

# ATM F673, Introduction to Micrometeorology

**Course Description:** This course gives a comprehensive explanation of micrometeorology, its basic theories of physics, mechanisms, measurement procedures and methods, and how micrometeorological processes interact and affect the meso- and large-scale atmospheric motion. This class will deal with weather conditions on small scales of space and time. Example applications of this course can be the weather conditions lasting less than a day in the area immediately surrounds a smokestack, a building, air flow in street channels, or a small air shed, seasonal series of ecosystem fluxes in Arctic Tundra and sub-Arctic Boreal forest and calculations of heat and momentum fluxes in glaciers and on sea-ice surfaces.

**Instructor:** Javier Fochesatto

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**Office:** IARC 315 – x7602

**Office hours:** Friday 10 AM to 12 AM or by appointment

**Class Days:** TBD (usually Tuesday and Thursday)

**Class time:** TBD (usually 2:00 PM to 3:30 PM)

**Classroom:** IARC 407

**Required textbook:** Pal S. Arya, 2001, “Introduction to Micrometeorology”, International Geophysics Series, Volume 79-Second Edition Academic Press. You should also read other printed material as assigned.

**Other course resources:** Atmospheric Boundary Layer books: “An Introduction to Atmospheric Boundary Layer” by R.B. Stull, and “Atmospheric Boundary Layer” by J. Garrat.

**Course objective:** By the end of the semester, you should be able to understand and explore micrometeorological processes, and put them into equations; solve fundamental problems related to the basics of micrometeorology and quantitatively describe how they typically occur in micrometeorological applications (e.g. surface and trace gas fluxes, air quality, evapotranspiration, turbulence, Bowen ratio and eddy covariance methods). Fundamental goals are that you develop skills to analyze and interpret micrometeorological data and identify micrometeorological processes. This includes application of learned material to different problems or putting learned material together in a new context to solve a problem where micrometeorological variables plays a fundamental role.

**Student Learning Outcomes:** (1) Understand the micrometeorological processes and put them into equations; (2) Solve fundamental problems related to the basics of micrometeorology; (3) Learn to develop skills to analyze and interpret micrometeorological data; (4) Identify micrometeorological process; and (5) Know how to write a research paper.

**Blackboard:** You need to download and read the material posted. It is your responsibility to apply for an UAF gmail account because Blackboard access is only available with that account. You will be hooked up automatically for access to Blackboard when you register for this class. However, if problems occur with this automatic procedure and you cannot log in, send the instructor an email so that the instructor will verify the email address, enroll you into Blackboard manually, and set up your Blackboard account for this class.

**Attendance:** You must attend class regularly and use the required book. Class attendance and participation in the in-class exercises/discussions are required and will be a part of your grade. Missing 50% of the classes will result in an F. Unexcused absence results in loss of attendance points. If you miss class you will also miss discussion of homework. Excused absences are approved in advance or absences due to a documented emergency. Such documentation must be made immediately upon the student's return to class. Please understand that this is a college course - you are expected to be on time for class and have all the required material unpacked.

**Computer Simulation Classes:** Computer simulation and data processing will be developed in Matlab. You are responsible for sign up with the ARSC-Arctic Region Supercomputing Center to acquire a login and security password. This will allow you participate in the computer exercise simulation classes in the Linux Terminals on the ARSC facilities.

**Reading Assignment:** Scientific papers will be posted for you to read as the course evolves. Class discussions will assume reading of the assigned material.

**Homework:** Includes reading assignment, problem solving and are due at the start of each week except for the reviews that are in writing and due after the third week. Each student is expected to be able to present the homework in front of the class. The contributions should be thorough and complete, reflecting the thought that you have put into your tasks. This presentation will be graded for completeness, correctness and understanding of the subject. You will be selected several times per semester for presenting

the homework. If you cannot present or do not have the homework when you are chosen to be the presenter, you will get an F. If homework is assigned as a group task, every group member must be able to answer questions related to the presentation or do the presentation. The group homework will be graded for completeness, correctness, understanding, presentation, discussion (50%) and how the group worked as a team (50%). This grading on group work is to learn efficient teamwork, because future research questions will require more and more teamwork.

No late homework will be accepted (except in excused absences). Late homework should be submitted in readable style. "Readable style" means typed, double-spaced, using at least a 12-point font, one-inch margins, and in hard copy format. It is simply too tricky to edit and make comments in single-spaced type. If you have not met these stipulations, it will be returned to you ungraded. Late homework will not be accepted via e-mail or fax unless you make prior arrangements with me.

It is your responsibility to prepare homework on time. It is suggested that you plan and schedule your work. It is recommended having backup systems in place so you can have all work completed on schedule. Getting work done on time is a key to early success in your future business, consultant or scientific career.

**Project:** You will have to sign up for a micrometeorological project of your interest or that is related to your research. You will do some literature research on the subject and prepare a research review paper on the project. The instructor will explain how to write a research paper. The class will use AGU TEX-style for formatting, layout and citations. After Thanksgiving break, you will provide a first draft in threefold hardcopies and an electronic version. The instructor will not grade the draft. Instead, two students and the instructor will review these hardcopies anonymously. The instructor will explain how to write a review and explain what a reviewer will look for. The reviewers will submit their review in writing double-spaced in the third week after spring break. The instructor will grade your reviews to ensure that you give your classmates a thorough review and to see whether you understood what is important for a paper. Based on the comments/suggestions and requests of the three reviews you will revise your paper and write responses to the reviewers. On the last day of our class in this semester, you will submit your project paper and the list of responses that the instructor will grade.

**Field Project:** The class will prepare and discuss a micrometeorology experiment to determine turbulent fluxes. The class will be divided in teams to analyze the data and produce a laboratory report discussing different aspects of the turbulent flow and exchange processes.

**In-class exercises:** These will often involve group work and are an important learning element to develop your ability to solve scientific questions, to improve your understanding by applying the material you learned in class and to learn science by working in a group. They are also preparation for the comprehensive exam (if you choose Micrometeorology as one of your electives) and for your future education at UAF and professional life.

**In-class presentations:** You must always be able to present the tasks that you provided as homework in front of the class. This means that you will not be told in advance when you will be the person who presents the homework in class. Should you not be able to explain and reproduce the homework you provided or the homework is incomplete or incorrect points will be deducted. If you co-work in groups, everybody of the group must be able to calculate the homework at the board in class. It is your responsibility to be aware of and to be prepared for each assigned task when it is due. Give the person who is speaking your undivided attention. It is not only common courtesy, but whispering or talking can distract, annoy, and even intimidate students around you as well as the instructor. Essentially, you should treat classmates as you would like, and expect, to be treated yourself.

**Examinations:** There are no mid-term or final examinations.

**Final presentations:** take place in the final week of classes. You'll have to attend all final presentations. Only in case of emergency (e.g. field trip, conference attendance), the instructor will allow you to give your presentation at an earlier time. Such emergencies have to be brought to the instructor's attention as soon as you find out about them. You'll have to deliver your presentation in the period of time stipulated. The presentations will be graded.

**Additional policies:**

1. No weapons allowed in class.
2. Due dates are firm, with the exceptions mentioned above as well as documented emergencies.
3. If you have a disability and require any auxiliary aids, services or accommodations under the Americans with Disabilities Act, I encourage you to contact me during the first week of the semester so that I can make reasonable accommodations. All disabilities are documented by UAF's Center for Health and Counseling's Disability Services Program ([www.uaf.edu/disability/](http://www.uaf.edu/disability/)). The disabilities

office center can be reached at 474-5655. I will work with the office to provide reasonable accommodations for students with disabilities.

4. Any student who is an UAF sponsored athletic or who has other personal or situational difficulty that might affect class performance is invited to contact me in the first week of the semester (or as soon as such matters emerge) so that ways of accommodating the difficulty may be anticipated.

5. Please also let me know if you have condition that could require direct medical attention (e.g. pregnancy, allergies, diabetes, and other chronic diseases).

6. If you are to attend a conference and/or participate in a field trip, please let me know in the first week of class so that arrangements can be made to make up for the classes missed and how to submit homework assignments.

**Academic integrity, honor code and plagiarism:** The instructor expects students to submit own original work and reference all other work and intellectual ideas with appropriate reference and citation. You are subject to the code of conduct [http://www.uaf.edu/catalog/catalog\\_12-13/academics/regs3.html#student\\_Conduct](http://www.uaf.edu/catalog/catalog_12-13/academics/regs3.html#student_Conduct).

**Other important information:** It is essential that you (1) keep up with the assigned readings, (2) budget your time wisely to complete all of your assignments, and (3) seek clarification on any material, which you do not understand, during business or class hours. If the instructor is not covering subjects adequately, or the in-class exercises are confusing or difficult, or if you do not understand the questions/tasks/expectations, please let the instructor know about it. The instructor wants you to understand the material.

### Lectures and Activities per week

Lectures	Title
<b>L-I</b>	Introduction to micrometeorology
<b>L-II</b>	Energy budget near the surface
<b>L-III</b>	Radiation balance near the surface
<b>L-IV</b>	Soil temperature and heat transfer
<b>L-V</b>	Field Class Project and visit to micrometeorological sites
<b>L-VI</b>	Air temperature and humidity in the Boundary Layer
<b>L-VII</b>	Wind distribution in the Boundary Layer
<b>L-VIII</b>	Fundamentals of Turbulence
<b>L-IX</b>	Turbulent Fluxes and Deposition
<b>L-X</b>	Viscous Flow
<b>L-XI</b>	Near-Neutral Boundary Layers and Thermally Stratified Surface Layer
<b>L-XII</b>	Stratified and Non-Homogeneous Boundary Layers
<b>L-XIII</b>	Evaporation and Transpiration
<b>L-XIV</b>	Advance Instrumentation for Micrometeorology

**Grading Policy:** Grades will be assigned in accordance with university policy [http://www.uaf.edu/catalog/catalog\\_12-13/academics/regs1.html](http://www.uaf.edu/catalog/catalog_12-13/academics/regs1.html). A student who scores greater than 90% on their submitted body of work is guaranteed an A. A student who scores greater than 75% on their submitted body of work is guaranteed a B. A student who scores greater than 60% on their submitted body of work is guaranteed a C. A student who scores greater than 50% on their submitted body of work is guaranteed a D. The class grade will be based on reading and participation in Lectures and Discussions (10%), Practicum including Data Analysis of field experiments and Homework Assignments (60%) split 50% each task and Research report and final presentation (30%).