Curriculum Development
In the Fairfield Public Schools

FAIRFIELD PUBLIC SCHOOLS
FAIRFIELD, CONNECTICUT

METEOROLOGY

BOE APPROVED 05/12/2009

METEOROLOGY

Statement of Purpose

Science education promotes essential understandings of the natural world and nurtures students' abilities to apply scientific knowledge as seen through a lens from both a personal and societal perspective. The purpose of this course is to provide an understanding on the properties of the atmosphere, the scientific principles that govern weather and climate, interaction between the atmosphere and other components of the Earth system, and the implications of those interactions for human kind. As such, this education requires that the fundamental approach to science be a creative and logical process for investigating, reasoning, critiquing and communicating about ideas, not just a static body of facts to be memorized. Understanding the interconnections between science and technology and their shared impact on the environment and societal issues is essential for all students.

Audience

Grade 11 or 12 students

Prerequisites

Successful completion of 4 credits of science including Biology

Design and Description

Meteorology, which is a laboratory-based and technology-based course, will promote and cultivate the development student scientific inquiry and scientific method skills, which are important critical thinking skills. Meteorology is particularly suited to these aims because it is an applied science that readily lends itself to familiar everyday life. Weather is not an arbitrary act of nature, weather forecasting has its limits, and the climate future is uncertain. The emphasis on scientific methodology provides a perspective on the accomplishments of meteorologists and the challenges still facing them.

Topics that will be covered include 1) how we monitor the weather through local weather stations, radars, and satellites, 2) how the interactions between temperature, air pressure, wind, humidity, and precipitation create our weather, and 3) how to forecast the weather on a daily basis. Other topics include severe weather, like tornados, hurricanes, and thunderstorms/lightning, and weather human hazards like global climate change, all of which will be embedded within curriculum.

Course Objectives

Students will be able to:

- describe the five weather factors that most affect our weather (temperature, air pressure, wind, humidity, and precipitation.
- collect and explain relationships among the five major weather variables.
- use mathematical calculations to manipulate weather data for interpretation.
- analyze weather maps, radars, and satellite imagery.
- synthesize various forms of weather data to formulate a description of weather events.
- differentiate between weather and climate.
- describe the structure and composition of the atmosphere.

- explain how solar and terrestrial radiation affects temperature over space (place to place) and time.
- predict how seasonal changes occur over space and time.
- hypothesize how the seasons occur.
- assess which factors are most likely influencing the seasons.
- evaluate personal prediction of how the seasons occur compared to data collected.
- differentiate between solar and terrestrial radiation.
- explain how heat is transferred through radiation, conduction, and convection.
- describe how albedo of various natural earth surfaces affects the seasons.
- explain how daily temperature rises and falls (diurnal cycle).
- hypothesize factors that affect the diurnal cycle.
- deduce how relative humidity, clouds, bodies of water, and heat islands affects the diurnal cycle.
- establish guidelines to use factors affecting the diurnal cycle to forecast temperature.
- interpret a synoptic weather map with pressures systems and fronts.
- interpret the wind patterns around pressure systems and their associated air masses.
- infer how pressure systems travel across the United States.
- differentiate cloud types using satellite imagery within a low pressure system.
- estimate precipitation rates using radar within a low pressure system.
- synthesize an integrated view of pressure systems, front, air masses, and movement.
- interpret and integrated view of current weather.
- predict weather based upon trends.
- describe various forecasting models.
- predict weather locally using forecasting models and other weather technology.
- self-evaluate forecasting predictions.

Core Standards

Scientific Inquiry

Scientific Inquiry is a thoughtful and coordinated attempt to search out, describe, explain, and predict natural phenomena.

Students will identify questions that can be answered through scientific investigation.

Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation.

Students will design and conduct appropriate types of scientific investigations to answer different questions.

Students will use appropriate tools and techniques to make observations and gather data.

Students will formulate a testable hypothesis and demonstrate logical connections between the scientific concepts guiding the hypothesis and the design of the experiment.

Scientific inquiry requires that the sharing of findings and ideas for critical review by colleagues and other scientists.

Students will articulate conclusions and explanations based on research data, and assess results based on the design of the investigation.

Scientific Literacy
Scientific literacy also includes the ability to search for and assess the relevance and credibility of scientific information found in various print and electronic media.

Students will read, interpret and examine the credibility and validity of scientific claims in different sources of information.

Students will assess the reliability of the data that was generated in the investigation.

Scientific Numeracy
Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and understanding.

Students will use mathematical operations to analyze and interpret data, and present relationships between variables in appropriate forms.

Earth Science Enrichment Standards
Energy in the Earth System
Energy enters the Earth system primarily as solar radiation and eventually escapes as heat.

Students will describe that the sun is a major source of energy for Earth.

Students will explain that some of the solar radiation is reflected back into the atmosphere and some is absorbed by matter and photosynthetic processes.

Students will describe that different atmospheric gases absorb the Earth's thermal radiation.

Climate is the long-term average of a region's weather and depends on many factors.

Students will explain weather and climate involve the transfer of energy into and out of the atmosphere.

Students will explain that latitude, elevation, topography, proximity to large bodies of water, and cold or warm ocean currents affect the climate.

Heating of the Earth’s surface and atmosphere by the sun drives convection within the atmosphere, and oceans, producing winds and ocean currents.

Students will explain differential heating of Earth results in circulation patterns in the atmosphere and oceans that globally distribute heat.

Students will describe the rotation of the Earth influences the circular motions of ocean currents and air.

Students will describe the interaction of wind patterns, ocean currents, and the distribution of land masses result in a global pattern of latitudinal bands of rainforests and deserts.

Structure and Composition of the Atmosphere
Life has changed Earth's atmosphere, and changes in the atmosphere affect conditions for life.

Students will describe the atmosphere has specific thermal structure and chemical composition.

Information and Technology Standards (to be added)

Essential Questions

- How is scientific knowledge created and communicated?
- What is the role of energy in our world?
- What processes are responsible for life's unity and diversity?

Focus Questions

- What is the difference between weather and climate?
- What are the sources of collecting weather information?
- How has technology changed the way we collect and communicate weather data?
- How does technology, from direct and remote sensing sources, used to collect and communicate weather data?
- What is the structure and composition of the Earth's atmosphere?
- How does the sun provide energy to the earth?
- How is the energy from the sun distributed over space and time?
- What factors affect heat transfers and conversions?
- What does the diurnal cycle look like on normal days (sunny days/clear night)?
- How is the diurnal cycle similar to seasonal cycles?
- How does humidity in the air affect the rise and fall of daily temperatures?
- How might clouds affect daily temperature?
- How does the thickness of clouds affect daily temperature?
- How do large bodies of water affect daily temperature? Does wind direction play a role?
- How do cities and other large areas of man-made materials affect daily temperature?
- Why are these factors important to forecast weather?
- How do you read a weather map?
- How do winds travel around high and low-pressure systems?
- What kind of weather is associated with high and low-pressure systems?
- How do you use technology, such as radar and satellites to assess and predict precipitation?
- How do you assess current weather patterns?
- How do you predict temperature and precipitation?

- What are the various types of forecasting models?
- How do we use the forecasting models to predict the weather?
- How do we assess our predictions to make a better forecast?

UNITS OF STUDY

Unit 1: Weather Monitoring

Core Standards

Scientific Inquiry

Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation.

Students will use appropriate tools and techniques to make observations and gather data.

Scientific Numeracy

Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and understanding.

Students will use mathematical operations to analyze and interpret data, and present relationships between variables in appropriate forms.

Earth Science Enrichment Standards

Energy in the Earth System

Climate is the long-term average of a region's weather and depends on many factors.

Students will explain weather and climate involve the transfer of energy into and out of the atmosphere.

Structure and Composition of the Atmosphere

Life has changed Earth's atmosphere, and changes in the atmosphere affect conditions for life.

Students will describe the atmosphere has specific thermal structure and chemical composition.

Essential Questions

- How is scientific knowledge created and communicated?
- What is the role of energy in our world?
- What processes are responsible for life's unity and diversity?

Focus Questions

- What is the difference between weather and climate?
- What are the sources of collecting weather information?
- How has technology changed the way we collect and communicate weather data?
- How does technology, from direct and remote sensing sources, used to collect and communicate weather data?
- What is the structure and composition of the Earth's atmosphere?

Core Topics

- Weather Variables

- Direct and Remote Sensing Data Collection
- Weather and Climate
- Structure and Composition of the Atmosphere

Unit Objectives

Students will be able to:

- describe the five weather factors that most affect our weather (temperature, air pressure, wind, humidity, and precipitation.
- collect and explain relationships among the five major weather variables.
- use mathematical calculations to manipulate weather data for interpretation.
- analyze weather maps, radars, and satellite imagery.
- synthesize various forms of weather data to formulate a description of weather events.
- differentiate between weather and climate.
- describe the structure and composition of the atmosphere.

Sample Assessment

Case Study on Hurricane Katrina

Pacing

2 weeks

Unit 2: Seasonal Solar and Terrestrial Radiation

Core Standards

Scientific Inquiry

Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation.

Students will formulate a testable hypothesis and demonstrate logical connections between the scientific concepts guiding the hypothesis and the design of the experiment.

Students will design and conduct appropriate types of scientific investigations to answer different questions.

Scientific inquiry requires the sharing of findings and ideas for critical review by colleagues and other scientists.

Students will articulate conclusions and explanations based on research data, and assess results based on the design of the investigation.

Earth Science Enrichment Standards

Energy in the Earth System

Energy enters the Earth system primarily as solar radiation and eventually escapes as heat.

Students will describe that the sun is a major source of energy for Earth.

Students will explain that some of the solar radiation is reflected back into the atmosphere and some is absorbed by matter and photosynthetic processes.

Students will describe that different atmospheric gases absorb the Earth's thermal radiation.

Essential Questions

- How is scientific knowledge created and communicated?
- What is the role of energy in our world?

Focus Questions

- How does the sun provide energy to the earth?
- How is the energy from the sun distributed over space and time?
- What factors affect heat transfers and conversions?

Core Topics

- Solar and Terrestrial Radiation
- Seasons
- Heat Transfers and Conversions
- Albedo

Unit Objectives

Students will be able to:

- explain how solar and terrestrial radiation affects temperature over space (place to place) and time.
- predict how seasonal changes occur over space and time.
- hypothesize how the seasons occur.
- assess which factors are most likely influencing the seasons.
- evaluate personal prediction of how the seasons occur compared to data collected.
- differentiate between solar and terrestrial radiation.
- explain how heat is transferred through radiation, conduction, and convection.
- describe how albedo of various natural earth surfaces affects the seasons.

Sample Assessment

Case Study: Seasonal Changes in Connecticut

Pacing

2 weeks

Unit 3: The Diurnal Cycle

Core Standards

Scientific Inquiry

Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena.

Students will identify questions that can be answered through scientific investigation.

Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation.

Students will design and conduct appropriate types of scientific investigations to answer different questions.

Students will use appropriate tools and techniques to make observations and gather data.

Scientific Numeracy

Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and ideas.

Students will use mathematical operations to analyze and interpret data, and present relationships between variables in appropriate forms.

Earth Science Enrichment Standards

Energy in the Earth System

Energy enters the Earth system primarily as solar radiation and eventually escapes as heat.

Students will explain that some of the solar radiation is reflected back into the atmosphere and some is absorbed by matter and photosynthetic processes.

Climate is the long-term average of a region's weather and depends on many factors.

Students will explain weather and climate involve the transfer of energy into and out of the atmosphere.

Students will explain that latitude, elevation, topography, proximity to large bodies of water, and cold or warm ocean currents affect the climate.

Essential Questions

- How is scientific knowledge created and communicated?
- What is the role of energy in our world?

Focus Questions

- What does the diurnal cycle look like on normal days (sunny days/clear night)?
- How is the diurnal cycle similar to seasonal cycles?

- How does humidity in the air affect the rise and fall of daily temperatures?
- How might clouds affect daily temperature?
- How does the thickness of clouds affect daily temperature?
- How do large bodies of water affect daily temperature? Does wind direction play a role?
- How do cities and other large areas of man-made materials affect daily temperature?
- Why are these factors important to forecast weather?

Core Topics

- Diurnal Cycle
- Relationships between…
  - Humidity and temperature
  - Clouds and temperature
  - Bodies of weather and temperature
  - Heat islands and temperature
- Forecasting temperature

Unit Objectives

Students will be able to:

- explain how daily temperature rises and falls (diurnal cycle).
- hypothesize factors that affect the diurnal cycle.
- deduce how relative humidity, clouds, bodies of water, and heat islands affects the diurnal cycle.
- establish guidelines to use factors affecting the diurnal cycle to forecast temperature.

Sample Assessment

Forecasting Temperature Project

Pacing

3-4 weeks

Unit 4: Weather Systems

Core Standards

Scientific Inquiry

Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation.

Students will design and conduct appropriate types of scientific investigations to answer different questions.

Students will use appropriate tools and techniques to make observations and gather data.

Scientific numeracy includes the ability to use mathematical operations and procedures to calculate, analyze and present scientific data and ideas.

Students will use mathematical operations to analyze and interpret data, and present relationships between variables in appropriate forms.

Earth Science Enrichment Standards

Energy in the Earth System

Heating of the Earth's surface and atmosphere by the sun drives convection within the atmosphere, and oceans, producing winds and ocean currents.

Students will explain differential heating of Earth results in circulation patterns in the atmosphere and oceans that globally distribute heat.

Students will describe the rotation of the Earth influences the circular motions of ocean currents and air.

Students will describe the interaction of wind patterns, ocean currents, and the distribution of land masses result in a global pattern of latitudinal bands of rainforests and deserts.

Essential Questions

- How is scientific knowledge created and communicated?
- What is the role of energy in our world?

Focus Questions

- How do you read a weather map?
- How do winds travel around high and low-pressure systems?
- What kind of weather is associated with high and low-pressure systems?
- How do you use technology, such as radar and satellites to assess and predict precipitation?
- How do you assess current weather patterns?
- How do you predict temperature and precipitation?

Core Topics

- Weather Maps

- Air Masses
- Pressure Systems
- Winds
- Precipitation
- Weather Analysis and Forecasting

Unit Objectives

Students will be able to:

- interpret a synoptic weather map with pressures systems and fronts.
- interpret the wind patterns around pressure systems and their associated air masses.
- infer how pressure systems travel across the United States.
- differentiate cloud types using satellite imagery within a low pressure system.
- estimate precipitation rates using radar within a low pressure system.
- synthesize an integrated view of pressure systems, front, air masses, and movement.
- interpret and integrated view of current weather.
- predict weather based upon trends.

Sample Assessment

Forecasting Temperature and Precipitation

Pacing

4 weeks

Unit 5: Weather Forecasting

Core Standards

Scientific Inquiry

Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation.

Students will formulate a testable hypothesis and demonstrate logical connections between the scientific concepts guiding the hypothesis and the design of the experiment.

Scientific inquiry requires the sharing of findings and ideas for critical review by colleagues and other scientists.

Students will articulate conclusions and explanations based on research data, and assess results based on the design of the investigation.

Scientific Literacy

Scientific literacy includes the ability to search for and assess the relevance and credibility of scientific information found in various print and electronic media.

Students will read, interpret and examine the credibility and validity of scientific claims in different sources of information.

Students will assess the reliability of the data that was generated in the investigation.

Earth Science Enrichment Standards

Energy in the Earth System

Heating of the Earth's surface and atmosphere by the sun drives convection within the atmosphere, and oceans, producing winds and ocean currents.

Students will explain differential heating of Earth results in circulation patterns in the atmosphere and oceans that globally distribute heat.

Students will describe the rotation of the Earth influences the circular motions of ocean currents and air.

Essential Questions

- How is scientific knowledge created and communicated?
- What is the role of energy in our world?

Focus Questions

- What are the various types of forecasting models?
- How do we use the forecasting models to predict the weather?
- How do we assess our predictions to make a better forecast?

Core Topics

- Forecast Models

- Forecasting with models and technology

Unit Objectives

Students will be able to:

- describe various forecasting models.
- predict weather locally using forecasting models and other weather technology.
- self-evaluate forecasting predictions.

Sample Assessment

Forecasting Project

Pacing

2 weeks (one week worth of forecasting)