THE MOUNT WASHINGTON OBSERVATORY, 1917 M

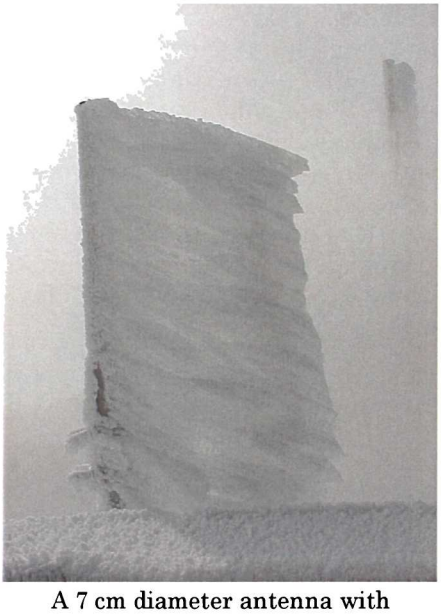
Kenneth L. Rancourt , Mount Washington Observatory, USA

The summit of Mt. Washington in winter, (source: MWO Archives)

The Mount Washington Observatory was founded in 1932 by an enthusiastic group of individuals who recognized the value of a scientific facility at a location that was locally known to experience severe weather conditions. Founded as a private, non-profit, membership-supported organization, the Observatory's mission is to observe and record the extreme weather conditions of Mount Washington, conduct scientific research at that location, devise educational programs on the science, history, and natural history of the White Mountains, and promote public safety in the White Mountains.

The first regular meteorological observations on Mount Washington were conducted by the U.S. Signal Service from 1870 to 1892. The Signal Service was a precursor to both the U.S. Weather Bureau, and the National Weather Service. The Mount Washington station was one of the first of its kind in the United States, and set an example that was followed in a number of other western states.

Mount Washington presents some of the most severe combinations of wind, cold, and icing available anywhere in the world where people are on hand to take measurements. To gain an understanding of the harsh conditions atop the mountain, observe the following statistics (also see the table below): The average year-round temperature is below freezing, at –3.1 C. Winds average 15.78 m/s on an annual basis. Dense fog frequently limits visibility to 30 meters or less. The average annual precipitation is 218.4 cm, including 6.4 meters of snow. The summit lies in the path of the principal storm tracks and air mass routes affecting the northeastern United States, and it is, because of its elevation, biologically and ecologically similar to the subarctic zone. At 1917 m, the summit is in the clouds about 60% of the time and winds exceed hurricane force (33.5 m/s) an average of 104 days a year.



A 7 cm diameter antenna with approximately 1 meter of rime ice accumulation (source: MWO Archives)

The world's highest recorded surface wind speed, 103.3 m/s (231 miles per hour), occurred here in April of 1934. First and foremost, the World Record Wind is a testimony to the real extremes that can rule on Mount Washington. Significant cold, abundant snowfall, dense fog, heavy icing, and exceptional winds are a prominent feature of Mount Washington's environment. There are

Observers on tower in winter (source: Jonathan Kannair)

colder places, such as Antarctica, and snowier places, such as some peaks in the Cascade Range. However, Mount Washington, a small peak by global standards, really does have weather that can rival some of the most rugged places on earth. There are days each winter when the combination of life-threatening weather factors on Mount Washington is remarkably similar to weather extremes which have been recorded in the polar regions and on peaks three or four times Mount Washington's height. The World Record Wind is one benchmark testifying to the mountain's truly severe weather. The fact that over 130 people have lost their lives in the immediate area is another.

It is a challenge to accurately measure severe weather on Mount Washington. Some measurements are relatively easy to obtain, such as using standard thermometers to record temperatures. For other weather parameters, measurement can be very challenging. To be able to accurately record the winds of Mount Washington, which are typically high and gusty, and to be able to do so during a severe icing event, is no simple matter. When winds are greater than 30 m/s, it is incredibly difficult and dangerous to climb atop the observation tower to insure that the required instruments are free from rime. To aid in this task, the Observatory uses a heated Pitot anemometer, a custom hybrid of the technology used aboard today's aircraft.

Heavy rime accumulation on the top of the tower. Note that the Pitot (on the far left) is free of ice (source MWO Archives)

Research plays an important role in the Observatory's mission. The Observatory's Center for Wind, Ice, and Fog Research has developed relationships with a number of Universities, both foreign and domestic, corporations, and agencies of the United States government.

Different techniques for measuring visibility have been tested in very dense fog at the Observatory: data from both the two transmissometers on the left and the scatterometer on the right were compared to human visibility measurements in this study (source MWO Archives)

Collaboration with the University of New Hampshire (UNH) began in 1954, with a project that monitors time variations of cosmic radiation and provides base line data for many cosmic ray modulation studies. The instrumentation is still in operation today. Present day research programs include the operation of air quality instrumentation located in the Observatory tower for the Atmospheric Investigation, Regional Modeling, Analysis and Prediction Cooperative Institute (AIRMAP) which is investigating regional atmospheric chemistry and dynamics and climate change in New England (for more information see: http://airmap.unh.edu/home/index.cfm)

Another project with UNH is the operation of a ground-based Lidar system that measures tropospheric winds. Eventually a Lidar system of similar design will be satellite based and will measure global atmospheric winds. A second site is now operational on Mauna Loa, Hawaii. (for more information see: http://groundwinds.sr.unh.edu)

The Observatory has recently conducted the Mount Washington Icing Sensors Project- a collaborative program with the U.S. Army Cold Regions Research and Engineering Laboratory, the National Oceanic and Atmospheric Administration's Environmental Technology Laboratory, the National Center for Atmospheric Research, University of Massachusetts, Quadrant Engineering, Defense Research Establishment at Valcartier, Quebec, Canada. and Stratton Park Engineering Corp. and was funded by The Federal Aviation Administration and NASA. The goal of the project was to test various methods for the remote sensing of inflight icing conditions, and in particular supercooled large droplets, which can lead to significant aircraft icing. K, X and W band radars, and a Lidar were located at the western base of Mount Washington, while laser based cloud probes and a polarimetric scanning radiometer were located on the summit. The combination of persistent cloud with high liquid water content and opportunity for continuous in-situ measurement provided at the summit was optimal for conducting the testing planned for MWISP. (for more information about MWISP see: http://www2.faa.gov/aua/awr/mwisp/index.htm) In addition, a very interesting case of downslope wind flow was documented during the program. Radar results and a brief description of the phenomena may be found at: http://www.etl.noaa.gov/~bmartner/downslope.html

Educational programs are also linked to Observatory research. Collaborating with the University of Ruhr, Germany, on a wind measurement project, students from various disciplines (climatology, meteorology, electronics, and geography) were trained to use high quality sonic anemometry to measure the horizontal and vertical components of the wind field around the summit. One goal of the program was to gather necessary data, but an additional feature was to expose students to working in the real world – and to learn how to cope with adverse environmental conditions while in the field. (for more information see: http://www.ruhr-uni-bochum.de/climusa/start_e.htm)

In addition to reliably recording severe weather on the summit for over 70 years, developing robust instrumentation for severe weather environments, and conducting many types of severe weather research and testing programs, the Observatory also hosts educational trips for its members. EduTrips are another way that the Observatory serves its membership and the general public's interest in the mountain and its environment. Occurring only in winter, EduTrips bring individuals to the summit to experience life on the mountain – through study of the geology, geography, climatology, and meteorology of a very unique summit. For more information on the Observatory see: http://www.mountwashington.org

Climate information:

Average Annual Temperature: -3.1 C

Average Annual Wind Speed: 15.78 m/s

Monthly Data:

	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Average Temp. C	-15.6	-15.0	-10.7	-5.3	1.6	6.5	9.1	8.2	4.6	-0.9	-6.3	-12.8
Average Wind Speed m/s	20.7	19.9	18.6	16.1	13.3	12.4	11.3	11.2	13.0	15.1	17.6	20.0
Peak Gust m/s	77.3	74.2	80.5	103.3	73.3	60.8	68.8	63.5	77.8	72.0	72.8	79.6

General Information:

Latitude = 44 deg. 16' 13" N

Longitude = 71 deg. 18' 13" W

Contact Information:

Kenneth L. Rancourt
Director of Research
Mount Washington Observatory
2779 White Mountain Highway
P.O. Box 2310
North Conway, New Hampshire 03860, U.S.A.

Phone: (603) 356-5704 x 102
FAX: (603) 356-5714
Pager: (603) 385-2808
Summit: (603) 466-3388

Informationen über das Observatorium auf dem Mt. Washington wurde auch schon in früheren Jahresberichten bereitgestellt: Dritter Jb (16-17) und XLIII Jb (11-30)

Auszug aus dem 43. Jahresbericht des Sonnblick-Vereines

Die Entwicklung der amerikanischen Bergobservatorien und das derzeitige Netz von Bergstationen in den Vereinigten Staaten von Amerika.

Von ROBERT G. STONE, Blue Hill Observatorium, Harvard University.

Der Beginn der Gebirgsmeteorologie war in Amerika wie auch in Europa durch den Bau von Touristenhäusern auf einigen bedeutenden Berggipfeln erleichtert, die durch Fahrwege und Bahnen zugänglich gemacht wurden.

Nach Besuchen des Mt. Washington in den Jahren 1856 und 1857 war der junge Geologiestudent J. H. Huntington von der Idee, einen Winter hindurch dort für wissenschaftliche Zwecke zu verbringen, so begeistert, daß er sich 1858 mit Prof. C. H. Hitchcock vom Dartmouth College über die Möglichkeit dieses Unternehmens ins Einvernehmen setzte. Sie ersuchten Prof. Joseph Henry, den Direktor der Smithsonian Institution und damals einer der führenden Meteorologen Amerikas, um Unterstützung dieses Wagnisses. Henry, dessen Interesse an Bergbeobachtungen schon durch das Werk Noyes geweckt war, war wohl für den Vorschlag eingenommen, konnte aber zufolge praktischer Hindernisse die Mittel für das Unternehmen nicht aufbringen; nichtsdestoweniger zweifelte er nicht, daß telegraphische Wetterberichte von einer Bergstation wie den Mt. Washington zusammen mit den gewöhnlichen telegraphischen Berichten, welche die Smithsonian Institution zur Herstellung von synoptischen Karten und für Wettervorhersagen zu verwenden versuchte, von besonderer Bedeutung sein könnten. Das war in der Zeit, als es in den White Mountains hieß, daß die Smithsonian Institution $ 1000.- dafür biete, daß jemand einen Winter hindurch auf dem Mt. Washington zur Durchführung von meteorologischen Beobachtungen verbringen sollte; dies scheint aber nur ein unbegründetes Gerede gewesen zu sein.

Der Bürgerkrieg verhinderte in der Folgezeit dieses wissenschaftliche Unternehmen, und Huntington und Hitchcock versuchten vergeblich von Zeit zu Zeit, während der nächsten zehn Jahre finanzielle Unterstützung für die geplante Mt.-Washington-Expedition zu erhalten. Als letzterer 1868 Staatsgeologe von New Hamshire wurde und Huntington ihm als Assistent beigegeben wurde, entschlossen sie sich, da der Eigentümer des Gipfelhauses am Mt. Washington die Erlaubnis zum Aufenthalt im Winter 1869 versagte, auf Anregung des Besitzers des Berghotels am Gipfel des Mt. Moosilauke, N.H. (1466 m), zunächst dort einen Versuch zu machen. Diesen unternahmen Huntington und noch ein anderer zwei Monate lang (Dezember 1869 bis Februar 1870) auf Huntingtons Kosten. Ihre Erfahrungen waren so aufsehenerregend und die Möglichkeit, auch den Winter hindurch auf solch einem Gipfel zu leben, war so gut erwiesen worden, daß wieder um die Erlaubnis angesucht wurde, im nächsten Winter das Haus auf dem Mt. Washington bewohnen zu dürfen.

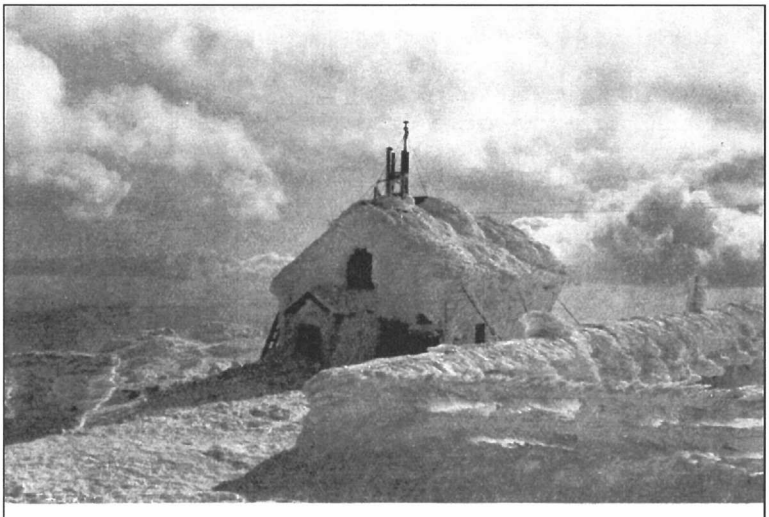


Abb. 1. Das Observatorium auf dem Mt. Washington, 1915 m.