Summer 2019 Vol. 60 No. 2

WINDswept

The Bulletin of the Mount Washington Observatory

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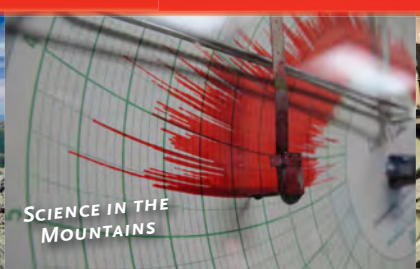

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MOUNT WASHINGTON OBSERVATORY

WINDswept

The Mount Washington Observatory is a private, non-profit scientific and educational institution organized under the laws of the State of New Hampshire. Its mission is to advance understanding of the natural systems that create the Earth's weather and climate, by maintaining its mountaintop weather station, conducting research and educational programs and interpreting the heritage of the Mount Washington region.

Membership in the Observatory is open to all. Members receive: an annual subscription to *Windswept: The Bulletin of the Mount Washington Observatory;* a 20 percent purchase discount at Observatory shops; Observatory tours; free admission to more than 300 science centers through ASTC Passport Program; free admission to Extreme Mount Washington; exclusive content on MountWashington.org; and an opportunity to be an Observatory volunteer. Members are encouraged to help support the Observatory, attend its Annual Meetings and visit the Observatory, Extreme Mount Washington and Weather Discovery Center in North Conway.

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Table of Contents

FEATURES

NEWS

EDUCATION

WEATHER

DEPARTMENTS

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Winds Enjoying Spotlight

Windswept *Editor Marty Basch*

BY **MARTY BASCH,** EDITOR

The wind has always had its way on the Mount Washington summit and clearly enjoys being in the spotlight. In February, a 171 mile per hour blast entered into the record books as being one of the Top 10 highest winds ever recorded on the mountain. Just a few weeks later, a standing-room only crowd packed the Weather Discovery Center to commemorate the 85th anniversary of the record 231 mph gust that shook not only a chained wooden structure on the summit but the world. It was another victory lap for the summit's legendary wind.

Even before that big blast, the wind was playing havoc with early Mount Washington explorers. Nearly 150 years ago, the expedition that led the way to summit weather research had its own wind demons, braving roars in excess of 100 mph and sub-zero temperatures. Always good reading, we present a condensed excerpt about the quest from Laura and Guy Waterman's "Forest and Crag: A History of Hiking, Trail Blazing, and Adventure in the Northeast Mountains," that was re-issued in March as a 30th anniversary edition. Curator Peter Crane provides insight in his introduction in these pages.

Winds of change also blow across the mountain. The Board of Trustees recently learned that Jack Middleton was stepping down as Secretary of the Observatory after more than 60 years of service. Middleton has something of a lifetime association with the Observatory and the mountain with positions from hut caretaker to Observer to Board member. Don't worry, he'll still be affiliated with the Observatory as you'll learn in the piece written by Trustee Rob Kirsch.

Now, who knows what the winds will be doing during Seek the Peak, July 19-20, but you know everyone will be talking about it. Or hiking in it. And definitely being touched by it. Outreach Coordinator Will Broussard has a keen eye for what blows in the wind. He's put together some suggestions on what to look for while hiking Mount Washington and other northern peaks this summer like flora, fauna, clouds and more. Sounds like a howling good time.

Ramping Up for A Productive Summer

Executive Director Sharon Schilling

BY **SHARON SCHILLING,**
EXECUTIVE DIRECTOR

It was a seriously long winter. At one point in April, my husband stood at our glass doors, looked across our property toward the mountains and in a voice that distinctly sounded like Eeyore from Winnie the Pooh, muttered "seven months." He was referring to the number of months we had been getting snow. He was tired of it. Tired of pushing it around, moving it, blowing it, sanding it and salting it—just simply tired of it. It felt like spring and summer would never get here and we wouldn't see green for a very long time. And then, just as it always does... it happened. The season changed, the snow melted and spring arrived. It happens every year, and for the Observatory it marks the quiet before the summer hubbub.

Our hubbub began in April when we marked the anniversary of the "Big Wind" with a big turnout. Over one hundred people came to hear the presentation by Director of Research Dr. Eric Kelsey and Weather Observer/ Research Specialist Taylor Regan. Eric and Taylor walked us through the what, who, why and how of recording an epic 231 mile per hour wind and then validating it so people would believe it. The presentation was made even more special due to the attendance of Observer Sal Pagliuca's son, Albert Salvatore and Observer Wendell Stephenson's son, Donald Stephenson. We celebrated their fathers' vital contributions by presenting them with an Observatory challenge coin called the "President's 6310 coin" (you will have to ask me the meaning of 6310) and then we had cake! What a really great day and so much fun to see so many turn out for the event. Thank you to all those who attended.

In the previous edition of *Windswept*, I wrote about working on the operational sub plans to our Strategic Plan. The department leads have finished their inputs, it has been compiled and now we are paring it back as it was overly ambitious. We seek something unified and simpler, but know that it is easier to get there from a very robust plan. I would expect that by the time you read this we will have it ready for public distribution. It provides the backbone to focus and guide our efforts over the next handful of years.

As part of constantly looking internally to be as efficient and productive as possible, we put our organizational structure to a review and have developed a new chart that streamlines

efforts and allows me to focus outward on relationships, business opportunities and most of all fundraising. As a result, my title has gone back to being that of Executive Director and the day-to-day operations of the organization will fall under two Directors, one for Science and Education and the other for Finance and Administration. There will be some title changes beneath that, but no elimination of positions. The efforts of our current staff are all very vital and necessary. Additionally, by the time you read this, we will have a Summit Operations Manager and will have added an Executive Coordinator to support our efforts. I look forward to introducing them to you this summer!

As part of constantly looking internally to be as efficient and productive as possible, we put our organizational structure to a review and have developed a new chart that streamlines efforts and allows me to focus outward on relationships, business opportunities and most of all fundraising.

Also coming up this summer:

Our Annual meeting was set for June 15 at the Weather Discovery Center in North Conway, so look for emails, newsletters and announcements regarding that. We scheduled a presentation as part of that meeting followed by a nature walk/hike.

This summer we kick off our 12th year of Science in the Mountains. Our presentations this time will include topics dealing with bees, "The Summer That Never Was" and one I'm particularly excited about, is having the inimitable Marty Engstrom visit and regale us with pictures and stories of his 38 year career on the Rockpile.

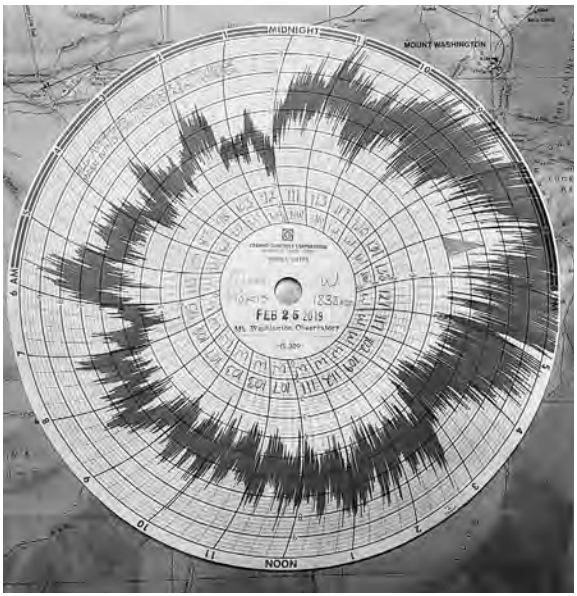
Our nineteenth Seek the Peak is on July 19-20. We already have fabulous prizes and will have Randy Propster from Backpacker magazine and the Get Out More Tour back again. Start fundraising now and compete for the Keys to the Castle, an overnight trip to the summit with your team and me. Even if you aren't hiking, come for the After Party. Hart's Turkey Farm does a fabulous job of catering a delicious turkey dinner (we have a vegetarian option too) and you can win some really great prizes, talk to Observers, listen to some fun music and just simply have a great time and support the Observatory.

So, enjoy your summer and I hope to see you at one of our events. If you happen to be in the neighborhood, I hope you will stop by and say hello.

February Gust Cracks Record Top 10

A February wind gust of 171 miles per hour became one of the windiest days on record on the Mount Washington summit.

The great gust at 6:35 p.m. on February 25 beat the previous February record of 166 mph set in 1972. It now ranks as the eighth windiest day recorded on the summit of Mount Washington, going by peak wind gusts, and sixth windiest day, going by 24-hour average.



The Hays Chart captured the historic 171 mph wind gust recorded on the summit in February.

In addition to the powerful blast the summit also experienced a 24-hour average at 110 mph with the highest hourly average being 138 mph. To give some perspective of the overall event, a category 4 hurricane has sustained winds at 130-156 mph.

"It was an incredible, slightly frightening experience to witness the power of this storm," said Weather Observer and Education Specialist Tom Padham. "This storm was on a different level than any I had experienced in my 6 years here. The windows vigorously flexed back and forth in their casings, the water in our plumbing was swishing back and forth. It was an experience I will never forget!"

Winds are recorded with a pitot tube anemometer, normally used to measure aircraft speed, but modified to accurately measure winds blowing by Mount Washington.

"We were fortunate enough to have not one but two working pitot anemometers for this storm," said Director of IT Keith Garrett "Our brand new next generation anemometer got a great first test, and held up extremely well during an incredible wind storm."

World Record Wind's 85th Anniversary Draws Crowd to WDC

An appreciative crowd packed the Weather Discovery Center in April to hear a special presentation about the day the record-breaking 231 mile per hour wind blew across the Mount Washington summit.

The day the "Big Wind" blew was April 12, 1934. On April 12, the Observatory held an 85th anniversary celebration that included an informative lecture by Director of Research Dr Eric Kelsey and Weather Observer and Research Specialist Taylor Regan, a free open house and four live video connections to the summit weather station with Weather Observers Adam Gill and Ian Bailey to find out what's going on in real time on the mountain.

The event brought out staffers, former staffers, Observatory members, board members and the general public from far flung locales like Florida and Quebec City.

Also attending were sons of two people who were on the mountain at the time— Sal Pagliuca and Wendell Stephenson. Donald Stephenson and Albert Salvatore (Pagliuca's son) received certificates honoring the work of their fathers as well as challenge coins from Observatory Executive Director Sharon Schilling.

Executive Director Sharon Schilling (r) presents certificates and challenge coins to Donald Stephenson (l) and Albert Salvatore (c) honoring the work their fathers did on the summit during that historic day.

The presentation called "The Story of the Big Wind" told what it was like to be on the

Weather Observer and Research Specialist Taylor Regan (l) and Director of Research Dr Eric Kelsey (r) gave a special presentation detailing the day the record wind blew across the Mount Washington summit on April 12, 1934.

mountaintop during the memorable event. On that day, two distinct gusts of 231 mph were recorded and as the afternoon wore on several gusts to 229 mph were recorded. Also, it was the highest wind speed measured on the earth's surface with an anemometer.

New Observer Joins Staff

Jay Broccolo

The Observatory recently welcomed Jay Broccolo as a new staff Observer.

The native Rhode Islander began his shift in March and was an internship program participant.

Broccolo was an Eagle Scout with a keen interest in the outdoors and weather. He graduated from the University of Rhode Island with a B.S. degree in Geology and Geological Oceanography.

After working offshore in the oilfield industries, he was an intern at Mt. Rainier National Park. Following that he attended the University of Leeds in England and completed an MRes in Climate and Atmospheric Science.

Climber Dies in Huntington Ravine

BY **PETER CRANE**

On Sunday, February 10, a Massachusetts man succumbed to injuries suffered in a fall in Mount Washington's Huntington Ravine.

Jeremy Ullmann, 37, of Somerville, had traveled to the mountain that day with a companion. His companion opted to hike up toward Lion Head; Ullmann decided to attempt a climb of Central Gully, a feature of Huntington Ravine.

Central Gully is typically considered one of the less difficult gullies in Huntington. Conditions vary greatly depending on the specifics of the snowpack, but at times, with favorable snow conditions and snow cover, the climb can be quite straightforward. At other times at least one ice bulge challenges the climber. No matter the conditions in the Gully, care is demanded, since a fall, if unchecked, could lead to a long and fast slide and a harsh landing in "The Fan," a boulder field at the base of the Ravine.

On the morning of February 10, U.S. Forest Service Snow Ranger Helon Hoffer's Avalanche Forecast noted that avalanche danger in the area was low. "Stable snowpack exists thanks to a warm and wet week followed by a bitter cold and windy weekend. Avalanche problems will be hard to find today and are greatly overshadowed by the potential for long sliding falls." He added, "The significance of a long, sliding fall and danger of a small stumble on seemingly benign terrain cannot be overstated. If you have not practiced self arrest with an ice axe you should. If you have practiced, you know that the effectiveness of this skill is limited in the hard icy snow you'll encounter in the mountains today. In these conditions, very careful movement is necessary to prevent a fall from happening in the first place."

At about 4:15 p.m., Ullmann's companion sought assistance at Pinkham Notch Visitor Center, stating that Ullmann was overdue. A search ensued, headed by the U.S. Forest Service, and including personnel from the Appalachian Mountain Club, Harvard Mountaineering Club, Mountain Rescue Service, and Androscoggin Valley Search and Rescue. Ullmann's lifeless body was found at about 7:45 p.m., among the boulders of the Fan.

While it is always difficult to determine the details of an unwitnessed accident, it appeared that Ullmann had fallen and slid, either while ascending or after he had commenced a descent. It seemed that he had not yet reached the ice bulge in Central Gully. Marks in the hard and icy snow, which in one report was called "boilerplate," suggested that he had tried to arrest his slide with an ice ax, but to no avail. Reports suggest that Ullmann was an experienced hiker and rock climber, but did not have much experience with the challenges of snow and ice climbing. Ullmann was a promising researcher, a neuroscientist working at Boston Children's Hospital. He left a wife and a three year old son, to whom we offer our condolences for such a tragedy.

Avalanche Claims Granite State Skier

BY **PETER CRANE**

On Thursday, April 11, a Campton, N.H. man was killed in an avalanche on Mount Washington.

Nicholas Benedix, 32, was unaccompanied and skiing down the Ravine of Raymond Cataract, located between Tuckerman Ravine and Huntington Ravine on the eastern flank of Mount Washington. The weather was fair on what many would consider an ideal day for spring skiing (the summit warmed to 24 degrees, winds for the day averaged 21 miles per hour, and there was 100 percent of possible sunshine for the day). Just after noon an avalanche occurred—the time determined by the Observatory webcam atop Wildcat Mountain—likely triggered by Benedix, and swept him down the Ravine. Due to the nature of the topography, with the avalanched snow sliding from a larger area to a smaller one, Benedix slid into what one U.S. Forest Service Snow Ranger later called a "terrain trap," where snow accumulated deeply due to funneling action.

Snow Ranger Frank Carus had been alerted to the possibility of a serious incident at about 1:30 p.m. A visitor on the Tuckerman Ravine Trail had noticed a crown line—indicating avalanche activity in the Ravine of Raymond Cataract—and mentioned it to Carus. Visiting the area, Carus noticed a set of ski tracks entering the area, but none leaving.

Carus commenced a beacon search, in the hopes that the skier was using an avalanche beacon, a device used to speed the locating of a buried victim. The beacon search bore fruit, with Benedix being located about three feet under the snow surface. While Benedix was breathing when found, which was at about 2:20 p.m. he soon went into cardiac arrest. Though CPR was initiated it was not successful; he succumbed to the avalanche, perhaps due to a perfect storm of trauma, hypothermia, and oxygen deprivation. (The skier had been buried for more than two hours; a rough rule of thumb is that a buried person's chance of survival drops to 50 percent after 30 minutes of burial.)

Earlier that day, Carus had issued an avalanche forecast which indicated moderate hazard. "Temperatures have continued to fall since yesterday resulting in a sketchy mix of wind scoured, bulletproof ice crust and fresh wind slabs. Areas that contain these wind slabs have moderate avalanche danger due to the possibility of a human triggered avalanche," he advised, and added, "Even a small avalanche can cause a significant problem today. A brief window of sunshine and warm temperatures may bring some softening this afternoon... the new wind slabs will weaken if and

when they warm today."

When considering avalanche hazard, some mountain travelers may misinterpret the meaning of "moderate avalanche danger," even to the point of saying danger is "only moderate." Moderate danger indicates that there are heightened avalanche conditions on specific terrain features; travelers are urged to evaluate snow and terrain carefully. While natural avalanches are considered unlikely in "moderate" conditions, human-triggered avalanches are well within the realm of possibility.

While use of an avalanche beacon is considered standard practice by thoughtful skiers and climbers in avalanche terrain—one element of the "Holy Trinity," as some call it, of beacon, shovel, and probe—the efficacy of a beacon depends on rapid location and clearing of a buried victim, which demands having a companion present (and not also buried). While the beacon search was in a limited sense "successful," the tragic outcome might have been avoided with a speedier rescue, which would depend on a companion (or fortuitous bystander) to begin a search immediately after the avalanche. Still, one must note that even with a rapid rescue from the snow, injuries sustained in an avalanche can be overwhelming.

Dating back to the 1950's, there have been at least a dozen other avalanche deaths on Mount Washington, involving skiers, climbers, and hikers.

Our condolences are extended to the family and friends of Nicholas Benedix.

Betty Gosselin, 1937-2019

Betty Gosselin

Betty Gosselin, daughter of Wallace and Olive Baker and adopted daughter of Walter and Ethel Austin, died March 13 after a long battle with chronic obstructive pulmonary disease. She was one of nine children born in Whitefield, N.H. and is survived by her husband, Guy, a daughter, Debbie Martin, of Rochester, N.Y., a son, Eustis and his wife Suzanne, of Merrimack, N.H., a son, Emil, of Marblehead, Mass., five grandchildren and three great-grandchildren plus two siblings, Theresa Carey, of Milford, N.H., and Mary Fogg, of Raymondville, Texas, and several nieces and nephews.

Betty overcame a difficult childhood to become a strong voice for women's rights and against domestic violence and child abuse. She received a bachelor's degree from the College for Lifelong Learning and earned a master's degree in Social Work from Boston University. She interned for Coos County Mental Health, served as local Director of the WIC program and became a Response program volunteer. After Joe Dodge died, she opened her home to the Mount Washington Observatory when it had no valley office and was for several years Membership Secretary and later Administrative Assistant.

Betty was elected for three terms to the Gorham School Board which she eventually chaired. She was at the forefront of promoting better understanding and treatment for dyslexia. She was known locally for her interest in companion medicine, especially the energy therapy of Reiki and the Emotional Freedom Technique (EFT). She was a Master in Reiki and trained many others.

She volunteered for many local programs and non-profit organizations and was involved in the formation of the Gorham Historical Society. She was, for several years, the driving force behind the collection of bicycles for Bikes Not Bombs, an organization that repairs and distributes bicycles internationally and was a Red Hat Society member.

Betty stressed the positive even during her struggle with COPD. She had a personality and attitude that was inspirational to her family and her many friends.
A memorial service will be held on July 13 at the labyrinth behind 3 Washington St. in Gorham at 11 a.m. Anyone wishing to attend should contact Suzanne Gosselin at 603-424-0739, or at mmgosselin@netscape.net. Contributions in her memory can be made to RESPONSE c/o Coos County Family Health, Berlin NH 03570, or to the Mount Washington Observatory.

Give Me More Cat Tunes

TRANSLATED BY
JAY BROCCOLO

Greetings from another paw-some windy night at the Observatory!

You have cat to be kitten me. It is paws-itively windy outside, again! I feel like it has been windy fur-ever. It has been quite the radical winter on the meowtain with gusts pushing over 100 mph every few days. I am surprised there has not been a cat-astrophe with such powerful gusts, other than losing part of a roof and some damage to a couple of instruments. Other than that, I have not spent much time up in the weather room, which has left me a bit purr-plexed. I like to sit on the computer desk and keep an eye on the mouse for the Observers, but I guess they are trying to keep the humidity in. Although, I was going up there and listening to all the Coachella mew-sic from that annual festival in Cat-ifornia. I must say though, I purr-ceive this new aged mew-sic to be in-fur-ior to my favorites like, Cat Stevens, Paw McCartney, Cat Benatar and Bing Clawsby. I have never heard of Meowly Cyrus or Kitty Purry, but they were not completely a-paw-ling.

Anyway, I am waiting for someone to paint a paw-trait of myself this summer. That way, I can be a part of the meowtain's history. Speaking of summer, I really look fur-ward to it. Why? So I can have some mice krispies and mice cream. As much as I loved winter, I think I am developing a bit of a cat-titude. Having said that, this feline is ready to B-line for summer!

Live long and paws-purr.

Natural Curiosities of the White Mountains Abound During Seek the Peak

BY **WILL BROUSSARD**

While seeking your peak this July keep an eye to the comings and goings of the world around you; the scurrying in the woods, the buzzing in the skies. In this feature I chose ten representatives of our natural world, a veritable *Wunderkammer* or cabinet of curiosities to help tell the story of our Northern landscape. From the chattering squirrels to the passing clouds, take part in your environment this summer by looking and listening carefully.

Red squirrels have a diet including acorns, hazelnuts, beech nuts, berries and fruits. Photos by Will Broussard.

Red squirrels (*Tamiasciurus hudsonicus*) are a common feature in the Northern landscape. Listen for their chattering. Notice their sign; shredded evergreen cones in piles. In fact, their Latin name *Tamiasciurus* refers to their well-documented hoarding habits. Red squirrels have a large diet which includes acorns, hazelnuts, beech nuts, berries and fruits, along with bird eggs and even young mice and rabbits. In fall they can be found drying mushrooms on tree branches and in spring are known to strip maple bark for sap. When out and about be on alert for the silky and elusive American marten (*Martes americana*), a medium-sized member of the weasel family. This slinky omnivore is at home in our high elevation evergreen forests where it spends its time hunting and foraging for mice, voles, red squirrels, and snowshoe hare. In summer, its' diet expands to include fruits of the *Ericaceae* or Heath family of plants, where it has been known to play an important role in their seed distribution. In winter, their large foot pads allow for fast travel on snowpack while their slender frame allows them to move easily through subnivean burrows on patrol for rodents. When tracking red squirrels this summer be mindful of the American marten lurking in the shadows nearby.

The Madison Boulder is a prime example of a glacial erratic.

Transported from rocky parent material ten thousand years ago, erratic boulders tell us about the power of frozen water to move large objects. Glacial history is rich here in New England and the White Mountains. High above Route 16 in Pinkham Notch sits the Glen Boulder, a 16-foot-tall by 12-foot-long rock perched along the aptly named Glen Boulder Trail. Across the notch near the summit of Mount Moriah sits another large boulder, and we cannot mention New Hampshire boulders without mentioning the mother of them all—Madison Boulder, the largest in North America which stands 23 feet tall, 83 feet long and 37 feet wide. With an estimated weight of 5,000 tons, this curiosity is definitely worth a visit. Though known as the Granite State, less than half of New Hampshire's bedrock is made of this igneous rock. Much of the Presidential Range, including Mount Washington, is made up of schist, a metamorphic rock formed of multiple layers of different minerals squeezed together over time. As you hike the White Mountains, chances are you will walk over many different kinds of this rock, including schists containing the shiny, platy mineral mica formed through immense pressure over time. The story of New Hampshire's geological past is one of numerous, great collisions of Earth's crust over 500 million years, and we can see some of that history as we walk along the footpaths of the White Mountains.

Basic knowledge of cloud shape and size, especially in the warmer months, can impart valuable knowledge. Two mid-level cloud types we can find here in the White Mountains, altocumulus castellanus and altocumulus lenticularis can tell us a lot about the state of the atmosphere and whether or not we should delay our plans. Castellanus clouds, so named for their resemblance to castles or turrets, signal the presence of an unstable atmosphere and the

Lenticular clouds resemble UFOs.

possibility of dangerous thunderstorms later in the day. Lenticular clouds, on the other hand, indicate the presence of relatively stable but moist air in the region. These stationary, UFO-shaped clouds form above or downwind of mountain ranges where air is forced to rise, forming standing waves. Lenticular clouds are favored by glider pilots who use their updrafts to ascend to heights of 50,000 feet or more.

One of the most unique but overlooked animals in the Northern Forest is the spruce grouse (*Falcipennis canadensis*), a slow-going, slate gray denizen of evergreen forests and spruce bogs. This chicken-like bird is equally at home on the ground and in trees, where it forages for spruce and pine needles, buds, berries and insects. This may be the tamest creature you can come across as it is more likely to freeze in place than flush when approached. As far as birds go, the chunky spruce grouse could not be more different from the diminutive and mouse-like winter wren (*Troglodytes hiemalis*) a songbird of mixed deciduous and evergreen forests. Speckled and barred with various hues of brown, winter wrens forage for insects on the forest floor with their tail cocked skyward, quickly hopping along all the while. Listen for its unique song while hiking; a rapid series of trills and bell-like notes lasting between 5 and 10 seconds.

Turning to our final pair of curiosities, I direct you to the American mountain-ash (*Sorbus americana)* and red trillium (*Trillium erectum*). Differing in size by several factors, the mountain-ash is a small to medium-sized perennial tree while the red trillium is a 1-foot-tall spring ephemeral wildflower. Both can be found throughout the White Mountains and Northern Forest, with the mountain-ash preferring high elevation forests and swamps and red trillium preferring interior floodplain and mid-elevation forests. The brilliant red fruit clusters of the mountain-ash provide food for migratory birds while the flowers of the red trillium release an odor that attracts carrion flies and beetles for pollination, giving this species its alternate name, "Stinking Benjamin." Both plants are common sights along the trails of the Northern Woods.

Outreach Coordinator Will Broussard is an avid bird watcher.

Shift Change at the Top

BY **ROB KIRSCH**

Jack Middleton

The Mount Washington Observatory has grown and flourished, due, in part, to its rock-solid institutional and geologic foundations. Since its inception, the Observatory has benefitted from the support and guidance of a dedicated core of volunteers, including its Trustees. Those individuals, drawn from a variety of backgrounds, communities and professions, are united in their interest in Mount Washington and their support for the Observatory's mission. The day-to-day management of the Board affairs is the responsibility of its President, Vice President, Treasurer and Secretary. The Observatory has been particularly fortunate, because since 1957, it has had the same individual serving in the capacity of Secretary and Executive Committee member. This spring, with gratitude, deep appreciation, and a wistful sense of regret, the Board of Trustees learned that Jack Middleton decided to step down from his position after serving more than 60 years as Secretary.

Jack's involvement with Mount Washington has spanned his entire adult life. After growing up near Philadelphia, he graduated from Lafayette College in 1950. Following his honorable discharge from the Marine Corps, Sargent Middleton arrived at the Appalachian Mountain Club's Pinkham Notch Camp in 1952. Joe Dodge sent Jack into Tuckerman Ravine, where he worked as the caretaker at the AMC's warming hut affectionately known as Ho Jo's. It was during that time he began his life-long relationship with Mount Washington and the Observatory.

In 1952 and 1953, Jack served as an Observer. It would be an auspicious start. Among his shift mates were Willie Hastings, who would go on to become a legendary officer with the state Fish and Game Service, and Bruce Sloat, who would be recognized as a North Country visionary. While Jack's involvement as a summit employee was brief, during this time he met and married Ann Dodge Middleton, essentially investing his DNA with that of Mount Washington and the Observatory. Naturally, Ann and Jack adopted the Observatory as part of their family, a tradition that promises to endure, since their son Peter also joined the Board of Trustees years ago.

Jack briefly left the Observatory in 1953 to attend law school at Boston University. He returned to New Hampshire

in 1956, becoming the tenth lawyer to join the office of the McLane Law Firm, today known as McLane Middleton which hosts more than 100 lawyers. In 1957, responding favorably to the request of trustees who recognized his potential, Jack assumed the role of corporate Secretary of the Observatory. Except for his recent two-year term as President, Jack has held the Secretary role ever since.

Even limiting our discussion to the Observatory and the greater Mount Washington community, it is not possible in this short article to do justice to the roles Jack has filled or the contributions he has made over the past 60-plus years. He is the sole surviving member of the original Mount Washington Commission, originally chaired by former Governor Sherman Adams, which crafted the long-term vision for the summit that we see playing out today. In addition to the Observatory, he has represented most entities associated or involved with Mount Washington, including the Mount Washington Summit Road Company, and the Cog Railway. Jack has traveled throughout the country to support and promote the Observatory and Mount Washington.

Jack is and always has been a reliable supporter of the Observatory. He has been sought out and has served on innumerable civic and charitable organizations during his career. Indeed, many say the list of New Hampshire organizations that Jack has not served on is shorter than that listing where he has served. However, throughout his life, as he and Ann built their home and family, as Jack developed his career and grew his firm, and as he

Jack and Ann Middleton

served on scores of civic and charitable roles, there was one constant—Jack Middleton was the Observatory's Secretary and an Executive Committee member of the Board of Trustees.

As a token of our recognition on his service and achievements, in 2018 the weather room at the summit Observatory was dedicated as the Jack B. Middleton Weather Room. In June, Jack surrendered the corporate seal to Paul Fitzgerald, who picked up the role of Secretary.

Fortunately, while he no longer will be the one taking the minutes of every board meeting, Jack will continue to serve as a Trustee, so the Observatory will continue to benefit from his advice and institutional memory.

Thank you, Jack.

Trustee Rob Kirsch is a partner in the law firm of Wilmer Cutler Pickering Hale and Dorr LLP in Boston.

Huntington-Hitchcock Expedition Led Way to Summit Research

BY **LAURA AND GUY WATERMAN**
WITH INTRODUCTION BY **PETER CRANE**

The Observatory is only one year away from a momentous occasion—the 150th anniversary of the Huntington-Hitchcock expedition, the bold scientific endeavor that, for the first time, occupied the summit of Mount Washington in winter. This 1870-1871 achievement led the way for other such projects which followed—the installation of the U.S. Army Signal Service on the summit from 1871 to 1892, the "re-occupation" of the summit by the Mount Washington weather station crew in the winter of 1932-1933, and the continuation of that effort to the present in today's Observatory.

To prepare for a celebration of the landmark event, we present a condensed excerpt from "Forest and Crag: A History of Hiking, Trail Blazing, and Adventure in the Northeast Mountains" by Laura and Guy Waterman. Originally published in 1989, the book was recently reissued by the State University of New York Press. It is noteworthy that the Watermans, who focused on recreational pursuits in the mountains of the region, felt compelled to acknowledge the contribution of such a scientific accomplishment to mountain exploration and the experience of the Northeastern wilds.

Amos Clough

Joshua Henry Huntington

Charles H. Hitchcock

As the winter of 1870-71 approached, Joshua Henry Huntington and Amos Clough, with the full support of Charles H. Hitchcock, were bursting to take on Mount Washington. But though spirits were willing, lack of funding remained an apparently insuperable problem, until at the last moment a curious figure stepped forward. In July of that summer, one S.A. Nelson of Georgetown, Massachusetts, approached Hitchcock, asking to join the summit party for the winter. Hitchcock was understandably cool toward this inexperienced volunteer. As the autumn dragged on, with no money in sight for the

project, Nelson added to his persistent requests that he might be able to raise five hundred dollars. Upon hearing this, Hitchcock promptly sent him a formal invitation. When Nelson joined the mountain team, he came to stay as a dependable and resourceful team member.

In the course of the fund-raising efforts, Hitchcock had pricked the interest of the War Department's newly created "Bureau of Telegrams and Reports for the Benefit of Commerce," an Army unit concerned with weather observation and forecasting. (That phrase "for the benefit of commerce," a bureaucratic rationale for the Army's involvement in weather observation, was to become an ironic slogan for the Mount Washington team.) The Army sent no money, but agreed to supply an observer and 3 miles of telegraphic wire, all of which proved to be of great value. In early December Sgt. Theodore Smith arrived, becoming the fourth member of the summit team.

One other individual became involved. Howard A. Kimball, a Concord, New Hampshire, photographer, signed on as an alternate to Clough. The two worked together smoothly, one or the other being on the summit most of the winter.

The mountain did not fail to show them its best—or worst. Even before they moved in, as the group prepared the interior of the small building erected for their use, an October storm of wind and driving rain brought excitement. As the battering increased, Huntington saw the door start to give and began to think fast about what they would need to do should it blow in.

"In the next moment...in it came. The boards and planks lying about in the building, were thrown in every direction, I never saw boards move about so lively, they seemed to have lost their weight. I knew they were heavy enough the other day, when I put them in the building. We tried to put the door in place, but with all our efforts we could not get it near the doorway; ...We put the door against the side of the building and tried to push it along, but when about six inches of it became exposed, in it came again."

They finally nailed a board to the floor inside the door, bracing a plank against that to hold the door in place—nailing themselves in until the storm passed.

Finally on November 12, 1870, Huntington moved in, his thirteen-year ambition realized. After eighteen days alone, he was joined by Clough and Kimball on November 30, by Smith and Nelson shortly thereafter.

On their first thirty days on the mountain, the photographers enjoyed but three on which conditions permitted work outside. On December 15, the temperature was –15 degrees, with winds clocked at 92 mph, they did not dare to try measuring at the peak of the gale. This was the first test of the new building, and the men realistically were not certain it would stand the pounding of the Presidential wind. They took the precaution of putting hardtack in their pockets and "had axe and saw handy to cut their way out if needed." It should be more than casually noted what this action implied: had their shelter been destroyed in those conditions and at night, they could not fail to be sensible of the consequences. They were in

Measuring the wind is always a formidable task on the mountain.

a true life-threatening situation. Yet Sergeant Smith shouted to the others above the roar of the storm that "if we were blown down into Tuckerman Ravine, it would be for the 'benefit of commerce,' and so, of course, all right."

Except for the hint provided to Huntington and Clough on Mount Moosilauke the winter before, this was the first time that people had experienced firsthand the full fury of Mount Washington's winter storms.

During a storm on February 4 and 5, winds of more than 100 mph rattled the building. Wrote Nelson in his journal: "We shout across the room to be heard.....Everything movable is on the move. Books drop from the shelves, we pick them up, replace them only to do it again and again." After two days of this, the men gathered at breakfast to talk over the experience, "recalling many laughable incidents, and agreeing that we rather enjoyed the night's experience than otherwise, that it was a sublime affair...but all things considered, were unanimous in the opinion that once a fortnight was quite enough for such grand displays of the storm-king's power."

A cheerful sangfroid was the style that winter. On January 23, Nelson's journal reads: "Temperature tonight ten P.M. –40 degrees; a changeable climate this." At midnight of the February storm, the wind exceeding 100 mph, he wrote, "Really there is quite a breeze just now."

Members of the expedition pass the time on the summit.

Huntington observed, "It is sometimes difficult to be perfectly cool, particularly when the thermometer gets below –40, as the chances of escape are very small should the house be crushed. But in general it only furnishes excitement enough to keep off the ennui incident to an isolated life."

Life wasn't all hard work and storms. For good weather spells, Huntington and Smith worked out a sled ride on the northeast shoulder of the mountain about a mile long. Once when Huntington raised a flag on the summit at the request of a party from Littleton, Smith and Nelson got together and formed the "Republic of Washington....We only lack three things to make our new government a success: a national debt, internal revenue, and two custom houses, one on the carriage road and the other on the railway."

Huntington loved the mountains in their fury. "Mountains without clouds are spiritless and tame," he wrote. "Whether we watch the storm as it approaches, or feel its force as it breaks in all its fury on the summit, there is grandeur and sublimity in these manifestations that fills the mind with awe and wonder." He was equally touched by the tender beauties to be seen. Frequently he called the others out of bed for a beautiful sunrise.

The first long winter on Mount Washington wound down reluctantly. As late as May 7 and 8, a furious snowstorm, with winds of 90 mph, dumped almost 3 feet of new snow at treeline and kept the summit crew trapped for two days. But that was winter's last blast. On Sunday, May 14, with Sergeant Smith and the photographers already departed, Huntington walked out of the observatory at 9 a.m. to descend the mountain for the last time of that

long winter. The mountain gods paid their final tribute to this kindred spirit, escorting him down with winds of 48 mph and temperatures of 14 degrees. Nelson worried about the bad conditions but knew Professor well enough not to stop him. Nelson then lingered on to savor the summit solitude for a few days.

From a mountaineering standpoint, the occupation of Washington during winter and repeated ascents by the observers under diverse conditions was a tour de force. By comparison, polar exploration was in its infancy. This was almost twenty years before Fridtjof Nansen crossed the Greenland ice cap, an event sometimes taken as the kickoff of serious Arctic-Antarctic work. The race for the poles was not to come until the 1890's and later. The winter weather experienced by Huntington and his friends on Moosilauke and Washington was something that only the native peoples of the far north and a handful of Arctic pioneers had ever seen.

For raw guts and determination, the exploits of Huntington and his mates deserve to be ranked not far below the polar expeditions of the next generation—of Peary, Amundsen, Scott, and Shackleton. If that assessment is fair, it is interesting to note how little known is the name of Huntington, much less those of Clough, Nelson, and Smith; probably not one in fifty of today's ice climbers in the ravine that bears his name could identify Joshua Henry Huntington.

Summer Ripe with Learning Opportunities

BY **BRIAN FITZGERALD**

Looking toward sunset during an overnight EduTrip in summer of 2018.

In the brief months that Mount Washington becomes accessible by road, train or foot, hundreds of thousands of visitors will learn about the mountain when they travel to the summit, take a weather station tour, visit the Extreme Mount Washington museum or the Weather Discovery Center in North Conway.

This summer the Observatory's education team will bring back a wide range of learning opportunities while adding programs for the general public and teachers, including Summer Overnight EduTrips and the Science in the Mountains Lecture Series. For our overnight EduTrip guests, the "Science of Thunderstorms" topic is back after a warm reception. We've introduced a brand new topic, "The Science of Hurricanes and Cyclones" that will delve into the building blocks of hurricanes and their rare but devastating impacts in the Northeast and on Mount Washington.

One of the most enjoyable programs to develop is the speakers and topics for our 12th annual Science in the Mountains lecture series. This free public lecture series takes place on Wednesday evenings in July and August at the Weather Discovery Center and we're

excited to share a new program developed by Outreach Coordinator Will Broussard, "Mount Tambora and the Year Without a Summer," which highlights the incredible power of volcanoes and their impacts on the Earth's climate system. See the entire SITM schedule on page 46.

Speaking of climate, the education team has been fortunate to take part in the Northeast Climate Change Education Collaborative over the last year. This group composed of educators from an array of non-profit, state and federal organizations across Northern New England looks to improve the way we teach about climate change. The Observatory has benefited from participating with the group by sharing our own expertise and resources while learning about innovative ways to teach such a complex topic to a broad audience.

Finally, in that vein we are excited to offer a special Summer Overnight EduTrip for teachers on August 24-25 called "Climate Change in the NGSS Classroom," which will give K-12 educators ways to connect Mount Washington climate data to classroom activities linked to the Next Generation Science Standards. In the long term, the Observatory has a tremendous opportunity to help students and the general public learn about the science and impacts of climate change using local data from Mount Washington.

A nearly full-house enjoy a Science in the Mountains presentation from former Observers Jeff DeRosa (r) and Michael Finnegan (l).

3:55 PM Fri. Dec 7

Working on the summit can lead to a sedentary lifestyle if you let it, especially in winter. In summer, it's easier to stay in shape.

During the summer, I try and get outside for a few hours each day when the weather is nice. Most of the time, I will go for a small hike after I finish my shift, or if the weather is bad, a run down the Auto Road after it is closed for the day. There are a few rocks around the summit cone that are a perfect height to do some box drills as well. If the weather is really bad, I usually will stay inside and do some basic exercises or take a rest day.

Winter is more complicated. Many of the workouts are inside. Living up here in the winter is more physical too as we need to go up the tower almost every hour whenever we see rime ice. The stairs up the tower is about 50 feet from the weather room with several rungs. After 12 hours of going up and down sometimes multiple times an hour, it can get exhausting. Plus, outside you are battling the winds and using a crowbar to get the ice off of the instruments.

The next big thing is shoveling. We have 4 doors that we need to keep as snow free as possible so if there is a big snowstorm, we could spend 2-3 hours shoveling in a single day.

We also we have an exercise bike and a few weights. When the building is closed, I will go for runs around the building and the public area since there are fewer tables and chairs. Running in the building gets boring fast so an audio book or good music is necessary to stave of the boredom. If you get

into a good rhythm, 30-45 minutes of running is possible.

It is good to do these exercises on a daily basis up here. It makes the physical parts of the job much easier and sometimes I will look forward to shoveling snow if it is a nice day with no wind.

—Adam Gill, Weather Observer/IT Specialist

3:41 PM Sat. Jan. 26

Each year, the American Meteorological Society hosts a conference, bringing together folks on the forefront of scientific discovery, as well as their research. It is an event that hosts thousands of like-minded scientists and weather enthusiasts, and results in providing real-time peer-to-peer feedback on some of the most innovative and novel applications of science as we currently understand it. The conference also provides resources for a variety of educational panels, short-course workshops, and a massive meeting of companies either well established, or entrepreneurial, each seeking to facilitate and advance scientific discovery and observation. Basically, it's an awesome resource, and this year, I got to go with Director of Research, Dr. Eric Kelsey.

For someone interested in weather, the flight in to Phoenix was perfect. I was treated to clear skies and got to see snow swaths painted across the Plains as well as the effects of river valleys and sunshine on a thin snowpack.

During the conference which saw dozens of students stopping by our table to learn about the unique weather and career opportunities the Observatory offers, I took part in an all-day "short-course" offering instruction and unique perspectives on the capabilities of Python and associated packages for performing machine learning and deep learning on atmospheric science data. After the short course, it was back to the career fair, and then over to the student posters. It was extremely exciting to see former interns Sarah Thunberg and Simon Wachholz each presenting their posters on research they undertook while interning on the summit!

I also went to some lectures, with so many concurrent sessions offering unbridled opportunities to sit in on some of the most intriguing research endeavors in atmospheric science and beyond.

Truthfully, I wanted to be in about six places at once all throughout the conference. There was so much insight offered that it was hard to choose where to spend my time! That said, I am very fortunate that I was able to attend. I learned so much and now have a whole host of new ideas on how the Observatory can extend its' research, observation, and education branches into the future.

—Taylor Regan, Weather Observer & Research Specialist

9:14 AM Fri. Feb. 22

I get a lot of questions about the Observatory and Mount Washington so I decided I would address a few:

Q: Is Mount Washington the coldest place in the lower 48?

On any given day, Mount Washington may be the coldest inhabited place in the lower 48, but there are several high-elevation towns in the western U.S. or northern plains that frequently see more extreme cold than Mount Washington. Mount Washington's average annual temperature of 28°F is more similar to the sub-arctic, but during the winter season we do not see extreme arctic (or Antarctic) cold. Our record low of -47°F pales in comparison to Alaska (-80°F) or the incredible -129°F record of Antarctica! Factoring in our winds we do see some pretty incredible wind chill values, sometimes exceeding -100°F.

Q: Is the Observatory a part of the National Weather Service?

The Observatory is a nonprofit organization that has operated a weather station on top of Mount Washington since 1932. Our focus is on weather observation, education, and research. We do submit our data to the National Weather Service each hour, and receive a small stipend for this service, but the majority of our support comes from thousands of people across the country interested in the work we do.

Q: What sort of research does the Observatory do?

The summit of Mount Washington is a great natural laboratory, and over the years we've tested the limits of all sorts of things. During the 1940s and 1950s airplane jet engines were tested on the summit to see how they handled the frequent icing conditions we see here. We've tested weather instrumentation, clothing, camping gear, even paint!

—Thomas Padham, Weather Observer & Education Specialist

6:01 AM Tues. March 12

Wildlife is a part of the Mount Washington summit. Winter wildlife is limited. The most common being the ravens. I've also seen scampering rogue rodents and sometimes a red fox.

In summer, wildlife returns with small and skittish birds—some with wonderful songs heard on calm mornings—being the most common like slate-colored juncos, white-throated sparrows, magnolia warblers, yellow-rumped warblers, and yellow-bellied sapsuckers.

Rodents (small mammals) are the next most common visitors. Deer mice and voles tend to be most common but chipmunks, red squirrels, gray squirrels, and flying squirrels scamper on the rocks, especially early and late in the day.

Then there are the larger mammals. The most common? You and me. Humans! Other mammals include red foxes, black bears, raccoons, weasels, a pine marten, a moose, a bobcat, a porcupine, a skunk, and a beaver. These are the ones I've seen in my 13-plus years on the summit.

—Ryan Knapp, Weather Observer & Staff Meteorologist

Winter's Record Winds

BY **TOM PADHAM**

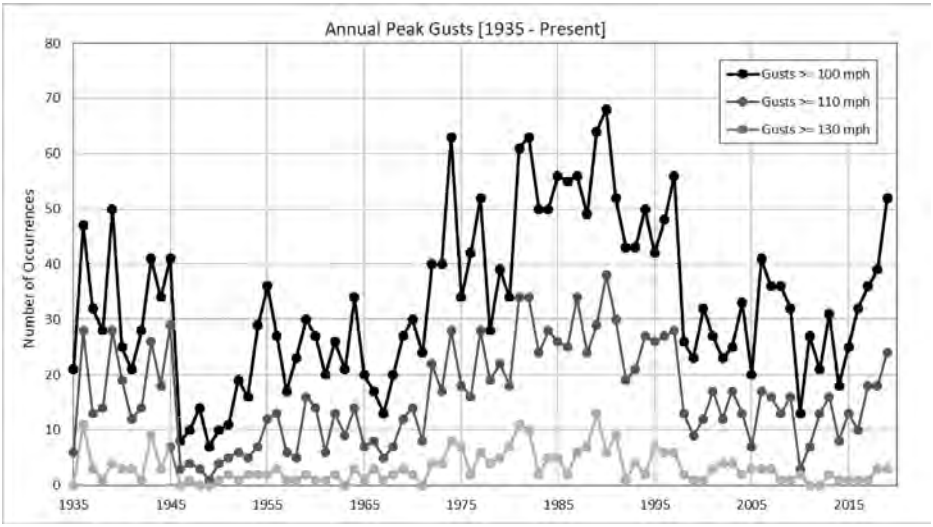
As we enjoy the longer, warmer days of summer, now is a great time to look back at what has been a very memorable winter season. This winter featured several very impressive storms on the summit, with three of the stronger wind events of the last decade all occurring over the same winter season (within five weeks of each other, in fact!). 137 mph winds were recorded on January 22, followed by a new decade-high peak of 148 mph on February 9, only to be overshadowed by a new all-time February record of 171 mph February 25!

The snow season was above average here on the mountain, just as it was in the valleys below. The fall season in particular was above average for snowfall, with slightly below normal snowfall for February and March. Despite this, the summit was a solid four feet above average, with 290" having fallen on the summit by early April. More snow will likely add to this total through June, when the summit typically sees its last measurable flakes. Temperatures averaged roughly two degrees below normal throughout most of the winter, allowing for our snow-pack to largely stay frozen. Tuckerman Ravine in particular has looked very impressive, and it will be interesting to see if patches of snow remain into July this year as they did in 2018.

The biggest take away from this winter on Mount Washington will certainly be the 171 mph wind storm of February 25. Besides setting a new monthly record, the storm also served as a bit of a reminder that winds equivalent to a Category 5 hurricane are not just a thing of the past, and though rare, still happen atop New England's highest peak. Diving a little more into our historical records it is apparent that this winter's winds are special not only because of the 171 mph storm, but also for the frequency of winds exceeding 100 mph on the summit.

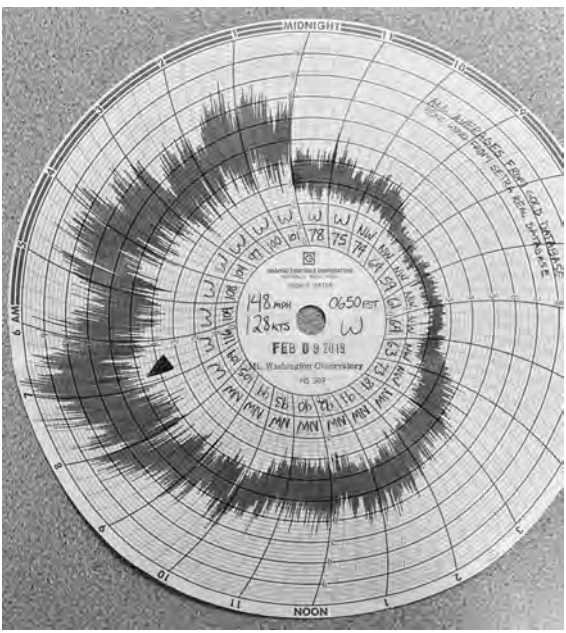
From the graph one can see that there are cycles of years with more frequent 100-plus mph days, with two apparent peaks in the late 1930s and early 1940s, and also centered around the 1980s. Recently we've also begun seeing an uptick in our extreme wind events, with this season of 2018-2019 (52 days as of this writing in early April) landing among the top 10. We'll likely add a few more 100-plus mph days to our total by the end of June, but not likely enough to catch the incredible 68 days in 1990 (roughly 1/5th the entire year!).

This past winter will be remembered by the staff here at the Observatory as a harsh one; with heavy snow, frigid temperatures, and an unrelenting onslaught of our world-famous winds. Just what the meteorologists ordered!



Number of days for each snow season year (July-June) with a peak gust of over 100 mph. 2019 is not yet complete, and will likely fall within the top 10 years of our records.

It was a demanding winter but our staff was up to the challenge. This past winter the shift of Taylor Regan, Tom Padham, and Ryan Knapp encountered 100 mph winds or higher each and every shift from mid-October through mid-April. Due to having the right combination of experience, proper gear, and a great support system it was business as usual. Thank you to our passionate staff, members, and those who have supported our work over the past year, with your continued support, we'll be ready for the next big one!



The Hays Chart recorded the 148 mph gust on February 9.

Winter 2018/Spring 2019 Weather Data

	DEC.	JAN.	FEB.	MARCH
Temperature (°F)				
Average	11.3	3.4	4.9	9.6
Departure	+1.2	-1.3	-1.2	-3.2
Maximum	44	36	37	41
Date(s)	21st	24th	8th	15th
Minimum	-12	-31	-29	-20
Date(s)	8th	21s	27th	7th
Precipitation (inches)				
Monthly	6.90	7.28	5.06	4.07
Departure	-0.83	+0.84	-1.71	-3.60
24-hour Maximum	2.00	1.38	1.24	1.20
Date(s)	21st/22nd	9th/10th	12th/13th	22nd/23rd
Snowfall (inches)				
Monthly	29.8	60.4	37.6	44.3
Departure	-15.7	+16.4	-2.5	-0.8
24-hour Maximum	3.9	12.2	8.4	17.0
Date(s)	3rd/4th	9th/10th	25th	22nd/23rd
Season Total	141.7	202.1	239.7	284.0
Departure	+38.5	+54.9	+52.4	+51.6
Wind (mph)				
Average	44.8	48.8	55.3	45.2
Departure	-0.1	+2.8	+11.2	+4.9
Peak Gust/Direction	117 NW	137 NW	171* W	123 W
Date(s)	18th	22nd	25th	23rd
Days 73+	21	24	24	22
Days 100+	9	11	11	5
Other				
% Sunshine	44	27	37	39
Clear Days	5	5	2	5
Partly Cloudy Days	8	2	7	6
Cloudy Days	18	24	19	20
Days with Fog	28	28	26	28
Days with Rain	4	3	6	4
Days with Snow	23	22	21	23

**New February wind gust record of 171 mph; previous record of 166 mph set on Feb. 4, 1972*

An Exceptional Winter

BY **RYAN KNAPP**

Cold temperatures, snow, and high winds are what these months are known for and this season was no exception with lows down to 31°F below, winds up to 171 mph, and seasonal snowfall remaining well above normal.

December 2018

December started with a weak ridge providing fair skies overhead with undercast conditions below. Clouds thickened and lowered overnight as a low from the Ohio River Valley moved NE. Temperatures rose to above freezing resulting in a wintry mix and a thunderstorm. A trailing cold front brought a return of snow, which lingered into the third. Upslope snow showers lingered for the fourth/fifth then tapered with a clearing pattern for the fifth as high pressure returned. Conditions deteriorated later that day as low pressure moved in from the Great Lakes spreading snow overnight into the sixth. Another low with a strong arctic cold front approached for late that day into the seventh with additional snowfall and plummeting temperatures. Fair skies but cold weather returned on the eighth but quickly gave way to fog and light snow on the ninth as low pressure approached from the NW. Snow tapered on the tenth and a clearing pattern returned providing fair weather into early on the eleventh. A cold front later returned clouds/fog and provided light snow into the twelfth as temperatures dropped. A ridge returned fair weather late and into the thirteenth. As the ridge departed, a return flow boosted temperatures but they remained cold enough for snow on the fourteenth as low pressure passed. A clearing pattern returned on the fifteenth as high pressure built in with fair weather lingering into the sixteenth as the ridge crested and slid east.

Low pressure tracked north of New England dragging a cold front across the region, which resulted in mixed precipitation on the seventeenth, followed by snow and high winds overnight and into the eighteenth. High pressure returned on the nineteenth with fair weather lingering into the twentieth. A warm front brought rain on the twenty-first and temperatures rose to set a new daily record high of 44°F for the date. By the time things wound down on the twenty-second, nearly 3 inches of rain fell on the summit in a two-day period prior to transitioning back to snow as temperatures dropped. Snow tapered on the twenty-third as a weak ridge crested. Then a Clipper on the twenty-fourth brought light snow showers along with a reinforcing shot of cold air. Snow tapered on the twenty-fifth and fair skies returned briefly, as a ridge crested overhead. Clouds returned on the twenty-sixth as a warm front approached. Light snow fell on the

twenty-seventh but as temperatures rose on the twenty-eighth, a wintry mix and eventually some rain worked in. As the low exited, high winds and cold air returned and precipitation returned to snow which fell heavy at times. Light upslope snow showers lingered on the thirtieth with the month ending with overrunning snow in response to an approaching coastal low.

January 2019

A coastal low brought continued snowfall for the first with a brief period of freezing rain and winds ramping to 123 mph. High pressure brought pleasant weather on the second followed by a Clipper on the third with light snowfall. Upslope snow showers lingered behind the low on the fourth. The low lingered to the northeast on the fifth but high pressure nudged in providing fair weather. A cold front brought a return of moderate snowfall and colder temperatures, which plunged to below zero prior to rebounding late on the seventh as a warm front approached. Snow from the warm front spread in on the eighth. A strong low passing nearly overhead on the ninth/tenth brought over a foot of snow and a peak gust of 122 mph. Arctic high pressure followed the storm bringing another round of 100-plus mph gusts and temperatures plunged to 23°F below on the eleventh. Clearing conditions returned on the twelfth and a light return flow allowed temperatures to gradually rise to just above zero during the overnight hours. High pressure brought a stretch of fair weather and moderating temperatures through the fifteenth.

As the ridge departed on the sixteenth, an area of low pressure advanced to our northwest. This brought snow and as a cold front trailed the low, cold air dropped temperatures below zero. High pressure returned clear but cold conditions on the seventeenth but wintry weather returned on the eighteenth and nineteenth as a pair of lows moved northeast. A strong low from the Gulf of Mexico moved in late on the nineteenth and impacted the region the twentieth through early on the twenty-second. The passing low brought moderate to heavy snow, wind gusts up to 137 mph, blizzard conditions, and temperatures as low as 31°F below. As the low exited, high pressure brought clearing on the twenty-second and winds gradually decreased. Fair weather didn't last long though as another low approached from the Great Lakes for the twenty-third. Temperatures warmed to above freezing on the twenty-fourth resulting in rain prior to switching back to snow as a cold front passed. Upslope snow showers lingered on the twenty-fifth. Partial clearing briefly returned on the twenty-sixth before another low approached from the west. Snow moved in late on the twenty-sixth and then continued for the twenty-seventh and into the twenty-eighth. Brief high pressure late that day gave way to a double barreled system for the twenty-ninth/thirtieth with the coastal low eventually strengthening and becoming the dominate system. The pair of lows brought several inches of snow before winding down. As the low exited, winds boosted to the triple digits and temperatures plunged ending the month with a low of 28°F below.

February

High pressure built over the region

for the first/second providing cold temperatures and high winds. A warm front approached late on the second and slowly moved north for the third through fifth. As temperatures rose, snow transitioned to a wintry mix and finally rain on the fifth and then tapered quickly as a cold front swept through. High pressure briefly provided fair skies, seasonable temperatures, and low winds on the sixth before a warm front overnight. The passing low front brought another round of a wintry mix which lingered into the seventh. A low on the seventh/eighth swung a warm front in bringing a continued wintry mix prior to a cold front passing late on the eighth with a sharp drop in temperatures and snowfall. A dry slot on the eighth allowed showers to briefly taper prior to picking up again as upslope snow showers returned. The ninth saw sunny skies but summits were met with temperatures of below zero and winds gusting to 148 mph, the highest gusts in over a decade. The tenth saw a low move into New England bringing snow, winds, and cold temperatures which lingered into the eleventh as a cold front trailed the exiting low. Another low to the north on the twelfth brought another round of snow. Upslope showers lingered into the thirteenth prior to tapering as high pressure built in. The ridge slid east on the fourteenth as low pressure approached from the Great Lakes swinging a warm front NE. The passing front brought light rain showers on the fourteenth/fifteenth as temperatures rose into the lower 40F's. A cold front passed on the fifteenth/sixteenth dropping temperatures and bringing snow showers. High pressure crested on the seventeenth followed by a weak low on the eighteenth which brought fog and snow. As the low exited, winds whipped up the low density snow leading to whiteout conditions. High pressure cleared skies on the nineteenth then slid east on the twentieth as low pressure approached late in the day returning clouds and snow overnight. Snow lingered into the twenty-first as low pressure passed then tapered early on the twenty-second as high pressure built in. Summits finally cleared out on the twenty-third as high pressure built in. The twenty-fourth brought a pair of lows in—one over the Great Lakes and another along the coast. This resulted in mixed precipitation followed by nearly a foot of snow with snow lingering until early on the twenty-eighth. More noteworthy though were the winds which boosted to a gust of 171 mph setting a new February record and the eighth highest gusts on record with the twenty-fifth becoming the sixth windiest 24-hour period on our records. Cold air then followed the system dropping temperatures with a new daily record of 27°F below on the twenty-sixth and equaling the low of 29°F below on the twenty-seventh. High pressure built late on the twenty-seventh and ended the month with fair skies and rebounding temperatures.

March

The month started with high pressure providing fair weather and improving temperatures as it suppressed lows to the south of the state. A pair of lows returned foggy/snowy weather late on the third and continued into the fourth.

An upper level trough kept fog and snow showers going for the fifth/sixth. Showers wound down on the seventh as high pressure built in providing a drier pattern and a generally clear pattern until early on the tenth. As low pressure moved into New England on the tenth, clouds thickened and lowered and snow spread in. A trailing cold front continued snow on the eleventh and dropped temperatures in its wake. Snow and high winds persisted on the twelfth as a trough swung through. High pressure tapered snow early on the thirteenth and fair weather returned. The fourteenth saw the ridge exit and a warm front swing NE boosting temperatures to well above normal for mid-March. The warmth peaked at 41°F on the fifteenth which resulted in copious snowmelt. Low pressure brought fog and showers that started as rain then turned to snow on the fifteenth/sixteenth.

A weak cold front brought colder air and continued snow showers for the seventeenth and into early on the eighteenth. Brief clearing gave way to fog and light snow for the eighteenth/nineteenth. High pressure returned late on the nineteenth and kept fair weather into the twentieth. Clouds thickened and lowered to fog on the twenty-first as low pressure approached from the SW. Snow spread in late on the twenty-first and picked up in intensity for the twenty-second then tapered on the twenty-third with nearly 20 inches falling. Winds increased with gusts reaching 123 mph on the twenty-third. High pressure briefly brought clearing on the twenty-fourth but a cold front returned fog/snow for the overnight into early on the twenty-fifth. High pressure brought fair weather and clearing later that day with fair skies continuing through the morning of the twenty-eighth. Clouds spread in during the day which then lowered to fog with snow showers spreading in overnight into the twenty-ninth with upslope snow showers lingering. Low pressure over the Great Lakes swung a warm front NE on the thirtieth and delivered a few light rain showers. Rain showers continued through most of the thirty-first only to taper to snow overnight as a cold front moved into the region.

RESEARCH VIEWS

A 171 mph Wind Gust...Again?

BY **DR. ERIC KELSEY**

Discussion about validating high wind speeds is occurring frequently this year around Mount Washington Observatory. I co-presented with Observer Taylor Regan an account of the 231 mph wind gust at the summit during our celebration of the 85th anniversary of the "Big Wind" in April. We are testing the next-generation pitot static tube anemometer (a collaboration with General Electric and University of Massachusetts-Lowell Engineering) at the summit and are comparing its data to the other operational anemometers.

Left: The next-gen pitot static tube anemometer co-developed by General Electric aviation engineers, University of Massachusetts-Lowell engineering students, and MWO staff.

Below: Heavy icing of >9 inches per hour put the two pitot static tube anemometers, their heaters and the wind vane to the test. Photo by Adam Gill.

Eventually, we will have collected enough data to be able to confidently state if the new anemometer can be used operationally and under what conditions —a critical process to be able to have valid wind speed measurements.

Did you know that MWO measured a wind gust of 171 mph on April 16? You might be thinking that the 171 mph gust occurred on February 25, and you're correct. We also measured a 171 mph wind gust again on April 16 (it is a coincidence that they are the same speed). Officially, we reported a peak wind gust for the day of 142 mph—this measurement came from our operational pitot tube anemometer, called Pitot 11, that has been on the parapet since 2011. The 171 mph gust was measured by the next-gen pitot and at that time the Pitot 11 was reporting 130-136 mph gusts. Why such a large difference? The answer is our arch nemesis: icing. Ice was accreting regularly on the tip of the Pitot 11 causing measured wind speed to decrease within minutes of deicing. Meanwhile, the next-gen pitot tip remained ice-free. Icing on the tip of the pitot to this extent does not occur frequently, but when it does, we are likely under-measuring the true wind speed.

Officially, we report a daily peak gust of 142 mph because the next-gen pitot is still undergoing testing and verification. It is possible that after testing we will be able to declare 171 mph as the April 16, 2019 daily peak gust speed retroactively. Similarly, other days may also get updated daily peak gust speeds when the next-gen pitot recorded daily peak wind gusts higher than the next-gen pitot. As my Research Views article from the Fall/Winter 2018-19 issue of *Windswept* describes in detail, we expect to see higher wind gusts measured by the next-gen pitot on a regular basis (without any impacts from icing) because it has significantly less tubing for dampening of a pressure pulse (from a gust) to occur before it is measured by the pressure-transducers. If testing shows this to be true, then it has important implications for wind gust measurements: 1) that gust measurements by the Pitot 11 are conservative and 2) the next-gen pitot will measure more accurate gust speeds that are faster. Theory of fluid dynamics state this will be the case, the first few months of data support the theory, but ultimately, many more months of testing are required to conclusively demonstrate that this is how the next-gen pitot system is performing.

Summer's Return Means Lots to Do

BY **HANK AND LINDA DRESCH**

There's nothing like the return of summer in the valley!
Even with a very good snow season, seven months of it to be exact, many enthusiastic fans of winter were okay with seeing spring come to melt the snow and return some color to the landscape. Despite the periodic storms, none were severe enough to delay any of our monthly Membership Mailings, as has happened in past years.

In mid-winter a request went out from the New England Ski Museum for help with the 2019 Bretton Woods Nordic Marathon. The competition is staged on the west side of Mount Washington. Olympians, college racers, citizen racers and others have taken part over the years. The assistance of MWOBS volunteers Linda Denis, Linda and Hank Dresch, Karen Franke, and Kim Henry was graciously appreciated.

Two of our Valley Volunteers took a running jump to sprucing up the Weather Discovery Center gardens. Thanks go to Barbara Althen and Bill Ofsiany who were out there in April tending to the grounds while there was still snow in the parking lot! A more intensive cleanup was scheduled for once the snow was gone and ground was dry.

With the 19th annual Seek the Peak fundraiser on the horizon, Marketing and Events Director Krissy Fraser has already sent out a call for volunteer help. This year's event will take place Friday, July 19 and Saturday, July 20. We'll be looking for folks available for two shifts in varied four-hour blocks of time both Friday and Saturday. In addition, we will also need help getting ready for the registration of hikers with the assembly of goody bags. Stuffing of the backpacks will be integrated into July's special monthly Membership Mailing on Thursday, July 18.

Our regularly scheduled monthly Membership Mailings continue on the second Tuesday of every month (except July). All MWOBS members, and their guests, are more than welcome to drop in at 9 a.m. and lend a hand. Join us and you will meet a very dedicated and interesting group of local volunteers.

Over the past few months these volunteers have included:

Barbara Althen
Floyd Corson
Marietta Deegan
Linda Denis
Linda & Hank Dresch
Peter Fisk
Karen Franke
Kim Henry
Ava Honan
Bill Housum
Marie Kaspar
Bill Ofsiany
Jean Perry
Jane & Ken Rancourt

Valley Volunteer Coordinators Linda and Hank Dresch can be reached at hankandlinda@mountwashington.org or by phone: 603-356-2137 ext. 208.

Teamwork Yields New Wildcat Webcam

BY **PETE GAGNE**

I'm happy to report that with a heap of help from staff and a donor we now have a new webcam at the Wildcat summit. Like me, the camera was offline for several months. For the camera, it was technical issues. For me, it was major shoulder surgery last December. I had a lot of help from other staff members while I was off my feet, from Director of Information Technology Keith Garrett to Facilities Coordinator Steven Whitaker and others. They made some trips to Wildcat in my absence to assess the camera and found that the most likely cause of the failure was defective capacitors. We are hopeful that the old camera can be repaired, but it would be impossible to repair in the field.

Director of Research Dr. Eric Kelsey climbs the tower at Wildcat.

Keith posted a notice on our website that the camera (in addition to the cameras at Attitash and Jackson) was defective and appealed for donations. The response was overwhelming. A generous donor bought us a great camera, an Axis P5635-E MKII PTZ IP with very high resolution. The donor

only asked that we acknowledge that the camera was donated in honor of the Balonek and Maben families. But acquiring the camera was just the beginning of the story.

Every camera is different, so any time we change one, there are almost always complications. It's not very different from our own experiences in life. How many times have you bought a new computer, or phone, and suddenly find that your old programs won't run, your ear bud's plug is different, or the jack for the plug simply isn't there anymore! It's the same for us. So, the first hurdle was getting the camera powered on and moving.

In the office, it's easy to plug the camera in the wall socket and it works. But on a solar array, we have to find a way to provide the camera not only the proper voltage, but enough current to give it sufficient power to actuate the motors so it can pan, tilt and zoom. The old Axis camera at Wildcat utilized a PoE (Power over Ethernet) injector that provided the proper voltage and current, plus data, over the same cable. The new camera would just not work this way, not even with a new PoE powered by the 24volts DC supplied by the Wildcat batteries.

Fortunately, the camera has a peripheral I/O port that, among several other things, accepts a regulated 24volt DC signal to power up the camera. Tests on the workbench confirmed that it worked as expected. At least it worked with our 24volt power supply on the bench. But would it work at Wildcat on the solar array? Only a field-test would confirm if it would.

So, in the midst of budget season, Strategic Planning meetings, and winter trips to the summit, we found the time to plan a trip to the Wildcat summit to replace the defective camera. Keith, Director of Research Dr. Eric Kelsey and I dragged the recently retired John Mitchell along to help haul all the gear, tools, and supplies on the lift, and provide moral support. Eric was the only staff member trained and qualified to climb towers in the National Forest, besides myself that is, so he spent the next several hours tethered 25' up swapping out probes for calibration, while John and I worked on swapping out the camera. This did require running a new cable for supplying the power, so we worked around, over and under the intrepid ski patrol members as they stood by ready to fly to the assistance of injured skiers.

We were all psyched (and relieved!) when I flipped the switch to activate the camera and it powered right up. We had to reteach the camera points and were blown away by the resolution! I swear you could almost see footprints in Tucks! Everyone took turns controlling the camera before we packed up and it was time to say goodbye to our friends.

Job done? Not yet. In order to actually display the camera images on our website, the program scripts had to be rewritten. That was a job for Keith, and by early evening he had the new hi-res pictures and time-lapse movies flowing.

So that is a little insight into what goes into a simple thing like replacing a component, any component, in our technological world. We constantly juggle a myriad of balls in the air and try to best utilize the limited time that we have.

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Wilderness Map Company
Zeb's General Store

...Thank you

BY STEPHANIE TURNBULL FITZGERALD

Congratulations to our members celebrating 10 years! Being a continuous member for the last 10 years may not seem like a major milestone compared to our 50- and 25-year members, but we are so grateful to everyone who is able to make the Observatory a priority year after year and support our non-profit's work. Thank you for making the Observatory a part of your life this last decade!

Since starting this process of listing long-term members in *Windswept* last fall, I have heard from a number of you wondering about your own records and years associated with the Observatory. Some people have reached out to let me know there are errors in our database. Our own Life Trustee Mark Van Baallen joined in 1966, not 1976, and member John Hicks has copies of *Windswept* going back to at least 1962, meaning they both should have been listed in our original "50+ years" member milestone. Other members have reached out wondering when they joined and still more got in contact to share their stories of when and why they decided to become a member. While the when changes, the why is often the same: a trip hiking or visiting the summit, awe of Mount Washington and the White Mountains, and all too often, an experience with the weather that knocked us off our feet (literally and figuratively).

Questions about your own membership? Let me know at sturnbull@mountwashington.org.

10 Years...

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SCIENCE IN THE MOUNTAINS, JULY 17-AUGUST 21

The always popular free Science in the Mountains lecture series is back for its twelfth season in July and August at the Weather Discovery Center in North Conway on Wednesdays at 7 p.m.

July 17
50th Anniversary of the Moon Landing

July 24
Connecting People with Science through Photography

July 31
Bee Decline in New England

August 7
Marty on the Mountain

August 14
MWO Intern Research

August 21
Year without a Summer

Learn more about the series and its speakers by visiting mountwashington.org.

19TH ANNUAL SEEK THE PEAK JULY 19-20

Take part in the Observatory's largest annual fundraiser by climbing Mount Washington or another peak of your choosing. Help raise $185,000 to support the Observatory during the 19th annual hike-a-thon. Each hiker is asked to raise a minimum of $200 and in turn is rewarded with prizes and entry into drawings. The first 500 entrants to raise $200 receive a Seek the Peak backpack and t-shirt. Start the inspiring event on July 19 by registering at the Weather Discovery Center in North Conway and then enjoy the Kick-Off Party in the interactive science museum. Then hit the trails Saturday morning, maybe take advantage of a guided hike or go on a summit weather station tour. Enjoy the Sponsor Expo at the base of the Mt. Washington Auto Road followed by the After Party with its all-you-can-eat dinner and awards. Visit seekthepeak.org to get involved.

SUMMER EDUTRIPS

Staff will be leading four programs this summer on the summit that allows you the chance to spend the night on the top of Mount Washington while learning about the weather and climate. The two programs are: The Science of Thunderstorms (offered July 27-28 and Aug. 10-11) and the new Hurricanes and Cyclones—The Science of Tropical Weather (offered Aug. 3-4 and Aug. 31-Sept. 1). Register at mountwashington.org.

Great Gust

Observatory staff and guests experienced an epic day of wind on the summit on February 25 by gathering in the legendary weather room with all eyes pegged to the Hays Chart to record with their smartphones the 171 mph blast. Weather Observer and Research Specialist Taylor Regan was one of the lucky ones up there. "Everyone gathered around the Hays Chart watching with bated breath as the ink climbed higher up the paper wheel," she said. "The building rumbled with the force of what seemed like several freight trains! Congratulations were exchanged as if we, personally, had achieved something great, simply by bearing witness to the raging storm."

19TH ANNUAL HIKE-A-THON TO SUPPORT **MOUNT WASHINGTON OBSERVATORY**

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For more details contact Krissy Fraser

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