
Applied geostatistics and open-source statistical computing

Exercise 0: Preparing the computing environment

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This document explains how to set up your personal computing environment so that you can complete the exercises.

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1 Preparing the R environment

There are four steps:

1. Install the R base program (§1.1);
2. Install the RStudio IDE (§2);
3. Install additional R packages (§2.1);
4. Set up an RStudio project (§2.2).

These steps are a bit different on the three major desktop platforms (MS-Windows, Mac OS X, Linux). In this note we only cover MS-Windows; if you use one of the other systems you should be able to modify the instructions accordingly; in case of problems please contact the instructor.

1.1 Installing the R base program

1. Connect your computer to the Internet and open a web browser.
2. Follow the link just below, which will redirect to the current Windows binary release and automatically begin the download of the installation program to a temporary location on your system:

<http://mirrors.dotsrc.org/cran/bin/windows/base/release.htm>

The program to install R under MS-Windows is named something like `R-3.0.2-win.exe`¹; the name changes with the version.

If you are on another OS, navigate to CRAN (The Comprehensive R Archive Network)², locate and download the R installation program for your OS.

3. Run the installation program; this will install R on your machine.

! → Note: you must have **administrator** priviledges in order to install R (or any other program).

4. A an icon for R should appear on your desktop; a shortcut to R should also be added to the “Start” menu.

2 Installing the RStudio IDE

It is possible to use R by typing at the command prompt or by cutting-and-pasting from documents. The R GUI for Windows also has a basic editor (under the FILE menu), but for serious work it is much easier to use a **code editor** to prepare and edit R commands, and send them to R for execution. Further, an **integrated development environment** (IDE) provides easy access to help text, package installation, graphical output,

¹ Version current as of 01-January-2014

² <http://cran.r-project.org/>

and so forth. There are several IDEs for R³; we recommend the RStudio IDE⁴ which is available for all three principal desktop OS.

To install RStudio:

1. Connect your computer to the Internet and open a web browser and navigate to the RStudio download page

<http://www.rstudio.com/ide/download/desktop>

This will detect your system and recommend the proper download. Download the installer program to a temporary location on your system, and then run it; this should install RStudio, icons, and shortcuts. R source code files (extension .R) are associated with RStudio.

2. Start RStudio. Your recently-installed R should open in the “Console” window (usually, lower-left pane).

2.1 Installing additional packages

The base installation of R includes the core packages for the S language, R base graphics, and the most common analyses; but there are thousands of additional packages for specific types of statistical analysis.

You can see the list of these at the CRAN site⁵ by clicking on the PACKAGES link at the left of the CRAN home page.

To set up for this course we need to install two basic geostatistical packages along with their dependencies (i.e., other packages the chosen one need in order to function properly); you can use this same procedure later to install other packages.

1. Connect your computer to the Internet.
2. Start RStudio.
3. Select menu item TOOLS | INSTALL PACKAGE(S)
4. If this is your first time installing packages, you will be asked to select a CRAN mirror; this is a machine in a nearby country which has agreed to store a copy of R and its packages. You can pick any mirror, they should all have the same information.
5. Specify packages gstat and sp; also check the box “Install dependencies”

The RStudio screen should look something like Figure 1.

³ See the list at http://www.sciviews.org/_rgui/

⁴ <http://www.rstudio.com/>

⁵ <http://cran.r-project.org/>

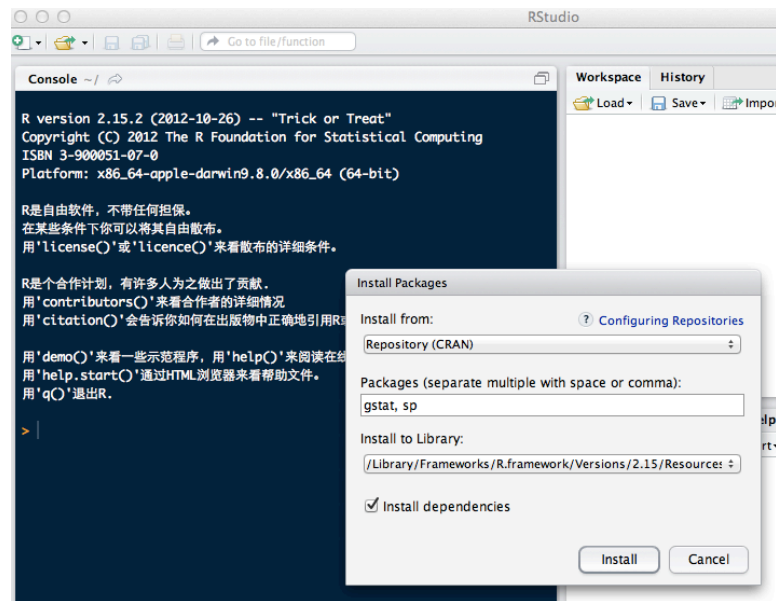


Figure 1: RStudio screen when requesting package installation

6. The selected packages and any dependencies will automatically be installed while you watch.

2.2 Setting up an RStudio project

It is good practice to separate your different analysis projects into different folders on your system. RStudio makes this easy with the concept of RStudio **projects**. To set up a project for this course under RStudio:

1. Create or select a directory to use for this course.

You can use an existing folder if you wish; the important point is to keep each project in its own folder; we consider this course to be a separate project.

For example, you might create a folder DEgeostats at an appropriate place in your folder structure.

2. Copy the R code files from directory **exercises/Rcode** on the CD image, or from Blackboard under LESSONS, item R CODE FOR EXERCISES, to this directory,
3. Start RStudio.
4. At the upper-right of the RStudio window is “Projects” button; there is also a PROJECTS menu; see Figure 2.
5. Select “new project” and then “Existing directory”; see Figure 3.
6. Navigate to the directory to which you copied the R source code; see Figure 4.

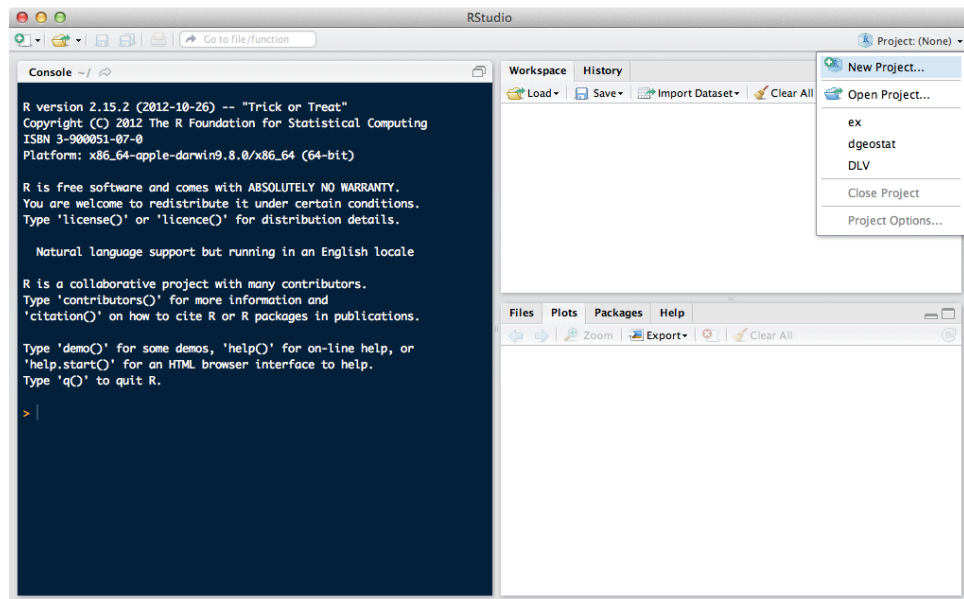


Figure 2: RStudio setup (1): the “Projects” button

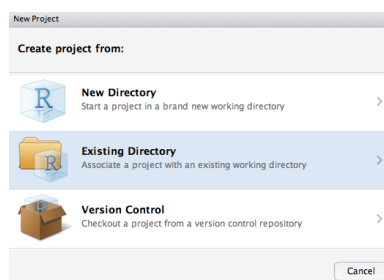


Figure 3: RStudio setup (2): using an existing directory

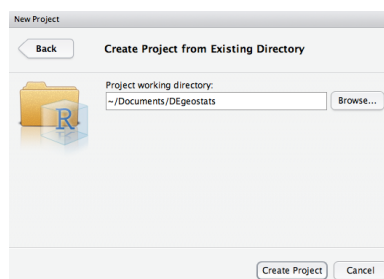


Figure 4: RStudio setup (3): specifying the directory

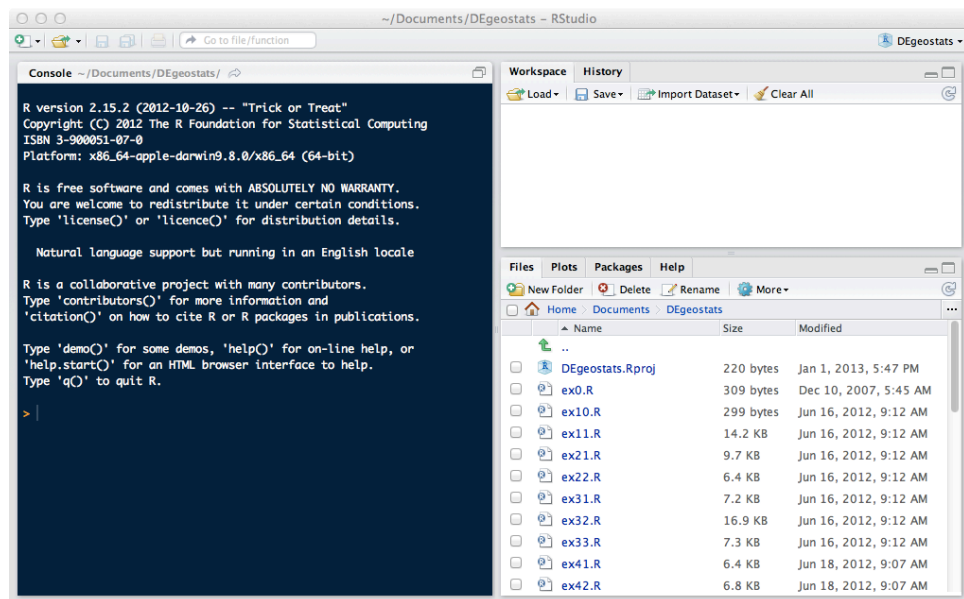


Figure 5: RStudio setup (4): after creating the project

7. Select “Create project”; the screen should now look like Figure 5. Notice how the upper-right of screen’s “Projects” button now has the name of the selected project.

You can create many projects; just select this course’s project to work on it. RStudio will start in the working directory for the project, open any code files that were open in the editor, and load the data saved from the previous session.

More information on RStudio projects can be found at <http://www.rstudio.com/ide/docs/using/projects>.

3 Example use of RStudio and R

This section has a small exercise where you learn to load scripts into RStudio and run them in R. This is a good way to work on the exercises.

1. Open RStudio.
2. If necessary, switch to the course project that you created in the previous §2.2 (use the “Projects” drop-down menu at upper-right).
3. Load file `ex0.R` into the editor window by clicking the icon for the file in the file list (lower-right panel).

The RStudio screen should look like Figure 6.

4. Send the first command either with RStudio menu command CODE | RUN LINES... or by clicking the “send line” toolbar button.

The output should appear in the R console window within RStudio; for this first command, it’s just your current working directory.

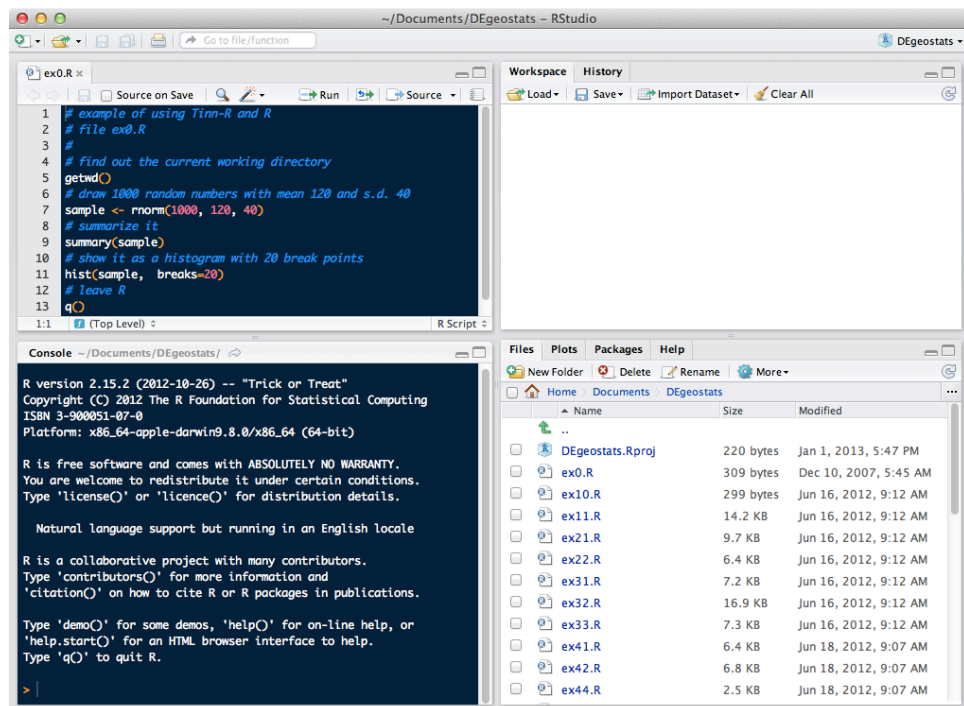


Figure 6: RStudio screen (1): after loading the source code file

5. Continue sending one line at a time and observing the results. Don't worry if you don't understand the command syntax now; we'll cover this in Exercise 1.
6. After sending the line `hist(sample, breaks=20)` you should see a histogram, displayed in the graphics pane (lower right), under the PLOTS tab.

The RStudio screen should now look like Figure 7.

7. Click on that line in RStudio and edit it to change the colour of the histogram bars:

```
hist(sample, breaks=20, col="lightblue")
```

8. Send that line again, by clicking the cursor anywhere on the line to highlight it, and then click the "send line" toolbar button again. You should see the same histogram but with different coloured bars.
9. Examine the other panes and tabs of the RStudio screen: (1) upper-right: workspace and history; (2) lower-right: file manager, package manager, help.
10. The last command will close R; then you can exit RStudio in the usual way.

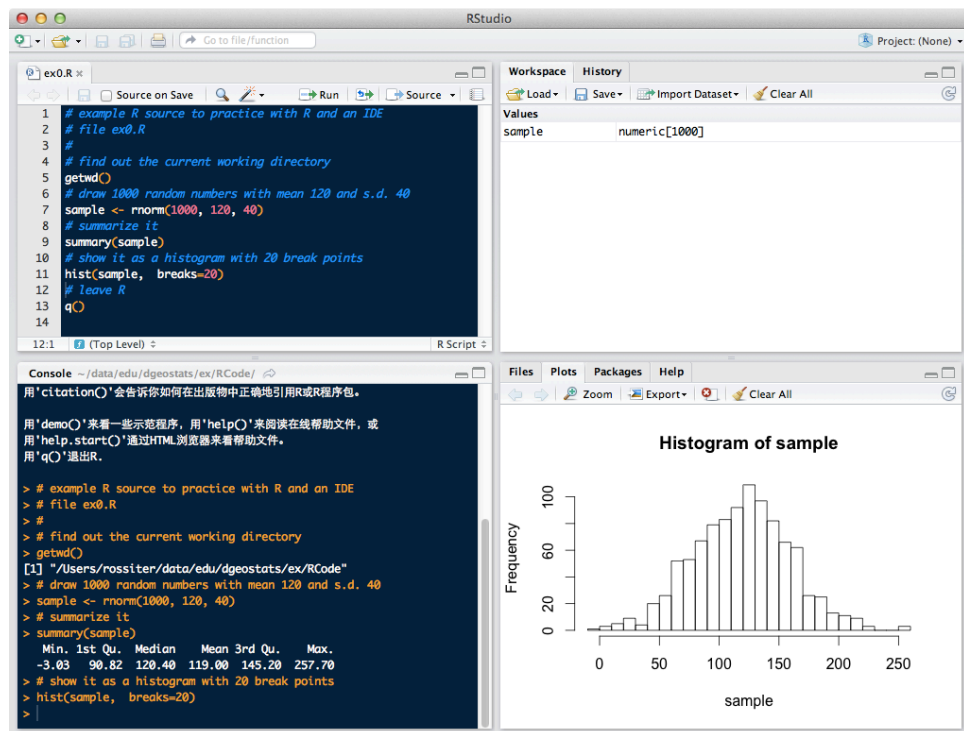


Figure 7: RStudio screen (2): after executing some commands

4 Accessing R code for the exercises

In the same way you loaded source code `ex0.R` in the previous §3, you can load all the source code files used in the tutorial exercises. Of course, you can read the R commands in the tutorial documents and type them yourself at the R prompt, or you can cut-and-paste from the exercise PDF. But it is easiest is to load the R code into RStudio and send it from there to R. Once sample code is loaded into RStudio, you can modify it if you wish; this is a good way to experiment with R and (geo)statistics.

Source code files are located under `exercises/Rcode` on the CD image, and under “Lessons; R Code for the exercises” in Blackboard. These files are named by exercise or part, with extension `.R`. For example, Exercise 1 has two source files: `ex10.R` (part zero, i.e., setup) and `ex11.R` (the analysis).

The exercise code was automatically generated from the exercise document using the Sweave [1, 2] or knitr reproducible research systems [3], so it is the same code that was executed to produce the output you see in the exercises. Some of the code is not relevant to the analysis and should be adapted or skipped, e.g. the calls to the `getwd` method to specify working directories. Use your judgement.

References

- [1] F Leisch. Sweave, part I: Mixing R and \LaTeX . *R News*, 2(3):28-31, December 2002. URL <http://CRAN.R-project.org/doc/Rnews/>.
- [2] F Leisch. *Sweave User's Manual*. TU Wein, Vienna (A), 2.7.1 edition, 2006. URL <http://www.stat.uni-muenchen.de/~leisch/Sweave/>.
- [3] Yihui Xie. *knitr: Elegant, flexible and fast dynamic report generation with R*, 2011. URL <http://yihui.name/knitr/>. Accessed 30-Dec-2012.