Tropical storms

from the Esri GeoInquiries™ collection for Earth Science

Target audience – Earth Science learners **Time required – 15 minutes**

Activity	Use hurricane track information to understand factors that encourage the formation of hurricanes.
Science Standards	**NGSS:MS-ESS2-5** – Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.
Learning Outcomes	• Students will use the tracks of hurricanes in 2005 to compare wind speed to the air pressure within the hurricane and sea surface temperature. • Students will determine the impact of air pressure and sea surface temperature on hurricane strength.

Map URL: http://esriurl.com/earthgeoinquiry14

Engage

Where and how do tropical storms form?

→ Click the link above to launch the map.
→ With the Details button underlined, click the button, Show Contents of Map (Content).
→ Check the box next to layer name, Hurricanes Wind Strength.
→ Click any point on the paths of these hurricane.
? What information is stored for each point along the way? *[Information about air pressure, wind speed, and ocean temperature is stored.]*
– All hurricanes start as tropical depressions (TD).
→ See the Filter Tooltip on page 2 to filter Hurricane Wind Strength. Set Category - Is - TD.
→ Where do most Atlantic storms reach TD status? *[Most become TD east of the Caribbean.]*

Explore

How does air pressure relate to wind speed in hurricanes?

– The 2005 Atlantic storms caused $160 billion in damage and 3,913 deaths. Winds cause property damage by blowing off roofs or collapsing buildings, but they also push the surface of the water into a storm swell. Homes and small buildings do not stand a chance against storm-driven ocean swells. Winds are generated by greater differences in air pressure and the geographic size of the low pressure.
→ Hover on the layer name, Hurricane Wind Strength. Click the button, Show Table.
→ In the Hurricane Wind Strength table, click the WIND_KTS (wind speed in knots) column header.
→ Click Sort Ascending.
? As you scroll down the table, how does the pressure column change relative to wind speed? *[They are inversely proportional to each other.]*

Explain

What determines the path a storm takes?

? Are there areas where lower pressures do not have as strong of winds? *[Winds are generally much smaller over land.]*
? Why do wind speeds slow down over land? *[Rougher land surfaces provide friction, slowing winds down. Also, the heat of evaporated water condensing into clouds is cut off over land.]*
→ Close the Hurricane Wind Strength table.

more ▶

Elaborate

Where do tropical storms get such strength?

- Click the button, Bookmark. Select Strengthening zone.
- Turn on the layer, Sea Temperature 05 (degs C).
- Click the layer name, Sea Temperature 05 (degs C). Click AvSeaTemp05 to expand the legend.
- ? At what temperature do storms consistently pick up energy? (You can also click the dots to verify temperatures.) *[Hurricanes may be sustained at lower temperatures, but most storms really grow above 28°C.]*

Evaluate

What other areas of the world have good conditions for tropical storms?

- Use the Filter Tooltip to identify one of the named storms.
- Click each dot. On a whiteboard, create a table of wind speeds and pressure.
- Create a graph of wind speed vs. pressure. *[Wind speed should be on the x axis. The pressure should be on the y axis—the resulting graph will go down to the right.]*
- ? What type of relationship do these two variables have? *[This is an inverse relationship.]*
- Click the Home button to zoom out to the entire world.
- ? List two other areas in the world that would be possible targets for tropical storms. *[China, Philippines, Indonesia, and Australia are all possible targets.]*

FILTER

- Hover on the layer name
- Cick the button, Filter.
- Build the expression **field** - Is - **value/unique**.
- If value, enter TD.
- If unique, scroll down to choose a hurricane name.
- Click Apply Filter, and then click Zoom To.

BOOKMARK

- At the top of the map, click the Bookmarks button.
- Choose your bookmark; the map will take you there.

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...

•Add a U.S. states layer, perform analysis, and aggregate hurricane wind strength by states.
•Symbolize the new layer based on how many hurricanes have crossed the state borders.

TEXT REFERENCES

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 3D*
- *Earth Science by Prentice Hall – Chapter 17*

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