

# CLIM762: Statistical Methods in Climate Research, Spring 2023

**Instructor:** Timothy DelSole (Email: tdelsole@gmu.edu)

**Office Locations and Phone Number:** Research Hall Rm112 (703-993-5715)

**Office Hours:** By appointment (request made by email).

**Catalogue Description:** Introduction to a core set of statistical methods that have proven useful to modern climate and predictability research. Topics include hypothesis testing, autoregression models, analysis of variance, statistical forecasting, linear regression, cross validation, principal component analysis, detection and attribution of climate change.

**Prerequisites:** linear algebra, programming experience, STAT 344; or permission of instructor.

**Class Meeting:** Mondays, 4:30-7:10pm, Research Hall, Rm 121

**Grading:** Homework: 50%, Exam: 25%, Project: 15%, Written Comments Prior to Class: 10%.

**Policy:** Homework assignments will be distributed on Monday and are due in class the following Monday. Late assignments will be penalized one letter grade per day late (exceptions for medical reasons).

**Honor System:** About 90% of the homeworks were given in previous years. Students are expected to refrain from consulting answers for previous years' homeworks.

**Class Web Site:** Blackboard

**Course Text** *Statistical Methods for Climate Scientists* by DelSole and Tippett. You do not need to purchase this book. I will distribute PDFs (with permission from the publisher). *These PDFs are protected by copyright laws. They should not be shared with anyone outside this course.*

**Software** Homework computations are expected to be done using the package **R**.

## Class Schedule

<b>01/23</b>	Probability concepts
<b>01/30</b>	Hypothesis tests
<b>02/06</b>	Confidence Intervals
<b>02/13</b>	Hypothesis Tests based on Ranks
<b>02/20</b>	Stochastic Processes
<b>02/27</b>	Power spectra
<b>03/06</b>	Multivariate Concepts
<b>03/13</b>	<b>Spring Break</b>
<b>03/20</b>	Linear regression: estimation
<b>03/27</b>	Linear regression: inferences
<b>04/03</b>	Principal Component Analysis
<b>04/10</b>	Model selection
<b>04/17</b>	FINAL EXAM
<b>04/24</b>	Pitfalls of Statistical Inference
<b>05/01</b>	TBD
<b>05/15</b>	Class Presentations

**Project** Each student will choose an original research question. Examples of suitable research questions will be given by instructor during the semester. Student should submit a proposal describing the research question to the instructor by April 28, 2022. Students are strongly encouraged to discuss the project idea with instructor before submitting proposal. Instructor will notify student of the appropriateness of the proposal by May 1, 2022. Student will address the question with appropriate statistical analysis. Student will present the results orally to the other students in a 15 minute presentation on May 16, 2022. Presentation slides will be submitted to the instructor immediately after all presentations.