

ATMOSPHERIC SCIENCES (ATS)

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

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.

Prerequisites: 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.

Prerequisites: ATS 201 with C- or better and ST 351 [C-]

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.

Prerequisites: (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 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.

Prerequisites: (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)

Radiative transfer in the earth and planetary atmospheres, absorption and scattering of sunlight, absorption and emission of terrestrial radiation, absorption and scattering cross sections for molecules, cloud droplets and aerosols. Applications include enhancement of photochemical reaction rates in clouds, remote sensing, and the earth's radiation budget, radiative-convective equilibrium, radiative forcing due to changes in atmospheric composition and climate change.

Prerequisites: (MTH 254 with D- or better or MTH 254H with D- or better) and (MTH 256 [D-] or MTH 256H [D-]) and (PH 213 [D-] or PH 213H [D-])

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 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.

Prerequisites: 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. PRINCIPLES OF CLIMATE: PHYSICS OF CLIMATE AND CLIMATE CHANGE. (4 Credits)

Physics of climate past, present and future. Covers radiative processes, thermodynamics, and dynamics, as well as the paleoclimate record and mechanisms driving this variability. Current modes of climate variability (e.g., ENSO) will also be surveyed. Climate models, ranging from 0- to 3-dimensional, will be examined and projections for the future assessed.

Recommended: MTH 252 and (PH 202 or PH 202H or PH 212 or PH 212H)

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. Lec/lab.

Recommended: ATS 420 or ATS 520

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

Prerequisites: 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.

Prerequisites: (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)

Radiative transfer in the earth and planetary atmospheres, absorption and scattering of sunlight, radiation, absorption and emission of terrestrial absorption and scattering cross sections for molecules, cloud droplets and aerosols. Applications include enhancement of photochemical reaction rates in clouds, remote sensing, and the earth's radiation budget, radiative-convective equilibrium, radiative forcing due to changes in atmospheric composition and climate change.

Recommended: MTH 254 and MTH 256 and PH 213

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 I. (4 Credits)

Derivation of equations governing atmospheric motions; shallow atmosphere approximation and the primitive equations. Simple balanced flows; vertical motion, circulation, vorticity and potential vorticity; Ekman layer dynamics; prototypical atmospheric waves; geostrophic adjustment; quasi-geostrophic motions; analysis of structure of synoptic-scale systems; baroclinic instability. Offered alternate years.

Recommended: MTH 256 and PH 213

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.

Prerequisites: 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.

Prerequisites: OEAS 530 with C- or better

ATS 520. PRINCIPLES OF CLIMATE: PHYSICS OF CLIMATE AND CLIMATE CHANGE. (4 Credits)

Physics of climate past, present and future. Covers radiative processes, thermodynamics, and dynamics, as well as the paleoclimate record and mechanisms driving this variability. Current models of climate variability (e.g., ENSO) will also be surveyed. Climate models, ranging from 0- to 3-dimensional, will be examined and projections for the future assessed.

Recommended: MTH 252 and (PH 202 or PH 202H or PH 212 or PH 212H)

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. Lec/lab.

Recommended: ATS 420 or ATS 520

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.

Prerequisites: 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 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.

Prerequisites: (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.