SOUTHEAST REGIONAL CLIMATE CENTER

Southern AER

Atmospheric Education Resource

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PLUS:

- **Games, Activities, FunFacts and More!**

Did You Know?

Extreme cold killed 26 people in the United States in 2000, significantly higher than 1999's total of 7. Of the 14 states suffering cold related deaths, South Carolina accounted for 7 of the 26 lives, more than any other state. Twenty-one fatalities (81%) occurred outside in the open.
Source: NOAA/NWS

What is Wind Chill?

Wind chill may not be something that most people, especially those of us who live in the Southeast, think about too often. In fact, you may have never even heard the term *wind chill* before. So before going any further, let's take a minute and look at what exactly wind chill is.

Simply put, the **wind chill temperature**, sometimes called the **wind chill factor**, **wind chill index**, or just **wind chill**, is the temperature it "feels like" outside and is based on how cold it is outside as well as how fast the wind is blowing. When the wind blows, it carries heat away from exposed skin, thus lowering the skin's temperature. The faster the wind blows, the more quickly heat is carried away and the colder it feels.

It is important to realize that the wind chill only describes how cold it *feels*, not how cold it actually *is* (the air temperature). The wind chill also only applies only to people and other living things. It has no effect on inanimate objects, such as cars, water pipes, or bridges. Inanimate objects cannot cool below the actual air temperature, no matter how strong the wind is blowing, although objects that are warmer than the outside air temperature will cool more quickly when the wind blows. This means that if the temperature is 10°F and the wind is blowing at 40 mph—creating a wind chill of –40° F—the water in your car's radiator will not freeze, even though it would feel like it's well below freezing to you!

The wind chill describes how cold it feels outside when the temperature is low and the wind is blowing.

A New Wind Chill Index

The wind chill index is a mathematical formula that is used to determine what the wind chill would be for different combinations of temperature and wind speed. Originally developed in 1939 by two scientists who were conducting research in Antarctica, the original wind chill index was first used by the National Weather Service in 1973.

Over time, people began to realize that the index overestimated the cooling effect that wind has on exposed skin. It was not until recently, however, that the National Weather Service, along with the Meteorological Service of Canada, decided to implement a new wind chill index.

The new wind chill index, developed jointly by researchers working at the Defense and Civil Institute for Environmental Medicine in Canada and at Indiana University-Purdue University Indianapolis in the United States, went into effect on November 1, 2001. The new index takes into account many factors that were missing from the old index, including the average height of the human face and how heat is transferred away from human skin.

The new wind chill index is a significant improvement over the old index and should allow people to judge more accurately just how cold it feels outside.

The Dangers of Wind Chill

Wind chill provides a useful way of expressing how cold it feels outside when the temperature is low and the wind is blowing, but why is it important to know this? Wind chill is important because prolonged exposure to low temperatures and strong wind can pose a serious health risk or even be life-threatening. Two of the most common health-related problems associated with spending too much time outside in the cold are **frostbite** and **hypothermia**.

Frostbite occurs when your skin becomes so cold that it actually freezes. This can cause serious damage to your body tissue and require immediate medical attention. The parts of the body that are most vulnerable to frostbite include fingers, toes, ears and the nose. A loss of feeling in these areas or the skin becoming white are symptoms that frostbite may be occurring.

Another danger of being out in the cold for too long is hypothermia, which occurs when your body temperature drops below 95°F. Signs that a person may be suffering from hypothermia include uncontrolled shivering, which may actually decrease as the temperature continues to fall, disorientation, confusion and slurred speech. People who are very young or very old are most susceptible of hypothermia. If someone is suffering from hypothermia, they should seek immediate medical attention. If none is available, it is important to warm the body slowly.

The best ways to protect yourself from the dangers of frostbite and hypothermia are to wear a warm hat, mittens, and several layers of loose-fitting, warm, lightweight clothing and to limit the amount of time spent outside, especially in the wind.

Wind chill only affects people and other living things, not inanimate objects like cars.

Wind Chill Q & A

Q: Does wind chill have any effect on pets?

A: Yes. Pets and other animals are affected by wind chill just as people are and should not be left outside during extreme wind chills.

Q: How about plants—are they affected by wind chill as well?

A: Plants lose water through their leaves and strong winds can make them lose moisture more rapidly and lead to dehydration. As long as the air temperature is above 32°F (0°C), however, plants are not in danger of freezing.

Q: How long does it take for frostbite to occur?

A: This depends on how cold it is and how fast the wind is blowing. The new wind chill chart developed by the National Weather Service, which can be found on the next page, is colored to show how it will take for various combinations of temperature and wind speed to produce frostbite on exposed skin. For example, a temperature of 0°F and a wind speed of 30 mph will result in a wind chill temperature of –26°F and can cause exposed skin to freeze in 30 minutes. If the wind were blowing at 60 mph with the same temperature, the wind chill would drop to –33°F, which can cause frostbite in just 10 minutes.

FunFacts!

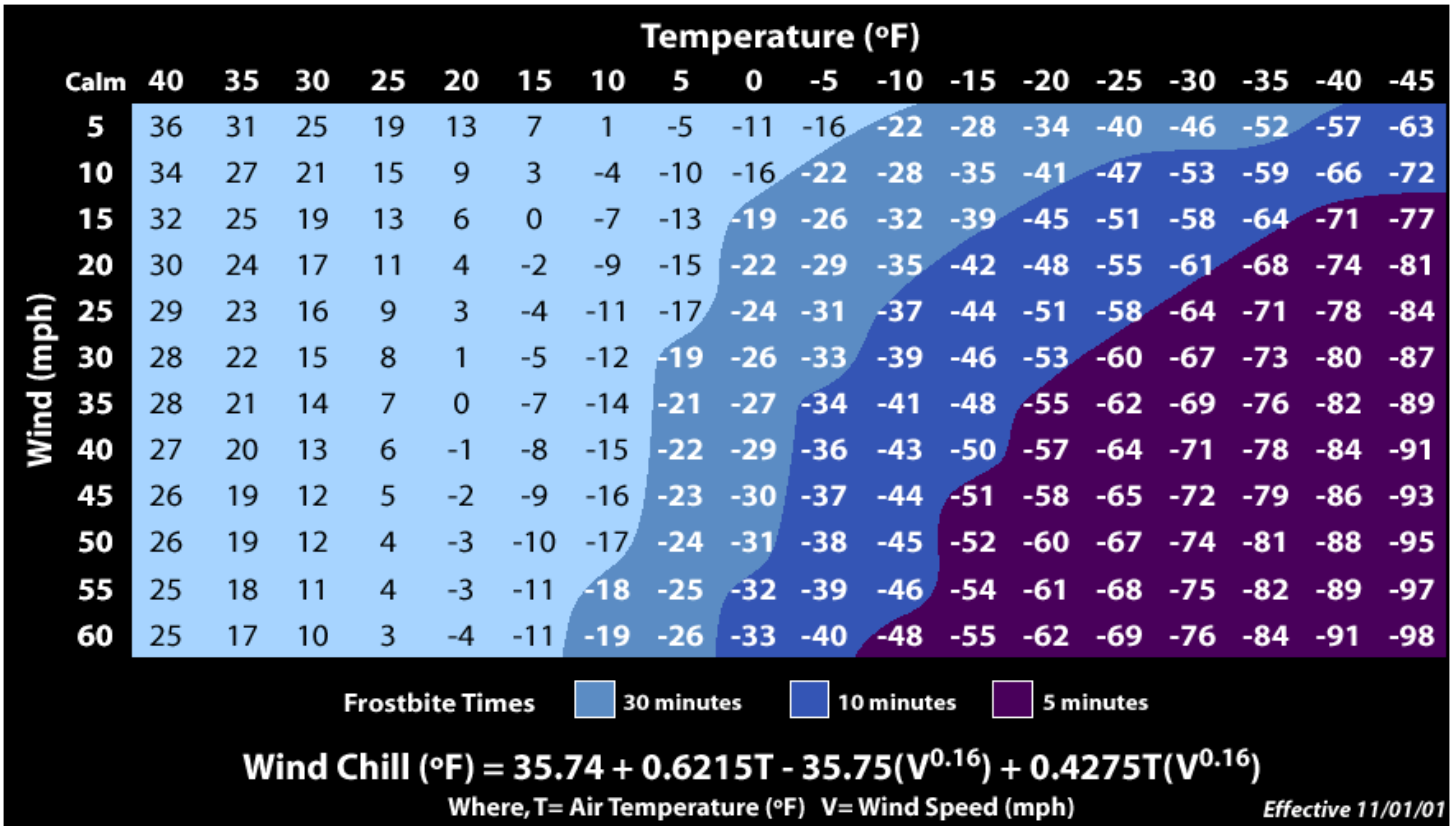
- On January 28, 1989, the temperature at Pelly Bay in Canada's Northwest Territories dropped to -51°C (-60°F). Strong winds, however, made it feel even colder, creating record wind chills of -91°C (-132°F).
- The lowest wind chill temperature ever recorded at an NFL game was -59°F on January 10, 1982. The record cold event occurred in Cincinnati during the AFC Championship game between the Cincinnati Bengals and the San Diego Chargers. The game, dubbed "The Freezer Bowl," was also the coldest game ever played in Cincinnati, with an actual air temperature of -9°F. Incidentally, Cincinnati beat the Chargers 27-7.
- Some of the lowest wind chill temperatures at a presidential inauguration occurred during Ulysses S. Grant's second swearing-in ceremony on March 4, 1873. The morning low was a record 4° F and the afternoon high only reached 16°F. Winds as high as 40 mph created wind chills from -15° to -30°F.
- Ronald Regan's second inauguration ceremony on January 21, 1985 was the coldest in recent history, with wind chills ranging from –10°F to –20°F.

Activities and Games

Fill In The Table

Below is the new, official wind chill chart provided by the National Weather Service. To use the chart, find the temperature at the top and the wind speed on the left side of the chart. Move down from the temperature and across from the wind speed until the two meet. The number where they meet is the wind chill temperature, in degrees Fahrenheit, for that temperature and wind speed. For example, a temperature of –5°F and a wind speed of 35 mph would result in a wind chill temperature of –34°F.

Below the wind chill chart is a table that shows different combinations of wind speed, temperature, and wind chill temperature. Each combination, however, has at least one value missing. Use the new wind chill chart to fill in the missing numbers in the table below. Have fun!



Temperature (°F)																		
Wind (mph)	Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
	5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
	10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
	15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
	20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
	25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
	30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
	35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
	40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
	45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
	50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
	55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
	60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes; 10 minutes; 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

Wind Speed (mph)	Temperature (°F)	Wind Chill (°F)
10	25	
20		-2
	32	40
60	0	
	-20	-53
25		-74
30	-5	
		-98

Quick Quiz

1. What does the wind chill tell us?

2. Can wind chill actually lower the air temperature outside?

3. What is the lowest wind chill temperature ever recorded at an NFL game ?

4. How many people died as a result of extreme cold in the U.S. in 2000?

5. What can you do to protect yourself from hypothermia?

Learn More About It

Now that you've learned about wind chill, how it's calculated, and some of the dangers associated with it, you may want to find out more.

Below are some websites that offer more information about wind chill:

The National Weather Service has a wind chill index page complete with an online wind chill calculator:

http://205.156.54.206/om/windchill

An informative wind chill fact sheet is available from the Meteorological Service of Canada:

http://www.msc.ec.gc.ca/windchill/fact_quiz_e.cfm

You can read more about the new wind chill index in an online article from Weatherwise magazine:

http://www.weatherwise.org/jf02.henson.html

Also, be sure to check out our website for more educational and climate data resources:

http://www.sercc.com

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