

Syllabus of A CICS-NC Short Course on R *R Programming for Climate Data Analysis and Visualization*

May 30 (Tuesday)-June 2 (Friday), 2017, 9:30am-12:00pm, 2:00-4:00pm
Classroom: NOAA/NCEI Conference Room, 151 Patton Ave., Asheville, NC 28801

Instructor: Dr. Samuel Shen
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Office Hours: 4:00-6:00pm (Tues-Fri) May 31-June 2 or by appointment

Text: Chapters 1-4 of “*R Programming for Climate Data Analysis and Visualization*”, Lecture Notes by Samuel Shen. PDF file of the notes will be distributed to the students.

Prerequisites: No formal computer programming experience is needed. Knowledge on data matrix addition, subtraction, multiplication, and eigenvectors is helpful.

Scope of the course: R is an open source computer programming language and software environment for data analysis and graphics. Originally released in 1995 for the purpose of statistical computing, R’s popularity and functionality have soared in the last decade and become a top five most popular big data programming skills together with SQL, Python, Java, and Hadoop. R Studio is a friendly user’s interface of R and has many functional buttons, such as *Run* and *Import Dataset*, and four windows: program script, executive console, history, and plots. Our short course will cover the following topics

- Basic operations of R: Plot time series, histograms, boxplots, scatterplots, regression, nonlinear data fitting, matrix operations, and symbolic calculations;
- R analysis of NOAA GlobalTemp data: Data reading and writing, data reformatting, map plotting, advanced time series plotting, visualization and animation of NOAA GlobalTemp data, and statistical analysis of the data;
- Advanced graphics for climate data: Plot the time series of two climate parameters on the same figure, fancy setups of plots, contour plots on maps, plot flow fields, and read and plot NCEP Reanalysis data; and
- EOFs: Fast computing for EOFs and PCs by the SVD approach, EOF plotting from NOAA GlobalTemp and NCEP Reanalysis data.

Computing: In class we will use R Studio, which is a friendly interface of R. Both R and R Studio are installed in NCEI server. Please test your access to R Studio and R from your laptop before the class begins. Bring your laptop to every class.

Instructional Format:

- Instructor lecture (9:30-11:00am and 2:00-3:00pm);
- Students in-class practice (11:00am-12:00pm and 3:00-4:30pm); and
- Office hour for individual tutorial (4:00-6:00pm).

It is recommended that students use the practice time to work on their own NCEI data projects using R.

Learning goal: Students will be able to write short R codes to efficiently perform NCEI job tasks. They can develop supplementary materials to the NOAA datasets for analysis and visualization for both scientists and the general public, including high school students and retired seniors.

About the instructor: Dr. Samuel Shen is Distinguished Professor of Mathematics and Statistics, San Diego State University, and the instructor of *Climate Mathematics* at Scripps Institution of Oceanography. He is a PI of multiple NOAA research grants.