

Macrosystems EDDIE: Getting Started + Troubleshooting Tips

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

<http://module3.macrosystemseddie.org>

Module development supported by NSF EF 1702506.

Last updated: 8 Jan. 2019

R and RStudio



R

- Statistical environment



RStudio

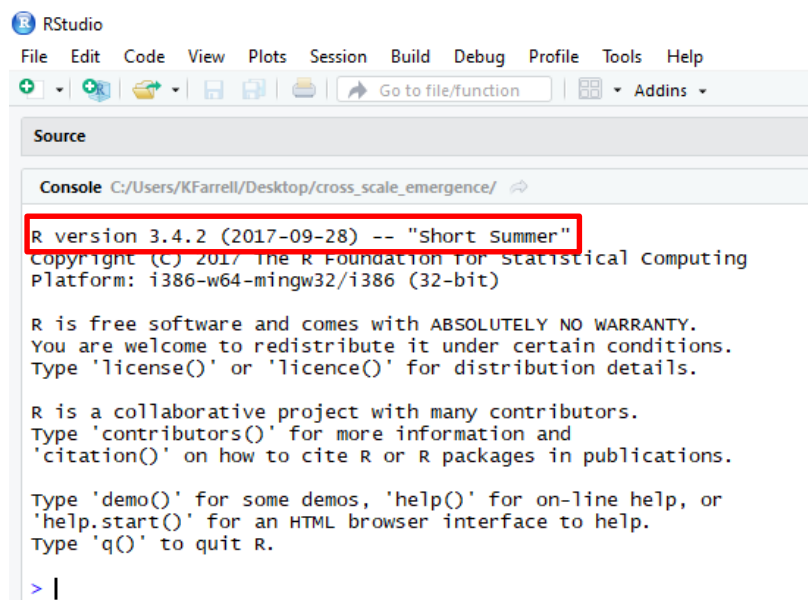
- Point and click program for using R in one place
 - Run code
 - Visualize plots
 - Access files

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 application window. The menu bar includes File, Edit, Code, View, Plots, Session, Build, Debug, Profile, Tools, and Help. The toolbar contains icons for file operations and a 'Go to file/function' search bar. The 'Source' pane is empty. The 'Console' pane shows the following text:

```
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)

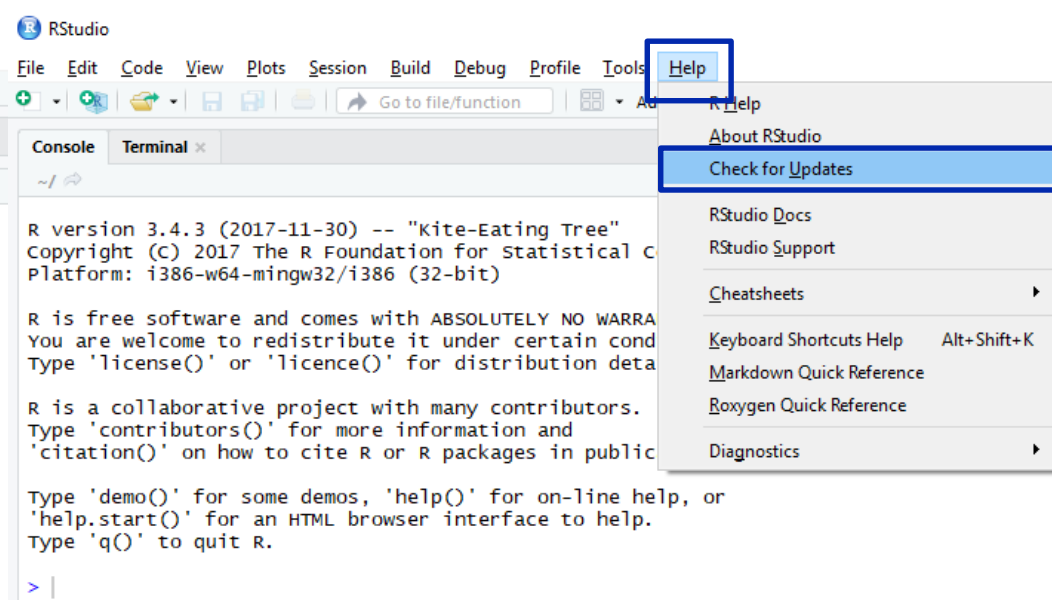
R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
Type 'license()' or 'licence()' for distribution details.

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 first line of the console output, 'R version 3.4.2 (2017-09-28) -- "Short Summer"', is highlighted with a red rectangular box.



The screenshot shows the RStudio application window with the 'Help' menu open. The menu items are: About RStudio, Check for Updates, RStudio Docs, RStudio Support, Cheatsheets, Keyboard Shortcuts Help (Alt+Shift+K), Markdown Quick Reference, Roxygen Quick Reference, and Diagnostics. The 'Check for Updates' option is highlighted with a blue rectangular box. The 'Console' pane shows the following text:

```
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.

> |
```

Download the module files

- Navigate to the Macrosystems EDDIE Module 3 website
 - <http://module3.macrosystemseddie.org>
- Scroll down to Teaching Materials and click Files for Running the Module

Teaching Materials:

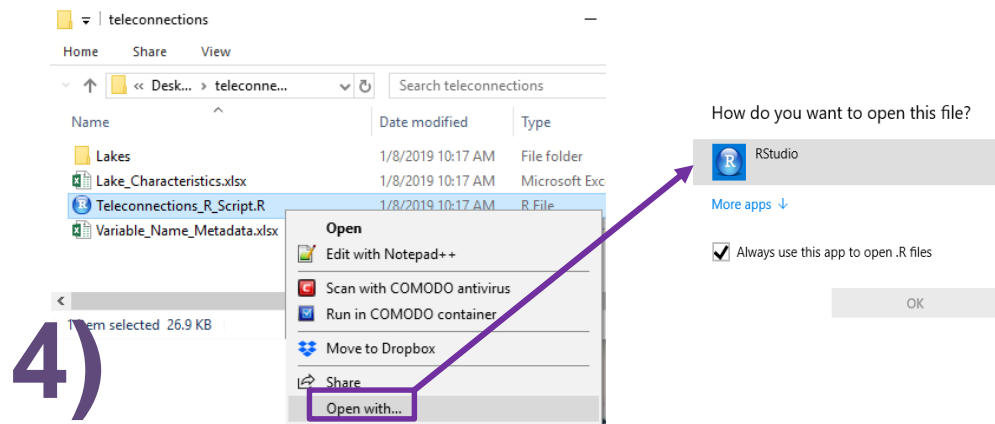
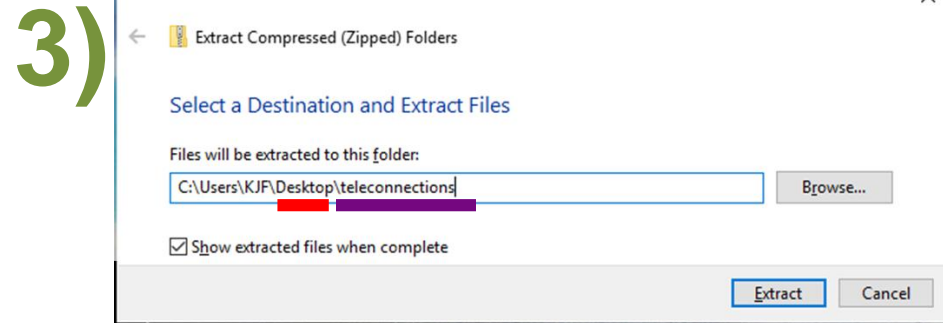
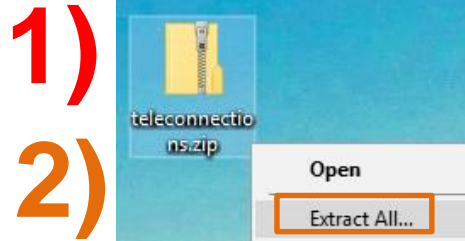
Note: We continue to update our lake model calibrations, so check back frequently to make sure you have the most up-to-date zip folder of files to use!

- [Files for Running the Module](#) (Zip Archive 2.1MB Nov2 18)– Zipped folder of all files needed to run the module in RStudio
- [R You Ready for EDDIE? Module 3](#) (Microsoft Word 2007 (.docx) 23kB Oct4 18)– Step-by-step guide to download R, RStudio, and module files

- Save the .zip folder to your Desktop

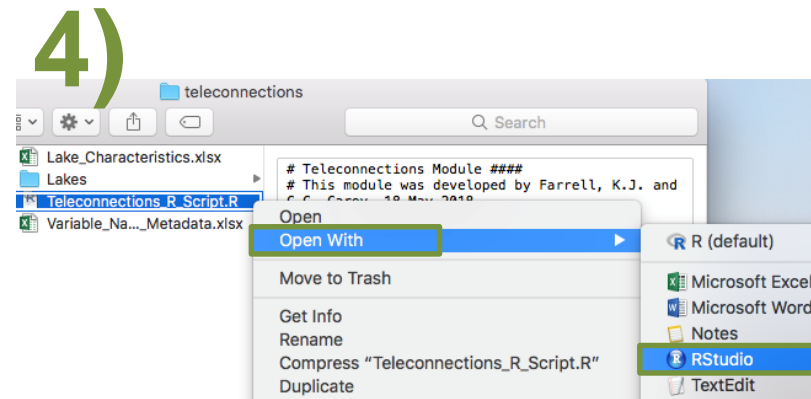
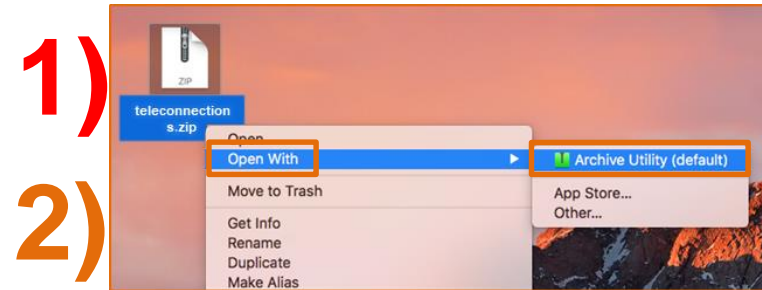
Unzip Files to Desktop: Windows

- 1) Download the zip folder directly from the MacroSystems EDDIE website to Desktop (or drag the zipped 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* **teleconnections**.Also **check the box** “Show extracted files when complete”
- 4) To open the module script in RStudio, right click on the file name (Teleconnections_R_Script.R), then choose **Open with...** and **RStudio**



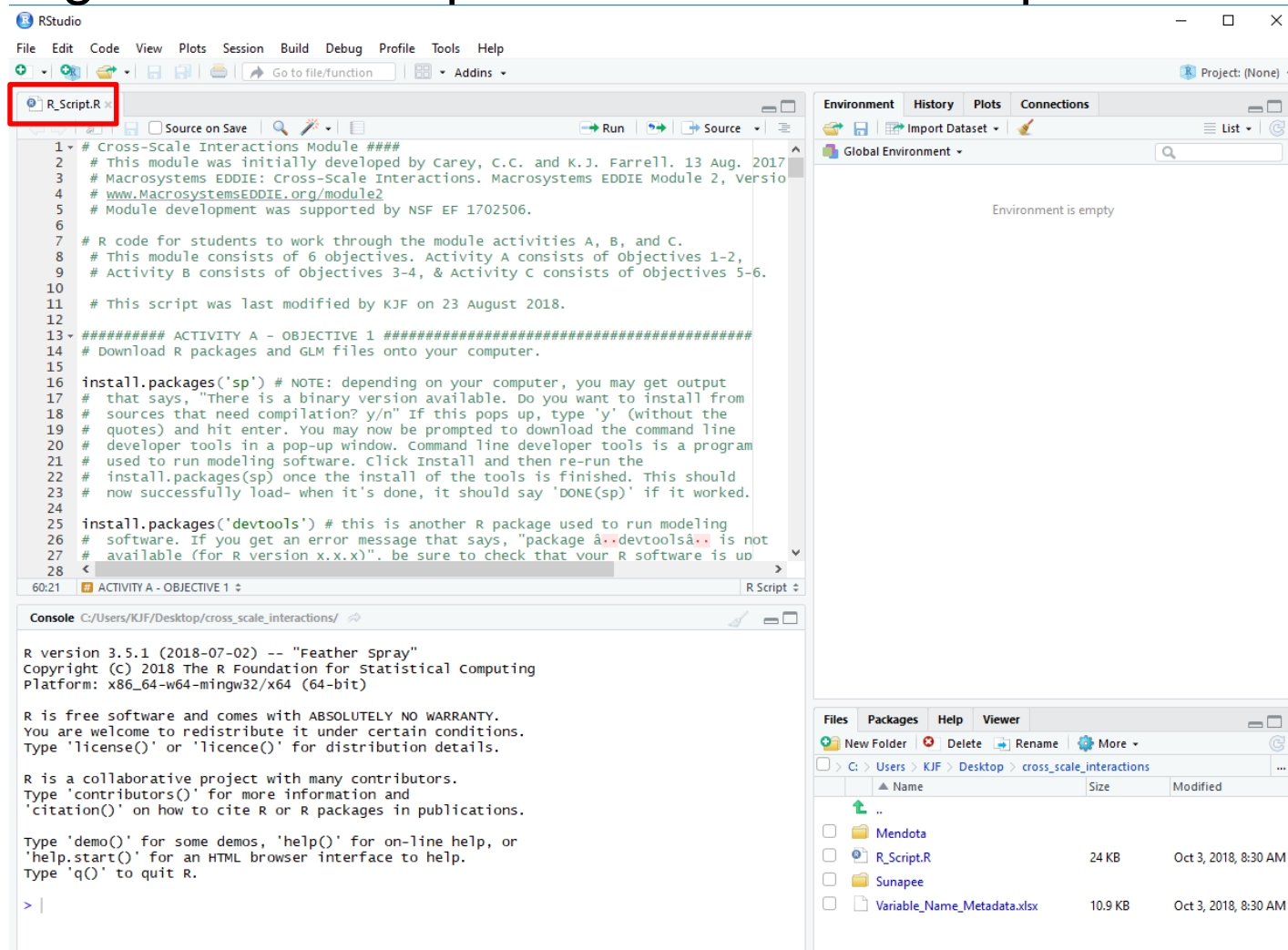
Unzip Files to Desktop: Mac

- 1) Download the zip folder directly from the MacroSystems EDDIE website, then drag the zipped 'teleconnections' folder from Downloads to the 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 teleconnections**.
- 4) To open the module script in RStudio, control + click on the Teleconnections_R_Script.R file, then choose **Open with...** and **RStudio**

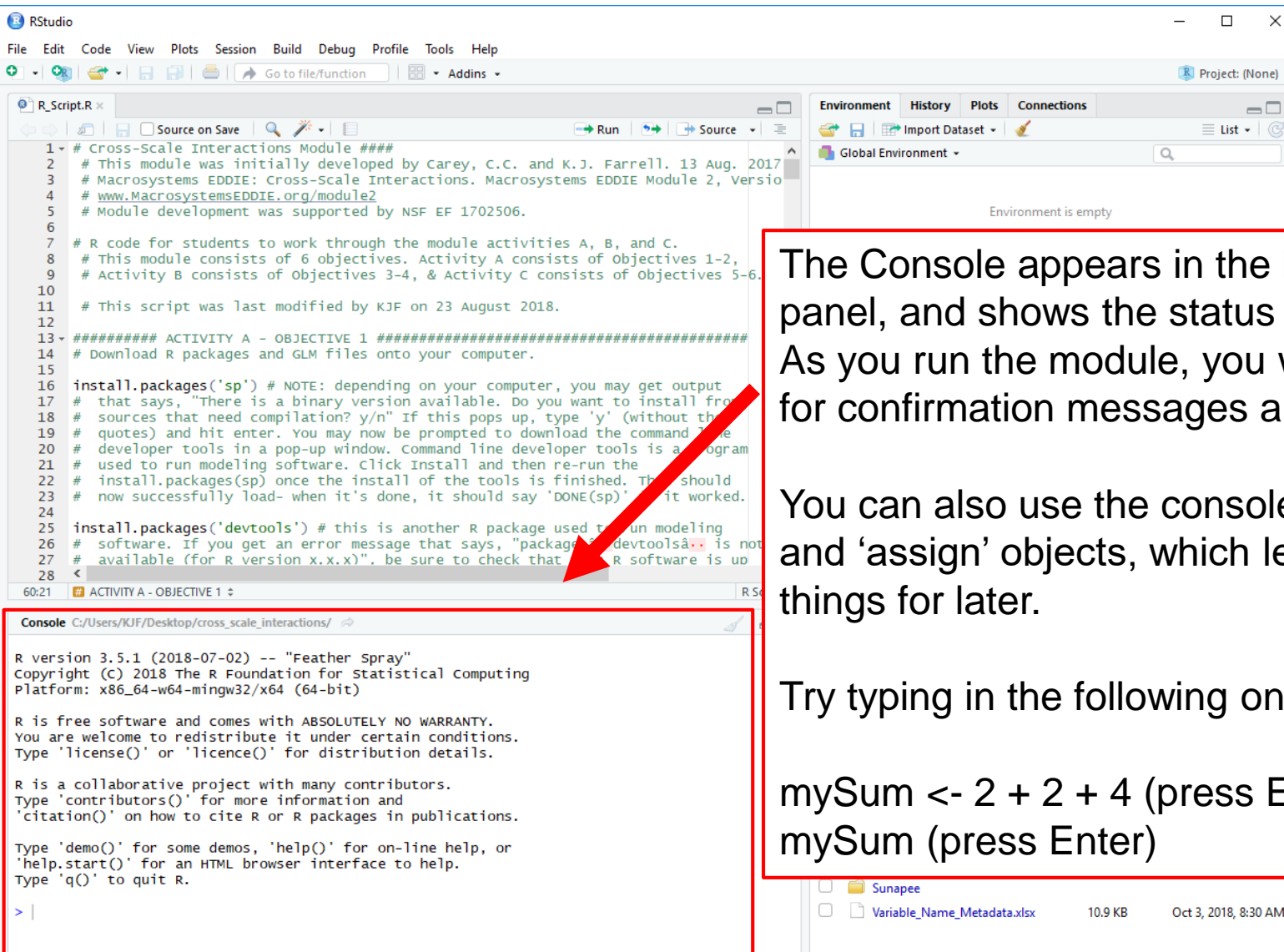


Opening Module Files in RStudio

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



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 'Go to file/function' 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 instructions for using R. The bottom right panel shows the Environment pane with a table of variables.

```
# Cross-Scale Interactions Module ###
# This module was initially developed by Carey, C.C. and K.J. Farrell. 13 Aug. 2017
# Macrosystems EDDIE: Cross-Scale Interactions. Macrosystems EDDIE Module 2, Versio
# www.MacrosystemsEDDIE.org/module2
# Module development was supported by NSF EF 1702506.

# R code for students to work through the module activities A, B, and C.
# This module consists of 6 objectives. Activity A consists of Objectives 1-2,
# Activity B consists of Objectives 3-4, & Activity C consists of Objectives 5-6.
# This script was last modified by KJF on 23 August 2018.

##### ACTIVITY A - OBJECTIVE 1 #####
# Download R packages and GLM files onto your computer.

install.packages('sp') # NOTE: depending on your computer, you may get output
# that says, "There is a binary version available. Do you want to install from
# sources that need compilation? y/n" If this pops up, type 'y' (without the
# quotes) and hit enter. You may now be prompted to download the command line
# developer tools in a pop-up window. Command line developer tools is a program
# used to run modeling software. Click install and then re-run the
# install.packages(sp) once the install of the tools is finished. This should
# now successfully load- when it's done, it should say 'DONE(sp)' and it worked.

install.packages('devtools') # this is another R package used to run modeling
# software. If you get an error message that says, "package 'devtools' is not
# available (for R version x.x.x)". be sure to check that R software is up
# to date.

60:21 ACTIVITY A - OBJECTIVE 1
```

Console C:/Users/KJF/Desktop/cross_scale_interactions/

```
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.
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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.

> |
```

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

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 three main panes. The top-left pane contains an R script with code for installing and loading GLM packages. The top-right pane shows the Environment tab with a variable 'mySum' having a value of 8. The bottom-left pane shows the console with R startup messages and a command prompt. A red arrow points from the text box to the 'mySum' variable in the Environment pane. Another red arrow points from the text box to the console input area.

```
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 <
```

Environment

Global Environment	
mySum	8

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)!

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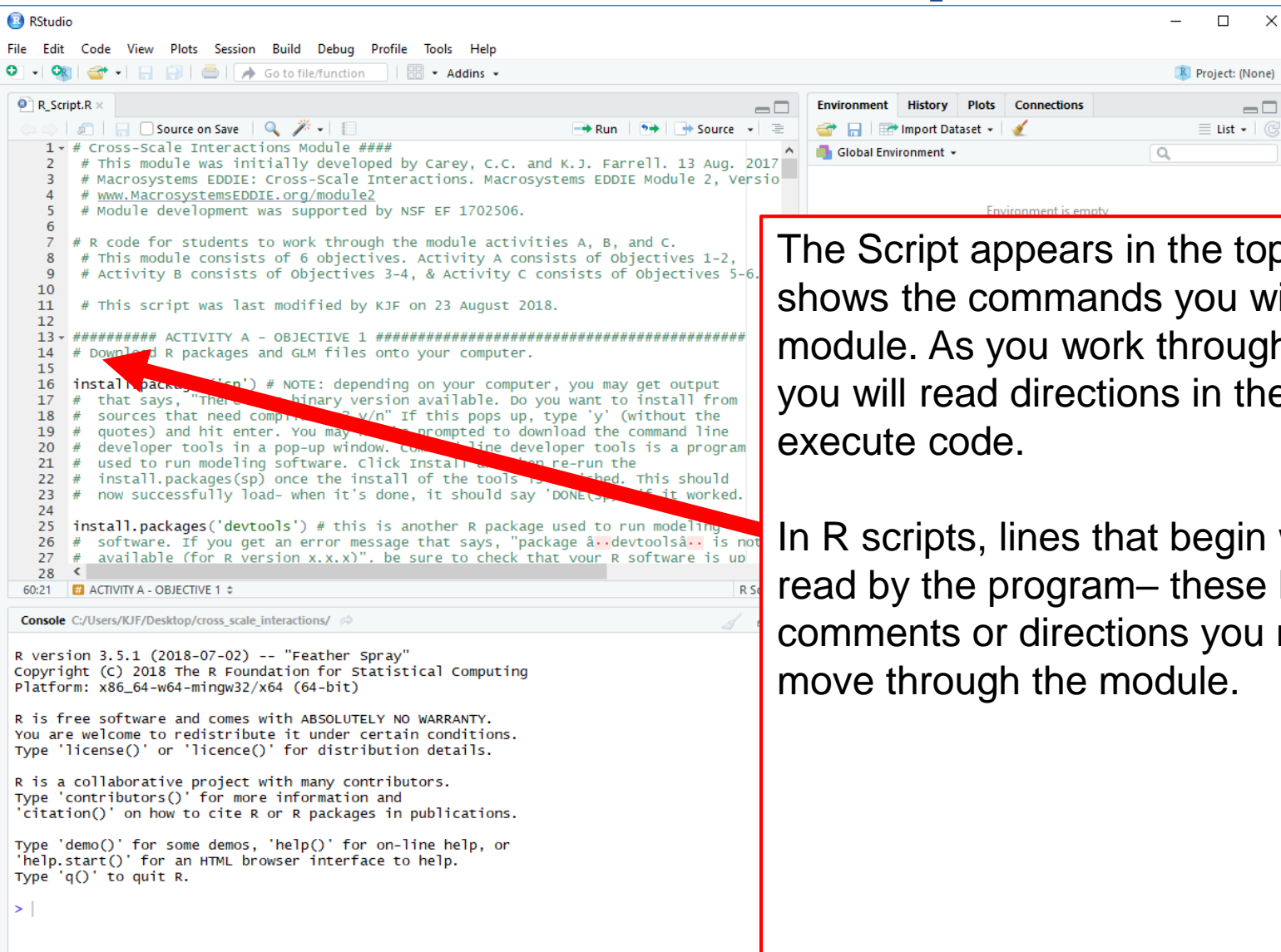
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Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

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

<input type="checkbox"/>	Mendota		
<input type="checkbox"/>	R_Script.R	24 KB	Oct 3, 2018, 8:30 AM
<input type="checkbox"/>	Sunapee		
<input type="checkbox"/>	Variable_Name_Metadata.xlsx	10.9 KB	Oct 3, 2018, 8:30 AM

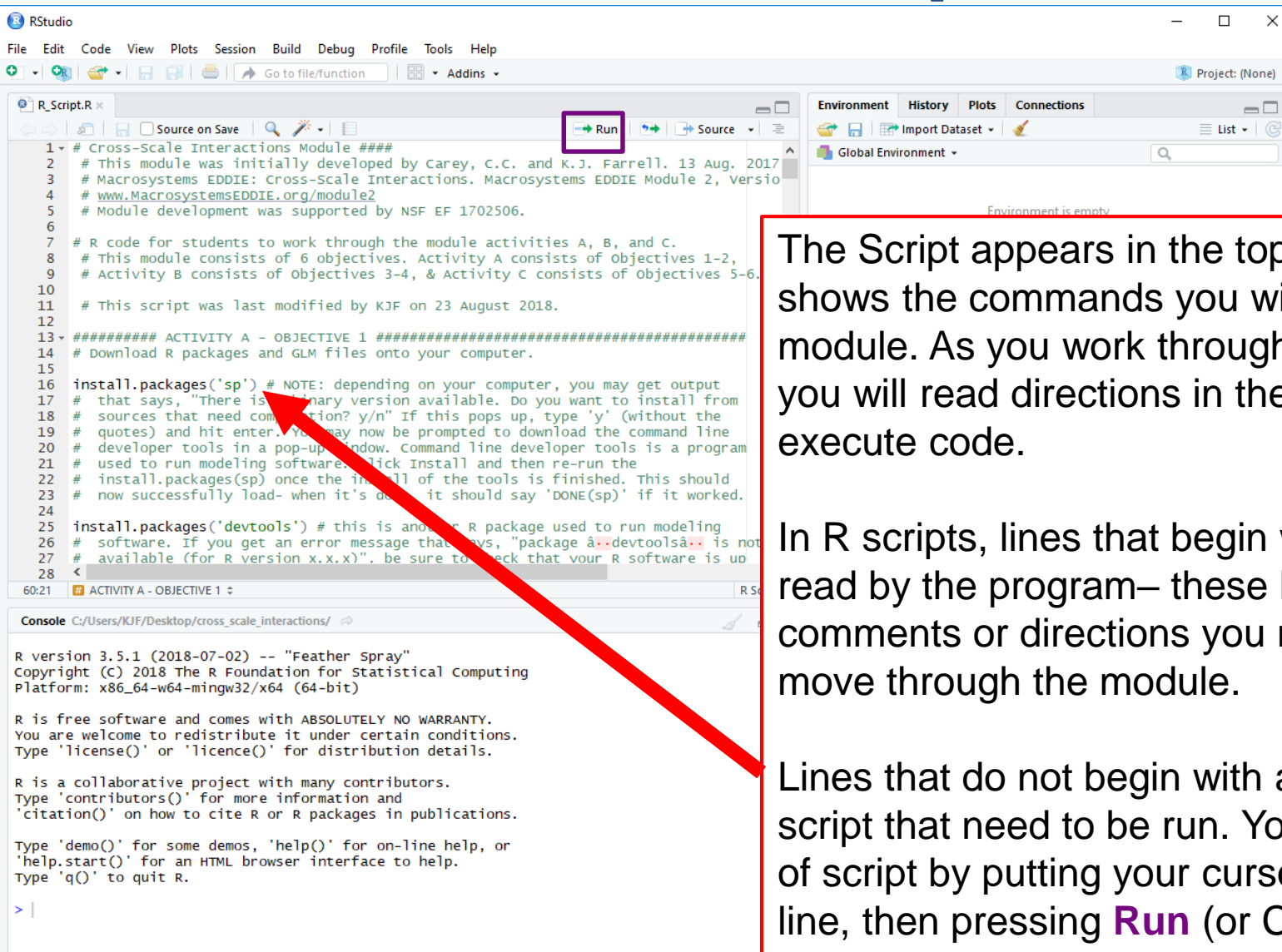
RStudio Basics: Script



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

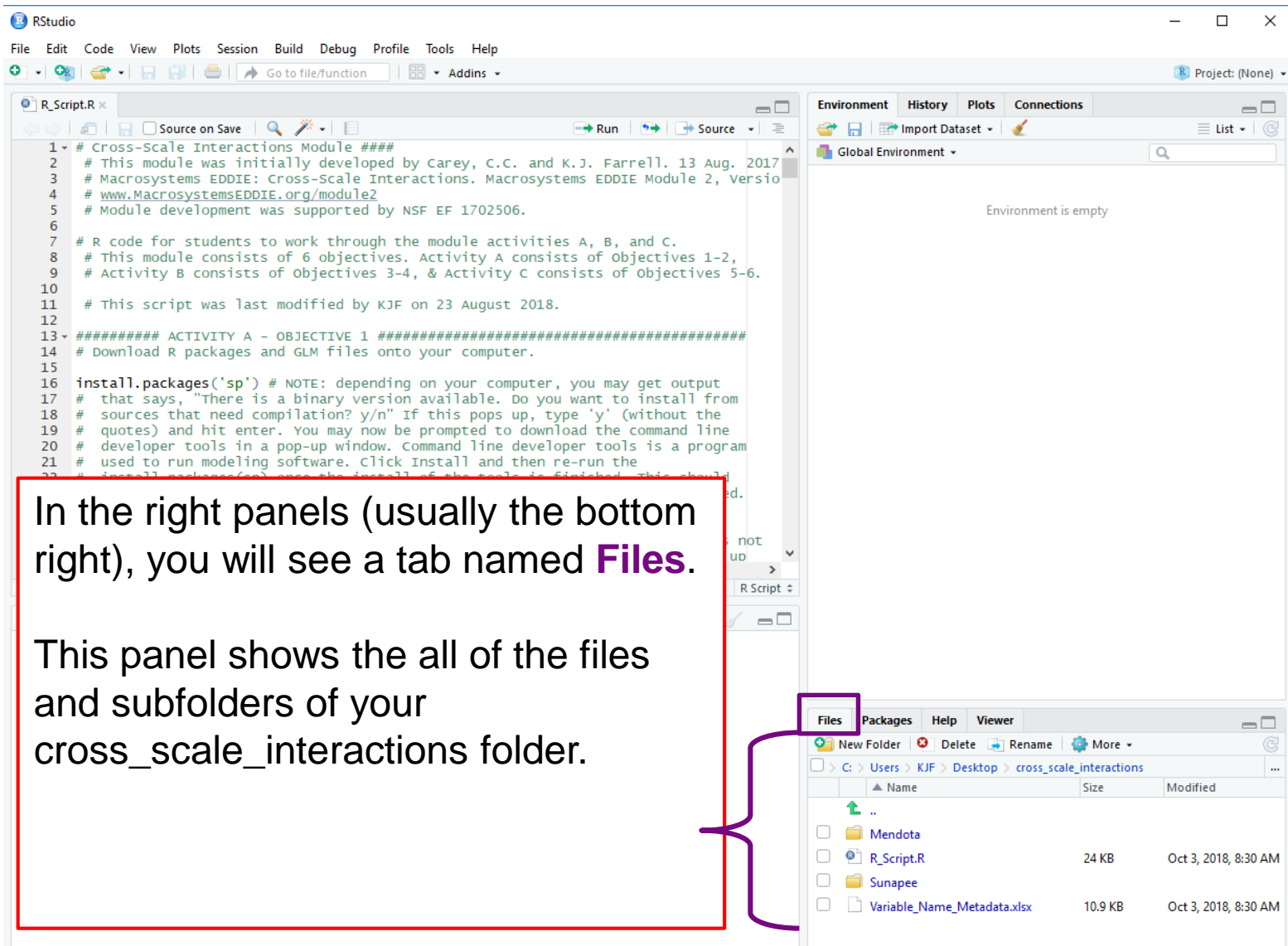


The Script appears in the top left panel, and shows the commands you will run for the module. As you work through the module, you will read directions in the script and execute code.

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



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

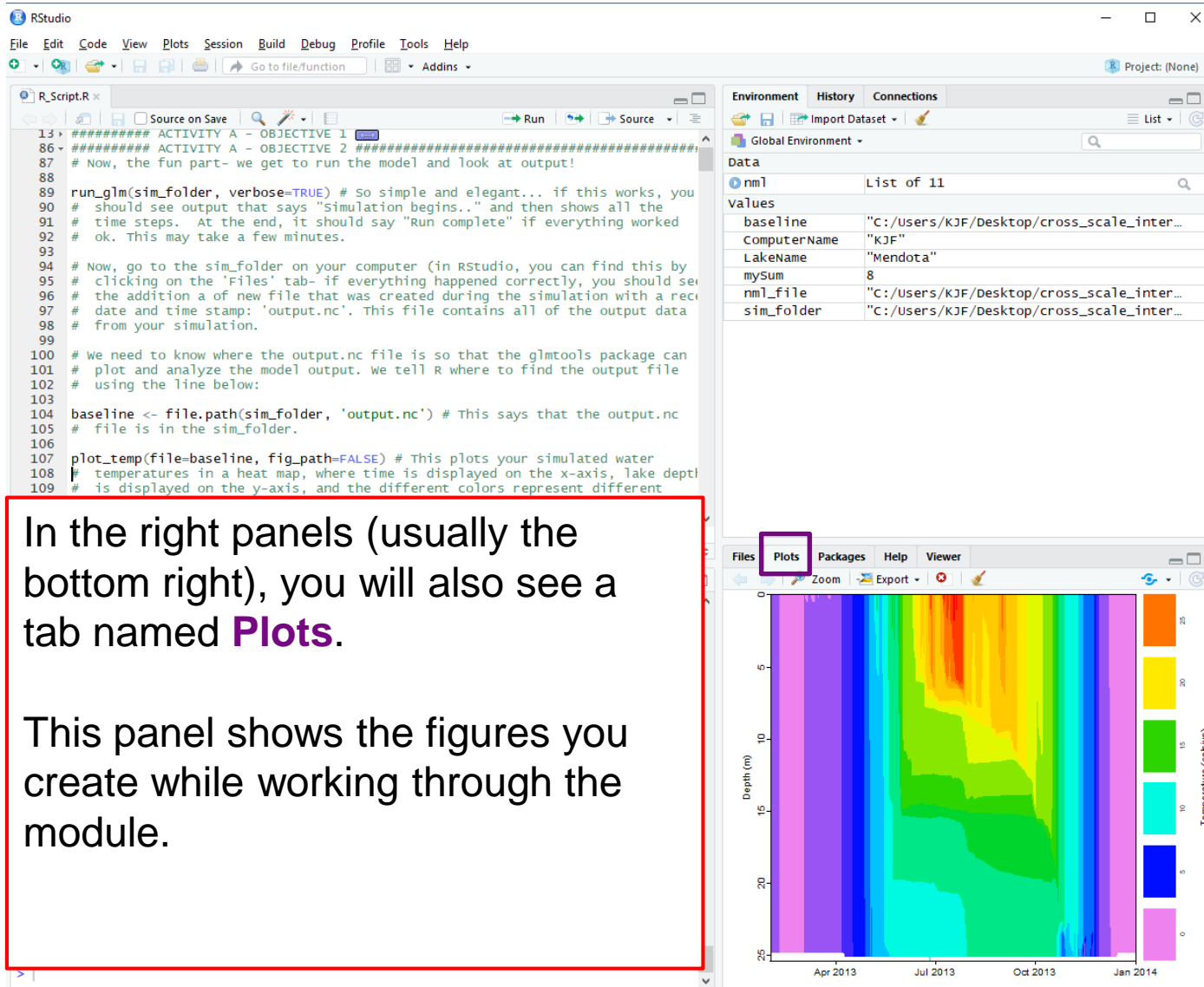
This panel shows all of the files and subfolders of your `cross_scale_interactions` folder.

The screenshot shows the RStudio interface with the following components:

- Source Editor:** Displays R code for the "Cross-Scale Interactions Module". The code includes comments about the module's development and instructions for installing R packages and GLM files.
- Environment Panel:** Shows the "Global Environment" which is currently empty.
- Files Panel:** Located at the bottom right, it shows the file structure of the `cross_scale_interactions` folder. The files listed are:

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. The left pane shows an R script with comments and code for running a simulation and plotting the results. The right pane shows the Environment tab with a list of objects. The bottom pane shows a heatmap plot of temperature over time and depth.

Script Editor (Left Pane):

```
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 a of new file that was created during the simulation with a rec
97 # date and time stamp: 'output.nc'. This file contains all of the output data
98 # from your simulation.
99
100 # we need to know where the output.nc file is so that the glmtools package can
101 # plot and analyze the model output. We tell R where to find the output file
102 # using the line below:
103
104 baseline <- file.path(sim_folder, 'output.nc') # This says that the output.nc
105 # file is in the sim_folder.
106
107 plot_temp(file=baseline, fig_path=FALSE) # This plots your simulated water
108 # temperatures in a heat map, where time is displayed on the x-axis, lake dept
109 # is displayed on the y-axis, and the different colors represent different
```

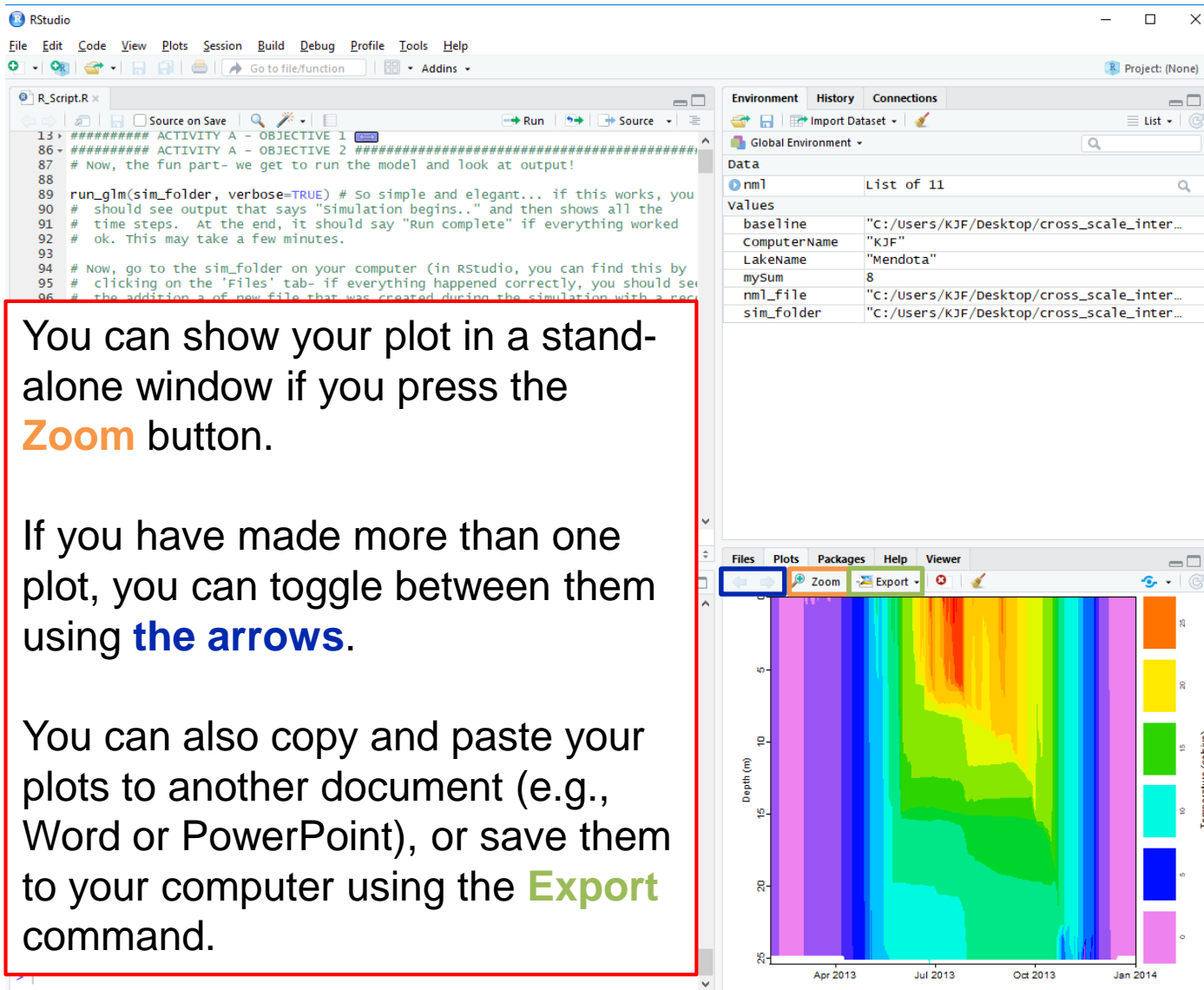
Environment Pane (Right Pane):

Object	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 Pane (Bottom Pane):

The plot is a heatmap showing temperature (Celsius) on the y-axis (Depth (m)) and time on the x-axis (Apr 2013, Jul 2013, Oct 2013, Jan 2014). The color scale ranges from 0 to 25 Celsius.

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. The left pane shows a script editor with R code. The right pane contains the Environment, History, and Connections tabs. The Environment tab shows a list of objects in the Global Environment, including 'nm1' and 'sim_folder'. The bottom pane shows a plot window with a zoomed-in view of a heatmap. The heatmap's y-axis is labeled 'Depth (m)' and ranges from 0 to 25. The x-axis is labeled with dates: Apr 2013, Jul 2013, Oct 2013, and Jan 2014. A color scale on the right indicates temperature in Celsius, ranging from 0 to 25. The plot window has a toolbar with buttons for Files, Plots, Packages, Help, and Viewer. The 'Zoom' button is highlighted with a red 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 red
```

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**.

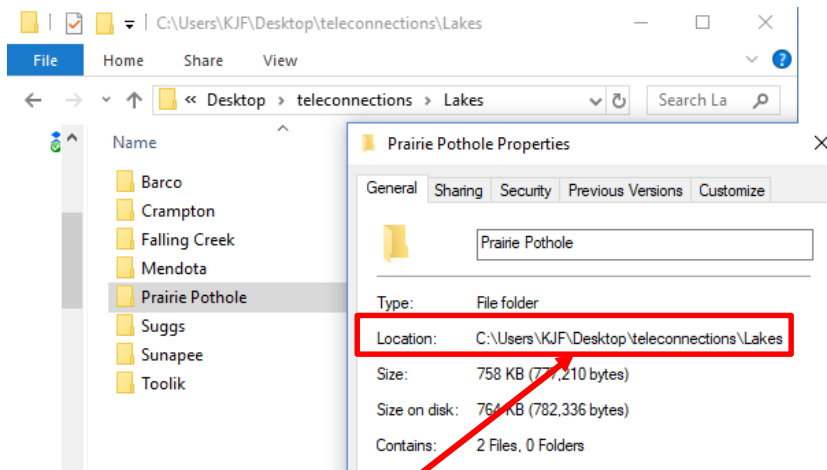
You can also copy and paste your plots to another document (e.g., Word or PowerPoint), or save them to your computer using the **Export** command.

Activity A: What's my sim_folder?

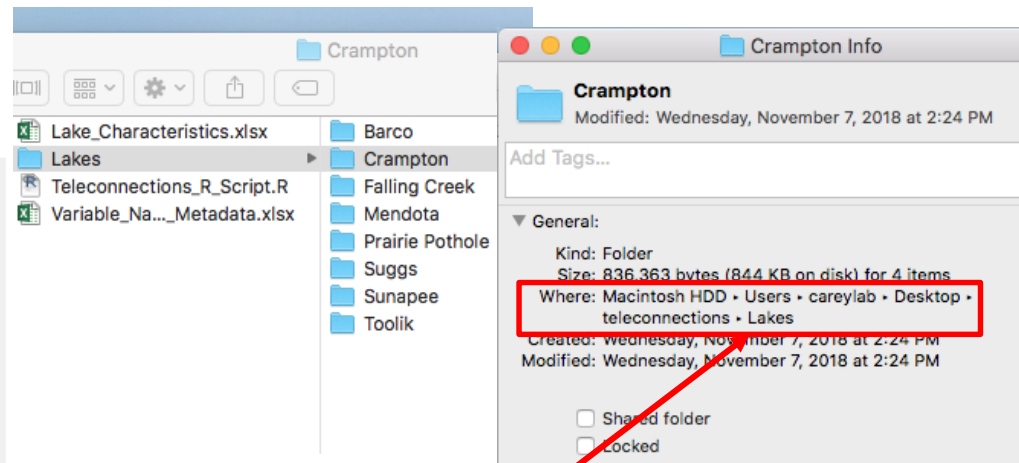
In Activity A, you need to set your `sim_folder` so that R knows where to find the module folders for your focal lake on *your* computer!

To find your folder path:

- 1) Navigate to the 'teleconnections' folder on your Desktop, then open the Lakes folder
- 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/teleconnections/Lakes/Prairie Pothole
 - Mac: Users -> careylab -> Desktop -> teleconnections -> Lakes -> Crampton



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.

```
59 # when working in R, we set the sim_folder to tell R where your files, scripts,
60 # and model output are stored.
61 # To find your folder path, navigate to the 'teleconnections' folder on your Desktop,
62 # then open the Lakes folder. Right click on the folder that matches your model lake,
63 # then select Properties (windows) or Get Info (Mac). Look under Location (windows)
64 # or where (Mac) to find your folder path (examples below):
65 # windows: C:/Users/KJF/Desktop/teleconnections/Lakes/LakeName
66 # Mac: Macintosh HDD -> Users -> careylab -> Desktop -> teleconnections -> Lakes -> LakeName
67
68 sim_folder <- '/Users/cayelan/Desktop/teleconnections/Lakes/LakeName' ##!! Edit this line
69 # to define the sim_folder location for your model lake. You will need to change
70 # the part after Users/ to give the name of your computer (e.g., my computer name
71 # is cayelan, but yours will be different!) AND change the LakeName part to be
72 # the name of your model lake.
73
74 setwd(sim_folder) # This line of code resets your working directory to the sim_folder.
75 # The point of this step is to make sure that any new files you create (e.g.,
76 # plots of model output) end up together in this folder.
77
```

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!

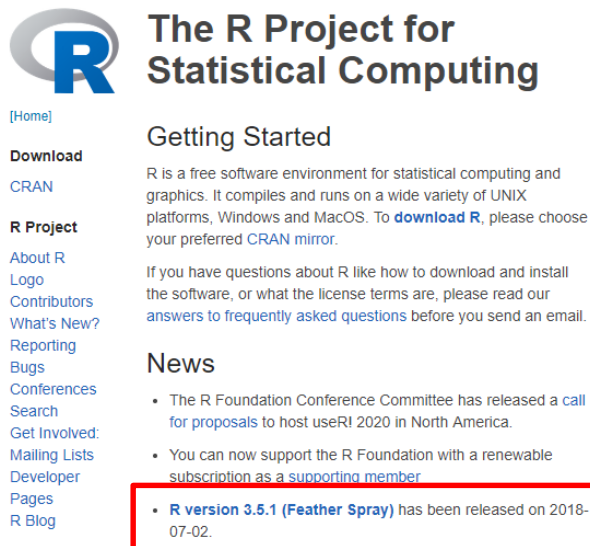
MACROSYSTEMS EDDIE: GLM TROUBLESHOOTING TIPS



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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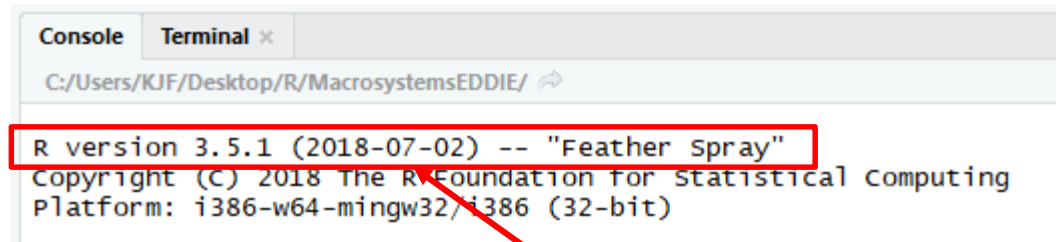
Getting Started

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?

- A GLM driver file (.csv) was opened in Excel, which corrupts the *time* column so it can't be read by GLM

How to fix it:

- 1) Open the .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) If you're still having trouble with this error after reformatting the file, download a new copy of the files from the Module 3 website, and *do not open* any files in Excel.

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.