Why Mount Washington

Elliot Abrams

To a casual observer the idea that Mount Washington has some of North America's worst weather may seem like promotional propaganda. It is not the highest mountain on the continent; it is not even the highest in the eastern United States. It is not the farthest north mountain. Its coldest temperatures are easily beaten by those in northwest Canada and Alaska, and its lowest temperature ever is about the same as a reading taken in a valley location not far away. Indeed, trying to prove Mount Washington weather ranks among the worst would be difficult if one was confined to simply studying observed weather; many other sites that skeptics might name are not properly instrumented. Yet, it is possible to apply concepts of meteorology and climatology to eliminate other places from consideration. To do this, we'll invoke some ideas that aren't widely known by non-meteorologists, but since you've had the wisdom and foresight to turn to this article, you'll get this inside information. I'll simplify the ideas as much as I can, a statement which also smokescreens the fact that if I get very technical I'll confuse myself.

First, land changes temperature faster than water. This means the continents are colder than the oceans in winter; the opposite is true in summer.

Second, temperature generally decreases with height. The rate of drop is 5.6 degrees F per thousand feet for dry air and an average value of 3 degrees per thousand feet when the air is saturated. Since cold air is more dense than warm air, this temperature drop with height may not make sense, but as long as there is enough wind to mix the air, it will be true. If the air is clear and calm, temperatures in low spots will be the coldest as cold dense air drains downhill. This explains how a valley location may have colder temperatures at night than a mountain top. Even so, that may not mean the weather is harsh. A zero degree reading with a 40-mile an hour wind feels a great deal worse than a temperature 30 below zero with no wind. By the way, I'm using Fahrenheit because I like it. In my usual experience with weather, I like a system wherein the hottest day in summer is close to 100 degrees and the coldest day in winter is close to zero. For many Americans, Fahrenheit is very convenient in that way. Also, since it is a finer unit of measurement, it gives reasonably precise readings without resorting to decimals. If and when we do change to Celsius, I hope readings are taken routinely in tenths of degrees. Some will argue it's too confusing to use so many decimals, but we have been giving barometer readings like 29.72 inches with no public revolt for many years! I appreciate the story about the Toronto resident who was called in a telephone survey and asked, "If the temperature in Toronto is 50 degrees Fahrenheit, what is it in Celsius?" The answer, "Where is that?"

Third, since winds tend to blow from west to east in the middle latitudes, and since the continents are the coldest places in winter, the coldest parts of a continent at any given altitude will be in the east. Air spends more time over cold land before reaching the eastern parts of a continent than it can spend before reaching the western part.

The major ocean currents are arranged in a manner that tends to bring warm water northward along east coasts while bringing cold water southward along west coasts. Currents are named either warm or cold by the effect they produce compared to what would be the case if the current did not exist. There are exceptions to the general pattern. Since the gulf stream turns somewhat eastward once it passes the North Carolina coast, it allows plenty of room for the cold currents that hug the northern New England coast. The contrast in water temperatures near the boundary between these cold waters and the gulf stream waters is very great; in fact, the water temperature contrasts near the New England coast are probably greater than such contrasts near any other part of the U.S. coastline.

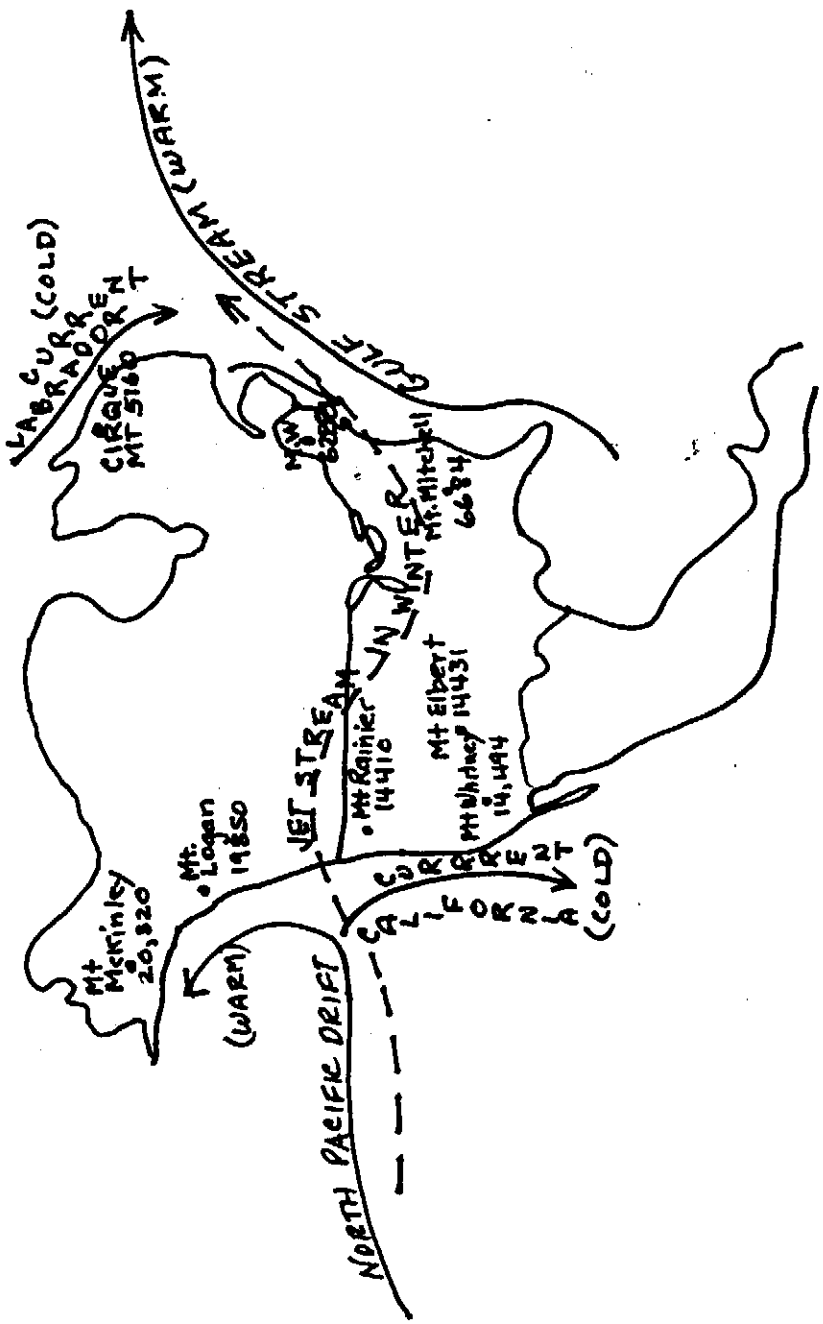
A fifth key concept is that storms grow fastest when they are able to feed on the vast amounts of energy released when cold and warm airmasses are in conflict. Because of the physical properties of warm and cold air, it turns out that the stronger the horizontal difference in temperature near the ground, the faster winds will increase in the vertical. In other words, we find very fast winds located above an area where there is strong temperature contrast. The very fastest winds are known as the jet stream, and storms are observed to travel in the direction of the stream, usually at speeds proportional to the wind speed in the jet.

Sixth, we observe that for every 20 degree drop in the temperature (Fahrenheit, again), the capacity of the air to hold water vapor is cut in half. This means that at extremely high altitudes (the heights of some of the world's taller mountains), where it is very cold, the air cannot hold anywhere near as much moisture as it can at lower altitudes. Why then are mountains often areas of increased precipitation? This is because they force air to rise, and as air rises it cools and as it cools it can't hold as much water vapor as it could when it was warm, and so it lets some of the water go in the form of clouds and rain or snow.

Now we are ready to put all this information to use in searching for places that will have harsh weather. Definitions of harsh may vary, but for use here we'll say it's weather that most challenges man's ability to survive even a short time with inadequate protection. A desert is only harsh in the long run if you don't carry water. A 150 mile an hour wind blowing 10 below zero air at you can do you in much faster; it is thus more harsh.

Since temperature decreases with increasing height, mountains should have harsher weather than lowlands. Many of North America's major mountains are shown on the map. The ones in the west are so much higher than the ones in the east that they would seem to be in a different league. However, since the eastern parts of the continent are very much colder than the western part at the same altitude, this factor goes a long way toward equalizing the temperatures. If the western mountains weren't over 10,000 feet high, they would be out of the running already. The average January temperature in Seattle, Washington, is 42 degrees, while in Portland, Maine, it is 22. Using an average temperature drop of 4 degrees F per thousand feet, a mountain in the far west would have to be 5,000 feet higher than one in the east to have comparable January temperatures. This is a firm demonstration of the warming influence of the Pacific on the west coast in winter.

But cold alone does not make the weather harsh. Where will the weather be stormiest, and where will the storm grow the fastest? Since the eastern part of North America is very cold and the offshore waters are relatively warm, there is a natural area for storm development along the east coast. Storms from the Pacific typically weaken as they move inland; east coast storms frequently experience their



Sketch map of North America showing principal mountains, the average location of the atmospheric jet stream in winter, and the primary ocean currents affecting the continent. A current is named warm or cold by its temperature compared to what would be the case if the current was not there. The jet stream is the band of fastest winds in the part of the upper atmosphere that most determines which way weather systems will travel.

fastest growth adjacent to the New England coast. Since Mt. Washington is farther north and closer to the area of strong storm development than Mt. Mitchell, we will drop the latter from our list of candidates. Cirque Mountain in Newfoundland would appear a viable candidate because it is so far north, but its storminess does not match Mount Washington's. By the time storms reach the latitude of Cirque Mountain, they are often weaker than they are to the south. This is not to say the weather on Cirque is not harsh; it obviously must be. However, there are likely many times when Mount Washington has weather that is worse, such as during the passage of strongly developing storms.

Returning to the west, we can eliminate Mt. Elbert because it is too far inland to have the type of severe storms prevalent over the Pacific or along the east coast. Mt. Whitney is south of the main storm belt in winter and is thus eliminated. Mt. Rainer does have harsh weather and so much snow there is a glacier. However, storms do weaken a bit from their mid-Pacific strength and so their intensity may be no greater than that of storms affecting our hero. Mt. Logan and Mt. McKinley are so high, the air cannot possibly carry the volume of moisture that it can to Mt. Washington. To be sure, it gets windy on both of those mountains, but they are not as close to the main storm track or storm development region as Mt. Washington is. Besides, no one lives there!

So, you see, Mt. Washington indeed does have some of the continent's harshest weather, and for sound meteorological reasons. It is not always harshest, and it is certainly not the coldest place, but the notion and legend of its severe climate is surely not just another hollow line for a tourist brochure. □

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Though some must be viewed as circumstantial,
The weight of the evidence is substantial;
That on the highest of any Presidential;
Harsh bitter weather is residential. □

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Elliot Abrams is Senior Vice-President of Accu-Weather, Inc., State College, Pennsylvania. The firm employs 31 full-time professional meteorologists and serves over 70 radio and television stations from New England to California. Accu-Weather forecasts for many of the New England's ski areas and for hundreds of government units around the country to help in their snow-fighting efforts.

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