



ENV -105
Weather and Climate
Credits: 3

Course description:

This course is designed to give the students a comprehensive introduction to the building blocks of atmospheric science to help them develop a basic understanding of why and how atmospheric disturbances occur and their long-lasting consequences. Topics include atmospheric composition (e.g.: exchange of gases and particles between earth's surface and the atmosphere); and structure (e.g.: density; pressure and temperature of the different atmospheric layers); thermodynamics (e.g.: energy transfer through conduction; convection and radiation and causes of earth's seasons); and atmospheric circulation/distribution dynamics (e.g.: circulation/distribution of winds; fronts; jet streams; ocean currents; El Niño and La Niña events; regional climate of North America and Europe; and climate classification; tropical cyclones; monsoons; urban climates and air pollution). Real time satellite images; videos and other supplementary visual aids compiled by NOAA; National Geographic; USGS; USEPA and other online sources will be integrated into the lectures to breathe life into this subject and to remain current.

Student outcomes/objectives:

Upon successful completion of this course; students will be able to:

1. apply the fundamental processes responsible for the structure and composition of the atmosphere to distinguish between weather and climate.
2. identify the major physical mechanisms and uncertainties related to our changing climate.
3. explain the interactions between the land-surface and atmosphere in affecting weather and climate.
4. read and interpret weather maps.
5. design a report on local weather patterns based on real-time data generated by local weather stations.
6. recognize and identify the interactions between human activities and modification of the earth-atmosphere system, and changes to the atmosphere and climate.
7. articulate the impact of weather & climate in our everyday lives and its role in influencing policy decision making.

Detailed Outline of Suggested Topics:

Session	Topics
1	<u>I Atmospheric Composition & Energy</u> Composition and Structure of the Atmosphere Gases; vertical structure; evolution of the atmosphere; weather basics
2	Solar radiation and the seasons Earth/sun geometry; seasonal & diurnal position of radiation

3	Energy Balance and Temperature Solar & terrestrial radiation; global distribution of energy; anthropogenic factors; greenhouse gases & global warming
4	<u>II Heat Energy</u> Atmospheric Moisture Evaporation; condensation; latent heat; and the hydrologic cycle; thermodynamic laws; diabatic and adiabatic processes; moisture variables & humidity
5	TEST 1 Cloud development and forms Stability of air; advection; cloud types and composition
6	Precipitation processes Condensation; distribution and forms of precipitation; measuring precipitation; cloud seeding <i>Project topic due and review of Excel worksheet</i>
7	<u>III Atmospheric Circulation & Distribution Dynamics</u> Atmospheric circulation and pressure distribution Spatial scale of weather phenomena; pressure changes and measurements; wind speed and direction
8	Air masses and fronts Types; formation and sources of air masses; cloud conditions and fronts
9	TEST 2 Mid-latitude weather & climate Regional climate of North America & Europe; cyclones and conveyor-belt; jet streams; thunderstorms and tornadoes
10	Lightning, thunder & tornadoes Processes of lightning formation; geographic and temporal distribution of thunderstorms; tornado outbreaks <i>Project outline due</i>
11	Tropical weather & climate Hurricanes and monsoons; geographical settings; formation; movement and dissipation of hurricanes; hurricane impact; recent trends; earth's climates
12	TEST 3 Weather forecasting Thermodynamic diagrams; forecasting types and methods; maps and images
13	Earth's Climates Identification and characteristics of main climate groups; climate normal or "average weather" <i>Term Project due</i>
14	Human effects on the atmosphere Types of atmospheric pollutants; photochemical smog; urban heat islands & local weather; past and future climate changes
15	Course Review/Discussion <i>Final Exam</i>

Proposed student text:

Aguado and Burt: Understanding Weather and Climate (6th ed.), Pearson, 2013; ISBN-13: 978-0-321-76963-3

Evaluation criteria and methods

The grade determination is based on test performance, term project, assignments and final exam. The percentage of each component is established as follows:

Assignments	20%
Tests	40%
Final exam	20%
Term Project (due week 13 th)	20%
Total	100%