

Macrosystems EDDIE: Getting Started + Troubleshooting Tips

Developed by K.J. Farrell and C.C. Carey
for use with Macrosystems EDDIE modules.

<http://module1.macrosystemseddie.org>

Module development supported by NSF EF 1702506.

Last updated: 19 Nov. 2018

R and RStudio



R

- Statistical environment



RStudio

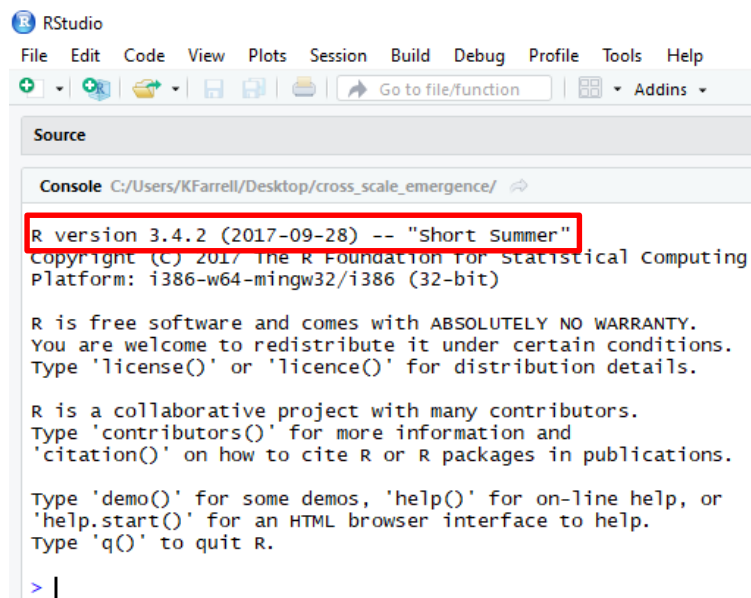
- Point and click program for using R in one place
 - Run code
 - Visualize plots
 - Access files

Check-in:

- Have you downloaded **both** R and RStudio?
- Look in your Applications (Mac) or in the Start menu (Windows) to confirm this-- both programs should be listed.
- If either program is missing, install it now!

Are R & RStudio up to date?

- Check that R and RStudio are both up-to-date, and download new versions if necessary
 - When you open RStudio, you will see your version of R. It should be at least **3.5.1**
 - Check for updates to RStudio by clicking **Help**, then **Check for Updates**



The screenshot shows the RStudio interface with the console pane active. The console output displays the R version and system information. The first line, "R version 3.4.2 (2017-09-28) -- 'Short Summer'", is highlighted with a red rectangular box.

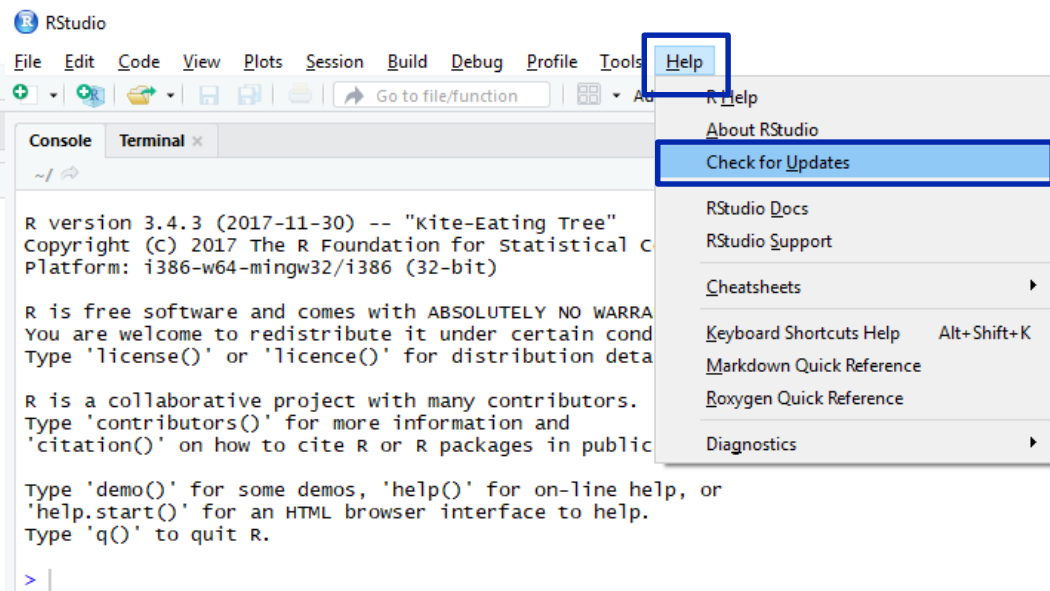
```
R version 3.4.2 (2017-09-28) -- "Short Summer"
Copyright (C) 2017 The R Foundation for Statistical Computing
Platform: i386-w64-mingw32/i386 (32-bit)

R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
Type 'license()' or 'licence()' for distribution details.

R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

> |
```



The screenshot shows the RStudio interface with the Help menu open. The 'Help' menu item in the top toolbar is highlighted with a blue box. The 'Check for Updates' option in the dropdown menu is also highlighted with a blue box.

```
R version 3.4.3 (2017-11-30) -- "kite-Eating Tree"
Copyright (C) 2017 The R Foundation for Statistical Computing
Platform: i386-w64-mingw32/i386 (32-bit)

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Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

> |
```

Help

- About RStudio
- Check for Updates
- RStudio Docs
- RStudio Support
- Cheatsheets
- Keyboard Shortcuts Help Alt+Shift+K
- Markdown Quick Reference
- Roxxygen Quick Reference
- Diagnostics

Download the module files

- Navigate to the Macrosystems EDDIE Module 1 website
 - <http://module1.macrosystemseddie.org>
- Scroll down to **Teaching Materials** and click **Files for Running the Module**

Teaching Materials:

- [Files for Running the Module](#) (Zip Archive 654kB Feb6 18)– Zipped folder of all files needed to run the module in RStudio
- [R You Ready for EDDIE? Module 1](#) (Microsoft Word 2007 (.docx) 30kB Feb6 18)– Step-by-step guide to download R, RStudio, and module files

- Save the .zip folder to your Desktop

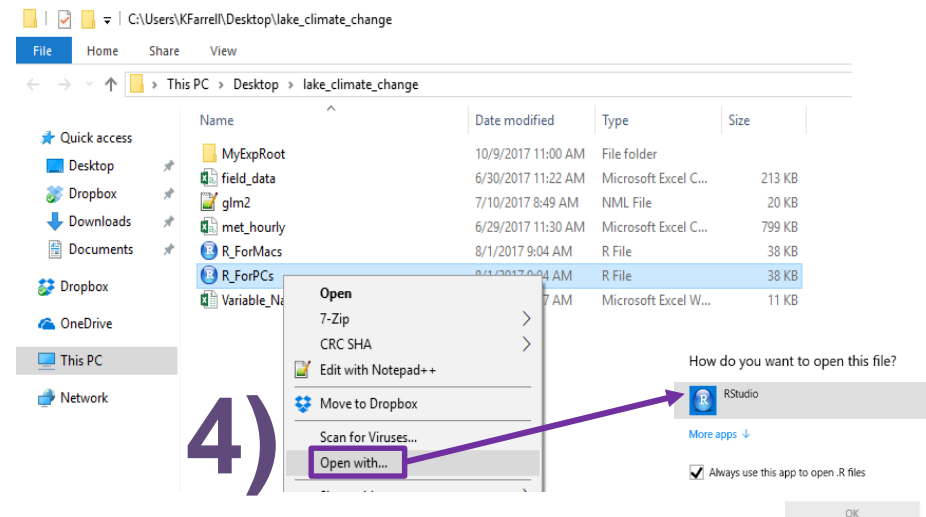
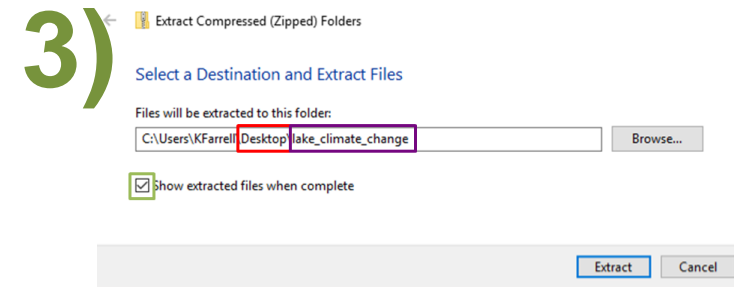
Unpack Files to Desktop: Windows

- 1) Download the zip folder directly to Desktop (or move folder from Downloads to Desktop)
- 2) Right click on the .zip folder and choose **Extract All**
- 3) Check that your files are:
 - being extracted to the **Desktop**
 - end *exactly* **lake_climate_change**.

Also **check the box**

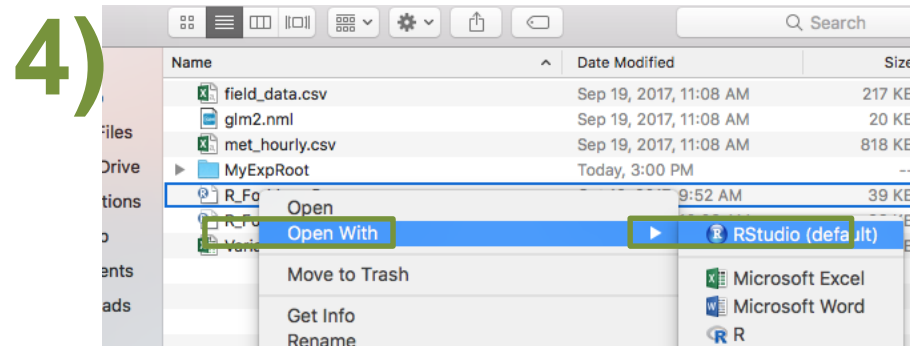
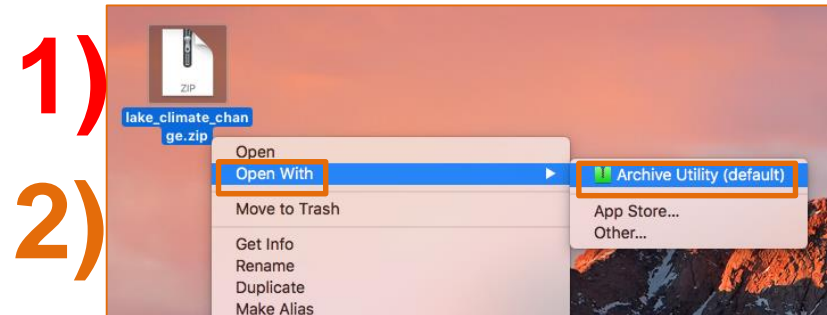
“Show extracted files when complete”

- 4) To open the module script in RStudio, right click on the file name (e.g., R_Script), then choose **Open with...** and **RStudio**



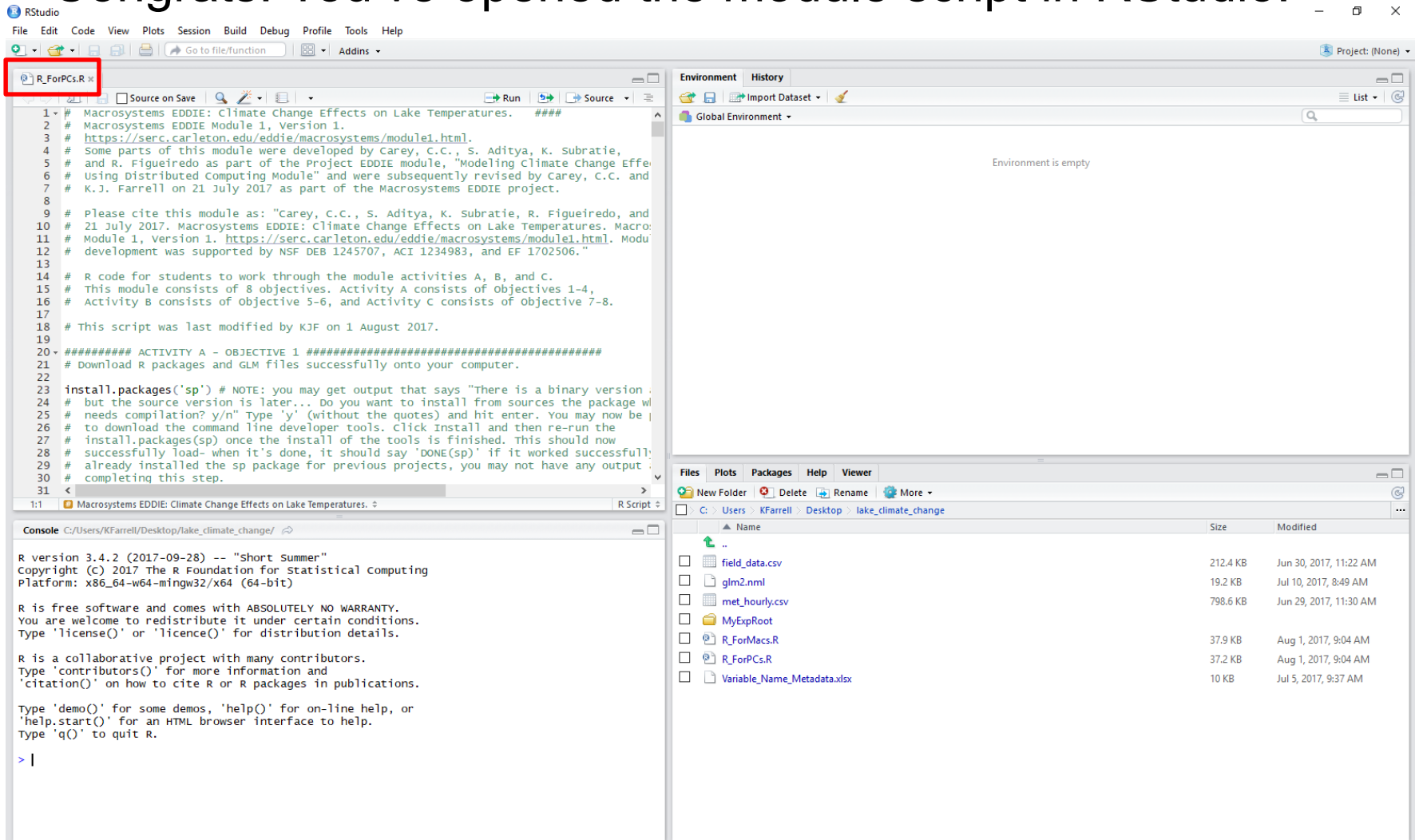
Unpack Files to Desktop: Mac

- 1) Download the zip folder directly from the Macrosystems EDDIE website to Desktop (or move folder from Downloads to Desktop)
 - **Note:** Your folder may have automatically been unzipped when you downloaded it. If it was, drag the **unzipped** 'teleconnections' folder from Downloads to the Desktop, and skip to step 4
- 2) Control + click on the .zip folder and choose **Open with** → **Archive Utility** to unzip the folder. Then double click on the unzipped folder
- 3) Check that your files are:
 - being extracted to the **Desktop**
 - called **exactly lake_climate_change**.
- 4) To open the module script in RStudio, control + click on the file name (R_Script), then choose **Open with...** and **RStudio**



Opening Module Files in RStudio

- Congrats! You've opened the module script in RStudio!



The screenshot shows the RStudio interface with the following components:

- Source Editor:** Displays the R script file `R_ForPCs.R`. The script contains comments about the MacroSystems EDDIE module and R code for installing packages and running activities.
- Environment:** Shows the Global Environment, which is currently empty.
- Files:** Shows the file explorer for the project directory `C:\Users\KFarrell\Desktop\lake_climate_change`. The file `R_ForPCs.R` is highlighted.
- Console:** Shows the R version (3.4.2) and copyright information.

```
1- # MacroSystems EDDIE: Climate Change Effects on Lake Temperatures. ####
2- # MacroSystems EDDIE Module 1, Version 1.
3- # https://serc.carleton.edu/eddie/macroSystems/module1.html.
4- # Some parts of this module were developed by Carey, C.C., S. Aditya, K. Subratie,
5- # and R. Figueiredo as part of the Project EDDIE module, "Modeling Climate Change Effects
6- # Using Distributed Computing Module" and were subsequently revised by Carey, C.C. and
7- # K.J. Farrell on 21 July 2017 as part of the MacroSystems EDDIE project.
8-
9- # Please cite this module as: "Carey, C.C., S. Aditya, K. Subratie, R. Figueiredo, and
10- # 21 July 2017. MacroSystems EDDIE: Climate Change Effects on Lake Temperatures. Macro-
11- # Module 1, Version 1. https://serc.carleton.edu/eddie/macroSystems/module1.html. Modu-
12- # development was supported by NSF DEB 1245707, ACI 1234983, and EF 1702506."
13-
14- # R code for students to work through the module activities A, B, and C.
15- # This module consists of 8 objectives. Activity A consists of Objectives 1-4,
16- # Activity B consists of Objective 5-6, and Activity C consists of Objective 7-8.
17-
18- # This script was last modified by KJF on 1 August 2017.
19-
20- ##### ACTIVITY A - OBJECTIVE 1 #####
21- # Download R packages and GLM files successfully onto your computer.
22-
23- install.packages('sp') # NOTE: you may get output that says "There is a binary version of
24- # but the source version is later... Do you want to install from sources the package with
25- # needs compilation? y/n" type 'y' (without the quotes) and hit enter. You may now be
26- # to download the command line developer tools. Click Install and then re-run the
27- # install.packages(sp) once the install of the tools is finished. This should now
28- # successfully load- when it's done, it should say 'DONE(sp)' if it worked successfully!
29- # already installed the sp package for previous projects, you may not have any output
30- # completing this step.
31- <
```

R version 3.4.2 (2017-09-28) -- "short summer"
Copyright (C) 2017 The R Foundation for Statistical computing
Platform: x86_64-w64-mingw32/x64 (64-bit)

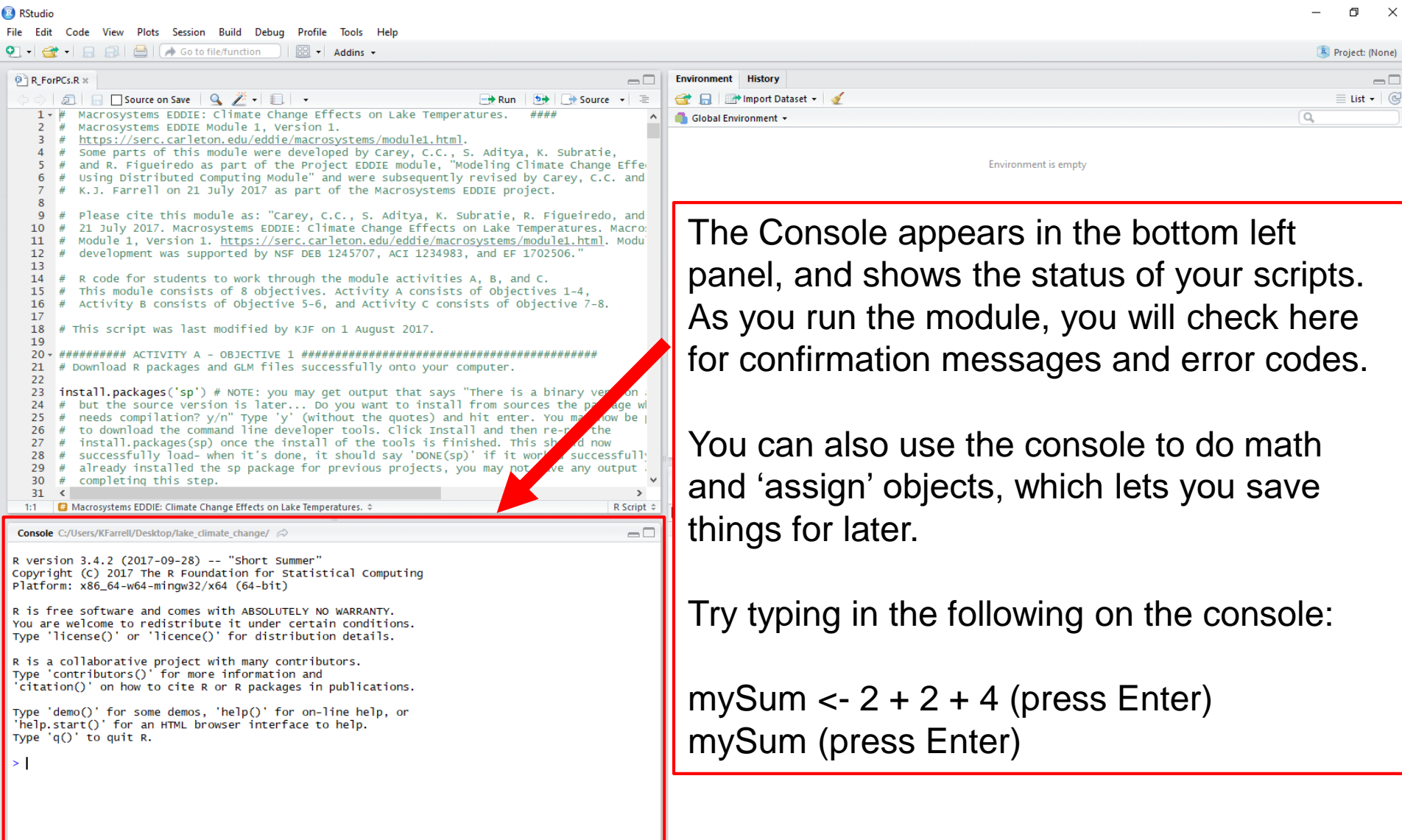
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Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

> |

RStudio Basics: Console



The Console appears in the bottom left panel, and shows the status of your scripts. As you run the module, you will check here for confirmation messages and error codes.

You can also use the console to do math and 'assign' objects, which lets you save things for later.

Try typing in the following on the console:

```
mySum <- 2 + 2 + 4 (press Enter)
mySum (press Enter)
```

```
R version 3.4.2 (2017-09-28) -- "Short summer"
Copyright (C) 2017 The R Foundation for Statistical Computing
Platform: x86_64-w64-mingw32/x64 (64-bit)

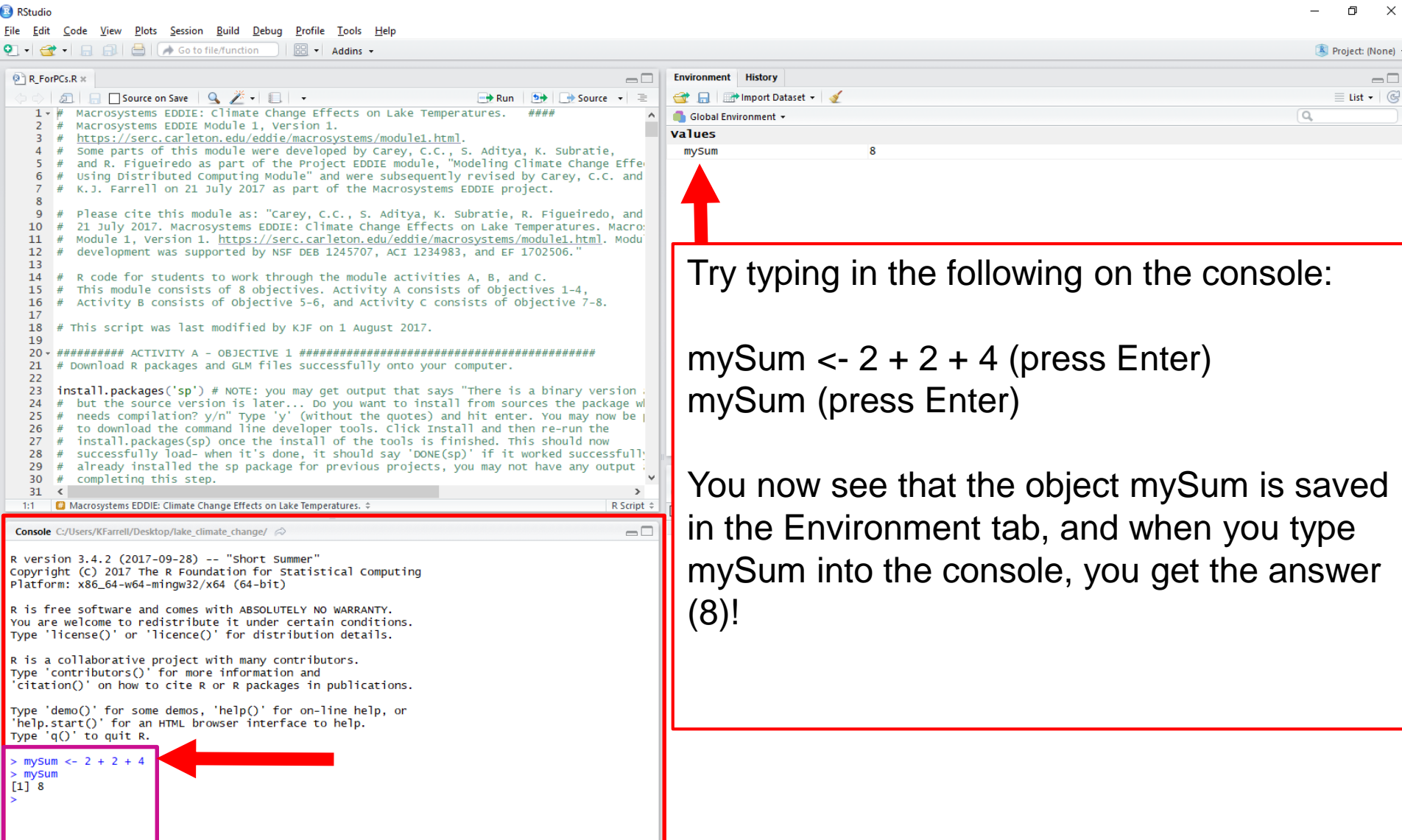
R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
Type 'license()' or 'licence()' for distribution details.

R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

> |
```


RStudio Basics: Console



The screenshot shows the RStudio interface with the following components:

- Source Editor:** Displays the R script file `R_ForPCs.R`. The script includes comments about the Macrosystems EDDIE project and R code for installing packages and setting up the environment.
- Console:** Shows the R version (3.4.2), copyright information, and the results of the commands `> mySum <- 2 + 2 + 4` and `> mySum`, which output `[1] 8`. A red arrow points to the console output.
- Environment:** Shows the Global Environment with the variable `mySum` having a value of 8. A red arrow points to the `mySum` entry.

Try typing in the following on the console:

```
mySum <- 2 + 2 + 4 (press Enter)
mySum (press Enter)
```

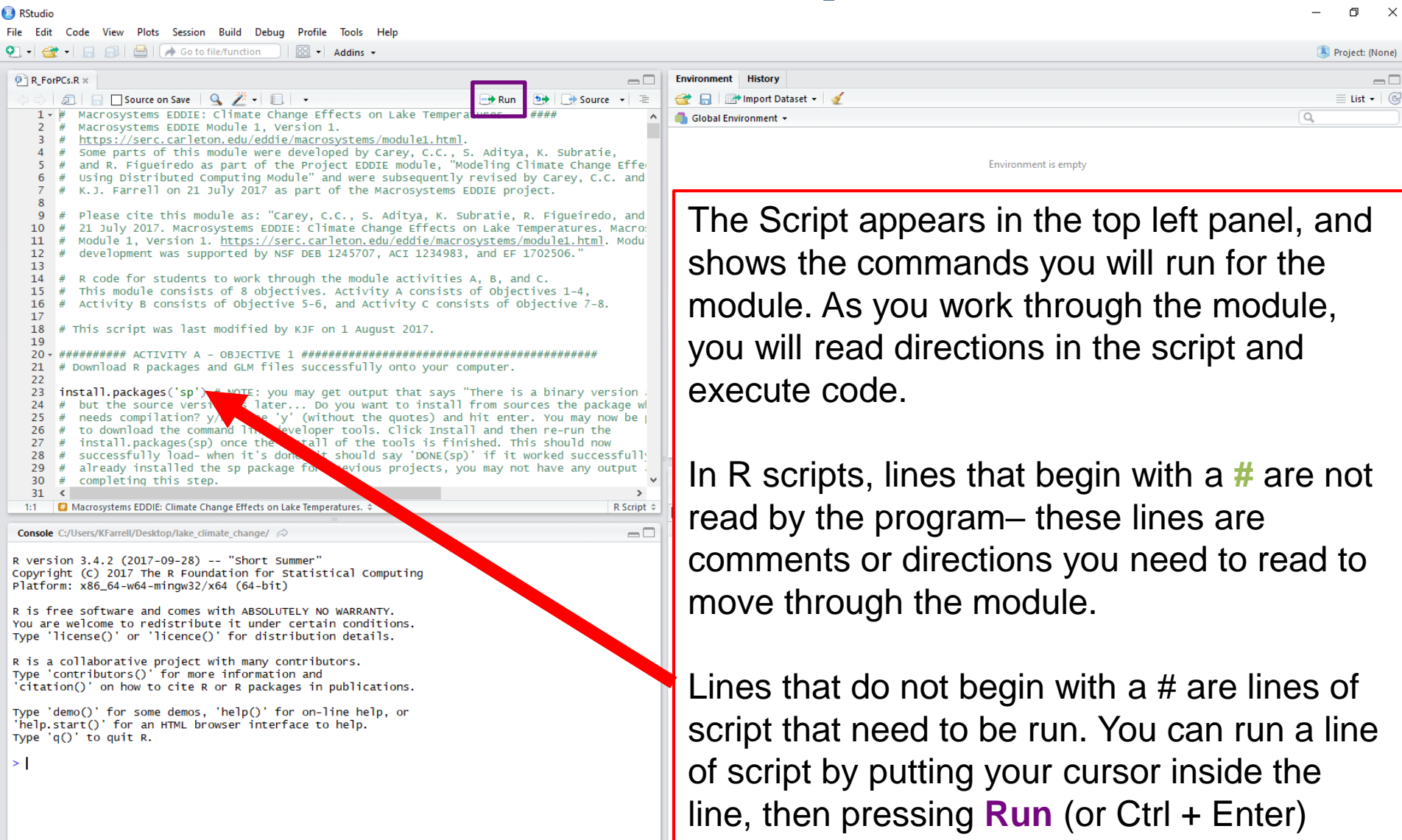
You now see that the object `mySum` is saved in the Environment tab, and when you type `mySum` into the console, you get the answer (8)!

RStudio Basics: Script

The Script appears in the top left panel, and shows the commands you will run for the module. As you work through the module, you will read directions in the script and execute code.

In R scripts, lines that begin with a `#` are not read by the program— these lines are comments or directions you need to read to move through the module.

RStudio Basics: Script



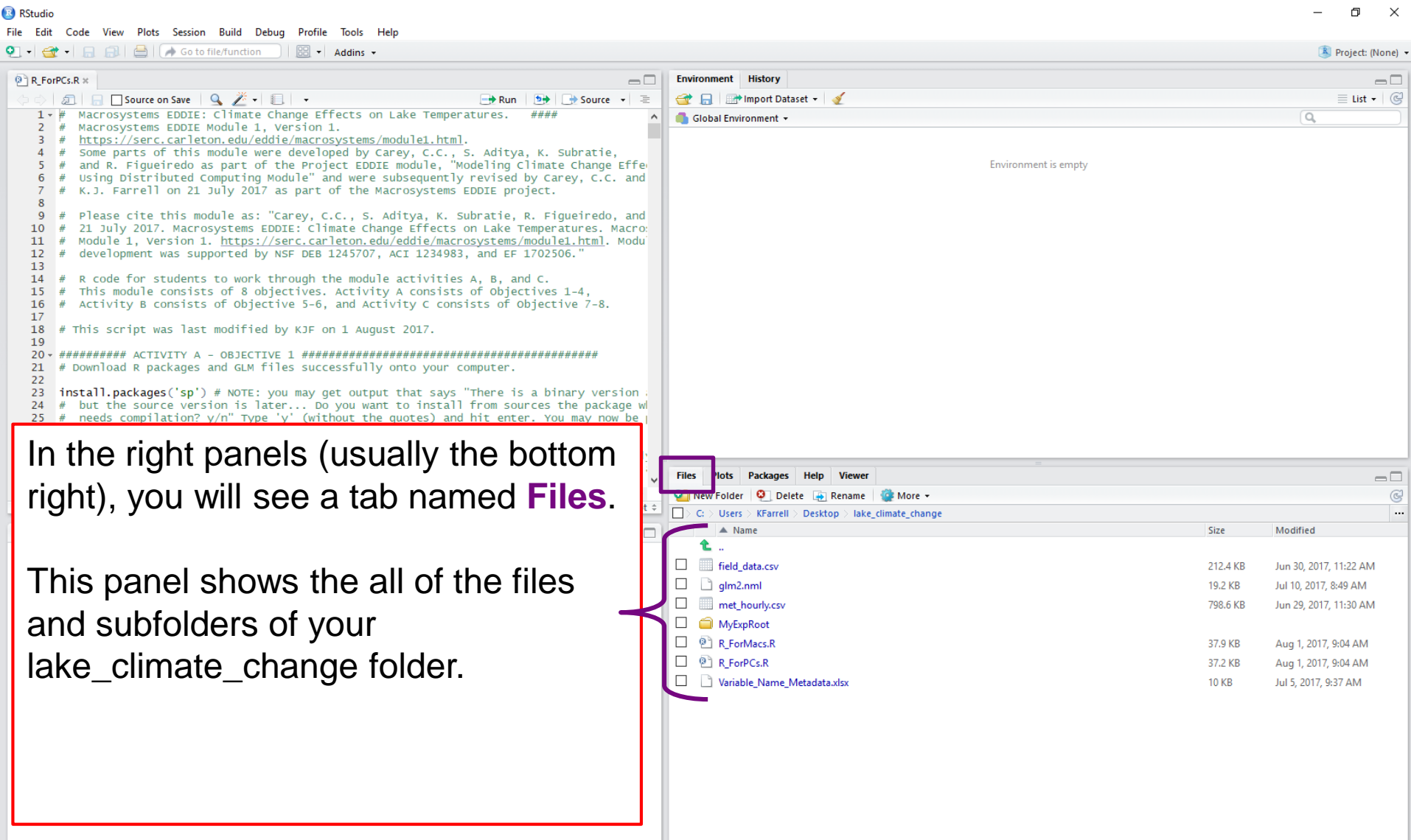
The screenshot displays the RStudio environment with four main panels. The top-left panel shows a script file named 'R_ForPCs.R' with R code. A red box highlights the 'Run' button (a green play icon) in the toolbar. A red arrow points from this button to the first line of code in the script that does not start with a hash symbol. The top-right panel shows the 'Environment' tab, indicating the environment is empty. The bottom-left panel shows the 'Console' tab with the output of the R startup process, including the version (3.4.2), copyright notice, and help instructions. The bottom-right panel contains three text boxes explaining the script structure and how to execute it.

The Script appears in the top left panel, and shows the commands you will run for the module. As you work through the module, you will read directions in the script and execute code.

In R scripts, lines that begin with a **#** are not read by the program— these lines are comments or directions you need to read to move through the module.

Lines that do not begin with a **#** are lines of script that need to be run. You can run a line of script by putting your cursor inside the line, then pressing **Run** (or Ctrl + Enter)

RStudio Basics: Files



The screenshot displays the RStudio environment. The top menu bar includes File, Edit, Code, View, Plots, Session, Build, Debug, Profile, Tools, and Help. The toolbar below the menu bar contains icons for saving, running, and other functions. The main editor window on the left shows an R script with comments and code for installing packages and downloading data. The right-hand side of the interface is divided into two panels: the top panel shows the 'Environment' and 'History' tabs, and the bottom panel shows the 'Files' tab. The 'Files' panel displays a file explorer view of the 'lake_climate_change' folder, listing files such as 'field_data.csv', 'glm2.nml', 'met_hourly.csv', 'MyExpRoot', 'R_ForMacs.R', 'R_ForPCs.R', and 'Variable_Name_Metadata.xlsx'.

In the right panels (usually the bottom right), you will see a tab named **Files**.

This panel shows the all of the files and subfolders of your lake_climate_change folder.

Name	Size	Modified
..		
field_data.csv	212.4 KB	Jun 30, 2017, 11:22 AM
glm2.nml	19.2 KB	Jul 10, 2017, 8:49 AM
met_hourly.csv	798.6 KB	Jun 29, 2017, 11:30 AM
MyExpRoot		
R_ForMacs.R	37.9 KB	Aug 1, 2017, 9:04 AM
R_ForPCs.R	37.2 KB	Aug 1, 2017, 9:04 AM
Variable_Name_Metadata.xlsx	10 KB	Jul 5, 2017, 9:37 AM

RStudio Basics: Plots

RStudio

File Edit Code View Plots Session Build Debug Profile Tools Help

Go to file/function Addins

```
110 # At the end of the model run, it should say "run complete" if everything worked ok.
111
112 # Now, go to the sim_folder on your computer (in RStudio, you can find this by clicking
113 # tab)- if everything happened correctly, you should see the addition of new files
114 # that were created during the simulation with a recent date and time stamp,
115 # including 'output.nc', 'lake.csv', and 'overflow.csv'. The most important of these is
116 # 'output.nc' file, which contains all of the output data from your simulation in netc
117 # format.
118
119 # We need to know where the output.nc file is so that the glmtools package can
120 # plot and analyze the model output. We tell R where to find the output file using the
121
122 nc_file <- file.path(sim_folder, 'output.nc') # This defines the output.nc file as being
123 # the sim_folder.
124
125 plot_temp(file=nc_file, fig_path=FALSE) # This plots your simulated water temperatures
126 # map, where time is displayed on the x-axis, lake depth is displayed on the y-axis, and
127 # different colors represent different temperatures. Again, this figure should be visible
128 # in the bottom righthand corner of RStudio's interface.
129
130 # To copy your plot (e.g., onto a PowerPoint slide), click "Export" within the Plots tab
131 # Then click "Copy to Clipboard", and click "Copy plot" in the preview window. You can
132 # paste your plot into word, PowerPoint, etc.
133
134 # If you want to save your plot as an image file or pdf file instead of copying it, click
```

Environment History

Global Environment

Data

nm1 List of 11

Values

nc_file	"C:/Users/KFarrell/Desktop/lake_climate_change/output.nc"
nm1_file	"C:/Users/KFarrell/Desktop/lake_climate_change/glm2.nm1"
sim_folder	"C:/Users/KFarrell/Desktop/lake_climate_change"

Files **Plots** Connections Packages Help Viewer

Zoom Export

Publish

Depth (m)

Temperature (celsius)

May 2000 Jun 2000 Jul 2000 Aug 2000

In the right panels (usually the bottom right), you will also see a tab named **Plots**.

This panel shows the figures you create while working through the module.

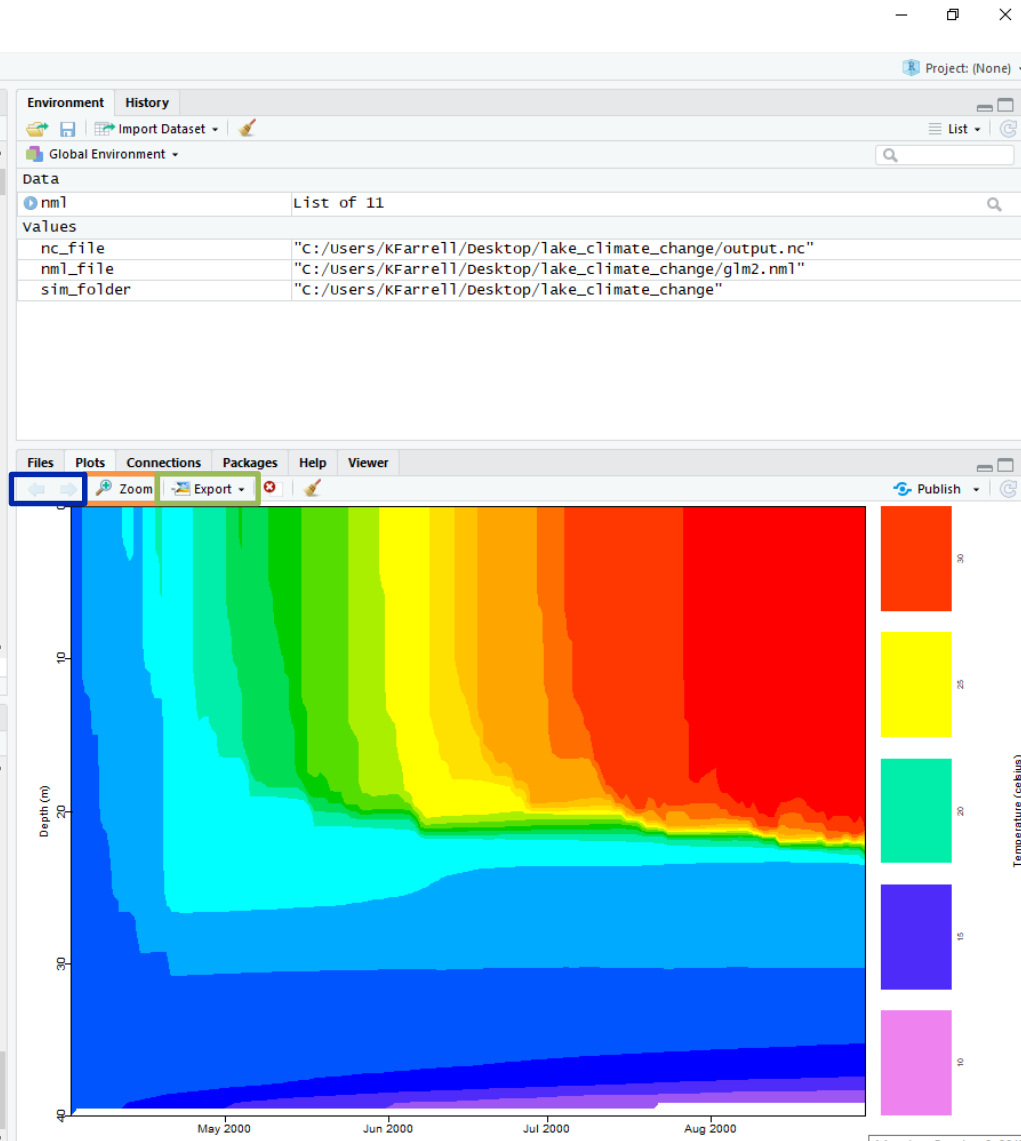
RStudio Basics: Plots

```
RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
Go to file/function Addins
R_ForPCs.R x
Source on Save Run Source
110 # At the end of the model run, it should say "run complete" if everything worked ok.
111
112 # Now, go to the sim_folder on your computer (in RStudio, you can find this by clicking
113 # tab)- if everything happened correctly, you should see the addition of new files
114 # that were created during the simulation with a recent date and time stamp,
115 # including 'output.nc', 'lake.csv', and 'overflow.csv'. The most important of these is
116 # 'output.nc' file, which contains all of the output data from your simulation in netc
117 # format.
118
119 # We need to know where the output.nc file is so that the glmtools package can
120 # plot and analyze the model output. We tell R where to find the output file using the
121
```

You can show your plot in a stand-alone window if you press the **Zoom** button.

If you have made more than one plot, you can toggle between them using **the arrows**.

You can also copy and paste your plots to another document (e.g., Word or PowerPoint), or save them to your computer using the **Export** command.

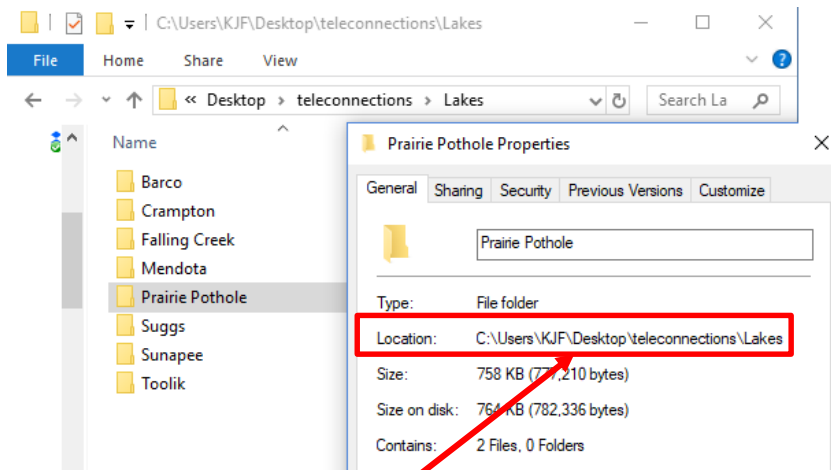


Activity A: What's my sim_folder?

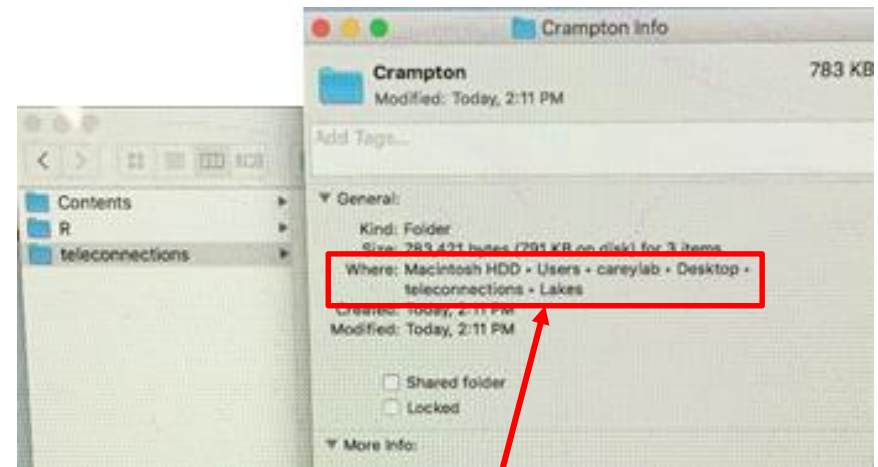
In Activity A, you need to set your `sim_folder` so that R knows where to find the module folders for your focal lake on *your* computer!

To find your folder path:

- 1) Navigate to the 'lake_climate_change' folder on your Desktop
- 2) Right click on the folder, then select Properties (Windows) or Get Info (Mac)
- 3) Look under Location (Windows) or Where (Mac) to find your folder path (examples below):
 - Windows: Users/KJF/Desktop/lake_climate_change
 - Mac: Users -> careylab -> Desktop -> lake_climate_change



In the R script, make sure you use the / dash, not \ (which is what Windows will show you!)



In the R script, make sure you use the / dash, not an arrow (which is what Mac will show you!)

Activity A: What's my sim_folder?

In the R script, you will need to change the part after Users/ to give the name of your computer (e.g., my computer name is cayelan, but yours will be different!).

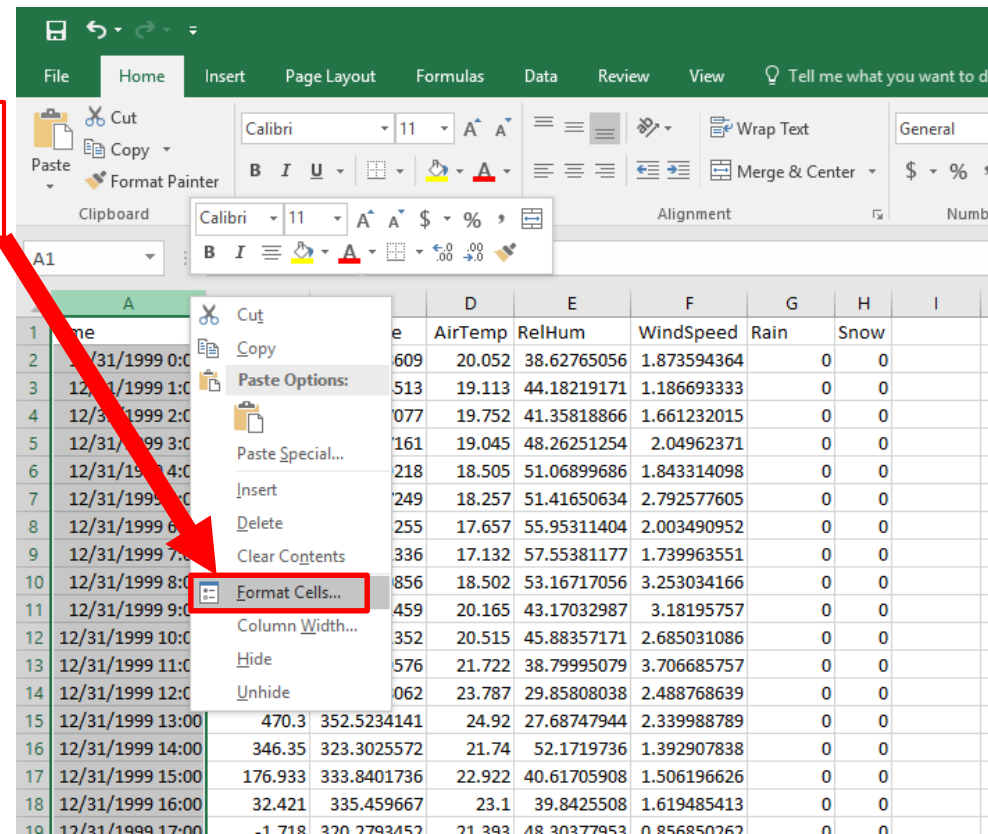
```
62 # when you downloaded this script, you unzipped the lake_climate_change folder
63 # to your Desktop. We now need to tell R where these files are. We do that by...
64
65 sim_folder <- '/Users/cayelan/Desktop/lake_climate_change' ##!! Edit this line
66 # to define your sim_folder location. This should be replaced with the
67 # path to the Desktop folder where you extracted your zipped files. Most likely,
68 # you will need to change the part after Users/ to give the name of your computer
69 # (e.g., my computer name is cayelan, but yours will be different!) Look in the
70 # Files tab on RStudio to see your file path.
71
72 setwd(sim_folder) ## This line of code is used to reset your working directory
73 # to the sim_folder. The point of this step is to make sure that any new files
74 # you create (e.g., figures of output) end up together in this folder.
75
```

If you don't change this part of the sim_folder file path, your model won't run because R won't know where to look for your files!

Activity B: Formatting Dates

- After you've modified your met_hourly file for your climate scenario, you need to explicitly format your date for GLM

Right click on the **A** at the top of the **time** column, then click **Format Cells**



Activity B: Formatting Dates

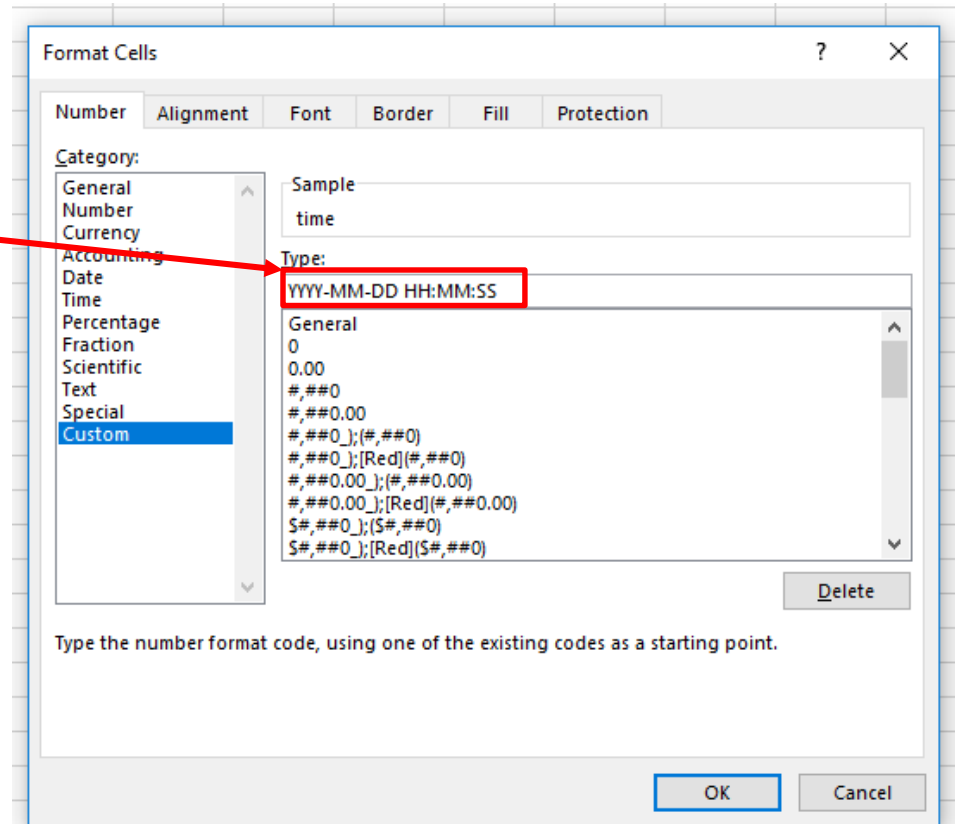
- After you've modified your met_hourly file for your climate scenario, you need to explicitly format your date for GLM

Click **Custom**, then type the correct format into the Type: box.

The format must be *exactly* as follows:

YYYY-MM-DD HH:MM:SS

Then press OK and save your .csv file.



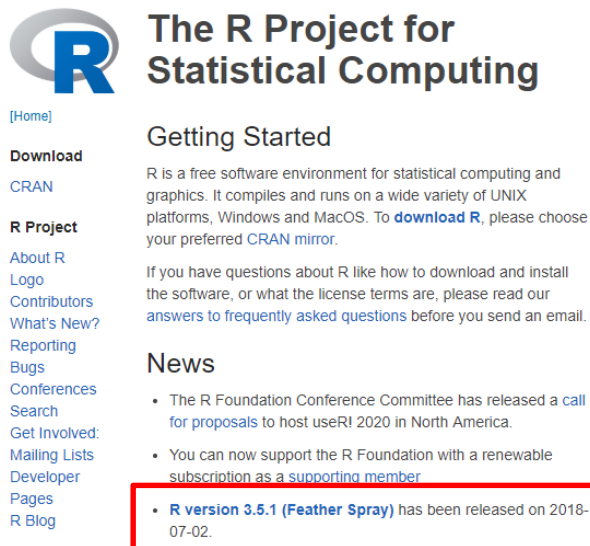
MACROSYSTEMS EDDIE: GLM TROUBLESHOOTING TIPS



Having trouble?

If you're having trouble running the Macrosystems EDDIE module, first double-check that you have the latest version of R!

- Go to <https://www.r-project.org/> and make sure that the version listed on the home page matches the version that opens when you open RStudio



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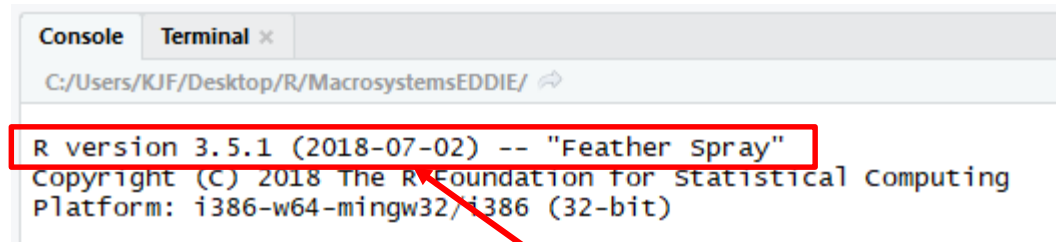
Getting Started

R is a free software environment for statistical computing and graphics. It compiles and runs on a wide variety of UNIX platforms, Windows and MacOS. To [download R](#), please choose your preferred [CRAN mirror](#).

If you have questions about R like how to download and install the software, or what the license terms are, please read our [answers to frequently asked questions](#) before you send an email.

News

- The R Foundation Conference Committee has released a [call for proposals](#) to host useR! 2020 in North America.
- You can now support the R Foundation with a renewable [subscription as a supporting member](#).
- **R version 3.5.1 (Feather Spray)** has been released on 2018-07-02.



```
Console Terminal x
C:/Users/KJF/Desktop/R/MacrosystemsEDDIE/

R version 3.5.1 (2018-07-02) -- "Feather Spray"
Copyright (C) 2018 The R Foundation for Statistical Computing
Platform: i386-w64-mingw32/i386 (32-bit)
```

These versions **must** match!
Otherwise you'll get error messages when
downloading packages to run the GLM model

- If it doesn't match, close RStudio, download and install the new version of R, then reopen RStudio and the Teleconnections_R_Script.R file

Error: `glm.exe` had status 309

When does it happen?

- `run_glm(sim_folder, verbose=TRUE)` will start the GLM run, but you will likely get an error similar to: “`glm.exe` had status 309”

Why?

- Problem with 32-bit vs. 64-bit R in Windows 10

How to fix it:

- 1) In the RStudio menu, click on Tools, then Global Options.
- 2) In the General tab, check what R version RStudio is using (the first line at the top of the window).
- 3) If the selected version starts with [Default] [64-bit], try pressing Change and selecting the [Default] [32-bit] option. You will then need to restart RStudio and try the script again.

Error: Day 2451636 (2000-04-01) not found

When does it happen?

- `run_glm(sim_folder, verbose=TRUE)` will start the GLM run, but you will likely get an error similar to: “Day 2451636 (2000-04-01) not found”

Why?

- *time* column in .csv file not formatted correctly for GLM

How to fix it:

- 1) Open .csv file in Excel. Right click on the *time* column, then select Format.
- 2) Choose Custom, then type in **YYYY-MM-DD HH:MM:SS** *exactly*. Save and close your .csv file.
- 3) Run the following lines in R to ensure your time column is formatted for GLM (search to find in the R script, then run):
 - `metdata <- read.csv("met_hourly_climate.csv", header=TRUE)`
 - `metdata$time <- as.POSIXct(strptime(metdata$time, "%Y-%m-%d %H:%M:%S", tz="EST"))`
 - `write.csv(metdata, "met_hourly_climate.csv", row.names=FALSE, quote=FALSE)`Make sure you edit the file name (in blue, above) to match your .csv file.

Error: "MSVCR100.dll is missing"

When does it happen?

- When you try to run GLM commands, you receive the error: "MSVCR100.dll is missing from your computer" or "The code execution cannot proceed because MSVCR100.dll was not found. Reinstalling the program may fix this problem"

Why?

- The MSVCR100.dll file is missing from your Windows C++ library

How to fix it:

The missing library (MSVCR100.dll) will need to be reinstalled on your computer. This is beyond the scope of Macrosystems EDDIE troubleshooting, and we recommend you check with a campus IT worker for help.

In the meantime, we recommend partnering with a student whose computer isn't having this problem to run the Macrosystems EDDIE module.