ATMOSPHERIC SCIENCES (ATS)

ATS 003, UNDERGRADUATE RESEARCH, 0 Credits

Engage in research activities appropriate to the discipline; and through the research experience, acquire skills, techniques, and knowledge relevant to the field of study. In consultation with a faculty mentor, engage in research activity, and make and execute a plan for a project.

ATS 004, INTERNSHIP, 0 Credits

Provides basic personal and professional skills that can be used within and outside of a work setting. Through practice, this experience guides students in building and maintaining positive professional relationships, networking/mentoring relationships, and enhances students' understanding of the connection between theory and practice in their respective disciplines.

ATS 201, *CLIMATE SCIENCE, 4 Credits

Physical laws governing the Earth's climate and their interactions with chemical and biological processes on land and in the atmosphere, oceans, and cryosphere. Past, present, and potential future climate changes due to natural and human causes are assessed using a variety of observations, models, and laboratory exercises. (Bacc Core Course)
Attributes: CPPS – Core, Pers, Physical Science
Available via Ecampus

ATS 295, OBSERVING CLIMATE, 3 Credits

One-week course taught during Spring Break at field sites near Corvallis, with ten hours of preparatory meetings on campus. Make and analyze observations of properties of the atmosphere, ocean, biosphere, and cryosphere that reflect processes relevant to regional and global climate. Serves as an introduction to upper-division course work in climate science. Field trip(s) required; transportation fee charged. Lec/lab.
Prerequisite: ATS 201 with C- or better or ATS 320 with C- or better

ATS 301, CLIMATE DATA ANALYSIS, 4 Credits

Quantitative methods to characterize the physical climate system and detect change. Interpret data based on source timescale, and statistics; communicate conclusions and uncertainties regarding past climate and future changes.
Prerequisite: ATS 201 with C- or better and ST 351 [C-]

ATS 302, MATHEMATICAL APPLICATIONS IN THE EARTH SCIENCES, 4 Credits

An introductory survey of mathematical applications in climate science, meteorology, oceanography, geology, and geophysics. Topics may include conservation laws, harmonic motion, exponential growth/decay, linear approximations, numerical methods, waves, diffusion, fluid flow, systems of equations, inverse problems, and data analysis.
Prerequisite: MTH 252 with C- or better
Recommended: PH 201 or PH 211

ATS 310, METEOROLOGY, 4 Credits

The study of the atmosphere, in particular atmospheric phenomena that we experience as weather. Key physical concepts in meteorology are introduced and explored. The physics of the atmosphere necessary to understand why atmospheric phenomena occur and how these are forecast is discussed. Meteorological data from observations and models will be analyzed to explore concepts introduced in the context of the weather we experience. Lec/Lab.
Prerequisite: (MTH 251 with C- or better or MTH 251H with C- or better) and (PH 201 [D-] or PH 201H [D-] or PH 211 [D-] or PH 211H [D-]) and (PH 202 (may be taken concurrently) [D-] or PH 202H (may be taken concurrently) [D-] or PH 212 (may be taken concurrently) [D-] or PH 212H (may be taken concurrently) [D-] or CH 121 (may be taken concurrently) [D-] or CH 231 (may be taken concurrently) [D-] or CH 231H (may be taken concurrently) [D-])

ATS 341, *SNOW, SMOKE, AND STORMS: CLIMATE CHANGE IMPACTS IN THE PNW, 3 Credits

Climate change will alter mountain snowpack, water availability, coastal storms, erosion, and sea level in the Pacific Northwest. Increasing temperatures and changing precipitation patterns will lead to more extreme drought and flooding events, wildfire seasons, and insect and disease outbreaks in forests. These changes will impact the region's natural resource economy; heritage and quality of life; water, transportation, and energy infrastructure; and health and social systems. Case studies of past extreme years highlight the close interrelationships between the climate, the natural and built environment, and the health and well-being of the Pacific Northwest's residents.
Attributes: CSST – Core, Synthesis, Science/Technology/Society

ATS 399, SPECIAL TOPICS, 1-16 Credits

Equivalent to: ATS 399H
This course is repeatable for 12 credits.

ATS 399H, SPECIAL TOPICS, 1-16 Credits

Attributes: HNRS – Honors Course Designator
Equivalent to: ATS 399
This course is repeatable for 12 credits.

ATS 401, RESEARCH, 1-16 Credits

This course is repeatable for 24 credits.

ATS 403, THESIS, 1-16 Credits

This course is repeatable for 24 credits.

ATS 405, READING AND CONFERENCE, 1-16 Credits

This course is repeatable for 16 credits.

ATS 406, PROJECTS, 1-16 Credits

This course is repeatable for 24 credits.

ATS 407, SEMINAR, 1 Credit

One-credit sections. Graded P/N.
This course is repeatable for 12 credits.

ATS 408, WORKSHOP, 0-12 Credits

May be repeated for credit when topic varies.
This course is repeatable for 12 credits.

ATS 410, INTERNSHIP, 1-12 Credits

Pre-career professional experience under joint faculty and employer supervision. Graded P/N.
This course is repeatable for 48 credits.
Recommended: 12 credits of upper-division college courses

ATS 411, THERMODYNAMICS AND CLOUD MICROPHYSICS, 4 Credits

Thermodynamic processes in the atmosphere, and an introduction to cloud microphysics. Offered annually.
Prerequisite: (MTH 254 with D- or better or MTH 254H with D- or better) and (PH 213 [D-] or PH 213H [D-])

ATS 412, ATMOSPHERIC RADIATION, 3 Credits

Examines properties of radiation and the electromagnetic spectrum. Explores reflection and refraction; radiative properties of natural surfaces; thermal emission; atmospheric transmission and emission; absorption by atmospheric gases; broadband fluxes and heating rates; introduction to the radiative transfer equation; scattering and absorption by particles.
Prerequisite: (MTH 254 with C- or better or MTH 254H with C- or better or ATS 302 with C- or better) and (PH 202 [C-] or PH 212 [C-])

ATS 413, ATMOSPHERIC CHEMISTRY, 3 Credits

Principles of atmospheric chemistry; chemical fundamentals, sampling principles, sources, reactions, scavenging, and deposition of sulfur, nitrogen, ozone, and carbon compounds. Atmospheric aerosol size distribution, mechanics, optics, and scavenging. Offered annually.
Recommended: (CH 121 [D-] or CH 201 [D-] or CH 231 [D-] or CH 231H [D-]) and (MTH 251 [D-] or MTH 241[D-])

ATS 415, ATMOSPHERIC DYNAMICS, 4 Credits

Derivation of the equations and physical constraints governing atmospheric motions, including conservation laws and their atmospheric applications. Primitive equations: non-linear differential equations used to approximate atmospheric flow. Various types of balanced flows. Vertical atmospheric motion and its causes. Circulation, vorticity, and divergence. Quasi-geostrophic motions and adjustment to geostrophic balance. Atmospheric waves: theory, development, and propagation. Synoptic-scale Rossby waves. Baroclinic instability. General circulation of the atmosphere.
Prerequisite: ATS 301 with C- or better and ATS 310 [C-] and (ATS 302 (may be taken concurrently) [C-] or MTH 254 (may be taken concurrently) [C-]) and (PH 202 (may be taken concurrently) [C-] or PH 212 (may be taken concurrently) [C-])

ATS 417, WEATHER SYSTEM DYNAMICS AND FORECASTING, 4 Credits

Dynamics of weather systems and basic forecasting methods. Mid-latitude storm formation and structure; basic dynamical equations and applications to real-time weather; map analysis; description and interpretation of weather prediction models; forecasting methods; Pacific NW weather. Lec/Lab.
Prerequisite: ATS 310 with C- or better or ME 311 with C- or better or ME 311H with C- or better or BEE 311 with C- or better or CE 311 with C- or better

ATS 420, CLIMATE PHYSICS, 4 Credits

Physics-based analyses of climate past, present, and future. Detailed explorations of the energy balance and radiative transfer at the top of the atmosphere, within the atmosphere, and at the Earth's surface. Hydrologic cycle. Ice and climate. Radiative-convective equilibrium. General circulation of the atmosphere and ocean. History and evolution of Earth's climate. Climate sensitivity and feedbacks. Climate variability. Natural and anthropogenic climate change.
Prerequisite: (MTH 252 with C- or better or MTH 252H with C- or better) and (PH 202 [C-] or PH 212 [C-]) and (ATS 301 [C-] or (PH 365 [C-] and PH 366 [C-])) and (ATS 310 [C-] or PH 315 [C-])

ATS 421, CLIMATE MODELING, 4 Credits

Numerical models of the physics, chemistry, biology, and geology of the climate system. A range of climate models from a simple, single equation to complex state-of-the-science systems used for future projections. Theoretical concepts will be linked to practical applications through hands-on programming exercises and data analysis.
Prerequisite: ATS 420 with C- or better and (ATS 301 [C-] or (PH 365 [C-] and PH 366 [C-])) and (MTH 254 [C-] or ATS 302 [C-])

ATS 441, ^NORTHWEST CLIMATE AND WEATHER, 4 Credits

A survey of climate and weather phenomena that are consequential in the northwestern United States. The Pacific Ocean, the North Pacific jet and storm track, mountain and coastal meteorology, and topographic features like the region's mountains and Columbia River Gorge all affect the climate and weather of the Northwest, which in turn affect the region's hydrologic characteristics, vegetation, and numerous other natural and human systems. Preexisting content knowledge and analytical skills are used to produce a comprehensive written report and oral presentation for a regional stakeholder. (Writing Intensive Course)
Attributes: CWIC — Core, Skills, WIC
Prerequisite: ATS 301 with C- or better and ATS 420 [C-]

ATS 475, PLANETARY ATMOSPHERES, 3 Credits

Origin and evolution of planetary atmospheres; vertical structure of atmospheres; hazes and clouds; atmospheric motions and general circulation. Presentation of recent observations and current research issues, focusing on Venus, Earth, Mars, Jupiter, Saturn, and Titan. Emphasis on comparative aspects and simple models.
Prerequisite: (MTH 254 with D- or better or MTH 254H with D- or better) and (PH 213 [D-] or PH 213H [D-])

ATS 499, SPECIAL TOPICS, 0-4 Credits

Equivalent to: ATS 499H
This course is repeatable for 12 credits.

ATS 501, RESEARCH, 1-16 Credits

This course is repeatable for 24 credits.

ATS 503, THESIS, 1-16 Credits

This course is repeatable for 999 credits.

ATS 505, READING AND CONFERENCE, 1-16 Credits

This course is repeatable for 16 credits.

ATS 506, PROJECTS, 1-16 Credits

This course is repeatable for 72 credits.

ATS 507, SEMINAR, 1 Credit

One-credit sections. Graded P/N.
This course is repeatable for 48 credits.

ATS 508, WORKSHOP, 0-12 Credits

May be repeated when topic varies.
This course is repeatable for 12 credits.

ATS 511, THERMODYNAMICS AND CLOUD MICROPHYSICS, 4 Credits

Thermodynamic processes in the atmosphere, and an introduction to cloud microphysics. Offered annually.
Recommended: MTH 254 and PH 213

ATS 512, ATMOSPHERIC RADIATION, 3 Credits

Examines properties of radiation and the electromagnetic spectrum. Explores reflection and refraction; radiative properties of natural surfaces; thermal emission; atmospheric transmission and emission; absorption by atmospheric gases; broadband fluxes and heating rates; introduction to the radiative transfer equation; scattering and absorption by particles.

ATS 513, ATMOSPHERIC CHEMISTRY, 3 Credits

Principles of atmospheric chemistry; chemical fundamentals, sampling principles, sources, reactions, scavenging, and deposition of sulfur, nitrogen, ozone, and carbon compounds. Atmospheric aerosol size distribution, mechanics, optics, and scavenging. Offered annually.
Recommended: (CH 121 or CH 201 or CH 221 or CH 231 or CH 231H or CH 224) and (MTH 251 or MTH 241)

ATS 515, ATMOSPHERIC DYNAMICS, 4 Credits

Derivation of the equations and physical constraints governing atmospheric motions, including conservation laws and their atmospheric applications. Primitive equations: non-linear differential equations used to approximate atmospheric flow. Various types of balanced flows. Vertical atmospheric motion and its causes. Circulation, vorticity, and divergence. Quasi-geostrophic motions and adjustment to geostrophic balance. Atmospheric waves: theory, development, and propagation. Synoptic-scale Rossby waves. Baroclinic instability. General circulation of the atmosphere.
Prerequisite: OEAS 530 with C- or better
Recommended: One year of college calculus and physics

ATS 516, ATMOSPHERIC DYNAMICS II, 4 Credits

Review of basic equations; scale analysis and approximations. Turbulence and boundary layers. Dry and moist convection; convective storms. Frontogenesis; symmetric instability; internal gravity waves and mountain waves; differentially heated circulations including sea breezes. Slope flows and urban circulations. Offered alternate years.
Prerequisite: ATS 515 with C or better

ATS 517, WEATHER SYSTEM DYNAMICS AND FORECASTING, 4 Credits

Dynamics of weather systems and basic forecasting methods. Mid-latitude storm formation and structure; basic dynamical equations and applications to real-time weather; map analysis; description and interpretation of weather prediction models; forecasting methods; Pacific NW weather. Lec/Lab.
Prerequisite: OEAS 530 with C- or better

ATS 520, CLIMATE PHYSICS, 4 Credits

Physics-based analyses of climate past, present, and future. Detailed explorations of the energy balance and radiative transfer at the top of the atmosphere, within the atmosphere, and at the Earth's surface. Hydrologic cycle. Ice and climate. Radiative-convective equilibrium. General circulation of the atmosphere and ocean. History and evolution of Earth's climate. Climate sensitivity and feedbacks. Climate variability. Natural and anthropogenic climate change.
Prerequisite: OEAS 530 with C- or better

ATS 521, CLIMATE MODELING, 4 Credits

Numerical models of the physics, chemistry, biology, and geology of the climate system. A range of climate models from a simple, single equation to complex state-of-the-science systems used for future projections. Theoretical concepts will be linked to practical applications through hands-on programming exercises and data analysis.
Prerequisite: ATS 520 with C- or better or OEAS 530 with C- or better
Recommended: One year of college calculus and physics. Python programming experience or concurrent enrollment in ATS 508 (Python for Climate Modeling)

ATS 541, NORTHWEST CLIMATE AND WEATHER, 4 Credits

A survey of climate and weather phenomena that are consequential in the northwestern United States. The Pacific Ocean, the North Pacific jet and storm track, mountain and coastal meteorology, and topographic features like the region’s mountains and Columbia River Gorge all affect the climate and weather of the Northwest, which in turn affect the region’s hydrologic characteristics, vegetation, and numerous other natural and human systems. Preexisting content knowledge and analytical skills are used to produce a comprehensive written report and oral presentation for a regional stakeholder.
Prerequisite: OEAS 530 with C- or better or ATS 520 with C- or better

ATS 546, EXPERIMENTAL ENERGY AND GAS EXCHANGE, 4 Credits

Experimental methods to quantify the atmospheric carbon dioxide, water, methane, heat, momentum, and radiative exchange at the vegetation-land-ocean-air interface. Techniques include bulk and gradient approaches, and eddy covariance. The central activity consists of student teams designing and conducting a field experiment, analyzing and interpreting observations, and presenting results. Lec/lab/discussion/activity.
Recommended: ATS 516 [D-] or ATS 564 [D-] or FS 564 [D-]

ATS 564, INTERACTIONS OF VEGETATION AND ATMOSPHERE, 3 Credits

Quantitative treatment of radiation, heat, mass, and momentum exchange between vegetation and atmosphere; forest, natural and agricultural ecosystem examples. Physical and biological controls of carbon dioxide and water vapor exchange; remote sensing of canopy processes; models of stand-scale evaporation, photosynthesis and respiration; landscape and regional scale exchanges; vegetation and planetary boundary layer coupling; vegetation in global climate models.
Equivalent to: FS 564
Recommended: MTH 251 and PH 201

ATS 575, PLANETARY ATMOSPHERES, 3 Credits

Origin and evolution of planetary atmospheres; vertical structure of atmospheres; hazes and clouds; atmospheric motions and general circulation. Presentation of recent observations and current research issues, focusing on Venus, Earth, Mars, Jupiter, Saturn, and Titan. Emphasis on comparative aspects and simple models.
Recommended: MTH 254 and PH 213

ATS 590, SPECIAL TOPICS, 0-4 Credits

May be repeated when topic varies.
This course is repeatable for 12 credits.

ATS 599, SPECIAL TOPICS, 0-4 Credits

This course is repeatable for 12 credits.

ATS 601, RESEARCH, 1-16 Credits

This course is repeatable for 36 credits.

ATS 603, THESIS, 1-16 Credits

This course is repeatable for 999 credits.

ATS 605, READING AND CONFERENCE, 1-16 Credits

This course is repeatable for 16 credits.

ATS 606, PROJECTS, 1-16 Credits

This course is repeatable for 84 credits.

ATS 607, SEMINAR, 1 Credit

One-credit sections. Graded P/N.
This course is repeatable for 48 credits.

ATS 608, WORKSHOP, 0-12 Credits

May be repeated when topic varies.
This course is repeatable for 12 credits.

ATS 615, LARGE-SCALE INTERACTIONS OF THE OCEAN AND ATMOSPHERE, 3 Credits

Ocean-atmosphere circulations in the time-mean and seasonal cycles, equatorial wave modes, El Nino-Southern Oscillation, Madden-Julian oscillation, teleconnections and atmospheric bridges, mid-latitude air-sea interactions, Pacific and Atlantic decadal variability, the North Atlantic oscillation/Arctic oscillation.
Prerequisite: (ATS 515 with C or better or OC 670 with C or better)

ATS 690, SELECTED TOPICS, 0-4 Credits

May be repeated for credit when topic varies.
This course is repeatable for 12 credits.

ATS 699, SPECIAL TOPICS, 0-4 Credits

This course is repeatable for 12 credits.