Developed by: David Burch

Activity Focus: Students view background data about mid-latitude storms (blizzards and tornadoes). Then they analyze historical data concerning the frequency and intensity of these events. Using this background and historical data, the students then look at the IPCC projections for the 21st century.

Major Concepts:
• Tornadoes and blizzards are the most violent and deadly mid-latitude storms
• Current studies on global climate change indicate possible changes in intensity and frequency of mid-latitude storms

Objectives: After completing this activity, students will be able to:
• Describe tornadoes and blizzards
• Locate mid-latitudes on the earth
• Interpret the Fujita Scale
• Project possible mid-latitude storm scenarios for the 21st century

Materials and Preparation: You will need to prepare the following materials before conducting this activity.

• Copy the Mid-Latitude Cyclones and Climate Change activity (make 1 copy per student).
• Make a transparency or PowerPoint slide for each data set (appendix) for use in the class discussion. You may want to make a color copy of the data set for groups of students.

Procedures: Students may work individually or in small groups (2-4 students) to complete this activity.

1. Introduce the activity by projecting pictures of tornadoes and blizzards (the ones included in the appendix, or others). Ask the class if anyone can relate a personal story about either blizzards or tornadoes. Discuss the danger and damage resulting from each storm.

2. Organize students into small groups of 2-4 or have students work independently on completing the rest of the activity. If students are working in small groups, have them read and discuss each question as a group before recording a consensus response.

3. Discuss the activity as a class, asking students to share their responses to the questions.
4. Have students reflect on their ideas as they re-answer the Engage questions, write their responses to the “What I now know and think” questions, and reflect on their own thinking with the “How my ideas and thinking have changed” question.


Assessments: The following assessments may be used as a pre/post activity assessment or as part of a module assessment.

1. Identify the two main mid-latitude storms; what area of earth is considered mid-latitude?

2. Describe the Fujita Scale of Tornado Intensity.

3. Data indicate an increase in the number of tornadoes, but a decrease in deaths and injuries from these storms. Offer an explanation for this apparent contradiction.

4. What is the IPCC?

5. Based on IPCC projections, which is more likely to increase: frequency or intensity of mid-latitude storms?

Quiz: The following quiz may be used as a post activity assessment.

1. Mid-latitude is _________
   A. 90° N or S    B. between 0° and 30° N or S
   B. between 30° and 60° N or S    D. between 60° and 90° N or S

2. The lowest air pressure ever recorded in a non-tropical storm in the US was during a ______
   A. blizzard    B. hurricane    C. thunderstorm    D. tornado

3. The Fujita Scale measures the intensity of a _____
   A. blizzard    B. hurricane    C. thunderstorm    D. tornado

4. Since the 1950’s, the number of reported tornadoes has ___
   A. decreased    B. increased    C. stayed the same

5. What is the IPCC?
Bibliography

The Science of Global Climate Change
http://www.geocities.com/csango80/gwweb02.htm

Effects of future climate change on regional air pollution episodes in the United States

Frequency of winter storms in Canada
http://www.colorado.edu/geography/blanken/GEOG%206181%20Fall%202003/noble/pages/Clim_change.html

Effects of future climate change on regional air pollution episodes in the United States

Air Quality Degradation due to Greenhouse Warming Decreasing the Frequency of Mid-latitude Cyclones, Eric M. Leibensperger
http://www-as.harvard.edu/chemistry/trop/presentations/powerpoints/eml2007/epa_leibensperger_feb07.ppt

Climate Impacts in New York City: Sea Level Rise and Coastal Floods

Future Weather
http://www.globalchange.umich.edu/globalchange1/current/lectures/samson/weather_patterns/index.html

Tornado Characteristics
http://www.ux1.eiu.edu/~cfrlw/T2k/Unit4/torend.html

The Tornado Project
http://www.tornadoproject.com/toptens/toptens.htm#top

Trends in Blizzards at Selected Locations in the Canadian Prairies
http://www.ingentaconnect.com/content/klu/nhaz/2003/00000029/00000002/05095393?crawler=true

The Effect of Climate Change on Tornado Frequency and Magnitude
http://jrscience.wcp.muohio.edu/studentresearch/climatechange02/tornado/website/tornado.html

Storm Events Database
http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms
Internet Weblinks for storms
http://www.physicalgeography.net/weblinks_ch7.html

Storms and Climate Change

Global Warming Awareness

Likelihood of Increased Mid-Latitude Storms
http://grida.no/climate/ipcc_tar/wg2/036.htm

Mid latitude cyclones and weather extremes
www.uib.no/People/gbsag/stormtracks.html
Appendix:

Top 10 Killer Tornadoes in the US (Source: The Tornado Project)

<table>
<thead>
<tr>
<th>Rank</th>
<th>State(s)</th>
<th>Date</th>
<th>Time</th>
<th>Dead</th>
<th>Injured</th>
<th>F-Scale</th>
<th>Town(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MO-IL-IN</td>
<td>March 18, 1925</td>
<td>1:01PM</td>
<td>695</td>
<td>2027</td>
<td>F5</td>
<td>Murphysboro, Gorham, DeSoto</td>
</tr>
<tr>
<td>2</td>
<td>LA-MS</td>
<td>May 7, 1840</td>
<td>1:45PM</td>
<td>317</td>
<td>109</td>
<td>F?</td>
<td>Natchez</td>
</tr>
<tr>
<td>3</td>
<td>MO-IL</td>
<td>May 27, 1896</td>
<td>6:30PM</td>
<td>255</td>
<td>1000</td>
<td>F4</td>
<td>St. Louis, East St. Louis</td>
</tr>
<tr>
<td>4</td>
<td>MS</td>
<td>April 5, 1936</td>
<td>8:55PM</td>
<td>216</td>
<td>700</td>
<td>F5</td>
<td>Tupelo</td>
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<tr>
<td>5</td>
<td>GA</td>
<td>April 6, 1936</td>
<td>8:27AM</td>
<td>203</td>
<td>1600</td>
<td>F4</td>
<td>Gainesville</td>
</tr>
<tr>
<td>6</td>
<td>TX-OK-KS</td>
<td>April 9, 1947</td>
<td>6:05PM</td>
<td>181</td>
<td>970</td>
<td>F5</td>
<td>Glazier, Higgins, Woodward</td>
</tr>
<tr>
<td>7</td>
<td>LA-MS</td>
<td>April 24, 1908</td>
<td>11:45AM</td>
<td>143</td>
<td>770</td>
<td>F4</td>
<td>Amite, Pine, Purvis</td>
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<tr>
<td>8</td>
<td>WI</td>
<td>June 12, 1899</td>
<td>5:40PM</td>
<td>117</td>
<td>200</td>
<td>F5</td>
<td>New Richmond</td>
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<tr>
<td>9</td>
<td>MI</td>
<td>June 8, 1953</td>
<td>8:30PM</td>
<td>115</td>
<td>844</td>
<td>F5</td>
<td>Flint</td>
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<tr>
<td>10</td>
<td>TX</td>
<td>May 11, 1953</td>
<td>4:10PM</td>
<td>114</td>
<td>597</td>
<td>F5</td>
<td>Waco</td>
</tr>
</tbody>
</table>
Frequency of intense winter storms in the northern hemisphere

Source: Environment Canada. The *Surface Climates of Canada, 1997*

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**United States Tornadoes**

1916-1999

Source: Nebraska Tornado Site
**Number of Tornadoes**

Source: NOAA

**Tornadoes per Year by Intensity**

- All Tornadoes
- Weak Tornadoes F0-F1
- Strong Tornadoes F2-F3
- Violent Tornadoes F4-F5

**Tornadoes by Year (U.S.)**

Source: NOAA
### The Fujita Scale (Source: The Tornado Project)

<table>
<thead>
<tr>
<th>Fujita-Scale Number</th>
<th>Intensity Phrase</th>
<th>Wind Speed</th>
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<tbody>
<tr>
<td>F0</td>
<td>Gale tornado</td>
<td>40-72 mph</td>
</tr>
<tr>
<td>F1</td>
<td>Moderate tornado</td>
<td>73-112 mph</td>
</tr>
<tr>
<td>F2</td>
<td>Significant tornado</td>
<td>113-157 mph</td>
</tr>
<tr>
<td>F3</td>
<td>Severe tornado</td>
<td>158-206 mph</td>
</tr>
<tr>
<td>F4</td>
<td>Devastating tornado</td>
<td>207-260 mph</td>
</tr>
<tr>
<td>F5</td>
<td>Incredible tornado</td>
<td>261-318 mph</td>
</tr>
<tr>
<td>F6</td>
<td>Inconceivable tornado</td>
<td>319-379 mph</td>
</tr>
</tbody>
</table>

www.theinsurancepolicy.com/consumers/tornadoes/
http://www.waco-texas.com/city_depts/fire/emtips

www.livejournal.com/.../wichitalife/51336.html
larc.hamgate.net/blizzard_of_1977.htm