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Oklahoma Climatologcial Survey

In the Oklahoma Climate Fall 2003 summary, the standard station model plot was described. This issue will use a modified station model plot consisting of air temperature in red, relative humidity in green, and Heat Index in blue. The maps also contain a color contour of each variable to help identify patterns easier. Map 1 contains the modified station plot and a color contour of air temperature. A red contour line of 95°F temperature is used to highlight the area of highest air temperatures. Map 2 contains the modified station plot and a color contour of relative humidity. The blue line contour represents relative humidities of 20%. The red line contour represents relative humidities of 55%. Map 3 contains the modified station plot and a color contour of Heat Index. A line contour of the 100°F Heat Index is used to highlight the area of highest Heat Index values. Brief descriptions of relative humidity and Heat Index follow.

Relative Humidity

Relative humidity is the ratio of the amount of water vapor actually in the air compared to the maximum amount that can be mixed in air at that particular temperature. Hence, when the temperature changes, so does the relative humidity, even without changing the amount of water vapor in the air.

Relative humidity is expressed as a percentage. If the relative humidity were 0% (unrealistic near Earth's surface), there would be no water vapor in the air. When the relative humidity is 100%, the air is saturated and the air temperature and dewpoint temperature are equal.

Relative humidity is a good indicator of the potential for evaporation to occur. When the relative humidity is high, little evaporation occurs. When the relative humidity is low, evaporation likely will occur, especially with moderate to strong winds and warm temperatures.

Evaporation

Evaporation is the process by which a liquid is transformed into a gas. Conversely, condensation is the physical process by which a gas becomes a liquid. Energy is exchanged during both of these processes.

When liquid water evaporates, energy is required to separate the molecular bonds which hold the water molecules close together in liquid form. This energy is removed from the nearby environment, whether that be the air or an object onto which the liquid water is attached. For example, when you step out of the shower into a drier environment, your skin suddenly feels cooler. This physical sensation is a result of the evaporation of the water on your skin into the air. Heat is taken from your body to change the water from liquid to gas. Hence, evaporation is a cooling process.

Heat Index (HI)

Heat Index is a calculated value used to represent how the body reacts to the combination of relative humidity and high temperature. When the human body gets too warm, it forms perspiration on the skin. As the perspiration evaporates, the skin feels cooler. In a high relative humidity atmosphere, the rate of evaporation slows and the perspiration falls off the skin. The body continues to produce perspiration without the benefit of evaporational cooling. This scenario leads to heat exhaustion and heat stroke as described in the Heat Index Table (Figure 1). The following classroom activity demonstrates the relationship between air temperature and relative humidity and their affect on Heat Index.

Heat Index
how hot the combination of temperature and humidity feels

Relative humidity (percent)

Air Temperature (°F)	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
140	125																				
135	120	128																			
130	117	122	131																		
125	111	116	123	131	141																
120	107	111	116	123	130	139	148														
115	103	107	111	115	120	127	135	143	151												
110	99	102	105	108	112	117	123	130	137	143	150										
105	95	97	100	102	105	109	113	118	123	129	135	142	149								
100	91	93	95	97	99	101	104	107	110	115	120	126	132	138	144						
95	87	88	90	91	93	94	96	98	101	104	107	110	114	119	124	130	136				
90	83	84	85	86	87	88	90	91	93	95	96	98	100	102	106	109	113	117	122		
85	78	79	80	81	82	83	84	85	86	87	88	89	90	91	93	95	97	99	102	105	108
80	73	74	75	76	77	77	78	79	79	80	81	81	82	83	85	86	86	87	88	89	91
75	69	69	70	71	72	72	73	73	74	74	75	75	76	76	77	77	78	78	79	79	80

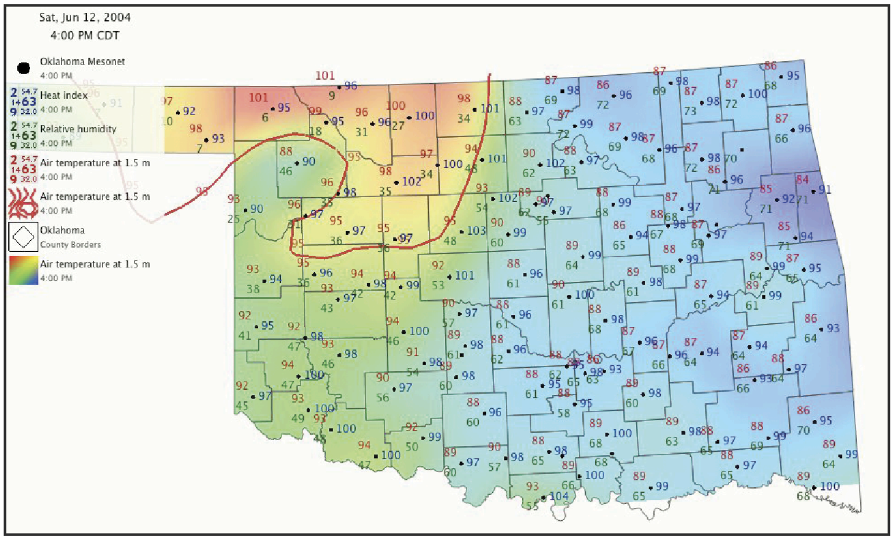
Extreme Danger (130°F or higher). Heatstroke or sunstroke likely.

Danger (105 - 129°F). Sunstroke, muscle cramps, and/or heat exhaustion likely. Heatstroke possible with prolonged exposure and/or physical activity.

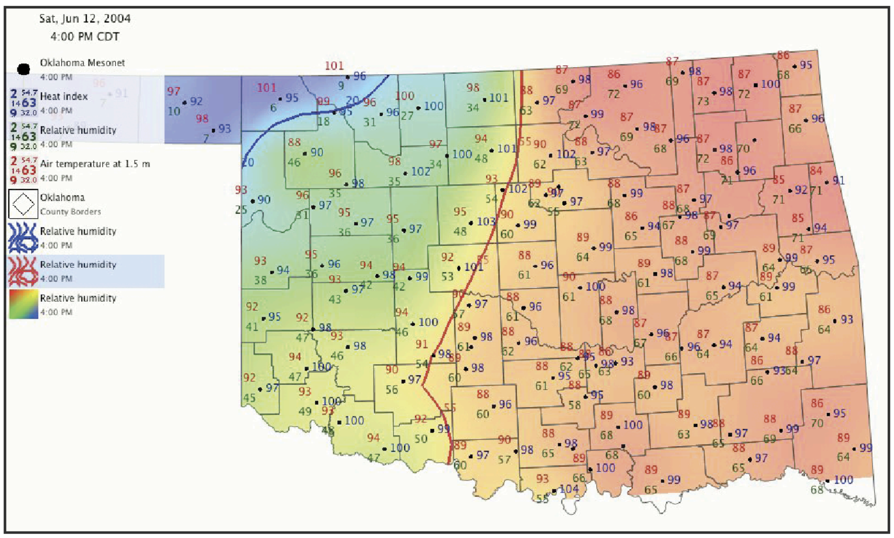
Extreme Caution (90 - 105°F). Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and/or physical activity.

Caution (80 - 90°F). Fatigue possible with prolonged exposure and/or physical activity.

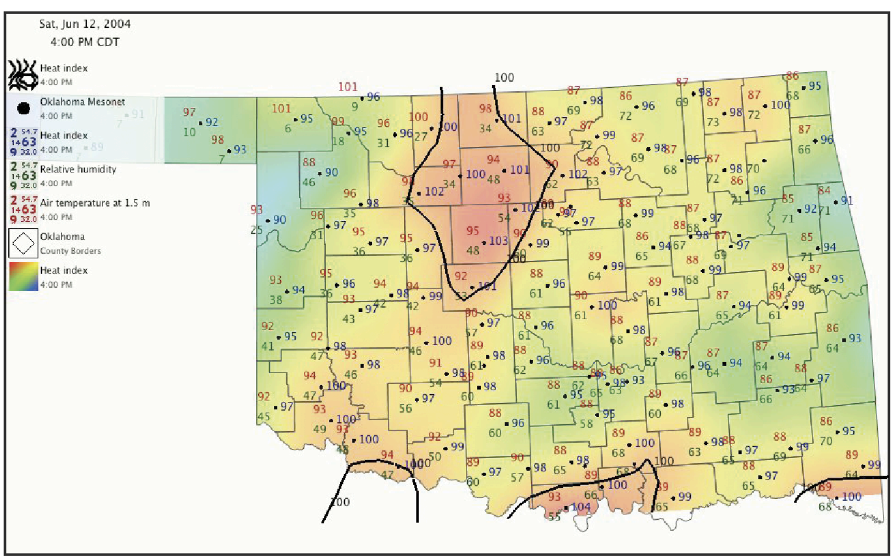
Figure 1 - Heat Index Table. Air temperature (°F) is on the vertical axis and relative humidity (%) is on the horizontal axis. Use these values to determine the Heat Index.



Map 1 – Air Temperature (°F)



Map 2 – Relative Humidity (%)



Map 3 – Heat Index (°F)

1. On Map 1, what is the range of relative humidity values in the area with the highest air temperatures?

2. On Map 2, what is the range of air temperature values in the area with the highest relative humidity?

3. Describe the area of highest Heat Index values in terms of air temperature and relative humidity. Are the highest Heat Index values located in the same location as the highest air temperatures or highest relative humidity values?

4. Calculate the difference between the Heat Index and the air temperature for each of the stations below. (Remember that air temperature is in red, relative humidity is in green and Heat Index is in blue.) Based on your calculations, would you rather spend the day in Harper, Love, or Nowata County?

101 95 6	87 98 73	93 104 55
Highest Temperature Station located in Harper County, Northwest OK	Highest Relative Humidity Station located in Nowata County, Northeast OK	Highest Heat Index Station located in Love County, South central OK

5. Explain how your body would react if you spent several hours outside at any of the three locations. Use the color-coded Heat Index table for reference.

6. Of the three stations above, explain why the Harper County station with the highest temperature and the Nowata County station with the highest relative humidity did not produce the highest Heat Index.

7. If you took the 101°F temperature from Harper County and combined it with the 73% relative humidity of Nowata County, what would be your approximate Heat Index value? How would your body react in these conditions?