



# Marine Data Science

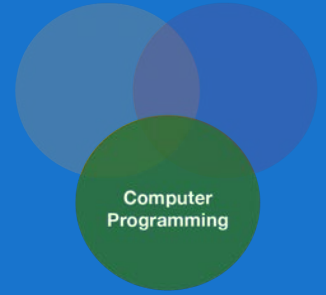


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# Data Analysis with R

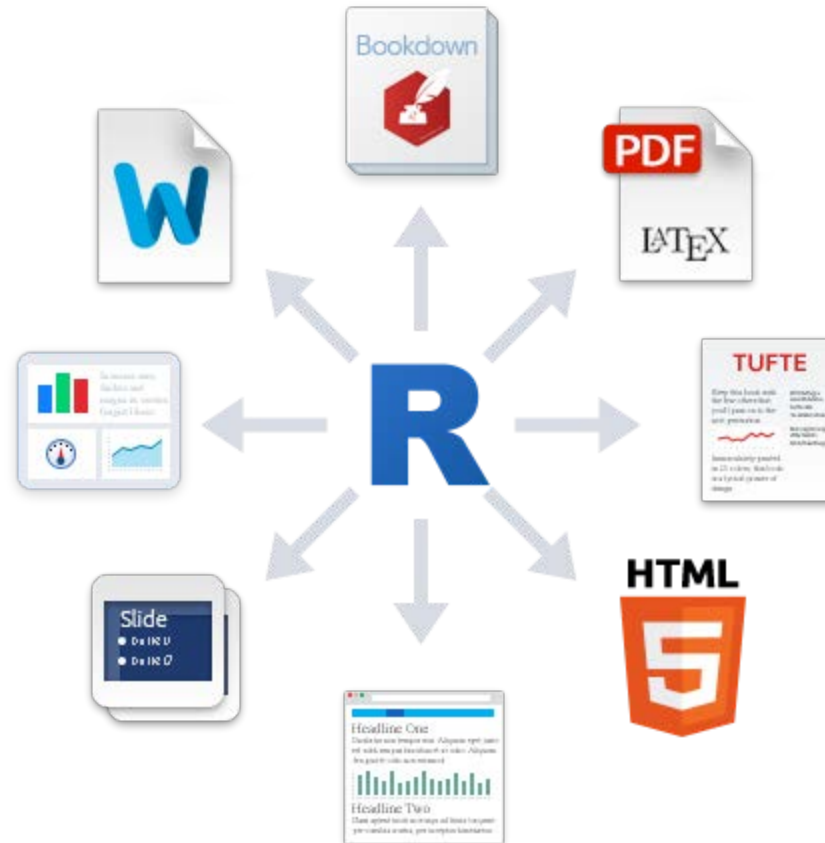
## 11 - R Markdown for communication

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Postdoctoral Researcher



# R Markdown

# How to go from R to any output format for sharing your results?

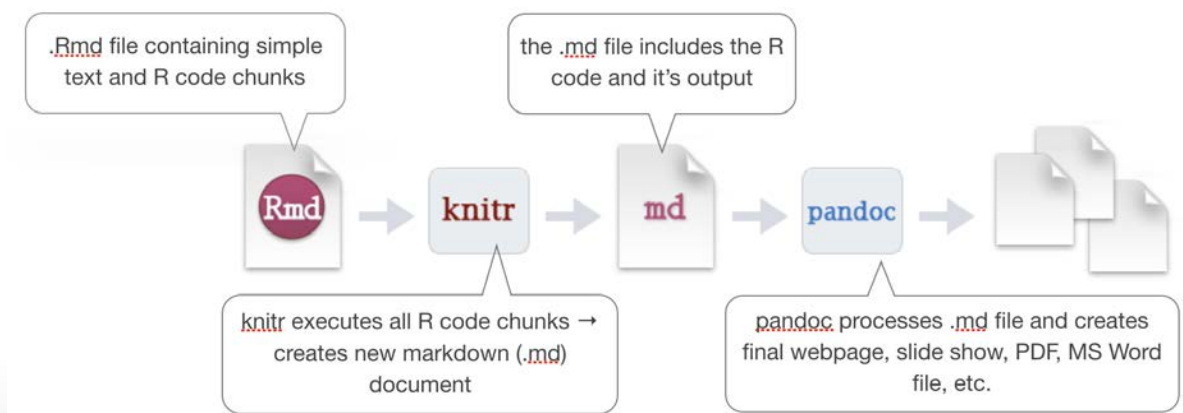


source: [rmarkdown.rstudio.com](https://rmarkdown.rstudio.com)

# By using R Markdown



- R Markdown is an easy-to-write **plain text formatter** designed to make web content, reports or presentations easy to create,
- can **weave** the outputs of your R code, like **figures and tables**, with **text** to create a report,
- supports not only the **reproducibility** of your analysis but also the **entire report**,
- supports various different **static** as well as **dynamic output formats**.
- How does it work? R Markdown encapsulates various processes into a single render function:



## A quick introduction

# What is R Markdown?



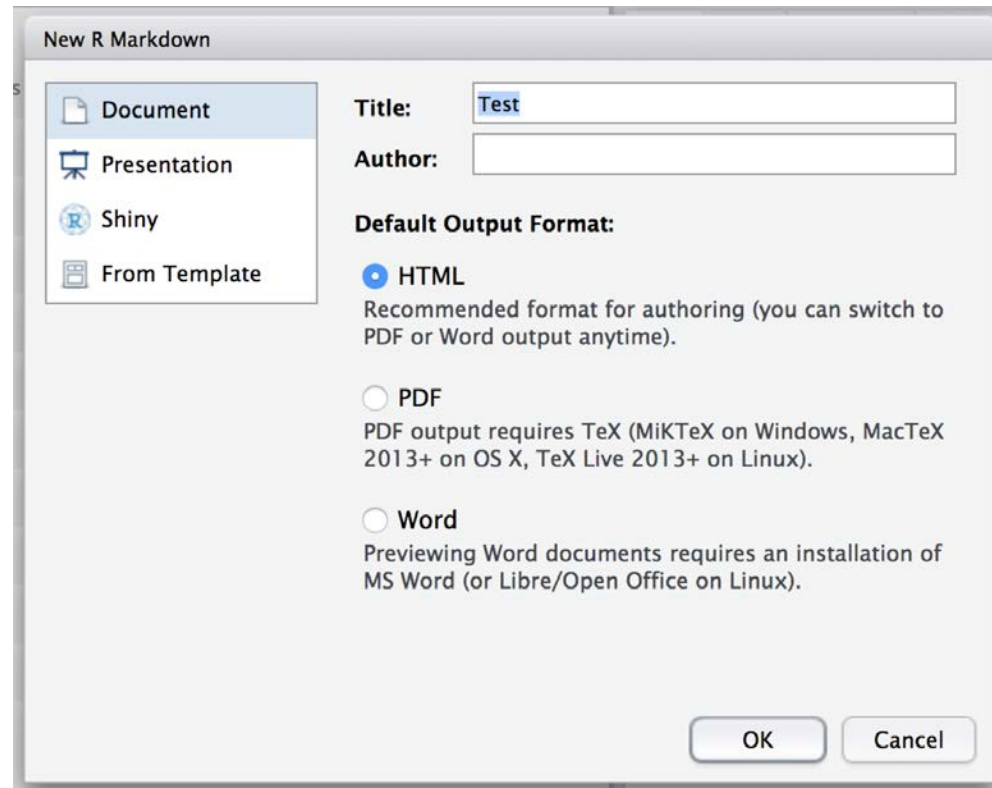
01:12



Studio



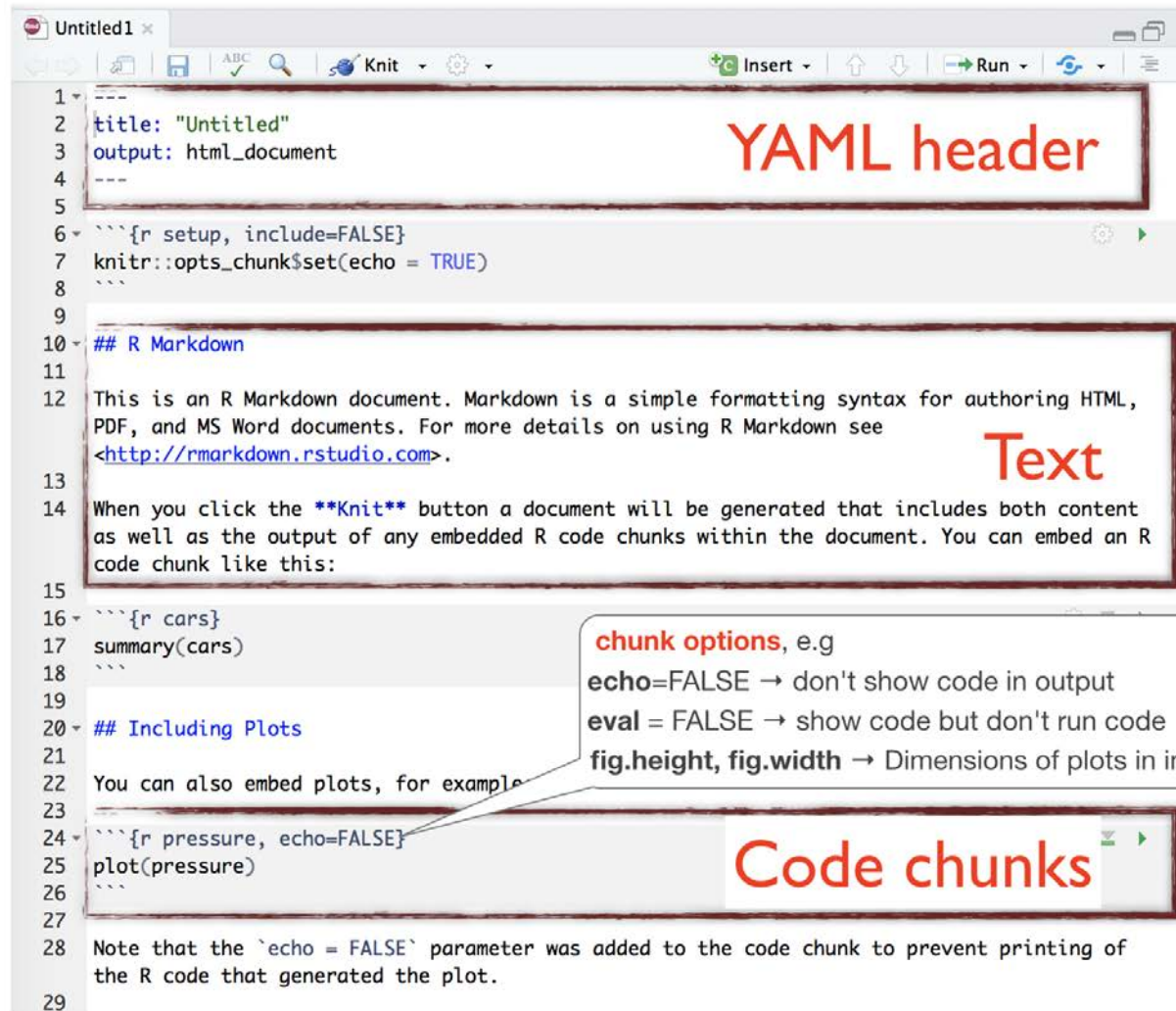
# How to create an .Rmd file



# Structure of an .Rmd file



# Structure of an .Rmd file



```
1 ---
2 title: "Untitled"
3 output: html_document
4 ---
5
6 ```{r setup, include=FALSE}
7 knitr::opts_chunk$set(echo = TRUE)
8 ```
9
10 ## R Markdown
11
12 This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML,
13 PDF, and MS Word documents. For more details on using R Markdown see
14 <http://rmarkdown.rstudio.com>.
15
16 When you click the Knit button a document will be generated that includes both content
17 as well as the output of any embedded R code chunks within the document. You can embed an R
18 code chunk like this:
19
20 ```{r cars}
21 summary(cars)
22 ```
23
24 ## Including Plots
25
26 You can also embed plots, for example:
27
28 ```{r pressure, echo=FALSE}
29 plot(pressure)
30 ```
31
32 Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of
33 the R code that generated the plot.
```

**YAML header**

**Text**

**Code chunks**

**chunk options**, e.g  
echo=FALSE → don't show code in output  
eval = FALSE → show code but don't run code  
fig.height, fig.width → Dimensions of plots in inches

Metadata  
section that  
determines the  
output style

Simple text with  
header (#)

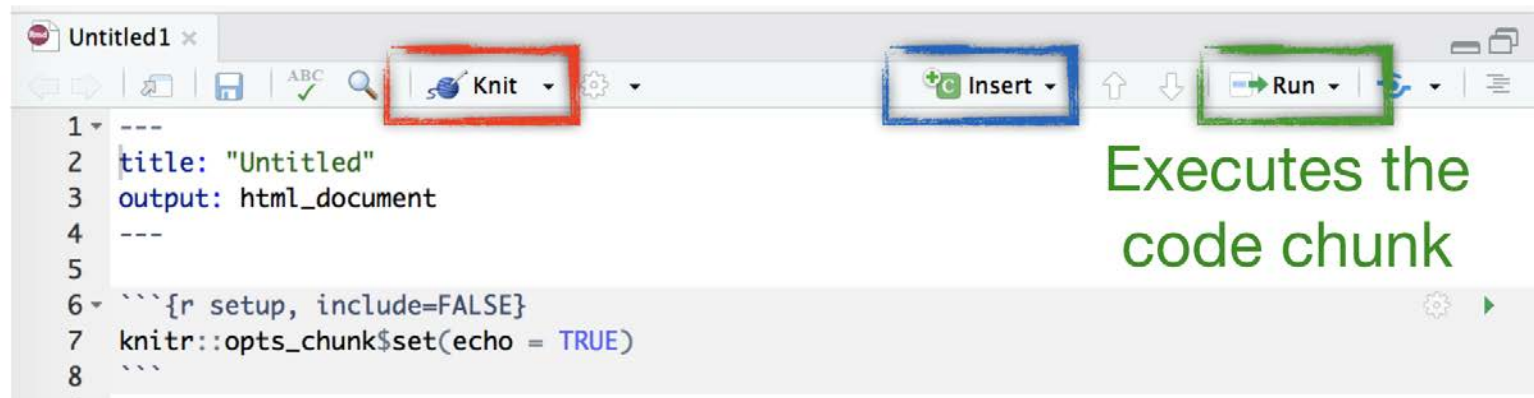
Actual R code  
encapsulated by

```
```{r }
```
```

# Rendering Output

Renders the .Rmd file  
into its output format

Inserts a new code chunk  
(for R, Python, C++,..)



Executes the  
code chunk

# (Markdown) Syntax

The image displays two side-by-side windows from the RStudio application. The left window, titled 'example.Rmd', shows the source R Markdown code. The right window, titled 'example.html', shows the rendered HTML output.

**Source R Markdown Code (Left Window):**

```
1 # Header 1
2
3 This is an R Markdown document. Markdown is a
4 simple formatting syntax for authoring webpages.
5
6 Use an asterisk mark to provide emphasis, such
7 as italics or bold.
8
9 Create lists with a dash:
10
11 - Item 1
12 - Item 2
13 - Item 3
14
15 Use back ticks to
16 create a block of code
17
18 Embed LaTeX or MathML equations,
19  $\frac{1}{n} \sum_{i=1}^n x_i$ 
20
21 Or even footnotes, citations, and a
22 bibliography. [1]
23
24 [1]: Markdown is great.
```

**Rendered HTML Document (Right Window):**

# Header 1

This is an R Markdown document. Markdown is a simple formatting syntax for authoring web pages.

Use an asterisk mark to provide emphasis, such as *italics* or **bold**.

Create lists with a dash:

- Item 1
- Item 2
- Item 3

Use back ticks to create a block of code

Embed LaTeX or MathML equations,  $\frac{1}{n} \sum_{i=1}^n x_i$




Or even footnotes, citations, and a bibliography. <sup>1</sup>

---

1. Markdown is great. ↩

source: [rmarkdown.rstudio.com](https://rmarkdown.rstudio.com)

# HTML vs Markdown vs R Markdown Syntax

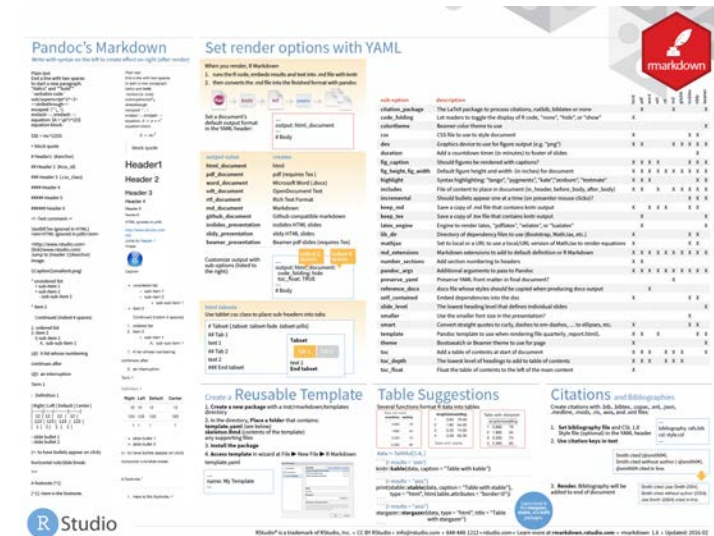
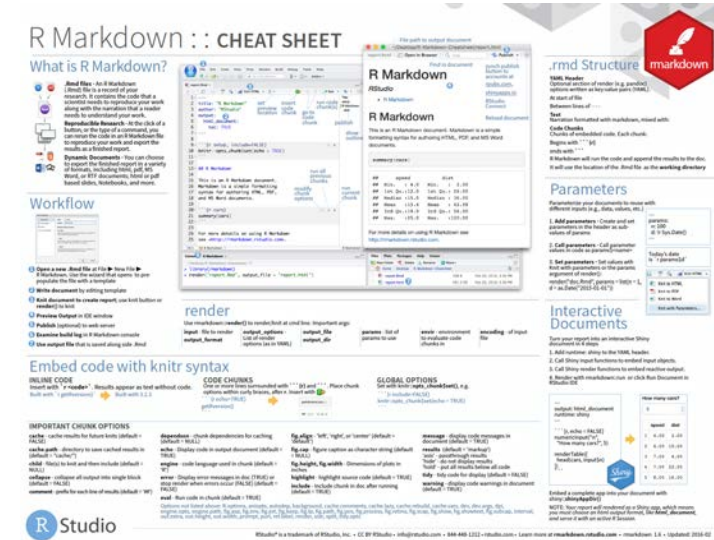
| HTML  | Markdown  | R Markdown   |
|---|---|--|
| <pre>&lt;h1&gt; R for Fledglings &lt;/h1&gt; &lt;p&gt; January 1, 2000 &lt;/p&gt;</pre>  | <pre># R for Fledglings January 1, 2000</pre>  | <pre># R for Fledglings `r date()`</pre>  |
| <p>R for Fledglings<br/>January 1, 2000</p>   | <p>R for Fledglings<br/>January 1, 2001</p>   | <p>R for Fledglings<br/>December 21, 2014</p>  |

source: Donovan, T., Brown, M., & Katz, J. (2015). Vermont Cooperative Fish and Wildlife Research Unit R Projects: R for Fledglings. Retrieved from [https://www.uvm.edu/rsenr/vtcfwru/R/fledglings/08\\_Markdown.html](https://www.uvm.edu/rsenr/vtcfwru/R/fledglings/08_Markdown.html) (under CC-BY-NC-ND 4.0 license)

# Get more infos



- The [cheatsheet](#) gives you a good overview.
- R Studio provides also a useful [reference guide](#).
- Look at the [R Markdown Webside](#) from R Studio for a first start.
- To dig deeper you will find many youtube videos and online tutorials.
  - A good one is, for instance: [R for fledglings](#)



Cheat sheet is freely available at  
<https://www.rstudio.com/resources/cheatsheets/>

**Your turn...**



## Task: Convert an R script into a Markdown file

Start your first R Markdown file that should render a html document and save it under any name. In lecture 8 on visualizations you were asked to answer the following questions using the `hydro` dataset (file "data/1111473b.csv"):

1. What happens if you make a scatterplot of station (x) vs temp (y)? Why is the plot not useful? What would be a better plot?
2. What happens if you make a boxplot of cruise (x) vs psal (y)? Why is this plot less suitable? What could be an alternative?

If you have done this exercise you can simply use your code and copy and paste it into the code chunks of your .Rmd file. If you haven't done the exercise you have now the opportunity to make up leeway.

# Implement the following in your .Rmd file

1. Start with R code chunks for loading the data and required libraries
2. Add code chunks for i) any data modifications ii) any plot
3. Think about which code chunks should be evaluated (eval=TRUE) or not displayed (echo=FALSE)
4. Think about the dimensions of the figure and add the required specifications in the chunk options
5. Include different headers and subheaders
6. Add your answers and think about whether you want to use i) any ordered or unordered lists ii) text in **bold** or *italic*
7. Add a webside link that fits to the topic
8. Add an image

Note:

Try to **knit** your .Rmd file **frequently** (after any major addition)!! It is highly likely that you will run into an error message and that way you can identify the cause much faster.







**Now its time for your FIRST CASE  
STUDY!!!**

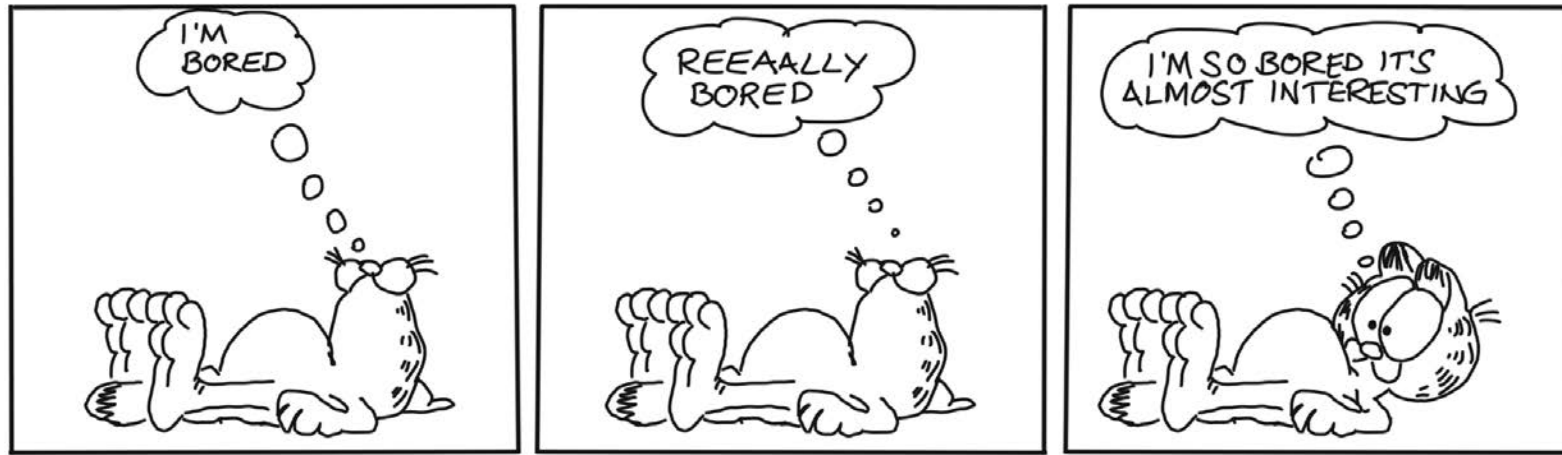
**How do you feel now.....?**

# Totally confused?



Practice on the exercise data and go through the suggested info material.

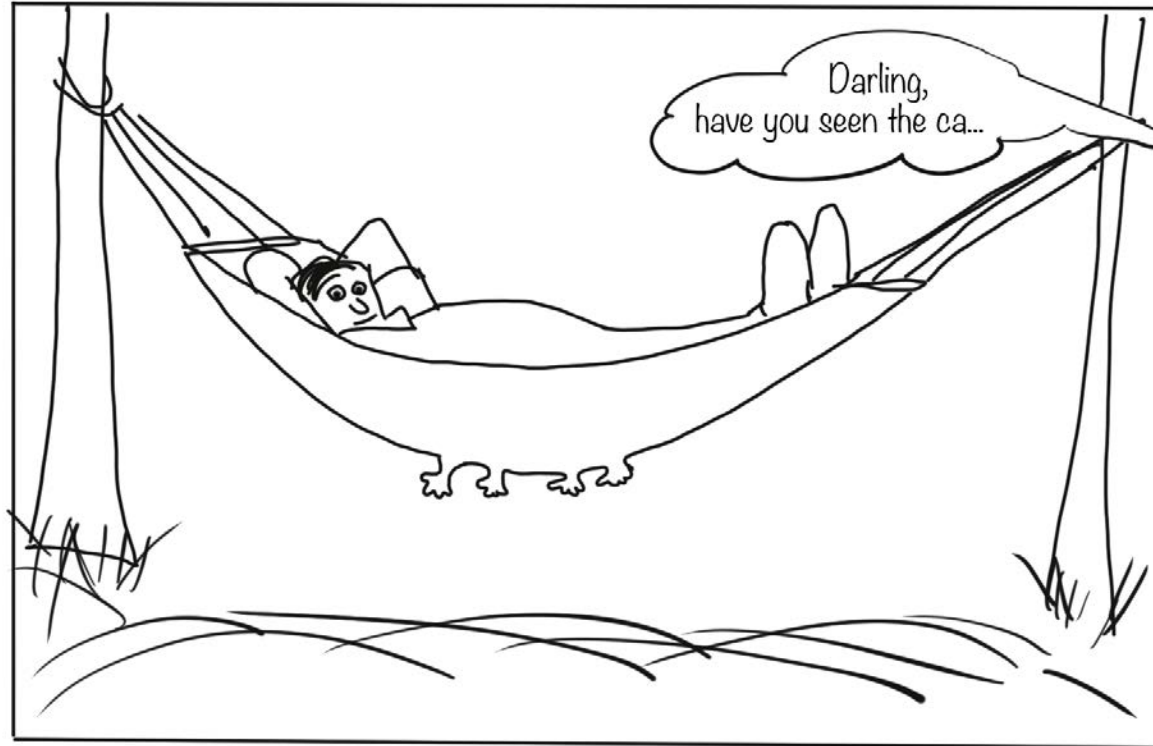
# Totally bored?



Once your done, change in the YAML header the output format to e.g. PDF and knit your .Rmd file again. How do you like that output? Play around with all the options and output formats that R Markdown provides. Convert any of your R scripts you wrote so far into an .Rmd file

## Totally content?

Then go grab a coffee, lean back and enjoy the rest of the day...!







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# Thank You

For more information contact me: [saskia.otto@uni-hamburg.de](mailto:saskia.otto@uni-hamburg.de)

[http://www.researchgate.net/profile/Saskia\\_Otto](http://www.researchgate.net/profile/Saskia_Otto)

<http://www.github.com/saskiaotto>



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**Image on title and end slide:** Section of an infrared satallite image showing the Larsen C ice shelf on the Antarctic Peninsula - USGS/NASA Landsat: [A Crack of Light in the Polar Dark](#), Landsat 8 - TIRS, June 17, 2017 (under CC0 license)