Course Materials

Required:

Others:

All books are on reserve at the SSEC Library (3rd floor AOSS building).

Course content

The atmospheric boundary layer is a) where you live, b) where weather impacts society the most, c) where turbulence happens, and d) where land/ocean friction and energy exchange are first and most directly felt by the atmosphere. A number of research problems in meteorology from air pollution dispersion to mesoscale modeling to land-ocean-atmosphere interaction require thorough understanding of boundary layer meteorology. This understanding is primarily gained by exploration of theories in micrometeorology (meteorology at the smallest of scales) and turbulence (high Reynolds number chaotic flow). This course will expose you to empirical and theoretical understanding of the atmospheric boundary layer and its connections to Earth systems’ sciences.

Grading

50% Problem sets and paper reviews (one approx. every week) / 30% Exams / 20% Research paper

Course Structure

Tuesday and Thursday classes will consist of standard lectures, and interactive discussion is encouraged. On most Thursdays, in addition to lecture, students will take turns orally presenting reviews to the most recent problem set or reading. Given the small class size, students are encouraged to work on the problem sets together and assist the presenter during the solution discussion. Since there is not enough time to cover all topics in the field, students will conduct independent research on a topic of their choosing related to boundary layer meteorology, write a short (5-10) page research paper and present a short (10 minute) presentation of their findings.
## Course Calendar

<table>
<thead>
<tr>
<th>Week</th>
<th>Dates</th>
<th>Topic</th>
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<tbody>
<tr>
<td>Week 1</td>
<td>1/19 &amp; 1/21</td>
<td>Introduction to boundary layer meteorology</td>
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<tr>
<td>Week 2</td>
<td>1/26 &amp; 1/28</td>
<td>Viscous and turbulent flow</td>
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<tr>
<td>Week 3</td>
<td>2/2 &amp; 2/4</td>
<td>Ensemble and Reynolds averaging, fluxes, TKE</td>
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<td>Week 4</td>
<td>2/9 &amp; 2/11</td>
<td>TKE, energy cascades, closure, parameterization</td>
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<td>Week 5</td>
<td>2/16 &amp; 2/18</td>
<td>Surface energy balance and boundary conditions</td>
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<td>Week 6</td>
<td>2/23 &amp; 2/25</td>
<td>Monin-Obhukov similarity theory</td>
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<td>Week 7</td>
<td>3/2 &amp; 3/4</td>
<td>Modeling and observing boundary layer turbulent flows</td>
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THU 3/4    Exam I

<table>
<thead>
<tr>
<th>Week 8</th>
<th>Dates</th>
<th>Topic</th>
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<tbody>
<tr>
<td>Week 9</td>
<td>3/9 &amp; 3/11</td>
<td>Atmospheric surface layer</td>
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<tr>
<td>Week 10</td>
<td>3/16 &amp; 3/18</td>
<td>Near-neutral boundary layers, static and dynamic stability</td>
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<td>Week 11</td>
<td>3/23 &amp; 3/25</td>
<td>Convective boundary layers</td>
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<tr>
<td>Week 12</td>
<td>4/6 &amp; 4/8</td>
<td>Stable boundary layers</td>
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<td>Week 13</td>
<td>4/13 &amp; 4/15</td>
<td>Cloud-topped boundary layers</td>
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<td>Week 14</td>
<td>4/20 &amp; 4/22</td>
<td>Marine boundary layers and geographic effects</td>
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THU 4/29    Exam II, Research paper due

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<tr>
<th>Week 15</th>
<th>Dates</th>
<th>Topic</th>
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<tbody>
<tr>
<td>Week 15</td>
<td>5/4 &amp; 5/9</td>
<td>Research presentations</td>
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NO FINAL

## Accommodation Policy

Campus policy: “We believe in the right of all students who are enrolled at the University of Wisconsin-Madison to full and equal educational opportunity. Disability should not be the basis for exclusion from educational programs. All students are entitled to an accessible, accommodating, and supportive teaching and learning environment. … Students are expected to inform faculty, in a timely manner, of their need for special instructional accommodations.”

Students requiring class accommodations due to a learning or physical disability must present documentation from the McBurney Disability Resource Center (http://www.mcburney.wisc.edu/; 608-263-2741, Middleton Bldg, 1305 Linden Dr) in the first week of class. Accommodations will be made in consultation with the McBurney Center.

Students who require temporary accommodations due to medical or psychological reasons should acquire documentation from University Health Services. Counseling is available from Counseling Services, University Health Services (http://www.uhs.wisc.edu/; 608-265-5600, 115 N Orchard St).