MWOBS®
MOUNT WASHINGTON OBSERVATORY

Spring 2025 | vol 66 no 1

WINDswept

The Bulletin of the Nonprofit Mount Washington Observatory

- **MWOBS Wind Instrumentation on Aconcagua**
- **Mesonet Expansion on Mount Washington Cog Railway**

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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 who donate at least $60/year or $5/month receive: Tours of our famous mountaintop weather station (generally mid-May through mid-October); 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; advanced notice of special events; a 15% 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* 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 mountwashington.org.

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WINDswept

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Reflections from the Summit: Fostering Community and Discovery on Mount Washington

Ellen Estabrook

BY **ELLEN ESTABROOK,** WINDSWEPT EDITOR

I am typing this introduction from the summit of Mount Washington; the wind is howling in the door jams, whistling against reinforced windows, and, paradoxically, luring us out into the elements. It is early evening and though our EduTrip group has been going outside intermittently for a majority of the day, we can't help but heed the siren song, gearing up to go outside once more, or, as one participant accurately put it, "get thrown around by Mother Nature for a minute."

The experiences we have on Mount Washington are both universal and personal. Whether feeling the juxtaposed calm and chaos for the first time or the 150th, no visit to the summit is like the one before or after, each bringing with it a new reflection. This truism guides each MWOBS team member to do their part in the sharing, fostering, and caretaking of this beloved institution, and in doing so, connecting the community with all that it has to share. We take these experiences and reflections with us into our next chapters, as Weather Observer and Education Specialist Francis Tarasiewicz poignantly describes in his parting letter (pg. 38).

True to form, the *Home of the World's Worst Weather* welcomed its fair share of eventful conditions this winter, which you'll read more about in the following pages. Notable weather highlights like these underscore the Observatory's enduring legacy as a staffed weather hub with continuous, human-guided instrumentation and data collection. These devices get put to the test not only on the highest peak in the Northeast, but now, as of February 18th, in the highest mountains in Asia and the Americas (pg. 29).

You'll also learn about the atmospheric phenomena behind these weather events, as explored in the research team's solid-to-liquid ratio feature (pg. 42) and winter intern Peter Edwards' Weather 101 explainer on Upslope Snow (pg. 15). We hope these informational pieces invite you to further explore these topics and find new ways to engage with the weather team's fascinating and important work.

As the shoulder season brings with it a widening range of extremes, we usher in the Observatory's 93rd year alongside an incredible community, our feet firmly planted in furthering weather discovery. Thank you for your stewardship, and we look forward to seeing you this spring. Happy reading!

A Brand New Winter on Mount Washington

Drew Bush

BY **DREW BUSH,** EXECUTIVE DIRECTOR

As I write, it's winter on Mount Washington, and already our summit team has braved high winds and bitter cold. On Tuesday, January 21, 2025 we had a daily maximum temperature of -13° F, tying a previous high of the same temperature on February 26, 2019. Winds this month also exceeded 161 mph.

Your support during our Year-End Campaign also just exceeded our wildest goals. This outpouring of generosity makes our summit team's commute to work, meals, instruments, and livelihoods possible. And, perhaps more importantly, it sustains their observations and forecasts 365 days per year, helping to fuel scientific research and keep millions of recreational visitors to the White Mountains safe.

This new year brings with it promise. We'll be adding broadcast technology to aid our summit team with new forecasts provided via radio in the Green Mountain State and Granite State. By the time you're reading these words, we likely will have begun our work with two new partners at New Hampshire Public Radio and Vermont Radio Group. We cannot extend enough thanks to them for their collaboration.

Your support during our Year-End Campaign also just exceeded our wildest goals… And, perhaps more importantly, it sustains observations and forecasts 365 days per year.

In this cold start to the new year, we are also thankful for our summit partners. Our growth these past two years would not have been possible without direct support from the Mt. Washington Auto Road and Mount Washington Cog Railway. We also recognize the staff at New Hampshire State Parks and Mount Washington State Park, in particular, for their collaboration and support while working in one of the most extreme environments on the planet.

Our scientific work has continued during this busy winter month, with recent visits from faculty of University of Maine and the United States Army Corps of Engineers Cold Regions Research and Engineering Laboratory (CRREL). Both hold the promise for new educational and research programs. And we also hosted New Hampshire Governor Kelly Ayotte, her family, staff, and New Hampshire Executive Councilor Joseph Kenney in February. We cannot thank them each enough for taking the time to learn about our mountain.

In coming months, we'll host a Big Wind Day celebration on April 12 with our new partners at Tuckerman Brewing Company who will be producing our official beer. Each time you buy a 6288' stout, you will also be supporting our work. As always, you can check out all we have planned for our 25th Anniversary Seek the Peak (we've hit the quarter century mark!) this July at the usual spot, SeekthePeak.org. Come hike with us.

We look forward to hearing from you and having you join us at our upcoming events and visiting our partners on Mount Washington, the northeast's highest peak. We appreciate you supporting us as we begin our 93rd year and continue our work in scientific research and education.

Meow-nitor of the Mountain

TRANSLATED BY **ALEXIS GEORGE**

Meow again! I've found myself perched at the window sill in the weather room more recently, surveying my kingdom with a keen eye – after all, a cat has to keep an eye on the weather. When it's a purr-fectly clear day at the summit, I can see for miles. The view is so breathtaking; it's enough to make any cat feel whis-ker-ly inspired. I often muse about the clouds on these meow-nificent clear days, and I can't help but think how paw-some it would be to leap among them.

When I am not busy watching the clouds roll in from the window, I am on the prowl. You see, the Observato-ry isn't just a lookout for weather, it's my hunting ground. The rodents here think they can scurry about without me noticing. Just the other day, I spotted a mouse trying to sneak past my domain. I was in the purr-suit of my dinner, and let me tell you, it was a cat-astrophe for that little guy!

I often notice the weather observers gathering data in the weather room. The observers like to joke that I'm the me-ow-nitor of the mountain, keeping tabs on the ever-changing weather at the summit. They say I have a claw-some ability to predict storms, but I think its just my cat-itude and a sprinkle of intuition. I also like to pop into their meetings, mostly to ensure they are not feline too stressed. After all, someone has to keep the atmosphere light! The observers say I'm the feline spirit of Mount Washington, bringing warmth and joy to even the coldest winter days. So, the next time you think of Mount Washington, remember that I, Nimbus the Summit Cat, bring paw-sitive vibes to the Observatory, as the observers' furry friend and the ultimate rodent wrangler!

MWOBS Trustee Ken Rancourt Receives Distinguished Alumni Award from Iowa State University

Ken Rancourt (second from right) with award.

In October 2024, former Director of Summit Operations and current Trustee Ken Rancourt gave a presentation to the Meteorology Program in Iowa State University's Department of the Earth, Atmosphere, and Climate from which he graduated in 1972. Approximately 40 undergraduate and graduate students along with staff and faculty heard about the research programs at Mount Washington Observatory (MWOBS). At an Awards Ceremony later that day, the Dean of the College of Liberal Arts and Sciences awarded him the Distinguished Alumni Award in Meteorology. Ken visited with each professor in the department and discussed both our Internship Programs and our long-term climatological and mesonet datasets.

Ken first started with MWOBS in 1979 as an Observer and Tractor Operator and rose through the ranks for over 30 years before retirement. The College of Liberal Arts and Sciences newsletter featured Ken and MWOBS on the cover of their monthly publication when he first began his career.

Volunteer NH Grant Award for MWOBS Volunteers

We're excited to share that the Observatory has been awarded a grant to add four iPads - with pens, keyboards and stands - to our volunteer program! This NH Volunteer Engagement project is made possible through a generous grant from Volunteer NH.

We hope these devices will make volunteering more streamlined for Seek the Peak's check-in process and general assistance for volunteers during our biggest community event of the year. We'll also be using the iPads for other events and ensuring accurate volunteer hours tracking for nonprofit reporting, among other projects.

This is an investment in our volunteer program and we're grateful to Volunteer NH for its support.

Amy Cotter Joins Summit Team as Weather Observer & Education Specialist

We are thrilled to share that Lead School Programs Educator Amy Cotter has joined the summit team as a Weather Observer & Education Specialist. Amy joined the organization as a summit intern in 2023 before taking on a seasonal educator position last year, then stepping into the Lead School Programs Educator role. As a Weather Observer and Education Specialist on the summit, Amy will be joining the weather team in carrying out daily weather observations, forecasting, and educational programs, and much more! You can learn more about Amy and her journey to the summit in her Observer Blog at mountwashington.org/journal.

Misha Leyfer Joins Education Team as Lead School Programs Educator

The education team was excited to welcome Misha Leyfer in January as Lead School Programs Educator. Misha comes to us by way of Newton, Massachusetts, and is a graduate of the University of Massachusetts at Amherst, where he earned a degree in Environmental Science with Biology and Geology minors. Misha is an environmental educator with great experience designing lessons, teaching, and serving most recently as a director at the Newton Environmental Science Program. He will be supported through November by AmeriCorps School Programs Educators Olivia Dodge and Alexander Templeton, who are already very busy with in-school, after-school, and field trip programs.

Governor Ayotte Visits Observatory

(Left to right): MWOBS Executive Director Drew Bush, Governor Kelly Ayotte, and Ayotte's husband Joseph Daly.

On February 28, New Hampshire Governor Kelly Ayotte visited Mount Washington to tour our weather station and meet with our summit partners, including New Hampshire State Parks, Mount Washington Cog Railway, Mt. Washington Auto Road, and Appalachian Mountain Club. Together we discussed the dynamics of extreme weather, tourism and New Hampshire's economy, infrastructure, and more, while experiencing winter conditions on Mount Washington.

Observatory, Cog Railway, & Key Partners Cut Ribbon on Mesonet Expansion

Five new remote weather monitoring stations went live on November 21, 2024 along the Mount Washington Cog Railway on the western side of Mount Washington. The expansion of the Mount Washington Regional Mesonet (MWRM) kicks off a broader project to enhance weather monitoring in the White Mountains and across New Hampshire. During the next four years, 18 original stations in the MWRM will be modernized, and the network will be expanded to more than 36 stations, with plans to broaden the mesonet into a statewide monitoring network.

This project is made possible by a Northern Border Regional Commission Catalyst Grant, funding from the Cog Railway, and Congressionally Directed Spending all thanks to support from U.S. Senator Jeanne Shaheen, U.S. Representative Chris Pappas, and the New Hampshire Department of Business and Economic Affairs.

Ribbon Cutting at New Marshfield Mesonet Station.

SUMMER/FALL 2024 WEATHER DATA

	AUG	SEPT	OCT	NOV
Temperature (°F)				
Average	49.4	44.9	33.5	25.9
Departure	+0.7	+1.8	+2.2	+5.1
Maximum	64	61	50	48
Date(s)	2nd	17th, 18th	4th, 6th, 19th, 23rd	1st, 5th, 6th
Minimum	36	28	4	7
Date(s)	22nd	9th	28th	30th
Precipitation (inches)				
Monthly	7.77	4.02	6.88	9.01
Departure	+0.50	-3.64	-3.11	+0.92
24-hour Maximum	1.84	2.71	1.07	2.13
Date(s)	8th/9th	25th/26th	15th/16th	28th/29th
Snowfall (inches)				
Monthly	T	0.1	29.3	39.8
Departure	-0.1	-1.1	+10.3	+4.2
24-hour Maximum	T	0.1	9.4	14.2
Date(s)	26th	8th	27th/28th	28th/29th
Season Total	T	0.1	29.4	69.2
Departure	-0.1	-1.2	+9.1	+13.3
Wind (mph)				
Average	22.4	21.0	33.7	46.4
Departure	-2.1	-6.6	-1.8	+7.0
Peak Gust/Direction	105 S	89 NW	121 NW	121 NW
Date(s)	9th	8th	12th	24th
Days 73+	4	4	13	20
Days 100+	1	0	1	7
Other				
% Sunshine	28	55	45	30
Clear Days	0	1	3	4
Partly Cloudy Days	4	9	9	6
Cloudy Days	27	20	19	20
Days with Fog	30	27	26	27
Days with Rain	23	9	9	11
Days with Snow	1	1	14	17

Summer/Fall 2024 Overview

BY **RYAN KNAPP**

August provided rainfall and plenty of thunderstorms, while September brought the first icing of the season despite several periods of high pressure, keeping summits a bit moisture-starved. October started the snow season off strong, ending the month nearly a foot above normal; however, several rain events in November made it difficult for the snowpack to get a solid footing.

August 2024

An upper-level trough provided fog, showers, and afternoon thunderstorms on the 1st, then clearing returned on the 2nd as high pressure built over the region. A shortwave trough on the 3rd resulted in another round of summit fog, showers, and thunderstorms. A boundary dropped southward on the 4th, providing scattered rain showers and thunderstorms that lingered into the 5th. A weak cold front on the 6th provided rain showers early, then a clearing trend developed as high pressure built from the west. Fair weather on the 7th eroded overnight as a warm front approached, with the 8th seeing fog and rain showers returning. The remnants of Hurricane Debby delivered 1.78" of rain as it passed on the 9th. Then, light upslope rain showers lingered on the backside of Debby on the 10th. An upper-level trough approached on the 11th, providing rain showers and thunderstorms. Drizzle and rain showers would linger for the 12th/13th as the trough passed over the region. High pressure briefly built overhead on the 14th, providing fair weather conditions. However, the upper-level trough would retrograde on the 15th, providing another round of showers, thunderstorms, and rotating thick wildfire smoke from western U.S. and Canadian wildfires.

High pressure provided drier weather on the 16th, but the wildfire smoke worsened, making for unhealthy air quality for sensitive groups. An approaching low from the west on the 17th allowed smoke to exit early, and clouds thickened and lowered to fog.

An upper-level trough from the west rotated several surface disturbances over the summits starting on the 18th and lingering through the 22nd, providing mostly foggy conditions with periodic drizzle and rain showers. Building high pressure provided clearing on the 23rd, with clear conditions lingering on the 24th as the ridge crested. A trough returned rain showers and thunderstorms on the 25th/26th, with a thunderstorm on the 26th providing a trace of sleet. High pressure provided clearing on the 27th, and then a cold front on the 28th provided a return of fog and rain. High pressure built behind the front, providing fair weather conditions for the 29th/30th. A warm front ended the month with fog and rain showers.

September 2024

A cold front on the 1st/2nd provided rain showers and temperatures dipped below freezing, allowing for a light coating of glaze ice. High pressure built over the region for the 3rd through the 6th, providing mild temperatures and fair weather skies. Low pressure on the 7th returned fog, drizzle, and rain showers. A trailing cold front on the 8th dropped temperatures below freezing, resulting in rain transitioning to snow. Brief clearing on the 9th gave way to fog, drizzle, and rain overnight into the 10th as a low passed. High pressure built overhead late on the 10th, then remained overhead through the 12th. A weak back door cold front returned fog on the 13th, and a secondary cold front on the 14th provided continued fog. High pressure returned on the 15th, providing a stretch of mild temperatures and fair-weather skies through the 19th. A coastal low on the 20th provided fog and drizzle, and then mild and clearing skies returned on the 21st as high pressure rebuilt overhead. The ridge remained through the 24th, but a cool onshore flow kept temperatures closer to seasonal averages, and onshore moisture provided periodic summit fog. A warm front returned fog/rain on the 25th, and a cold front on the 26th provided additional moderate to heavy rainfall. Lingering low-level moisture on the 27th kept summits foggy; intermittent clearing provided some sunshine as drier air worked in on the 28th. High pressure allowed for clearing on the 29th. Fair skies eroded to clouds and fog on the 30th as a weak cold front approached for the overnight.

October 2024

A passing cold front on the 1st provided cooler temperatures and fog. A moisture-starved cold front provided additional fog and drizzle for the 2nd. A moist flow lingered into the 3rd with continued fog, drizzle, and rain. High pressure briefly provided clearing and mild temperatures on the 4th, followed by a cold front on the 5th, returned fog, and rain showers that tapered to snow showers. Mild and dry conditions returned with a weak ridge on the 6th, and then a strong cold front approached overnight. The passing front provided drizzle and rain on the 7th, which transitioned to snow by the 8th. A broad upper-level low provided continued

winter weather from the 9th through the 11th. A weak ridge crested on the 11th but quickly departed as a strong cold front approached overnight. Initial snow overnight transitioned to rain by the 12th, and winds ramped to 121 mph. A deep trough on the 13th provided snow and sleet. The summits saw snow transition to rain as warm air worked in on the 14th. Cold air returned overnight, and snow continued for the 15th and into the 16th. By the time things wound down, 12.3 inches of snowfall had been collected, which resulted in a delayed shift change.

High pressure returned on the 17th, allowing for ample sunshine and improving conditions as the observers utilized the Cog for their shift change. The ridge continued over the region through the 20th when a weak trough swung through from the north, providing some clouds overhead. High pressure built back over the area for the 21st/22nd, then slid offshore on the 23rd as a cold front approached for the 24th, providing light rain showers. A secondary cold front approached on the 25th, providing light rain and sleet that transitioned to snow on the 26th. As the front passed, colder air returned. A trough on the 27th/28th provided 9.7 inches of snow. A warm front on the 29th provided moderate rainfall and rising temperatures that continued into the 30th. A Bermuda High built northward for the 31st.

November 2024

A cold front started the month with drizzle and rain, followed by dropping temperatures into the 2nd. High pressure provided clearing for the 2nd/3rd then shifted offshore on the 4th as a low approached from the west. A warm front provided frozen and freezing precipitation on the 4th but transitioned to rain on the 5th as temperatures rose to 48F, tying the daily record high. The front stalled on the 6th, keeping summits warm and rainy. A cold front passed overnight, and dropping temperatures on the 7th allowed rain to taper to freezing drizzle. A secondary cold front on the 8th/9th provided 4.4 inches of snow. A warm front swung north late on the 10th, providing rain showers. A cold front on the 11th transitioned from rain to snow. A secondary cold front on the 12th provided light to moderate snow and sleet and gusts up to 109 mph. High pressure provided improving weather on the 13th and lingered through the 15th.

Low pressure retrograded late on the 15th into the 16th, providing fog, sleet, and gusts up to 100 mph. A weak ridge on the 17th gave way to a clipper on the 18th, providing a wintery mix. High pressure provided clearing for the 19th/20th. A pair of lows, one over the Great Lakes and another off the coast, provided a wintery mix on the 21st that transitioned to snow on the 22nd, which lingered through the 24th. As high pressure built into the 25th, winds peaked at 121 mph. A warm front on the 26th provided a wintery mix, then a cold front on the 27th returned snow. A deep low on the 28th provided moderate to heavy snow, delivering 12.1 inches of new snow. Lake effect moisture and high winds provided 4.8 inches of additional snow on the 29th/30th and a return of cold air.

Upslope Snow

BY **PETER EDWARDS**, SUMMIT INTERN

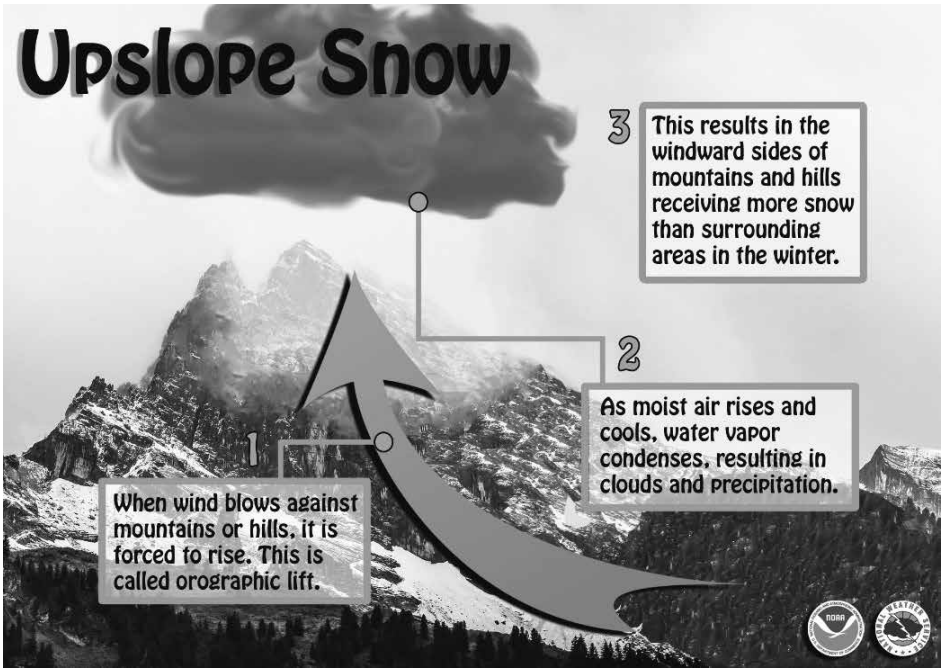
The steep terrain of the White Mountains acts as a vital component in shaping the weather that impacts the higher summits and the surrounding region. Unlike lower elevations, high terrain experiences unique atmospheric conditions that result in localized weather phenomenon – including topographically enhanced precipitation and wind events that would otherwise not occur. In other words, mountainous terrain "makes its own weather" by acting as a physical barrier that significantly influences how variables such as wind, humidity and temperature interact – resulting in conditions that are vastly different from lower elevations.

One notable example is upslope snow, the topic I am currently researching as part of my internship here at the summit this winter. Upslope snow occurs on the higher summits when relatively moist air is forced to rise up the windward slopes of the mountains. As the air ascends the mountain, it cools, causing the moisture it is carrying to condense into clouds and precipitation. This process, known as orographic lifting, is a key driver of mountain precipitation globally.

The White Mountains are particularly well-suited for upslope snow due to their perpendicular orientation to the prevailing westerlies along with the Northeast's notoriously active storm track and harsh winter climate. These factors frequently create the necessary conditions for upslope snow to develop.

Before diving into the finer details of what drives upslope snow, it's necessary to define how it differs from snowfall associated with nor'easters and other low-pressure systems. While these larger storm systems are distinct from upslope snow events, they often set the stage for them.

The Northeast's active storm tracks fuel upslope snow in two key ways. As storms move out of the region, they deposit moisture in the low-levels of the atmosphere. This moisture gets trapped within the mountain valleys, creating a reservoir of moisture for upslope snowfall. After a storm's associated cold front passes, strong westerly or northwesterly winds develop – directing the low-level winds up the western facing slopes and producing snowfall on the higher summits.



Above is a diagram visualizing the orographic lifting process over a mountain range. The arrow represents the direction of the wind and its trajectory over the top of a mountain. Upslope snow or orographically enhanced precipitation is one of the main reasons why mountains generally see more snow in the winter and more precipitation annually. (Credit: National Weather Service)

To illustrate how upslope snow events play out from a more in-depth meteorological perspective, we'll examine a significant upslope snow event that occurred last fall from October 26 to October 28, 2024. In fact, this event closely resembles many typical upslope snow setups in the White Mountains.

The event began when an area of low pressure moved across the country, passing over the Great Lakes region before entering New England on the 24th and 25th, producing mostly rain. As the low continued northeastward, it dragged a cold front in its wake, dropping the higher summits to below freezing.

As the low stalled over the Canadian Maritimes, an area of high pressure built over the center of the United States. This "squeeze" between these two features developed a steep pressure gradient over the Northeast which funneled winds into the region out of the northwest. As the winds rushed in, they forced the warmer, moist air that was deposited at lower elevations, up the windward slopes of the White Mountains. As this air rose to the higher elevations it condensed into clouds and snow, triggering a prolonged upslope snow event.

Over the course of three days, upwards

of 10 inches of snow fell on Mount Washington, highlighting how an initially warm, rain producing system can set the stage for winter weather at high elevations while lower elevations remain largely unaffected.

Though upslope snow events are of importance to the White Mountains snowpack, hydrology and ecosystems, they often get overlooked, and their impacts can be difficult for forecasters to predict. My goal is to build out a climatology of the events using Mount Washington Observatory's observational data, regional weather station data and synoptic reanalysis data going back to 1985 to see if they have changed in frequency and magnitude over time.

Peter enjoying sunrise on the summit in January.

Winter Transitions, Upgrades, and Partnerships

BY **MIKE CARMON**

Winter is a time for the most extreme weather on Mount Washington. My first few months as Summit Weather Operations Manager included perhaps the most critical annual transition for summit and weather operations: the transition to winter conditions, which put to the test our most seasoned infrastructure and operations.

Space upgrades

Several staff and board organizational committees have been focused on upgrades to the space where our weather observers work and live. The summit station has been housed in Mount Washington State Park's Sherman Adams Building for nearly 45 years. Upgrades are critical to operations and aesthetics alike. Coordination of a new ceiling installation in the weather room was a unique challenge in the waning months of fall, but the weather provided just enough windows to make this project (and the necessary transportation) happen.

The kitchen received a new chest freezer, while the installation of new bunkroom windows has begun. These new windows will increase both safety and airflow for staff and guests. We've also begun replacing desks in the weather room with standing/sitting adjustable

The summit team running some tests on the precipitation can in the weather room.

The team stops at Cragway Turn during a winter shift change day.

work-stations—an exciting development for the hard-working observers!

Expanded data collection

Atop those new workstations sit a number of brand-new computers, courtesy of a few generous donors. These machines give observers seamless access to critical resources for "forecasting, data analysis", while providing a platform for professional external communications.

One key to effective research and accompanying data analysis is…more data. Through several federal grants, MWOBS has worked to upgrade and expand our regional mesonet. In late October, we officially launched five new mesonet stations along the Mount Washington Cog Railway. This exciting new data stream of temperature, humidity, wind, and solar radiation gives us the capability to effectively analyze conditions on the western aspect of Mount Washington. The mesonet expansion will continue in the next year across much of Coos County, with our Director of Technology Keith Garrett leading the charge.

Staff changes

The start of 2025 brought with it the departure of Weather Observer & Education Specialist Francis Tarasewicz, as

he moved forward with a new chapter in his career. Amy Cotter, a former summit intern and member of the MWOBS education team, has stepped into that role seamlessly.

Jurij Czernow has also joined the team as an additional member of the transportation crew. In true Mount Washington fashion, the weather has already put Jurij to the test with many days of challenging road and visibility conditions. We're glad to have him on board!

Media attention

January's temperatures averaged a mere 1.6°F over the month, and reached their nadir at a frosty –22°F. These chilly readings were experienced not just on Mount Washington but across a large portion of the continental U.S. As is often the case, local, regional, and national news outlets turned their attention towards Mount Washington.

Our summit team participated in a multitude of related interviews and appearances. Sharing the excitement of the Mount Washington extremes while simultaneously educating the public in such forums is not a trivial undertaking. Our summit team walks this line quite well as they speak with passion and professionalism. They share publicly the vital work they perform for weather and climate science, as well as for the safety of the local recreational communities.

Partnerships

MWOBS is lucky enough to be part of a greater scientific community with respect to our mission. Director of Weather Operations Jay Broccolo and Weather Observer and Research/IT Specialist Charlie Peachey represented our weather operations team at the 105th annual American Meteorological Society meeting in New Orleans. They shared timely research results, strengthened existing partnerships, and cultivated new ones.

We continue to collaborate with the University of New Hampshire through the COSMO project. More collaborations with the University of Maine and Plymouth State University are ongoing. We have expanded our internship program to include joint winter internships with the Mount Washington Avalanche Center, Appalachian Mountain Club, and Hubbard Brook Research Foundation.

Partnerships with our mountaintop cohabitants remain instrumental to our success. MWOBS and Mount Washington State Park have teamed up on countless challenging winter transportation days. On a formidable early winter day, with blowing snow and impassable drifts clogging the higher portions of the Auto Road, we implemented a critical shift change via the Cog Railway.

The second half of winter brings its own unique challenges. Our hearty summit crew will keep operations moving forward as the snows continue but ultimately give way to the inevitable emergence of spring.

Advancing Mountain Meteorology: Research and Innovation at Mount Washington Observatory

BY **JAY BROCCOLO**

The Mount Washington Observatory (MWOBS) continues to make significant strides in atmospheric science research as we pursue pushing the boundaries of mountain meteorology through expanding instrumentation, data acquisition, research, and collaborations. From state-of-the-art technology deployments to student-driven research projects, recent efforts have reinforced MWOBS's role as a leader in high-altitude weather observations and climate research.

Strengthening Atmospheric Observations:

One of the most anticipated advancements is the upcoming deployment of the Atmospheric Scanning LiDAR, funded through Congressional Directed Spending (CDS). The equipment is set for delivery this spring, with installation and training provided by Vaisala. The LiDAR will enhance MWOBS's ability to monitor and analyze airflow through complex terrain, providing crucial data for forecasting and climate modeling efforts.

Meanwhile, the **mesonet network** continues to grow, with 23 new and upgraded stations being deployed through CDS and the Northern Border Regional Commission (NBRC) this year. Among these advancements are the addition of 20 **snow depth sensors** and 3 **Vaisala AQ560 air quality monitors**, showcasing the Observatory's commitment to a more comprehensive environmental monitoring system.

(Left to right) Interns Frank Vazzano, Peter Edwards, and Mees Franssen in the Weather Room.

Expanding Research through Intern Contributions:

MWOBS's robust internship programs continue to yield valuable research contributions. This winter, interns have tackled critical meteorological challenges:

- **Peter Edwards** (MWOBS Intern) is refining methods to better characterize **upslope showers**, documenting filtering criteria and analyzing progress.
- **Mees Franssen** (MWOBS Intern) has completed a **Fourier analysis of lapse rate distribution**, adding to previous work and contributing to the **Snow-to-Liquid Ratio (SLR) project** funded by Synoptic.
- **Marin MacDonald** (Mount Washington Avalanche Center (MWAC) Joint Intern) is also advancing the **SLR project**, with a focus on characterizing snow estimation techniques and refining how MWOBS measures summit snow depth.
- **Frank Vazzano** (Appalachian Mountain Club (AMC) Joint Intern) is working on climate-focused topics for the **White Mountains Climate Almanac**, covering winter melt-outs, extreme cold, and snow event frequency, providing key insights into seasonal variability.

In addition to intern-led research, MWOBS has secured a **Davis Conservation Foundation grant** of $17,050 to fund two 2025 interns, supporting ongoing snow stake studies with Plymouth State University and data validation efforts for pre-2015 mesonet observations.

Advancing Collaborative Efforts:

MWOBS is playing a leading role in the **Northeast Network of Mountain Observatories (NENMO)**, partnering with the **National Mesonet Program (NMP)** and **Synoptic Data** to aggregate and visualize mountain weather data. A new web portal is being developed in partnership with **the University of Vermont (UVM)** to integrate mesonet observations while ensuring proper credit to contributing observatories.

Additional collaborations include continued engagement with the **Northeast Snow Survey (NESS)**, where MWOBS is assisting with station siting and data management tools. Similarly, MWOBS is supporting **Cold Regions Research and Engineering Laboratory (CRREL)** projects, including autonomous vehicle testing on the Mount Washington Auto Road.

Product Testing and Innovation in Extreme Conditions:

Product testing remains a focus, with MWOBS engaged in several harsh weather instrument evaluation projects.

- **U.S. Air Force and Mesotech Testing**: Evaluations of the **FT-7 ultrasonic wind sensor** and the **Vaisala FD-70 present weather sensor** are underway. However, a recent storm resulted in the **shearing of the FD-70 due to ice load and high winds**, prompting discussions on instrument durability in extreme conditions.
- **Intellisense AWOS Testing**: MWOBS is exploring potential deployments of this advanced Automated Weather Observing System (AWOS).

MWOBS/MWAC Winter Intern Marin MacDonald on the Observation deck with sling psychrometer.

- **Furano Radar Collaboration**: New funding opportunities are being pursued to expand MWOBS's capabilities in remote sensing applications.

Scientific Contributions and Outreach:

MWOBS researchers and interns continue to present findings at regional and national conferences, ensuring that insights gained from Mount Washington contribute to broader meteorological discourse and build our presence in the field.

Recent and upcoming presentations include:

- **Eastern Snow and Avalanche Workshop (ESAW 2024)** – Charlie Peachey on Rain-on-Snow (RoS) research.
- **Northeast Storms Conference (NESC 2025)** – Charlie Peachey (RoS research) and Mike Carmon.
- **AMS 2025** – Jay Broccolo (MWOBS/Fairfield University) presenting on extreme snowfall events in complex terrain using CMIP6 projections. Charlie Peachey on Rain-on-Snow (RoS) research.

Additionally, MWOBS has launched an **Undergraduate and Graduate Adventures Program** that provides structured opportunities for students to engage with extreme weather research. Public outreach is expanding, with webinars planned to introduce these programs to prospective Universities and Organizations.

Future Directions:

Looking ahead, MWOBS aims to continue refining its research methodologies while expanding its instrumentation footprint. Upcoming projects include:

- **Expanding precipitation sampling at the summit**, with oxygen isotope analysis conducted by **UMaine** to add to historical climate records.
- **Modeling wind dynamics in the White Mountains**, leveraging small-scale particle physics to produce high-resolution forecasts tailored to complex terrain.
- **Pursuing additional funding through the Commerce, Justice, and Science (CJS) FY 25 Program**, ensuring sustained support for MWOBS's core initiatives.

Through these efforts, MWOBS remains at the forefront of high-altitude meteorology, harnessing cutting-edge technology, student-driven research, and interdisciplinary collaboration to improve understanding of extreme mountain weather. As the Observatory continues to innovate, its contributions will prove invaluable for scientists, forecasters, and outdoor enthusiasts alike.

Watts Down!

BY **KEITH GARRETT**

The low sunlight months of December and January have passed, and along with them, two of the new mesonet stations. We knew the station at 5600 feet, Skyline Station, was likely to disassemble itself during the destructive winds and icing of a typical Mount Washington winter. It did well, until suddenly, it did not.

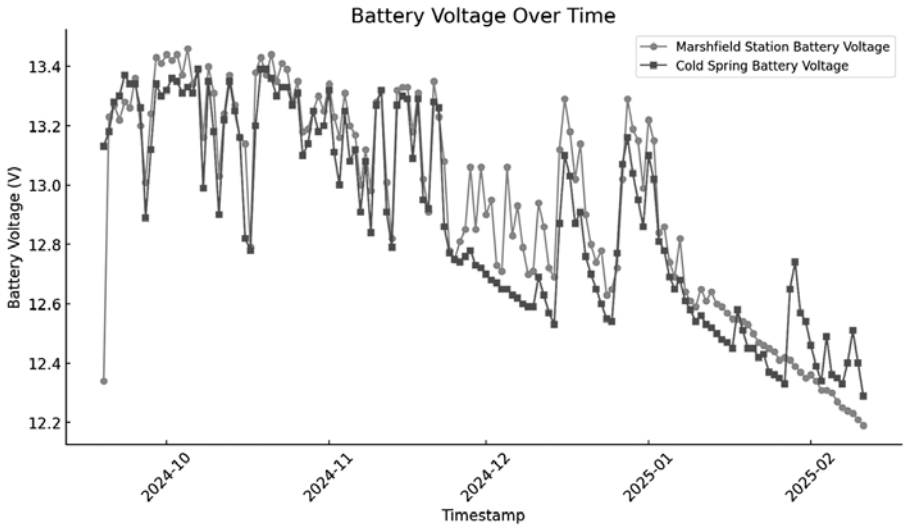
Behold! The wrath of high winds and rime ice loading! The mountain thoughtlessly accepts the sacrifice of an 8 foot tall, too-thin-walled galvanized steel mast and the weather instrumentation it bore! The temperature sensors can now measure the temperature beneath the snow. The anemometer lies waiting and still underneath the snowpack for the spring melt to reveal it. The radio transmitter sends its last determined microwave broadcasts down into the bedrock. The control system lays upon the ground, where the pyranometer lies is unknown.

The tripod held.

Each leg, anchored with half inch bolts, set with determination into that schist that makes up the bedrock of Mount Washington, has performed as expected. The solar panel thus far has remained in position, and is likely still delivering some miniscule trickle of power from its low efficiency sunlight to electricity conversion system to its lead-acid batteries. I sometimes wonder how hard it would be to get a permit for a radioisotope thermoelectric generator that could both generate power, and keep lithium iron phosphate batteries warm enough to operate. Think of the vast array of sensors that could be powered!

This is no cornfield agricultural deployment. Few instruments can survive our harsh weather, and none thus far can operate consistently without regular human intervention. As to

Photo of destroyed skyline station captured by Josh Bishop, The Cog Railway



A plot comparing state of charge at both Marshfield Station and Cold Springs station along the Cog Railway Vertical Profile. Ice/snow covering of panels is shown by consistent decrease in system voltage.

be expected, there have been quite a few repairs and maintenance tasks on summit instrumentation recently, with four sensors being rendered completely inoperable. One of our pitot anemometers has loose parts, that will hopefully be fixed shortly after writing this before it completely disassembles itself. Two ultrasonic anemometers have failed, with the theory being that shock and vibration from de-icing is somehow damaging them. A propeller-based anemometer threw a bearing, proceeding to eat itself from the inside-out. A "present weather" sensor, a sensor commonly used for reporting airport conditions, was ripped apart during a recent 142 mile per hour gust. Its last valid data timestamp matches the timing of the gust to the second. It was large enough that it only flew 3-4 meters.

It's awesome. Every failure, every challenge, every repair is exciting. Equipment that works as intended is even better! Speaking of testing our instruments' mettle, read about our recent anemometer installation on Aconcagua on page 29. This project marks a milestone for MWOBS instrumentation: we now have anemometers on the highest mountains in Asia and the Americas.

One of our winter wind vanes, called Vane B, has been in operation for at least a decade. It has been rebuilt several times over, most recently this summer where bearings were replaced, threads tapped, and its 7 foot long shaft repaired. It is a simple machined unheated vane, attached to a long shaft that terminates inside the tower. An optical encoder attached to the bottom of the shaft measures direction. It has a low cross section, so ice buildup does not occur quite so rapidly under normal circumstances, but still requires hourly de-icing. It is an excellent example of simplicity. It is not

over designed. Its build is not complex. It does exactly what it was intended to do.

Our GE, or NextGen pitot system is also operating well. It also required a full rebuild over the summer. It is a great example of something that is over-engineered. Too many parts, too many little screws, an overly complicated disassembly and re-assembly process, and parts prone to failure. For now, it is working. It will need another full rebuild in the spring.

Two of our new stations along the Cog Railway, Marshfield Station and Cold Springs, are also working extremely well. Each of the new mesonet stations being deployed will be of the same design as these two (and Skyline). Each has operated consistently during December and January, and each has experienced solar panels iced over for a month at a time, maintaining all measurements and communications abilities. The weather at these two locations is more representative of where the rest will be deployed throughout northern New Hampshire. This is a win!

We have more information now. It's time to iterate. Guy wires may have kept the mast at 5600 feet upright, but instrumentation would still have been ripped away. We are sourcing carbon fiber tubing for masts at certain locations, and the Cog Railway machine shop is working on building us a very robust solution. I may have asked for a steampunk looking tripod. Don't tell anyone. You can just build things.

Do you want to build things? The tech team is hiring. Act quickly as the process will be underway as this issue comes out. JOATMON welcome. Buttons, Wires, Code, Servers, Lasers, Radar, Sonar, Networking, with a little bit of weather mixed in.

EDUCATION

Fostering Curiosity and Weather Discovery with Hands-on Learning

BY **BRIAN FITZGERALD**

With the end of the school year already in sight, positive momentum is continuing for educational programs at Mount Washington Observatory (MWOBS) in new and exciting ways. This January, the education team welcomed three new members to the department as Lead School Programs Educator Amy Cotter transitioned to the summit as a Weather Observer & Education Specialist. Misha Leyfer, by way of Newton, Massachusetts, has taken over the permanent Lead School Programs Educator position, while Olivia Dodge and Alexander Templeton have joined the team serving as AmeriCorps School Program Educators through November

Students with the MWOBS Education team at the Cog Railway base ready for winter adventure (Photo Courtesy Cog Railway)

of this year. All three educators jumped right into the mix of learning and teaching programs, and not a moment too soon with School Programs Coordinator Jackie Bellefontaine working with more than 17 member schools across the region totaling more than 194 hours of programming to be delivered by the end of the school year. Grant support from the New Hampshire Charitable Foundation's Neil and Louise Tillotson Fund and the Kendal and Anna Ham Foundation have been significant contributors to this effort, allowing many of the Observatory's programs to come with little or no cost to schools in need.

MWOBS summit field trips for schools are once again proving to be a popular offering, made possible by our partners at the Mount Washington Cog Railway and Mt. Washington Auto Road. Following a successful pilot of winter field trips in 2024, schools were eager to jump on board this winter to give their students the opportunity to experience the mountain and winter, learn about the science of snow, and contribute to long-term snow depth measurement on the mountain. MWOBS sponsor Gordini has even supported the effort by donating 500 pairs of kids' gloves and mittens for students to be able to enjoy learning in the outdoors this winter.

Speaking of youth learning, MWOBS educators along with Tin Mountain Conservation Center, White Mountain Science, Inc. (WMSI), and Conway Public Library have teamed up this winter and spring to develop a new "Climate Exploration Track" for the Mount Washington Valley (MWV) STEM Expo. Put on by our local school district, the MWV STEM Expo invites students from grades 4 through 12 to develop, test, and present scientific experiments and engineering design projects. Funding from NASA's Learning Ecosystem Northeast project has made this

"connected learning" project possible encouraging students to take on climate-related projects that investigate any of the scientific processes of Earth's climate system. Project partners worked together to develop project ideas and resources and even offered a February school vacation week camp hosted by Conway Public Library to help students learn about how to develop and carry out a science project. Additional funding has helped to pay stipends to project mentors, and even for a cash prize for the top climate-related projects! If you'd like to support youth science fair projects, be sure to reach out and learn more through ***www.mwvstemexpo.com***.

For those of us continuing our life-long learning, MWOBS has been able to offer many opportunities throughout the winter and spring of 2025 to enrich weather and climate education. The *Science in the Mountains* lecture series saw experts in a variety of topics ranging from Climate Resilience in Boston, to the history and science of forensic meteorology, to an overview of the Northeast Regional Climate Center at Cornell University with many more exciting speakers and topics coming our way this year. On the mountain, Winter EduTrips and partner-led climbing trips continued in earnest this year. Both programs invited visitors to learn alongside MWOBS summit staff with instruction in topics such as weather forecasting, mountaineering essentials, and the science of winter storms all in the natural classroom of Mount Washington. For those fortunate enough to participate, the unique aspect of these on-the-mountain programs leads some participants to say it was "the experience of a lifetime."

Even though snow may still be on the ground, we all know that summer will be here before we know it. For MWOBS's educational programs that just means we get to look forward to even more time spent outdoors learning in "the field". On the summit, MWOBS staff will be ready to welcome both members of the Observatory and the general public for another year of weather station tours for those traveling up the mountain by foot, Cog Railway train, or by Auto Road stage. MWOBS educators will also host two overnight K-12 teacher sessions as part of our "Peak Perspectives" professional development series in July and August, along with two week-long "Storm Scouts" camp sessions based at our North Conway offices along with excursions to the summit weather station.

In conjunction with the University of Maine Upward Bound program, MWOBS is also excited to host a pilot field experience for Maine high school students. Started in 1965, the University of Maine's Upward Bound program has served thousands of high school students who come from low-income homes and/or homes in which no parental figures hold a bachelor's degree, with an emphasis on providing science, technology, engineering, and mathematics (STEM) learning and explorations.

Wherever your interests lie, MWOBS is excited to introduce and inspire learners of all ages to the science and wonder of Mount Washington and our atmosphere!

From Everest to Aconcagua: Instrument Innovation Across Continents

BY **ELLEN ESTABROOK**

On February 18, 2025, a team of climbers and scientists summited Aconcagua – the highest mountain in the western and southern hemisphere – and installed a weather station a few meters from the top, at 22,769 feet, or 6,940 meters above sea level.

Climatologist, professor, and National Geographic Explorer Dr. Baker Perry co-led the expedition with a Mount Washington Observatory (MWOBS) pitot anemometer—and other instruments supplied by partners—in tow. The goal: to deploy five observation sites on the mountain to better understand water availability in the Andes Centrales, a region critically impacted by a 15-year mega-drought.

This project comes just three years after the team's expedition on Mount Everest, the first successful use of a modified MWOBS pitot being installed at altitudes exceeding Mount Washington's summit. Two of the MWOBS anemometers were installed at Everest Camp IV and Bishop Rock (~7,925 meters and 8,830 meters, respectively). Moreover, the Everest network comprises the highest weather station on Earth.

When MWOBS Director of Technology Keith Garrett was approached by Baker Perry to supply another unit for Argentina's Aconcagua, there was no hesitation. For efficiency regarding the machining process, one additional unit and extra parts were manufactured for testing and repair purposes during the Mount Everest expedition. The unit now installed on Aconcagua had just returned from a year of deployment at Camp IV on Mount Everest.

"Our summit pitot systems are extremely large and heavy. A unit needed to be constructed that would not only be convenient to pack into these remote locations, but also survive the anticipated extreme conditions," Garrett said.

A pitot system, he continued, is fairly straightforward, consisting of a pitot tube and a differential pressure transducer enclosed in an extremely robust housing, relying on measurements of temperature, relative humidity, and pressure to complete the calculations necessary to determine wind speed.

"The housing needed to be simple to machine due to time constraints (its "can-like" aesthetic). It needed to have built-in mounts capable of several variations of

installation, and be as simple as possible. It only requires four wingnuts to be tightened for installation," Garrett said, again highlighting the simplicity of installation being a key factor given the extremes of their deployed locations.

Garrett turned to his team to help with production, including Brett Williams of Wolfeboro, who did the 3D drawings/CAD work, and Hanson Precision Machine of Tamworth, who manufactured the enclosures. The pitot tube itself was a customized design sourced from a Virginia based aerospace contractor.

"The next iteration of these units should weigh less than 2.5kg each, and be able to vane with the wind, both features which are difficult to employ due to the technology of a pressure transducer," Garrett explained. "Our first completely wireless tests have been successful, however add cost, complexity, and a multitude of failure points which I would love to avoid, with lightning being a major concern."

The custom pitot units are fixed-direction, with a directional window of about +- 20 degrees from their orientation, and are aimed into the prevailing winds, meaning they capture wind blowing within a narrow range of the fixed direction.

They record wind speed and the raw sensor output used to calculate the wind speed.

The pitot complements a suite of many instruments built to withstand the extremes of these alpine locales. Wind, temperature, humidity, solar radiation, air pressure, and precipitation along with other measurements are being recorded continuously.

Information collected by these stations is integrated into a global network for scientists to use, transmitted via the NOAA GOES satellite constellation and ingested directly by NOAA DCS (Data Collection System). The data collected from Aconcagua and other sites will aid in better understanding factors shaping the world's high altitude glaciers and weather patterns over time.

"We really have not had observations from these elevations in the Andes, and this is a huge opportunity to expand our knowledge, our observational networks, into this critical part of the world," Perry said.

Changes in temperature and precipitation in the Andes Centrales are noted as two key variables for water availability in the region. "The Aconcagua weather stations will provide critical data to understand the hydrological cycle in this important water tower that sustains the Mendoza River and millions of people downstream," Perry said.

Overall implications of the research are far-reaching, not only relaying real-time information on the changing climate of the Andes Mountains, but also improving visitor safety for the thousands recreating there with improved forecasts (an estimated 3,000 climbers attempt Aconcagua each year).

Alongside key partners, MWOBS is helping scientists understand high alpine and extreme environments on a global scale through instrument innovation.

"Having something that is a direct product of Mount Washington

Tom Matthews (left), Pierre Pitte (center) and Baker Perry (right) make final adjustments on the summit station. Photo by Pablo Betancourt

Observatory deployed on two different continents, on two of the Seven Summits, is beyond words," Garrett said.

Project Wayra, ("Wayra" means "wind" in Quechua, an Andean Indigenous language), is a collaboration between Argentina and the United States, with support from numerous partners including the National Aeronautics and Space Administration (NASA), INKA Expeditions, National Geographic, Instituto Argentino de Nivología, Glaciología y Ciencias Ambientales (IANIGLA), among others.

Along with MWOBS's pitot anemometer, equipment was also provided by Campbell Scientific, OTT HydroMet, RM Young, and Lightning Master.

Pierre Pitte, glaciologist, expedition co-lead, and IANIGLA researcher, said of the project: "[It] is a unique opportunity that has allowed us to bring together agencies and universities from different countries, and it shows that by joining forces, we can achieve incredible things, such as equipping the highest peak in the Americas—a challenge that had never been accomplished."

Pitte continued: "It would have been impossible for us to accomplish what we did without a strong international collaboration, especially in this very complex moment for science."

Extreme Commuting on Mount Washington: The Logistics Behind Winter Travel to the Home of the World's Worst Weather

BY **LAUREN CLEM**

This article was originally published in the Winter 2024/25 edition of Mt. Washington Valley Vibe, a unique, outdoor-focused, seasonally-printed publication in the Mt. Washington Valley of New Hampshire.

In his 19 years serving as a weather observer for the Mount Washington Observatory, Ryan Knapp has seen it all.

He's seen 10-foot snow drifts piled against the walls of the Sherman Adams Building. He's experienced minus-40-degree temperatures with a wind chill of 101 below. He's seen clear days with a view 130 miles in every direction, and starry nights when the aurora borealis danced above the Presidential Range.

"No two days are exactly the same," says Knapp, who currently works the overnight shift at the summit observatory. "What's nice about this job is you do the forecast in the morning, you wake up in the evening, and you're out there experiencing what you forecasted for."

Still, some days are more memorable than others. Knapp remembers clearly the night of February 24, 2019, when the wind reached speeds of 171 miles per hour—a monthly record for the Observatory, and his personal wind speed record during his years on the summit.

WiseguyCreative.com photo

WiseguyCreative.com photo

"We sat down for dinner, and you could hear every wind that was occurring," he says. "We have a little monitor downstairs near our dining table, and every time we heard a wind gust, we'd look at the monitor."

But it's what happened over the following days that cemented the event in Knapp's memory. The Observatory, a nonprofit organization that relies on donations and grants, offers overnight EduTrips to members of the public. Guests typically head up the mountain by snow cat on Mondays and leave the following day. On this week, however, the persistent high winds combined with nearly a foot of snow stranded the group on the summit, and they were forced to spend an extra night. Knapp says there were no complaints from guests, who'd been warned they may get to witness "the world's worst weather" firsthand.

"The next two days we had 123 miles per hour on the 26th– and on the 27th, we had 103-mile-per-hour winds," he says. "Not very many people get to experience those kinds of winds, but more importantly, survive those kinds of winds."

After aborting its mission on Tuesday, the Observatory snow cat was eventually able to retrieve the guests—and bring a fresh shift of weather observers—on Wednesday. Scaling a 6,288-foot mountain in winter is never easy, but Knapp explains how it can be particularly treacherous in high winds. As the snow cat heads up the Mt. Washington Auto Road, the treads kick up snow, obscuring visibility as the wind piles snow drifts in its path. A single trip can take hours, and the arrival must be timed exactly right.

"All that snow was continuing to pile onto the road, so it required a lot of blading to continue to get up to the summit," Knapp recalls.

In extreme weather, as well as everyday conditions, Observatory staff rely on a team of snow cat operators to get them to and from the summit safely. The snow cat (often referred to as a Sno-Cat after its trademarked variety) offers a way to

Upon arrival at the summit, snow cat operator Jon Powers holds the door for weather observer & education specialist, Francis Tarasiewicz.

Aside from people and their belongings, each trip carries weekly food and supplies which need to be unloaded - no matter the weather conditions.

Staff and volunteers unload weekly supplies.

The Summit Stage Office at daybreak.

On a rare calm evening, Mount Washington casts its shadow over Wildcat Mountain.

Weather observers, who typically work one week on and one week off, focus on the weather.

reach the summit in potentially deadly winter conditions, but the job requires a level of skill and judgment far beyond that of the typical weather enthusiast.

Without these specialized operators, the more than century-old tradition of weather observing from the summit—and the forecasts it produces for all in the

Mt. Washington Valley—would quickly evaporate.

SCALING THE MOUNTAIN

The 30-foot birch poles stand up beside the Auto Road like the pylons of an unfinished chairlift. Here in the alpine zone, they tower over everything around us, marking the way to the summit in all weather conditions—or at least, that's the idea.

"There have been years that the tops of those have been completely covered," says Jon Powers, transportation coordinator for the Mount Washington Observatory.

Powers, behind the wheel of the Observatory's white pickup truck, has offered to show me how staff make the trip to the summit in the unpredictable winter and shoulder seasons. As luck would have it, the White Mountains have delivered an unseasonably warm November day, and tourists zoom by on their way up the Auto Road. On this mountain, you can never be too prepared, and halfway up the road, the Observatory's white Bombardier snow cat sits parked at an overlook, lying in wait for colder temperatures. At the first sign of snow, operators will trade their tires for treads and fire up the snow cat.

Operating a snow cat is far more than just driving over snow. The machine's blade is made for leveling and shaping snow rather than clearing it, allowing operators to widen the road as they go. Underneath the treads, 196 carbide picks provide traction, keeping the occupants from falling into a treacherous slide. The greatest challenge, Powers says, is visibility. With the mountain's high winds and constant drifts, the landscape is never static, and operators are often navigating through poor visibility on a path that shifts by the hour.

"Say on Wednesday you went up on shift change and made the road perfectly clean," he says. "If there's a snowstorm overnight and you get enough snow and the right winds, there's no road anymore, so you have to rebuild the whole thing."

Powers—who works as a captain and paramedic for the Conway Fire Department when he's not on the Auto Road—oversees a team of three operators in charge of getting people and supplies up and down the mountain. In the winter, the snow cat operates as many as five days a week. This includes weekly shift changes, EduTrips, media trips, and other opportunities to get the word out about the Observatory's work.

On a good day, traveling at a max speed of 8 miles an hour, the snow cat can reach the summit in about 90 minutes. More often, the trip lasts several hours. Powers recalls one EduTrip last year when the journey took seven and a half hours. In the worst conditions, the snow cat turns around before reaching the summit. It's a call made by the operator, he says, one that can distinguish an inexperienced driver from a good one.

"What you can see is what you drive. If you can't see, you turn around," he says.

Even during shoulder season, the changing temperatures present challenges. The tractor's carbide picks damage the road's asphalt surface, so staff transport the tractor via flatbed truck to a staging point midway up the mountain early in the season. When snow begins to fall at higher elevations, staff members drive

the bare portion of the road in a pickup or van—sometimes using tire chains—then transfer to the snow cat to complete the journey. The whole routine can sometimes take longer than a snow cat trip from base to summit.

The worsening of extreme weather studied by scientists at the summit can also hinder their ability to reach it. According to Charlie Buterbaugh, director of external affairs for the Observatory, summit researchers have identified an increased incidence of rain-on-snow events, affecting snowpack stability and avalanche risk, as well as transportation. In spring 2023, heavy rains washed out portions of the Auto Road and shut it down for a week, forcing staff members to instead rely on the Mount Washington Cog Railway to provide transportation for shift changes.

"With the increase of extreme weather throughout the country, the Observatory is more and more being seen as kind of a hub for learning and research on understanding extreme weather," Buterbaugh says.

SUMMIT LIFE

As we round the summit, a white cross near the top of the Cog Railway reminds us that despite the mild weather, visitors to the mountain are never far from danger. The Sherman Adams Building is closed for the season, with gift shop merchandise and maintenance supplies stacked around its silent halls. Inside a door to the Observatory, Karl Philippoff and Francis Tarasiewicz record their hourly measurements in the weather room while Knapp rests for his overnight shift. Weather observers work one week on and one week off, traveling up to the summit on Wednesdays. They're typically accompanied by one or two interns and several volunteers, who handle the cooking and cleaning in exchange for a chance to stay on the summit overnight.

On the day I visit, a crock pot of chili is bubbling on the counter, and Nimbus the resident summit cat is hiding away in a corner, fast asleep. Philippoff, a native of New Jersey, describes his coworkers as his "summit family" and notes he spends as much time on the summit as away. Even for a weather enthusiast, though, the hours are long, and all three observers recall with annoyance days when extreme weather delayed their shift change.

"I love being up here, but eight days is still a long time. Usually, I'm pretty ready to go down," Philippoff says.

For Knapp and Tarasiewicz, the ride up is one of the less enjoyable parts of the job. Knapp experiences motion sickness and prefers to walk behind the snow cat when conditions allow. Tarasiewicz, meanwhile, is afraid of heights, and more than two years in, still sits on the left side of the tractor cab, facing the mountain, on the way up.

"I always liken the trip in the snow cat to the teacup ride at Disneyland on a boat," Knapp says.

"If you're prone to motion sickness, Dramamine is your best friend."

Aside from people, the snow cat carries weekly supplies and occasional odds and ends—like a Christmas tree in December, and Nimbus when he has a vet appointment in the Valley. The Observatory is stocked with several weeks' worth of

food, and a generator serves the building in times of power outage. (The summit is connected to the electrical grid via the Cog Railway side.)

Despite the supplies, observers are aware that in many ways, they're just as isolated as hikers. The summit has a helipad, but landings are not always possible, and any trip to the base depends on weather conditions and an operator's ability to travel the 7-and-a-half miles to reach it. Last February, Philippoff, and Tarasiewicz were on the mountain for a cold snap when the Observatory tied its record low temperature of -47 degrees—conditions that would quickly turn fatal outside the Observatory doors.

"A lot of people have the misconception that we're so close to civilization that someone's just going to come and rescue us," Knapp observes. "Just because there's a road going up it, doesn't mean the cavalry's going to come save you".

HISTORY OF TRANSPORT

Despite the long history of weather observing on the mountain going back to the first private expedition in 1870, snow cats are a relatively new technology on Mount Washington. The Observatory didn't purchase its first snow cat until 1979. That first tractor came to the mountain from Cranmore, where it had been used to groom ski trails.

In the early days, observers hiked up the mountain along the Cog Railway tracks, according to Peter Crane, curator of the Observatory's Gladys Brooks Memorial Library. Until the completion of Fabyan Station in the 1870s, observers arrived at the base in a sleigh from Littleton stocked with supplies. Later observers would hike up via the Auto Road on the eastern side.

"The typical routine was to get material up the mountain in the fall for the winter," Crane says. "Any other material you were going to bring up over the course of the winter, you'd either hike up or ski up with it."

By the 1950s, other entities—including military contractors and WMTW—had established their own snow cat routes on the mountain, and observers were able to hitch a ride. In the 60s or 70s, Crane says, the Observatory briefly experimented with snowmobiles, but the consensus was they were not well suited for summiting.

Since 1979, the Observatory has owned a series of four snow cats, with the current one more than two decades old. The Observatory has already secured $400,000 in congressional-directed funds to purchase a new PistenBully—the same brand owned by Mount Washington State Park and the Auto Road—to replace the white Bombardier, and hopes to have it on the mountain later this year.

With government and research entities depending on the Observatory's daily weather observations, not to mention the thousands who read the Higher Summits Forecast every week, securing access to the summit is an essential role in the organization's work. For operators like Powers—who says he prefers days that "make you use your brain a little bit"—the challenge of getting there safely is part of the appeal of the job. Even those less keen on the road traveled agree the destination makes it worth every bit.

"I just haven't found anything that has that Venn diagram of what Mount Washington has to offer," Knapp says.

FEATURE

Atop the Rockpile: An Emotional End

BY **FRANCIS TARASIEWICZ**

This article was originally published in the New Hampshire Union Leader on January 3, 2025. You can view our monthly column "Atop the Rockpile" at unionleader.com.

From the summit to sea level, December left little doubt that winter arrived. While Lake Effect Snow buried the Great Lakes region, and intrusions of Arctic air disrupted milder patterns at lower elevations, the higher summits of the Whites have been accumulating rime ice and snow in great abundance. If you've been following our webcam, you've likely noticed its icy obstructions. Lately, the most common emails I've received carry subject lines like "webcam iced over" or "please clean off webcam," with the occasional exasperated "clean the darn webcam!"

Recent rime ice accumulations have been extraordinary. A highlight was watching my coworker, Karl, code "heavy" icing—a designation reserved for events where supercooled cloud droplets create ice at a rate of nine inches or more per hour. This meant Karl climbing our 45-foot tower four times an hour for 12 hours—the equivalent of nearly one Pitcher Mountain's worth of vertical. Go Karl!

After dozens of inquires of varying tones and urgency we did eventually get to clearing off the webcam.

Well, we at least got the process started.

After numerous inquiries, we eventually tackled clearing it using helmets, a 2x10 piece of lumber, and Karl's 6'2" frame. While our efforts were largely successful, Mother Nature's intervention—40-degree air and driving rain—finished the job.

December brought what summit veterans describe as a more typical wintry pattern. Near-constant light snow events, some lasting four days, characterized the month. The summit may be experiencing its first negative monthly temperature anomaly in 13 months, currently sitting at -1.1° below average. Unless a "Grinch" rainstorm intervenes, we'll maintain this cold

anomaly. One such "snow eater" storm recently devoured 13 inches of snow pack, complicating shift changes and necessitating bare-pavement snow tractor rides. Thankfully it was a far-cry from the December 18th, 2023 epic warm up and deluge. Our snowpack and vehicles parked near the highly-active Peabody River greatly appreciate it.

Despite the reduced snowpack, our holiday spirits remained high. Karl, Ryan, Nimbus, and I celebrated Christmas under clear skies with 130-mile visibility. While I missed celebrating with family, I reflected on the first winter-long Huntington-Hitchcock expedition of 1870, whose meager Christmas dinner consisted of canned beef, tomato sauce, coffee, and pilot bread in a room that reached just 42° despite two fires.

I will be sure to keep this in mind before I ever complain about our Wi-Fi going down again.

Sixty-two years later, in 1932, the first MWOBS observers enjoyed a more festive Christmas. Two radio engineers creatively wired colored bulbs in series with the anemometer register, causing the lights to blink with each mile of wind—a uniquely summit-style tree lighting. Observer Bob Monahan captured the moment in his journal: "Soon the rapidly flashing lights completed the picture of a genuine Christmas celebration."

Christmas wasn't the only reason to celebrate on the Rockpile this month. We also celebrated an observatory milestone. My coworker Ryan is ringing in 20 years with the Mount Washington Observatory. After being around for 21% of the Observatory's history, Ryan holds the title as the longest serving observer in the Observatory's history. As our staff meteorologist he has been instrumental in creating and maintaining our observational and forecasting processes and standards. Beyond his job description, Ryan is an exceptional mentor, and a rock amongst the frequent chaos that unfolds at 6,288 feet.

Having such incredible coworkers makes the next part of this update particularly difficult. After two and a half transformative years, January 8th was my last full day as a weather observer on the Rockpile. As a somewhat awkward scientist, I find goodbyes challenging, so I'll keep this brief to avoid embarrassing myself too much.

When I arrived at the Observatory, I felt anxious and somewhat uncertain in my life. My first ride up featured a somewhat hilarious struggle to even look over the edge of the Auto Road. Thanks Alexis for helping me with that. Over time, due to the support of my coworkers, I found my niche—telling the story of our dynamic atmosphere through the lens of a weather observer at New England's highest point. More importantly, my time here has provided a profound sense of family and belonging. Something that, as a person raised in the foster care system, has been a rarity for me.

From auroras and the smiling faces of students to 47-below air, my summit memories are countless. For all the highs of successful school programs

Francis on the deck during his final observation in January taken by volunteer Carol Haney.

and the lows of broken instruments, I'm immensely grateful.

Thank you, Ryan, for your leadership, wisdom, and passion. Thank you, Karl, for the laughter, patience, and camaraderie. Working alongside you both to expand our mission of understanding Earth's weather and climate has been the honor of a lifetime. To spend my late 20s as a bridge between the extreme weather of the White Mountains and the community impacted by it as well as an educator has forever sculpted my approach to communicating science. I can only hope my contributions have upheld our 92-year legacy.

Before the "cold air" causes me to tear up I'd like to share a bit of good news.

"Atop the Rockpile" will continue with our Summit Weather Operations Manager, Mike Carmon, who has been with the Observatory for over eight years. I'm confident he'll share many captivating tales from his time on the summit and am excited for you all to meet him in the next edition.

Thank you all so much for the community and for your continued fascination with Mount Washington and the hardworking team that makes it all possible.

See you at the next storm.

Francis

FEATURE

Solid-to-Liquid Ratio: Overview & Implications for Research

BY **MARIN MACDONALD** - SUMMIT INTERN FROM COLORADO STATE UNIVERSITY
MEES FRANSSEN - SUMMIT INTERN FROM MCGILL UNIVERSITY
CHARLES PEACHEY - OBSERVER AT MOUNT WASHINGTON OBSERVATORY
KARL PHILLIPOFF - OBSERVER AT MOUNT WASHINGTON OBSERVATORY

Predicting snowfall on Mount Washington in the winter can be tricky because solid precipitation comes in many forms, like snow, sleet, and graupel. Unlike rain, which is straightforward, these different types of frozen precipitation make forecasting and measuring snowfall more uncertain. Snowflakes themselves can look very different depending on the temperature and wind conditions when they form—some are big and branched like classic snowflakes, while others are tiny ice columns (Figure 1). These variations make it even harder to figure out exactly how much snow or other frozen precipitation will fall on the summit

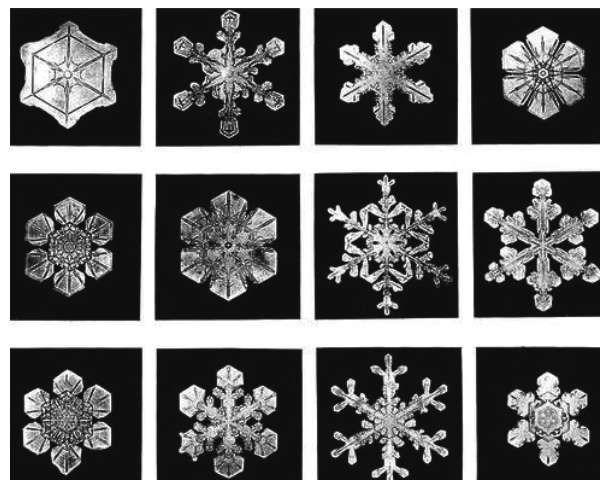


Figure 1. Diagram depicting various snowflake crystal habits which can be produced depending on the temperature and humidity present in the cloud in which they formed. These pictures were taken by Wilson Bentley between the 1880s and about 1930. *Snow Crystals*, a record of 2,500 of his best photographs of individual snow crystals, was first published in 1931 and is still in print.

In order to forecast the depth of precipitation when frozen precipitation is expected, meteorologists can simplify this task by breaking down the problem into three discrete steps.

- Determine how much liquid precipitation a storm is expected to bring.

- Determine, based on atmospheric profiles and the summit's temperature, what type of precipitation is expected to fall (e.g. snow, sleet, graupel).
- Apply an estimated solid-to-liquid ratio to determine the total amount of frozen precipitation that is forecast to fall using the expected liquid amount.

The solid-to-liquid ratio, usually shortened to the acronym 'SLR,' is the amount of liquid precipitation that could be expected when melting a given amount of solid precipitation. It's typically expressed as the number of inches of snow per inches of water, as in the following equation:

$$SLR = \frac{inches\ of\ solid\ accumulation\ or\ snowfall}{inches\ of\ liquid\ equivalent}$$

SLR is most often cited as being a 10:1 ratio in many forecast models, meaning for every 1 inch of liquid water, 10 inches of snowfall would be expected. Although this is a commonly used metric, SLR can vary quite substantially based on local atmospheric conditions, with factors such as temperature and humidity playing a critical role. Dense, heavy snow can have an SLR as low as 3:1, and in extreme cases, snow can fall so light and airy it can reach an SLR of up to 100:1. However, most winter storms fall somewhere between the 5:1 to 30:1 SLR spectrum on the summit. All of this means that applying the simple 10:1 ratio in all cases can be flawed, especially considering the impact which temperature and wind can have on the formation of snow crystals, and can lead to large errors in snowfall forecasts.

Mount Washington Observatory's extensive precipitation and snowfall record, as well as temperature and windspeed records, offer an opportunity to refine these ratios for forecasting snowfall on the higher summits. In addition, assessing SLR over the period of record through the development of a time-series analysis will provide insight into how accurate our historical observations have been and insight in how to improve them in the future. By investigating which atmospheric parameters affect SLR, the Observatory hopes to establish a more thorough understanding of how to forecast wintertime precipitation, and create better estimates of snowfall during times of extreme weather, with results having the potential to be applied in the context of snow observations and outdoor safety initiatives within the Presidential Range.

To generate a climatology of SLR values at the summit, historical data dating back to the 1980-1981 winter season was assessed. Daily precipitation and snowfall data were used to calculate SLR using the formula described above. In order to look at changes between winters, a metric coined the "snow year" was used to separate data by each individual winter season, which spans two calendar years (e.g. fall 2024 to spring 2025). This was used rather than grouping data by year, which would split one winter season's worth of data into two separate years, potentially leading to inaccurate conclusions concerning

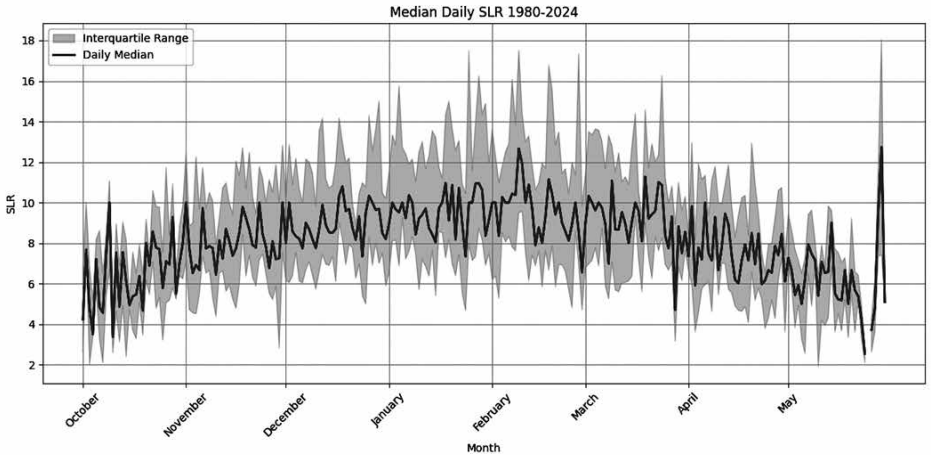


Figure 2. Median Daily Solid to Liquid ratio of precipitation from October-May (winter season) for snow seasons 1980/1981 to 2023/2024. Shoulder seasons are indicated by lower SLR values.

seasonal SLR values and their trends. The snow year was defined as October 1 through May 31 to capture each full snow season, with each day given a corresponding Snow Day of Year value. Years were also given snow year values, with the 1980/1981 snow season being defined at snow year 1.

After completing preprocessing, it was found that the SLR data for the period of interest had a non-normal distribution. Because of this, median daily values were selected for the climatology to minimize the importance of outliers in the data (such as very high or very low SLRs). Looking at how the median daily SLR value varies throughout the snow year (Figure 2), it is clear that shoulder seasons (October-November and April-May) tend to have lower SLR values, meaning denser precipitation. Considering that these periods have a greater frequency of mixed precipitation events, it is plausible that the precipitation during this time would have a lower SLR. With SLR during shoulder seasons becoming as low as 2:1, this shows the inaccuracy of the 10:1 SLR estimate commonly cited in the literature. While values between December and March tend to be closer to the 10:1 metric, there is still variability in SLR, with daily medians for this period varying between 7:1 and 13:1. There are also changes in the variability of SLR across the entire 1980-2024 period, with increased variability in mid-winter SLR values starting around 2004.

Going forward, a multivariate linear regression will be used to assess the importance of temperature and wind speed in determining the SLR of solid precipitation. The results from this model will help in the estimation of SLR values in the future, and provide a more representative estimate for the Higher Summits than the 10:1 standard.

The Cog Railway

On a recent snowy, windy morning, our office phone rang, not unexpectedly. On the line was Jackie Bellefontaine, the School Programs Coordinator at the Mount Washington Observatory. She was calling from the top of the infamous hill on Base Station Road, just east of the Omni Mount Washington Resort. Even on a perfectly warm and clear bluebird day, coming over the top of that hill is not unlike the moment when your stomach drops and goes "weeeeeee" on the old wooden Roar-O-Saurus kiddie coaster at Storyland. But when everything below and as far as the eye can see is a hazy shade of winter– like today– well, one's death-grip on one's steering wheel tends to tighten.

Jackie was calling to let us know that the bus carrying the school group scheduled for the 10:15 train to Waumbek Station had turned around in Crawford Notch due to the wintry conditions. We had layered up and charged camera batteries in order to document today's train ride with the kids, and had planned an interview with Jackie for this article afterwards. She apologized profusely, hoping that we could reschedule. Of course we said yes, because the partnership between The Cog and MWOBS, and particularly with the school program, has been one of the most fruitful and satisfying collaborative efforts up here in recent memory. We've been committed to providing substantially discounted train tickets for school field trips for years, but the fairly recent addition of weather programming has taken the Railway experience for students and teachers to a whole new level.

Overseen by Director of Education Brian Fitzgerald, Jackie and her teaching partner Amy Cotter work with dozens of regional elementary and high school

groups every year. Most trips include tours of the weather station, using The Cog for transportation to and from the summit. Group sizes vary from a handful to a full trainload (or more), and regular passengers riding along with the kids enjoy the value-added benefit of the educators' weather-specific narration on the way up. With the addition of daily, year-round service to our new and improved Waumbek Station at 4000', we're seeing more and more winter field trips.

After she signed off from our phone conversation this morning, Jackie took one last look at the well-plowed but still snowy hill before turning around and heading back to her office in North Conway. Maybe she was thinking about white knuckles on the Roar-O-Saurus' buzz bar, maybe not, but we opted to do the interview by phone and e-mail, not here in the office. It reminded us of how we often describe our mountain-climbing railway, with tongue very firmly planted in cheek, as the world's slowest roller coaster. With an average grade of 25% and a hair-raising top speed of 5mph, to our knowledge it is also the only one in the world that lets you get off at the top for an hour to think things over before the steep but equally low-speed descent. And get this: EVERYBODY rides back down!

For more information, visit us at ***www.thecog.com***.

NEWS FROM OUR PARTNERS

Mt. Washington Auto Road

Greetings! There are many exciting infrastructure improvements afoot for the Mt. Washington Auto Road. In spring 2025, we will pave over one mile of the lower mountain stretching from the Jenny Lind Bridge to the 2-mile post. This project will happen after Spring Clearing and before Memo-

rial Day weekend.

Regarding environmental initiatives, in 2023, a 40 kW solar array was installed on the roof of the Auto Road maintenance building. This 88-panel array covers all of the electrical needs of the maintenance shop, Toll House, Hideaway retail shop, and other outbuildings on the property. In late 2024, a large solar array was constructed for the Glen House designed to cover all the electricity needed for the hotel beyond what the current Hydro Generator produces. The array, located in the field below the hotel, consists of 672 panels each producing 595 watts for a total production of approximately 400 kW DC/300 kW AC. These solar panels are just one part of the Mt. Washington Auto Road's commitment to sustainability, energy efficiency, and environmentally conscious practices. To learn more about our initiatives, please visit:

mt-washington.com/environmental-initiatives.

Auto Road Operations will reopen in early May (weather permitting). This year we are offering a new pricing/rate model that reflects customer feedback. One highlight is that a Seasons Pass will be available for $125. This flat fee will be per person for driving yourself. We hope locals will also enjoy this opportunity for savings for visits from May through November. Snow enthusiasts may especially benefit from this season pass model in May & June. For more details on our new price structure, please visit: ***mt-washington.com/status-weather/.***

We cordially invite you to save the date–May 17, 2025–for the ribbon cutting of the new Bridge & Toll House. The completed bridge project addresses increased pedestrian safety as well as congestion on Route 16 during peak times and busy event days. For the first time in the 2025 season, drive-yourself customers and guided tours will route through the new traffic flow.

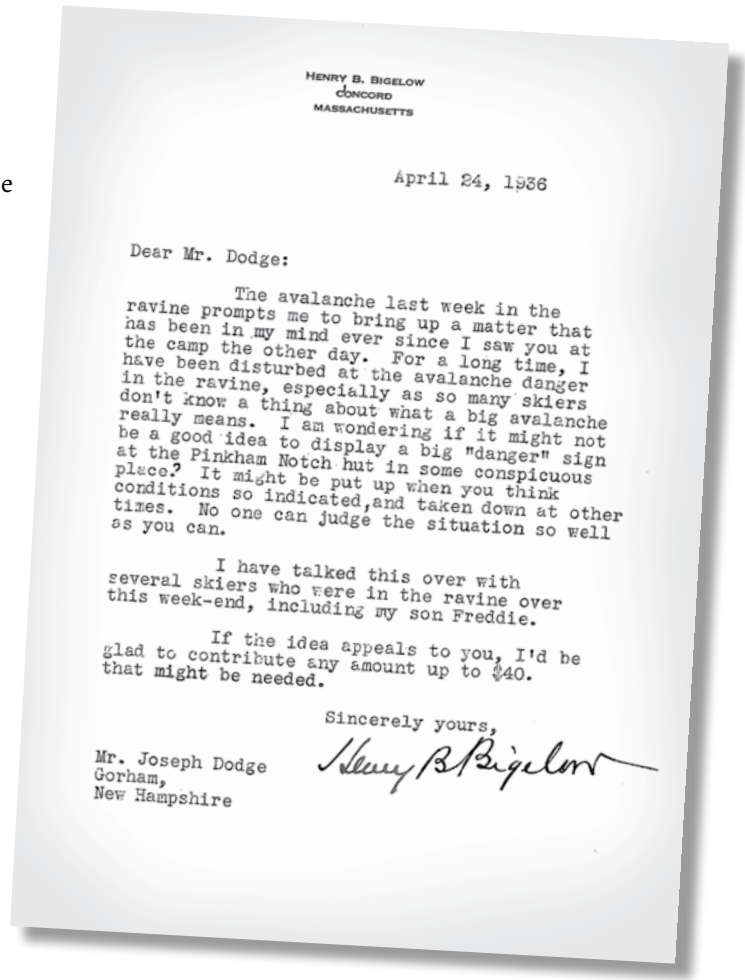
In programmatic news for Summer 2025, in addition to continuing our beloved signature races–Delta Dental Mount Washington Road Race and the Mt. Washington Auto Road Bicycle Hillclimb, we are excited to announce a new title sponsor for the 24-Hour Bike Race (August 2–3). Our neighbor to the north, Big Day Brewing, stepped up to answer the call as the headlining sponsor. For this year's theme, we're going under the sea for the race, camping, parties, kids' events, live music, and bash celebrating the most delicious suds around made by Big Day Brewing. Registration is open for 24 and 12-hour teams and solo riders. Learn more about this weekend of bikes, community, food, brews, and fun here: ***greatglentrails.com/24-hours.***

Looking forward to a great season ahead!

The Beginning of Avalanche Education on Mount Washington?

BY **PETER CRANE**

The Observatory is privileged to have files in its archives that come from the private collection of Joe Dodge, a founder of the Observatory who also served for many years as Huts Manager for the Appalachian Mountain Club. Among the Dodge papers is a brief correspondence on a matter of mountain safety, dating to the days long before trailhead information kiosks and QR codes.



HENRY B. BIGELOW
CONCORD
MASSACHUSETTS

April 24, 1936

Dear Mr. Dodge:

The avalanche last week in the ravine prompts me to bring up a matter that has been in my mind ever since I saw you at the camp the other day. For a long time, I have been disturbed at the avalanche danger in the ravine, especially as so many skiers don't know a thing about what a big avalanche really means. I am wondering if it might not be a good idea to display a big "danger" sign at the Pinkham Notch hut in some conspicuous place? It might be put up when you think conditions so indicated, and taken down at other times. No one can judge the situation so well as you can.

I have talked this over with several skiers who were in the ravine over this week-end, including my son Freddie.

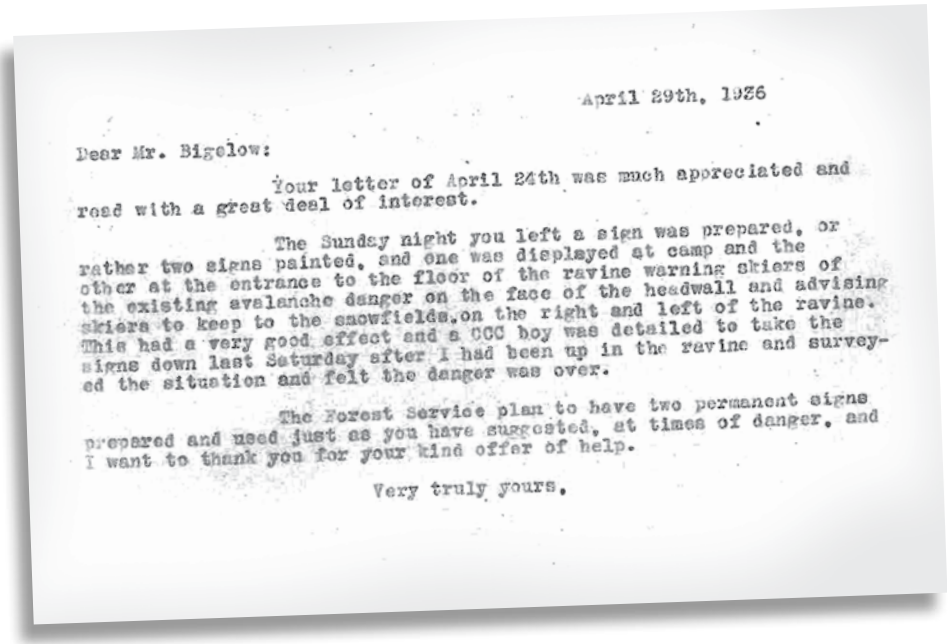
If the idea appeals to you, I'd be glad to contribute any amount up to $40. that might be needed.

Sincerely yours,

Henry B Bigelow

Mr. Joseph Dodge
Gorham,
New Hampshire

In April of 1936, Henry B. Bigelow of Concord, Massachusetts, wrote to Joe Dodge, suggesting some signage



April 29th, 1936

Dear Mr. Bigelow:

Your letter of April 24th was much apprecciated and read with a great deal of interest.

The Sunday night you left a sign was prepared, or rather two signs painted, and one was displayed at camp and the other at the entrance to the floor of the ravine warning skiers of the existing avalanche danger on the face of the headwall and advising skiers to keep to the snowfields,on the right and left of the ravine. This had a very good effect and a CCC boy was detailed to take the signs down last Saturday after I had been up in the ravine and surveyed the situation and felt the danger was over.

The Forest Service plan to have two permanent signs prepared and used just as you have suggested, at times of danger, and I want to thank you for your kind offer of help.

Very truly yours,

be created to advise people about avalanche danger in Mount Washington's Tuckerman Ravine. Bigelow even offered $40 to pay for the signs! (Seemingly a small amount, but by some estimates worth about $900 in today's dollars.) Dodge wrote back that there were some signs that had just been put up, evidently temporary ones, but that the Forest Service was in the process of making some permanent signs to warn visitors of avalanche danger.

This was even before legendary U.S. Forest Service Snow Ranger Brad Ray was born! But it can perhaps date the start of Forest Service avalanche education on Mount Washington to 1936.

Henry B. Bigelow was a Harvard professor of zoology, founding Director of the Woods Hole Oceanographic Institute, and father of Henry B. Bigelow Jr., who died in an accident in Huntington Ravine in September 1931. The younger Bigelow, a mere 18, was rock climbing on the left side of the Ravine, and the rock to which he was clinging detached from the wall with fatal consequences. One must suspect that this tragedy to the Bigelow family only heightened Mr. Bigelow's sense of caution in mountain terrain.

These Bigelows were related to Jacob Bigelow (1818-1890), physician and botanist for whom Mount Washington's Bigelow Lawn is named; they shared a common ancestor, Thomas Bigelow (1683-1756).

Our Volunteer Community in Action

BY **WENDY ALMEIDA**

Volunteers are at the heart of Mount Washington Observatory, lending their time, talents, and energy to support everything from membership mailings and donor outreach to event planning and summit operations support. Whether they're cooking in the summit kitchen, planting in the garden at our Valley office, mailing our membership reminders or assisting with events like Seek the Peak (and many others), their dedication to helping where it's needed most makes an incredible impact.

With nearly 200 volunteers logging more than 3,000 hours last year, their contributions go far beyond the numbers - they foster the connections and teamwork that keep our programs thriving. In this column we celebrate the many ways volunteers have supported the Observatory over the past few months and share how you can be part of this incredible community too!

Monthly Membership Mailing

Each month, a wonderful group of volunteers gathers at the Observatory's North Conway offices for Membership Mailings, held on the second Thursday of the month at 9:00AM. It's more than just stuffing envelopes - it's a time to catch up, share stories, and enjoy a few laughs while working together. Many of our local volunteers return month after month. We even have some

Monthly mailing volunteers helping our Education Team sort *The Little Glove Project* donations from Gordini, which is helping us keep student hands warm on school field trips this winter.

Mulch Day volunteers enjoy lunch after prepping the garden beds for winter at the Valley office in November.

volunteers from Maine and Massachusetts join us when they can (thanks Mark Asaro and Peter Fisk!). If you'd like to join our Membership Mailings group, email Wendy Almeida at **walmeida@mountwashington.org**.

Our monthly mailing volunteers include Mark Asaro, Peter Crane, Linda Denis, Hank & Linda Dresch, Donna Dunn, Peter Fisk, Karen Franke, Donna Gray, Kim Henry, Ava Honan, Marie Kapsar, Joan & Sandy Kurtz, Karen & Gary MacDonald, and Mary Anne Sledzinski

Donor Outreach Card Writing

We have a new group of volunteers who have helped us step up our personal donor outreach appreciation program over the winter. Many thanks to these folks from across the Northeast — not just those living near our Valley office — for taking the time to help us express appreciation to our supporters. In an era of digital messages, the lost art of a handwritten note makes an impact, and I'm especially grateful for these dedicated volunteers who put pen to paper for our membership program!

Joining our longtime card writing volunteer, Marietta Deegan, new card writing volunteers include Susan Barnes, Brianna Desharnais, Meredith Doyle, Erica Fuller, Ava Honan, Maureen Jenks, Marilyn Kasper, Jay Katzanek, Stacey Morrissey, Rebecca Pillsbury, Nancy Protzmann, Ayla Queiroga, Corie Rand, Bruce Shepley and Erica Valez.

Spring Bloom from our Gardeners

A huge thank-you to our amazing garden volunteers - *Barbara Althen, Bill Ofsiany, and Donna Gray* - for planting an incredi-

ble 800+ bulbs last fall, including tulips, daffodils, crocuses, and more. Bulbs are emerging at our North Conway office and will be bursting with colorful flowers in the coming month thanks to their hard work, and some generous donations they solicited from local businesses. Plan a visit to the Valley Office in April to enjoy the big bloom and see their efforts in action!

Upcoming Volunteer Opportunities

Retail Manager Brandi Webb is looking for extra hands to **help prepare for the opening of the summit museum and gift shop**. We need volunteers to assist with sorting inventory, tagging items, and packing shipments at our Valley office in April and May. There may also be an opportunity to help transport inventory to the summit and organize stock with an early spring trip to the summit. If you can spare a couple of hours to lend a hand, contact Brandi at bwebb@mountwashington.org. Your help would be greatly appreciated!

We're in full swing with **Seek the Peak planning** and rely on volunteers to make this event a success. From check-in (a new check in process is in the works thanks to a grant from Volunteer NH for our new iPads!) to assisting vendors, managing concessions, directing parking, and helping in all sorts of ways for the Apres Hike Expo, volunteers play a vital role. It's a great way to connect with fellow outdoor enthusiasts and support the Observatory's mission. Volunteers receive a free Seek the Peak T-shirt, Après Hike Expo entry and a meal voucher. With 2025 marking the event's 25th anniversary on July 18-19, we'd love for you to be part of this milestone year! Contact Wendy Almeida at walmeida@mountwashington.org for more information on how you can help.

Volunteer Program by the Numbers – 2024*

Our incredible volunteer community made a significant impact last year. From supporting operations at the summit to enhancing our valley programs and events, their dedication shines through in every moment and milestone for the Observatory. Here's a look back at what our volunteer community accomplished in 2024.

- **3,035** – Total hours logged by our volunteer community overall. *
- **4,158** – Membership renewal notices folded and mailed by volunteers. *
- **199** – Active volunteers in 2024. *
- **315** – Summit sunsets witnessed by volunteers working alongside our team, including those many days shrouded in fog!
- **60** – Volunteers who lent their time and talents to make Seek the Peak 2024 a success.
- **66** – Volunteers who attended the Fall Gathering.
- **800** – Spring bulbs planted by our Valley Gardening Volunteers.

* *These numbers are from April to December 2024.*

Celebrating Community Builders: The Zlogars

BY **WENDY ALMEIDA**

For the past 20 years, volunteers Mike and Sue Zlogar have dedicated countless hours to the Mount Washington Observatory. Their contributions, from repair projects to cooking family-style meals, have touched every corner of summit life. Their love for the Observatory and the people they've met along the way lies at the heart of everything they do. For the last decade, they've also delivered a special gift each year — the annual summit Christmas tree — bringing holiday spirit to staff during the season.

Mike, left, and Sue Zlogar on the summit during their annual holiday trip this year.

The Zlogar's volunteer journey began after listening to stories from Marty Engstrom. "We were fascinated by the Century Club," Sue said, referring to the tradition of braving 100+ mph winds. "I've yet to make it and doubt I will, but that's when it started."

Over the years, Mike and Sue have volunteered during every season, but they both agree winter is their favorite. "We love the quiet," Sue shared. "Our favorite time is early morning, having coffee and looking out over the mountains — if we see them! — and the rime ice. We've enjoyed that enormously." For Mike, it's about the weather extremes. "We don't see winters like this in Western Massachusetts," he explained. "Being able to come up here and just enjoy the winter weather is a special treat."

The Zlogars' impact goes beyond their appreciation for the landscape. Mike is a jack-of-all-trades and a go-to volunteer for all kinds of repair work at the

summit. “It probably comes with being a firefighter,” he said. “I just kind of got asked to help with things — painting, helping contractors with ceilings, and so many little things around here.” Over the years, he’s collaborated with others on building the summit bunk rooms and parapet decking. One of the more unusual requests he still chuckles about was the time he pressure-washed the tower interior to prepare it for painting. “I like staying busy and just doing things to help out,” he said. “We just pitch in wherever and it’s just been fun.”

Sue enjoys baking at elevation and said the key is figuring out how to use leavening. “The first time I came up, there was a sign on the back of one of our cupboards that said, ‘at this elevation, do this.’ It makes a difference.” She summed up her summit baking experience with a big smile: “It’s always an experiment.”

One of her most memorable experiences baking at the summit was when she got a call to help bake cookies for the Seek the Peak event. “I made 658 cookies — I counted! That was a lot of fun. And only about 2 dozen were left over.”

The Zlogar’s love for the summit extends to the moments that make volunteering special. Sue fondly remembers when a fox wandered up and sat beside her during one of their early visits. “It was really pretty cool,” she said. For Mike, memories range from de-icing in 90+ mph winds to a rare calm September day when bugs unexpectedly appeared. “It’s different every time,” he reflected. “The lighting, cloud cover, sun, ice formations — it never gets old. The only thing we’ve missed so far is seeing a good aurora.”

However, for Mike and Sue, the community is the heart of their volunteering experience. “It’s about the people,” Mike explained. “The crews have become friends over the years, and we still stay in touch with many of them. It’s the friendships, the personal connections, and the opportunity to just be part of it.” Sue added, “For me, it’s collecting stories. There are so many wonderful people, and they tend not to toot their own horn. I’ve learned so much from them and enjoyed their company enormously.”

Mike and Sue’s contributions, from their teamwork in the kitchen to their willingness to tackle any project, embody the spirit of the Mount Washington Observatory. Their generosity and positivity create an environment where staff, visitors, and volunteers feel welcome.

“Every night having dinner with the crew is a real joy,” Sue said.

As the Observatory reflects on the impact of its volunteers, Mike and Sue’s story is a reminder of the meaningful connections that define this organization. Our volunteers’ time and talents help the summit run smoothly and foster a sense of belonging that makes the Mount Washington Observatory truly special. In the past year alone, volunteers collectively contributed more than 3,500 hours at both the summit and the valley office — a testament to the dedication and vital role all our volunteers play in supporting the Observatory and our mission.

From 'Elevation Zero' to the Summit: Ed Rhodes Reflects on 25 Years of Membership

BY **WENDY ALMEIDA**

"I've always been hiking the Whites, and believe it or not, I didn't even know the Observatory existed for many years," Edwin (Ed) Rhodes III, admitted. "I'd been to the summit and never knew there was a weather station until I ran into somebody, and they told me about it, and Seek the Peak."

That chance conversation opened the door for Ed to join the Mount Washington Observatory (MWOBS), which has now spanned 25 years of membership.

Ed by the Mount Washington State Park summit sign.

From the start, Ed has gone above and beyond as a member and supporter. "They used to publish wish lists of things the observers needed for the summit. One year they were wishing for new alarm clocks so I donated, I don't know, eight or nine new alarm clocks for the bunkrooms."

Ed's dedication is especially evident in his involvement with Seek the Peak, MWOBS's largest community hiking event of the year. He has been a longtime member of the Kilted Hikers team, a group known for their enthusiasm and remarkable dedication to fundraising for the event and supporting the Observatory's work. For a couple of years, the group even pooled additional funds to sponsor remote learning programs for school kids.

Ed, second from left, on the summit in winter with his Seek the Peak fundraising team, the Kilted Hikers.

One of Ed's most cherished memories was a winter trip to the summit with the Kilted Hikers after the team won the top prize for their Seek the Peak fundraising efforts. "We were all experienced hikers, so we got to go out hiking in extreme winter weather. It was something we'll never forget."

His love for MWOBS is evident in his everyday life. "It's funny, because my family asks, 'Do you have anything in your wardrobe that doesn't say something about Mount Washington?' I've got shirts and T-shirts and jackets, and my truck's got two or three bumper stickers from Mount Washington. I'm like, 'No, actually, I really don't.'"

As Ed puts it, "I'm a flatlander down here in Connecticut. You know, I live at elevation zero." But his decades of involvement with Seek the Peak and steadfast support for MWOBS exemplify his dedication to the Observatory's mission and the mountain he loves — a commitment he plans to continue for years to come.

To our 25-year members like Ed, your support allows us to sustain our legacy of weather observation and research, inspire the next generation of scientists, and improve weather safety for all who explore Mount Washington and beyond. Your commitment ensures that the Observatory's work continues to make a lasting impact. Thank you.

~ 25 years ~

James W. Adams
Sandra Barnes
Eric Baumgartner
Brian and Valerie Benedict
Harold Coyle
Dana Davidson
Kevin Doyle
Barbara Drury
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Michael A. Morrison
Bill R. Ofsiany
Scott Rahuba
Edwin W. Rhodes III
Steven M. Saad
Roger A. Schoenbeck
Dick and Lupe Sears
Margaret L Silloway
Robert and Linda Watts

~ Our deepest gratitude! ~

91st Big Wind Day Celebration

We are excited to once again celebrate Big Wind Day with our partners at Tuckerman Brewing Company in Conway, NH! All are invited to celebrate and explore this landmark event by joining us at the Brewery on April 12, 2025 from 3:00-6:00pm, where there will be live music, fun educational activities to engage youth and families, young STEM innovators from the community, weather trivia, and more (plus, there will be an exciting product launch)! Visit mountwashington.org/events for more information.

Upcoming Dine-to-Donates

Join the Mount Washington Observatory team at Black Cap Grille in North Conway, NH on May 8, 2025 from 5:00-8:00 PM for fresh and flavorful food. A portion of all proceeds will be donated to support our work in weather and climate science. Our staff will be on-hand to make special presentations, hold raffles, give away free gear, and help hikers sign up for our 25th Annual Seek the Peak. You can find our event at 1498 White Mountain Highway, North Conway, NH 03860.

We will also be at Flatbread Pizza Company in Portsmouth, NH on June 3, 2025 from 4:00-9:00 PM—Stop by!

NHPR By Degrees Summit

Join us for NHPR's 3rd Annual By Degrees Climate Summit: Healthy Connections, in partnership with New Hampshire PBS, on Friday, May 2nd at St. Anselm College. Mount Washington Observatory research intern Frank Vazzano will present during the afternoon breakout sessions, sharing new insights collected as he endures Mount Washington's challenging weather. Participants will learn about the Higher Summits Forecast, practical adaptations like gear choices, and opportunities to share observations that shape climate research. Learn more at nhpr.org.

Seek the Peak: 25 Years of Reaching New Heights

Any Hike. Any Day.

Seek the Peak is Mount Washington Observatory's largest fundraiser, directly supporting our forecasting, research, and educational programs. Whether you're summiting Mount Washington, walking a local nature path, or conquering a personal milestone, your adventure makes a difference. Join us in celebrating the 25th Anniversary this year! Sign up today at seekthepeak.org to get 50% off registration for a limited time (ends April 12), and celebrate with us at the Après Hike Expo on Saturday, July 19 from 4:00-7:00 PM at Great Glen Trails!

TRIBUTES & MEMORIAL GIFTS

In Memory of Sam Gawel

Norman Silverman
Leah Gawel
Jess, Ramon and Ooma Gawel
Amelia Pavlov
Stephanie Westover
Debbie Baker
Henrike Frowein
Norman Silverman
Deborah Wolney

Mark Allen ..... In Memory of Robert L Allen Dartmouth 10th Mountain Division Army
Sandy Barry ..... In Memory of Rick Salmonsen
Carmen Jane Booth ..... In Honor of Minus 33 Merino Wool Clothing
Christine Boutilier ..... In Memory of Jim Boutilier
Kris Bowden ..... In Honor of Nimbus!
Marcia Brown ..... In Honor of Molly, Sarah, and Emily Thunberg
Wayne Bunker ..... In Memory of Briggs H. Bunker
Mo Chase-Powers ..... In Memory of Merle Sciacca, a wonderful hiker & friend, gone too soon
Stephen R Chiacchia ..... In Memory of Wayne Wrubel
Jocelyn Clark ..... In Memory of Victor Clark
Daniel Coogan ..... In Memory of Matt DiCioccio
Joanna C Daniel ..... In Memory of Richard M. Daniel, Jr.
Steven Dennehy ..... In Memory of Michael Dennehy
Donna Devine ..... In Memory of Bee and Steve Alderson
Ann Dobens ..... In Memory of my sister who has loved our Mount Washington
Caryl Dow ..... In Memory of Albert Dow
Robert Dowling ..... In Memory of Julie Schiavone
Marianne Downie ..... In Honor of William T. Housum
Stanley W. Ellis ..... In Memory of Jack Lockwood
Armanda Famiglietti ..... In Memory of Charlotte Markey
Arlene L. Feit ..... In Memory of Nicole Isaak
David Fitzgerald ..... In Memory of Ron Zandy
Jonathan Gray ..... In Memory of Robert E. Gray
Scott Haenssler ..... In Honor of Willard
Sharon Hewitt ..... In Honor of Elizah McLaughlin
Kathleen Hoil ..... In Honor of Christian Leavitt
Jenne James ..... In Memory of David James
Rob C Kircsh ..... In Memory of Guy Gosselin
David Langelier ..... In Honor of all the summit cats over the years
Jeff Lathrop ..... In Memory of Francis O. Lathrop
Annette Lawlor ..... In Memory of Bob Coleman
Harvey Leonard ..... In Memory of Guy Gosselin
Kerri Livesey ..... In Honor of Gregory & Deborah Livesey

Robert Longmoore.....In Memory of Ronald Zandy
Sharon Maas .....In Honor of my Father who loved the mountain even in winter
Edward MacColl ..... In Memory of Rev W. Stewart MacColl
Emily Markey ..... In Honor of Charlotte Markey
Pamela Masters .....Thank you for memories of hiking with my dad
Lois McNamara ..... In Memory of Charlie Humphreys
Janna Michael ..... In Honor of Ty Gagne
Tiffany Montgomery .....In Honor of Wendy!
Peter Muellers..... In Memory of Christopher Brown
Ian Ogilvie ..... In Memory of Dotty Burt
Arthur O. Poltrack ..... In Memory of Anthony S. & Arlene O. Poltrack
Heather Rainier ..... In Honor of Todd Rainier
Rappahannock County, Virginia .....In Memory of Ronald Zandy
Allen Ray .....In Honor of our grandchildren in support of the climate change studies done by MWOBS
Kelly Richey..... In Memory of Rodney Richey
Karla Leandri Rider..... In Memory of Dotty Burt
Lisa Roberts..... In Honor of Bruce Roberts
Bruce Roberts..... In Honor of Bruce Roberts
Wendy Rundle .....In Honor of Jim & Marcia Rundle
Barbara Sadler ..... In Memory of Paul F. Sadler
Frederick Savage..... In Memory of Alex MacKenzie
Tracy Sheppard .....In Memory of Mr. Ellis Porter, USN veteran and dad; died 2024-12-22
Heather Stanley.....In Honor of Michael Stanley
Michael Stanley .....In Honor of Michael Stanley
Cynthia Louise Stoss..... In Honor of Rob Clausen, my hiking son
Marybeth Sullivan ..... In Memory of Jim Sullivan
Craig Sutter ..... In Honor of Jack Middleton
Marguerite Swain .....In Memory of Howard Swain,Jr
Terrain Legal, PC ..... In Honor of Lydia Carnevale.
Mark Van Baalen..... In Memory of Guy and Betty Gosselin
Stephen Wheeler.....In Memory of Nathalie Brisson Wheeler
Tyler Whipple..... In Memory of Robert G Miller
Ben Williams..... In honor of the members of MWOBS, and Joe Lentini!
Donna Wolohojian ..... In Memory of Caryl Brensinger
Gretchen S Yealy .....In Memory of W Holmes Yealy

Are You Interested in Learning about Planned Giving?

By naming Mount Washington Observatory in your will or estate plan,
you can continue supporting our mission for future generations.
For more information, please email giving@mountwashington.org.

IN-KIND GIFTS

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Big Dave's Bagels

Cabot Creamery Co-Operative

Carol Haney

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Eugene Bank

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Wendy Almeida

Thank you for your support!

CORPORATE SUPPORT

GREEN FLASH

Photo of Dennis Marrotte, 26 (left), and Dennis Marenius, 22, on the summit in 1977. Marrotte, a supporter of the Observatory since 1976, had recently volunteered and was invited back for Christmas. He and Dennis Marenius summited on their second attempt on December 24th, pictured here. Thank you, Dennis, for sharing this memory with us! Photographer: Al Oxton.

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Volunteer Opportunities

For more information:
mountwashington.org/about-us/volunteer

Event Volunteer:

- Annual Seek the Peak event in July*
- Other events throughout the year*

Summit Volunteer *(weeklong commitment)*:

- Summer docent at the summit *Extreme Mount Washington Weather Museum**
- Summer summit volunteer*

Other opportunities:

- Monthly membership mailings
- Membership support: Donor card writing and/or phone calls*
- Assist with programs at local schools
- Organizing archival materials & collections
- Sorting & fulfillment for retail (seasonally)
- Gardening at valley office (seasonally)

** Living near White Mountains not necessary to volunteer*

To learn more, contact our Development Officer, Wendy Almeida at
walmeida@mountwashington.org