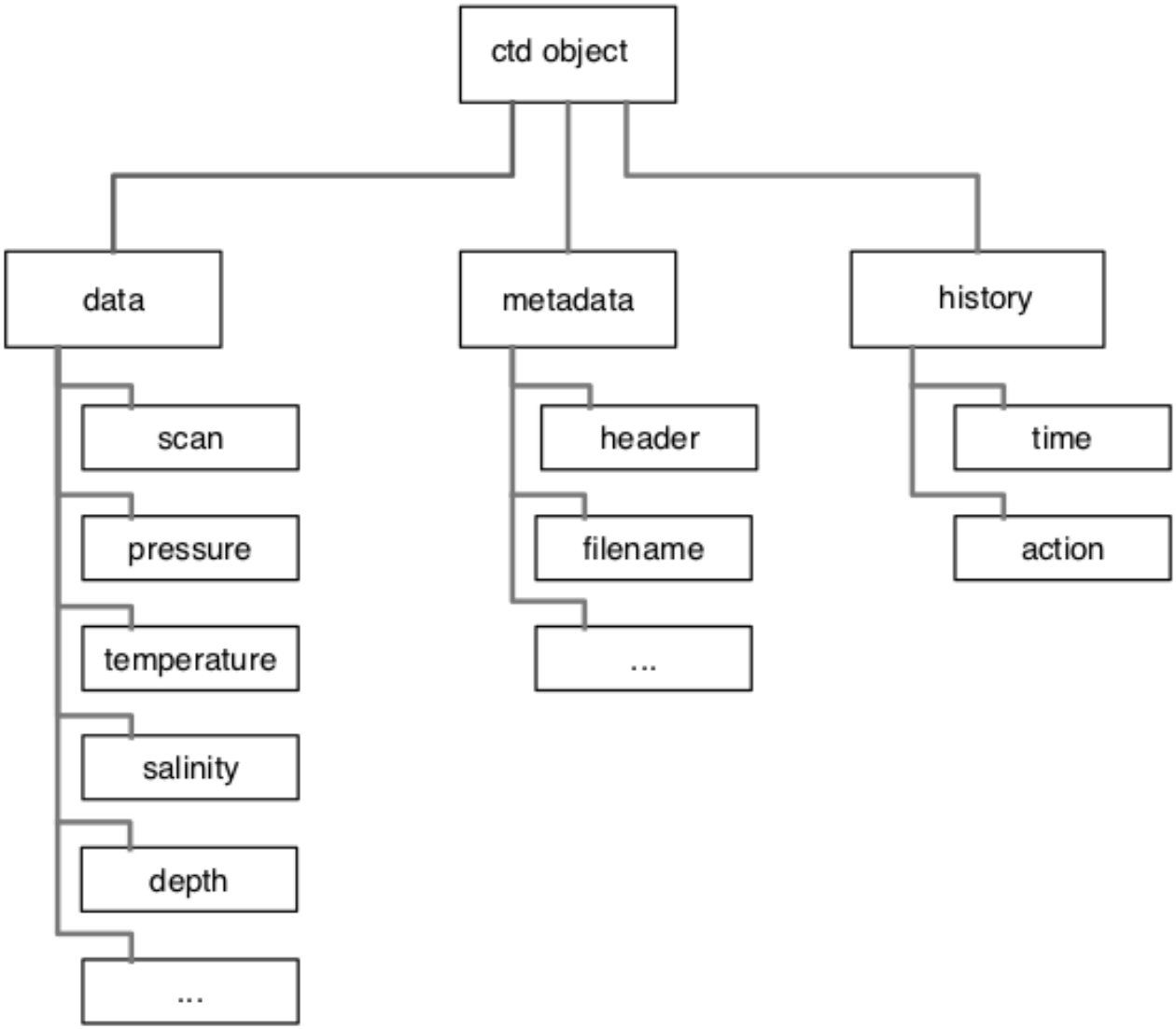
- R in Nature: `http://www.nature.com/news/programming-tools-adventures-with-r-1.16609?WT.ec_id=NATURE-20141225`
- Hadley Wickam
  - Advanced R: `http://adv-r.had.co.nz/`
  - R packages: `http://r-pkgs.had.co.nz/`
- RStudio: `https://www.rstudio.com/`

Thanks!

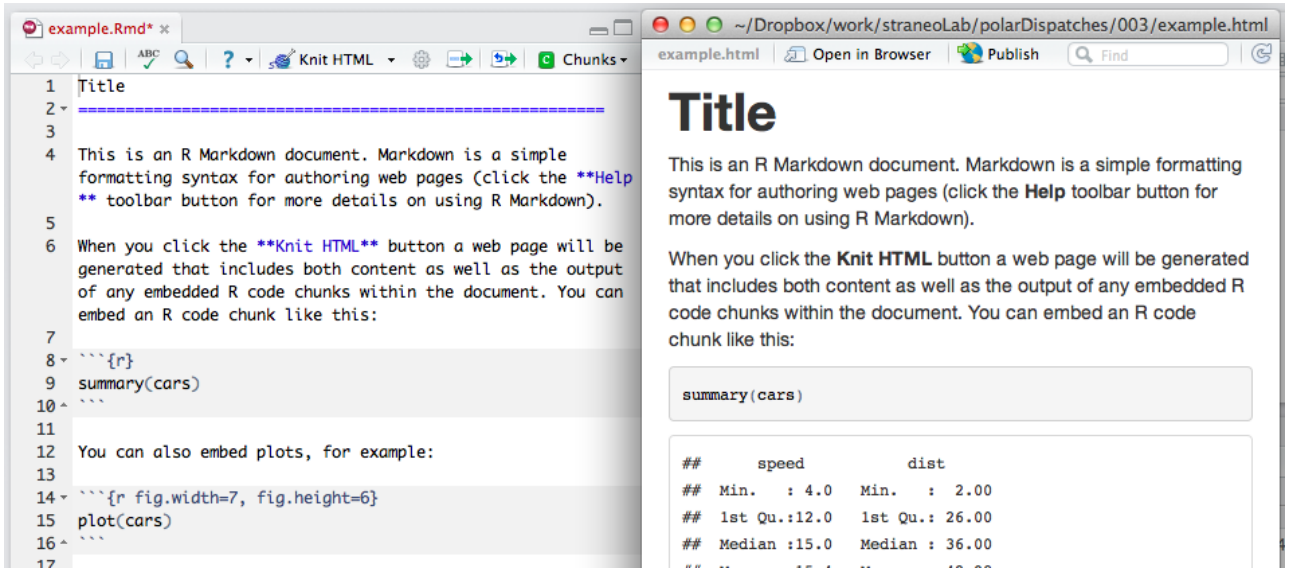
# Object orientation

## Example ctd object

- object classes
- generic methods
- `plot()`, `summary()`, `subset()`



# Reproducible Research




## Dynamic Documents

- Seamless integration of text, code, and figures
- Markdown or LaTeX source (also Jupyter notebooks)
- Output to various different formats (PDF, HTML, DOCX, ...)
- This document is an example