ATM OCN 100 — WEATHER AND CLIMATE
3 credits.

Nature and variability of wind, temperature, cloud and precipitation. Storm systems, fronts, thunderstorms, tornadoes and their prediction. Air composition and pollution. Global winds, seasonal changes, climate and climatic change. Enroll Info: Open to Fr. Stds may not receive cr for both ATM OCN 100 101
Requisites: None
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Elementary
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2018

ATM OCN 101 — WEATHER AND CLIMATE
4 credits.

Nature and variability of wind, temperature, clouds and precipitation. Discussion session will include map analyses and basic quantitative lab exercises. Storm systems, fronts, thunderstorms, tornadoes and their prediction. Air composition and pollution. Global winds, seasonal changes, climate and climatic change. Enroll Info: Open to Fr. Stds may not receive cr for both ATM OCN 100 101
Requisites: None
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Elementary
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2018

ATM OCN/ENVIR ST/GEOSCI 102 — CLIMATE AND CLIMATE CHANGE
3 credits.

This course describes the basic climate principles governing the climate system. It describes the climate and climate variability at present, climate evolution in the past, and the projected climate change into the future. The scientific principles underlying the natural and anthropogenic greenhouse effect and climate model forecasts are elucidated. Enroll Info: None
Requisites: None
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Elementary
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2018

ATM OCN/GEOSCI 105 — SURVEY OF OCEANOGRAPHY
3-4 credits.

Nature and behavior of ocean water, interaction of oceans and atmosphere, structure of the ocean floor, life in the oceans, our relationship to the marine environment. Enroll Info: High school physics or chem recommended. Open to Freshmen
Requisites: None
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Elementary
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2018

ATM OCN/ENVIR ST/GEOG 121 — ATMOSPHERIC ENVIRONMENT AND SOCIETY
2 credits.

Changing interactions between humans, other animals and plants, and the atmospheric environment, both in time and space. Enroll Info: None
Requisites: None
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Elementary
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No

ATM OCN/SOIL SCI 132 — EARTH'S WATER: NATURAL SCIENCE AND HUMAN USE
3 credits.

Water is central to the functioning of planet Earth. As humans increase their impact on Earth's systems and cohabitants, our understanding of the multiple roles of water becomes critical to finding sustainable strategies for human and exosystem health. Explores the science of Earth's hydrosphere, with constant attention to human uses and impacts. Enroll Info: None
Requisites: None
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Elementary
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2018

ATM OCN/GEOSCI 140 — NATURAL HAZARDS AND DISASTERS
3 credits.

An exploration of the science behind natural disasters including earthquakes, tsunamis, volcanic eruptions, landslides, tornadoes, hurricanes, and floods. Why, where, and when do these events occur, and why are some predictable but others are not? The course will also address hazard assessment, forecasting, and mitigation to lessen their impact on society. Enroll Info: None
Requisites: None
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Elementary
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Fall 2017
ATM OCN 141 — NATURAL HAZARDS OF WEATHER
2 credits.
Explores the basic science of weather hazards ongoing around the globe and practical issues of Prediction, Risk Reduction, Resilience and Vulnerability (PRRRV) associated with these hazards. Enroll Info: None
Requisites: None
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Elementary
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No

ATM OCN/ENVIR ST 171 — GLOBAL CHANGE: ATMOSPHERIC ISSUES AND PROBLEMS
2-3 credits.
Atmospheric problems of global significance. Greenhouse warming, ozone layer, acid rain, climate change. Study based on elementary principles of atmospheric science. Systems approach applied to changing atmospheric composition. Interactions among geochemical cycles, anthropogenic inputs and other parts of the environment. Enroll Info: None
Requisites: None
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Elementary
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2018

ATM OCN 252 — INTRODUCTION TO WEATHER ANALYSIS AND FORECASTING
3 credits.
Elementary issues in dynamics, thermodynamics, local and synoptic-scale circulations examined in the context of daily diagnoses and forecasting of the weather. Includes analysis of surface and upper air observations, satellite and radar data, output from numerical weather prediction models. Enroll Info: PHYSICS 201 or 207, MATH 221 or cons inst. Open to Fr
Requisites: None
Course Designation: Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2006

ATM OCN 310 — DYNAMICS OF THE ATMOSPHERE AND OCEAN I
3 credits.
Introduction to theory of fluid motions for atmosphere and ocean. Elementary kinematics, fundamental forces, effects of earth's gravity and rotation, concepts and applications of hydrostatic and geostrophic balance. Enroll Info: PHYSICS 208 or con reg MATH 234 or con reg
Requisites: None
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Fall 2017

ATM OCN 311 — DYNAMICS OF THE ATMOSPHERE AND OCEAN II
3 credits.
Intermediate theory of fluid motions for atmosphere and ocean. Emphasis on large scale applications and basic theory for geophysical wave types. Thermal wind shear, frictional flow, vorticity concepts, Rossby waves, Sverdrup ocean flow. Enroll Info: ATM OCN 310, 330
Requisites: None
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2018

ATM OCN/GEOG 323 — SCIENCE OF CLIMATE CHANGE
3 credits.
This is a calculus-based treatment of climate system physics and the mechanisms of modern-day anthropogenic climate change. By the end of this course, students will understand: a. How solar radiation and rotating fluid dynamics determine the basic climate state; b. Mechanisms of natural variability and change in climate; c. Why anthropogenic climate change is occurring; and d. Which scientific uncertainties are most important to estimates of 21st century change. Enroll Info: None
Requisites: PHYS 103, 201 or 207; and MATH 217, 221 or 275. Not open to students who have enrolled in ATM OCN 425
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Fall 2016

ATM OCN 330 — PHYSICS OF THE ATMOSPHERE AND OCEAN I
3 credits.
Physical variables, laws, characteristics and direct measurements for atmosphere and ocean. Thermodynamics and moist atmospheric processes. Basic physics of clouds, precipitation, and chemical constituents. Enroll Info: PHYSICS 208 or con reg MATH 234 or con reg
Requisites: None
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Fall 2017
ATM OCN/ENVIR ST/GEOG 332 — GLOBAL WARMING: SCIENCE AND IMPACTS  
3 credits.

Climate change is underway and will continue into the foreseeable future. This course offers a fundamental understanding of how and why global warming is happening, and what to expect in the future. Together, we will investigate and discuss the evidence for change, the science that explains these observations, predicted impacts on humans and ecosystems, and the societal debate over proposed solutions. Enroll Info: IES 120 or 127 or ATM OCN 100 or equivalent recommended. Freshmen permitted only with consent of instructor

Requisites: None

Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No

Last Taught: Spring 2017

ATM OCN/ENVIR ST/GEOG/GEOSCI 335 — CLIMATIC ENVIRONMENTS OF THE PAST  
3 credits.

Climatic change at timescales from the last 1,000,000 years to the last 1000 years. Examines how climate variability arises from interplay between external forcings, feedbacks within the earth system, and (more recently) human activity. Enroll Info: None

Requisites: GEOG/ENVIR ST 120, GEOG/ENVIR ST 127, or ATM OCN 100

Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No

Last Taught: Fall 2017

ATM OCN 340 — PHYSICS OF THE ATMOSPHERE AND OCEAN II  
3 credits.

Radiation, energy budget, and cloud physics. Scattering, absorption, emission and diabatic heating by shortwave and longwave processes. Introduction to cloud physics including cloud nucleation processes, particle growth, precipitation development, and convective cloud processes. Enroll Info: Atmospheric-Oceanic 330

Requisites: None

Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No

Last Taught: Fall 2017

ATM OCN 404 — METEOROLOGICAL MEASUREMENTS  
2 credits.

Practical experience in planning experiment implementation, performing instrument quality control, conducting computational data analysis, and writing and presenting of meteorological and climatological observations in a team setting. Enroll Info: None

Requisites: Consent of instructor

Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S

Repeatable for Credit: No

Last Taught: Spring 2018

ATM OCN 405 — AOS SENIOR CAPSTONE SEMINAR  
1 credit.

Required senior seminar for AOS majors provides a synthesis and overview. Research on a topic of the student's choosing is presented at the end. Enroll Info: ATM OCN 310, 311, 330, 340

Requisites: None

Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S

Repeatable for Credit: No

Last Taught: Spring 2018

ATM OCN 425 — GLOBAL CLIMATE PROCESSES  
3 credits.

Overview of physical processes of the atmosphere and its coupling to the ocean and land. Understanding its seasonal climatology and variability. Synthesis through application of junior AOS core dynamics and physics to quantitatively understand diabatic, transport, and dissipative processes. Examples include global warming, air-ocean coupling, ENSO, ozone hole, tropospheric water and chemistry issues, diurnal to interannual time scales. Enroll Info: ATM OCN 311, 340, or cons inst

Requisites: None

Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S

Repeatable for Credit: No

Last Taught: Fall 2017

ATM OCN 441 — RADAR AND SATELLITE METEOROLOGY  
3 credits.

Provides undergraduate students with the necessary knowledge about radar and satellite meteorology. Enroll Info: ATM OCN 340 or cons inst

Requisites: None

Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S

Repeatable for Credit: No

Last Taught: Spring 2018
ATM OCN 452 — SYNOPTIC LABORATORY I: THE FRONTAL CYCLONE
4 credits.

Cyclone and frontal theory; case studies illustrating the structure and evolution of the frontal cyclone; diagnostic techniques: interpretation of satellite photographs, preparation of vertical cross sections and isentropic analysis. Enroll Info: ATM OCN 311 340, or cons inst
Requisites: None
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Fall 2017

ATM OCN 453 — SYNOPTIC LABORATORY II: MESOSCALE METEOROLOGY
4 credits.

Local wind systems, thunderstorms, mesoscale convection systems, interactions with synoptic scale weather. Analysis, prediction, nowcasting and observation of mesoscale weather, including interpretation of satellite and radar information. Enroll Info: ATM OCN 311 340, or cons inst
Requisites: None
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2018

ATM OCN 455 — SEVERE STORM FORCasting AND OBSERVATION
1-2 credits.

Application of severe storm forecasting and nowcasting techniques under operational conditions. Severe storm observation and photography (storm chasing), application in the field. Enroll Info: ATM OCN 453 or cons inst
Requisites: None
Course Designation: L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Summer 2011

ATM OCN 508 — TEACHER WORKSHOP IN SATELLITE METEOROLOGY
1-2 credits.

This workshop is designed to address the professional development needs for K-12 science teachers. Enroll Info: None
Requisites: None
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Summer 2014

ATM OCN 509 — TEACHER WORKSHOP IN EARTH SYSTEM SCIENCE - WEB
1-3 credits.

These courses are designed to address the professional development needs for K-12 science teachers in the earth and space sciences. Topics will be designed to meet the Wisconsin State Science standards and be presented by science and education experts. Enroll Info: None
Requisites: None
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Summer 2013

ATM OCN/ENVIR ST 520 — BIOCLIMATOLOGY
3 credits.

How climate systems and biological organisms operate and interact at the global scale and the implications of this for climate change, ecosystem ecology and human land use. Enroll Info: Junior standing and ATM OCN 101, ATM OCN 252 or ATM OCN/GEOG 323, and BIOLOGY/BOTANY/ZOOLOGY 152
Requisites: None
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2018

ATM OCN 522 — TROPICAL METEOROLOGY
3 credits.

Characteristics of the tropical atmosphere; local and diurnal phenomena; tropical synoptic systems; circulation and energetics; mechanisms of tropical climate variations. Enroll Info: ATM OCN 311, 340
Requisites: None
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2016

ATM OCN/ENVIR ST/GEOG 528 — PAST CLIMATES AND CLIMATIC CHANGE
3 credits.

Climatic change throughout geologic time, especially in the last 10 millennia; mechanisms of change, evidence, and criteria, paleogeography and paleoclimatology, climate models. Enroll Info: Jr st or one year calculus-based college physics or introduction to weather and climate; or cons inst
Requisites: None
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
ATM OCN/AGRONOMY/SOIL SCI 532 — ENVIRONMENTAL BIOPHYSICS
3 credits.

Plant-environment interactions with particular reference to energy exchanges and water relations. Models are used to provide a quantitative synthesis of information from plant physiology, soil physics, and micrometeorology with some consideration of plant-pest interactions. Enroll Info: Students should have completed at least one course in Botany, Agronomy, or Plant Sciences to feel comfortable with the course content.

Requisites: BIOLOGY/BOTANY 130 and (MATH 211, 217, 221 or 275) and (PHYSICS 103, 201, 207, or 247), or graduate/professional standing

Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req

Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: No

Last Taught: Fall 2016

ATM OCN/ENVIR ST 535 — ATMOSPHERIC DISPERSION AND AIR POLLUTION
3 credits.

Physical principles of atmospheric transport processes. Variation in transport in time and place. Local and regional concentrations of pollutants. Environmental implications of air pollution and control strategies. Enroll Info: Math 212, PHYSICS 202, or cons inst

Requisites: None

Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req

Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: No

Last Taught: Spring 2016

ATM OCN 573 — COMPUTATIONAL METHODS IN ATMOSPHERIC AND OCEANIC SCIENCES
2 credits.

Provides students with an introduction to multiple programming languages and technical computing methods used in the Atmospheric and Oceanic Sciences. Data analysis methods and software development for specialized applications related to the field are also highlighted. Enroll Info: None

Requisites: MATH 234 and (COMP SCI 301 or COMP SCI 302)

Course Designation: Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S

Repeatable for Credit: No

Last Taught: Spring 2017

ATM OCN 575 — CLIMATOLOGICAL ANALYSIS
3 credits.

Mathematical and statistical tools applicable to the investigation of climatological problems; nature and treatment of climatological data. Enroll Info: ATM OCN 311 340, or cons inst

Requisites: None

Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req

Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: No

Last Taught: Spring 2017

ATM OCN 601 — CHALLENGING PROBLEMS OF ATMOSPHERIC AND OCEANIC SCIENCES
2-3 credits.

Individual staff members weave detailed subjects into the general fabric of the physical environment. Enroll Info: None

Requisites: None

Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req

Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: Yes, unlimited number of completions

Last Taught: Fall 2010

ATM OCN 610 — GEOPHYSICAL FLUID DYNAMICS I
3 credits.

Basic dynamic concepts: equations of motion, basic approximations, Coriolis force, wave motions, normal modes, gravity waves, frictional turbulence and convective processes, geostrophic adjustment, scaling argument, effects of rotation on wave motions. Vorticity and potential vorticity. Enroll Info: PHYSICS 208, MATH 234 cons inst

Requisites: None

Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: No

Last Taught: Fall 2017

ATM OCN 611 — GEOPHYSICAL FLUID DYNAMICS II
3 credits.

Quasi-geostrophic motion, potential vorticity equations, E-P fluxes, Rossby waves, boundary layer processes, wind-driven ocean circulation and western boundary currents, barotropic and baroclinic instability, tropical flows. Enroll Info: ATM OCN 610 or cons inst

Requisites: None

Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req

Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: No

Last Taught: Spring 2018
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Requisites</th>
<th>Enroll Info</th>
<th>Last Taught</th>
<th>Repeatable for Credit:</th>
<th>L&amp;S Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATM OCN 615</td>
<td>LABORATORY IN ROTATING FLUID DYNAMICS</td>
<td>1</td>
<td>Rotating fluid experiments, theory and data analysis are used to deepen understanding of geophysical fluid dynamics and observed phenomena in the atmosphere and ocean. The course will be primarily in the laboratory – focusing on hands-on experiences in the rotating tank lab and with real data. Enroll Info: ATM OCN 311 or ATM OCN 610</td>
<td>None</td>
<td>Spring 2016</td>
<td>No</td>
<td>Counts as Liberal Arts and Science credit in L&amp;S</td>
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<tr>
<td>ATM OCN 630</td>
<td>INTRODUCTION TO ATMOSPHERIC AND OCEANIC PHYSICS</td>
<td>3</td>
<td>Graduate level core course, covering thermodynamics theory of multiphase systems, thermodynamic analysis of atmosphere, microphysical processes in the atmosphere, atmospheric and oceanic chemical processes, conduction of heat and moisture into the atmosphere from ocean and land surface. Enroll Info: PHYSICS 208, MATH 234 cons inst</td>
<td>None</td>
<td>Fall 2017</td>
<td>No</td>
<td>Counts toward 50% graduate coursework requirement</td>
</tr>
<tr>
<td>ATM OCN 637</td>
<td>CLOUD PHYSICS</td>
<td>3-4</td>
<td>Processes of cloud formation, growth, and dissipation from the standpoint of both the cloud particles and the whole cloud as a dynamic entity. Enroll Info: ATM OCN 311 340, or cons inst</td>
<td>None</td>
<td>Fall 2017</td>
<td>No</td>
<td>Counts toward the Natural Sci</td>
</tr>
<tr>
<td>ATM OCN 638</td>
<td>ATMOSPHERIC CHEMISTRY</td>
<td>3</td>
<td>Evolution of the atmosphere, chemical structure, instrumental analysis, trace gases, aerosol mechanics, chemical processes. Enroll Info: One year calculus-based college physics, chemistry, and calculus for science majors, or cons inst</td>
<td>None</td>
<td>Spring 2015</td>
<td>No</td>
<td>Counts as Liberal Arts and Science credit in L&amp;S</td>
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<tr>
<td>ATM OCN 640</td>
<td>RADIATION IN THE ATMOSPHERE AND OCEAN</td>
<td>3</td>
<td>Graduate level core course in radiation. Introduction to basic laws, radiative transfer under clear sky conditions, scattering by individual particles, multiple scattering, radiative properties of clouds and aerosols, energy budget, miscellaneous applications. Enroll Info: PHYSICS 208, MATH 234 cons inst</td>
<td>None</td>
<td>Spring 2018</td>
<td>No</td>
<td>Counts as Liberal Arts and Science credit in L&amp;S</td>
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<tr>
<td>ATM OCN 650</td>
<td>ANALYSIS OF ATMOSPHERIC SYSTEMS</td>
<td>3</td>
<td>Graduate level core lab and lecture course designed to quantitatively analyze, descriptively define and physically interpret atmospheric structures, climate and flow systems depicted by observations on scales ranging from the global circulation to those of turbulence in the planetary boundary layer. Observation and analysis strategies. Enroll Info: ATM OCN 610, 630 or cons inst</td>
<td>None</td>
<td>Fall 2010</td>
<td>No</td>
<td>Counts toward 50% graduate coursework requirement</td>
</tr>
<tr>
<td>ATM OCN 651</td>
<td>SYNOPTIC-DYNAMIC LABORATORY</td>
<td>3</td>
<td>Quantitative lab applications of atmospheric dynamics and thermodynamics to synoptic systems. Jet stream systems, cyclone development, global air motions, performance of numerical prediction models, local surface forecasting. Enroll Info: ATM OCN 610 630 cons inst, or ATM OCN 650</td>
<td>None</td>
<td>Spring 2015</td>
<td>No</td>
<td>Counts toward the Natural Sci</td>
</tr>
<tr>
<td>ATM OCN 660</td>
<td>INTRODUCTION TO PHYSICAL OCEANOGRAPHY</td>
<td>3</td>
<td>Physical properties of sea water: ocean climatology, water, salt and heat budget, measurements, ocean circulation and water mass of the world ocean, thermocline, thermohaline, equatorial ocean and southern ocean. Enroll Info: PHYSICS 208, MATH 234 cons inst</td>
<td>None</td>
<td>Spring 2016</td>
<td>No</td>
<td>Counts as Liberal Arts and Science credit in L&amp;S</td>
</tr>
</tbody>
</table>

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**Notes:**
- **Grad 50%** - Counts toward 50% graduate coursework requirement
- **L&S Credit** - Counts as Liberal Arts and Science credit in L&S
- **Level** - Advanced
- **Req**
- **Requisites:**
  - Majors, or cons inst
  - Year calculus-based college physics, chemistry, and calculus for science majors
  - MATH 234 cons inst
  - ATM OCN 610 630 or cons inst
  - ATM OCN 311 340, or cons inst
  - ATM OCN 311 330, or cons inst
ATM OCN 681 — SENIOR HONORS THESIS
3 credits.

Enroll Info: None
Requisites: Consent of instructor
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S Honors - Honors Only Courses (H)
Repeatable for Credit: No

ATM OCN 682 — SENIOR HONORS THESIS
3 credits.

Enroll Info: None
Requisites: Consent of instructor
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S Honors - Honors Only Courses (H)
Repeatable for Credit: No

ATM OCN 691 — SENIOR THESIS
2-3 credits.

Enroll Info: A) atm ocn major; B) ATM OCN 311, 340 or con reg; C) approval Assoc Chairman of Undergrad Affairs
Requisites: Consent of instructor
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No

ATM OCN 692 — SENIOR THESIS
2-3 credits.

Enroll Info: A) atm ocn major; B) ATM OCN 311, 340 or con reg; C) approval Assoc Chairman of Undergrad Affairs
Requisites: Consent of instructor
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No

ATM OCN 698 — DIRECTED STUDY
1-5 credits.

Offered on a N grading basis. Does not count toward Grad residence credit. Enroll Info: Jr or Sr st; requires cons inst
Requisites: Consent of instructor
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: Yes, unlimited number of completions

ATM OCN 699 — DIRECTED STUDY
1-5 credits.

Enroll Info: Jr or Sr st. Graded on a lettered basis; requires cons inst
Requisites: Consent of instructor
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: Yes, unlimited number of completions

ATM OCN/CIV ENGR 701 — THE CHEMISTRY OF AIR POLLUTION
2 credits.

The course will cover background and modern research methods for the application of chemical analysis tools to understanding of the origin, composition, and the chemical transformations of pollutants that occur in the atmosphere. Emphasis will be directed at the pollutants impacting human health, climate change, and ecosystem degradation. Approximately half of the course materials will be taken from the scientific literature and will provide the opportunity to advance skills in the critical reading of journal articles. The course is directed at graduate students conducting research and interested in air pollution and environmental chemistry. As part of the course, students will gain experience in presenting scientific research methods and results related to course materials. Enroll Info: None
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2016

ATM OCN 705 — THE MIDDLE ATMOSPHERE
3 credits.

Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2016

ATM OCN 712 — GENERAL CIRCULATION OF THE ATMOSPHERE
3 credits.

The theory of the general circulation with emphasis on the sources, sinks, and transport of mass, angular momentum, and energy that serve to maintain the circumpolar vortex. Enroll Info: ATM OCN 610, 630 or equiv
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2018

ATM OCN 718 — DYNAMICS OF MOIST CONVECTIVE SYSTEMS
3 credits.

Governing equations for non-hydrostatic dynamics, mixed phase thermodynamics and microphysics. Cumulus parameterization and scale interactions. Application to theoretical and numerical models of thunderstorms (and attendant weather phenomena) and Mesoscale Convective Systems in the extra tropics and tropics. Enroll Info: ATM OCN 610, 630
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2018
**ATM OCN 740 — ADVANCED ATMOSPHERIC RADIATION**  
3 credits.  
The course deals with advanced topics in atmospheric radiative transfer. These include numerical methods to solve the radiative transfer equation, theory of scattering by spherical and non-spherical particles and advanced topics in gas absorption. Enroll Info: ATM OCN 640  
Requisites: Graduate/professional standing  
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement  
Repeatable for Credit: No  
Last Taught: Spring 2013

**ATM OCN/ENVIR ST 745 — METEOROLOGICAL SATELLITE APPLICATIONS**  
2-3 credits.  
Use of satellite imagery and measurements in meteorological research and operations; orbital characteristics; navigation; instrumentation. Enroll Info: ATM OCN 640 or 1 yr calc-based college physics MATH 234  
Requisites: Graduate/professional standing  
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement  
Repeatable for Credit: No  
Last Taught: Spring 2017

**ATM OCN/ENVIR ST/GEOSCI/ZOOLOGY 750 — PROBLEMS IN OCEANOGRAPHY**  
3 credits.  
Introduction to techniques used in the study of the biology, chemistry, geology, and physics of the marine environment. Enroll Info: None  
Requisites: Graduate/professional standing  
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement  
Repeatable for Credit: No  
Last Taught: Spring 2016

**ATM OCN 760 — LARGE-SCALE OCEAN-ATMOSPHERE COUPLING**  
3 credits.  
Various aspects of global ocean-atmosphere coupling and climate variability; global surface flux distribution; mixed layer dynamics; tropical dynamics and El Nino and Southern Oscillation; extratropical ocean-atmosphere coupling; interannual to interdecadal climate variability. Enroll Info: ATM OCN 611 660, or cons inst  
Requisites: Graduate/professional standing  
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement  
Repeatable for Credit: No  
Last Taught: Fall 2015

**ATM OCN 761 — DYNAMICS OF OCEAN CIRCULATION**  
3-4 credits.  
Thories of general oceanic circulation: Sverdrup flow, western boundary layer; thermocline circulation, recirculation theory, ventilated thermocline theory; thermohaline circulation, abyssal flow, thermohaline instability and multiple equilibria. Enroll Info: ATM OCN 610, 660  
Requisites: Graduate/professional standing  
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement  
Repeatable for Credit: No  
Last Taught: Fall 2012

**ATM OCN 771 — NUMERICAL MODELING IN METEOROLOGY**  
3 credits.  
Advanced techniques for development of meteorological numerical models. Survey of existing models for general circulation, operational weather prediction, mesoscale convection, and turbulence with emphasis on numerical methods and solution accuracy. Enroll Info: ATM OCN 610, 630 or cons inst  
Requisites: Graduate/professional standing  
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement  
Repeatable for Credit: No  
Last Taught: Fall 2011

**ATM OCN 773 — BOUNDARY LAYER METEOROLOGY**  
3 credits.  
Observations of and theories for boundary layers, turbulence, spectra, plumes, dust devils, convection, terrain effects, and other phenomena in the lowest 2 km of the atmosphere. Enroll Info: ATM OCN 311, 340; or 610, 630  
Requisites: Graduate/professional standing  
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement  
Repeatable for Credit: No  
Last Taught: Spring 2017

**ATM OCN 801 — TOPICS IN THEORETICAL METEOROLOGY**  
2-3 credits.  
Advanced level subjects in dynamics, synoptics, climate-dynamics and atmospheric physics including recent advances. Enroll Info: Graduate level gen meteor consent of instructor  
Requisites: Graduate/professional standing  
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement  
Repeatable for Credit: Yes, unlimited number of completions  
Last Taught: Fall 2017

**ATM OCN 900 — SEMINAR-METEOROLOGY**  
1-2 credits.  
Enroll Info: None  
Requisites: Graduate/professional standing  
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement  
Repeatable for Credit: No  
Last Taught: Fall 2016
ATM OCN/BOTANY/CIV ENGR/ENVIR ST/GEOSCI/ZOOLOGY 911 — LIMNOLOGY AND MARINE SCIENCE SEMINAR
1 credit.
Sections in various fields of zoological research. Enroll Info: Grad st in limnology marine sci grad prgm or cons inst
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2018

ATM OCN 915 — SEMINAR-DYNAMICS
1-2 credits.
Enroll Info: None
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Fall 2012

ATM OCN/ENVIR ST 925 — SEMINAR-CLIMATOLOGY
1-2 credits.
Historical climatology with emphasis on the last few centuries. Enroll Info: None
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2017

ATM OCN 935 — SEMINAR-PHYSICAL METEOROLOGY
1-2 credits.
Topics in physical meteorology are explored at an advanced graduate level, including severe storms, cloud physics and atmospheric chemistry, depending on instructor. Enroll Info: None
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2012

ATM OCN 945 — RADIATION AND REMOTE SENSING SEMINAR
1-2 credits.
Topics in radiation and remote sensing of the atmosphere and ocean. Emphasis will be on current and classical problems in radiative transfer and remote sensing. Enroll Info: None
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Summer 2013

ATM OCN/AGRONYMISTRY/BOTANY/ENTOM/ENVIR ST/F&W ECOL/GEOG/GEOSCI/ZOOLOGY 953 — INTRODUCTION TO ECOLOGY RESEARCH AT UW-MADISON
1-2 credits.
This seminar course will introduce new graduate students to the diversity of ecologists across the UW-Madison campus. Course meetings will include discussions of key topics in professional development, research presentations by faculty members, and discussions of assigned papers with senior graduate students. Enroll Info: None
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2018

ATM OCN 965 — SEMINAR-OCEANOGRAPHY
1-2 credits.
Enroll Info: None
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Fall 2017

ATM OCN/BOTANY/ENVIR ST/F&W ECOL/GEOG/GEOSCI/ZOOLOGY 980 — EARTH SYSTEM SCIENCE SEMINAR
1 credit.
Topics in earth system science. Emphasis on the coupling between atmospheric, oceanic and land surface systems, involving physical geochemical and biological processes, and including interactions with human systems. Enroll Info: None
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Fall 2016

ATM OCN 990 — RESEARCH
1-12 credits.
Enroll Info: None
Requisites: Consent of instructor
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions

ATM OCN 999 — ADVANCED INDEPENDENT STUDY
1-6 credits.
Enroll Info: None
Requisites: Consent of instructor
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions