temperatures, and has misled several investigators into interpreting the volatilization of the oxide to be due to its vapor pressure, when in fact the oxide, heated in the absence of carbon or reducing papers, shows little or no volatility. The volatilization of magnesium oxide is of this class.

Whether the pressure which is essential to the preparation of good quartz glass in quantity acts upon the vapor pressure of the silica, or whether it affects the reduction of the silica to the metal, has not yet been determined. It is not unlikely that both reactions occur, and that the narrow temperature limits within which we found it practicable to work, lie between the temperature of volatilization of the silica and that of its reduction by carbon. This question is not material to the successful production of quartz glass, and will be considered in a later paper.

One other conclusion appears to be reasonably certain from our work, namely, that air once enclosed within the body of a charge of quartz glass can not be displaced, either by long-continued heating or by extremely high temperatures.

Our experience did not suggest that we were approaching any necessary limit in the size of the charge which could be handled. A furnace of suitable size, provided with somewhat more power, would undoubtedly produce clear quartz glass in much larger units than we were able to do in our small furnace.

Summing up the conditions for preparation of good quartz glass, we find them to be: An initial temperature of 2,000° or more, without pressure, to produce sufficient quartz vapor to drive out the air from between the grains, followed by pressure (at least 500 pounds), and a reduced temperature (perhaps 1,800°), with time for the quartz to flow compactly together without being attacked by the graphite.

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Washington, D. C.,
April 18, 1906.

METEOROLOGICAL PHENOMENA ON MOUNTAIN SUMMITS.

Much of our knowledge of the upper air has been obtained from observations made on the summits of mountains. With the single notable exception of the Prussian Aeronautical Observatory near Berlin, where, for several years, daily observations at great heights have been obtained with the aid of kites and balloons, we are still dependent upon the mountain observatories for information concerning annual and seasonal changes in the upper air at different heights, and for other data not easily secured except by means of continuous observations made at the same place. The chief error arising from any general application of such observations is caused by the unknown influence of the mountain itself upon the meteorological conditions in its vicinity. The results from observations in the free air do not show the same vertical changes that are observed on mountains, the diurnal periodic change of temperature noticeable on all mountains disappearing at a height of 1,000 meters in the free air.

A few approximate comparisons have already been made, of Ben Nevis (1,343 meters high) in Scotland by Mr. Dines, and of the Brocken (1,100 meters high) in Germany by Dr. Assmann, but in both instances the kite or balloon observations apparently were made at a distance exceeding 90 kilometers from the mountain observatory. Also, Mr. Clayton has compared the temperature on Blue Hill with that of the free air.

The data obtained indicated that the temperature on mountain summits is lower than that of the free air at the same height. No information as to differences of humidity or wind velocity is available, although it appears quite probable that the wind velocity is higher on mountains than in the free air at the same height.

During the last week in August, 1905, I was able to make a comparison of the weather conditions on Mount Washington, N. H., with those of the free air, by means of kites flown in the Ammonoosuc Valley 16 kilometers west of and 1,500 meters lower than the summit of

the mountain. This valley is open toward the west, whence come the prevailing winds, and there are ample open spaces suitable for kite flying.

The meteorological data were obtained from four meteorographs constructed as nearly alike as possible in order to secure uniform action, all having the same scales and each recording the temperature, atmospheric pressure, humidity and velocity of the wind upon a paper-covered cylinder rotated once in twelve hours by a clock. The time-scale was about 25 millimeters an hour and data could be obtained every two minutes. Two of these instruments were employed in recording the conditions on the summit of Mount Washington and at the kite station near Twin Mountain, and two were adapted for use in the kite experiments, being a modified form of the kite meteorograph devised by me for use at the Blue Hill Observatory. All of the instruments were carefully compared with standards.

The meteorograph on the summit of the mountain was exposed in the north window of the office of the newspaper *Among the Clouds,* the editor, Mr. Frank H. Burt, very kindly volunteering to keep it in operation during the experiment. The exposure, so far as temperature, humidity and pressure are concerned, was very good. The anemometer, which recorded electrically, was placed on the roof of the office near the western end and was well exposed to the winds from all directions except those between northeast and southeast, which were obstructed by the other buildings on the summit.

The kites employed were two Eddy kites respectively of 1.67 and 3.20 square meters area, and two 'Blue Hill box' kites, each having a lifting surface of 2.0 square meters. A 'hand' windlass containing 3,400 meters of No. 11 music wire, and provided with accurate devices for indicating the length of line employed and for recording the pull of the kites, was employed in flying the kites. The heights reached were chiefly determined from altitudes obtained by means of a transit, though intermediate heights could be obtained from the record of atmospheric pressure.

It was intended to keep one of the kite meteorographs as nearly as possible at the same height as the summit of Mount Washington, and the other about half as high, and in this way obtain a vertical section of about 1,500 meters; the Twin Mountain station being 427 meters and the summit 1,916 meters above sea level.

The instruments at the summit and kite stations were compared with a standard thermometer three times each day and comparisons of the kite meteorographs were made at the beginning and end of each flight.

After the apparatus was installed there remained but five days for the actual work of observation, and to my surprise, the wind was so exceedingly light throughout the entire period that but two flights could be obtained; during one of which, however, the upper meteorograph was carried to within 60 meters of the height of Mount Washington. An accident to one of the kites prevented more than one observation at this height; but since this appears to be the first time such observations have been made so near a mountain observatory, it may be worth while giving the results in detail.

AUGUST 24, 1905.

Time P. M.	Conditions at Kite.				Conditions on Mt. Washington, 1,489 Meters above Valley.		
	Height above Valley, in Meters.	Temperature, °C.	Relative Humidity, Per Cent.	Wind Velocity, Meters per Second.	Temperature, °C.	Relative Humidity, Per Cent.	Wind Velocity, Meters per Second.
3:15	0	22.2	90	6	7.2	5?	19
3:26	267	19.4	90	6	7.2	5?	19
4:11	456	15.6	85	9	6.1	4?	20
4:17	658	14.4	100	13	6.1	20?	18
4:38	970	11.7	80	14	5.6	25	17
5:02	1,135	11.1	75	12	6.1	28	17
5:31	1,224	11.0	65	12	6.1	30	15
5:41	1,408	10.0	65	13	6.1	30	16
5:43	1,428	9.4	65	13	6.1	33	16

At 5:44 P.M. one of the two supporting kites collapsed and the other, not being sufficient to support the meteorograph and line until they were reeled in, fell into the forest on the north slope of the 'Three Sugar Loaves' (a small mountain 300 meters higher than the kite station) and the flight came to an abrupt end.

Allowing for the difference of level of 61 meters, the observations indicate a decidedly lower temperature and a much higher wind velocity on Mount Washington than are found in the free air. The hygrometers had not been tested below 40 per cent. and the comparison of humidities, while indicating a lower humidity on the mountain, is not considered trustworthy.

Unusually clear, fine weather prevailed throughout the time that could be devoted to the experiments and the summits of the mountains were seldom hidden by clouds. On two successive days (August 25 and 26) the average wind velocity on Mount Washington was less than three meters per second, and on several other days it was almost as low. The conditions for kite flying may not be more difficult near mountains than in other places, but the consequences of accidents to the kites, and the fall of the line and apparatus into the dense forests in these regions, demand that unusual precautions be taken to avoid mishaps. A small gasolene motor for quick manipulation of the line during periods of light wind is almost a necessity.

These experiments have also demonstrated the great value of a simple and compact meteorograph in obtaining data at a place like Mount Washington. The time required for changing the records of the instrument employed was about five minutes, or less, each day, the construction of the recording mechanism of the anemometer being such that this operation could be performed at any time convenient to the observer, or even omitted for a day without loss of records by superimposing. After the meteorograph was installed, on August 20, continuous records of the four elements already referred to were maintained until the close of the season on the summit. It was not practicable to record the direction of the wind on this meteorograph except by means of a device indicating only the eight principal directions; and while such approximate data are useful in studies of climate they are of small value in other meteorological researches.

If circumstances favor, this work will be continued during at least three weeks of the summer of 1906, and, it is hoped, more definite results will be obtained than those described in this preliminary study.

I am indebted to Mr. H. H. Clayton for the use of four Blue Hill box kites; to the staff of *Among the Clouds,* Messrs. Burt, Dunham, Libby and Duff, for their assistance in caring for the meteorograph on Mount Washington, without which these experiments could not easily have been made; to Mr. D. J. Flanders, of the Boston and Maine Railroad, for transportation over the Mount Washington Railway for the purpose of installing the meteorograph on the summit; to the foreman at the Rosebrook Inn, and to Mr. Anderson, of the American Museum of Natural History, for valuable assistance in the kite flights.

S. P. Fergusson.

Hyde Park, Mass.,
February 25, 1906.

QUOTATIONS.

THE CALIFORNIA UNIVERSITIES.

The amended report of the condition in which Leland Stanford, Junior, University is left by the earthquake is most comforting. But if the first statement that its buildings had all been reduced to heaps of dust had proved true the university would not have been, as the headlines had it, 'wiped out.' A university does not exist in its material part. The plant is, in fact, the least part of it. Perhaps it would have been worth the sacrifice of the beautiful Boston-planned architecture of Leland Stanford, Junior, University representing Hispano-Mexican history and the semi-tropical local color of California as vividly as the architecture of Harvard and Yale represent the associations of old New England with Cambridge and Oxford universities, if the impressive object-lesson had been conveyed to our 'splendid materialism,' that the buildings, though they may represent many millions and that in irreproachable good taste, too, do not make and can never make the university. The Leland Stanford Junior University is what it is not by grace of Leland Stanford's money, but by virtue of certain great and fearless minds, with their unwaver-