

# How's the weather?

from the Esri GeoInquiries™ collection for Earth Science

Target audience – Earth Science learners

Time required – 15 minutes

Activity

Explore relationships between temperature, pressure, and humidity with daily weather forecasts.

Science Standards

NGSS:MS-ESS2-5 - Collect data to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.

**Learning Outcomes** 

- Students will show regional patterns to the pressure of the air around the content.
- Students will show how pressure variation and temperature changes can be used to predict upcoming weather.

## Map URL: http://www.esriurl.com/earthgeoinquiry13



## 📆 Engage

#### How do TV weather reporters make their maps?

- → Click the link above to launch the map.
- ? Which color indicates high-pressure air? [The darkest areas of purple represent high pressure.]
- → With the Details button underlined, click the button, Show Contents of Map (Content).
- → In the upper-right corner, click the link, Modify Map.
- → Click the button, Edit.
- → Label the high and low pressure areas on the map. Add at least three low-pressure "L" and three high-pressure "H" symbols. If needed, see the Tooltip on page 2, Edit (Add Features).



## Explore

## How do air masses generally move across the country?

- → Hover over the layer name, Weather Stations.
- → Click the button, Change Style.
- → Set Step 1: TempF
- → Set Step 2: Counts & Amounts (Color)
- → Click the button, Options. Set Theme: Above and Below.
- → Click Symbols. Click Fill. Select a Red-to-blue color ramp.
- → If necessary, click Invert Colors to indicate red for warmer and blue for cooler temperatures.
- → Press Ok repeatedly to close menus. Press Done.
- ? Identify states that are particularly warm and cool. [Warm: KS, TX, FL; Cool: WA, MN]



## **Explain**

### What happens when air masses meet?

- Radiated infrared energy warms air masses over darker ground or at lower latitudes. Warm, moist air expands and rises, and a low-pressure air mass results. Air over lighter-colored ground (like snow) is generally cooler. Air molecules then pack more closely together, making dense, dry, high-pressure air.
- The differential heating of air masses and the pressure difference between them causes the winds to blow. Where two air masses of different temperatures and humidity collide, a front is formed. Weather changes occur when two air masses meet along a front. Whether a cold or warm air mass is pushing them determines the type of clouds and weather systems.
- Fronts are symbolized for the air that is coming into an area.
- → Click the Edit tool. Then, draw a blue line to indicate where cold air is advancing eastward, and draw a red line to indicate where warm air is advancing eastward. These lines indicate fronts where there are rapid changes in temperature. more



#### How are precipitation and wind speed studied?

- Air flows from high to low pressure.
- → Hover over the layer name, Weather Stations.
- → Click the ellipses. Select Copy.
- → This creates a new layer named, Weather Stations Copy.
- → On the new layer, change the style.
  - → Set Step 1: AVERASPEED
  - → Set Step 2: Counts & Amounts (Size)
  - → Click Options. Click Symbols, and switch from Shapes to Arrows.
  - → Choose any colored downward arrow, and click OK in the symbol box.
  - → While still in the Options window, scroll down to check the box by Rotate Symbols.
  - → Choose ADIRECTION (which represents the wind direction), and ensure that Geographic is chosen.
  - → Click OK, and then click Done.
- ? What direction does wind blow between highs and lows? [Winds curve outward from highs-clockwise-and then inward toward lows-counterclockwise-in the northern hemisphere.



#### How will air masses affect weather in front of them?

- ? What will the weather be like tomorrow in Boston, Massachusetts, according to the map? [Boston should be warmer and dry.]
- ? How should a person in Nebraska dress to go to work or school according to the map? [Nebraska will start out warm and windy, with cooler weather approaching. There is little chance for precipitation with this *change in temperature.*]

#### **EDIT (ADD FEATURES)**

- At the top of the map, click the Edit button.
- Click the text marker labeled H or L.
- Click the map, and type in an H or L to indicate high- and low-pressure areas.

#### **CHANGE SYMBOLS**

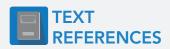
- Click the arrow to the right of the layer, and then click Change Symbols.
- Click the Use arrow to choose the type of symbol.

## **Next Steps**

DID YOU KNOW? ArcGIS Online is a mapping platform freely available to public, private, and home schools. A school subscription provides additional security, privacy, and content features. Learn more about ArcGIS Online and how to get a school subscription at http://www.esri.com/schools.

#### THEN TRY THIS...

- Log in to your ArcGIS organization account.
- To visualize high and low pressure masses, click the Weather Stations More Options button (ellipses). Choose to perform analysis, and then choose Analyze Patterns — Interpolate Points.
- To find areas of rainfall, click the Weather Stations More Options button (ellipses). Choose to perform analysis, and then choose Analyze Patterns — Find Hotspots On The Dewpoint From Temperature field. Areas closer to current dew point are more likely to rain.



This GIS map has been cross-referenced to material in the weather sections of chapters from middle-school texts.

- Earth Science by Glencoe McGraw Hill Chapter 16
- Earth Science by Holt Chapter 16

- Earth Science by McDougal Littell Chapter 3
- Earth Science by Prentice Hall Chapter 17



