stimulates the chemical changes that are going on within the leaf. Even the faint twilight or the blue light that simmers down through a leafy forest, or the fractional part of daylight received by an object in the shade, is sufficient to maintain these chemical changes; strong daylight is usually not essential, and the final result depends more on the duration of the gentle twilight than on its intensity. In fact, such changes may go on under artificial light that is far less intense than the ordinary daylight. The amount of light received by a horizontal surface in the open air when the sun is 20° above the horizon, as during the arctic summer, is almost equally divided between the direct light of sunshine and the diffuse light of the sky; the amount received by a leaf of a plant will depend upon its aspect, and it may easily receive more from the sky than from the sun. We must, therefore, believe that as the storage of sugar within the beet root must depend originally upon its manufacture in the leaf, and as the quantity diminishes with temperature, the manufacture and the storage both depend essentially on the *duration* of the chemical action of skylight and sunlight upon the juices of the leaf; this must be the reason why the beet is sweeter in proportion as it is grown in northern latitudes. From this point of view we see why it is that nothing but excessively thick clouds and rain cut off enough sunshine to materially affect the sweetness of the beet, since those waves of light that are most active in stimulating the formation of sugar pass quite freely through ordinary moist air and thin clouds.

The temperature of the air is often confounded with the temperature of the soil. This latter temperature depends so much on the loss of heat from the surface of the earth by radiation through a clear sky that we are apt to forget that the soil may be very cold all day long at a few inches depth, while the surface of the ground is warmed up by a few hours of direct sunshine. Clear blue sky does not warm up the soil although it does exert a stimulating influence on the leaves of plants. If warmth is injurious to the sugar content of the beet as these investigations seem to show, then it becomes important to ascertain by experiments in mulching whether it is the warmth of the soil or the warmth of the leaf that is objectionable. In the mountainous parts of France it is a common experience that irrigation with very cold water from the glaciers retards greatly the growth of wheat and other grains, while it favors the growth of some grasses, many of which grow at temperatures near freezing. By analogy we might infer that the temperature of the irrigation water used in beet fields would be a matter of importance. At any rate the investigation of the beet root and its environment requires that we should study very carefully the temperature of the soil down to the lowest end of the tap root.

WEATHER BUREAU WORK DURING THE ECLIPSE OF AUGUST 30, 1905.

The U. S. Naval Observatory having organized an expedition for astronomical work during the eclipse of August 30, the U. S. Weather Bureau was invited to carry out the meteorological work. The details of the necessary organization were entrusted to Prof. Frank H. Bigelow who, with his assistant, Mr. Stanislav Hanzlik, left Washington about June 14 and 18, respectively, and with others, sailed from Norfolk in the U. S. transport *Cæsar*. The astronomers of the party left New York on the U. S. S. *Minneapolis;* supplies and instruments were sent on the U. S. S. *Dixie.*

Under date of July 28, near Tortosa, Spain, Professor Bigelow writes as follows:

The *Dixie* arrived at Gibraltar July 6, the *Cæsar* July 7, and the *Minneapolis* July 17. I was then transferred to the *Minneapolis* by Admiral Chester. We all sailed from Gibraltar July 19, the *Dixie* with Mr. Hanzlik and his equipment direct to Bona, where he is to establish our three African stations. He now understands my plans fully and I believe he will do the work properly. It had been my intention to go there from Valencia as soon as my Spanish stations were in order, but the *Minneapolis* sails July 28, on its course, Valencia, Bona, Lisbon, Cadiz, Gibraltar, returning to Valencia by August 17, so that I can not go that way, and I know of no other transportation from Valencia to Bona. I shall have to leave Mr. Hanzlik to do his duty as well as he can by himself. Captain Norris, in charge, will assist him with the organization.

The *Cæsar* and *Minneapolis* arrived at Valencia July 21. Several days, Friday to Monday, were consumed in making trips of exploration to settle upon the sites of the astronomical stations and finally Daroca is chosen for the central station and Porta Coeli for that near the southern edge of the track.

The boxes went ashore Monday afternoon, July 24, and while the transfer and preliminary work was being done by the astronomers, I located my instruments for two secondary stations. One I have placed at Castellon in the Institute. The other I have established in the Solar Physics Observatory of the Ebro, about two miles distant from Tortosa, where I am writing this note.

Admiral Chester has given me enough men for the primary stations and I am arranging with the people here for the secondary stations. At Castellon I paid a small sum for the work and set up our own instruments. They took meteorological observations there 20 years ago, but had abandoned them. At Tortosa they have a splendidly equipped observatory on the very plan that we are developing at Mount Weather and they will give me a copy of their observations for 40 days for $10. This plan is cheaper for the Government than the other one of sending and maintaining our naval officers and men.

To-day (July 28) I return to Valencia, thence to Porta Coeli to organize the work there, then to Daroca to put that station in order, then to Zaragoza where I have already secured my observer, then to Guadalajara or Madrid, and finally I will return to Daroca for my own share in the eclipse.

The meteorographs were fully revised or repaired at Gibraltar and the *Cæsar* will call there to take on the kites which I have urgently requested to be sent.[1]

On the return homeward the *Cæsar* will sail from Valencia, September 5, for Nice, and thence September 13, and should arrive in Hampton Roads about October 5.

It will not be possible for me to attend the meeting of the International Meteorological Committee at Innsbruck, Austria, which will not get under way until September 11. However, I shall have from September 2 to September 13 to myself and propose to go to Paris, Potsdam, Brunswick, and Munich on my way to Nice.

At this Observatory of the Ebro they are organized as it should be. It is under the order of the Jesuit Fathers, and they have about ten highly educated, well trained men, each one responsible for a line of work, and all under one scientific director, Cirera. It is the only possible policy for success, this is inexpensive for them and the priests get no salaries; they are supported by wealthy Catholics.

Tortosa is in the eclipse track and it will carry off the honors in solar physics this time.

Under date of August 10, Professor Bigelow writes from Madrid, as follows:

The primary astronomical station near the southern edge of the shadow is located at Porta Coeli, about seven miles from Betera to the north, this being twelve miles west of Valencia. It is placed in the grounds of the old convent, not in use at present, except in an irregular way by visitors during the summer. The site is admirable and the climate all that could be desired. The work is in charge of Professor Littell, assisted by Peters, Anderson, and Hill, with numerous helpers. At the time of the eclipse the party will be increased to about forty persons by details from the U. S. S. *Minneapolis*, which is at present cruising to Bona, Algiers, Tangier, Lisbon, and Gibraltar, returning to Valencia about August 17.

My observatories have been running steadily since about August 3. The trio of stations, Porta Coeli, Castellon, and Tortosa, is strongly affected by the sea breeze and as the total eclipse occurs in the midst of the local convection it will be interesting to try to separate the effect of the shadow proper from it. The other three stations, Daroca, Zaragoza, Guadalajara, are too far inland to feel this wind from the sea and the contrast between the curves for the two sets of stations ought to be instructive.

At Daroca, near the central line, the astronomical station is being established with Professor Eichelberger in charge and Mitchell, Yowell, and Hoxton with several others in cooperation. I have placed more of my instruments at Daroca than at Porta Coeli, intending to return

[1] Five new kites, with extra fixtures and materials for repairs, etc., and with improved attachments for kite meteorographs were sent Professor Bigelow, August 10, 1905, by express, in care of the American Consul at Gibraltar, and it is hoped these will reach him in time to be used on the return trip across the Atlantic.—*C. F. M.*

thither from Madrid for my own observations with the Ebert electrometer, the Brashear polarimeter, and the mercury actinometer.

At Zaragoza I placed the work in charge of Prof. José Blanco, S. J., at the Colegio del Salvador, in an excellent location.

At Guadalajara I was fortunate enough to secure the assistance of Lieut. Col. Vivez y Vich, the Director of the Military Aerostatic Service of Spain, who already has a meteorological station there. He showed me his large balloons intended for the eclipse ascensions at Burgos, for the International Commission, also his homing pigeons, and the various valuable works he is conducting.

At Madrid I called upon the director of the observatory, who gives the time signals to all astronomers for longitude, etc., and left with him my last package of circulars on the shadow bands.

I return to Daroca to-morrow and shall remain there until September 1, when we return to Valencia. The ships all meet at Nice on September 5 or 6 and sail for home September 13. I have heard nothing from Doctor Hanzlik about the African stations.

METEOROLOGY IN PETERMANN'S GEOGRAPHISCHE MITTEILUNGEN.

Since the eminent climatologist, Prof. Dr. A. Supan, became the editor of Petermann's Mitteilungen that important geographical journal has devoted an increased attention to meteorology. Not only have occasional special articles of importance appeared therein, but we have in mind particularly the reviews of meteorological publications and the invaluable indexes to local climatological data as arranged by countries and stations. These reviews and indexes constitute the "Geographischer Literaturbericht," or systematic review of geographical literature, which occupies quite as large a space as the mitteilungen themselves. Thus, in the fiftieth volume, for 1904, we have 298 pages of the latter and 226 pages of the reviews and indexes, besides 21 large charts. In these climatological indexes special attention is paid to records of observed rainfall. Number 14 is a number that is retained throughout volume No. 50 for what are called local climatological contributions in which references to numerical data are arranged by countries and stations, and this is followed by other reviews bearing on pressure, moisture, glaciation, change of climate, and terrestrial magnetism. The separate reviews are numbered, the last number being 799.

In the current volume for 1905 the opening article by Nansen on the "Causes that produce ocean currents" is a clear and popular presentation of the various theories that have been advanced on this matter, but we see no mention of Professor Ferrel's explanation of the Gulf Stream, although Nansen's presentation of the subject is closely analogous to that of Ferrel in his Recent Advances, Chapter VII, and elsewhere.

The local climatological contributions constitute No. 34 of these reviews for 1905 and occupy six closely printed pages, followed by a series of perhaps ten pages of reviews of recent publications on the rainfall, and especially on the circulation of the atmosphere. There is a very appreciative notice of the work of Dr. O. L. Fassig on kite-flying in the Tropics by Dr. R. Süring of the Meteorological Office in Berlin. There are also elaborate reviews of the various publications that have appeared in the MONTHLY WEATHER REVIEW from Professors Bigelow, Dewar, Shaw, Algué, and others.

In the Mitteilungen for March 28, 1905, we find a note by Supan on the kite work over the ocean, especially that by Hergesell over the Atlantic Ocean for the Prince of Monaco. With regard to the ascension made on August 9, 1904, west of the Canary Islands, and therefore far removed from all continental influences, he says:

> We may assume the conditions there found as typical for the whole region between Portugal, the Canaries, and the Azores, except in the immediate vicinity of the latter. As the kite ascended the thermograph record shows that the temperature fell adiabatically up to about 500 meters, then rose rapidly up to about 1100 meters, where it was warmer than at the earth's surface, and whence it steadily fell up to 5000 meters. The warm and dry intermediate layer, the gradual shifting of the wind from northeast to northwest by west, and the complete failure of the southwest trade winds at the altitude where it always prevails on Teneriffe led the Prince of Monaco to consider this as a very local phenomenon.

On the other hand Supan considers that:

> These kite observations were not made in the region of well developed trade winds, but within the subtropical zone of high pressure. The distribution of temperature and moisture seems to suggest that the movement of the air diminishes with altitude, even in the Bahamas. Mr. Fassig's work was done outside of the region of the maximum trades and he found no inversion of temperature, but a steady adiabatic diminution. We shall not be able to draw any theoretical conclusions until we have a section through the atmosphere over the whole North Atlantic.

On pages 81–90, and 108–115, Dr. Jacob Hoffman gives an exhaustive review of our knowledge of the temperatures on the highlands of tropical Africa, south of the equator. As the records from every available station and traveler are quoted we can not summarize this paper which goes into the details of the influence of insolation, nocturnal radiation, the wind, the cloudiness, and the presence of oceans and lakes. The reader will be amazed to perceive how much has been recorded relative to African meteorology.

On page 91 we have a list of the courses of lectures on geography in German universities during the summer of 1905. As meteorology and climatology are generally included under geography, we give the following items relating thereto:

METEOROLOGY IN GERMAN UNIVERSITIES AND TECHNICAL SCHOOLS.

Aix-la-Chapelle.—Technical High School. Doctor Polis; two hours weekly on climatology.

Berlin.—The University. Doctor Philippi; one hour weekly on the climate of geological epochs. Prof. Dr. von Bezold; two hours weekly on theoretical meteorology or thermodynamics of the atmosphere. Technical High School.—Doctor Kassner; one hour weekly on precipitation with special reference to technology.

Bonn.—The University. No meteorology.

Brunswick.—Technical High School. Professor Koppe; two hours weekly on barometric hypsometry.

Breslau.—The University. No meteorology.

Dantzic.—Technical High School. No meteorology.

Darmstadt.—Technical High School. No meteorology.

Dresden.—Technical High School. No meteorology.

Erlangen.—The University. No meteorology.

Freiberg in Baden.—The University. No meteorology.

Giessen.—University. No meteorology.

Göttingen.—University. Professor Wagner; general climatology, four hours weekly. Professor Wiechert; meteorology, two hours weekly.

Greifswald.—University. Professor Credner; elements of climatology. Professor Holtz; one hour weekly in meteorology, including its optical phenomena treated popularly with experiments. Professor Deecke; on glaciers and the glacial epoch.

Halle in Saxony.—The University.—No meteorology.

Hanover.—Technical High School.—No meteorology.

Heidelberg.—The University. Professor Wolf; two hours weekly on meteorology.

Jena.—The University. No meteorology.

Carlsruhe.—Technical High School. No meteorology.

Kiel.—The University. No meteorology.

Königsberg in Prussia.—The University. No meteorology.

Leipsic.—The University. No meteorology.

Marburg in Hesse.—The University. No meteorology.

Munich.—The University. No meteorology. Technical High School. No meteorology.

Münster in Wurtemburg.—University. No meteorology.

Rostock.—University. No meteorology.