

SABRINA WOODS

Chilled to the Bone

How Cold Can Affect Both Body and Mind

Winter will soon be in full force and if you are anything like this Arizona native, the very idea of it is daunting. Sure, winter brings some of my favorite things: skiing, hockey, and everything having to do with warm, spiced drinks. But it also brings extra layers of clothing, runny noses, slick sidewalks, and static electricity *everywhere*.

Far more insidious, prolonged exposure to the cold of the winter months can wreak havoc on your body, slowly corrupting your basic motor functions. The deception here is that it is not always the actual cold that will get you, but rather the effects of the cold that can have serious adverse consequences. These effects are called cold stress and for airmen, the cumulative effects can be a chilling wake-up call.

Let me explain further.

Cold Case Files

The following scenarios will be in Fahrenheit (apologies to my more metric-savvy readers) and I will factor in the “wind chill” — the relative temperature your exposed skin and body feel when air temperature and wind speed are combined.

Scenario 1

50 degrees: I’d be in jeans, a long-sleeve shirt, and closed-toed shoes. I’d have my favorite zip-up hoodie to ward off the chill. My Canadian buddy, René, clad only in shorts and a tee, *might* consider switching from flip-flops to boat shoes.

Scenario 2

45 degrees with 10mph winds (effectively lowering the temperature to 40 degrees): I am starting to shiver despite my clothing. My teeth are chattering and my fingers and ears, which are exposed, start to tingle. René puts on socks.

Scenario 3

40 degrees with 15mph winds (32 degrees): If I don’t get a heavier coat and gloves to help keep me warm, my fingers and hands will go numb. Any exposed skin would start to pale and my muscles would spasm. René sips some coffee.

Scenario 4

32 degrees with 15mph winds (22 degrees): Despite putting on a heavy winter coat, gloves, a scarf, and insulated boots, my strength is being sapped. My breath has become labored and I find it harder to pay attention to the task at hand. René puts on a tuque.

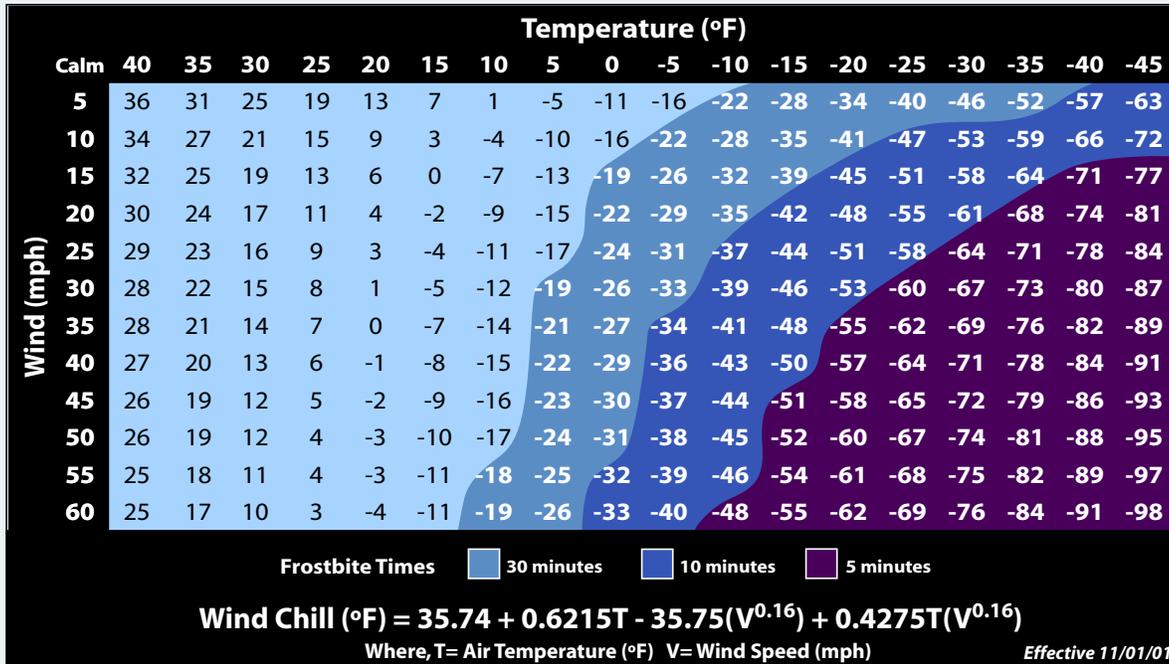
Scenario 5

20 degrees with 20mph winds (4 degrees): Due to my prolonged time out in the elements my muscles have become stiff. My speech is slurred and my breathing has become shallower and slower. I feel confused and sleepy and although the shivering has stopped, my body is cold to the touch. René adds a scarf.

All humor aside (and with much love to my neighbors to the north), the intent here is to show that with only a five to eight degree difference



Wind Chill Chart



between most of the ambient temperatures, the wind had a big impact on the relative temperature. Humidity also plays a role. In fact, when it comes to potential for cold stress, a damp, windy 50-degree Seattle day is effectively no different from a calm, dry 35-degree day in Denver. And although there is some merit to the idea that people from different climates are more tolerant of their own indigenous weather patterns — i.e., Arizonans defending their “dry heat” and Win-nipeggers relishing any day that clears zero degrees F — the fact is that the average human core temperature is 98.6 degrees. This temperature *must* be maintained in order for the body to function properly. Any atmospheric temperature between 32 and 60 degrees can lead to non-freezing cold weather injuries such as chilblains — the painful inflammation of small blood vessels in your skin, or worse, hypothermia — a medical emergency that occurs when your body loses heat faster than it can produce it, causing a dangerously low body temperature.

It’s a War in There

Leading the charge in cold weather combat is your brain’s hypothalamus. This gland’s primary job is to maintain balance within your body and as such, it also serves as your internal thermostat. Through the process known as thermoregulation, it will beg, borrow, and steal what it needs just to keep the vitals — in particular your heart, lungs, and brain — up to temperature. It is the body’s ultimate defense system against the dipping degrees, and your extremities

are the poor pawns that will be sacrificed first on the frontlines of battle.

This is why those fine motor skills are the first things to go when you get cold. Your hypothalamus and autonomic nervous system trigger many different reactions to jump start the heat. You might shiver or your teeth might chatter — expending this kind of energy generates a small amount of warmth. Then come the “pins and needles” in your fingers and toes, and your ears and nose

Be prepared by recognizing a bad situation before it starts, understanding how your body will react to that situation, and having what you need to help your hypothalamus out.

might get a burning sensation. This is a result of the capillaries underneath the fine, thin skin constricting as blood flow is reduced (reserving it for the vitals).

And these are just a few examples of the *early* stages of hypothermia. The later stages get much worse. A significant drop in body heat left unchecked leads to permanent nerve damage, muscle lock, weakness, a substantial decrease in cognitive ability, and a slowed pulse. It will eventually lead to unconsciousness and finally, death.

What does all this mean for those who take to the air or maintain aircraft in these lower temps? Two words: be prepared. Be prepared by recognizing a bad situation before it starts, understanding how your body will react to that situation, and having what you need to help your hypothalamus out.



Baby, It's Cold Outside

The first part of being prepared is recognizing your situation. This means being able to predict the weather to within a few degrees of actual. You need to know the forecasted precipitation levels, winds, and how much ice and snow would preclude you from flying altogether. Crosswinds, windshear, and gusting winds have felled more than one seasoned aviator, so take measures to avoid becoming a statistic. Shorter winter days invariably increase the times at which you might end up flying in the dark, a situation that makes for a whole different set of challenges besides just the weather.

Your forecast should include your destination, as well as some “Plan B” contingency routes. Besides requesting a weather briefing from Flight Service, either by phone or via DUAT/DUATS, there are many different weather information tools you can use to plan your flight. You probably know about the ADDS site (www.aviationweather.gov/adds/) operated by the National Weather Service. For both preflight planning and inflight updates, some favorites among the smartphone and tablet users are: NOAA Radar US, MyRadarPro, Intellicast HD, and ForeFlight. Like some of the newer panel-mounted avionics devices, some of these also include ADS-B weather.

To get the greatest benefit from these tools during winter, you'll want to know at least three things. First, where is the freezing level? Second, where (and at what level(s)) is precipitation present or likely to form? Third, where are these weather phenomena in relation to your route of flight? The weather may be different above the ground than

what is occurring at the surface. Hazardous conditions such as icing, turbulence and reduced visibility must be considered for any flight during the winter months. This information is key to helping you develop contingency plans.

You're as Cold as Ice

In addition to focusing on the fast moving fronts, strong winds, blowing snow, and icing conditions that can come with winter flying, you have to be aware of how each change in the climate affects your body. Don't dismiss it when, while standing in a snowbank trying to clear the ice from your prop, your fingers and toes start to protest. Remember they are *pawns*, and there are far greedier organs at work here. Respect the fact that if you are uncontrollably shivering, the path to hypothermia has already started. The next steps on that path are poor judgment and apathy, which could negatively influence your go/no-go decision making abilities. Note too that difficulty balancing or walking could turn a misjudged step into a real catastrophe — especially when there is ice involved.

Any part of your body directly exposed to the elements will be subject to frostbite, which is when the skin and underlying tissue begins to freeze. It most commonly occurs in the fingers, toes, cheeks, ears, and nose. First degree frostbite — indicated by that tingling or burning sensation — can be irritating, but it rarely causes any permanent damage once the tissue thaws. Third degree frostbite, on the other hand, is signified by the complete loss of sensation, and swollen and purplish skin color. It often results in permanent damage.

Everyone, regardless of body mass, age, race, gender, and overall health, is susceptible to hypothermia and frostbite. The discriminating factors only serve to vary the amount of time one progresses through the cold stress stages.

Prep Yourself, Before You Wreck Yourself

Before you even tend to that flightplan and pre-flight, you need to prep yourself. Some things to keep in mind are:

- A full tummy is a happy hypothalamus. Sounds odd, but trust me — in our incredibly intricate (and often awe-inspiring) biology, everything is connected. Eating keeps your metabolism up which, in turn, also keeps you warmer. Stay hydrated, also.
- Even though it's already prohibited by regulations, it might help to know that consuming alcohol to stay warm is merely a myth. Contrary to the wonderful misconception of an Alpine St. Bernard carrying a barrel of brandy to stricken mountaineers, drinking alcohol lowers the core temperature of your body. It also impairs your judgment and undermines the body's ability to do things (such as shiver) to keep itself warm.
- Limit direct exposure to the elements. If you can prep and preflight in a hangar, or behind a wind break, do so. Adhere to work/rest cycles if you must continue working. The less time you spend in the cold temps, the less likely it is for cold stress effects to take hold. In addition, stay as dry as possible. When clothes get wet they are no longer able to retain their insulation.
- Don't overdo it! One of the key factors of cold stress is early fatigue, so overexerting yourself will only exacerbate the situation. The more energy you burn through, the less your body has to maintain its core temperature. Make sure you get plenty of rest before heading out.
- Always dress for the weather you are flying in. Even when departing in more temperate weather, if your destination leads you on a path over mountainous terrain, higher altitudes, or lower temperatures, dress for it! Dress using many thin layers so you can adjust as needed. Wear a hat to prevent losing heat from your head. Insulated boots and gloves are a must, and for all of your clothing,

choose synthetics or wool rather than cotton, as cotton loses all functionality when it gets wet. Lastly, wear a good water-proof coat as an outer layer.

Understand that when the drifts and gusts get high, it is a possibility that the destination FBO, although near and dear to your heart, might be pretty far down on the list of priority for those whose job it is to clear and maintain the roadways. This can mean two things for you. The first is that if the weather turns nasty forcing you to jump to Plan: "Get Down as Quickly and Safely as Possible." That same nasty weather could create a serious problem for your survival at whatever parking patch you end up claiming. Even if you get to your intended destination, there is no guarantee that it will still be open and waiting to accept you. Inclement weather can shut down a landing strip fast, leaving you, quite literally, out in the cold with rescue capability severely hampered.

Not only should you dress warmly enough to withstand the cold, you might want to also consider packing a few essentials in your aircraft to bridge the gap to rescue. This list includes some high-energy food, water, a Mylar blanket, a change of clothes in case yours get wet, some chemical warming packets, and an emergency locator transmitter and cell phone.

You don't always have to flee or fold-up when the cold months come. With an understanding of cold weather patterns and effects, and some careful preparation on behalf of you and your aircraft, you can keep flying all through the hazy shades of winter. 

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Learn More

NWS Wind Chill Calculator

<http://www.nws.noaa.gov/om/windchill>

OSHA Winter Tips

https://www.osha.gov/dts/weather/winter_weather/hazards_precautions.html

FAA Winter Flying Tips

http://www.faa.gov/gslac/alc/libview_normal.aspx?id=10520