# METEO515 Practical Statistics for Atmospheric Sciences (Fall 2018)

**Course Instructor:**

Dr. Melissa Gervais

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**Class Times:** Monday, Wednesday, and Friday 9:05-9:55am

**Office Hours:** Tuesdays 2pm-4pm

**Course Description:**  
The aim of this course is to build practical statistical tools for data analysis in the atmospheric sciences. The course will first provide the students with a solid foundation in fundamental statistical concepts, including hypothesis testing, maximum likelihood estimation, random variables, and probability density functions. Once the students are familiar with the basic terminology and concepts in statistics, the course will move on to a suite of more advanced statistical techniques that are commonly used in atmospheric science research. The advanced topics include regression analysis, nonparametric tests and resampling techniques, data reduction such as eigendecompositions and principal component analysis, time series analysis, spatial statistics, and Bayesian modeling. The emphasis will be on the sound application of these techniques and their interpretations, rather than technical foundations and derivations. The goal is to build intuition behind commonly used statistical tools and learn how to avoid potential pitfalls in their applications.

**Prerequisites and Concurrent Courses**: There are no prerequisites for this course. However, this course assumes familiarity with calculus and linear algebra, including basic matrix manipulations and eigendecompositon.

**Assistance with Textbooks**

Penn State honors and values the socioeconomic diversity of our students. If you require assistance with the costs of textbooks for this course, contact the Office of Student Care and Advocacy (120 Boucke Building, 863-4926, <http://studentaffairs.psu.edu/studentcare>). For additional need related to socioeconomic status please visit <http://sites.psu.edu/projectcahir>.

**Recommended textbooks**: Statistical Methods in the Atmospheric Sciences, Third Edition, Daniel S. Wilks, 2011

**Internet materials and links**: Available for free online through the Penn State library system

**Course Goals and Objectives** (e.g., list the course objectives and outcomes developed for the Penn State-required program assessment or for ABET accreditation)

**Course Content**

* Exploratory Data Analysis
* Parametric Distributions
* Statistical Inference
* Empirical Orthogonal Functions
* Self-organizing Maps
* Time Series Analysis

# Required Course Policies and Statements

## Assessment Policy:

Assignments:

Assignment will occur roughly weekly during the first half of the semester and bi-weekly in the second half of the semester. These will be based directly on materials from the lectures and any required reading. When programming is required, students are free to program in the language of their choice; however, sample code and resources will typically be provided in Matlab. The number of assignments is subject to change based on course progression. Due dates for each assignment will be communicated upon their distribution.

Mid-Term:

There will be one midterm that will cover the material on the first half of the course. The objective of the midterm is to ensure that students have mastered the materials presented in the lectures.

Final Project:

This project will focus on topics covered in the second half of the class but concepts from the first half of the class will remain of importance. There will also be a final presentation worth 20% and a paper worth 20% of the final grade.

## Grading Policy:

The following weights are used to determine the final course grade:

* Assignments: 35 %
* Midterm: 25 %
* Final Project: 40 %

A: Above 90 %, A-: 85-89, B+: 80-84 %, B: 75-79 %, B-: 70-74 %, C+: 65-69 %, C: 60-64 %, D: 55-59 %, F: Less than 55 %

## Academic Integrity

Students in this class are expected to write up their problem sets individually, to work the exams on their own, and to write their papers in their own words using proper citations. Class members may work on the problem sets in groups, but then each student must write up the answers separately. Students are not to copy problem or exam answers from another person's paper and present them as their own; students may not plagiarize text from papers or websites written by others. Students who present other people's work as their own will receive at least a 0 on the assignment and may well receive an F or XF in the course. Please see: Earth and Mineral Sciences Academic Integrity Policy: <http://www.ems.psu.edu/undergraduate/academic-advising/forms-and-procedures/academic-integrity>, which this course adopts. To learn more, see Penn State's "[Plagiarism Tutorial for Students](http://tlt.its.psu.edu/plagiarism/tutorial)."

## Course Copyright

All course materials students receive or to which students have online access are protected by copyright laws. Students may use course materials and make copies for their own use as needed, but unauthorized distribution and/or uploading of materials without the instructor’s express permission is strictly prohibited. University Policy AD 40, the University Policy Recording of Classroom Activities and Note Taking Services addresses this issue. Students who engage in the unauthorized distribution of copyrighted materials may be held in violation of the University’s Code of Conduct, and/or liable under Federal and State laws.

For example, uploading completed labs, homework, or other assignments to any study site constitutes a violation of this policy.

## Accommodations for Students with Disabilities

Penn State welcomes students with disabilities into the University's educational programs. Every Penn State campus has an office for students with disabilities. The Student Disability Resources (SDR) website provides contact information for every Penn State campus: (<http://equity.psu.edu/student-disability-resources/disability-coordinator>). For further information, please visit the Student Disability Resources website (<http://equity.psu.edu/student-disability-resources>).

In order to receive consideration for reasonable accommodations, you must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: <http://equity.psu.edu/student-disability-resources/applying-for-services>. If the documentation supports your request for reasonable accommodations, your campus’s disability services office will provide you with an accommodation letter. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. You must follow this process for every semester that you request accommodations.

## Attendance

This course abides by the Penn State Attendance Policy E-11: <http://undergrad.psu.edu/aappm/E-11-class-attendance.html>, and Conflict Exam Policy 44-35: http://senate.psu.edu/policies-and-rules-for-undergraduate-students/44-00-examinations/#44-35. Please also see Illness Verification Policy:  <https://studentaffairs.psu.edu/health-wellness/medical-services/policies-patient-resources>, and Religious Observance Policy: <http://undergrad.psu.edu/aappm/R-4-religious-observances.html>. Students who miss class for legitimate reasons will be given a reasonable opportunity to make up missed work, including exams and quizzes.  Students are not required to secure the signature of medical personnel in the case of illness or injury and should use their best judgment on whether they are well enough to attend class or not; the University Health Center will not provide medical verification for minor illnesses or injuries. Other legitimate reasons for missing class include religious observance, military service, family emergencies, regularly scheduled university-approved curricular or extracurricular activities, and post-graduate, career-related interviews when there is no opportunity for students to re-schedule these opportunities (such as employment and graduate school final interviews).  Students who encounter serious family, health, or personal situations that result in extended absences should contact the Office of the Assistant Vice President for Student Affairs (AVPSA) and Student Care and Advocacy for help: <http://studentaffairs.psu.edu/studentcare>.  Whenever possible, students participating in University-approved activities should submit to the instructor a Class Absence Form: <http://undergrad.psu.edu/aappm/classabs.pdf>, at least one week prior to the activity.

## Weather Delays

Campus emergencies, including weather delays, are announced on [Penn State News](http://news.psu.edu/) and communicated to cell phones, email, the Penn State Facebook page, and Twitter via PSUAlert ([Sign up at: https://psualert.psu.edu/psualert/](https://psualert.psu.edu/psualert/)).

Reporting Bias-Motivated Incidents

Penn State takes great pride to foster a diverse and inclusive environment for students, faculty, and staff. Acts of intolerance, discrimination, or harassment due to age, ancestry, color, disability, gender, gender identity, national origin, race, religious belief, sexual orientation, or veteran status are not tolerated (<https://policy.psu.edu/policies/ad29>) and can be reported through Educational Equity via the [Report Bias webpage](http://equity.psu.edu/reportbias/).

Counseling and Psychological Services

Many students at Penn State face personal challenges or have psychological needs that may interfere with their academic progress, social development, or emotional wellbeing.  The university offers a variety of confidential services to help you through difficult times, including individual and group counseling, crisis intervention, consultations, online chats, and mental health screenings.  These services are provided by staff who welcome all students and embrace a philosophy respectful of clients’ cultural and religious backgrounds, and sensitive to differences in race, ability, gender identity and sexual orientation. Services include the following:

[Counseling and Psychological Services at University Park  (CAPS)](http://studentaffairs.psu.edu/counseling/): 814-863-0395  
Counseling and Psychological Services at [Commonwealth Campuses](http://senate.psu.edu/faculty/counseling-services-at-commonwealth-campuses/)  
Penn State Crisis Line (24 hours/7 days/week): 877-229-6400  
Crisis Text Line (24 hours/7 days/week): Text LIONS to 741741

# Recommended Policies

#### Syllabus and Paper Acknowledgement FormsIt is the recommendation of the college that all students sign and return the [Syllabus Acknowledgement Form](http://facdev.e-education.psu.edu/sites/default/files/files/Syllabus%20acknowledgement%20form.doc) (http://facdev.e-education.psu.edu/sites/default/files/files/Syllabus acknowledgement form.doc) during the first week of the semester. In addition, The College also recommends the [Paper Submission Form](http://facdev.e-education.psu.edu/sites/default/files/files/Paper%20submission%20form.docx) (http://facdev.e-education.psu.edu/sites/default/files/files/Paper submission form.docx) as a way to have students take responsibility for papers/labs/homework done as part of group work.

## Penn State E-mail Accounts

All official communications from Penn State are sent to students' Penn State e-mail accounts. Be sure to check your Penn State account regularly, or forward your Penn State e-mail (see <http://kb.its.psu.edu/node/2303>) to your preferred e-mail account, so you don't miss any important information.

## Deferred Grades

If you are prevented from completing this course within the prescribed amount of time for reasons that are beyond your control, it is possible to have the grade deferred with the concurrence of the instructor, following Penn State Deferred Grade Policy 48-40 (<http://senate.psu.edu/policies-and-rules-for-undergraduate-students/47-00-48-00-and-49-00-grades/#48-40>). To seek a deferred grade, you must submit a written request (by e-mail or U.S. post) to the instructor describing the reason(s) for the request. Non-emergency permission for filing a deferred grade must be requested before the beginning of the final examination period. It is up to the instructor to determine whether or not you will be permitted to receive a deferred grade. If permission is granted, you will work with the instructor to establish a communication plan and a clear schedule for completion. If, for any reason, the course work for the deferred grade is not complete by the assigned time, a grade of "F" will be automatically entered on your transcript.

## Military Personnel

Veterans and currently serving military personnel and/or spouses with unique circumstances (e.g., upcoming deployments, drill/duty requirements, disabilities, VA appointments, etc.) are welcome and encouraged to communicate these, in advance if possible, to the instructor in the case that special arrangements need to be made.

## Technical Requirements

For this course, we recommend the minimum technical requirements outlined on the Dutton Institute Technical Requirements page (<https://www.e-education.psu.edu/techspecs>), including the requirements listed for same-time, synchronous communications. If you need technical assistance at any point during the course, please contact the ITS Help Desk ([http://itservicedesk.psu.edu](http://itservicedesk.psu.edu/)).

## Netiquette

The term "Netiquette" refers to the etiquette guidelines for electronic communications, such as e-mail and bulletin board postings. Netiquette covers not only rules to maintain civility in discussions, but also special guidelines unique to the electronic nature of forum messages. Please review some [general Netiquette guidelines](http://facdev.e-education.psu.edu/node/271) that should be followed when communicating in this course.

Disruptive Behavior

Behavior that disrupts normal classroom activities will not be tolerated, in accordance with Items 9 and 14 in the [Student Code of Conduct](https://studentaffairs.psu.edu/support-safety-conduct/student-conduct/code-conduct).

Safety

In the case of an emergency, we will follow the College of Earth and Mineral Sciences Critical Incident Plan (<https://www.ems.psu.edu/sites/default/files/documents/cip_update9-17.pdf>). In the event of an evacuation, we will follow posted evacuation routes and gather at the Designated Meeting Site. Evacuation routes for all EMS buildings are available at <http://www.ems.psu.edu/resources-faculty-and-staff/safety-and-emergency-information>. For more information regarding actions to take during particular emergencies, please see the [Penn State Emergency Action Guides](http://police.psu.edu/emergency-action-guides).

Mandated Reporting Statement

Penn State’s policies require me, as a faculty member, to share information about incidents of sex-based discrimination and harassment (discrimination, harassment, sexual harassment, sexual misconduct, dating violence, domestic violence, stalking, and retaliation) with Penn State’s Title IX coordinator or deputy coordinators, regardless of whether the incidents are stated to me in person or shared by students as part of their coursework.  For more information regarding the University's policies and procedures for responding to reports of sexual or gender-based harassment or misconduct, please visit Penn State's [Office of Sexual Misconduct Prevention & Response](http://titleix.psu.edu/) website.

Additionally, I am required to make a report on any reasonable suspicion of child abuse in accordance with the [Pennsylvania Child Protective Services Law](http://www.legis.state.pa.us/WU01/LI/LI/CT/HTM/23/00.063..HTM).

Diversity, Inclusion, and Respect

Penn State is “committed to creating an educational environment which is free from intolerance directed toward individuals or groups and strives to create and maintain an environment that fosters respect for others” as stated in Policy AD29 Statement on Intolerance. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment and to interact with civility.  
  
For additional information, see:

* [Penn State Affirmative Action non-discrimination statement](http://www.psu.edu/dept/aaoffice/statements.htm)
* [Policy AD 85 Sexual and gender-based harassment and misconduct, Title IX](http://policy.psu.edu/policies/ad85)
* [Policy AD91 Discrimination and Harassment, and Related inappropriate Conduct](https://policy.psu.edu/policies/ad91)
* [Penn State Statement on Diversity, Equity, and Inclusive Excellence](http://equity.psu.edu/diversity-statement)
* [Penn State Values](http://universityethics.psu.edu/penn-state-values)
* [Penn State Principles](http://www.psu.edu/this-is-penn-state/penn-state-principles)
* [All In at Penn State: A Commitment to Diversity and Inclusion](http://allin.psu.edu/)

Accessible Syllabus

Notes: Any syllabus posted online (e.g. a Word/PDF file or an online syllabus) should make destinations clickable links such as is done throughout this page. Also, in order to comply with[Penn State Policy AD69](http://policy.psu.edu/policies/ad69)(Accessibility of Penn State Web Pages, <http://policy.psu.edu/policies/ad69>), PDF documents cannot be the sole source of presenting online information. Such documents include syllabi, homework assignments, and scanned notes.

## Disclaimer Statement

Please note that the specifics of this Course Syllabus can be changed at any time, and you will be responsible for abiding by any such changes. Changes to the syllabus shall also be given to the student in written (paper or electronic) form.