

DataStreme: Meteorology for Educators Course Outline

Unit 1: Energy, Sunlight, and Seasons

Learning Objectives:

- Describe the flow of energy into and out of the Earth system
- Explain how the tilt and orbit of Earth create seasonal changes in sunlight distribution
- Interpret the components of the surface energy budget
- Connect uneven heating to the development of temperature gradients that ultimately drive atmospheric motion

Unit 2: Observing the Weather

Learning Objectives:

- Explore the tools used for direct weather observations
- Draw isopleths, including isotherms and isobars, to see patterns in spatial data
- Convert local times to UTC for synchronizing weather observations globally
- Decode surface and upper-air weather symbols, including pressure, temperature, and wind, to analyze current conditions
- Examine remote sensing imagery to identify weather patterns

Unit 3: Atmospheric Circulation

Learning Objectives:

- Investigate how unequal heating of Earth's surface drives global atmospheric circulation
- Explain why warm air rises and how this contributes to the development of surface pressure systems
- Explore how air pressure gradients generate wind
- Describe how Earth's rotation influences wind direction through the Coriolis effect
- Interpret the concept of geostrophic balance in the upper atmosphere
- Distinguish between surface and upper-level winds and their weather patterns

Unit 4: The Role of Water in Weather

Learning Objectives:

- Explore water's properties
- Explain how and why phase changes occur in the atmosphere
- Distinguish between different measures of atmospheric moisture, including humidity and dew point
- Describe the role of condensation nuclei in cloud and fog formation
- Apply these concepts to interpret common weather phenomena that your students encounter in their daily lives

Unit 5: Stability, Clouds, and Precipitation

Learning Objectives:

- Distinguish between stable and unstable atmospheric conditions using lapse rates
- Describe how rising air leads to cloud formation
- Explain how CAPE relates to atmospheric instability and storm potential
- Identify major cloud types and the basic processes responsible for precipitation
- Interpret reflection and Doppler radar images

Unit 6: Middle Latitude Weather Systems

Learning Objectives:

- Describe the characteristics of high- and low-pressure systems and their associated weather patterns
- Distinguish among different types of fronts and the weather they typically produce
- Explain the stages of the Norwegian cyclone model in a conceptual framework
- Interpret how the jet stream influences the development and movement of midlatitude weather systems

Unit 7: Thunderstorms and Severe Weather

Learning Objectives:

- Describe the processes that lead to the development of convective storms
- Identify the key ingredients that contribute to severe weather, including tornado formation
- Distinguish between different types of winter storms and the conditions that produce them
- Interpret weather radar imagery to analyze storm structure and movement

Unit 8: Tropical Weather and ENSO

Learning Objectives:

- Identify the key ingredients necessary for hurricane development
- Describe how trade winds and the Walker circulation influence tropical weather patterns
- Explain the physical underpinnings of El Niño and La Niña and their broader impacts
- Connect tropical processes to weather patterns that affect distant regions

Unit 9: Extreme Weather

Learning Objectives:

- Describe the key atmospheric conditions that contribute to heat waves and fire weather
- Explain the mechanisms that lead to drought development and persistence
- Interpret how atmospheric rivers influence precipitation and flood potential

- Connect large-scale climate patterns to regional weather extremes and hazards

Unit 10: Data, Forecasting, and Communication

Learning Objectives:

- Explain the steps to formulate a weather forecast
- Describe how forecast models contribute to weather prediction
- Evaluate the effective communication of weather information