

FALL/WINTER 2021-22 VOL. 62 NO. 3

WINDswept

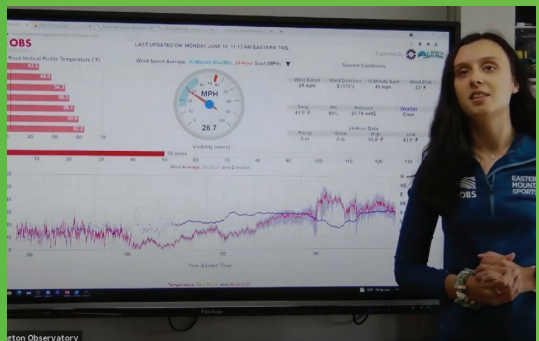
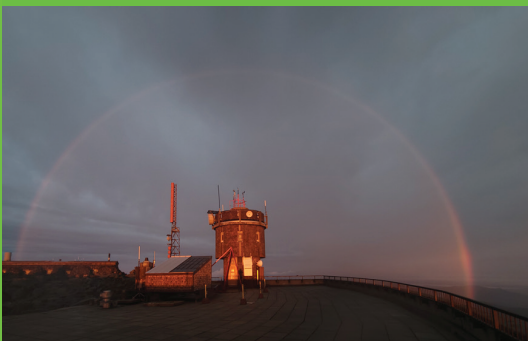
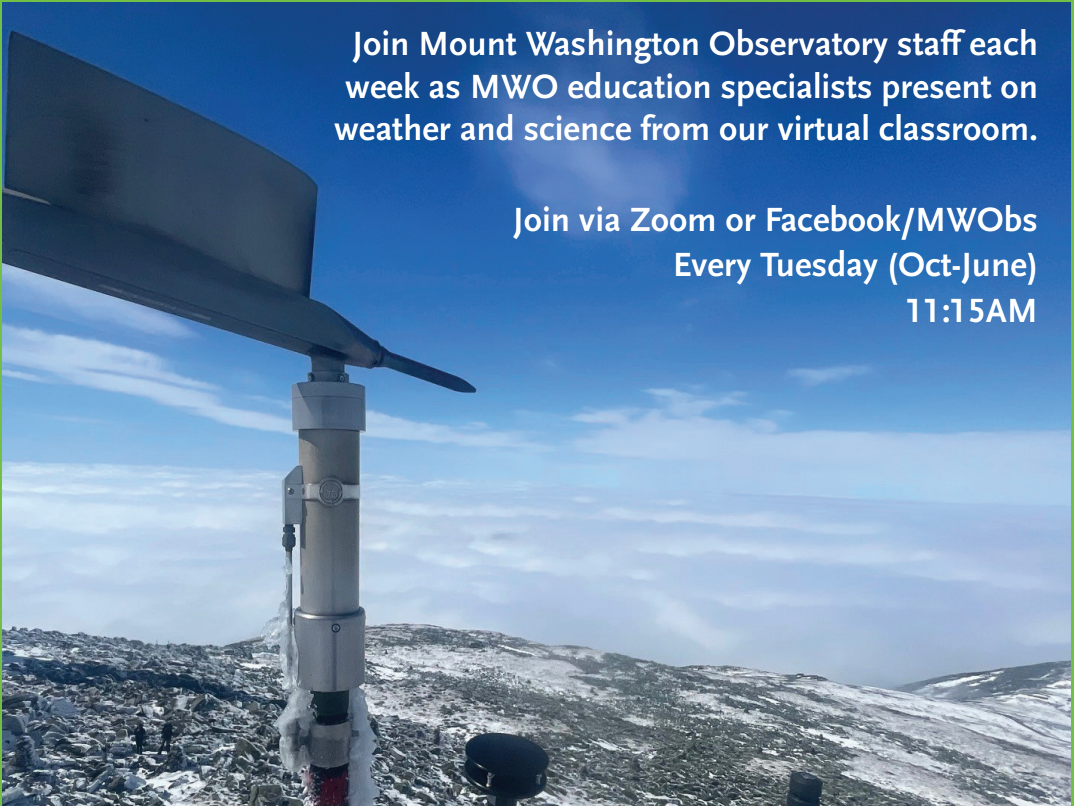
THE BULLETIN OF THE NON-PROFIT MOUNT WASHINGTON OBSERVATORY



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Mount Washington Observatory is a private, nonprofit, member-supported institution with a mission to advance understanding of the natural systems that create Earth's weather and climate. It serves this mission by maintaining a weather station on the summit of Mount Washington, performing weather and climate research, conducting innovative science education programs, and interpreting the heritage of the Mount Washington region.

Membership in the Observatory is open to all. Members receive: Free tours of our famous mountaintop weather station in summer (updates to come in 2022); a one-year subscription to *Windswept: The Bulletin of the Mount Washington Observatory*; meteorology and climate research news from the summit of Mount Washington, straight to your inbox; free admission to Extreme Mount Washington museum (up to 4 people); advanced notice of special events; a 20% discount on all purchases in our museum and online shop; and free admission to more than 300 science centers through the ASTC Passport Program (restrictions apply, please see the ASTC website for details).

Members will receive the three issues of *Windswept: The Bulletin of the Mount Washington Observatory*, for the year following the quarter in which they join. Please make checks payable to the Mount Washington Observatory and send to Mount Washington Observatory, PO Box 2310, North Conway, NH 03860-2310, or join at www.mountwashington.org.

Windswept: The Bulletin of the Mount Washington Observatory (ISSN 1098-7215, USPS 330-710) is published three times a year (spring, summer, fall/winter) by the Mount Washington Observatory. Single-copy price is \$4.00, or \$3.00 for members. Periodical postage paid at North Conway, NH, and additional mailing offices. Editorial office to which all correspondence and address changes should be mailed is PO Box 2310, North Conway, NH 03860-2310 or submit via email to cbuterbaugh@mountwashington.org

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WINDswept

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Mount Washington Observatory

2779 White Mountain Highway | PO Box 2310
North Conway, NH 03860-2310
603-356-2137 | email@mountwashington.org | MountWashington.org

Administrative Offices

2779 White Mountain Highway
North Conway, NH 03860-2310
603-356-2137 phone
603-356-0307 fax

Summit Facility

Mount Washington
603-356-2137 phone

WINDswept

Editor: Charlie Buterbaugh

Graphic Design: Brenda Court

Phone: 603-356-2137

Email: cbuterbaugh@mountwashington.org

Contributors:

Jay Broccolo, Brian Fitzgerald, Peter Crane,
Charlie Buterbaugh

Cover Credit: Ryan Knapp. Undercast at
dusk obscures the southern Presidentials
on Sept. 17, 2021.

Staff

Matthew Addison, *Weather Observer & Meteorologist*

Jackie Bellefontaine *Weather Observer & Education Specialist*

Jay Broccolo *Weather Observer & Meteorologist*

Charlie Buterbaugh *Development Coordinator*

Dr. Peter Crane *Curator*

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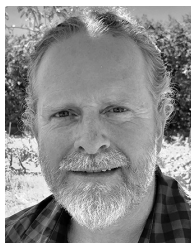
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With Great Excitement, a Project Begins



Charlie Buterbaugh

BY CHARLIE BUTERBAUGH,
EDITOR

Right after starting as the new *Windswept* editor, story ideas started flowing, often inspired by conversations with staff, trust-

ees, and members about the role of our bulletin, first published in 1939.

Soon enough, responsibility tempered my excitement. There are the proverbial big shoes to fill, with Marty Basch's cleated cycling shoes at the front of a line of past editors who've shepherded this publication. I hope to make them, and our hard-working staff, proud.

I have not yet had the pleasure of meeting many of you, yet I feel compelled to thank you for this opportunity. After all, it is you who make this publication possible, and it is your interest in Mount Washington Observatory that *Windswept* is meant to serve.

Thanks to some 450 readers who completed our recent survey, meant to help chart *Windswept's* future, we know the publication provides a valuable connection to the Observatory and Mount Washington.

One question asked readers to select their three favorite story topics. The top responses were: history of Mount Washington and the Observatory (selected by 74.5% of respondents), weather/meteorology (selected by 74%), and summit operations and observer life (selected by 72%).

"I love to see personal stories about the people living there," wrote one survey respondent. Another said, "Give me life at the top!"

The most important thing, in my view, is to keep asking good questions about these and other topics, then find novel and authentic ways of approaching them through well-written articles and photography.

Such questions include, what is it really like to spend a hard-won winter on the summit? What causes the most extreme storms that track over the Whites? And how does the summit, at a unique layer of the atmosphere, provide an ideal location to understand climate change?

The Observatory's many layers of work and community inspire a rich variety of interests among our supporters. We will aim to peel back these layers through articles focusing on summit life, weather science and technology, history, climate research, educational programs, outdoor adventure in the Presidential Range, photography, and other subjects.

The role of *Windswept* is to support the Observatory's mission, working to advance understanding of Earth's weather and climate. With our sights trained on Mount Washington's unique and extreme environment — and support from our community and talented Observatory staff — tremendous potential lies ahead.

Observatory Holds Unique Position to Track a New Normal



Donna Dunn

BY **DONNA DUNN**,
INTERIM EXECUTIVE DIRECTOR

The leaves outside the office window are heralding fall. When you read this issue of *Windswept*, we will be looking at snow on the sum-

mit of Mount Washington and the start of our winter season.

We know from personal experience, no matter where we live, that winters are different from 10 or 20 years ago. I grew up in western Massachusetts when snow was plentiful during winters. Lots of shoveling, plowing, sledding, drifts, snowmobiling, and fun. It's not the same anymore. Or at least that's what I perceive. Bare ground between snowstorms. Fewer snowstorms and what seems like more rain. No snow on the ground for the holidays. Lots of accumulation in one storm. Then nothing. It seems like a shorter winter, at least as far as snow is concerned. And it's not just winter. Summers seem warmer and more humid. And more buggy. And longer.

The climate is changing. The new U.S. Climate Normals from the National Weather Service and NOAA demonstrate that difference. They have been updated from the previous 30-year normals. In this issue, read about the comparisons our observers and interns found as they looked at the new official climate nor-

We seek to improve understanding of the planet's climate by gathering and analyzing data in an extreme, mountain environment; this data is used by the Observatory and others to forecast the weather, to inform research and to support public service and safety.

mals for Mount Washington and the valley. Things really are changing.

Have you noticed that storms seem different too? More named storms during hurricane season. Storm strength seems different, or at least more variable. Changing climate means changing storm patterns and changing strengths of storms. Learn how nor'easters form, their purpose, and our weather station's unique vantage point as these storms arrive in the Northeast.

Mount Washington Observatory is uniquely positioned to investigate and compare the U.S. Climate Normals with a long-term perspective. Our 90-year record of temperature, precipitation, humidity, and wind speed makes the Observatory the place with one of the richest data sets for comparison. Very

few other locations have the continuous data record that we do.

That data record was a key piece of the conversation when our Board of Trustees began their work on a new strategic plan in May. Data and the science behind it is key to the future of the Observatory. The strategic plan states:

We seek to improve understanding of the planet's climate by gathering and analyzing data in an extreme, mountain environment; this data is used by the Observatory and others to forecast the weather, to inform research and to support public service and safety.

Being able to do that requires significant funding. Our operations on the summit of Mount Washington are possible, in large part, through the contributions of our members. We receive some support from NOAA/National Weather Service. But as a private, non-profit science organization, we cannot operate without the support of our members.

Our desire to improve understanding of climate depends on you. Our year-end appeal will be headed your way soon. Please consider a generous year-end donation to the Mount Washington Observatory.



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Offering More Adventure Options, Reimagined Seek the Peak Climbs New Heights

BY KRISSY FRASER



Cheers to 2021 teammates from The Seekers and The Seekers Too, shown here atop Dome Rock during their Seek the Peak weekend hike. View many more photos from the 2021 event at facebook.com/groups/MWOSearchThePeak.

It was an incredible feeling to gather with our backcountry adventure family once again in July. A little rain couldn't dampen the spirits of participants, expo representatives, staff, and volunteers as we rolled out an enhanced format for the 21st annual Seek the Peak, adding our new Mount Washington Adventure Expo.

Combining pledges, sponsorship, and retail sales, the event raised just over \$160,000 for Mount Washington Observatory's nonprofit mission.

"We can't thank our participants and

sponsors enough for their continued commitment to making this event successful," said Interim Executive Director Donna Dunn. "We didn't know what to expect for turn-out both onsite and in the fundraising arena as we are all still feeling the impact of the pandemic, but we are just amazed at the physical turnout and for the funds raised. We are so thankful for the support and dedication of everyone involved in this event."

Building on 20 successful years as a hike-a-thon — with last year's event

being limited to virtual interaction — the 2021 event on July 16-17 took on a new shape, incorporating a multi-sport concept that included hiking, biking, trail running, rock climbing, kayaking, yoga, and fly fishing. Many participants still opted to hike Mount Washington, while others took advantage of the many guided options.

Several event sponsors were onsite to showcase goods, services, clinics and friendly expertise. Anchored by Backpacker Magazine's Get Out More Tour, Eastern Mountain Sports, Oboz Footwear, and Great Glen Trails, the exhibitors had lots of amazing gear to give away to participants. Granite Outdoor Alliance (GOA) had a large presence as they launched their Rock City featuring many NH companies such as NEMO, Ragged Mountain Equipment, Burgeon

and more. Many nonprofits were also onsite to share their expertise.

Seek the Peak is made possible with support from additional sponsors including GOA, Garmin, Smartwool, The Mt. Washington Auto Road, Martini Northern, First Light, White Mountain Oil, Eastern Slope Inn, Northway Bank, Melcher Prescott Insurance, Settlers Green, Delta Dental, and WMWV 93.5.

Seek the Peak 2022 is scheduled for July 15-16 with hopes of reintroducing weather station tours, an awards ceremony, and even more expanded adventure options. Registration will open December 1 at seekthepeak.org.

To view photos from this year's event, check out facebook.com/groups/MWO-SeekThePeak.



NOAA Renews Contract to Source MWO Weather and Climate Data

The National Weather Service and National Oceanic & Atmospheric Administration (NOAA) will continue relying on Mount Washington Observatory (MWO) weather observations, which help to inform NOAA's weather forecasts, warnings, and climatological services.

Under a new five-year contract, MWO will continue providing hourly weather observations to NOAA, including wind, temperature, dew point, precipitation amount and type, air pressure, and other weather variables.

As noted in the renewed agreement, "The climate record of Mt. Washington is used by scientists representing many discip-

lines to study global climate change." In addition to observations from the MWO summit weather station, NOAA will source and rely on data from MWO's network of remote stations in and around the White Mountains — known as the Mount Washington Regional Mesonet — to enhance modeling, forecasting, and warning efforts.

As a private, nonprofit science organization, MWO relies primarily on the support of donors to maintain a weather station at the summit of Mount Washington. However, the renewed funding from NOAA will supplement MWO's operating budget over the next five years.

MWO Introducing New Membership Model

Mount Washington Observatory (MWO) is changing how membership is defined by introducing a more inclusive, donation-based model that honors all donors as members of the unique MWO community.

In the past, membership dues and donations were considered separate, with multiple membership tiers based partly on family make-up. Moving away from a multi-tiered dues structure, starting in 2022, any donation to MWO qualifies you as a member and can be used as a way to join or renew a membership.

The MWO community of members has been, and continues to be, vital to operat-

ing a mountaintop weather station and providing essential data and forecasts. Supporters can join or renew online, by mail, or by phone with an annual or monthly donation.

All supporters who donate at least \$60 per year, or \$5 per month, will receive a membership card, invitation to MWO's Annual Meeting, an annual subscription to *Windswept*, and other benefits listed on our Frequently Asked Questions page at mountwashington.org/membership. More details and updates will be provided in the coming months. Please send any questions to membership@mountwashington.org

Kendall D. Smith

1937-2021

Kendall D. "Ken" Smith, a life trustee at Mount Washington Observatory and former editor of this publication, passed away on July 1, 2021.

A resident of Melrose, MA, Ken joined the Observatory as a member in 1958 and became a trustee in 1977. As summarized in the Winter 1990 edition of the Observatory's News Bulletin, "Ken's abiding love for New Hampshire's White Mountains, and in particular, Mount Washington and the Observatory" were developed during a hike on the Tuckerman Ravine Trail, followed by summer work on the AMC Trail Crew and at Lakes of the Clouds Hut.

For many years, Ken and his daughter Patty made their annual day trip hiking to the top of Mount Washington, varying their route each summer. Ammonoosuc Ravine Trail was one of their favorite paths to the summit. "We'd always stop at Lakes of the Clouds, then get to the top and go into the Observatory. They'd be making soup and I'd pet the cat," Patty said. "That was his thing, his place. He was happy as could be."

Born in Newton, MA, Ken grew up in Melrose and in 1955 graduated from Melrose High School. He enlisted in the United States Air Force in 1959 and was



Kendall Smith

honorably discharged in 1963. In that time, Ken married his beloved Marilyn O'Connor in 1962, and the family moved to Madison, Wisconsin during his time in the service.

After his discharge, Ken and his family returned to Melrose, and he went to work as a Technical Writer for several electronic companies. He also received his bachelor's degree from Boston University.

During the early 1970s, then Observatory President Alan A. Smith was searching for an editor of the News Bulletin. "He approached Ken and vigorously pursued him over the next two years. In 1974, Alan won, finally twisting Ken's arm until he said 'ouch'," according to the Winter 1990 edition, which also mentions numerous awards that Ken won for excellence in communications, including two awards for his work editing the News Bulletin over the course of three years.

As stated in his obituary, "Ken's big heart, kindness, and love will be missed by all who know and loved him."

Ken shared 59 years of marriage with Marilyn E. (O'Connor) Smith. He is also survived by his daughter Patricia A. Spencer, her husband Peter, grandchildren Timothy and Grace, and his niece Darcy.

Brad Ray 1938-2021

Bradley C. Ray, 82, of Milan, NH died on September 16 after a period of failing health.

Brad was known to generations of Mount Washington skiers, climbers, and hikers as one of the first and longest-serving U.S. Forest Service Snow Rangers, assessing avalanche danger, communicating many tenets of mountain safety to the public, and participating in countless search and rescue missions in Tuckerman Ravine, Huntington Ravine, and elsewhere.

Brad was a bit unusual in today's Forest Service, being a true local and serving the public in his "home district" throughout his Forest Service career.

Born in Berlin, NH, he served in the U.S. Marines and then joined the Forest Service in 1958. As is typical of snow rangers, he worked on the mountain in the winter and spring, then elsewhere in the Androscoggin District during the summer and fall, including his work at Dolly Copp campground and in the timber program. He retired in 2002.

While Brad was not the first snow



Brad Ray

ranger, the fact that the avalanche program continues today, assisting visitors to Mount Washington and the White Mountains while making them more aware of avalanche and related issues here and in their adventures farther afield, can be attributed to Brad's recognition of the value of the program and his deep dedication to it.

There were times in the past when changing policies or trimmed budgets raised doubts about the survival of the program, but Brad's persistence was doubtless a critical factor in keeping this important public service activity alive.

Brad was known for his practicality, a dry sense of humor, and very understated compassion for those who were victims of the mountain's harshness or their own misjudgment.

Our condolences go to his family and many friends. (For more about Brad Ray, see *Mountain Voices* by Rebecca Oreskes and Doug Mayer (2012)).

Getting the Hang of Things

TRANSLATED BY **STEPHEN DURHAM**

Meow! In my first few months on the meowntain, the views have been absolutely paw-some! At times during the past summer, I got to look out the window and see all the hikers, tourists, cars, and more moving around the mountain. On the nice and warm days, I was allowed to go outside and enjoy the fresh air on the observation deck.

My weather observers say I have quite the purr-sonality. I love asking for treats, chin scratches, taking naps, and playing with all my toys on the weather desk to try and distract the observers from their work. They do sometimes ask for some claw-enforcement when they need help with observations. My favorite days are the sunny and warm days, but when in the clouds, I take lots of cat naps!

Seek The Peak in July was claw-some! The Meowtaineers and I raised money in memory of my predecessor Marty, and we did a great job. Also over the summer, I got to watch the Mount Washington Hillclimb up the auto road and see Travis Pastrana smash his previous record from 2017! He's going to go down in hiss-tory with how fast he goes!



Nimbus on one of his supervised walks on the observation deck.

It has been a busy and unfur-gettable first few months here on the meowntain. The observers say the weather will get very cold after the leaves change colors, and snow will return! I hope fur some more warm weather though before we get snow. I need to explore more outside this meow-nificant place!

The Science behind Nor'easters

Extra-Tropical Cyclones and the Extreme Weather
they Make on Mount Washington

BY JAY BROCCOLO

Unique beasts known for punishing weather, nor'easters serve an important purpose for our globe despite their infamous reputation.

A type of extra-tropical cyclone (ETC), nor'easters get their colloquial name from unique localized characteristics, mainly the coastal northeast flow that occurs before the onset of the storm, which often portends snowfall, coastal high surf, and high winds.

The factors influencing the paths of these beautiful and destructive systems are similar. Serving a critical purpose, ETCs and nor'easters redistribute heat energy from the tropics to the poles.

The earth, engineered to seek equilibrium, uses ETCs as a synoptic-scale (massive) temperature and moisture regulating mechanism. Irregular heating and our spinning sphere prevent total equilibrium, yet the earth accomplishes its need to redistribute energy.



Observers were glued to the Hays Chart on February 25, 2019 as the passage of an ETC and the development of a secondary area of low pressure, which is characteristic of a nor'easter, caused a 171 mph wind gust.

As seen in Figure 1, heat rises from the equator and lifts north. The airmass, as it reaches the poles, cools and then sinks to the surface, heading south to start the process over again. As heat rises and lifts from the equator, and the other air masses cool, descend, and travel south, they eventually meet in the mid-latitudes.

At 44.17°N, Mount Washington's latitude is less than 1° away from the exact middle point between the North Pole and equator. The position of the Presidential Range relative to the Atlantic Ocean, which is a considerable distance, and the elevation of the peaks, put the White Mountain summits in prime position to experience some intense winds and snowfall rates from ETCs.

When combined with the orographic (how mountains alter weather), wedge set-up of the Presidential Range, ETCs and nor'easters have produced some of the most extreme weather events experienced on Mount Washington's summit.

Extreme wind events in Mount Washington Observatory's (MWO) history that were caused by the passage of an ETC and the development of a secondary area of low pressure, which is characteristic of a nor'easter, include the fastest wind speed ever directly observed by people on April 12, 1934 at 231 mph.

During a recent wind event on February 25, 2019, observers recorded a gust of 171 mph, caused by a set-up

similar to the 1934 World Record Wind. While the secondary low is a characteristic phenomenon of a nor'easter, the secondary development usually merges and overtakes the primary low or forms as a single entity in the Mid-Atlantic and moves northeast along the coast.

It is important to note that the most extreme wind events experienced on Mount Washington were not caused exclusively by nor'easters. They exhibited many nor'easter features, but in these cases, a deep upper-level wave, commonly cut off from the polar vortex, was intense enough to cause an anomalously deep wave in tropopause pressure.

In early March 2021, such a system brought high winds gusting at 147 mph to the summit along with some of the coldest temperatures of winter 2021. The temperature dropped to -28°F. With sustained 130 mph winds, wind chills plunged to 80°F below zero. Meanwhile in the valley, power and heat outages as well as significant damage occurred, including a downed tree in the Observatory's North Conway office parking lot.

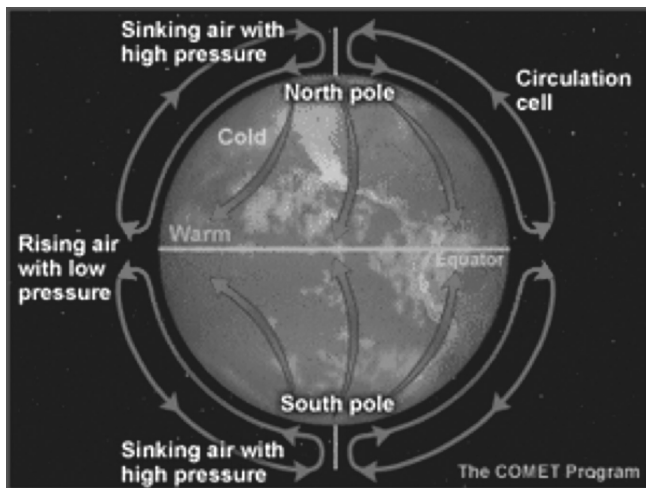


Figure 1: General circulation of air from equator to poles and poles to equator. COMET® Program graphic.

ETCs, also referred to as mid-latitude or wave cyclones, develop as air masses mix in an attempt to dynamically bring about equilibrium of temperature, moisture, and pressure. When the two air masses meet, fluids are deflected to the right (or left in the southern hemisphere) due to the Coriolis effect. This creates counter-clockwise rotation around an area of low pressure.

ETCs are a type of cyclone, which are synoptic-scale low-pressure systems that occur in the mid-latitudes, generally between 30°N and 60°N. They are responsible for a majority of the inclement weather across the globe, especially along the boundary between an eastern continental landmass and a western coast of an ocean.

All nor'easters are ETCs, but not all ETCs are Nor'easters. In the U.S., ETCs tend to affect the northern half of the country as Alberta Clippers and commonly make their way to New England. Nor'easters affect the eastern coastline with particular focus on the Mid-Atlantic and New England. Sometimes, there is a combination of the two, and even cases where systems merge. The previously mentioned record wind gusts measured by MWO all resulted from merging systems. Strong and deep tropospheric waves affected the stratosphere, destabilizing the jet stream and allowing the polar vortex to destabilize and detach.

These systems are not to be confused with tropical cyclones (hurricanes). Extratropical and tropical systems (see Weather 101 on page 36 to learn about tropical storms) can and sometimes do look strikingly similar on satellite, but differ in some very distinct ways. Arguably the most visible and notable contrast between the two is the comma-shape extension of an ETC that com-

monly extends to the south along the cold front of the system. ETCs also lack a closed eyewall typically observed in tropical cyclones.

Dynamics wise, the development and evolution of ETCs involve strong temperature and moisture gradients between air masses, known as baroclinic zones, which is why these systems are also called baroclinic cyclones. As a mid-to-upper-level wave approaches such a zone, the two air masses begin to mix and the process of cyclogenesis ensues. This is in contrast to tropical cyclones, which are more vertically surface-based, non-frontal, and develop from convection over warm ocean waters in low horizontal wind shear (gradient) environments.

Every ETC is an individual. Despite each storm's unique features, they do have many similarities, generally forming along boundaries of differential air masses where temperature and moisture gradients occur with significant vertical wind differences (shear). Cyclogenesis occurs along baroclinic zones near an area in the jet stream where winds are the highest. Known as jet streaks, these areas happen in the atmosphere's lower and upper levels.

Lower-level jets tend to pass at elevations around the summit of Mount Washington, assigning the Observatory an important responsibility of measuring jet streak velocities.

As the cyclone progresses, the cold front rotates counterclockwise and moves around the back of the cyclone with denser, cooler, and drier air. Meanwhile, the associated warm front progresses more slowly. The warm front's air mass has to fight gravity as it lifts and mixes into a cooler air mass ahead of the sys-

tem. As the cold front sweeps around, the denser air undercuts the less dense, warmer, and more humid air, forcing air aloft as well. Later, when the cold front meets and mixes with the warm front, the cyclone begins to occlude.

Occlusion is when the cold air mass overtakes the warm front and becomes cut off from the center of the low by being blocked off by the cold air. Colder air begins to fill the air column, replacing the warm, humid air which causes the system to weaken. Cold air in the column prevents lift and decreases the temperature gradient enough for the cyclone to become barotropically cold. The system becomes stacked and collapses on itself until it dissipates along with the frontal systems associated with the ETC.

Atmospheric pressure can fall very rapidly when there are strong upper-level forces on the system or there is extreme latent heat release as a system moves from a dry continental air mass to a moist oceanic air mass.

When the pressure falls faster than 1 MB (0.030 inHG) per hour, the process is called explosive cyclogenesis or bombogenesis, and these tend to be the nor'easters well known in the Northeast.

Having discussed the life cycle of an ETC, what makes nor'easters different from other ETCs? The difference lies in the track plus the heightened potential of a nor'easter to undergo explosive cyclogenesis due to the geographic set-up of North America. Commonly, areas of low pressure form on the lee side of the Rocky Mountains as an upper-level wave feature crosses over the range, then meets the warm, humid air lifting north from the Gulf of Mexico.

The upper-level troughs in the jet stream tend to dip farther south than the wave features that form Alberta Clippers. The Gulf of Mexico is a very warm body of water that helps feed the Gulf Stream, which moves northeast along the eastern seaboard. Some of these areas of low pressure that come off of the Rockies deepen as convection kicks off, and heat energy is absorbed by what could develop into a nor'easter. As the beginning of the system moves over the Appalachians around the Mid-Atlantic states, it becomes compressed and spreads out to deepen again on the Appalachians' lee side.

Having said that, an interesting feature also tends to occur on the windward side, and this can be unique to North America, similar to the injection of warm, humid air from the gulf. The cold air descending from the north gets wedged between the Appalachians and the East Coast in a process called cold air damming. Ultimately, the damming can enhance baroclinicity in the lower levels and often form a secondary area of surface low pressure separate from the initial trough and wave feature.

This newly developed center of surface low pressure begins to rotate as warm air is pushed east and absorbs moisture from the warm Atlantic waters. Because of the heightened baroclinicity and the amount of potential energy that warm surface waters of the coastal Atlantic store and can release, explosive or rapid intensification occurs.

With the arrival of another winter in the White Mountains, Mount Washington will undoubtedly be treated with many ETCs and hopefully some more high winds, cold temperatures, and snow from nor'easters.

New Normals Reveal Valley and Summit Temperature Increases, Among Other Climate Trends

BY BRIAN FITZGERALD

Chances are, you've heard a meteorologist refer to weather conditions as near, above, or below "normal."

But just what is normal for where you live? Who gets to say? How is it even determined?

Every 10 years, the National Centers for Environmental Information [(NCEI) formerly known as the National Climatic Data Center] are charged with generating climate statistics known as U.S. Climate Normals, based on requirements from the World Meteorological Organization (WMO) and National Weather Service (NWS).

These statistics are calculated for thousands of locations throughout the country, across a uniform 30-year period, and serve as a baseline to compare against weather forecasts just like the one you might have seen today. Statistics such as daily, monthly, seasonal, and annual averages of temperature, precipitation and other climate variables are computed for roughly 15,000 stations nationwide, including the summit of Mount Washington based on weather data transmitted from Mount Washington Observatory (MWO) staff. With the anticipated release of the new normals in late spring 2021, MWO staff naturally wondered: what has changed?

As countless investigations such as the US National Climate and IPCC assessment reports have shown, a warming planet has led to climate changes throughout the entire globe, with regionally specific trends. Changes unique to Mount Washington, as shown by Murray et al. (2021, "Climate Trends on the Highest Peak of the Northeast: Mount Washington, NH") include elevation-dependent warming rates over many decades. With this in mind, many were curious: What if any evidence of climate change could be seen by comparing the 1981-2010 and 1991-2020 climate normals, even though these two datasets have 20 overlapping years between them.

To help us answer some of these questions, our summit interns, with guidance from NH State Climatologist Mary Stampone (a MWO trustee) and myself, took on the investigation this past summer to help us understand not only what may have changed on the summit (KMWN, 6,288 ft.), but also up and down the Mount Washington Valley at sites including Pinkham Notch Visitor Center (GHMN3, 2,025 ft.) and North Conway Village (NCON3, 522 ft.). As the interns began to compare each station's 1991-2020 climate normals set versus the older 1981-2010 set, three broader stories began to appear:

An increase in annual average temperature, with variation among the three sites.

As shown in the data table below, all three sites saw annual average temperatures increase in the new normals, with North Conway showing evidence of warming every single month of the year. All told, the annual average temperature at North Conway is +1.6F degrees warmer than the previous set of normals. Mount Washington’s annual average temperature warmed +0.7F degrees, while Pinkham Notch saw a nearly even split between months that warmed or cooled in comparison, making an annual average temperature that warmed just +0.2F degrees.

An increase in annual average snowfall, particularly later in the season.

When comparing the three sites and their relative changes in annual snow-

fall, Pinkham Notch surprisingly saw the largest increase for total snowfall. Among the sites, Mount Washington now averages 281.8 inches annually, with Pinkham averaging 135.8 inches, and North Conway 84.0 inches. Pinkham’s increase to 135.8 inches annually is now 9.7 inches higher than in the previous normals, versus 4.0 inches more in North Conway and just 0.6 inches more on the summit of Mount Washington.

In addition to the variations among the three sites, it was notable that within the snow season, all three stations saw an overall increase in snowfall in February (see Figure 1.). This increase across the board slightly later in the snow season is worthy of a closer look to understand how the nature of our winters are changing, and what the impacts may be to the region’s snow packs.

MONTH	MT. WASHINGTON AVG TEMP (F)	PINKHAM NOTCH AVG TEMP (F)	NORTH CONWAY AVG TEMP (F)
JANUARY	5.8 (+1.1)	16.1 (+0.8)	19.9 (+2.2)
FEBRUARY	5.9 (-0.2)	17.9 (0.0)	22.3 (+1.1)
MARCH	12.9 (+0.1)	25.6 (-0.2)	31.1 (+1.1)
APRIL	23.7 (-0.2)	37.9 (-0.8)	43.2 (+0.9)
MAY	36.3 (+0.8)	50.2 (-0.2)	55.4 (+1.6)
JUNE	45.5 (+0.5)	58.9 (-0.3)	64.6 (+1.3)
JULY	49.9 (+0.8)	64.0 (+0.1)	69.7 (+1.6)
AUGUST	48.7 (+0.6)	62.8 (+0.5)	67.9 (+1.6)
SEPTEMBER	43.1 (+1.5)	56.3 (+1.1)	60.0 (+2.2)
OCTOBER	31.3 (+1.1)	44.6 (+0.8)	47.7 (+2.1)
NOVEMBER	20.8 (+0.1)	33.1 (-0.3)	36.8 (+1.2)
DECEMBER	11.8 (+1.7)	22.6 (+0.9)	26.6 (+2.3)
ANNUAL	28.0 (+0.7)	40.8 (+0.2)	45.4 (+1.6)

Table 1. Mean average monthly and annual temperatures for KMWN, GHMN3, and NCON3, New Hampshire, for 1991-2020 (with comparison to the prior 1981-2010 normals).

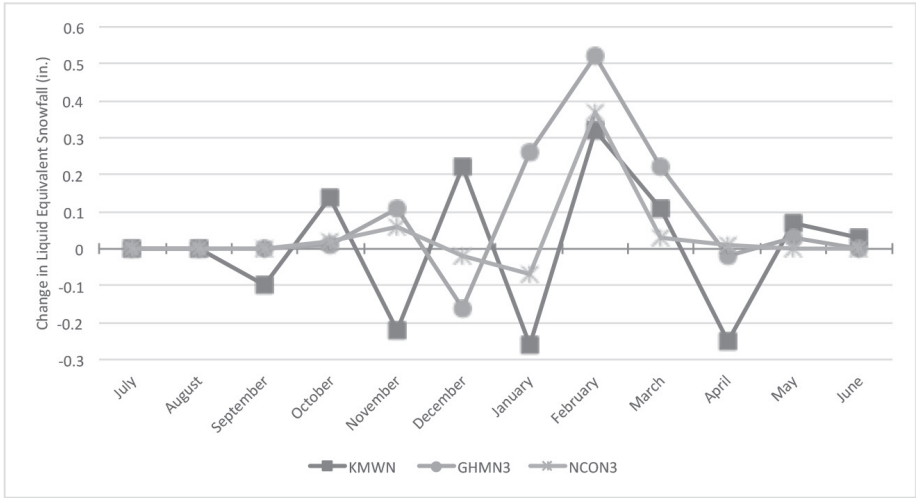


Figure 1. Change in liquid equivalent snowfall at KMWN, GHMN3, and NCON3 between the 1981-2010 and 1991-2020 climate normals.

Changes in precipitation varied drastically among the three stations.

Finally, when comparing the three stations' new precipitation normals versus the prior set, fairly noticeable variation throughout the year, and from station

to station, seems to appear. Overall, precipitation dipped more than five inches annually on average at Mount Washington, while Pinkham Notch gained almost five inches, and North Conway saw a marginal annual increase of 0.5 inches (see Figure 2.).

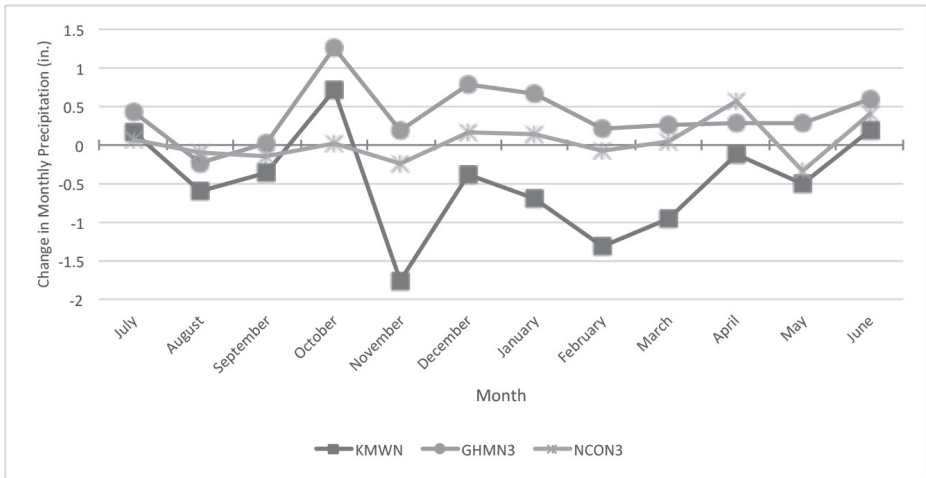


Figure 2. Change in precipitation at KMWN, GHMN3, and NCON3 between the 1981-2010 and 1991-2020 climate normals.

One area of consistency among the three stations appeared in October, where a general increase in average precipitation totals was observed. From a meteorological perspective, the team was unable to complete a forensic investigation of particular storms or weather patterns in the 2011-2020 timespan that may have accounted for this increase; however, best guesses at this stage may point to an increase in the intensity or perhaps even frequency of extreme precipitation events from coastal, bomb-cyclone-type nor'easters.

All together, the investigation comparing the new climate normals versus the prior set across the Mount Washington Valley has uncovered some broad-based differences and a number of lingering questions. Future investigations into these datasets could shed light on precisely what, if any, shifts in the snow season may be occurring, and how such changes may differ across a variety of mountainous terrain and elevation.

Although this investigation was a comparison of two largely overlapping datasets, versus an analysis of longer-term climatological data, the research conducted by our summit interns has

Overall, precipitation dipped more than five inches annually on average at Mount Washington, while Pinkham Notch gained almost five inches, and North Conway saw a marginal annual increase of 0.5 inches.

given MWO a clearer understanding of what our “new normal” on the summit of Mount Washington is. If you’re curious to learn what your “normal” weather is in your backyard, we encourage you to visit ncei.noaa.gov to search for climate normals near your town. Additionally, to learn more about MWO’s recent climate normals project and read the summary report, visit mountwashington.org/research.

MWO Observers Jay Broccolo and Sam Robinson, and MWO summer interns Alexandra Branton, Michael Brown, Madeline DeGroot, and AJ Mastrangelo contributed to this story.

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Inspired by Maps

BY PETER CRANE

It's said there are two types of people—those fascinated by maps, and those who aren't. If you're among the latter, I feel sorry for you. And if you're among the former, I hope you were able to visit "Wayfinding: Maps of the White Mountains" this summer at the Museum of the White Mountains in Plymouth, New Hampshire. If you missed it, fear not. The museum has an online version of the exhibit for long-term enjoyment at plymouth.edu/mwm.

"Wayfinding" is co-curated by two well-known White Mountain historians. Adam Apt, who is a cartographic historian by avocation, previously curated a White Mountain map exhibition at Harvard University in 2006. David Govatski, a retired U.S. Forest Service staffer, is a well-regarded naturalist and a keen collector and area historian.

Their work on the exhibit is obviously a labor of love and shows their dedication to the region and its cartographic docu-

mentation. The exhibit demonstrates the evolution of surveying and mapping technology from the 18th century to the present, and also shows how the use of maps has varied over the years, encompassing facets of culture, politics, and the economy.

First off, a note about what is missing from the exhibit: examples of pre-European maps of the area. It's not known what, if any, maps were created by indigenous inhabitants of northern



Summit structures are clearly delineated in this detail, cropped from a "Bird's Eye View" map of the Mount Washington area, published by the Boston and Maine Railroad in 1902.



This detail from George Bond's White Mountains map of 1853 might be considered the first topographic map of the area. Note the transposition of the names of Mounts Jefferson and Adams. The names of these peaks were slightly muddled in this era.

New England. Was birch bark or hide used to make area maps? Or were the maps employed by the native Abenaki all “mental” ones?

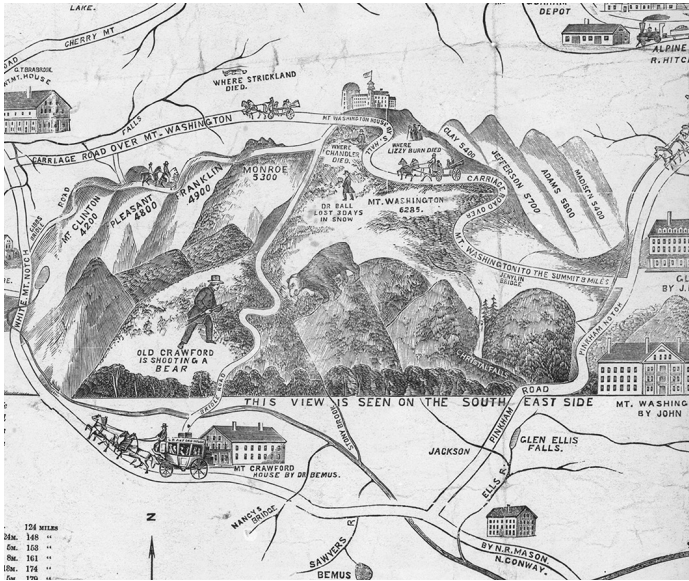
The exhibit notes that the earliest surviving maps that feature the White Mountains date to the 17th century. The first map that specifically indicates these peaks is from 1677 – a few decades after the first recorded ascent of today’s Mount Washington in 1642.

John Foster’s “A Map of New England,” included in William Hubbard’s book “A Narrative of the Troubles with the Indians,” was published in Boston and in London. The Boston version is the first map printed in North America, and includes “The White Hills.” (The London version has a misprint, as it calls these peaks “The Wine Hills.” Wishful thinking?)

It was quite a while before Mount Washington itself was featured on a map. In the second volume of Jeremy Belknap’s “History of New Hampshire” (1791), there is a sketch map of the Mount Washington area, but though it indicates “Cutler’s R(iver),” “New R(iver),” and “The Notch,” there is no name given to the highest peak in the region; the summits are simply referred to as “White mountains.” It was not until 1796 that Washington’s name is associated with the peak in a printed map, and that map was published in Germany, referring to “Washington B(erg)” – Mount Washington.



This beautiful detail of the White Mountains region, including Mount Washington, comes from the 1878 geological “Atlas” which accompanied Charles Hitchcock’s magnum opus, “The Geology of New Hampshire.” (1874).



A detail from Franklin Leavitt's rather fanciful tourist map of the White Mountains, 1859. Leavitt published eight versions of this map, from 1852 to 1888. Woefully crude, his 1852 map might nonetheless be considered the first to depict the area as a specific region.

Such a map reference begs the question – when did Mount Washington receive that name? The first reference to this nomenclature in print occurred in 1792, in the third volume of Belknap's "History." As Apt notes, "the wording of the reference suggests that the name was becoming common usage." Belknap has a somewhat murky and undated reference to Manasseh Cutler using the name. But was the name used in some fashion as early as 1784, when Belknap and Cutler visited the mountain – and thus was it named for General George Washington, who served his new country from 1775 to 1783? Or did the naming come later, perhaps not until Washington became the nation's first president in 1789? A yet-undiscovered document – or map – might someday solve this mystery.

The exhibit also includes early, relatively

primitive topographic maps of the White Mountains, including those of George Bond (1853) and Harvey Boardman (1858). While such maps, and others of the era, had some use for tourists, it was not until 1882 that the first real hiking map of the area appeared, William Pickering's "Map of the Mt. Washington Range," which accompanied his "Walking Guide to the Mt. Washing-

ton Range." This guide and map were precursors to similar products that the Appalachian Mountain Club would publish, culminating in today's very popular "White Mountain Guide."

The exhibit features about four score maps, plus many related photos, books, and some unusual artifacts, such as ceramic ware decorated with White Mountain maps. Also included are examples of evolving mapping tools, from primitive (but effective) measuring wheels to theodolites and laser measuring devices, such as those used by Bradford Washburn in his mapping of the region.

If you are keen on the White Mountains – and keen on the beauty and utility of maps – be sure to visit the online version of this exhibit!

A Gift that Gave our Audience a Boost

BY CHARLIE BUTERBAUGH

When Observer Ryan Knapp learned of a potential donation on the way, in his honor, he could hardly believe it.

A few years ago, he received a note that long-time donor Peter Goodwin, of Wolfeboro, was impressed with his work at the Observatory, so much that he wanted to support what Knapp believed was “the area of most need.”

“I want to support his desires as he knows the organization well,” Goodwin wrote at the time.

The Summer 2017 *Windswept* cover photo, taken by Knapp looking down the ridge past Lakes of the Clouds Hut, became Goodwin’s final reason to donate in the observer’s honor.

Little did he know that one of his gifts, with an open-ended request attached, would make a far-reaching impact at the Observatory. Then again, maybe Goodwin knew exactly what he was doing.

Investing in the Observatory while honoring the aspirations of a dedicated weather scientist was his giving strategy. And it has paid off.

Writing in response to Goodwin, Knapp said, “In my decade plus of working on the summit, there have

been so many times we have said, ‘if we had more funding, wouldn’t it be cool if?’”

With financial support on the way, Knapp had some ideas, but he wanted to get input from his coworkers “so that we were all on board with whatever decision was made.”

Eventually, the votes went in favor of revamping the weather wall, a display where meteorological instruments are located in the Jack Middleton Weather Room of the summit weather station.

After much planning, the new weather wall was designed and installed, making room for a versatile touch-screen TV while retaining important and frequently used instrumentation.

Thanks to a matching gift from past trustee Brad Griswold, along with collaborative planning by Observatory staff, the new weather wall became a reality, making it possible for the Observatory to grow its audience and set the stage for a widening sphere of positive impact through new virtual programs.

A “wouldn’t it be cool if” became an “isn’t it cool that.”

Readily seen during summit editions of Facebook Live and Zoom programs as staff interact with classrooms, news

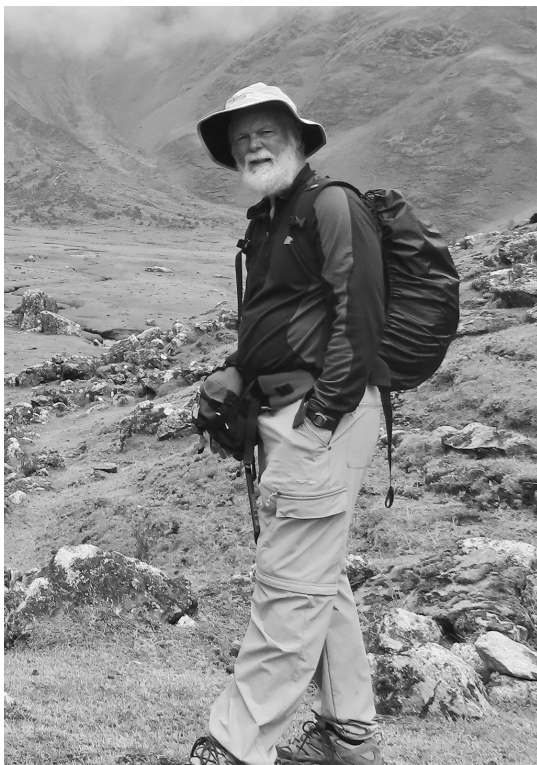
organizations, and other audiences, the wall also contains an indoor barograph, Hays Chart, and precision digital barometer.

With the push for online learning, our education team hosted 83 virtual programs in fiscal year 2021, including virtual classrooms that connect 6-8th graders – or anyone interested – with the extreme weather and science taking place at Mount Washington’s summit, plus our *Science in the Mountains* virtual lectures. Thousands of attendees have tuned in.

Goodwin’s love of mountains, including Mount Washington, can be traced back to hiking as a boy. By age 10, he had climbed Washington, Adams, and Jefferson, plus the Adirondack 46ers with his father, who taught Peter to appreciate hiking, especially above timberline to experience the elements.

As a young educator, he joined the Kent School faculty in Connecticut, where he would continue as a physics teacher for 35 years. Goodwin also taught meteorology, and one day convinced the school’s headmaster that an overnight stay at the Observatory would benefit his weather curriculum. On that trip, many years ago, the lecturer was talking about his research on climate change.

Goodwin often used information from the Observatory website for his classes. His love of weather, along with the Observatory’s data, forecasts, climate research, and growing virtual programs, have compelled his continued giving.



Peter Goodwin is shown before ascending a 15,000-foot pass during a trek to Machu Pichu.

After retirement, Goodwin and his wife Susan spent a week on the summit as cooks for the crew. This strengthened their relationship with the Observatory, where they experienced hurricane-force winds and rime ice in June. They’re happy to support the Observatory’s success at a mountaintop weather station that’s regularly exposed to extreme elements — where observers work long hours to maintain our 90-year dataset, publish specialized forecasts, and collaborate on climate research.

We’re grateful for Peter and Susan’s generosity.

Thousands Reached via Summit Museum, WeatherX, and Virtual Programs

BY BRIAN FITZGERALD

While the weather station remained closed to the public through summer 2021, the Observatory continued to offer educational programs in a variety of spaces for a number of different audiences interested in weather and climate.

Staff were particularly excited to interact with the public in person once again through one of the most visited spaces of the Observatory, the Extreme Mount Washington museum. From Memorial Day through mid-October, over 325,000 people visited the summit where they had the opportunity to learn about the mountain's weather, climate, ecology, geology, and cultural history.

The National Science Foundation-funded *WeatherX* project team – made up of educators, curriculum developers, and researchers from Mount Washington Observatory (MWO), Education Development Center, Concord Consortium, and the universities of Maine and Washington – have been hard at work wrapping up the second year of this three-year curriculum development project. Following a full year of testing both the “Mount Washington” and “Local” units in classrooms throughout northern New Hampshire and Maine, initial assessments and interviews with teachers and students have resulted in significantly helpful feedback that will aid the revision and re-testing of these units in more classrooms this upcoming school year.

In addition to revision work, MWO and the *WeatherX* project team partnered up with professional videographer Tom Guilmette to produce a series of educational videos meant to provide a visual context for the extreme weather data that students explore during their experience. This video series covers the who, what, when and why of temperature, wind, and pressure in atmospheric science, in addition to an extreme weather event on Mount Washington, the life of MWO Weather Observers, and how weather observations become the data points found on the screen before them. To learn more about the *WeatherX* project, visit mountwashington.org under the Educational Programs tab.

Pandemic or not, MWO has continued to be active in the virtual learning space through distance learning programs, with individual groups and classrooms, and the monthly *Science in the Mountains* lecture series this past summer. Interest from undergraduate programs has increased in recent years as well, including engagements with Hofstra University, for example, becoming mainstays for professors looking for ways to connect their budding scientists with professionals in STEM careers.

In addition to more targeted programming, *Science in the Mountains* has continued to attract broad audiences to the monthly weather and climate-based pro-

grams featuring speakers both internal and external to MWO. June, July, and August programs gave a platform to two MWO research projects, along with a captivating “Science of Fire Weather” program from former MWO observer and current Assistant Professor at the University of Nevada, Reno, Dr. Neil Lareau.

Finally, MWO’s Virtual Classroom program, *Home of the World’s Worst Weather Live*, took a well-deserved summer off as it was re-tooled for the upcoming school year. Our weather observer/education specialists kicked off the Virtual Classroom program once again in October, returning to a middle school-level span of



Former Weather Observer/Education Specialist Nicole Tallman is captured in a WeatherX curriculum video discussing her lifestyle and role as a scientist at MWO for students in the classroom.

topics in weather, climate, and climate change. Come join us in the classroom by visiting mountwashington.org/classroom to register.

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Spring/Summer 2021

Weather Data

	APRIL	MAY	JUNE	JULY
Temperature (°F)				
Average	25.1	35.7	47.8	48.1
Departure	+1.2	-0.6	+2.3	-1.8
Maximum	48	61	63	62
Date(s)	9th, 10th	21st	7th	15th
Minimum	-4	16	30	32
Date(s)	2nd	1st	23rd	31st
Precipitation (inches)				
Monthly	7.53	4.21	4.82	9.74
Departure	+0.09	-3.47	-3.77	+0.81
24-hour Maximum	2.69	0.63	1.14	1.87
Date(s)	30th	5th/6th	15th	17th/18th
Snowfall (inches)				
Monthly	32.4	11.8	T*	0.2*
Departure	-3.2	-1.1	-1.3	+0.2
24-hour Maximum	8.5	4.8	T*	0.2*
Date(s)	30th	11th	15th	23rd
Season Total	201.9	213.7	213.7	0.2
Departure	-66.1	-67.2	-68.5	+0.2
Wind (mph)				
Average	33.8	31.3	33.9	24.7
Departure	-0.9	+1.7	+7.1	-0.8
Peak Gust/Direction	132 NW	94 NW	85 W	95 SW
Date(s)	23rd	6th**	27th	9th
Days 73+	11	9	8	5
Days 100+	3	0	0	0
Other				
% Sunshine	31	35	37	20
Clear Days	1	0	0	0
Partly Cloudy Days	3	4	3	2
Cloudy Days	26	27	27	29
Days with Fog	26	20	26	31
Days with Rain	7	17	21	24
Days with Snow	16	16	1*	2*

* Some or all fell as hail/small hail

** Last of several occurrences

A Look at Weather Events during the Season

BY RYAN KNAPP

Winter gave way to spring and summer, transitioning the summit from snow and ice to bare rocks and green sedge. As summer progressed, conditions in July proved to be wetter and cooler than normal.

April 2021

A cold front approached on the 1st resulting in mixed precipitation that transitioned to snow by the 2nd. Dry air provided partial clearing on the 2nd then a weak disturbance returned fog/snow overnight and into the 3rd. High pressure provided clearing late on the 3rd and into the 4th. Late on the 4th and into the 5th, low pressure retrograded providing a mix of snow/sleet. Precipitation transitioned to a wintry mix then tapered on the 6th as the low exited and high pressure built from the west. The ridge remained until the 10th then shifted southeast as a Great Lakes low approached. On the 11th, a backdoor cold front passed and while it lacked precipitation, it aided in boosting winds and dropping temperatures. The summits then became wedged between a low to the west and another to the east. While some mixed precipitation passed on the 12th, summits remained precipitation-free but foggy through the 14th. The low to the east departed on the 14th and the western low moved in on the 15th providing

light snow/sleet showers.

A coastal low on the 16th provided snow/sleet that amounted to around 5 inches. Snow tapered on the 17th as the low shifted offshore and high pressure returned for the 18th. A weak disturbance on the 19th provided intermittent fog and light snow prior to clearing overnight. Fog returned on the 20th and a cold front provided snow and elevated winds into the overnight hours. A coastal low on the 21st provided a wintry mix prior to transitioning to snow that would continue overnight and into the 22nd. As the low departed, cold air wrapped in and winds boosted with several gusts reaching over 100 mph overnight and into the 23rd when a peak gust of 132 mph was recorded. Winds dampened the 24th as high pressure built in. The ridge provided clearing but neighboring showers and virga limited visibilities at times. A pair of lows converged on the region on the 25th/26th providing a wintry mix tapering to snow late on the 26th as a cold front passed. A ridge on the 27th provided dampened winds and clearing skies until the morning of the 28th. A warm front late on the 28th resulted in light rain. Rain/drizzle lingered the 29th as the low passed. An upper level low on the 30th provided rain that quickly turned to snow.

May 2021

The low that ended April lingered into the 1st with nearly a foot of snowfall prior to tapering overnight. An occluded front then set up and allowed a series of lows to track northeast providing a wintry mix the 2nd through the 6th. The front finally exited on the 7th allowing high pressure to build over the region providing fair weather skies. A low over southern New England spread clouds, summit fog, and light snow northward for the 8th/9th. A trough on the 10th/11th resulted in about 5 inches of snow with a secondary trough providing nearly 2 inches of additional snow on the 12th. A ridge provided fair skies on the 13th. As the ridge departed on the 14th, a shortwave provided clouds/fog/snow in the afternoon and overnight. The 15th had some afternoon convection, which provided a few scattered snow showers.

Low pressure dragged a cold front through on the 16th which became stationary on the 17th resulting in light mixed precipitation and thunderstorms on the 17th. High pressure built up from the mid-Atlantic on the 18th/19th. As the ridge shifted offshore, a frontal boundary over the region resulted in light rain showers on the 20th/21st. A shortwave brought light rain for the 21st/22nd and increased winds as it slid offshore. A secondary low on the 23rd provided light/moderate rain/drizzle. Cold air trailed the exiting low on the 24th but a building ridge allowed temperatures to rebound quickly. Temperatures continued to climb on the 25th and afternoon convection resulted in rain showers. A pair of cold fronts the 26th/27th provided light rain showers. High pressure built behind the

front and strong NW winds dropped temperatures back to freezing for the 28th/29th. A weak low on the 29th resulted in rime accumulations and light snow. The 30th had a trough pass as a coastal low moved northeast. Snow transitioned to rain which lingered into the 31st then tapered as the low exited offshore.

June 2021

The month started with high pressure on the 1st/2nd then a trough approached for the overnight and into the 3rd returning fog and light rain. A stronger trough on the 4th/5th provided intermittent fog and rain to the region. A weak shortwave on the 6th provided light rain followed by a ridge that provided fair weather overnight and through the 7th. Late on the 8th, a cold front provided light rain and neighboring thunderstorms followed by intermittent clearing on the 9th. High pressure on the 10th provided fair weather for most of the day but clouds returned late as a weak disturbance approached for the 11th providing fog and light rain. The 12th would see fair weather return as high pressure built overhead. Generally fair conditions lingered for the 13th as an occluded front set up along the international border. A low would follow the front for light rain/drizzle on the 14th. A stronger low on the 15th passed along the border and resulting in strong convective cells that provided thunderstorms, heavy rain, and hail.

High pressure built on the 16th but a moist flow and stiff winds kept it foggy through the day. Clearing eventually returned on the 17th and lingered into the 18th prior to an occluded front pass-

ing overnight. A cold front on the 19th provided rain and neighboring thunderstorms, some of which became severe to our north. High pressure the 20th provided fair weather for the day but a low from the west returned foggy and rainy conditions overnight and the 21st saw thunderstorms in the afternoon. A cold front on the 22nd provided drizzle, rain, and thunderstorms along with cold temperatures that resulted in freezing drizzle and rime ice by the morning of the 23rd. High pressure cleared summits late on the 23rd and lingering until the morning of the 25th when a weak low to the south provided a return of summit fog. Fog dropped to undercast conditions on the 26th prior to lifting back to fog with light rain as a weak shortwave passed. A Bermuda High would then set up the 27th-29th pumping hot and humid air over the region and a frontal boundary to the northwest would provide periods of fog/drizzle/rain. The front would sag south on the 30th providing thunderstorms, rain, and slightly cooler conditions.

July 2021

Rain showers and cooling conditions continued on the 1st as the front stalled to our SW. A coastal low and a secondary low over northern New England provided foggy/rainy conditions for the 2nd/3rd. A cold front on the 4th provided fog/clouds/rain as well as unseasonably cool weather making it feel like Fall and not the 4th of July. The 5th saw clearing and a return of seasonal weather as high pressure crested overhead. A cold front passed on the 6th providing fog/rain/thunderstorms. Another cold front brushed the north of the state

on the 7th providing a few additional rain showers. A low over NY state lifted a front overhead providing light rain showers and drizzle. On the 9th, the remnants of Tropical Storm Elsa moved in providing increased winds and moderate rainfall. High pressure followed on the 10th providing fair skies and warmer weather. The ridge lingered for the 11th/12th then gave way to a trough and associated rain on the 13th. A low from the west the 14th provided additional rainfall with a trailing upper level trough continuing rain showers on the 15th.

A cold front on the 16th brought another round of rain showers. A slow-moving low tracked up the coast on the 17th/18th delivering over an inch of rain to the summit. A trough on the 19th/20th provided thunderstorms and rain showers. The 20th saw wildfire smoke from the west and Canada, limiting visibility at times. A cold front on the 21st provided light rain and cleared out the smoke. High pressure provided fair weather for the 22nd and early the 23rd. A weak front late on the 23rd provided thunderstorms and rain showers and sleet. High pressure returned fair conditions on the 24th. A warm front on the 25th provided thunderstorms and rain. The 26th had smoke/haze return as a low stalled to the west. The low passed and dragged a cold front through on the 27th. A ridge on the 28th aided in clearing the haze/smoke and fair weather briefly returned. A warm front on the 29th and a cold front on the 30th provided rain and a trace of sleet. Temperatures plunged to freezing by the morning of the 31st but a building ridge allowed for improving conditions.

2:41 PM Mon. April 12

“Big Wind Day 2021.” It is hard to imagine what a 231-mph wind gust sounds and feels like. I imagine it from my own perspective, which is from the inside of a building constructed around 45+ years later, at a different location on the summit. The Mount Washington Observatory (MWO) leases space on the NW end of the Mount Washington State Park Sherman Adams Building. My own experience with high winds is from this perspective; a more modern 40-year-old building with a complete heating system, reinforced concrete walls, and windows that should be able to withstand 300-mph winds. Having said that, it’s not as if high winds don’t have an effect on the building. What I find so interesting are the different impacts high winds and wind direction have on summit buildings. Back on April 12th, 1934, the day the infamous 231-mph Big Wind occurred, the Observatory was positioned on the SE quadrant of the summit with obstacles such as a hotel to the west and southwest. It was an A-Frame style roof, constructed of beams with wood shingles as the exterior... I can only imagine how difficult it was to maintain a semblance of comfort in the early 1930s structure with winds in excess of 200 mph pulling the heat right out. Or any of the tasks that current observers complete

today, but 87 years ago.

—Jay Broccolo, Weather Observer/Meteorologist

12:20 PM Mon. May 17

So far on the summit, I have been learning the basics about taking meteorological observations, and there is definitely a lot more to it than I originally thought. Becoming familiar with the nearby mountains and ridges to determine visibility is just one unique aspect of the observation process, something with which I will have to become more familiar. I have also been working with fellow observers to create forecasts and discussions for both the summit and valley. While I was greeted by blowing snow and foggy conditions my first day on the summit, skies cleared the following morning, revealing a picturesque sunrise. I took the picture shown on page 33 just as the sunlight began to clear the horizon and virga (precipitation that doesn’t reach the ground) fell from a distant altocumulus cloud. The sight was truly spectacular for me, but only registered as a 3/10 event for veteran observer Ryan Knapp. I guess that means there is a lot more to see here on the summit, and I can’t wait!

—A.J. Mastrangelo, Summit Intern



Distant virga as the sun begins to rise on May 17. A.J. Mastrangelo photo.

5:19 PM Tue. May 25

I did not know what to expect as I began my first week interning at the Observatory. I got a little apprehensive when Observer Nicole Tallman said, “you’re basically signing up to be stranded at the top of a mountain,” but as my first shift is coming to a close, I have felt anything but stranded. I find myself unable to pull my eyes away from the mountains in the distance and have had good company with fellow intern Maddie and observers Nicole, Sam, and David. I have already learned so much from them, like how to forecast as well as how to take accurate meteorological observations, and I cannot wait to learn more. Although we haven’t gotten much interesting weather yet, I got to experience a 78 mph gust while on the deck and got to see ice form on the ground after a night of below freezing temperatures something I am not used to... I

feel so fortunate to have the opportunity to experience what it’s like to live at the home of the world’s worst weather and to contribute to the Observatory’s mission.

—Alex Branton, Summit Intern

9:27 AM Tue. June 1

During my short time on the summit so far, I have learned quite a lot. Having only had a little education in meteorology so far, I was a little worried that I would be well behind in my knowledge, but that has simply not been the case. I quickly became acquainted with many Observatory duties, including taking hourly temperature observations, determining cloud layer heights, and measuring visibility using local geography. In my off-time so far, I have enjoyed watching sunsets, exploring the summit with the other intern on my shift, A.J., and

chatting with the day and night observers. I am very excited to greet visitors to the summit museum in the next few weeks, and I look forward to the projects that lie ahead in this internship.

—Michael Brown, Summit Intern 11:45

9:57 AM Tue. June 8

During my first week up here, I had plenty of time to acclimate myself to essentially being stranded on top of the tallest peak in the Northeast with several complete strangers and a cat. I've only once lived with a cat, as my roommate in college had one, but I only lived with her for just over a semester before COVID hit. I was spoiled with three straight days of bright, sunny weather and above normal temperatures with minimal wind. The views were incredible, and I felt like the luckiest person in the world to have the opportunity to be surrounded by the beauty of White Mountain peaks. Over the weekend though, my luck ran out as the fog rolled in, temperatures dropped and winds picked up. Not being able to see farther than 10 yards in front of me was an incredibly isolating feeling, but being up here with other observers helped put me at ease. I'm now almost halfway through my second week and I'm still having a blast!

—Madeline DeGroot, Summit Intern

4:01 PM Mon. June 14

Spring was being snarky. Outside our Woodsville, NH motel room, the temperature was a wintry 37 degrees. Not what you want to see when you're starting a bicycle trip from the banks of

the Connecticut River on the Vermont border, heading east on the 83-mile Cross New Hampshire Adventure Trail (xNHAT) to Bethel, ME. So we donned multiple layers and gloves to start our late-May two-wheel overnight adventure on a collection of bumpy unpaved rail trails, dirt roads, bike paths and bucolic back roads across northern New Hampshire's alpine splendor. But my wife Jan and I knew we'd remove that gear quickly as the MWOBS regional forecast was calling for highs around 70. Even better, there'd be sunshine and a push from tailwinds out of the southwest at about 10 miles per hour. Riding before 7 a.m. from the Nootka Lodge, morning dew glistened, a yellow finch checked us out and a rabbit paid us no mind as we pedaled along the Ammonoosuc Rail Trail and its namesake river.

—Marty Basch, Past Windswept Editor

11:45 AM Mon. June 21

The summit is usually a busy place, but as we head into the summer season, the hustle and bustle really picks up. In the last few weeks, we have added two live forecast update videos, seen an increase in mountain activities (as well as visitors), and stepped up our promotion of Seek the Peak. We have also been enjoying the nicer weather that comes with the summer season, as well as the lack of de-icing. With that being said, do not forget that the weather can be just as unpredictable and extreme during the summer months, and wintry weather is still very possible.

—Sam Robinson, Weather Observer/
Engineer



Cumulonimbus Clouds to our distant north over the Cog Railway, Mt. Washington Auto Road, and the Northern Presidentials on June 19.

4:12 PM Mon. July 19

After experiencing such extreme weather and gorgeous sunrises and sunsets, I wanted more. I felt determined to return one day as a weather observer. I felt like two weeks wasn't enough at the summit. It is my dream job to be here at the Observatory. Tuesday night before my first up-bound trip

to the summit, I felt like a kid on the night before Christmas, excited and just ready for the new challenges ahead being a weather observer and education specialist. You know you're in the right place in life when you wake up excited to do your job, as the common saying goes by Marc Anthony, "If you do what you love, you'll never work a day in your

life," and I get to do that each day observing and forecasting weather in a location that I adore, love, and care about greatly. I can't wait for the coming days, weeks, and months ahead.

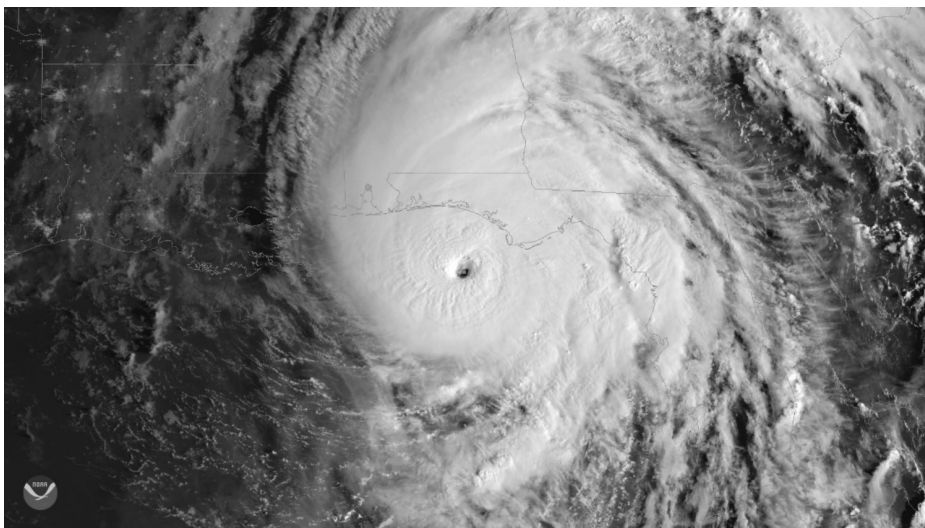
**—Stephen Durham,
Weather Observer/Education Specialist**



New Weather Observer/Education Specialist Stephen Durham is shown on the summit back in January 2019.

Tropical Storms

BY NICOLE TALLMAN



An example of a hurricane's eye and surrounding eye wall, where the most ferocious winds of the storm occur. NOAA photo.

Come late summer and early fall, we begin to hear more about activity in the tropics. The threat of hurricanes becomes more prominent and you may find yourself thinking about how and why these storms are forming.

One of the strongest storms known to people, a hurricane begins its life cycle as a cluster of thunderstorms in the tropical or sub-tropical waters. These waters tend to be their warmest in the late summer after intense summer sunlight has been beating down for several months. The air surrounding the surface of the water begins to heat up,

evaporating some of the moisture from the ocean. This is the initial ingredient needed to begin building a thunderstorm.

Once the air is warm and moist, it begins to rise through the cooler atmosphere. The ideal set-up for developing strong storms is when the atmosphere is cool, yet the ocean waters are still warm. Moving into early fall, the oceans hold onto their warmth and the air begins to cool, creating instability for the warm moist air at the surface of the ocean. The air continues to rise in the atmosphere, creating a thunderstorm.

The ocean continues to warm the air closest to the water's surface and in turn, feeds the rising pocket of air. This allows for low pressure to form because the air is rising up higher into the atmosphere. Low-pressure centers in the northern hemisphere rotate counterclockwise, and in the development of a hurricane, you will start to see the cluster of thunderstorms become more organized and even begin to rotate.

Once the system has its own cut-off low-pressure system, winds will begin to increase, creating a stronger storm. Once winds reach 39 mph the storm gets the label of a tropical storm. It becomes a hurricane at 74 mph.

The categories of a hurricane on the Saffir Simpson scale are wind-dependent, and as the storm produces higher and higher winds, it can increase itself to a category 5 hurricane, the strongest storm known. A very indicative physical feature of a strong hurricane is its eye. This is the calm center of the low-pressure system where winds die down and rain ceases. However, surrounding the eye is the eye wall, which has the most ferocious winds of the storm. Very strong hurricanes will develop this eye, which can clearly be visible from satellite, like in the example on page 36.

A few hazards of hurricanes include devastating wind speeds, storm surge, very strong thunderstorms and even tornadoes imbedded in the rain bands of the hurricane.

Most of these hazards dwindle once a hurricane makes landfall and is no longer over its main energy source, the warm ocean waters. However, hurri-

canes that have weakened or died out can continue to impact the weather of surrounding areas and areas "downstream" from the storm.

The immense amount of moisture and energy from hurricanes have been known to make their way from areas such as the gulf or southern east coast of the U.S. all the way to the Northeast. While it is less common for areas in New England to receive a direct impact of a hurricane, we quite frequently will get saturating rains, elevated winds, or a round of very inclement weather due to the remnants of tropical storms and hurricanes.

One recent example is Hurricane Isaias, which occurred in August 2020. Isaias made landfall on the coast of North Carolina with wind speeds sustained near 85 mph. It caused significant storm surge, and multiple tornadoes at landfall. Once on land, the storm weakened to a tropical storm and continued to impact cities such as New York and Philadelphia.

Remnants eventually made their way to the summit of Mount Washington, where the crew experienced heavy downpours and a max gust wind speed of 147 mph, a new record wind speed for the month of August.

These massive, intense storms can impact areas all the way from their development to far past their site of landfall.

Forging Ahead as Summit Operations Evolve

BY REBECCA SCHOLAND

Summit operations continue to be an ever-evolving state of affairs.

Since I last wrote, the summit has regained some normalcy, but as we turn the corner into fall and winter, COVID has yet to release its grip.

Things certainly took a large stride forward over the summer. The New Hampshire State Parks once again reopened the Sherman Adams Summit Building, and the Mount Washington Cog Railway and Mount Washington Auto Road operated to the summit. A milestone included the successful re-opening of our Extreme Mount Washington Museum and gift shop for the 2021 season after being closed all of 2020. It was a busy summer!

Many hands supported the re-opening of our summit museum. Not only did attendants MJ Walsh, Patti Capone, and Hsin-Chein Tai do an excellent job, but interns, valley staff, and trustees stepped in as valuable assets. As with many businesses, shipping delays were something to contend with. Nonetheless, the museum attendants worked diligently to get product out on shelves as it arrived. They also worked through some interesting transportation scheduling. With protocols in place to spread our weather station staff out across bunkrooms, there were limited “bunks”

available. This marked the first year our museum attendants didn’t live on the summit; they drove the auto road each day.

Weather Observer/Education Specialist Jackie Bellefontaine (also a former winter intern) continued to study for her successful passing of the National Weather Service METAR exam. Nicole Tallman and David DeCou transitioned to new adventures in life. We welcomed new Weather Observer/Education Specialist Stephen Durham and, most recently, Matthew Addison to the team. Stephen has worked hard during his short time with us to already become



New Weather Observer/Education Specialist Stephen Durham.

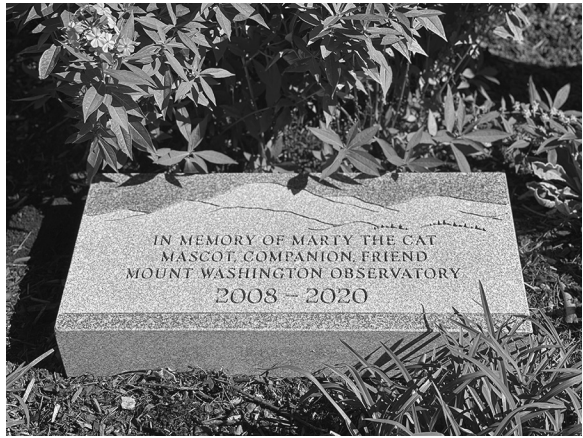
METAR-certified, and Matthew is well on his way. Additionally, we welcomed three new fall Interns, Abigail Fitzgibbon, Sam Gowel, and Adam Muhith.

We welcomed four summer Interns, Madeline DeGroot, Alexandra Branton, Michael Brown, and AJ Mastrangelo, who helped facilitate physical plant projects, looked at climatological data, and assisted in the gift shop. Added hands also allowed observers to catch up on vacation time and relax.

While we have not reinstated the Summit Volunteer program, we think of our wonderful volunteers often and look forward to the day when we can restructure this program to complement our evolving needs on the summit. For now, the summit staff has grown accustomed to cooking (even gotten quite good at it!) for one another and sharing the chore load in the living quarters. With our continued limited staff on the summit, we have been able to structure and accommodate the addition of these tasks to their routines.

Nimbus continues to settle into his new home and role on the mountain. Being on the younger side, we have taken our time introducing him to different parts of the building and started to venture outside with him on nicer days. He has, however, gained himself the nickname “Naughty Nimbus” after we discovered his love of hot dog buns. Not to worry though, they have been moved to a secure container. And while we

near a year since Marty the cat left us, we have a beautiful new monument to remember him. Donated by a gracious member and supporter of the Observatory, Marty is remembered as “Mascot, Companion, and Friend.” The monument sits lovingly in the gardens by the Observatory’s administrative offices in North Conway, which are blooming in early fall as I write.



Our late summit cat Marty is now remembered by a new monument just outside our administrative offices.

With the transition of seasons, we start to prepare for winter transportation to the summit, including staging our snowcat halfway on the mountain and readying the new V-plow on the front of the new Chevy truck. Preparations are currently underway to fit and test chains as well as fix downed and leaning posts along the auto road. Before we know it, heavy snow will be in our forecasts.

It is unquestionable that as we rebuild and grow from the challenges of 2020-21, we will forge ahead into the Observatory’s 90th year stronger and more resilient.

Partnerships Key to Continuous Mesonet Operation

BY PETER GAGNE

Ringo Starr was mostly the silent, steady figure in the Greatest Band of all Time, but one line from a Beatles' song that featured his vocals is particularly pertinent to our topic: "Oh, I get by with a little help from my friends."

During my time at the Observatory, we have partnered with many businesses, organizations, and universities to support our Mount Washington Regional Mesonet (MWRM). These include Campbell Scientific, Vaisala, Taylor Engineering, Boston Dynamics, Plymouth State University, UNH, MIT, UMass Lowell, and even our local Kennebec High School machine shop class. Most of the local ski areas have been instrumental in situating mesonet sites at elevation. Sites are also provided by the Cog Railway, Mount Washington Auto Road, and private landowners such as the Progrins in Jackson on top of old Tyrol Ski Area.

I'd like to focus on one partner in particular, the Appalachian Mountain Club (AMC).

MWRM, our multi-site connected series of weather stations, would not be possible without AMC's permission and cooperation. Some of the earliest mesonet stations were installed at their Mizpah Spring Hut, Lakes of the Clouds Hut, the Hermit Lake Shelters, and the Highland Center. These



Technology & Operations Manager Pete Gagne, right, helps an AMC staffer prepare for airlifting 150-pound batteries plus other heavy items to Mizpah Spring and Lakes of the Clouds huts on Sept. 13.

sites were already operating prior to my start at the Observatory in August 2010, although in some cases they were not fully completed. I was the "new guy," replacing my predecessor Brian Forcier, and I was crazy jealous to hear of helicopter trips to transport tower sections and heavy equipment, arranged courtesy of AMC staff. Perhaps someday, I'd get the chance to "fly like an eagle."

Much of the MWRM was funded by grants obtained in partnership with AMC. The Obs was operating under the three-year Alpine Project when I started. It was a multi-pronged approach to expand our mesonet, developing a web-based system for data display and educational modules, such as distance learning via teleconference, outreach through use of new displays, Edutrips, presentations, guest speakers, and arti-

cles in membership publications. Needless to say, there were many people involved from many departments across both organizations.

In all symbiotic relationships, there is give and take. In addition to providing historical weather data for AMC's internal research, our interactive system provides access to live information beyond temperature, humidity, and wind at their hut locations. We also monitor their solar arrays and battery voltage in real time. This way, they know in an instant if there are any problems.

In some cases, we have installed and operated specific weather instruments at AMC's request. Examples include ground temperature sensors at ARVP 5,300 and an ozone counter at the Cog Base, among many others.

In fall 2021, our mesonet team was tasked with providing our own solar power at Mizpah and Lakes huts. We had been operating on AMC's solar arrays at both of these sites since they were established, but they have been slowly switching from lead-acid to lithium-ion batteries, which provide an infinitely more stable power output, but cannot be charged below 32 degrees. That obviously is a problem in the White Mountains, so we had to devise a solution.

Working together with Tom Siedel,



AMC helicopter.

Seth Quarrier, and David Evankow, we came up with a plan that does not require us to install new exterior solar panels. Adding anything on the outside of the huts requires National Forest approval, and that can take years in some cases. So they are allowing us to tap into their existing photovoltaic array, as long as we have our own charge controller and batteries separate from their system.

We purchased a Midnite Solar "The Kid" charge controller and a Sunwise 240 amp/hour AGM battery for the job. Lots of wires, connectors, conduit, hangers, and other hardware make quite a load, and we're grateful to AMC for helping with logistics to get everything to the remote sites.

Some may have noticed that data from Lakes of the Clouds hasn't been displaying for quite some time. The old radio failed, and the last spare we had was no good, so we decided it was time to replace all of the radios on the western side of the Observatory with newer, faster ones. We hope to complete this work before winter.

With AMC's support, we will keep the lights on (figure of speech) and the data flowing from these sites.

Observatory Approaches Research with Versatility

BY BRIAN FITZGERALD

The term “research” can encompass a fairly broad scope of work conducted by Mount Washington Observatory (MWO) or in partnership with other groups. A research project typically falls into one of three categories: original research, hosted research, or hybrid research.

In the realm of original research, MWO is producing investigations with primarily MWO-led resources, personnel, interns, and volunteers. An example includes the summer 2021 intern project exploring newly released U.S. Climate Normals (see feature story on page 17).

In addition, Technology & Operations Manager Pete Gagne is currently engaged in drafting a technical overview of the Mount Washington Regional Mesonet (MWRN), meant for publication in a peer-reviewed journal for the benefit of the broader mesonet community. The goal of this overview is to formally share MWO’s unique expertise in maintaining a network of remote weather stations across challenging terrain and weather conditions of the White Mountains.

Hosted research, sometimes described as “research services,” is another area of MWO’s work. Historically, this category has included the testing of weather instrumentation such as anemometers



The Mount Washington Regional Mesonet is comprised of more than a dozen remote weather stations, each needing continuous monitoring and maintenance to capture weather conditions across the varied White Mountains terrain.

or visibility sensors for the FAA, or evaluation of household consumer product performance at relatively high elevation, such as windows, coffee machines, or dialysis equipment.

In the summer through fall 2021, MWO hosted New Hampshire Fish & Game biologists studying the White Mountain Fritillary and Draper Laboratory scientists conducting night sky observations. Another ongoing hosted research example is the University of New Hampshire’s cosmic ray monitoring (Cosmo) project, hosted on the summit since 1955.



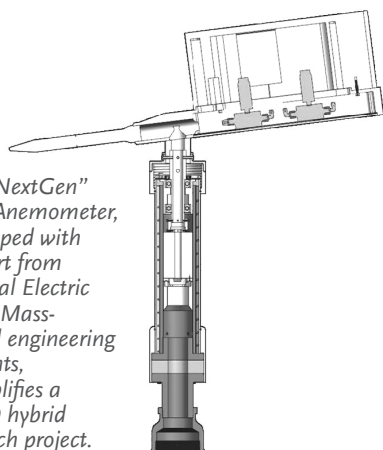
Cosmic rays have been monitored on the summit beginning in 1955. In 2014, the “cosmo shack” was newly constructed to house monitoring equipment on the observation deck.

Last but certainly not least, hybrid research can include a mix of hosted and original research projects in which MWO staff may or may not play a lead or major role. Past projects include AIR-MAP, a program led by the University of New Hampshire that had a goal of identifying the causes of climate variability and the source of persistent air pollutants in New England.

Hybrid research relies on strong partnerships, and at present MWO’s NextGen Pitot Anemometer project is a good example of one rounding the final corner. First started as a partnership between MWO, General Electric, and engineering students at UMASS Lowell, MWO has produced a new and improved pitot anemometer system meant to eventually replace the “Pitot 19” system (named for its 2019 installation on the summit).

Improvements to the NextGen Pitot Anemometer include stronger heat-

ers, higher (finer) gust sensitivity, and more convenient connectors for removal/installation when maintenance is needed. MWO has engaged with the University of New Hampshire’s John Olson Advanced Manufacturing Center to evaluate and certify the NextGen Pitot Anemometer for official use at the summit weather station beginning in early 2022.



The “NextGen” Pitot Anemometer, developed with support from General Electric and UMass-Lowell engineering students, exemplifies a MWO hybrid research project.

All told, the past, present, and future of research at MWO remains a deeply important avenue for increasing the public’s understanding of the forces that create Earth’s weather and climate. With many more important and exciting projects on the horizon, be sure to follow along with us at mountwashington.org/research and through MWO’s social media pages.

Together Again

BY HANK AND LINDA DRESCH

It was with great pleasure that our Valley Volunteers were able to gather once again for monthly mailings, supporting Observatory membership, during the summer and early fall. Previous to that, our last gathering was in March 2020! Too long to be separated from each other.



Top left: Linda Dresch, left, and Jean Perry prepare materials for mailing to Obs members. Right: Bill Ofsiany works in the garden outside the Obs administrative offices in North Conway.



Our August gathering also included Seek the Peak fund raising appreciation letters. And in September, we were thrilled to meet at the Observatory's newly renovated administrative offices in North Conway.

Under Krissy Fraser's leadership, the 2021 Seek the Peak – Mount Washington Adventure Expo included a new format with some new volunteer responsibilities, but it was very successful. Our Valley Volunteers, supplemented by other volunteers as well as staff, were involved in most aspects of the event. We look forward to an expansion of this new format in July 2022.

Gardens around the administrative office building continued to bloom and shine thanks in the greatest part to Barbara Althen and Bill Ofsiany's continuing efforts, in addition to help from Peter Crane and others. Their many hours of planting, weeding, and general tending inspire numerous compliments. A fall clean-up session is being planned now that renovations at the building are complete.

Any successful non-profit organization depends in part on the efforts of its dedicated volunteers. Mount Washington Observatory is no exception. Over the

Director of Development Stephanie Fitzgerald, upper-left, visits with volunteers as they work on the August mailing. Clockwise from left are Fitzgerald, Ava Honan, Bill Housum, Karen Franke, Linda Denis, Jim Vanasse, Marietta Deegan, Jean Sweeny, and Judy Meagher.



past few months, these volunteers include:

Barbara Althen	Pat Daly	Bill Housum	Socco Nuno
Mark Asaro	Linda Denis	Khريس Lalemand	Bill Ofsiany
Marty Basch	Linda & Hank Dresch	Gail Langer	Jean Perry
Marianne Borowski	Peter Fisk	Sonia Leone	Beth Phelps
Will Broussard	Karen Franke	Dennis Maiorino	Jane & Ken
Holly Campbell	Kim Henry	Tracy Marnich	Rancourt
Patti Capone	Marietta & Bob	Larry Martin	Jean Sweeney
Christina Cozzens	Deegan	Judy Meagher	Angie & Jim
Peter Crane	Bob Holdsworth	Ed Merians	Vanasse
Brenda Daly	Frank Holmes	Alex Nemeth	Jesse Wright
Keegan Daly	Ava Honan		

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

MEMBERSHIP MILESTONES

50 Years

BY CHARLIE BUTERBAUGH

Seven long-term supporters reached 50 years of membership this year, and we're thrilled to celebrate their dedication. I was lucky enough to speak with one of our semicentennial members, Frona Brooks Vicksell, over the phone recently.

Frona's father, Dr. Charles F. Brooks, helped establish Mount Washington Observatory (MWO) in 1932, served as director of meteorology for nearly 20 years, and founded the American Meteorological Society. He also directed Blue Hill Observatory and, while there, could speak to observers on Mount Washington and listen to anemometer clicks via radio link.

Frona, the youngest of seven siblings, was born the night before the Big Wind in 1934. She has fond memories of walking down the "Carriage Road" with her mother, Eleanor S. Brooks, a biologist, during WWII, while her father tended to weather station business at the

summit. They enjoyed identifying various plants while descending from arctic to sub-alpine zone, and so on, marveling at the dramatic changes in ecology as they walked down the mountain.

Frona became a computer programmer, working in navigation systems, radar, and other marine and avionics technology, spending a small part of her career at Boeing, where she also taught programming. Now retired and living in Concord, MA, she expressed her enjoyment in keeping up with MWO's research and education projects.

We're grateful for Frona's support and the continuous dedication of all of our 50-year members, which helps sustain our work year after year.

50 Years...

Frona Vicksell
Ledge Clayton
Michael J. Cohen
John G. Kelley

Richard H. Clark Jr.
Marguerite Krupp
John Fisher

UPCOMING EVENTS

SCIENCE IN THE MOUNTAINS

NASA has big plans for getting astronauts back to the Moon and then on to Mars, plus ideas about exploring asteroids and other moons. Getting there is one big challenge. Being there is another. What kinds of conditions will astronauts have to contend with as they journey away from Earth? On Tuesday, Dec. 14 at 7pm, join Mirka Zapletal, Director of Education, McAuliffe-Shepard Discovery Center, for *Extra-Earth Exploration: What's It Like Where We're Going?* Register today at mountwashington.org/sitm.

PROGRAM CONNECTS STUDENTS WITH WEATHER EXTREMES

Our education team has resumed free weekly distance learning programs to support STEM curricula throughout the nation. Students and weather enthusiasts can connect live to the Northeast's highest peak as MWO Weather Observer/Education Specialists present via Zoom and Facebook during brief sessions titled "Home of the World's Worst Weather Live." Programs are every Tuesday at 11:15 a.m. EDT. Targeted for grades 6-8 (but open to all). Register for programs today at mountwashington.org/classroom.

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Dawn Crowell.....	In Memory of Allen Giles
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Kathleen Boyer.....	In Honor of Allen Giles
Robert and Deborah DeMarco.....	In Honor of Allen Giles
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Scott L. Edwards.....	In Memory of Ruth Innes
Ms. Sallie K. Gilman.....	In Memory of Laurie Kinne
Samantha Kirsch.....	In Memory of Richard Kirsch
Kevin Hayes	In Honor of Kurtis Malone
Craig Sutter	In Honor of Jack Middleton
Martha Cook	In Memory of Nicole Moore
Elissa Moore	In Memory of Nicole Moore
Arlene L. Feit.....	In Memory of Nicole Moore
Keely Meehan.....	In Memory of Nicole Moore
Nicholas Isaak	In Memory of Nicole Moore
Christopher J. Daly.....	In Memory of Nicole Moore
David Glass.....	In Memory of Walter "Bud" Palmer
Jennifer Pollock.....	In Memory of Carol Pollock
Jacqueline J. Shakar	In Honor of Frederick Ross
Paul T. Fitzgerald	In Memory of Kendall Smith
Mark Van Baalen.....	In Memory of Kendall Smith
Brian & Betsy Fowler	In Memory of Kendall Smith
Chris Hawkins.....	In Memory of Kendall Smith
Robert C. Kirsch.....	In Memory of Kendall Smith
Nancy Gerry	In Memory of Kendall Smith
Cynthia and Robert Trudeau.....	In Memory of Kendall Smith
Marilyn Skaliotis	In Memory of Kendall Smith
William MacDonnell.....	In Memory of Kendall Smith
Brian Oconnor	In Memory of Kendall Smith
Guy Gosselin	In Memory of Kendall Smith
Marilyn Smith	In Memory of Kendall Smith
Andrea Kruger.....	In Memory of Michele Tallman
Lisa and Lee Jussim.....	In Memory of Michele Tallman



First Snow

During shift change on Wednesday, September 29, our weather station team took a break from their meetings to celebrate a new season rite of passage as the first observed snowfall of the 2021-22 winter season passed over the summit. Shown in front of the Charles F. Brooks Observatory Tower are intern Abigail Fitzgibbon, left, Weather Observer/Education Specialist Jackie Bellefontaine, Weather Observer & Meteorologist Jay Broccolo, Director of Science & Education Brian Fitzgerald, Weather Observer & Meteorologist Ryan Knapp, intern Samuel Gowel, Weather Observer/Education Specialist Stephen Durham, Weather Observer Sam Robinson, and intern Adam Muhith.

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EST. 1967

Thank you, Marty, for 14 years as our
dedicated *Windswept* Editor.

We wish you all the best as you turn the
page on your next adventure!

Welcome, Charlie, as Marty
passes the pen to you!



Marty Basch



Charlie Buterbaugh



WIND*swept*

PO Box 2310
North Conway, NH 03860
Phone: 603-356-2137
www.MountWashington.org

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