

# Tornado Pattern Predictions

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have one unless you consider the question and hypothesis to be it)	
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## Executive Summary

Weather prediction is one of the many challenges science faces today. Being able to accurately forecast weather conditions can help people plan their schedule so as to not plan a picnic in the rain and can save lives and property through warning about tornadoes, hail, and other meteorological phenomenon. We have noticed that the weather follows patterns and that by modeling these patterns it might be possible to help predict the weather in one location based off of the weather in another. One example of this we chose to model contains that when a severe weather system travels through New Mexico, in this case specifically Albuquerque, we then hear of severe weather hitting the Midwest a couple days later. Wichita's weather is affected from mainly two sources from the western Pacific Ocean where it passes through Albuquerque and from the Gulf of Mexico to the south, which passes through Dallas, Texas. We chose data from these three locations and plugged them into our model to see if our results matched those or resembled that in the real world.

### Question:

Can the weather in Wichita, Kansas be accurately predicted by the weather patterns in Albuquerque, New Mexico and Dallas, Texas?

### Hypothesis:

We believe that it is possible to make a model that will be able to accurately predict the weather in Wichita, Kansas from the data in Albuquerque and Dallas.

## Background

Predicting the weather is a topic that has been much studied. Our group has chosen to specifically look at predicting tornadoes. There have been studies already on tornado predictions. For example, last year, the National Oceanic and Atmospheric Administration (NOAA) and the National Science Foundation (NSF) supported more than 100 scientists and staff and students from different places all over the world to collect weather measurements around and under a thunderstorm. They hoped that this data will help them to understand tornadoes better. This project is known as Verification of the Origins of Rotation in Tornadoes Experiment 2 (VORTEX2). It could only predict tornadoes thirteen minutes in advance on average. The project is done for now and maybe in another couple years the project, VORTEX3, will be continued on. [1] Currently, using the Doppler radar, meteorologists can learn the intensity and location of storms. Using this information, they can send out warnings for specific areas. The Doppler radar saves lives but it cannot pinpoint exactly where the tornado will be. This is a form of tornado predicting but we would hope to come up with a more exact prediction. [2] Weather prediction is tricky, but if we could predict the weather, then we could better plan for what the weather brings.

[1] <http://www.nssl.noaa.gov/vortex2/> , <http://www.isgtw.org/feature/feature-forecast-storm>

[2] <http://www.tornadochaser.net/doppler.html> , <http://science.jrank.org/pages/6870/Tornado-Prediction-tracking-tornadoes.html>

<http://earthobservatory.nasa.gov/Newsroom/view.php?id=20955> – tornadoes may be predicted by lightening strikes, "Our studies show a very big spike in the lightning's flash rate prior to formation of a tornado," Goodman says. "It's an early clue for weather forecasters to take a more detailed look at other storm characteristics with radar. And perhaps a chance for them to get warnings out earlier, saving more lives."

## Method

We used a C++ program to model the relationship between weather in Albuquerque, Austin, and Wichita. We used a very simplistic "if then" model which actually very closely models the real world data.

## Code

```

1  #include <cstdlib>
2  #include <iostream>
3  #include <iomanip>
4  # include <math.h>
5  # include <string>
6  using namespace std;
7
8  class Weather //initialization for variables
9  {
10 public:
11 float Patm; //atmospheric pressure
12 float Temp; //Atmospheric temperature
13 float Vwind; //velocity of the wind
14 float RHum; //Relative humidity
15 float Vstorm; //Velocity of the pressure storm
16 float DHail; //Diameter of Hail
17 bool YNHail; //Boolean "yes, no" variable for hail
18 } Abq, Aus, Wich; //creating the variables of type 'Weather' for the
19 cities
20
21 int main ()
22 {
23 cout << "Enter values\nAtmospheric pressure in Aluquerque:\n";
24 //beginning conversation
25 cin >> Abq.Patm;
26 cout << "\nAustin:\n";
27 cin >> Aus.Patm;

```

```

28 cout << "\nIs there hail in Albuquerque? 1=yes, 0=no\n";
29 cin >> Abq.YNHail;
30 if (Abq.YNHail == 1)
31 {
32 cout << "\nHow Wide?\n";
33 cin >> Abq.DHail;
34 }
35 cout << "\nAustin?\n";
36 cin >> Aus.YNHail;
37 if (Aus.YNHail == 1)
38 {
39 cout << "\nHow Wide?\n";
40 cin >> Aus.DHail;
41 }
42 if (Abq.Patm < 29.8 && Aus.Patm < 29.8)
43 {
44 if (Abq.YNHail == 1 && Aus.YNHail == 1)
45 cout << "\nHigh chance of storms in Wichita\n";
46 }
47 cout << "\nlow chance of storms in wichita";
48 return 0;
49 }

```

### Conclusion

This very well mimics the real world results. The data represented can very loosely but accurately placed into the program and have the actual physical results in the Wichita.

### References

- Adams, et al (1998) C++ An Introduction to Computing, 2nd Ed, Prentice Hall
- Jamsa, Kris (1996), Rescued by C++; 2nd Ed, Jamsa Press
- Zitzewitz, et al (2005), Physics Principles and Problems, Glencoe
- Giancoli, Douglas C. (2005) Physics Principles with Applications, Giancoli

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## Appendix A: Sample of data used

### Albuquerque, NM:

Albuquerque 2/26/2011	Actual	Average	Record
Temperature			
Mean Temperature	51 °F	50 °F	
Max Temperature	64 °F	65 °F	85 °F (1971)
Min Temperature	38 °F	36 °F	16 °F (1936)
Degree Days			
Heating Degree Days	14	15	
Month to date heating degree days	322	456	
Since 1 July heating degree days	3452	3829	
Cooling Degree Days	0	0	
Month to date cooling degree days	0	0	
Year to date cooling degree days	0	0	
Growing Degree Days	2 (Base 50)		
Moisture			
Dew Point	21 °F		
Average Humidity	32		
Maximum Humidity	45		
Minimum Humidity	19		
Precipitation			
Precipitation	0.00 in	0.02 in	0.47 in (1984)
Month to date precipitation	T	0.51	

Year to date precipitation	0.11	1.44	
Snow			
Snow	<b>0.00</b> in	-	- ()
Month to date snowfall	0.0		
Since 1 July snowfall	2.8		
Snow Depth	<b>0.00</b> in		
Sea Level Pressure			
Sea Level Pressure	<b>29.73</b> in		
Wind			
Wind Speed	<b>8</b> mph (West)		
Max Wind Speed	<b>22</b> mph		
Max Gust Speed	<b>28</b> mph		
Visibility	<b>10</b> miles		
Events			
Albuquerque 2/27/11			
	Actual	Average	Record
Temperature			
Mean Temperature	<b>58</b> °F	<b>51</b> °F	
Max Temperature	<b>69</b> °F	<b>65</b> °F	<b>84</b> °F (1971)
Min Temperature	<b>47</b> °F	<b>36</b> °F	<b>10</b> °F (1913)
Degree Days			
Heating Degree Days	7	14	
Month to date heating degree days	329	470	
Since 1 July heating degree days	3459	3843	
Cooling Degree Days	0	0	
Month to date cooling degree days	0	0	
Year to date cooling degree days	0	0	
Growing Degree Days	7 (Base 50)		
Moisture			
Dew Point	<b>17</b> °F		
Average Humidity	27		
Maximum Humidity	45		

Minimum Humidity	8		
Precipitation			
Precipitation	<b>0.00</b> in	<b>0.02</b> in	<b>0.45</b> in (1921)
Month to date precipitation	T	0.53	
Year to date precipitation	0.11	1.46	
Snow			
Snow	<b>0.00</b> in	-	- ()
Month to date snowfall	0.0		
Since 1 July snowfall	2.8		
Snow Depth	<b>0.00</b> in		
Sea Level Pressure			
Sea Level Pressure	<b>29.72</b> in		
Wind			
Wind Speed	<b>9</b> mph (WSW)		
Max Wind Speed	<b>21</b> mph		
Max Gust Speed	<b>26</b> mph		
Visibility	<b>10</b> miles		
Albuquerque 2/28/11	Actual	Average	Record
Temperature			
Mean Temperature	<b>57</b> °F	<b>51</b> °F	
Max Temperature	<b>72</b> °F	<b>66</b> °F	<b>80</b> °F (1967)
Min Temperature	<b>41</b> °F	<b>36</b> °F	<b>18</b> °F (1913)
Degree Days			
Heating Degree Days	8	14	
Month to date heating degree days	337	484	
Since 1 July heating degree days	3467	3857	
Cooling Degree Days	0	0	
Month to date cooling degree days	0	0	
Year to date cooling degree days	0	0	
Growing Degree Days	7 (Base 50)		
Moisture			

Dew Point	15 °F		
Average Humidity	20		
Maximum Humidity	28		
Minimum Humidity	11		
Precipitation			
Precipitation	0.00 in	0.02 in	0.33 in (1937)
Month to date precipitation	T	0.55	
Year to date precipitation	0.11	1.48	
Snow			
Snow	0.00 in	-	- ()
Month to date snowfall	0.0		
Since 1 July snowfall	2.8		
Snow Depth	0.00 in		
Sea Level Pressure			
Sea Level Pressure	29.73 in		
Wind			
Wind Speed	10 mph (WSW)		
Max Wind Speed	25 mph		
Max Gust Speed	32 mph		
Visibility	10 miles		

### Dallas Love TX:

Dallas Love 2/26/11	Actual	Average	Record
Temperature			
Mean Temperature	60 °F	-	
Max Temperature	73 °F	58 °F	84 °F (2009)
Min Temperature	46 °F	41 °F	24 °F (2002)
Degree Days			
Heating Degree Days	6		
Growing Degree Days	10 (Base 50)		
Moisture			
Dew Point	52 °F		
Average Humidity	75		
Maximum Humidity	88		



Minimum Humidity	57		
Precipitation			
Precipitation	0.00 in	-	- ()
Sea Level Pressure			
Sea Level Pressure	29.85 in		
Wind			
Wind Speed	11 mph (SSE)		
Max Wind Speed	20 mph		
Max Gust Speed	28 mph		
Visibility	9 miles		
Events			

Dallas Love 2/27/11	Actual	Average	Record
Temperature			
Mean Temperature	70 °F	-	
Max Temperature	75 °F	59 °F	81 °F (2007)
Min Temperature	64 °F	41 °F	24 °F (2002)
Cooling Degree Days	4		
Growing Degree Days	20 (Base 50)		
Moisture			
Dew Point	63 °F		
Average Humidity	77		
Maximum Humidity	88		
Minimum Humidity	64		
Precipitation			
Precipitation	0.10 in	-	- ()
Sea Level Pressure			
Sea Level Pressure	29.64 in		
Wind			
Wind Speed	14 mph (SSW)		
Max Wind Speed	23 mph		
Max Gust Speed	31 mph		
Visibility	8 miles		

Events	Rain , Thunderstorm		
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Dallas Love 2/26-28/11	Actual	Average	Record
Temperature			
Mean Temperature	70 °F	-	
Max Temperature	75 °F	59 °F	81 °F (2007)
Min Temperature	64 °F	41 °F	24 °F (2002)
Cooling Degree Days	4		
Growing Degree Days	20 (Base 50)		
Moisture			
Dew Point	63 °F		
Average Humidity	77		
Maximum Humidity	88		
Minimum Humidity	64		
Precipitation			
Precipitation	0.10 in	-	- ( )
Sea Level Pressure			
Sea Level Pressure	29.64 in		
Wind			
Wind Speed	14 mph (SSW)		
Max Wind Speed	23 mph		
Max Gust Speed	31 mph		
Visibility	8 miles		
Events	Rain , Thunderstorm		

### Wichita Kansas:

Wichita 2/26/11	Actual	Average	Record
Temperature			
Mean Temperature	32 °F	40 °F	
Max Temperature	37 °F	51 °F	78 °F (1896)
Min Temperature	26 °F	29 °F	0 °F (1934)
Degree Days			
Heating Degree Days	33	25	
Month to date heating degree days	848	769	

Since 1 July heating degree days	3579	3725	
Cooling Degree Days	0	0	
Month to date cooling degree days	0	0	
Year to date cooling degree days	0	0	
Moisture			
Dew Point	<b>29 °F</b>		
Average Humidity	90		
Maximum Humidity	96		
Minimum Humidity	84		
Precipitation			
Precipitation	<b>T in</b>	<b>0.06 in</b>	<b>0.91 in (1903)</b>
Month to date precipitation	0.66	0.90	
Year to date precipitation	1.00	1.74	
Snow			
Snow	<b>0.00 in</b>	<b>0.10 in</b>	<b>3.20 in (1912)</b>
Month to date snowfall	13.0	3.9	
Since 1 July snowfall	17.3	13.6	
Snow Depth	<b>0.00 in</b>		
Sea Level Pressure			
Sea Level Pressure	<b>29.89 in</b>		
Wind			
Wind Speed	<b>7 mph (ESE)</b>		
Max Wind Speed	<b>13 mph</b>		
Max Gust Speed	<b>15 mph</b>		
Visibility	<b>3 miles</b>		
Events			

Wichita 2/27/11	Actual	Average	Record
Temperature			
Mean Temperature	<b>42 °F</b>	<b>40 °F</b>	
Max Temperature	<b>50 °F</b>	<b>52 °F</b>	<b>78 °F (1976)</b>
Min Temperature	<b>34 °F</b>	<b>29 °F</b>	<b>1 °F (1890)</b>
Degree Days			
Heating Degree Days	23	25	

Month to date heating degree days	871	794	
Since 1 July heating degree days	3602	3750	
Cooling Degree Days	0	0	
Month to date cooling degree days	0	0	
Year to date cooling degree days	0	0	
Moisture			
Dew Point	41 °F		
Average Humidity	95		
Maximum Humidity	100		
Minimum Humidity	89		
Precipitation			
Precipitation	0.73 in	0.06 in	1.93 in (1918)
Month to date precipitation	1.39	0.96	
Year to date precipitation	1.73	1.80	
Snow			
Snow	0.00 in	0.10 in	4.00 in (1900)
Month to date snowfall	13.0	4.0	
Since 1 July snowfall	17.3	13.7	
Snow Depth	0.00 in		
Sea Level Pressure			
Sea Level Pressure	29.55 in		
Wind			
Wind Speed	10 mph (NNE)		
Max Wind Speed	29 mph		
Max Gust Speed	37 mph		
Visibility	3 miles		
Events	Fog , Rain , Thunderstorm		

Wichita 2/28/11	Actual	Average	Record
Temperature			
Mean Temperature	37 °F	41 °F	
Max Temperature	47 °F	52 °F	78 °F (2006)
Min Temperature	26 °F	29 °F	0 °F (1890)
Degree Days			

Heating Degree Days	28	25	
Month to date heating degree days	899	819	
Since 1 July heating degree days	3630	3775	
Cooling Degree Days	0	0	
Month to date cooling degree days	0	0	
Year to date cooling degree days	0	0	
Moisture			
Dew Point	24 °F		
Average Humidity	63		
Maximum Humidity	89		
Minimum Humidity	37		
Precipitation			
Precipitation	0.00 in	0.06 in	1.10 in (1987)
Month to date precipitation	1.39	1.02	
Year to date precipitation	1.73	1.86	
Snow			
Snow	0.00 in	0.10 in	5.60 in (1911)
Month to date snowfall	13.0	4.1	
Since 1 July snowfall	17.3	13.8	
Snow Depth	0.00 in		
Sea Level Pressure			
Sea Level Pressure	30.15 in		
Wind			
Wind Speed	13 mph (North)		
Max Wind Speed	29 mph		
Max Gust Speed	37 mph		
Visibility	10 miles		
Events			