

## Teacher Guide Weather and Climate

**Developed by:** David Burch

**Activity Focus:** Students collect and interpret weather data, then they analyze temperature and precipitation data for possible indications of climate change.

**Major Concepts:** Climate consists of a collective average of weather conditions over time; changes in temperature and precipitation over time may indicate climate change. However, local variation may differ from the collective average data. This activity on Weather and Climate will discuss the differences between local weather variations and regional climate patterns.

**Objectives:** After completing this activity, students will be able to:

- Identify weather factors and the instruments used to measure them
- Explain the role of temperature and precipitation in determining climate
- transform data into a graph(s)

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

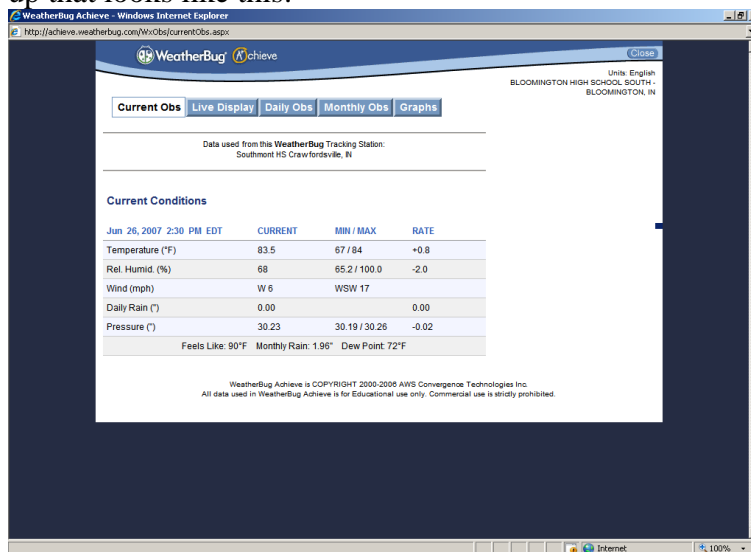
- Copy the *Weather and Climate* activity (make 1 copy per student).
- Provide each student/group with graph paper for making a temperature or precipitation graph from their collected weather data. You may want to provide each group with a transparency of grid paper where they can record their data transformations.
- 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 students working as groups.
- Students will need internet access to gather data from [www.aws.com](http://www.aws.com) or [www.weather.com](http://www.weather.com).
- Students will need computer access if you decide to use Microsoft Excel to graph data.

**Procedures:** Students may work individually or in small groups (2-4) to do the activities.

1. Introduce the activity by asking the students about their perceived accuracy of daily TV weather forecasts.

2. For the *Extend* portion of the activity, either do the TV weather forecasts as a pre-activity for the month before, or access the data online. Here are the basic instructions for accessing this data:

- Log on to [www.aws.com](http://www.aws.com)
- Scroll down to the 'WeatherBug' section; click on 'Educators'
- Click on 'Teachers'
- On the menu line at the top of the page, click 'Login'
- Click on 'Enter the Classroom'
- Enter your local zip code, then click 'Submit'. If a station exists for your zip code, it will show up. If this does not bring up a station and you know of a station in your area, try that zip code. If all else fails, try this zip code-- 47401, then click 'Submit'
- Use the drop-down menu for 'Select your School Name'; click on the school to highlight it, then click on 'Submit'.
- Use the drop-down menu for grade; click on a grade, then click 'Submit'.
- Under the 'TOOLS' menu, click on 'Change Tracking Station'; Use the drop-down menus to choose the closest state and city; click on any station that comes up under the pull down.
- Under the 'TOOLS' menu, click on 'Weather Observations'; if a new data page does not come up, try another city until you get a page that will come up that looks like this:



- Click on the tab labeled 'Monthly Obs';
- Select a previous month; you should get a page like the one on the student worksheet. This page can be highlighted, copied, and pasted into Microsoft Excel. The data could also be graphed by hand.

Here are some basic instructions for graphing weather data in Microsoft Excel:

- Starting in the lower right of the weather data on the AWS website, click and drag to the upper right to highlight the data. (It works best if you stop at the first data box and do not highlight the labels).

- Open Excel
  - Go back to the website and Right-click on the highlighted data; copy the data
  - Box A1 should be lighted in Excel; click into that box and paste the data
  - To graph high and low temperature, click and drag from Box A1 to C30 or C31 (depending on the length of the month)
  - At the top of the screen, click on the graph icon
  - Select line graph; fill in axis labels, etc., to finish graph. The Excel 2007 is somewhat different as far as graphing, so take the time for trial and error to make it work
3. For the *Apply* section, have students work individually or in small groups to discuss the visuals and answer the questions.
  4. Discuss the activity as a class, asking students to share their responses to the questions. Have several groups share their data transformations and to explain how and why they re-visualized the data. Use the data set to focus the discussion.
  5. Have students complete the *Reflect* section by re-answering the engage questions and by completing the “how my ideas and thinking have changed” question. This could be done individually or as a group.
  6. Collect student/group responses. Administer assessment item.

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

1. Identify 5 weather variables and the instruments that measure them.
2. What is the difference between weather and climate?
3. Name 3 sources of accurate weather data.
4. What basic trend is indicated from maps and graphs of temperature and precipitation in the US over the last century?

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

Match the weather instrument with the factor it measures:

- |                 |                  |
|-----------------|------------------|
| 1. Anemometer   | A. Pressure      |
| 2. Barometer    | B. Temperature   |
| 3. Psychrometer | C. Precipitation |
| 4. Rain Gauge   | D. Wind Speed    |
| 5. Thermometer  | E. Humidity      |
6. The average of collective weather conditions over time is called \_\_\_\_\_.
7. The two main factors which determine climate are \_\_\_\_\_ and \_\_\_\_\_.
8. Based on current data, we can expect temperatures to \_\_\_\_\_ in the future, and can expect precipitation to \_\_\_\_\_ in the future.

## **Bibliography**

Reproduction of the Climate Change in the 20th Century by a Numerical Climate Model-  
Attribution of Causes of the Global Mean Surface Air Temperature Change: Temperature  
Rise in Late 20th Century Attributed to Human Activities-

Center for Climate System Research, University of Tokyo, Akimasa Sumi, Masahide  
Kimoto, Toru Nozawa, Seita Emori

<http://www.jamstec.go.jp/frcgc/eng/press/041105/index.html>

Automated Weather Source (WeatherBug)

<http://achieve.weatherbug.com/>

Rain gauge

<http://www.kkpaddywhacks.com/carib/estore/contents/media/Rain%20Guage.jpg>

Thermometer

[www.weatherequipment.com/taylor\\_thermometers.htm](http://www.weatherequipment.com/taylor_thermometers.htm)

Hygrometer

[www.techinstrument.com/cgi-bin/ss001000.pl?PR...](http://www.techinstrument.com/cgi-bin/ss001000.pl?PR...)

Psychrometer

[www.terratech.net/product.asp?specific=jscnerg0](http://www.terratech.net/product.asp?specific=jscnerg0)

Anemometer

[http://www.smg.gov.mo/dm/equip/e\\_ws.htm](http://www.smg.gov.mo/dm/equip/e_ws.htm)

Global Climate Change 1880-2000

<http://yosemite.epa.gov/OAR/globalwarming.nsf/content/Climate.html>

Predictions for 21<sup>st</sup> century climate change

[http://www.grida.no/climate/ipcc\\_tar/wg1/368.htm](http://www.grida.no/climate/ipcc_tar/wg1/368.htm)

Temperature and Precipitation trend 1976-2006

<http://www.cpc.ncep.noaa.gov/anltrend.gif>

US Precipitation and Temperature, 1895-2006

<http://climvis.ncdc.noaa.gov/>

INDICES OF CLIMATE CHANGE FOR THE UNITED STATES

Thomas R. Karl, Richard W. Knight, David R. Easterling, and Robert G. Quayle

<http://lwf.ncdc.noaa.gov/oa/climate/gcps/papers/icc.html>

Climate Change, Regional Impacts and Adaptation, Joel D. Scheraga

[http://scheraga.com/pub\\_address.pdf](http://scheraga.com/pub_address.pdf)

**Appendix:**

**Daily Weather Readings**

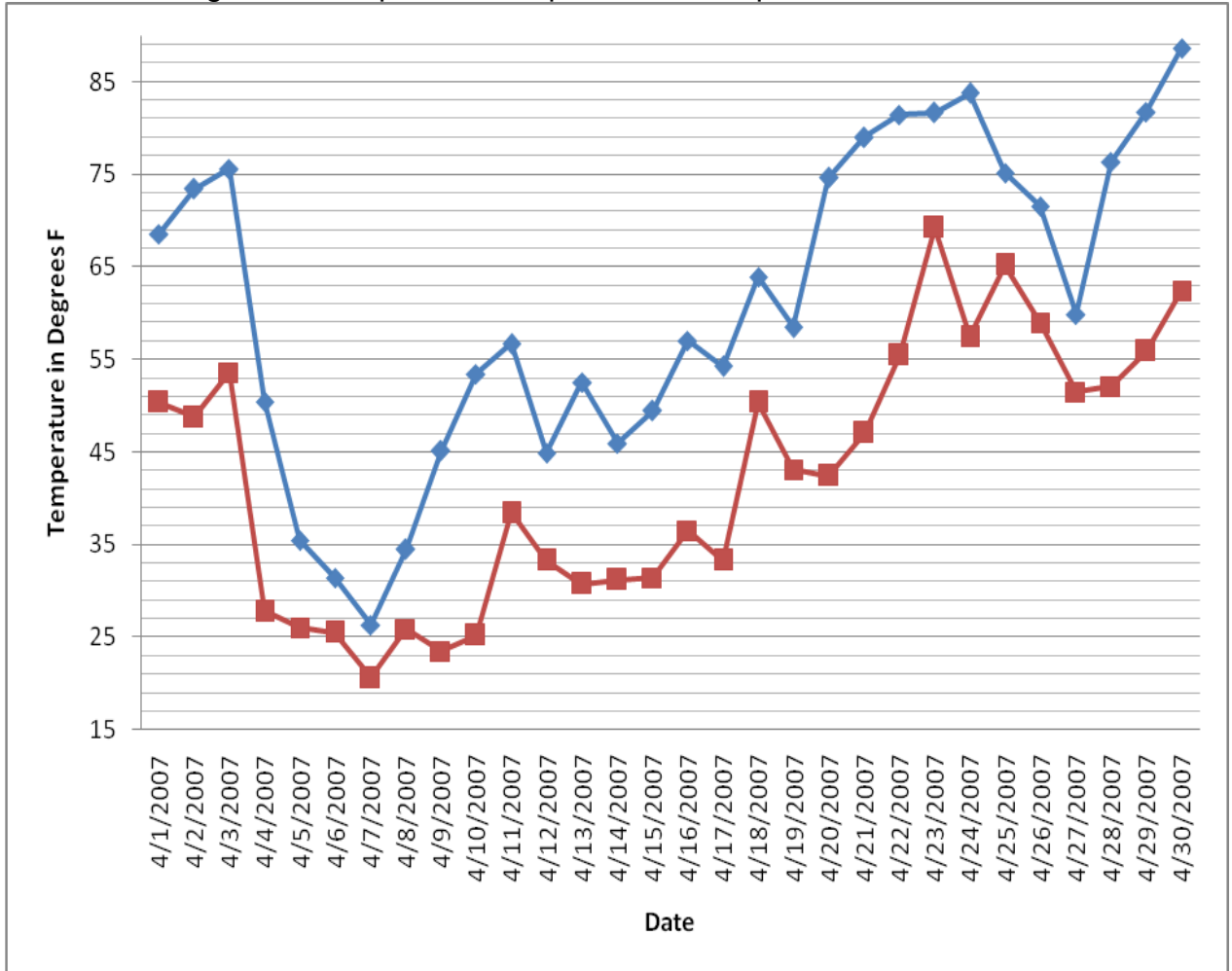
Month: \_\_\_\_\_

DATE	TIME	PRESENT TEMP	HIGH TEMP	LOW TEMP	BAROMETRIC PRESSURE	RELATIVE HUMIDITY	DAILY PRECIP	WIND SPEED	WIND DIRECTION
1									
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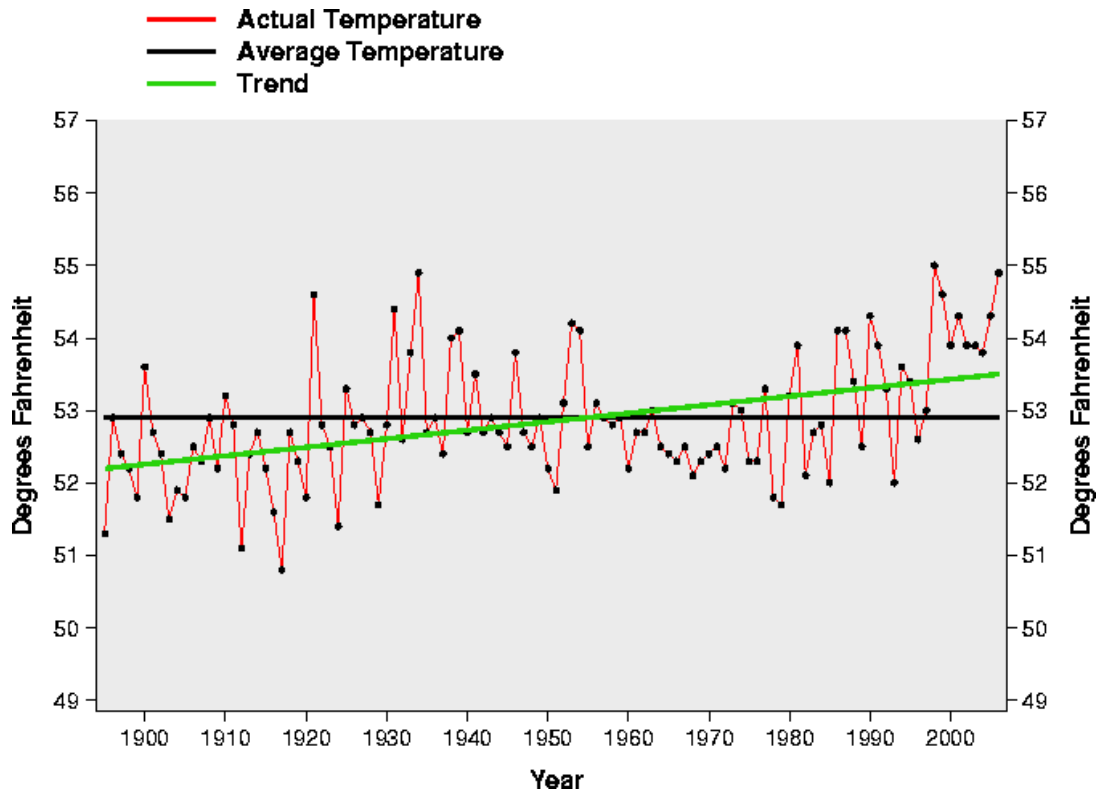
## Weather Data for Zip Code 47401, April 2007(Source: AWS)

April, 2007									
Observation Date	Max Temp °F	Min Temp °F	Rain / Month in	Rain / Year in	Wind Gust mph	Min Pressure "Hg	Max Pressure "Hg	Min Humid %	Max Humid %
04/01/2007	68.55	50.32	0.40	8.01	37.93	29.79	29.90	35.83	100.00
04/02/2007	73.44	48.74	0.40	8.01	19.95	29.92	30.06	22.76	86.22
04/03/2007	75.62	53.57	1.39	9.00	36.83	29.77	30.01	39.80	100.00
04/04/2007	50.44	27.76	1.39	9.00	33.32	29.84	30.17	68.85	98.93
04/05/2007	35.46	26.01	1.39	9.00	26.31	30.10	30.19	54.56	86.96
04/06/2007	31.36	25.45	1.39	9.00	31.13	29.97	30.09	39.64	78.02
04/07/2007	26.30	20.56	1.39	9.00	29.38	29.97	30.05	49.41	65.62
04/08/2007	34.49	25.85	1.39	9.00	17.76	30.04	30.10	56.37	72.06
04/09/2007	45.13	23.43	1.39	9.00	19.95	30.02	30.12	35.94	99.70
04/10/2007	53.40	25.17	1.39	9.00	19.29	29.83	30.09	26.41	92.12
04/11/2007	56.68	38.39	2.16	9.77	52.61	29.30	29.83	42.63	100.00
04/12/2007	44.85	33.22	2.20	9.81	36.83	29.52	30.12	72.29	95.87
04/13/2007	52.49	30.74	2.20	9.81	18.85	30.09	30.28	31.69	85.14
04/14/2007	45.93	31.19	2.63	10.24	28.50	29.65	30.12	49.75	100.00
04/15/2007	49.46	31.36	2.63	10.24	36.83	29.73	29.90	36.65	94.73
04/16/2007	57.00	36.47	2.63	10.24	25.21	29.93	30.10	27.42	60.04
04/17/2007	54.26	33.26	2.63	10.24	7.89	29.99	30.03	39.94	89.82
04/18/2007	63.89	50.33	2.63	10.24	22.14	29.74	29.89	45.49	72.57
04/19/2007	58.48	43.08	2.63	10.24	18.41	29.87	30.06	56.74	89.51
04/20/2007	74.63	42.39	2.63	10.24	18.85	30.11	30.25	26.43	98.48
04/21/2007	79.01	47.08	2.63	10.24	17.76	30.12	30.27	23.02	85.03
04/22/2007	81.45	55.40	2.63	10.24	29.38	30.00	30.17	25.21	66.11
04/23/2007	81.67	69.19	2.65	10.26	33.76	29.96	30.03	39.29	83.58
04/24/2007	83.76	57.43	2.96	10.57	34.64	29.92	30.08	27.47	97.59
04/25/2007	75.13	65.17	3.39	11.00	27.18	29.75	29.96	60.59	100.00
04/26/2007	71.55	58.99	3.82	11.43	42.31	29.63	29.84	62.62	100.00
04/27/2007	59.89	51.45	3.82	11.43	21.92	29.74	29.96	69.28	100.00
04/28/2007	76.33	52.09	3.82	11.43	30.03	29.92	30.01	34.33	90.02
04/29/2007	81.77	55.85	3.82	11.43	21.48	30.02	30.12	27.82	73.68
04/30/2007	88.65	62.43	3.82	11.43	24.11	29.92	30.04	28.41	66.64

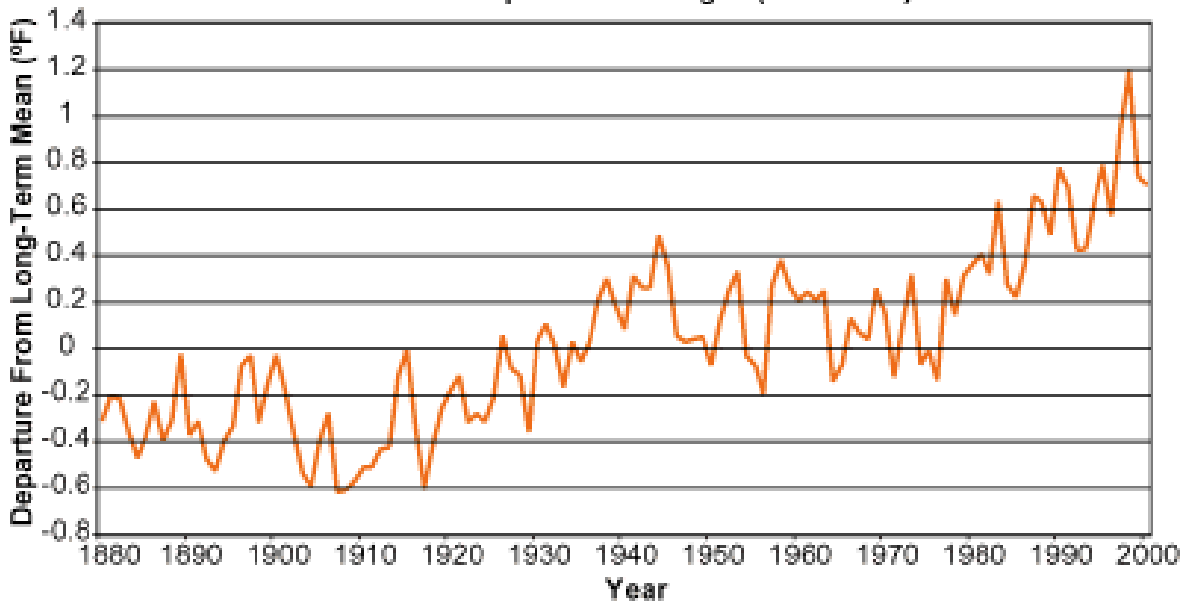
High-Low Temperatures, April, 2007 for Zip Code 47401



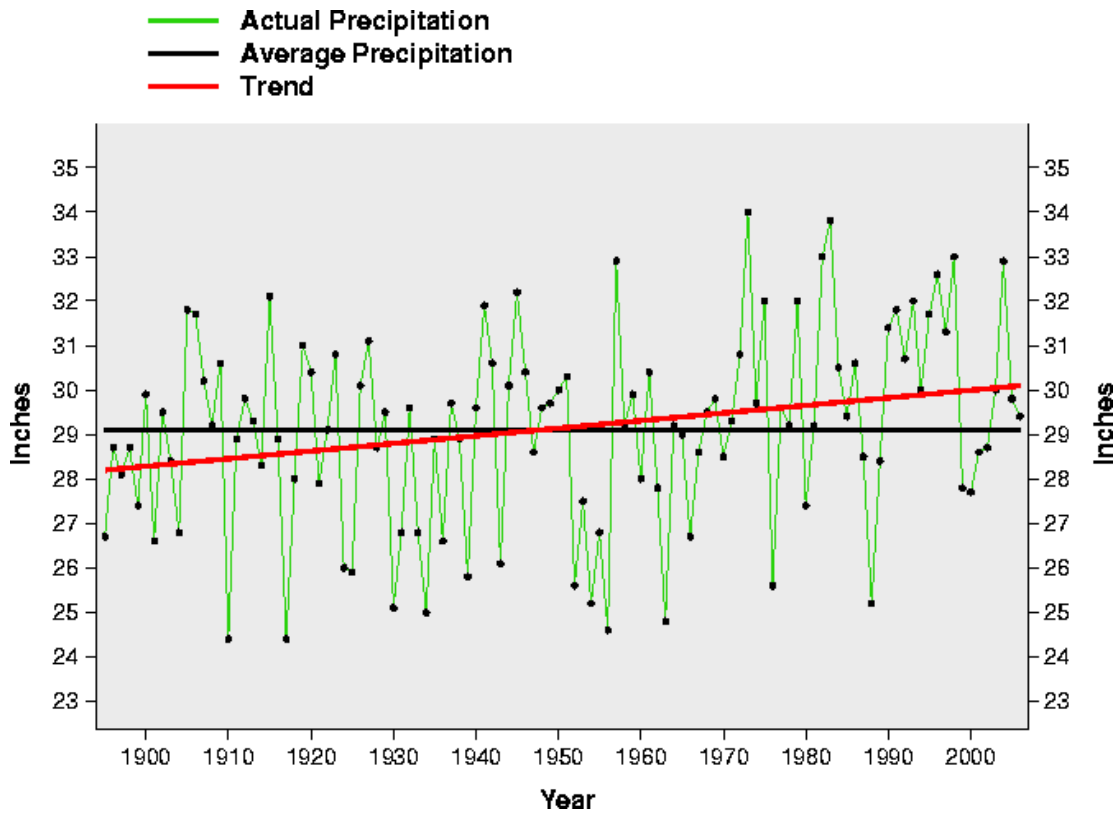




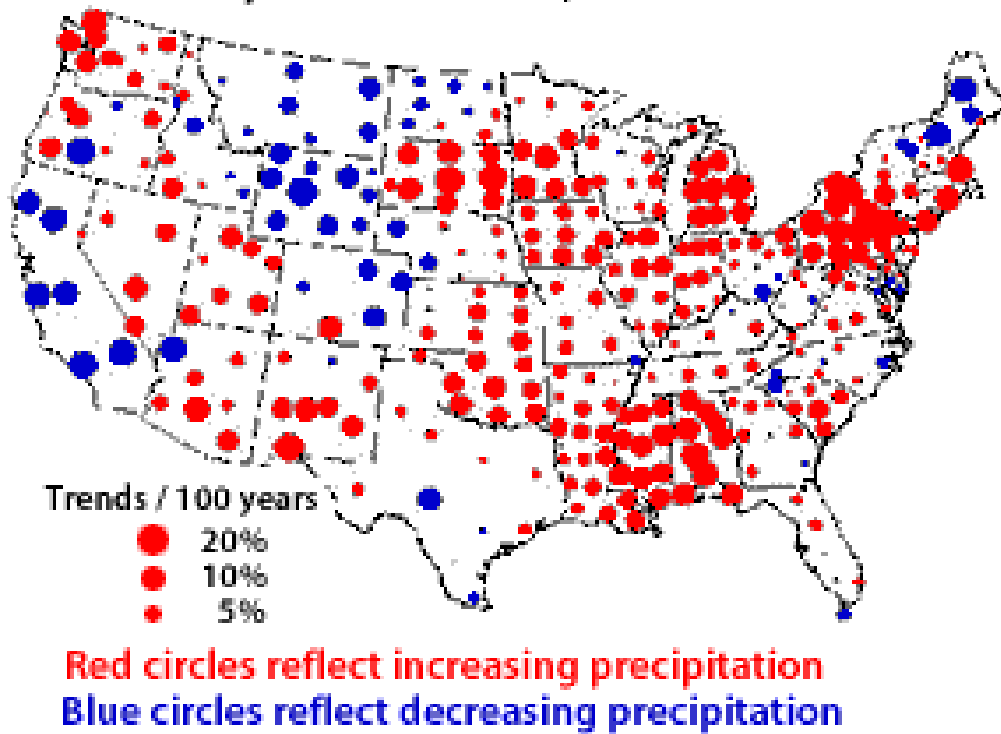
Global Temperature Changes (1880-2000)

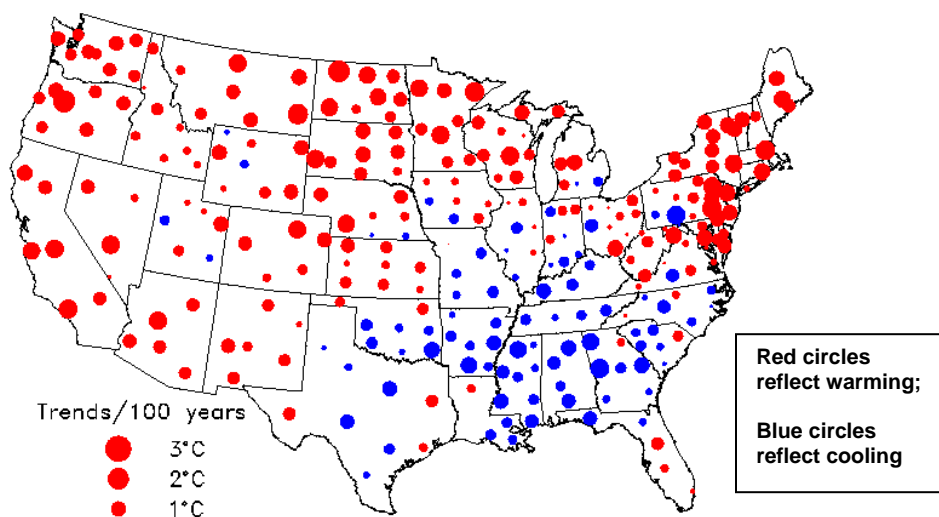


Source: U.S. National Climatic Data Center, 2001



### Precipitation Trends, 1900 to Present





Hansen, J., R. Ruedy, M. Sato and K. Lo (2006) GISS Surface Temperature Analysis, Global Temperature Trends: 2005 Summation, NASA's Goddard Institute for Space Studies, available at: <http://data.giss.nasa.gov/gistemp/2005/>

