PROFILE

ASRC Whiteface Mountain Field Station

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Perched high atop an iconic summit of the Adirondack Mountains, nestled among the krummholz and alpine tundra, and carved from the granite of the mountain itself, is a historically unique and state-of-the-art scientific research station. Known to locals as the Whiteface Observatory, the Atmospheric Sciences Research Center's (ASRC) Whiteface Mountain Field Station was established on February 16, 1961 by the State University of New York as a University-wide center to promote and encourage programs in basic and applied sciences related to the atmosphere.

Located high in the clouds, the mission of the research at ASRC's Whiteface Observatory is to enhance our fundamental understanding of the chemical and physical nature of the atmosphere, and to apply that knowledge to study the interaction of chemical, physical, geological, and biological processes impacting our environment. At 1,500 m above sea level, where air masses approaching from the west first encounter the highlands of New York and New England, there is no other site in the Adirondacks that offers researchers the opportunity to directly study these air masses that shape our weather and that transport the pollutants which result in acid rain.

Two scientific research facilities, comprising the Whiteface Mountain Field Station, serve the ASRC in fulfilling its mission. The main facility at the Marble Mountain Lodge (110 Marble Mountain Lane, Town of Wilmington, NY) is perched on the shoulder of the Whiteface massif at an elevation of 604 m. The Lodge has a large lecture hall as well as office and research laboratory space. An annex building houses dry and wet laboratories, offices, and storage facilities for refrigerated and frozen samples.

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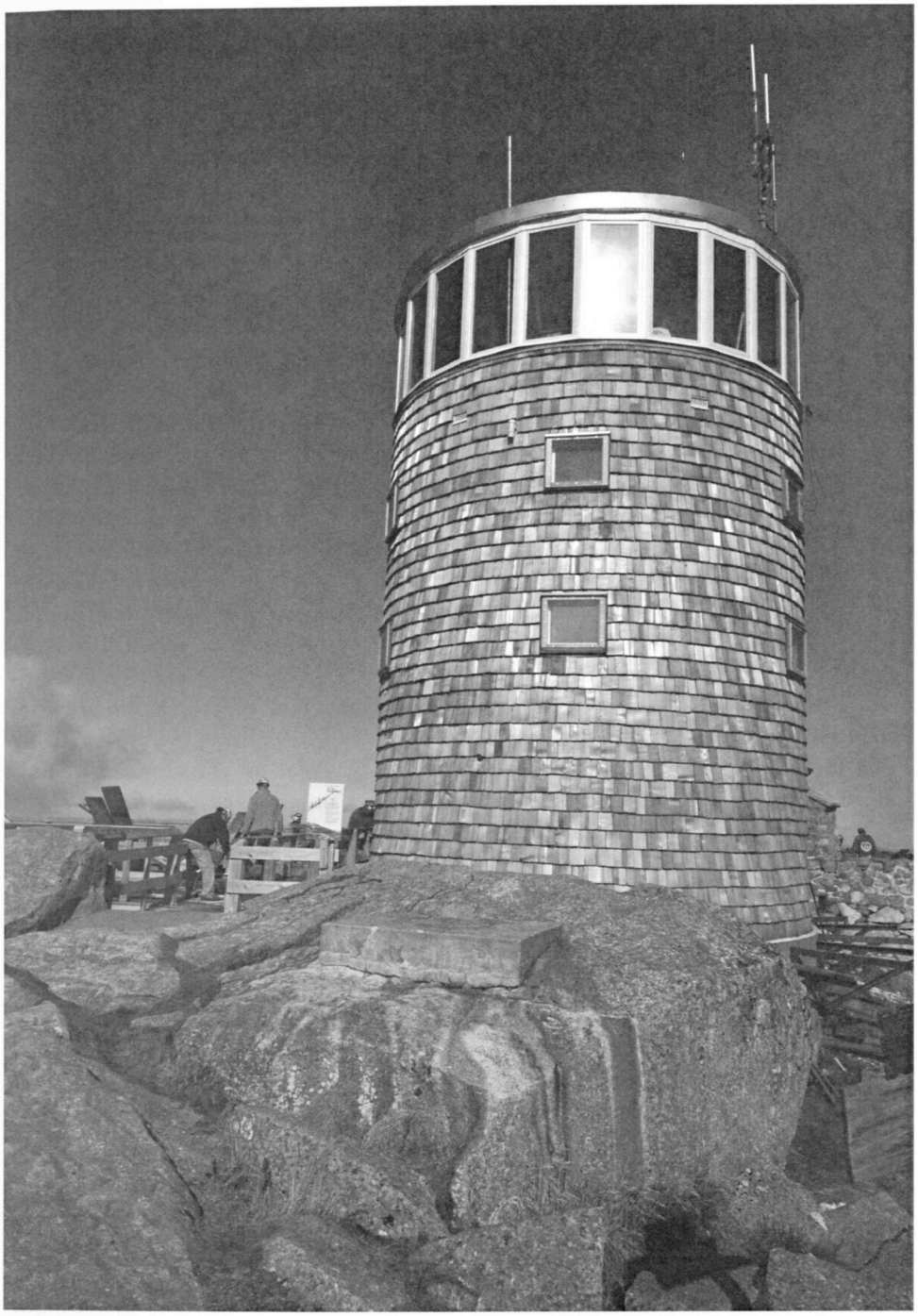
At the Marble Mountain Lodge, ASRC researchers sample the chemical content of the atmosphere, including pollutants and particulates, and continuously monitor weather conditions. Precipitation is also measured as part of the National Atmospheric Deposition Program. In October of 2012, a flow tower and passive Ammonia sampler were added to estimate dry deposition as part of the Environmental Protection Agency's secondary standard pilot program. Atmospheric trace gases, particulates, and meteorological measurements are made at a monitoring site located 30 m above the lodge. Monitored gases include carbon monoxide (CO), sulfur dioxide (SO_2), ozone (O_3), and nitrous oxides (NOx). Condensed phase pollutants measured include sulfates and nitrates that result in acid rain, as well as black carbon, which provides a measure of smoke and combustion–related particulates in the air. Overall these measurements at the Lodge, located at a relatively low elevation on the mountainside, represent conditions experienced by most of the ecosystems and communities in the Adirondacks.

By contrast and by design, the Whiteface Mountain Field Station makes many of the same measurements and weather observations, but is situated at 1,483 m (4867 ft.) in elevation. The silo-shaped observatory is three stories tall and features an observation deck that was recently enclosed as part of a comprehensive renovation project in 2012. The summit and observatory have paved road access to within 92 m of the summit via the Veterans Memorial Highway, AC power, and fiber-optic internet service.

To allow comparisons between low- and high-elevation atmospheric conditions, many of the same trace gas, particulate, and weather measurements are made at the Whiteface summit as at the Lodge site. However, what makes the Whiteface summit observatory unique and unparalleled in the Adirondacks is the ability to study the clouds themselves. Cloud water analysis provides highly, and perhaps the most reliable information on the amount of pollution being transported to the Adirondacks from other regions. Cloud water is collection in the warm season (June through September) by the Adirondack Lakes Survey Corporation (adirondacklakessurvey.org) using a custom-designed apparatus that automatically samples cloud water and logs liquid water content. Ray Falconer and other scientists developed the ASRC cloud collector at the Whiteface Mountain Field Station to better understand the role clouds play in the deposition of pollutants in high-elevation ecosystems. The collection and chemical analysis of cloud water from the summit of Whiteface Mountain began in 1976 and remains ongoing. The data generated from the collection of these cloud water samples have played a major role in helping to quantify the deposition rates of acid rain precursors on the summit of Whiteface, and in helping to inform policy makers and leaders for the purpose of air pollution regulation and mitigation.

The ASRC Whiteface Mountain Field Station is ideally suited to conduct environmental monitoring programs



and to support a range of ecological research studies. One of the primary reasons for tracking atmospheric trace gases and particulates on Whiteface is to gauge the effectiveness of pollution controls. Acid rain, ozone, and particulate aerosol research and monitoring programs at this Station have been very successful for over 40 years.

While much scientific work remains to be done regarding pollution impacts on the Adirondacks, there have been some major accomplishments in which ASRC has played an important role. Recent reductions in pollution emissions that cause acid rain have been largely attributed to the Clean Air Act amendments, which were based in part on environmental monitoring and research programs conducted in the Adirondack region (including ASRC). In amending legislation to strengthen emissions caps and incentives, policy makers and regulators required a metric to determine if air pollution controls were having the intended effect and were cost-effective. In the case of acidic deposition, the mandated pollution control has led to a remarkable decrease of acidic precipitation precursors and an increase in precipitation pH. The success of these acid rain research and monitoring programs can be built upon to address other areas of environmental concern.

Climate change is quickly becoming an issue of great public concern and debate– as it has been in the environmental community for many years. An important first step in understanding climate change is to identify and quantify the drivers of climate change and to ask what is changing about our climate and what effect might these changes have? In helping to answer this question, one of the greatest but untapped assets at the ASRC is an extensive long-term data record that exists for both the Lodge and Summit sites. Meteorological data have been collected at the summit since the 1930s and at the Lodge since the 1940s. The continuous surface ozone measurements at Whiteface Mountain since 1973 provide one of the longest ozone records available in North America. Previous studies involving the impacts of acid rain on nutrient cycling, soil chemistry, and forest productivity have also been conducted using the acidic deposition and cloud chemistry datasets. These long-term data also contribute to assessing how the Adirondack climate is changing, the effects of these changes, and how these effects might interact with other environmental changes, including acid rain, invasive species, and human land use. These long-term data sets are often difficult to locate, and we

are in the process of identifying both published and unpublished research that has taken place at Whiteface Mountain.

Biological indicators can provide excellent long-term information on climate change. There are many examples of this in our relatively pristine Adirondack environment. One such example exists in the boreal forest ecosystem on Whiteface. A second resurvey of forest inventory plots established on Whiteface in the 1960s and resurveyed in the 1980s is currently being led by Jay Wason, Dr. Martin Dovciak, and several collaborators at SUNY-ESF and UC-Berkeley. Wason will sample protected high- elevation mountain boreal forest vegetation on Whiteface and several other mountains in New York, Vermont, New Hampshire, and in Maine. At each, researchers will establish vegetation plots across the elevation gradient, measure the forest community, and collect tree increment cores to compare growth rates of the dominant tree species. Wason, Dovciak, and their collaborators will use these data to compare the impact of recent climate change on these high-elevation forests through individual tree growth and forest community demographics. This survey will test the hypothesis that plant communities will shift in response to climate change. This type of biological survey has the potential to provide critical insight into the changes that may be occurring in high-elevation forest communities in the Adirondacks, particularly by comparison with previous work at Whiteface Mountain. The response of these communities to a changing climate can be empirically measured and monitored to help climate models predict future changes to the ecosystem. Confidence in the models can be assessed by looking at past changes to these ecological communities in which their structure and composition represent decades of environmental change. The long-term data sets collected at the Whiteface Mountain Field Station help us to understand the complexity of the climate/biosphere interface that exists in the montane ecosystems of the Adirondacks and surrounding regions.

Another important aspect of the ASRC Whiteface Mountain Field Station is the proximity of the research station to a major tourist destination. The Veterans Memorial highway is visited by thousands of tourists annually. People come from all over the world and all walks of life. For many of these individuals, a visit to Whiteface Mountain provides a unique opportunity to experience a high-elevation montane ecosystem in a largely unmodified condition. The opportunity to learn about the atmospheric monitoring and research activities being conducted at the ASRC Whiteface Mountain Field Station is critical in promoting scientifically sound public policy. In 2012, several new exhibits explaining the science being conducted at the summit of Whiteface Mountain, as well as the flora, fauna, and natural history of the region, were developed and installed by staff from The Wild Center (wildcenter.org) in cooperation with multiple partners, including the Adirondack North Country Association, the NYS Department of Environmental Conservation, the Wildlife Conservation Society, the Olympic Regional Development Authority, the NYS Department of Transportation, and the Atmospheric Sciences Research Center. The exhibits include interpretive signage, interactive time lapse video, instrumentation displays, real time weather data, National Weather Service maps and radar, and video segments explaining some of the research being conducted at Whiteface. A new high-resolution real-time web camera was installed on the Whiteface Observatory silo, and can be accessed via the Wild Center at wildcenter.org/summitcam/wfsummit.jpg. Such public outreach efforts help to fulfill an important part of the ASRC's mission to enhance the fundamental understanding of the chemical and physical nature of the atmosphere. Efforts to facilitate public access to meteorological data from the ASRC Whiteface Mountain Field Station are ongoing. Developments in information technology have raised the bar in disseminating non-proprietary data sets.

In summary, several features make the ASRC Whiteface Mountain Field Station a unique and valuable facility for environmental monitoring and research. The location of the summit weather observatory allows scientists to position instrumentation in the path of air masses approaching the Adirondack Park from the West. These air masses often carry pollutants from power plants and other industrial sources located great distances from the Adirondack Park. The Lodge site enables data collection 4.7 km from the Summit site, separated by an elevation difference of 879 m. This allows us to examine pollutant load differences between regional air masses and those more local in nature. Clouds that pass over the summit also provide a rare opportunity to examine the chemical composition of cloud water from both natural and anthropogenic sources. The ability to collect cloud water from a ground-based system allows for continuous cost effective assessment of cloud chemistry. The availability of long-term chemical, biological, and meteorological data sets for both sites allows for statistically significant analyses that are critical to ensure scientifically sound conclusions.

The ASRC Whiteface Mountain Field Station would like to extend an invitation to the scientific community and to the general public to visit our site and see what we have to offer. The public interface with scientific research and environmental monitoring is critical to ensuring that policy makers and regulators continue their investments in sound science. The ASRC Whiteface Mountain Field Station also hosts the Falconer science and natural history lecture series. Lectures are held every other Tuesday evening in July and August. The lectures are free and open to the public. Anyone interested in visiting the ASRC Whiteface Mountain Field Station can visit our website (http://asrc.albany.edu/observatories/whiteface/whiteface.html), contact me by e-mail at pcasson@albany.edu, or call us at (518) 946-2142.