

# Physical Geography

## Unit 2 - World Climate Patterns

Unit 2 provides an opportunity for students to examine some of the basic forces that produce our weather and climate, how they produce climate patterns on the earth's surface, and relate to human activity. These patterns are strongly affected by the distribution of landforms and water forms.

## Unit 2: World Climate Patterns

### Outcomes

***SCO 2.1: The student will be expected to demonstrate an understanding of how the earth's movement in space causes the occurrence of and the conditions related to day and night and the seasons, including the following delineations:***

- 2.1.1 Distinguish between the terms rotation and revolution. (k)
- 2.1.2 Explain how cloud cover influences the range of temperatures from day to night. (k)
- 2.1.3 Define the terms equinox and solstice. (k)
- 2.1.4 Explain how changes in the seasons, in the northern hemisphere and southern hemisphere, relate to the earth's revolution around the sun. (k)
- 2.1.5 **Describe the factors that account for differences in length of day as seasons change. (k)**
- 2.1.6 **Describe the factors that account for differences in temperature as seasons change. (k)**

### Sample Learning/Teaching Strategies

*Teachers can have students*

- using a model of the planetary system, relate the occurrence of day and night to the earth's rotation.
- using a model of the planetary system, describe how the march of the seasons relates to the earth's revolution around the sun.

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### Sample Assessment Strategies

*Students could, for example:*

- given a diagram of the earth's revolution around the sun, identify the season associated with a given position of the earth on its orbital path (see teacher note 1).
- use sentence completion exercise to test student knowledge of reasons for seasonal changes in length of day and night (see teacher note 2).

### Teacher Notes

- Refer to the website <http://www.physicalgeography.net/fundamentals/6h.html> for excellent explanations, diagrams and animations (earth-revolution animation, winter solstice animation, and equinox animation) that support SCO 2.2. (1)
- Assign TR Worksheet 4.1. (2)

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### Outcomes

***SCO 2.2: The student will be expected to detect patterns in the distribution of temperatures on the earth's surface, including the following delineations:***

- 2.2.1 Explain how the greenhouse effect moderates climate. (k)
- 2.2.2 Generalize that temperatures *tend* to decrease from low to high latitudes. (a)
- 2.2.3 **Explain how the earth's shape causes temperatures to decrease from low to high latitudes. (k)**
- 2.2.4 Given selected data, assess the accuracy of temperature descriptions. (i)

### Sample Learning/Teaching Strategies

*Teachers can have students*

- with the aid of a diagram, describe how the earth's shape causes temperatures to decrease from the low to the high latitudes.
- for mean annual temperature data given, draw a scattergraph to show the relationship between temperature and latitude.
- given a world map of temperatures in July and a world map of temperatures in January, determine the validity of such statements about temperature conditions as (see teacher note 2):
  - west coast temperatures for North America and Eurasia are colder than inland temperatures on the same latitude
  - in the southern hemisphere, January is the cooler period

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### Sample Assessment Strategies

*Students can, for example:*

- with the aid of a table of temperatures for selected stations in the Northern Hemisphere, describe the general pattern of temperatures from the low to the high latitudes (see teacher note 1).
- given a world map of temperatures in July and a world map of temperatures in January, determine the validity of such statements about temperature conditions as (see teacher note 2):
  - low latitude temperatures are always hot
  - in the high latitudes there is a great difference summer and winter temperatures
- analyze a climograph for a station in the middle or high latitudes of the Northern Hemisphere and one for a station on the same latitude in the Southern Hemisphere. Explain why they are different.

### Teacher Notes

- In teaching Delineation 2.2.2, review the use of scattergrams as a tool to illustrate the positive and negative correlation between two variables.
- Refer students to the scattergraph before they write their conclusion. See Exercise 13, pages 58-59. (1)
- Refer to ST, Figure 4.7, page 60. (2)

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### Outcomes

*SCO 2.3: The student will be expected to demonstrate an understanding of the cause of winds and how winds affect climate, including the following delineations:*

- 2.3.1 Define the term prevailing winds. (k)
- 2.3.2 Describe conditions that result in land breezes and sea breezes. (k)
- 2.3.3 State the impact of the coriolis effect on wind direction. (k)**
- 2.3.4 Infer how wind systems relate to major pressure belts. (a)**
- 2.3.5 Explain how wind systems and temperature are related. (k)**
- 2.3.6 Define the terms windward, leeward, and rain shadow. (k)
- 2.3.7 Examine how the type of rainfall (i.e., orographic, frontal, and convectional) is related to the nature of location. (a)**
- 2.3.8 Explain how wind systems and precipitation are related. (k)

### Sample Learning/Teaching Strategies

*Teachers can have students*

- given air temperatures above the sea and above the land for a specific time during the day (or night), identify the wind direction.
- given a diagram, describe the influence of the Coriolis force on the direction of winds (see teacher note 1).
- on a world map, identify the major winds systems and relate them to the major pressure belts.
- with the aid of a diagram, describe how frontal rainfall occurs.
- with the aid of a diagram, describe how convectional rainfall occurs.
- with the aid of a diagram, describe how orographic rainfall occurs.
- given a world temperature map, cite an example of how a prevailing wind system influences temperature.

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### Sample Assessment Strategies

*Students could, for example:*

- with the aid of a diagram, write a paragraph to describe how orographic rainfall occurs.
- write each of the terms orographic rainfall, frontal rainfall, and convectional rainfall on the correct diagram.
- given annual rainfall data for places near the ocean and places farther inland, write a statement about the influence of winds on precipitation.
- write a brief paragraph to explain how land and sea breezes are caused (see teacher note 2).
- given a world map showing major ocean currents, shade the coastal areas that may experience
  - cool temperatures in summer
  - warm temperatures in winter.

### Teacher Notes

- Relate Delineation 2.3.7 to 2.6.3.
- To introduce the notion of convection currents, refer to TR, “Explaining Convection Currenys ...”, page 42.
- Refer to the Danish Wind Turbine Manufacturers Association website for text and animation on the coriolis effect. (1)  
*<http://www.windpower.org/en/tour/wres/coriolis.htm>*
- The Danish Wind Turbine Manufacturers Association has a website containing text and animation for sea breezes. (2)  
*<http://www.windpower.org/en/tour/wres/localwin.htm>*

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### Outcomes

***SCO 2.4: The student will be expected to demonstrate an understanding of how ocean currents affect climate, including the following delineations:***

- 2.4.1 Define the term ocean current. (k)
- 2.4.2 Analyze how ocean currents can create different climatic conditions for two coastal locations on the same latitude. (a)

### Sample Learning/Teaching Strategies

*Teachers can have students*

- using a world map of ocean currents, identify cold currents and warm currents.
- given a world map of ocean currents and temperature data for two locations on the same latitude, one near a cold current and one near a warm current, write a statement to describe the difference in temperature.

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### Sample Assessment Strategies

*Students could, for example.*

- given the map of ocean currents, describe the difference in temperature and why they occur for such locations as:
  - Callao and Salvador
  - Prince Rupert and Rigolet (see teacher note 1)
- given a world map of ocean currents, explain why palm trees grow in Land's End, England.

### Teacher Notes

- Ask students first to search the Internet for climate statistics for each of these places before they attempt to account for the differences. (1)

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### Outcomes

***SCO 2.5: The student will be expected to demonstrate an understanding of how distance from the ocean affects climate, including the following delineations:***

- 2.5.1 Define the term temperature range. (k)
- 2.5.2 Analyze the relationship between range in temperature and distance from the ocean. (a)
- 2.5.3 Define the term monsoon. (k)
- 2.5.4 **Explain why winter and summer monsoons occur. (k)**
- 2.5.5 Describe the relationship between seasonal level of precipitation and distance from the ocean. (k)

### Sample Learning/Teaching Strategies

*Teachers can have students*

- provide a map showing a coastal location and an inland location on the same latitude. Ask students to determine if there is a significant difference in mean annual temperature and, if so, to explain why.
- explain why the seasonal winds of the winter and summer monsoons occur.
- given a set of climate statistics for selected stations and describe the seasonal pattern in temperature and precipitation.

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### Sample Assessment Strategies

*Students could, for example.*

- using a table giving average January and July temperatures for selected stations (on generally the same latitude in either North America or Eurasia) and their distance from the sea, construct a scattergraph to show the relationship between the annual range of temperature and distance from the coast. Write a statement to describe the relationship (see teacher note1).

### Teacher Notes

- The National Drought Mitigation Centre website provides climographs for 30 U.S. cities.  
*<http://www.drought.unl.edu/index.htm>*
- Refer to ST, Exercise 33, page 69. (1)

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### Outcomes

***SCO 2.6: The student will be expected to demonstrate an understanding of the relationship between elevation and climate, including the following delineations:***

- 2.6.1 Define the term elevation. (k)
- 2.6.2 Describe the relationship between the elevation of a point and its temperature and precipitation. (k)
- 2.6.3 **Analyze the relationship between temperature and precipitation of a point and its location relative to a mountain system. (a)**

### Sample Learning/Teaching Strategies

*Teachers can have students*

- given a table showing the temperature for locations on generally the same latitude but at different elevations, write a statement about how elevation affects temperature.
- through use of a diagram, describe how prevailing onshore westerly winds and mountains together affect rainfall conditions of west coast areas of North America and South America.

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### Sample Assessment Strategies

*Students can, for example:*

- given a set of rainfall statistics for a location on the windward side of a mountain system (Rocky Mountains or Andes Mountains) and a location on the leeward side, write a sentence to compare the rainfall conditions (see teacher note 1).

### Teacher Notes

- Relate Delineations 2.6.3 and 2.3.7.
- Refer to ST, Exercise 38b, page 71. (1)

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### Outcomes

***SCO 2.7: The student will be expected to demonstrate an understanding of the combined effect of climatic conditions and the zones they produce, including the following delineations:***

- 2.7.1 Given relevant information, determine climatic conditions within selected zones. (a)
- 2.7.2 Draw conclusions about patterns in the distribution of climatic zones. (a)

### Sample Learning/Teaching Strategies

*Teachers can have students*

- given a world climates map, write a statement describing how distance from the equator affects temperature.
- given (1) a world climate map showing the location of selected cities and (2) climographs for these cities, determine which city each climograph represents.
- analyze a world climate map and describe the climatic conditions that exist at a specific location and some of the factors that account for these conditions.
- examine information about prevailing winds and proximity to the ocean and explain why Western Europe experiences a mild and rainy climate.
- draw a chart to describe the factors that most influence the climate of your area:
  - location
  - nearness to the sea
  - elevation

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### Sample Assessment Strategies

*Students can, for example:*

- given a world climates map, identify:
  - the most widespread climatic zone in the low latitudes
  - two climatic zones with dry conditions for most of the year
  - the type of climate that is most widespread in North Africa
  - the continents which do not experience continental climates
  - the climate of the local area (see teacher note 1)
- analyze a set of climate statistics for several different sites and read a series of statements describing climatic conditions. Match each statement with the correct location (see teacher note 2).
- select from a series of statements the one that best describes the climate represented by a given climograph.
- in a small group, arrive at a consensus about which factors have the greatest influence on the climate of the local area (see teacher note 3).

### Teacher Notes

- For delineation 2.8.2, ensure that very simple examples are provided for World Geography 3200 students. With these activities you may wish to use an illustrated atlas where photos are used to illustrate each climatic zone (e.g., a desert scene for arid zones). It would suffice if these students can draw very simple conclusions; for example, warm moist areas tend to be located near the equator. (1)
- Refer to ST, Exercise 40a, page 72. (2)
- The cooperative learning structure, Think-Pair-Share, would be a useful strategy for this task. (3)
- For a culminating activity, refer to TR Worksheet 4.5.

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### Outcomes

**SCO 2.8:** *The student will be expected to demonstrate an understanding of how climate conditions may affect human activity, including the following delineations:*

- 2.8.1 Illustrate how human activity is influenced by climatic conditions. (a)
- 2.8.2 Examine how human activity affects climatic conditions (e.g., greenhouse effect, ozone depletion, global warming). (a)
- 2.8.3 **Argue a preference for the appeal of selected climatic conditions.** (i)
- 2.8.4 Examine how selected climatic phenomena (e.g., El Nino, lake effect, hurricanes) affect human activity. (i)

### Sample Learning/Teaching Strategies

*Teachers can have students*

- research and write a brief report to describe how the latitudinal arrangement of temperatures and the reversal of the seasons have economic implications (e.g., the availability of produce in a supermarket year around; northerners vacationing in southern destinations during winter).
- given a case study of rice growing in monsoon India, relate the sequence of rice growing activities to the occurrence of specific climatic conditions (see teacher note 1).
- given a table showing wheat yields per hectare for a given period, construct a line graph to represent the relationship between wheat yield and rainfall. Write a statement to describe the pattern shown.
- summarize a newspaper or magazine article about a weather- or climate-related disaster. Pay particular attention to the property effects.
- research a newspaper article about the impact of a weather- or climate-related disaster. Project the possible human effects of the disaster (e.g., deaths, injury, emotional trauma, economic impact).
- examine a piece of art and describe how landscape and climate influenced what the artist's mood and technique.
- conduct research to present a case that human activity can have a detrimental effect on climatic conditions (see teacher note 2).

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### Sample Assessment Strategies

*Students can, for example:*

- examine an advertisement for a southern holiday package (e.g., Florida, Cancun) in summer and in winter. They could write a statement to compare the cost in winter to the cost in summer. Explain why this difference occurs.
- analyze a case study about a weather-related disaster (e.g., a storm surge in the Bay of Bengal; a hurricane in the Gulf of Mexico) to decide whether a given event may be categorized as a cause, effect, or a human response. The analysis may be charted:

| Disaster-Related Event | Cause | Effect | Human Response |
|------------------------|-------|--------|----------------|
|                        |       |        |                |
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- assume the role of an individual who is to migrate to another country. Evaluate the degree to which climate might be a factor in your decision-making process.
- analyze a case study and describe the methods used to reduce the risk of a weather-related threat (e.g., the construction of sea wall defences in eastern England to prevent erosion by the sea).

### Teacher Notes

- The Geography World website has excellent material (text, photos, and video and sound clips) on weather- and climate-related hazards, e.g., droughts, tornadoes, and hurricanes.
- Also refer to About Geography website (<http://geography.about.com/mbody.htm>) and select “Climate and Weather” to find material on “Climate Effects on Human Health.”
- For an example of a sequence of coffee growing activities, refer to TR Worksheet 5.3, page 56. (1)
- See ST, pages 237-238.

