Instructor Contact Information
Instructor:  Professor Lu Hu
Office:  CHEM 301A
Email:  lu.hu@umontana.edu
Office Hours:  By appointment

Day, time, and place of class meetings: Monday and Friday 8:30 – 9:45 am, via Zoom at least the first two weeks (https://umontana.zoom.us/j/2415948974); we may meet at Forestry 206 later in the semester.

Class Description
"Trees cause more pollution than automobiles do." -- Ronald Reagan

Is it really true? Don’t we want more ozone because the ozone layer is being depleted? What is the debate over the booming U.S. fracking activities? In this course, we will gain an understanding of the factors governing the changing chemical makeup of the atmosphere. We will explore the interplay between natural processes and human activities in terms of air pollution, stratospheric ozone depletion, and chemical forcing of climate.

This course will discuss basic concepts in physics and chemistry of the atmosphere. We will study how air pollutant is created, how it moves and how it can be removed. We will also focus on specific air pollution issues such as photochemical smog, acid rain, ozone hole, and discuss their impacts on human health and climate change.

Course Outcomes
Upon completing this course, you will be able to

• Explain the role of the atmosphere in the Earth system and the interactions between different Earth system components.
• Obtain a basic understanding of chemical kinetics.
• Summarize Earth atmosphere’s evolution, and the history of atmospheric chemistry.
• Explain fundamental processes governing the variation of atmospheric composition at variety of scales.
• Apply this knowledge to a variety of phenomenon about atmospheric pollution and climate change.
• Answer those questions posed on the course description.
• Explain key aspects of aircraft mission design and flight planning.
• Interpret a small suite of aircraft observations and present the results.
Required & recommended materials

- Two supplemental books:
  - John Seinfeld and Spyros Pandis, Atmospheric Chemistry and Physics: From Air Pollution to Climate Change, Wiley, 2016, both hard copies and e-version available at UMT library
  - Guy Brasseur and Daniel Jacob, Modeling of Atmospheric Chemistry, e-version available at UMT library

Your final course grade will be based on

- **Homework** 40%
- **Midterm Exam** 15%
- **Final Exam** 20%
- **Term project** 25%

Term project

Students select projects from the following or their own project per discussion with Professor Hu. Students will analyze the data over the course of the semester. You will participate in 2-3 science team meetings for discussion and planning, and get feedback from each other. You will prepare a formal conference poster and present the results at a mini conference that will be open to the department. You may work as a team up to 2 students for data analysis but each will need to come up with own hypothesis, present results and a poster of your own. Undergraduates can use this project for the UM Conference on Undergraduate Research ([https://www.umt.edu/ugresearch/umcur/default.php](https://www.umt.edu/ugresearch/umcur/default.php)).

- Aircraft observations from the National Center for Atmospheric Research C-130 aircraft
- Indoor air quality and COVID inflection risk: You may borrow a few low cost sensors (i.e, CO2, CO, PM, temperature and RH) and collect data by yourself.
- NASA satellite products for detecting air pollutants
- Regulatory monitoring data from local Department Environmental Quality or US EPA

Breakdowns for the term project grading

- Participation in discussion and planning with Professor Hu and peers: 20%
- Data analysis and Science Team Meeting discussion: 25%
- Feedback to peers: 15%
- Poster presentation of data analysis: 40%

Important dates: tentative

- 2/1: project selected
- 3/1: data collected; preliminary data analysis; science team meeting 1
- 3/15: Science team meeting 2
- 4/1: Science team meeting 3, and first draft of posters
Tentative Schedule after 9/14 on Wednesdays and Fridays

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<thead>
<tr>
<th>Date/Time</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1/11-1/15</td>
<td>Overview, history of atmosphere</td>
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<td>1/22</td>
<td>Atmospheric radiation</td>
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<td>1/25-1/29</td>
<td>Atmospheric composition, Geochemical cycles</td>
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<td>2/1-2/5</td>
<td>Box model</td>
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<td>2/8-2/12</td>
<td>Chemical kinetics</td>
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<tr>
<td>2/15-2/19</td>
<td>Stratospheric chemistry and ozone hole</td>
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<td>2/22</td>
<td>Midterm exam</td>
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<td>2/25</td>
<td>Science meeting</td>
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<td>3/1-3/5</td>
<td>Tropospheric chemistry</td>
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<td>3/8-3/12</td>
<td>Emission source</td>
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<td>3/15-3/9</td>
<td>Sink, removal processes</td>
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<td>3/22-3/26</td>
<td>Pollution transport</td>
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<td>4/5-4/9</td>
<td>Air pollution control</td>
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<td>4/12-4/16</td>
<td>Health effect</td>
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<td>4/19-4/23</td>
<td>Regulatory, climate, Poster presentation on term projects</td>
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<tr>
<td>4/26-4/30</td>
<td>Final exam (exact date/time to be announced)</td>
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Definition of Grades

A 4.0
- Represents achievement that is outstanding relative to the level necessary to meet course requirements.
- Student comes to class prepared and contributes readily to the conversation but does not dominate it.
- Demonstrates excellent preparation: has sought out additional information other than that presented in class or lectures.
- Combines pieces of the discussion to further the group’s understanding of goals.
- Demonstrates ongoing very active involvement.
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<tr>
<th>Grade</th>
<th>Description</th>
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| B 3.0 | - Represents achievement that is significantly above the level necessary to meet course requirements.  
- Demonstrates good preparation: has thought through the implications of lecture material and other resources.  
- Contributes well to discussion in an ongoing way: responds to other students’ points, thinks through own points, questions others in a constructive way.  
- Demonstrates consistent ongoing involvement. |
| C 2.0 | - Represents achievement that meets the course requirements in every respect.  
- Demonstrates adequate preparation: knows the basics of any assigned reading, but does not show evidence of trying to interpret or apply information.  
- Offers straightforward information (e.g., straight from the lecture or reading), without elaboration or very infrequently.  
- Does not offer to contribute to discussion, but contributes to a moderate degree when called on.  
- Demonstrates sporadic involvement in the discussions.  
- Alternatively, student participates but in a problematic way: talks too much, rambles, or interrupts others. |
| D 1.0 | - Represents achievement that is worthy of credit even though it fails to meet fully the course requirements  
- Present, not disruptive.  
- Tries to respond when called on but does not offer much.  
- Demonstrates very infrequent involvement in discussion. |
| F | - Represents failure (or no credit) and signifies that the work was either (1) completed but at a level of achievement that is not worthy of credit or (2) was not completed and there was no agreement between the instructor and the student that the student would be awarded an I (see also I). |
| I | - (Incomplete) Assigned at the discretion of the instructor when, due to extraordinary circumstances, e.g., hospitalization, a student is prevented from completing the work of the course on time. Requires a written agreement between instructor and student. |