ATS 150 Science of Global Climate Change Credits: 3 (3-0-0)
Course Description: Physical basis of climate change. Energy budget of the earth, the greenhouse effect, carbon cycle, paleoclimate, projections of 21st-century climate.
Prerequisite: None.
Restriction: Must be a: Undergraduate.
Registration Information: Sections may be offered: Online.
Term Offered: Fall, Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ATS 350 Introduction to Weather and Climate Credits: 2 (2-0-0)
Course Description: Behavior of atmosphere and its influence upon human's activities.
Prerequisite: None.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ATS 351 Introduction to Weather and Climate Lab Credit: 1 (0-3-0)
Course Description: Actual weather data, visualization of meteorological phenomena, in-depth discussion of current environmental issues.
Prerequisite: ATS 350, may be taken concurrently.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ATS 495 Independent Study Credits: Var[1-18] (0-0-0)
Course Description: 
Prerequisite: None.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 543 Global Climate Change Credits: 2 (2-0-0)
Also Offered As: ESS 543.
Course Description: Climate change science, climate change impacts, and climate change mitigation, including discussions of current topics in climate change.
Prerequisite: BZ 300 to 499 or ECOL 300 to 499 or LIFE 300 to 499 or CHEM 300 to 499.
Registration Information: Sections may be offered: Online. Credit not allowed for both ATS 543 and ESS 543.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ATS 553 Global Climate Change Credits: 2 (2-0-0)
Also Offered As: ESS 553.
Course Description: Climate change science, climate change impacts, and climate change mitigation, including discussions of current topics in climate change.
Prerequisite: BZ 300 to 499 or ECOL 300 to 499 or LIFE 300 to 499 or CHEM 300 to 499.
Registration Information: Sections may be offered: Online. Credit not allowed for both ATS 543 and ESS 543.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ATS 555 Air Pollution Credits: 3 (3-0-0)
Course Description: Nature, ambient concentrations, sources, sinks, and physiological activities of pollutants; meteorology; legislation; social and economic factors.
Prerequisite: (CHEM 113) and (MATH 261 or MATH 340) and (PH 122 or PH 142).
Term Offered: Spring (odd years).
Grade Mode: Traditional.
Special Course Fee: No.

ATS 556 Climate Intervention to Cool a Warming Planet Credits: 2 (2-0-0)
Course Description: Introduction to the climate system and its modification by human activities, different potential climate intervention methods, and the social, legal and political issues salient to the topic.
Prerequisite: None.
Restriction: Must not be a: Freshman, Sophomore.
Registration Information: Junior standing. Credit not allowed for both ATS 556 and ATS 580A4.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ATS 560 Air Pollution Measurement Credits: 2 (1-3-0)
Course Description: Examination and application of techniques for air pollution measurement. Includes sampling and analysis of gases, aerosols, and precipitation.
Prerequisite: CHEM 114.
Registration Information: Must register for lecture and laboratory.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ATS 601 Atmospheric Dynamics I Credits: 2 (2-0-0)
Course Description: Equations of motion; earth's rotation; balanced motion; vorticity and Rossby waves; shallow water models; potential vorticity.
Prerequisite: MATH 261 and MATH 530.
Restriction: Must be a: Graduate, Professional.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ATS 602 Atmospheric Dynamics II Credits: 2 (2-0-0)
Course Description: Sound waves, gravity waves, Rossby waves; numerical weather predication; baroclinic instability; general circulation; tropical dynamics.
Prerequisite: ATS 601.
Restriction: Must be a: Graduate, Professional.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ATS 604 Atmospheric Modeling Credits: 3 (3-0-0)
Course Description: Design of numerical models of the atmosphere; applications to current problems. Emphasis on practical understanding of relevant numerical methods.
Prerequisite: ATS 601.
Restriction: Must be a: Graduate, Professional.
Term Offered: Fall (odd years).
Grade Mode: Traditional.
Special Course Fee: No.

ATS 605 Atmospheric Circulations Credits: 3 (3-0-0)
Course Description: Observations and theory of the general circulation of the atmosphere, with emphasis on understanding physical mechanisms.
Prerequisite: ATS 602, may be taken concurrently.
Restriction: Must be a: Graduate, Professional.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.
ATS 606 Introduction to Climate Credits: 2 (2-0-0)
Course Description: Global energy balance, surface energy balance, the hydrological cycle, atmosphere general circulation, ocean general circulation, climate variability, climate sensitivity and feedbacks.
Prerequisite: MATH 261 and MATH 530.
Restriction: Must be a: Graduate, Professional.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ATS 620 Thermodynamics and Cloud Physics Credits: 2 (2-0-0)
Course Description: Equilibrium thermodynamics, cloud microphysics, precipitation formation, and cloud electrification.
Prerequisite: MATH 340 and PH 142.
Restriction: Must be a: Graduate, Professional.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ATS 621 Atmospheric Chemistry Credits: 2 (2-0-0)
Course Description: Overview of chemical kinetics and equilibria; sources and sinks of pollutants; photochemistry and smog formation; aqueous-phase chemistry; acid rain.
Prerequisite: CHEM 114 and MATH 340 and PH 142.
Restriction: Must be a: Graduate, Professional.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ATS 622 Atmospheric Radiation Credits: 2 (2-0-0)
Course Description: Role of radiation in the energy balance of the climate system; Absorption and scattering of solar radiation; Emission and absorption of terrestrial radiation; Interactions of radiation with clouds and aerosols; Role of radiative active trace gases.
Prerequisite: ATS 620.
Restriction: Must be a: Graduate, Professional.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ATS 623 Atmospheric Boundary Layer Credits: 2 (2-0-0)
Course Description: Equations for shallow atmospheric motions; thermal instability of a fluid layer; atmospheric turbulence; flow stability; 1-D mixed layer models.
Prerequisite: ATS 601, may be taken concurrently.
Restriction: Must be a: Graduate, Professional.
Term Offered: Fall (even years).
Grade Mode: Traditional.
Special Course Fee: No.

ATS 631 Introduction to Atmospheric Aerosols Credits: 2 (1-3-0)
Course Description: Physical, chemical and microphysical characteristics of atmospheric particulate matter; measurement principles and techniques.
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ATS 632 Interpreting Satellite Observations Credits: 2 (1-3-0)
Course Description: Broad theoretical and practical overview of satellite observations of atmospheric composition. Introduction to the theoretical foundations of satellite composition retrievals of both gases and aerosols, and the associated strengths and weaknesses of commonly used atmospheric products.
Prerequisite: ATS 621 and ATS 622.
Restriction: Must be a: Graduate, Professional.
Registration Information: Must register for lecture and laboratory. Credit not allowed for both ATS 632 and ATS 681A1.
Term Offered: Spring (odd years).
Grade Mode: Traditional.
Special Course Fee: No.

ATS 640 Synoptic Meteorology Credits: 2 (1-2-0)
Course Description: Synoptic-scale weather systems; thermodynamic diagrams; vertical motion; fronts; cyclones and anticyclones.
Prerequisite: ATS 601, may be taken concurrently.
Restriction: Must be a: Graduate, Professional.
Registration Information: Must register for lecture and laboratory.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ATS 641 Mesoscale Meteorology Credits: 2 (1-2-0)
Course Description: Mesoscale weather systems; instabilities; orographic flows; dynamics of convective storms; organized convection.
Prerequisite: ATS 640.
Restriction: Must be a: Graduate, Professional.
Registration Information: Must register for lecture and laboratory.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ATS 650 Measurement Systems and Theory Credits: 2 (2-0-0)
Course Description: Surface and upper air measurement systems; theory and system response, sensor design; automated data collection, analysis and display systems.
Prerequisite: PH 142 and STAT 301.
Restriction: Must be a: Graduate, Professional.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.
ATS 651 Data Assimilation in Numerical Models Credits: 3 (3-0-0)
Course Description: Methods for combining theoretical understanding encoded in complex weather and climate models with real-world observations. Applications include weather prediction and other problems in the geosciences.
Prerequisite: (MATH 530) and (MATH 340 and STAT 301).
Restriction: Must be a: Graduate, Professional.
Term Offered: Spring (odd years).
Grade Mode: Traditional.
Special Course Fee: No.

ATS 652 Atmospheric Remote Sensing Credits: 2 (2-0-0)
Course Description: Concepts of electromagnetic and acoustic wave propagation; active and passive remote sensing techniques including radar, lidar, thermal emission systems.
Prerequisite: ATS 622.
Restriction: Must be a: Graduate, Professional.
Term Offered: Fall (odd years).
Grade Mode: Traditional.
Special Course Fee: No.

ATS 655 Objective Analysis in Atmospheric Sciences Credits: 3 (3-0-0)
Course Description: Objective analysis of geophysical data: general statistics; matrix methods; time series analysis. Emphasis on applications to real-world data.
Prerequisite: ATS 601 or MATH 530.
Restriction: Must be a: Graduate, Professional.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ATS 653 Responsible Research in Atmospheric Science Credit: 1 (0-0-1)
Course Description: Scientific misconduct; ethical publishing; record keeping; data management; professional skills applicable to atmospheric science.
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Registration Information: Must be admitted to Atmospheric Science degree program.
Term Offered: Spring.
Grade Mode: S/U Sat/Unsat Only.
Special Course Fee: No.

ATS 659A Thesis: Global Climate Change Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 699B Thesis: Land-Atmosphere Interactions Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 699C Thesis: Tropical Meteorology Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 699E Thesis: Ocean-Atmosphere Interactions Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 699F Thesis: General Circulation Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.
ATS 699I Thesis: Atmospheric Chemistry Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 699J Thesis: Aerosol and Cloud Microphysics Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 699K Thesis: Dynamic Meteorology Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 699L Thesis: Data Assimilation and Causality Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: S/U Sat/Unsat Only.
Special Course Fee: No.

ATS 699M Thesis: Mesoscale Meteorology Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 699N Thesis: Dynamics and Physics of Clouds Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 699O Thesis: Mesoscale Modeling Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 699P Thesis: Radiation Transfer Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: S/U Sat/Unsat Only.
Special Course Fee: No.

ATS 699Q Thesis: Radar Meteorology Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 699R Thesis: Aerosol and Cloud Chemistry Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 699S Thesis: Climate Dynamics Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 699T Thesis: Climate Analysis Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: S/U Sat/Unsat Only.
Special Course Fee: No.

ATS 699U Thesis: Tropospheric Chemistry Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 699V Thesis: Atmospheric Variability Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 703 Numerical Weather Prediction Credits: 2 (2-0-0)
Course Description: Quasi-geostrophic approximation; barotropic, baroclinic, primitive equation, and general circulation models; numerical methods.
Prerequisite: ATS 602.
Restriction: Must be a: Graduate, Professional.
Term Offered: Fall (even years).
Grade Mode: Traditional.
Special Course Fee: No.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATS 704</td>
<td>Large-Scale Atmospheric Dynamics</td>
<td>2</td>
<td>(ATS 623) and (ATS 602)</td>
</tr>
<tr>
<td>ATS 705</td>
<td>Atmospheric Waves and Vortices</td>
<td>3</td>
<td>(ATS 602) and (ATS 605)</td>
</tr>
<tr>
<td>ATS 706</td>
<td>Middle Atmospheric Dynamics</td>
<td>3</td>
<td>(ATS 605) and (ATS 602)</td>
</tr>
<tr>
<td>ATS 707</td>
<td>Geophysical Vortices</td>
<td>3</td>
<td>(ATS 602) and (ATS 605)</td>
</tr>
<tr>
<td>ATS 708</td>
<td>Microclimate</td>
<td>2</td>
<td>(ATS 602) and (ATS 605)</td>
</tr>
<tr>
<td>ATS 709</td>
<td>Dynamics of Clouds</td>
<td>3</td>
<td>(ATS 602) and (ATS 605)</td>
</tr>
<tr>
<td>ATS 710</td>
<td>Atmospheric Oxidation Processes</td>
<td>2</td>
<td>(ATS 602) and (ATS 605)</td>
</tr>
<tr>
<td>ATS 711</td>
<td>Air Quality Characterization</td>
<td>2</td>
<td>(ATS 602) and (ATS 605)</td>
</tr>
<tr>
<td>ATS 712</td>
<td>Theoretical Topics in Radiative Transfer</td>
<td>3</td>
<td>(ATS 602) and (ATS 605)</td>
</tr>
<tr>
<td>ATS 713</td>
<td>Atmospheric Radiation and Energetics</td>
<td>2</td>
<td>(ATS 602) and (ATS 605)</td>
</tr>
<tr>
<td>ATS 714</td>
<td>Cloud Microphysics</td>
<td>2</td>
<td>(ATS 602) and (ATS 605)</td>
</tr>
<tr>
<td>ATS 715</td>
<td>Mesoscale Modeling</td>
<td>3</td>
<td>(ATS 602) and (ATS 605)</td>
</tr>
</tbody>
</table>

**Course Description:**

ATS 704 Large-Scale Atmospheric Dynamics: Quasi-static, quasi-geostrophic equations; planetary waves; geostrophic adjustment; barotropic, baroclinic instability; frontogenesis; tropical cyclones.  
Prerequisite: ATS 602.  
Restriction: Must be a: Graduate, Professional.  
Term Offered: Fall (odd years).  
Grade Mode: Traditional.  
Special Course Fee: No.  

ATS 705 Atmospheric Waves and Vortices: Atmospheric wave motions and embedded vortices spanning mountain waves to large-scale Rossby waves and critical layers.  
Prerequisite: ATS 605.  
Restriction: Must be a: Graduate, Professional.  
Registration Information: Must register for lecture and recitation.  
Term Offered: Fall (odd years).  
Grade Mode: Traditional.  
Special Course Fee: No.  

ATS 706 Middle Atmospheric Dynamics: Dynamics of the stratosphere and mesosphere with emphasis on the lower and middle stratosphere.  
Prerequisite: ATS 602.  
Restriction: Must be a: Graduate, Professional.  
Term Offered: Spring.  
Grade Mode: Traditional.  
Special Course Fee: No.  

ATS 707 Geophysical Vortices: Observational, experimental, and theoretical aspects of geophysical vortices, such as hurricanes, polar lows, tornadoes, and dust devils.  
Prerequisite: ATS 605.  
Restriction: Must be a: Graduate, Professional.  
Term Offered: Fall (even years).  
Grade Mode: Traditional.  
Special Course Fee: No.  

ATS 708 Microclimate: Momentum, heat, water, and trace gas fluxes near the earth's surface, including fluxes between the atmosphere and the land/ocean/ice surfaces.  
Prerequisite: MATH 340 and ATS 623.  
Restriction: Must be a: Graduate, Professional.  
Term Offered: Fall (even years).  
Grade Mode: Traditional.  
Special Course Fee: No.  

ATS 709 Dynamics of Clouds: General theory of cloud dynamics; parameterization of microphysics and radiation; models of fog, stratocumuli, cumulonimbi, and orographic clouds.  
Prerequisite: ATS 623.  
Restriction: Must be a: Graduate, Professional.  
Term Offered: Spring (odd years).  
Grade Mode: Traditional.  
Special Course Fee: No.  

ATS 710 Atmospheric Oxidation Processes: Atmospheric hydrocarbon and nitrogen oxide reactions; aqueous phase scavenging and reactions; chemical pathways in the atmosphere.  
Prerequisite: ATS 621.  
Restriction: Must be a: Graduate, Professional.  
Term Offered: Fall (odd years).  
Grade Mode: Traditional.  
Special Course Fee: No.  

ATS 711 Air Quality Characterization: Planning, executing, and reporting on a measurement campaign to characterize local air quality.  
Prerequisite: (ATS 560) and (ATS 555 or ATS 621).  
Restriction: Must be a: Graduate, Professional.  
Registration Information: Must register for lecture and laboratory.  
Term Offered: Spring.  
Grade Mode: Traditional.  
Special Course Fee: No.  

ATS 712 Theoretical Topics in Radiative Transfer: Physics of atmospheric radiation; theoretical techniques used to show radiation transfer equation.  
Prerequisite: ATS 622.  
Restriction: Must be a: Graduate, Professional.  
Term Offered: Fall (odd years).  
Grade Mode: Traditional.  
Special Course Fee: No.  

ATS 713 Atmospheric Radiation and Energetics: Radiative transfer in the atmosphere; implications on remote sensing and energetics.  
Prerequisite: ATS 622.  
Restriction: Must be a: Graduate, Professional.  
Registration Information: Must register for lecture and recitation.  
Term Offered: Spring (odd years).  
Grade Mode: Traditional.  
Special Course Fee: No.  

ATS 714 Cloud Microphysics: Theories and observations of nucleation; cloud droplet spectrria broadening; precipitation growth and breakup; ice multiplication; cloud electrification.  
Prerequisite: ATS 621.  
Restriction: Must be a: Graduate, Professional.  
Term Offered: Spring (odd years).  
Grade Mode: Traditional.  
Special Course Fee: No.  

ATS 715 Mesoscale Modeling: Development of basic equations used in mesoscale models and methodology of solution  
Prerequisite: ATS 602 and ATS 623.  
Restriction: Must be a: Graduate, Professional.  
Term Offered: Fall (even years).  
Grade Mode: Traditional.  
Special Course Fee: No.
ATS 735 Mesoscale Dynamics  Credits: 3 (3-0-0)
**Course Description:** Analysis of physical and dynamical processes that initiate, maintain, and modulate atmospheric mesoscale phenomena.
**Prerequisite:** ATS 602.
**Restriction:** Must be a: Graduate, Professional.
**Term Offered:** Fall (odd years).
**Grade Mode:** Traditional.
**Special Course Fee:** No.

ATS 737 Satellite Observation of Atmosphere and Earth  Credits: 3 (3-0-0)
**Course Description:** Satellite measurements; basic orbits and observing systems; applications of remote probing and imaging to investigations of atmospheric processes.
**Prerequisite:** ATS 622 and ATS 652.
**Restriction:** Must be a: Graduate, Professional.
**Term Offered:** Spring (even years).
**Grade Mode:** Traditional.
**Special Course Fee:** No.

ATS 740 Atmospheric Electricity  Credits: 2 (2-0-0)
**Course Description:** Foundations of atmospheric electricity, including global electric circuit and the role of thunderstorms in maintaining this circuit, thunderstorm electrification processes based on non-inductive charging theory, lightning detection based on RF and optical sensing, and lightning phenomena including Transient Luminous Events.
**Prerequisite:** ATS 620.
**Restriction:** Must be a: Graduate, Professional.
**Registration Information:** Written consent of instructor. Credit not allowed for both ATS 740 and ATS 780A3.
**Term Offered:** Spring (odd years).
**Grade Mode:** Traditional.
**Special Course Fee:** No.

ATS 741 Radar Meteorology  Credits: 3 (3-0-0)
**Course Description:** Radar systems; radar equation and applications; multiple Doppler observation and processing; radar studies of mesoscale systems.
**Prerequisite:** ATS 652.
**Restriction:** Must be a: Graduate, Professional.
**Term Offered:** Spring (odd years).
**Grade Mode:** Traditional.
**Special Course Fee:** No.

ATS 742 Tropical Meteorology  Credits: 2 (2-0-0)
**Course Description:** Overview of the tropical atmosphere, monsoons, intraseasonal variability, hurricanes, theory of tropical convection and the large-scale circulation.
**Prerequisite:** ATS 601 and ATS 602 and ATS 606.
**Restriction:** Must be a: Graduate, Professional.
**Term Offered:** Spring (even years).
**Grade Mode:** Traditional.
**Special Course Fee:** No.

ATS 743 Interactions of the Ocean and Atmosphere  Credits: 3 (3-0-0)
**Course Description:** Ocean-atmosphere interactions in observations, theory, and models. Time mean atmosphere-ocean circulations through climate variability and change.
**Prerequisite:** ATS 602.
**Restriction:** Must be a: Graduate, Professional.
**Term Offered:** Spring (odd years).
**Grade Mode:** Traditional.
**Special Course Fee:** No.

ATS 745 Atmospheric General Circulation Modeling  Credits: 3 (3-0-0)
**Course Description:** Current problems in modeling of the general circulation of the atmosphere.
**Prerequisite:** ATS 602 and ATS 605.
**Restriction:** Must be a: Graduate, Professional.
**Term Offered:** Spring (even years).
**Grade Mode:** Traditional.
**Special Course Fee:** No.

ATS 750 Climate Dynamics: Atmospheric Variability  Credits: 3 (3-0-0)
**Course Description:** Analysis and interpretation of large-scale patterns of climate variability and observed climate change.
**Prerequisite:** ATS 605 and ATS 655.
**Restriction:** Must be a: Graduate, Professional.
**Term Offered:** Fall (even years).
**Grade Mode:** Traditional.
**Special Course Fee:** No.

ATS 752 Inverse Methods in Atmospheric Science  Credits: 2 (2-0-0)
**Course Description:** Introduction to inverse modeling, with particular application to remote sensing retrievals, flux inversions and data assimilation.
**Prerequisite:** None.
**Restriction:** Must be a: Graduate, Professional.
**Registration Information:** Ph.D. standing in Atmospheric Science required.
**Term Offered:** Fall.
**Grade Mode:** Traditional.
**Special Course Fee:** No.

ATS 753 Global Hydrologic Cycle  Credits: 3 (3-0-0)
**Course Description:** Hydrologic cycle, moisture transport and air-ground exchange; water budgets of meteorological phenomena; climatology of atmospheric water.
**Prerequisite:** (ATS 601) and (ATS 622 or ATS 652).
**Restriction:** Must be a: Graduate, Professional.
**Term Offered:** Spring (even years).
**Grade Mode:** Traditional.
**Special Course Fee:** No.

ATS 755 Theoretical and Applied Climatology  Credits: 3 (3-0-0)
**Course Description:** Current topics in climate research.
**Prerequisite:** ATS 606.
**Restriction:** Must be a: Graduate, Professional.
**Term Offered:** Fall (even years).
**Grade Mode:** Traditional.
**Special Course Fee:** No.

ATS 760 Global Carbon Cycle  Credits: 2 (2-0-0)
**Course Description:** Exchanges of CO2 between the atmosphere, the land surface, and oceans. Biogeochemical processes. Micrometeorological and inverse flux estimation.
**Prerequisite:** ATS 606.
**Restriction:** Must be a: Graduate, Professional.
**Term Offered:** Spring (odd years).
**Grade Mode:** Traditional.
**Special Course Fee:** No.
ATS 761 Land-Atmosphere Interactions  Credits: 2 (2-0-0)
Course Description: Exchange of energy, water, momentum, and carbon between the land surface and the atmosphere.
Prerequisite: ATS 606.
Restriction: Must be a: Graduate, Professional.
Term Offered: Fall (even years).
Grade Mode: Traditional.
Special Course Fee: No.

ATS 762 Biosphere-Chemistry-Climate Interactions Credits: 2 (2-0-0)
Course Description: Explore the sensitivity of the climate system to atmospheric chemical composition with emphasis on connections to biospheric processes and feedbacks.
Prerequisite: ATS 621.
Restriction: Must be a: Graduate, Professional.
Term Offered: Spring (odd years).
Grade Mode: Traditional.
Special Course Fee: No.

ATS 765 Climate Dynamics-Ocean Variability Credits: 3 (3-0-0)
Course Description: Climate variability on time scales of years to millennia with focus on the role of the ocean circulation. Approach through dynamical systems theory.
Prerequisite: ATS 606.
Restriction: Must be a: Graduate, Professional.
Term Offered: Fall (even years).
Grade Mode: Traditional.
Special Course Fee: No.

ATS 770 Ocean Modeling Credits: 3 (3-0-0)
Course Description: Conceptual and numerical ocean models and their application to current problems in climate science and biogeochemical cycles.
Prerequisite: ATS 601.
Restriction: Must be a: Graduate, Professional.
Term Offered: Fall (even years).
Grade Mode: Traditional.
Special Course Fee: No.

ATS 772 Aerosol Physics, Chemistry, Clouds & Climate Credits: 3 (3-0-0)
Course Description: The physics and chemistry of atmospheric aerosols including composition, size, and interaction with radiation and clouds, including the development of research-grade models of aerosols, clouds, and radiation.
Prerequisite: (CHEM 114 and MATH 161) and (PH 122 or PH 142).
Restriction: Must be a: Graduate, Professional.
Term Offered: Fall (odd years).
Grade Mode: Traditional.
Special Course Fee: No.

ATS 784 Supervised College Teaching Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 786 Practicum Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 795 Independent Study Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 796 Group Study Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 799A Dissertation: Global Climate Change Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 799B Dissertation: Land-Atmosphere Interactions Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 799C Dissertation: Tropical Meteorology Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 799D Dissertation: Weather Systems Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 799E Dissertation: Remote Sensing Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 799F Dissertation: Ocean-Atmosphere Interactions Credits: Var[1-18] (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.
ATS 799G  Dissertation: General Circulation  Credits: Var[1-18]  (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 799H  Dissertation: Remote Sensing of Climate  Credits: Var[1-18]  (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 799I  Dissertation: Atmospheric Chemistry  Credits: Var[1-18]  (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 799J  Dissertation: Aerosol and Cloud Microphysics  Credits: Var[1-18]  (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 799K  Dissertation: Dynamic Meteorology  Credits: Var[1-18]  (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 799L  Dissertation: Data Assimilation and Causality  Credits: Var[1-18]  (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 799M  Dissertation: Mesoscale Meteorology  Credits: Var[1-18]  (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 799N  Dissertation: Dynamics and Physics of Clouds  Credits: Var[1-18]  (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 799O  Dissertation: Mesoscale Modeling  Credits: Var[1-18]  (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 799P  Dissertation: Radiation Transfer  Credits: Var[1-18]  (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 799Q  Dissertation: Radar Meteorology  Credits: Var[1-18]  (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 799R  Dissertation: Aerosol and Cloud Chemistry  Credits: Var[1-18]  (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 799S  Dissertation: Climate Dynamics  Credits: Var[1-18]  (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

ATS 799T  Dissertation: Climate Analysis  Credits: Var[1-18]  (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: S/U Sat/Unsat Only.
Special Course Fee: No.

ATS 799U  Dissertation: Tropospheric Chemistry  Credits: Var[1-18]  (0-0-0)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.
ATS 799V  Dissertation: Atmospheric Variability  Credits:  
Var[1-18] (0-0-0)  
Course Description:  
Prerequisite: None.  
Restriction: Must be a: Graduate, Professional.  
Terms Offered: Fall, Spring, Summer.  
Grade Mode: Instructor Option.  
Special Course Fee: No.