Students review graphs and charts of severe weather data then answer True and False questions about the content they convey.

Materials
• One set of graphs paired with True-False statements per group

Directions
1. Spend class time discussing ways in which information is often presented (books, speeches, reports, graphs, tables, billboards, websites, apps...). Discuss which communication methods are most often chosen for information of a more technical, quantitative, or scientific nature.
2. Draw, project, or print simplistic samples of graphs, pie charts, tables, maps, and models. Review the basics of each tool, and why they are frequently used in science and mathematics to convey statistical, quantitative and other technical information.
3. Discuss recent severe weather events with students, allowing them to share information that they have heard about or experienced first hand.
4. Review and discuss the nature of science with students and how it differs from other ways of knowing. Review Ch. 1 of Science for All Americans if you would like to review the Nature of Science before any class discussion.
5. Tell students that they will be tasked with analyzing graphs and diagrams that convey information about severe weather events. Students’ understanding will be assessed based on their answers to the true/false questions that are paired with each graph.
6. Project each graph or diagram at the front of the class for discussion and review once students have completed all true/false statements. Students should discuss what is being conveyed in each graph and any questions that they might have about it.
7. Ask them to consider if the visual representation is more effective and efficient than words alone? Why or why not? Which graph, if any, warrants further clarification? Ask questions that require students to extend what the graphs convey and make future predictions based on some of the trends shown.
8. As an extension activity, have students write a statement for one of the graphs of their own development that their classmates have to judge to be either true or false.

NOTE: All true statements are in the column at left, while false statements are in the column at right.

Background
The visual representation of scientific data often conveys important information in a manner that is more efficient and clear than words alone, but it can also potentially mislead those less experienced or thoughtful about interpreting statistical data, graphs, charts, and tables.

Learn More Online!
Spark, UCAR Science Education, http://spark.ucar.edu
NCAR: Weather on steriods, https://www2.ucar.edu/atmosnews/attribution/events-spectrum
National Climate Data Center (NCDL) tornado climatology, http://www.ncdc.noaa.gov/oa/climate/severeweather/tornadoes.html
DEFINITIONS OF TOOLS

These definitions provide a general overview and only a small sample of the most common visual statistical tools. Learn more at Statistics Canada at http://www.statcan.ca/english/edu/power/glossary/dictionaries/dictionaries.htm

Bar Graph: A bar graph is a visual display used to compare two or more variables in terms of amount, frequency, or magnitude. A bar graph has two axes plus the necessary number of bars. One axis represents the range of frequency, amount, or magnitude, while the other axis corresponds to the type of data being compared, often called the grouped data. The bars can have their base at either the vertical axis or horizontal axis. Labels are necessary for each to describe what information is provided.

Constant: In mathematics, the term constant is a fixed but possibly unspecified value.

Graph: A visual representation of a relationship between two variables, x and y. Graphs have two axes, one horizontal called x, and one vertical called y. Each axis should be adequately labeled. The term origin refers to where the two axes intersect, often identified as the point (0, 0). Each point on a graph is defined by a pair of numbers, referred to as coordinates. The first coordinate in the pair corresponds to the x axis, and the second corresponds to the y axis. Line graphs, area graphs, and scatterplots are all types of graphs widely used in science and other fields.

Map: A visual representation of an area with any of a variety of objects displayed upon it to convey information to its reader.

Model: A representation of a concept, system, or object. Models can be simple or exceedingly complex, depending on what they seek to represent and the detail sought. A climate model is a program, usually run on a supercomputer, that uses quantitative methods to simulate the interactions of the atmosphere, ocean, land surface, and ice. They are used for a variety of purposes including projections of future climate.

Pie Chart: A pie chart is a circular chart, divided into pie-shaped wedges, each of which represents relative size, magnitude, frequency or percent of a given variable in proportion to the whole. It is called a “Pie Chart” because it does in fact resemble a pie cut into slices.

Table: A mode of visual communication and a way to arrange data via a matrix or database. Tables vary significantly and are widely used in both professional and everyday life.

Variable: An unknown quantity that has the potential to change. Variables are often contrasted with constants, which are fixed and unchanging. Height, age, school grades, and amount of income are all examples of variables.
The graph shows significant increases in the number of tornadoes from March to May since the 1950s.

The data from the 1950s is likely more inaccurate than the data from the 2000s.

2011 was an extremely prolific spring in terms of the number of tornadoes produced.

The graph shows that approximately 790 tornadoes occurred in 2008.

If the average annual number of tornadoes in the US in recent decades is 1253, then all of these years are under the average.

On average, someone alive in the 1950s would be less likely to experience a tornado in the spring than someone alive in the 1970s.
The graph shows that the most prolific state for producing tornadoes since 1991 has been Texas.

It is highly unlikely that Wyoming will have more than 12 tornadoes in any given year.

If the data represented 1950 - 2010 averages, state averages would mostly decline.

Alaska never has any tornadoes.

The state's further north and/or west in the US on average have less tornadoes.

On average, southern states (LA, MS, GA, AR, FL, AL, TN) are hardest hit by the shear number of tornadoes there each year.
The graph shows that on many days there are a multiple number of tornadoes that form.

The number of tornadoes thus far reported for 2012 exceeds the 2011 average for the same time period.

The graph clearly shows that there was a day in February 2011 that produced over 120 tornadoes.

June 2011 produced more tornadoes than all the other months combined.

No tornadoes occurred after June in the US in 2011.
Tornado averages by a given area (10,000 sq. miles) makes it easier to determine areas within a state consistently above the state average.

Although CO has on average 53 tornadoes and TN has 21 on average each year, when looked at by no. of tornadoes per 10,000 square miles, they have approximately the same number.

The top two states that experienced the most tornadoes by area between 1991 - 2010 are Florida and Kansas.

The state that had the most tornadoes between 1991 and 2010 was Florida.

Rounding up to the nearest tenth, 4 tornadoes occur per 10,000 square miles in the US on average each year.

Florida had the most tornado devastation between 1991 and 2010.
It's very likely that injuries and fatalities reported on the list would be lower if these tornadoes occurred in recent years.

According to the table, the only deadly tornado since 2000 occurred in 2011 in Joplin, MO.

It's possible that the US tornado that injured the most people in the past century is not on the list.

The “EF5” in the Estimated Intensity column for #7 is an obvious typo.

The tornado that caused the most fatalities also caused the most injuries.

All of the tornadoes on the list occurred within Tornado Alley.
Directions: Place a T for True or an F for False in the box to the left of the statement to be judged.

- The precipitation information conveyed in the image would be considered climate data. [T/F]

- According to the rankings, nearly a third of the country was at above normal conditions for precipitation in March 2012. [T/F]

- Drier-than-average conditions prevailed in the interior West and Northeast in March 2012. [T/F]

- The precipitation information shows that the majority of states received near normal precipitation for March 2012. [T/F]

- The numbers on each state refer to the number of inches of water they received. [T/F]

- The amount of precipitation in states of the same color is approximately the same. [T/F]