ATMOSPHERIC AND OCEANIC SCIENCES (ATM OCN)

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. Stdts may not receive cr for both ATM OCN 100 101
Requisites: Open to Fr.
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
Repeateable for Credit: No
Last Taught: Spring 2017

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. Stdts may not receive cr for both ATM OCN 100 101
Requisites: Open to Fr.
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
Repeateable for Credit: No
Last Taught: Spring 2017

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.
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
Repeateable for Credit: No
Last Taught: Summer 2017

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. Open to Freshmen
Requisites: High school physics or chem recommended.
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
Repeateable for Credit: No
Last Taught: Spring 2017

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.
Requisites: Open to Fr
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
Repeateable for Credit: No
Last Taught: Fall 2009

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. This course explores the science of Earth’s hydrosphere, with constant attention to human uses and impacts. Open to Fr
Requisites: HS math science.
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
Repeateable for Credit: No
Last Taught: Spring 2017

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.
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
Repeateable 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.

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 2017

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. Open to Fr
Requisites: PHYSICS 201 or 207, MATH 221 or cons inst.
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.
Requisites: PHYSICS 208 or con reg MATH 234 or con reg
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 2016

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.
Requisites: ATM OCN 310, 330
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 2017

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. Not open to students who have enrolled in ATM OCN 425
Requisites: PHYS 103, 201 or 207; and MATH 217, 221 or 275.
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.
Requisites: PHYSICS 208 or con reg MATH 234 or con reg
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 2016

ATM OCN/ENVIR ST/GEOG 331 — 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.
Requisites: Atm Ocn/Geog/ENVIR ST/ATM OCN/GEOG 121, or GEOG/ ENVIR ST 120, 123, 124 or 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 2016
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. Freshmen permitted only with consent of instructor

Requisites: Geog/IES 120 or 127 or ATM OCN 100 or equivalent recommended.
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 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.

Requisites: Atmospheric-Oceanic 330
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 2017

ATM OCN 401 — TOPICS IN METEOROLOGY
2-3 credits.

Special topics to be given as the need and opportunity arise. May be repeated for credit.

Course Designation: Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2017

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.

Requisites: ATM OCN 310, 311, 330, 340
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2017

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.

Requisites: ATM OCN 311, 340, or cons inst
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 2016

ATM OCN 441 — RADAR AND SATELLITE METEOROLOGY
3 credits.

Provides undergraduate students with the necessary knowledge about radar and satellite meteorology.

Requisites: ATM OCN 340 or cons inst
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 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.

Requisites: ATM OCN 311 340, or cons inst
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 2016

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.

Requisites: ATM OCN 311 340, or cons inst
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 2017
ATM OCN 455 — SEVERE STORM FORECASTING AND OBSERVATION
1 credit.
Application of severe storm forecasting and nowcasting techniques under operational conditions. Severe storm observation and photography (storm chasing), application in the field.
Requisites: ATM OCN 453 or cons inst
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.
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.
Requisites: Cons inst
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.
Requisites: Junior standing and ATM OCN 101, ATM OCN 252 or ATM OCN/GEOG 323, and BIOLOGY/BOTANY/ZOOLOGY 152
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.
Requisites: Jr st or one year calculus-based college physics or introduction to weather and climate; or cons inst
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: Fall 2014

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.
Requisites: Intro calc, PHYSICS 103, BOTANY/BIOLOGY 130 comp programing; or cons inst
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 of transport in time and place. Local and regional concentrations of pollutants. Environmental implications of air pollution and control strategies.
Requisites: Math 212, PHYSICS 202, or cons inst
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.
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.
Requisites: ATM OCN 311 340, or cons inst
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.
Requisites: Cons inst
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.
Requisites: PHYSICS 208, MATH 234 cons inst
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 2016

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.
Requisites: ATM OCN 610 or cons inst
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 615 — LABORATORY IN ROTATING FLUID DYNAMICS
1 credit.

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.
Requisites: ATM OCN 311 or ATM OCN 610
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2016

ATM OCN 630 — INTRODUCTION TO ATMOSPHERIC AND OCEANIC PHYSICS
3 credits.

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.
Requisites: PHYSICS 208, MATH 234 cons inst
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 2010

ATM OCN 637 — CLOUD PHYSICS
3-4 credits.

Processes of cloud formation, growth, and dissipation from the standpoint of both the cloud particles and the whole cloud as a dynamic entity.
Requisites: ATM OCN 311 340, or cons inst
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 2014
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Course Description</th>
<th>Requisites</th>
<th>Course Designation:</th>
<th>Last Taught:</th>
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</thead>
<tbody>
<tr>
<td>ATM OCN 638 — ATMOSPHERIC CHEMISTRY</td>
<td>3 credits.</td>
<td></td>
<td>Evolution of the atmosphere, chemical structure, instrumental analysis, trace gases, aerosol mechanics, chemical processes.</td>
<td>One year calculus-based college physics, chemistry, and calculus for science majors, or cons inst</td>
<td>Breadth - Physical Sci. Counts toward the Natural Sci req</td>
<td>Spring 2015</td>
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<tr>
<td>ATM OCN 640 — RADIATION IN THE ATMOSPHERE AND OCEAN</td>
<td>3 credits.</td>
<td></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.</td>
<td>PHYSICS 208, MATH 234 cons inst</td>
<td>Level - Advanced</td>
<td>Spring 2017</td>
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<tr>
<td>ATM OCN 650 — ANALYSIS OF ATMOSPHERIC SYSTEMS</td>
<td>3 credits.</td>
<td></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.</td>
<td>ATM OCN 610, 630 or cons inst</td>
<td>Level - Advanced</td>
<td>Fall 2010</td>
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<tr>
<td>ATM OCN 651 — SYNOPTIC-DYNAMIC LABORATORY</td>
<td>3 credits.</td>
<td></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.</td>
<td>ATM OCN 610 630 cons inst, or ATM OCN 650</td>
<td>Level - Advanced</td>
<td>Spring 2015</td>
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<tr>
<td>ATM OCN 660 — INTRODUCTION TO PHYSICAL OCEANOGRAPHY</td>
<td>3 credits.</td>
<td></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.</td>
<td>PHYSICS 208, MATH 234 cons inst</td>
<td>Level - Advanced</td>
<td>Spring 2015</td>
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<tr>
<td>ATM OCN 681 — SENIOR HONORS THESIS</td>
<td>3 credits.</td>
<td></td>
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<td>Consent of instructor</td>
<td>Level - Advanced</td>
<td>Summer 2017</td>
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<tr>
<td>ATM OCN 682 — SENIOR HONORS THESIS</td>
<td>3 credits.</td>
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<td>Consent of instructor</td>
<td>Level - Advanced</td>
<td>Summer 2017</td>
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<tr>
<td>ATM OCN 691 — SENIOR THESIS</td>
<td>2-3 credits.</td>
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<td></td>
<td>ATM OCN major; ATM OCN 311, 340 or con reg; approval Assoc Chairman of Undergrad Affairs</td>
<td>Level - Advanced</td>
<td>Summer 2017</td>
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<tr>
<td>ATM OCN 692 — SENIOR THESIS</td>
<td>2-3 credits.</td>
<td></td>
<td></td>
<td>ATM OCN major; ATM OCN 311, 340 or con reg; approval Assoc Chairman of Undergrad Affairs</td>
<td>Level - Advanced</td>
<td>Summer 2017</td>
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<tr>
<td>ATM OCN 698 — DIRECTED STUDY</td>
<td>1-5 credits.</td>
<td></td>
<td>Offered on a Cr/N grading basis. Does not count toward Grad residence credit.</td>
<td>Jr or Sr st; requires cons inst</td>
<td>Level - Advanced</td>
<td>Summer 2017</td>
</tr>
</tbody>
</table>
ATM OCN 699 — DIRECTED STUDY
1-5 credits.
Graded on a lettered basis; requires cons inst
Requisites: Jr or Sr st.
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
Last Taught: Summer 2017

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.
Requisites: Graduate or 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.
Dynamics, chemistry and radiation of the stratosphere and mesosphere.
Structure and composition. Observing techniques. Gravity, Rossby, and
Modeling the middle atmosphere. Ozone layer. Greenhouse effect.
Requisites: ATM OCN 610, 630 or equiv
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Advanced
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.
Requisites: ATM OCN 610, 630 or equiv
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2014

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.
Requisites: ATM OCN 610, 630
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2013

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.
Requisites: ATM OCN 640
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.
Requisites: ATM OCN 640 or 1 yr calc-based college physics MATH 234
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/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.
Requisites: Cons inst
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.

Requisites: ATM OCN 611 660, or cons inst

Course Designation: Level - Advanced
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.

Theories 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.

Requisites: ATM OCN 610, 660

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

Requisites: ATM OCN 610, 630 or cons inst

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.

Requisites: ATM OCN 311, 340; or 610, 630

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

Requisites: Graduate level gen meteor consent of instructor

Course Designation: Grad 50% - Counts toward 50% graduate coursework
requirement

Repeatable for Credit: Yes, unlimited number of completions

Last Taught: Spring 2017

ATM OCN 900 — SEMINAR-METEOROLOGY

1-2 credits.

Requisites: Grad st

Course Designation: Grad 50% - Counts toward 50% graduate coursework
requirement

Repeatable for Credit: No

Last Taught: Spring 2017

ATM OCN/BOTANY/CIV ENGR/ENVIR ST/GEOSCI/ZOOLOGY 911 —
LIMNOLOGY AND MARINE SCIENCE SEMINAR

1 credit.

Sections in various fields of zoological research.

Requisites: Grad st in limnology marine sci grad prgm or cons inst

Course Designation: Grad 50% - Counts toward 50% graduate coursework
requirement

Repeatable for Credit: Yes, unlimited number of completions

Last Taught: Spring 2017

ATM OCN 915 — SEMINAR-DYNAMICS

1-2 credits.

Requisites: Grad st

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.

Requisites: Grad st

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.

Requisites: Grad st

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.

Requisites: Grad st
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Summer 2013

ATM OCN/AGRONOMY/BOTANY/ENTOM/ENVIR ST/F&W ECOL/GEOG/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.

Requisites: None
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2016

ATM OCN 955 — SEMINAR - WEATHER SYSTEMS
1-2 credits.

Topics in weather systems are explored at an advanced graduate level, including problems in synoptics, mesoscale, and micrometeorological weather phenomena, depending on instructor.

Requisites: Grad st
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Fall 2008

ATM OCN 965 — SEMINAR-OCEANOGRAPHY
1-2 credits.

Requisites: Grad st
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 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.

Requisites: Grad st
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.

Requisites: Grad st
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Summer 2017

ATM OCN 999 — ADVANCED INDEPENDENT STUDY
1-6 credits.

Requisites: Grad st
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Summer 2017