

Macrosystems EDDIE: Getting Started + Troubleshooting Tips

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

<http://module2.macrosystemseddie.org>

Module development supported by NSF EF 1702506.

Last updated: 8 Jan. 2019

R and RStudio



R

- Statistical environment



RStudio

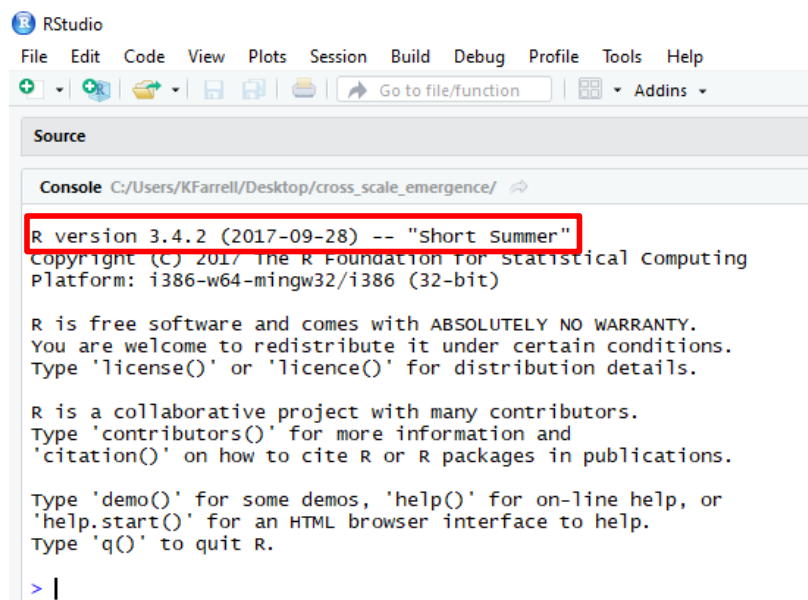
- Point and click program for using R in one place
 - Run code
 - Visualize plots
 - Access files

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.

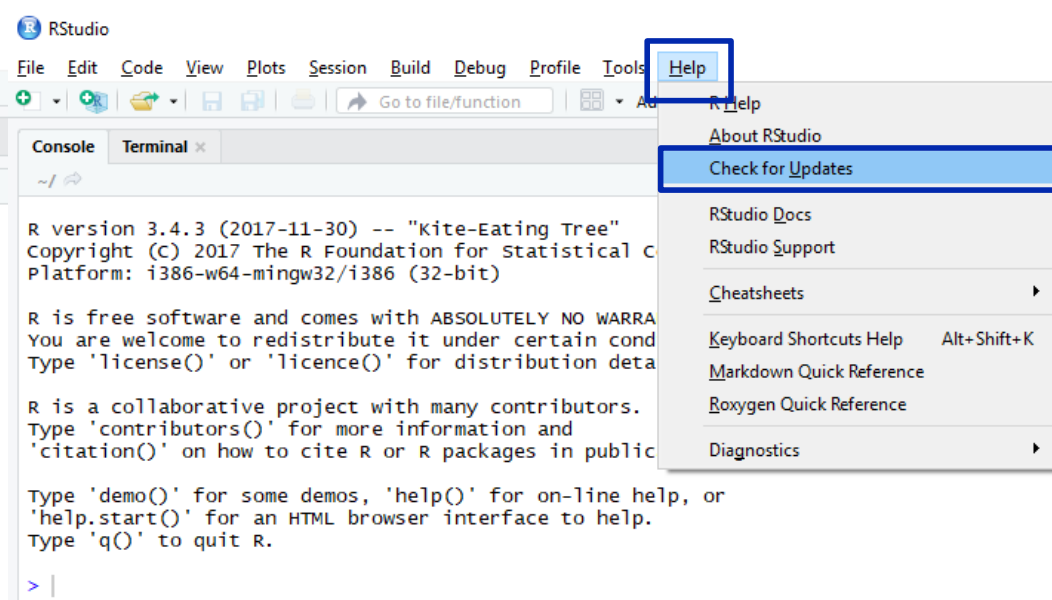
```
R version 3.4.2 (2017-09-28) -- "Short Summer"
Copyright (C) 2017 The R Foundation for Statistical Computing
Platform: i386-w64-mingw32/i386 (32-bit)

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 2 website
 - <http://module2.macrosystemseddie.org>
- Scroll down to **Teaching Materials** and click **Files for Running Module 2**

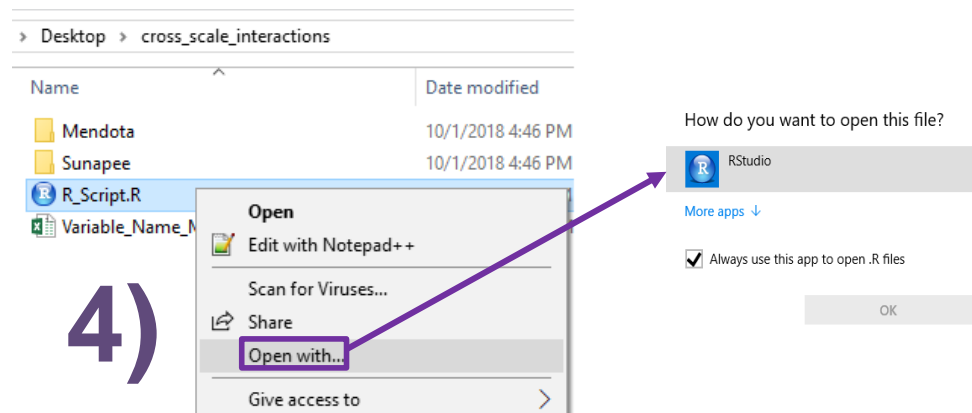
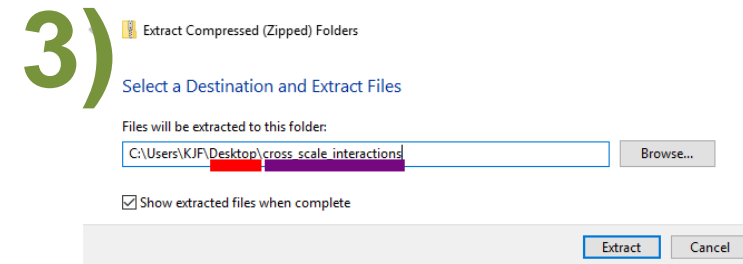
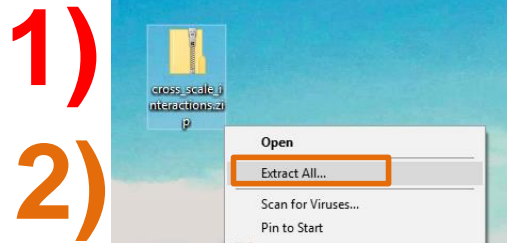
Teaching Materials:

- [Files for Running Module 2](#) (Zip Archive 795kB Aug24 18) – Zipped folder of all files needed to run the module in RStudio
- [R You Ready for EDDIE? Module 2](#) (Microsoft Word 2007 (.docx) 23kB Aug24 18) – Step-by-step guide to download R, RStudio, and module files

- Save the .zip folder to your Desktop

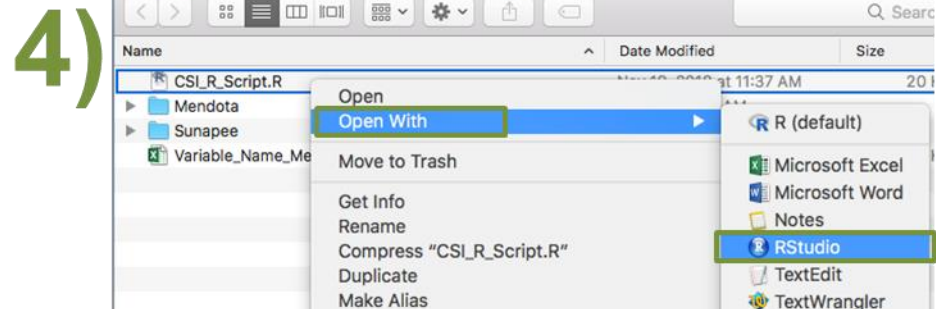
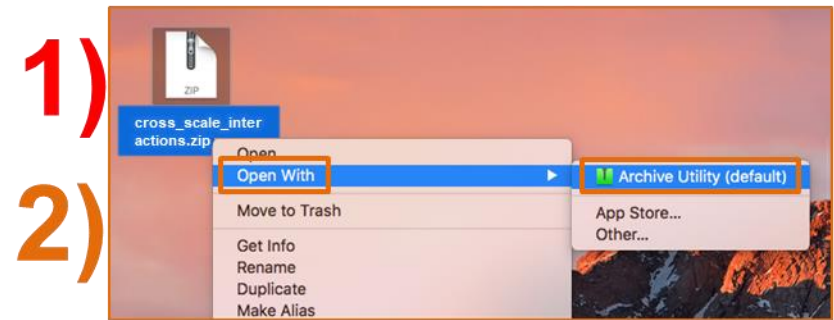
Unpack Files to Desktop: Windows

- 1) Download the zip folder directly from the MacroSystems EDDIE website 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**
 - called *exactly* **cross_scale_interactions**.Also **check the box** “Show extracted files when complete”
- 4) To open the module script in RStudio, right click on the file name (CSI_R_Script), then choose **Open with...** and **RStudio**



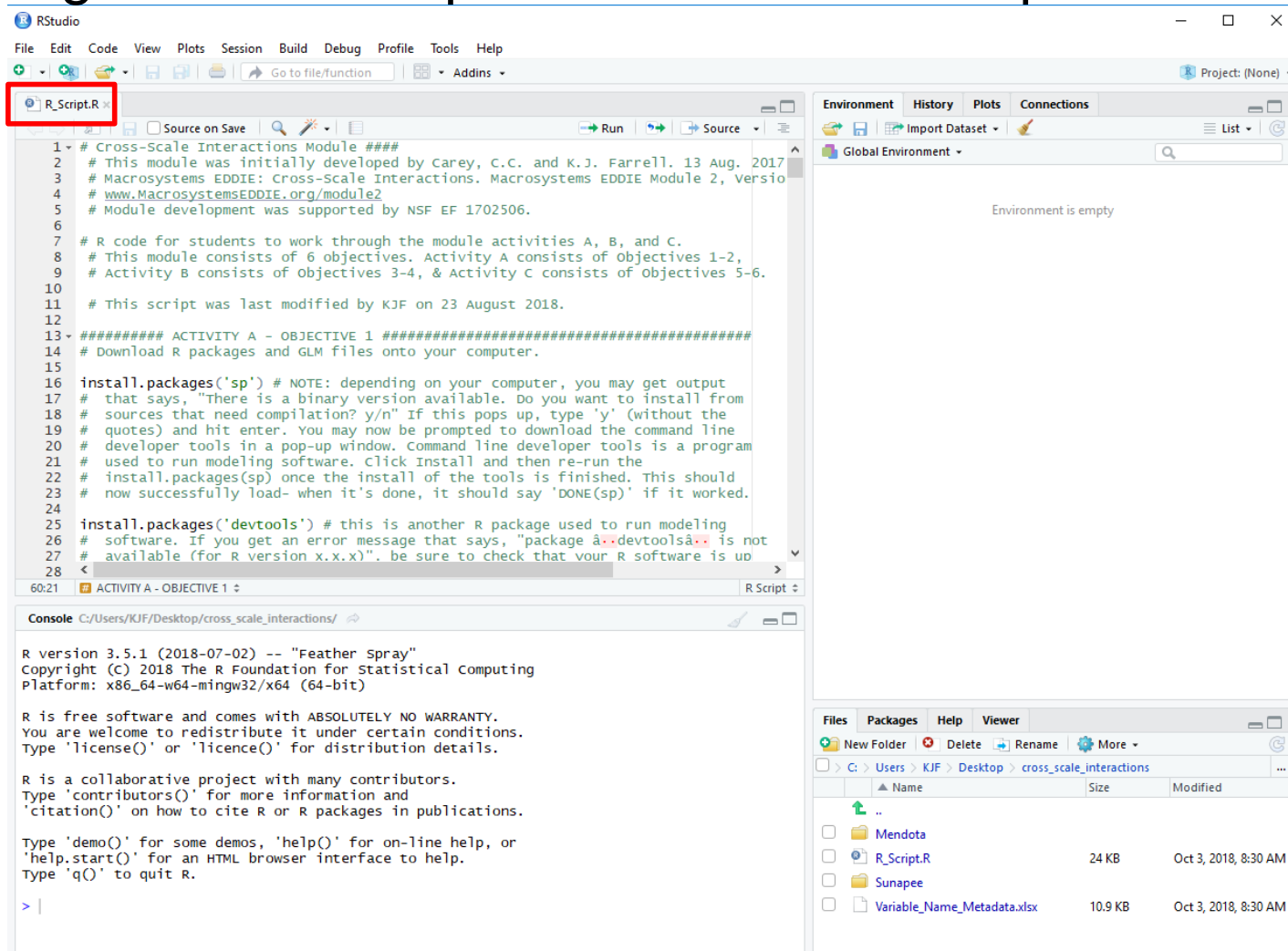
Unpack Files to Desktop: Mac

- 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** 'cross_scale_interactions' 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 folder is:
 - being extracted to the **Desktop**
 - called **exactly cross_scale_interactions**.
- 4) To open the module script in RStudio, control + click on the file name (CSI_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 R_Script.R file open in the editor. The console displays the R version and license information.

Editor Content:

```
1 # Cross-scale Interactions Module ####
2 # This module was initially developed by Carey, C.C. and K.J. Farrell. 13 Aug. 2017
3 # Macrosystems EDDIE: Cross-Scale Interactions. Macrosystems EDDIE Module 2, Versio
4 # www.MacrosystemsEDDIE.org/module2
5 # Module development was supported by NSF EF 1702506.
6
7 # R code for students to work through the module activities A, B, and C.
8 # This module consists of 6 objectives. Activity A consists of Objectives 1-2,
9 # Activity B consists of Objectives 3-4, & Activity C consists of Objectives 5-6.
10
11 # This script was last modified by KJF on 23 August 2018.
12
13 ##### ACTIVITY A - OBJECTIVE 1 #####
14 # Download R packages and GLM files onto your computer.
15
16 install.packages('sp') # NOTE: depending on your computer, you may get output
17 # that says, "there is a binary version available. Do you want to install from
18 # sources that need compilation? y/n" If this pops up, type 'y' (without the
19 # quotes) and hit enter. You may now be prompted to download the command line
20 # developer tools in a pop-up window. Command line developer tools is a program
21 # used to run modeling software. Click Install and then re-run the
22 # install.packages(sp) once the install of the tools is finished. This should
23 # now successfully load- when it's done, it should say 'DONE(sp)' if it worked.
24
25 install.packages('devtools') # this is another R package used to run modeling
26 # software. If you get an error message that says, "package 'devtools' is not
27 # available (for R version x.x.x)". be sure to check that your R software is up
28 # to date.
```

Console Output:

```
R version 3.5.1 (2018-07-02) -- "Feather Spray"
Copyright (C) 2018 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.
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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.

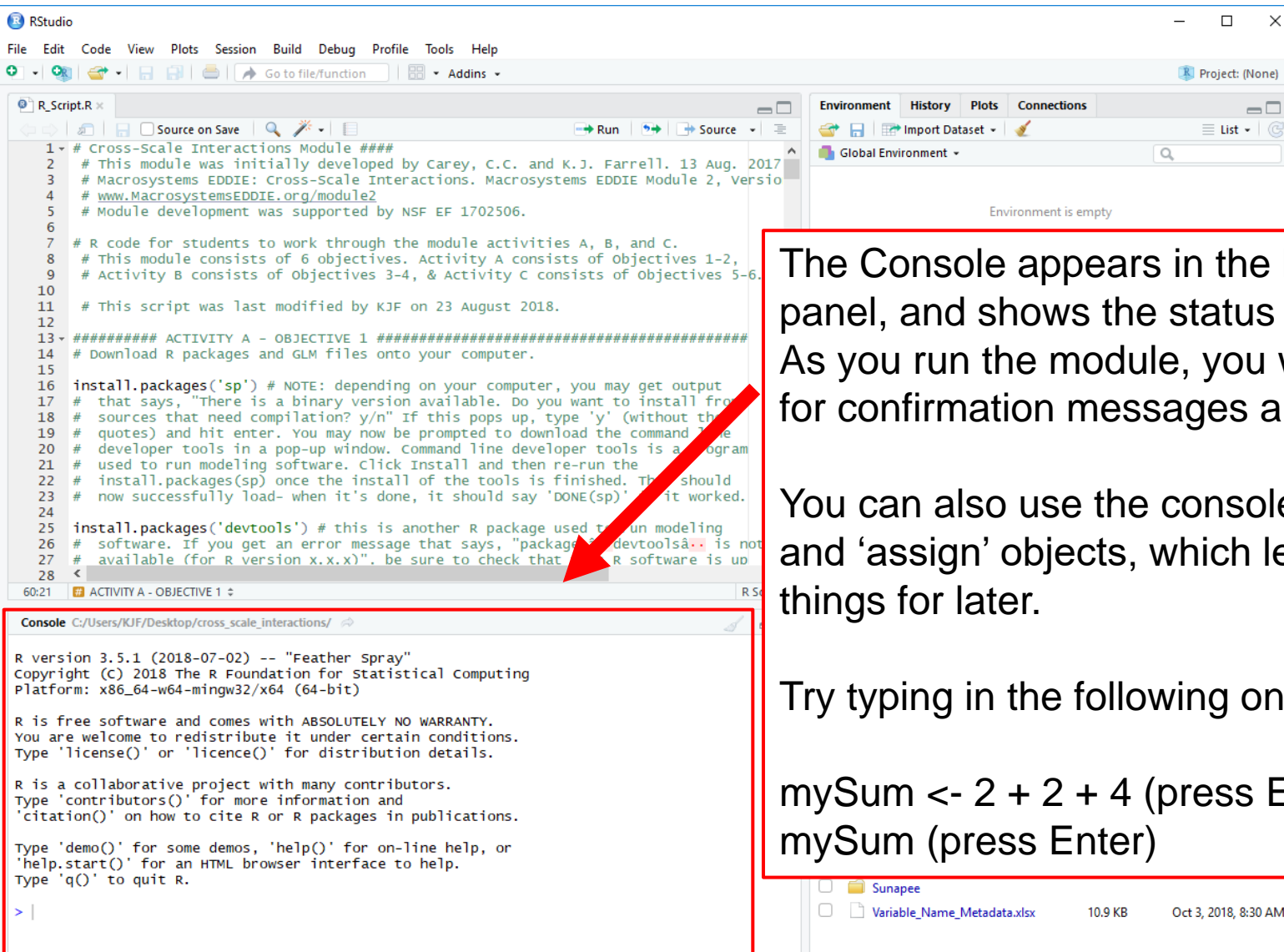
Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

> |
```

Files Panel:

Name	Size	Modified
..		
Mendota		
R_Script.R	24 KB	Oct 3, 2018, 8:30 AM
Sunapee		
Variable_Name_Metadata.xlsx	10.9 KB	Oct 3, 2018, 8:30 AM

RStudio Basics: Console



The screenshot shows the RStudio interface. The top menu bar includes File, Edit, Code, View, Plots, Session, Build, Debug, Profile, Tools, and Help. Below the menu is a toolbar with icons for file operations and a search bar. The main editor window displays an R script with comments and code for installing packages and running modeling software. A red arrow points from the script to the console panel at the bottom left. The console panel shows the R version (3.5.1), copyright information, and a list of contributors. The bottom right panel shows the Environment pane with a table of variables.

```
R version 3.5.1 (2018-07-02) -- "Feather Spray"
Copyright (C) 2018 The R Foundation for Statistical Computing
Platform: x86_64-w64-mingw32/x64 (64-bit)

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'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.

> |
```

Variable	Class	Size	Created
Sunapee	data.frame	10.9 KB	Oct 3, 2018, 8:30 AM
Variable_Name_Metadata.xlsx	data.frame	10.9 KB	Oct 3, 2018, 8:30 AM

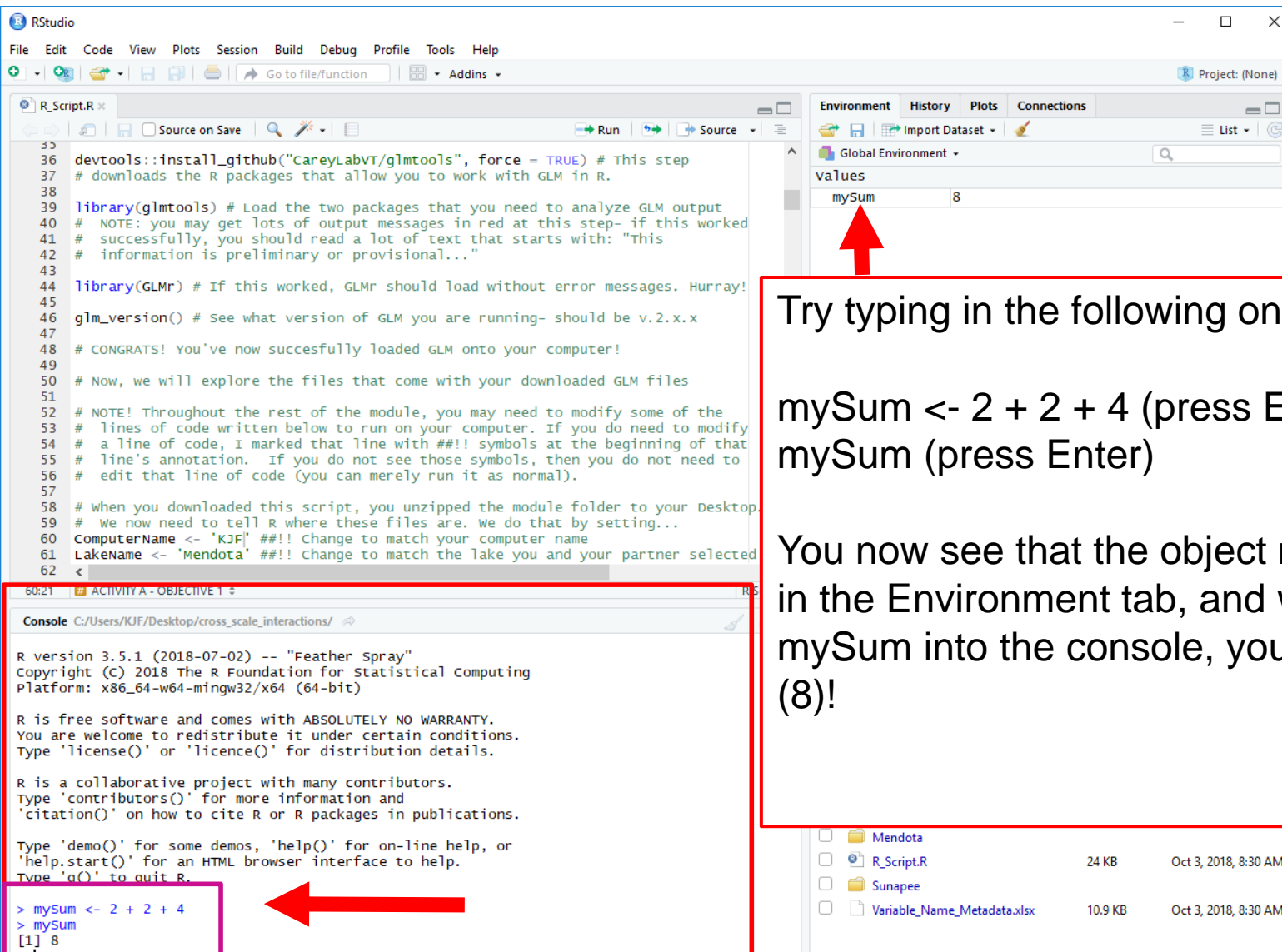
The Console appears in the bottom left panel, and shows the status of your scripts. As you run the module, you will check here for confirmation messages and error codes.

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)
```


RStudio Basics: Console



The screenshot shows the RStudio interface with the following components:

- Source Editor:** Contains R code for installing and loading GLM packages, and setting environment variables.
- Environment Tab:** Shows the 'Global Environment' with a variable 'mySum' having a value of 8. A red arrow points to this entry.
- Console:** Displays the R version (3.5.1), copyright information, and the results of the commands entered in the console. A red box highlights the final output: `> mySum` and `[1] 8`. A red arrow points to this output.
- Files Panel:** Shows a list of files in the current project, including 'Mendota', 'R_Script.R', 'Sunapee', and 'Variable_Name_Metadata.xlsx'.

Code in Source Editor:

```
35 devtools::install_github("CareyLabVT/glmtools", force = TRUE) # This step
36 # downloads the R packages that allow you to work with GLM in R.
37
38
39 library(glmtools) # Load the two packages that you need to analyze GLM output
40 # NOTE: you may get lots of output messages in red at this step- if this worked
41 # successfully, you should read a lot of text that starts with: "This
42 # information is preliminary or provisional..."
43
44 library(GLM) # If this worked, GLM should load without error messages. Hurray!
45
46 glm_version() # See what version of GLM you are running- should be v.2.x.x
47
48 # CONGRATS! You've now successfully loaded GLM onto your computer!
49
50 # Now, we will explore the files that come with your downloaded GLM files
51
52 # NOTE! Throughout the rest of the module, you may need to modify some of the
53 # lines of code written below to run on your computer. If you do need to modify
54 # a line of code, I marked that line with ### symbols at the beginning of that
55 # line's annotation. If you do not see those symbols, then you do not need to
56 # edit that line of code (you can merely run it as normal).
57
58 # when you downloaded this script, you unzipped the module folder to your Desktop
59 # We now need to tell R where these files are. We do that by setting...
60 computerName <- 'KJF' ### Change to match your computer name
61 LakeName <- 'Mendota' ### Change to match the lake you and your partner selected
62 <
```

Console Output:

```
R version 3.5.1 (2018-07-02) -- "Feather Spray"
copyright (C) 2018 The R Foundation for Statistical Computing
Platform: x86_64-w64-mingw32/x64 (64-bit)

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'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.

> mySum <- 2 + 2 + 4
> mySum
[1] 8
```

Environment Tab:

Values
mySum

Files Panel:

File Name	Size	Modified
Mendota	24 KB	Oct 3, 2018, 8:30 AM
R_Script.R	10.9 KB	Oct 3, 2018, 8:30 AM
Sunapee		
Variable_Name_Metadata.xlsx		

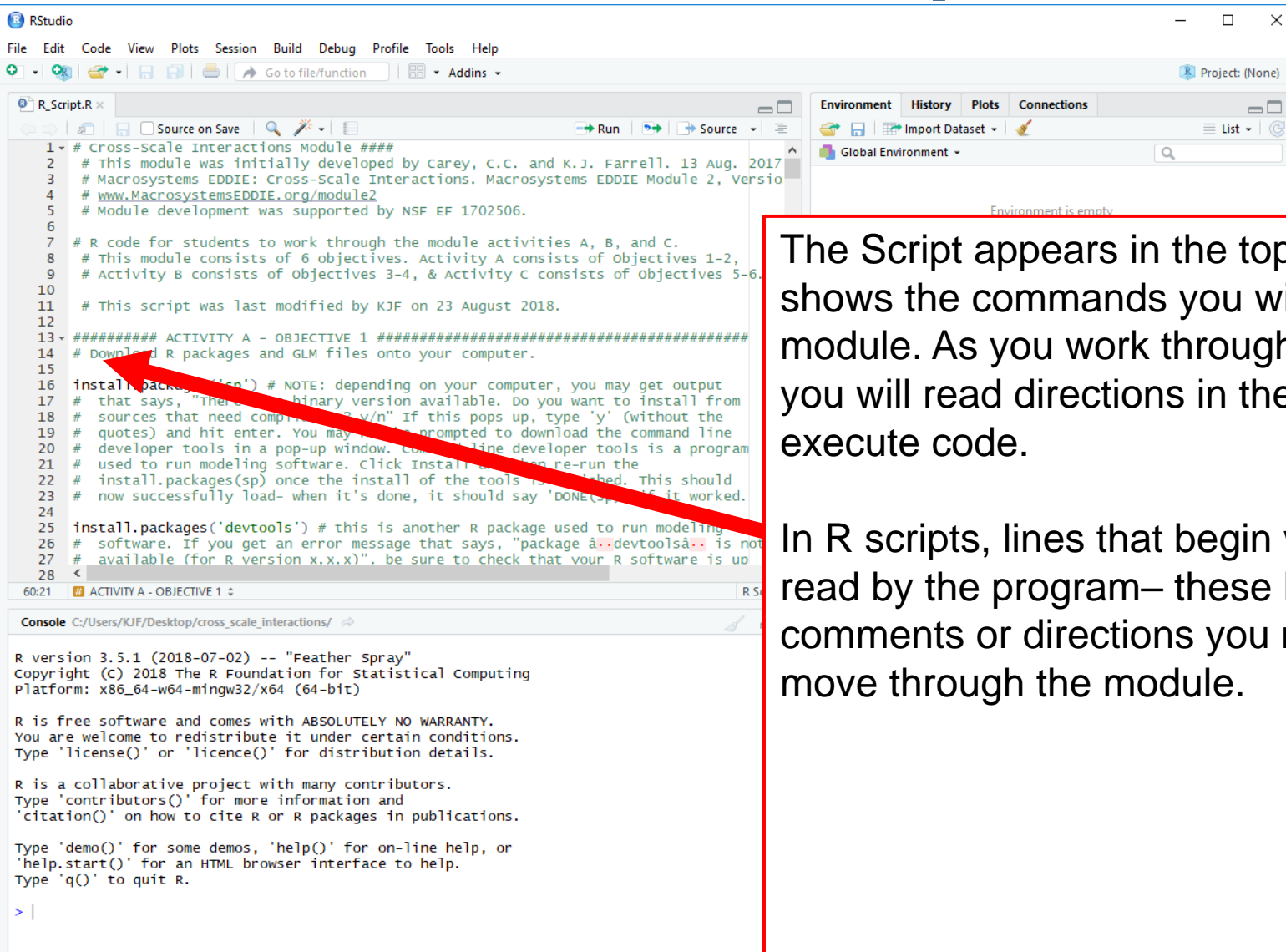
Try typing in the following on the console:

`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)!

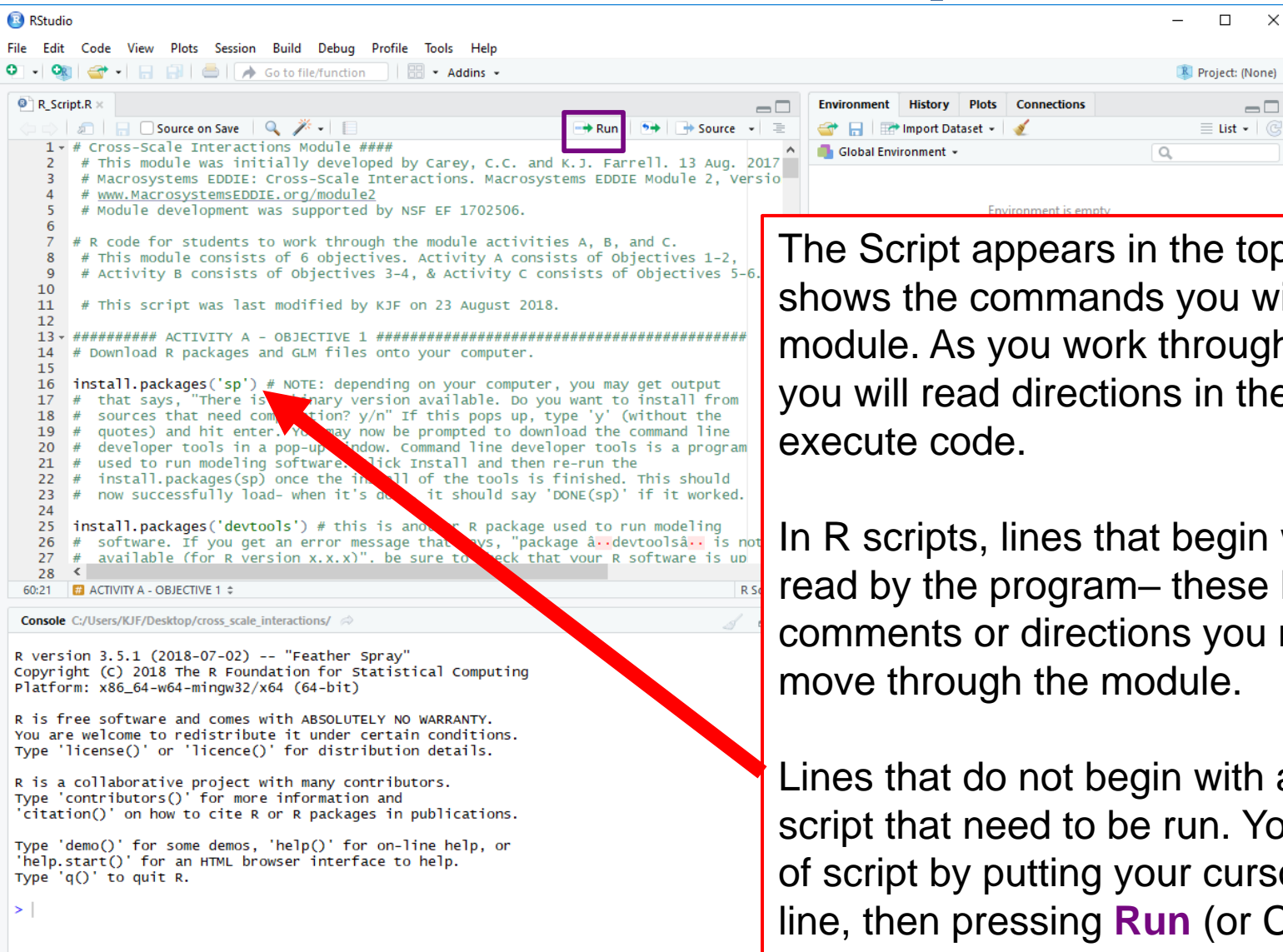
RStudio Basics: Script



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

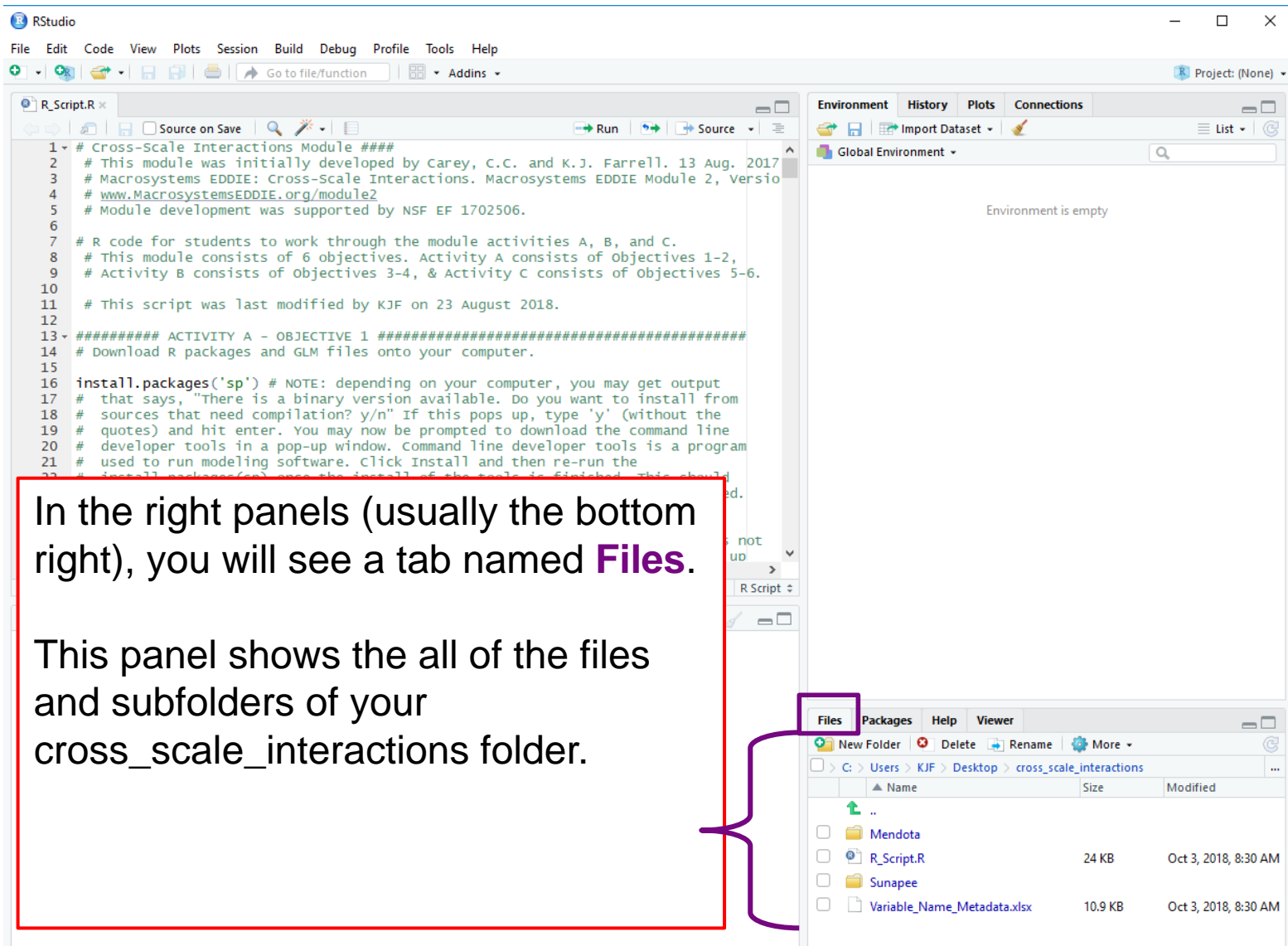


The Script appears in the top left panel, and shows the commands you will run for the module. As you work through the module, you will read directions in the script and execute code.

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



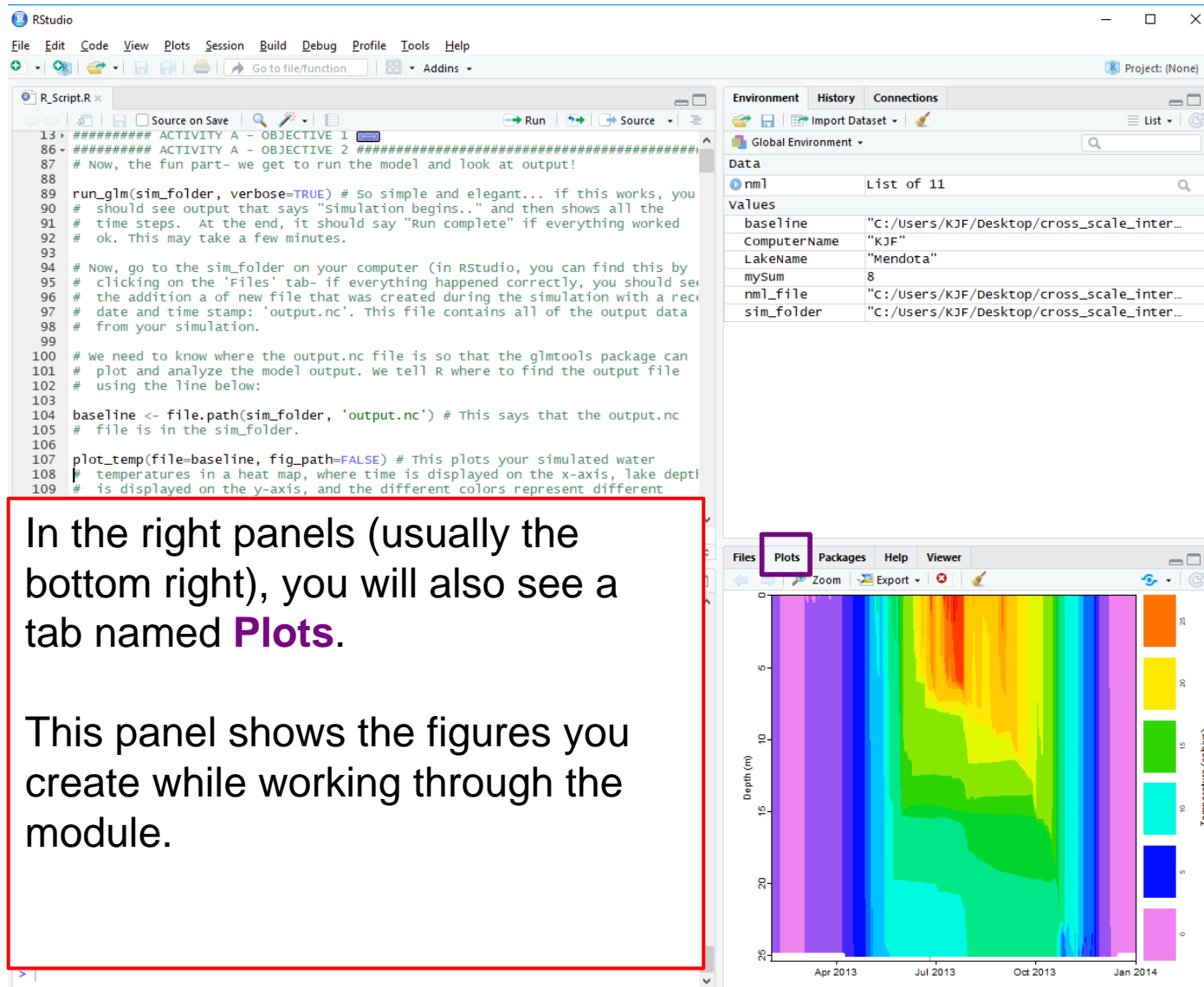
The screenshot shows the RStudio interface. The main editor window on the left contains an R script with comments and code for installing packages. The right-hand side of the interface is divided into several panels. The 'Files' panel, located at the bottom right, is highlighted with a red box and a purple bracket. It shows the file structure of the current project, which is 'cross_scale_interactions'. The file list includes 'Mendota', 'R_Script.R', 'Sunapee', and 'Variable_Name_Metadata.xlsx'. The 'Environment' panel above it shows 'Global Environment' and 'Environment is empty'.

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

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

Name	Size	Modified
..		
Mendota		
R_Script.R	24 KB	Oct 3, 2018, 8:30 AM
Sunapee		
Variable_Name_Metadata.xlsx	10.9 KB	Oct 3, 2018, 8:30 AM

RStudio Basics: Plots



The screenshot displays the RStudio environment with three main panels. The left panel shows an R script with comments and code for running a simulation and plotting a heatmap. The top-right panel shows the 'Environment' tab with a table of variables. The bottom-right panel shows the 'Plots' tab with a heatmap of temperature over time and depth.

Environment Panel:

Variable	Value
baseline	"C:/Users/KJF/Desktop/cross_scale_inter..."
ComputerName	"KJF"
LakeName	"Mendota"
mySum	8
nm1_file	"C:/Users/KJF/Desktop/cross_scale_inter..."
sim_folder	"C:/Users/KJF/Desktop/cross_scale_inter..."

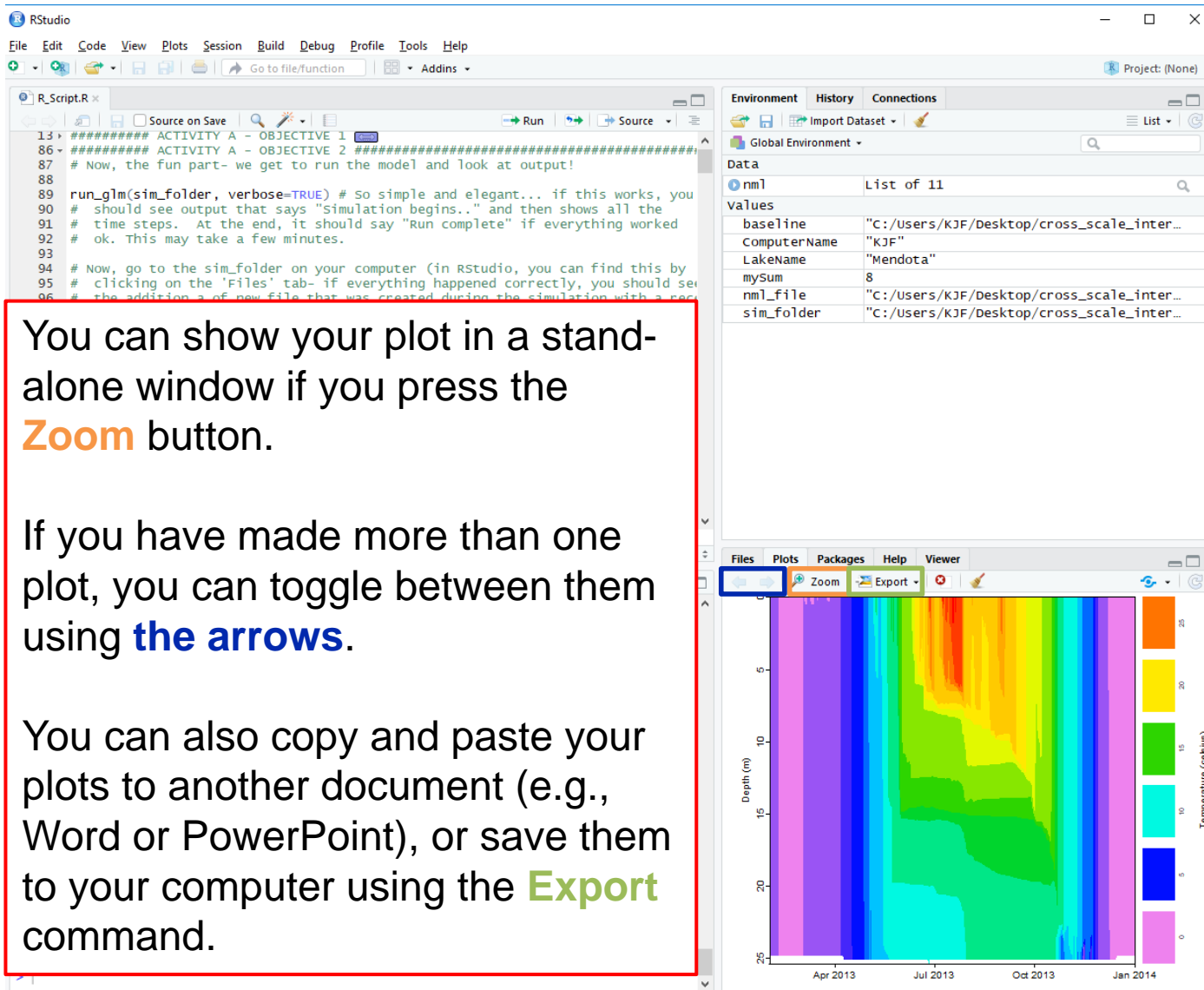
Plots Panel:

The heatmap shows temperature (Celsius) on the color scale (0 to 25) against Depth (m) on the y-axis (0 to 25) and Time on the x-axis (Apr 2013 to Jan 2014). The plot shows a clear seasonal pattern with warmer temperatures in the summer and cooler temperatures in the winter.

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



The screenshot displays the RStudio environment. The top menu bar includes File, Edit, Code, View, Plots, Session, Build, Debug, Profile, Tools, and Help. Below the menu is a toolbar with icons for running code, saving, and other functions. The main editor window shows an R script with comments and code for running a simulation. The Environment pane on the right lists variables in the Global Environment, including 'nm1' and 'sim_folder'. The Plots pane at the bottom shows a heatmap plot of Temperature (Celsius) versus Depth (m) over time, with a color scale from 0 to 25. The 'Zoom' button in the plot toolbar is highlighted with a blue box.

```
13 ##### ACTIVITY A - OBJECTIVE 1
86 ##### ACTIVITY A - OBJECTIVE 2 #####
87 # Now, the fun part- we get to run the model and look at output!
88
89 run_glm(sim_folder, verbose=TRUE) # So simple and elegant... if this works, you
90 # should see output that says "simulation begins.." and then shows all the
91 # time steps. At the end, it should say "Run complete" if everything worked
92 # ok. This may take a few minutes.
93
94 # Now, go to the sim_folder on your computer (in RStudio, you can find this by
95 # clicking on the 'Files' tab- if everything happened correctly, you should see
96 # the addition of a new file that was created during the simulation with a new
```

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**.

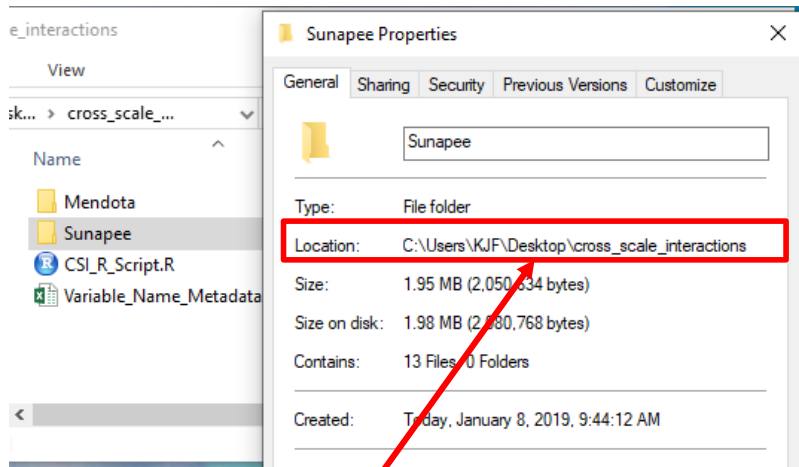
You can also copy and paste your plots to another document (e.g., Word or PowerPoint), or save them to your computer using the **Export** command.

Activity A: What's my sim_folder?

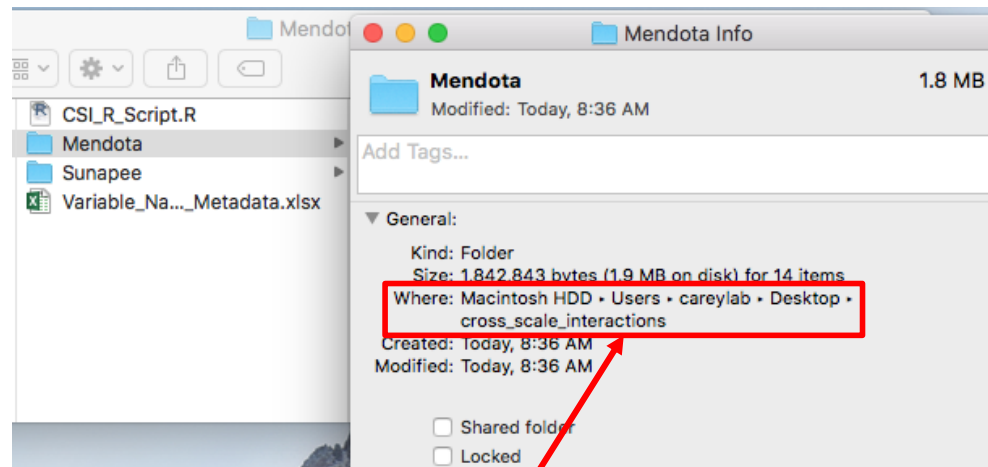
In Activity A, you need to set your `sim_folder` so that R knows where to find the module folders for your focal lake on *your* computer!

To find your folder path:

- 1) Navigate to the 'cross_scale_interactions' folder on your Desktop
- 2) Right click on the folder that matches your model lake, 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/cross_scale_interactions/Sunapee
 - Mac: Users -> careylab -> Desktop -> cross_scale_interactions -> Lakes -> Mendota



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!) AND change the LakeName part to match the name of your model lake's folder (e.g., Mendota or Sunapee).

```
55 # when working in R, we set the sim_folder to tell R where your files, scripts,
56 # and model output are stored.
57 # To find your folder path, navigate to the 'cross_scale_interactions' folder on
58 # your Desktop. Right click on the folder that matches your model lake (Mendota or Sunapee),
59 # then select Properties (windows) or Get Info (Mac). Look under Location (windows)
60 # or where (Mac) to find your folder path (examples below):
61 # windows: C:/Users/KJF/Desktop/cross_scale_interactions/LakeName
62 # Mac: Users -> careylab -> Desktop -> cross_scale_interactions -> LakeName
63
64 sim_folder <- '/Users/cayelan/desktop/cross_scale_interactions/LakeName' ### Edit this line
65 # to define the sim_folder location for your model lake. You will need to change
66 # the part after Users/ to give the name of your computer (e.g., my computer name
67 # is cayelan, but yours will be different!) AND change the word LakeName to be
68 # the name of your model lake (Mendota or Sunapee).
69
70 setwd(sim_folder) ## This line of code is used to reset your working directory
71 # to the sim_folder. The point of this step is to make sure that any new files
72 # you create (e.g., figures of output) end up together in this folder.
73
```

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

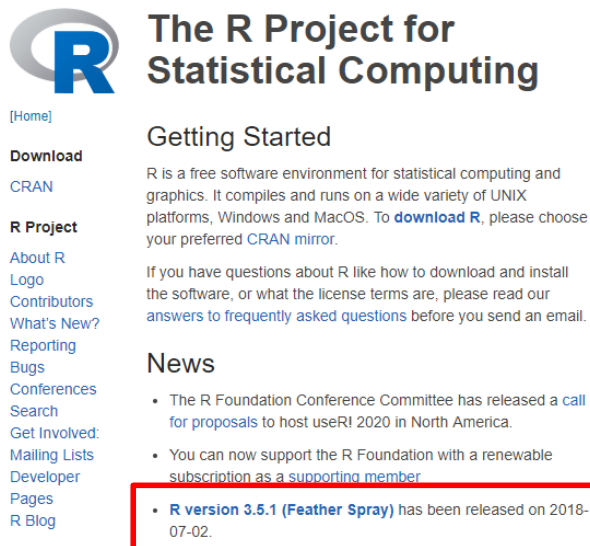
MACROSYSTEMS EDDIE: GLM TROUBLESHOOTING TIPS



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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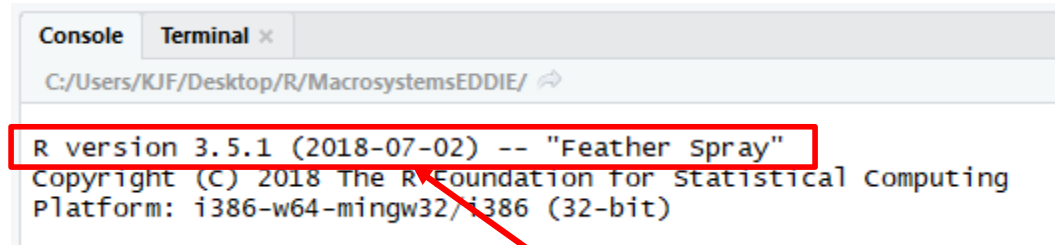
Getting Started

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.