stand attached to the middle of the balancing board, so that the lead is about 5 feet above the board. The globe is provided with tubular apertures, not shown in the figure, to allow it to be filled with saturated and nucleus-laden air at pleasure; but during an experiment these apertures are closed. It is also provided with wires, *W*, led through an india rubber bung, and connected in the interior of the globe by means of a fine platinum wire, to allow heat to be supplied to the air at pleasure by passing an electric current through the fine wire.

When the globe has been filled with suitable air, and the apertures closed, any motion of the board diminishes or increases the pressure in the interior by the motion of the mercury vessel. The increase or diminution of pressure tends to resist the motion of the board, and by adjusting the positions of the counterpoise and the lead weight, the arrangement can be made to balance just within the limits of stability, when the elasticity of the enclosed air is taken into account. When this adjustment is made, it is clear that a slight motion of the board in the direction of increasing the volume of the enclosed air throws over the lead weight toward the same side as the globe, and brings to bear a largely increased moment of forces tending to continue the expansion; so that the ultimate expansion resulting from any cause tending to depress the balance on the globe side produces a rarefaction depending on the degree of dynamical instability of the balance. Such a cause arises when the air in the globe is slightly warmed by passing a current through the wire. If the mercury vessel were fixed, the heating would produce increase of pressure in the closed space, and consequently increase of pressure in the mercury surface supported by the board. As, however, the balanced vessel is movable, the balance comes over, and then the dynamical instability causes expansion, determined not solely by the amount of heat which originated the motion, but by the loads on the balance and their position.

The success of the experiment, for the demonstration of the production of a cloud—i. e. a diminution of temperature—on heating, depends upon the proper selection of the area of the tube in comparison with the volume of the globe. I have found a 4-inch globe with a 1½-inch tube give completely satisfactory results. The counterpoising weights are about seven pounds on each side, and the lead weight with iron stand supporting it, perhaps fifteen pounds. Under these conditions, with the globe filled with saturated air and closed, and the mercury vessel properly counterpoised, the commencement of heating at once determines a depression of the board on the globe side, a rarefaction corresponding to about three-quarters of an inch of mercury and an abundant cloud. The experiment can be repeated with the same air, after readjusting the balance, until the exhaustion of nuclei for the deposit of globules makes the arrangement insensitive. Its activity can always be restored by refilling it with suitable air.

The degree of instability of the balance corresponds to the temperature gradient for height in nature. I have not yet formed an estimate of the temperature gradient to which my arrangement of the apparatus would correspond. But the analogy between the two is formally correct, and with a slight modification of the apparatus the equivalent temperature gradient could be determined. It would be still more strikingly clear to the eye if the globe and tube were attached to the balance and the mercury reservoir fixed. In that case the globe of air would indeed rise with increase of heat, and the arrangement would become simply an apparatus for multiplying the effect of the rise, a rise of 2 inches with my apparatus being equivalent to a rise of about five hundred feet in nature. It thus becomes a comparatively simple means of conducting in the laboratory, operations which really take place on a large scale in nature.

CLIMATOLOGICAL DATA FOR JAMAICA.

Through the kindness of Mr. H. H. Cousins, chemist to the government of Jamaica and now in charge of the meteorological service of that island, we have received the following table in advance of the regular monthly weather report for Jamaica:

Comparative table of rainfall for June, 1903.

Divisions.	Relative area.	Number of stations.	Rainfall.	
			1903.	Average.
	Per cent.		*Inches.*	*Inches.*
Northeastern division	25	24	6.32	9.86
Northern division	22	53	5.16	4.80
West-central division	26	26	8.53	9.08
Southern division	27	36	3.99	5.72
	100	139	6.00	7.36

The rainfall for June was therefore much below the average for the whole island. The heaviest rainfall was 17.93 inches at Brownsville in the west-central division, while 0.48 of an inch fell at Port Royal Naval Hospital in the southern division.

TORNADO AT GAINESVILLE, GA., JUNE 1, 1903.

By Mr. J. B. MARBURY, Section Director, Atlanta, Ga.

On the afternoon of June 1 one of the most destructive tornadoes in the history of Georgia struck the outskirts of the City of Gainesville, in Hall County, about 50 miles northeast of Atlanta. The track of the storm was about 4 miles in length and from 100 to 200 feet in width.

The course taken was from southwest to northeast along the southern outskirts of the city, and was marked by death, destruction, and desolation.

The city proper is situated on an elevated plateau about 1300 feet above sea level, but the section passed over by the tornado runs northeast and southwest around the town, and is over 100 feet lower, forming a miniature valley-like depression with hills on either side. The devastated territory was occupied by several large cotton mills and the homes of employees and the negro element of the city. The fearful death list is due to the crowding together of so many persons employed in the doomed mills. Most of the negroes were away on a large picnic excursion, or the loss of life would doubtless have been doubled.

The weather map for the morning of the 1st presented no abnormal features, certainly nothing heralding any severe storms. Cloudy and unsettled weather covered the major portion of the country, and thunderstorms occurred at numerous points in middle and northern Georgia during the preceding night. The pressure was highest over the Great Lakes with the barometer 30.40 inches at Marquette, Mich. The lowest pressure east of the Rockies was in Missouri where it was but little lower than normal. The temperature was below 70°, except in the southeastern portion of this State.

During the early hours of the day the weather was somewhat erratic, alternating between sunshine and light showers with rather oppressive temperature. About noon heavy black clouds were seen forming in the southwest and soon continuous, though at first distant, thunder was heard. At the same time the wind blew briskly from the northeast, increasing in force as the clouds approached. A few moments later regular tornado clouds began forming, first in the southwest, and later in the west and northwest, in which was noticed what seemed to be a violent whirling motion; at the same time clouds were observed rushing in nearly all directions toward the tornadic disturbance. The tornado clouds were of the characteristic greenish hue, increasing in their horrible grandeur as they drew nearer. The clouds so closely resembled smoke that many thought it was smoke from an approaching locomotive; the cloud was approaching along the general direction of the Southern Railway. This appearance preceded by only a few seconds the development of the funnel-shaped cloud which descended toward the earth. Then there was a few seconds of death-like calm, the thunder ceased. Soon, to the southwest was heard a deafening roar. The funnel-shaped cloud kept close to the surface and began its deadly work about one mile southwest of Gainesville, striking a large cotton mill at exactly 12:45 p. m., eastern time, just 10 minutes after 750 employees had filed into the great structure from dinner. Only the fourth and fifth floors of this building were injured by the wind, although the entire structure was damaged by the heavy downpour of rain. On the top floor of the mill were employed 250 children, and it was here that the greatest loss of life occurred. The force of the wind tore the roof and top story off and hurled giant timbers and massive blocks of marble for a distance of more than a hundred feet. Children employed in the spinning room were hurled to the ground and instantly killed. Only two or three bodies were found inside the building, the rest were buried in the débris in front of the building. The fifth floor of the mill fell forward in the direction of the storm's progress, while the rear end remained almost intact, the floor slanting at an angle of about 45°. For half a mile to the southwest of the mill trees were blown down and a few outhouses wrecked, but no great damage was done. The village of the mill where most of the employees live, in 80 of the company's houses, was absolutely unharmed by the storm. This is due to the fact that this village stood on a high hill above the mill.

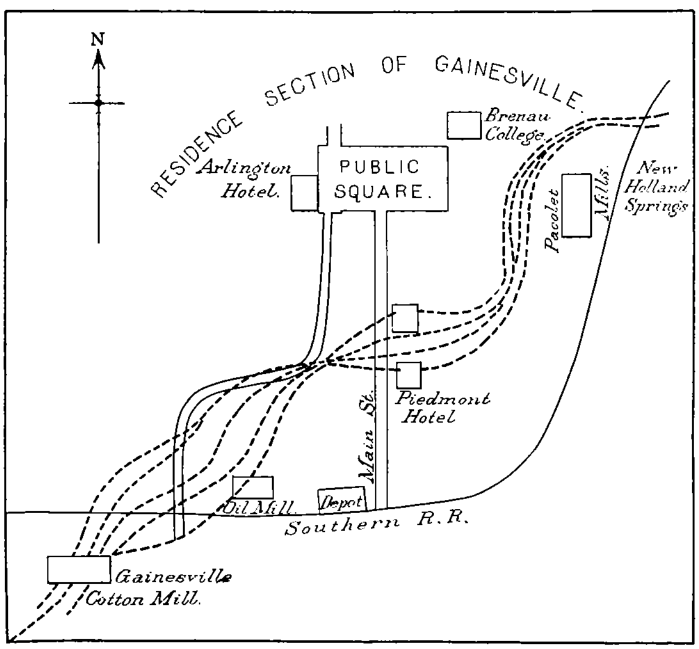

FIG. 1.—Path of the storm.

The walls of the mill fell outward and the roof was lifted into the air and held suspended for several seconds, showing that a decided vacuum was formed just over the doomed building.

The people in the building had no opportunity to prepare for the great danger. Clouds overhung the sky most of the morning, but they looked like many other rain clouds they had seen, and no special attention was paid to them. With a roar and a rush sounding like "a hundred express trains" the storm came down upon the unsuspecting victims with all its maddening fury. The fury of the gale lasted only a few seconds, when the air became as quiet and still as death for a few moments. Then the rain came down in torrents, accompanied by vivid lightning and wild rolls of thunder. During this time the rescuers worked among the débris.

In the rear of the mill was an immense standpipe, fully 50 feet off the ground and about 50 feet tall in itself. This standpipe was about 40 feet in diameter and was covered with an immense sheet iron cupola. This great cupola, weighing several tons, was lifted bodily from the top of the standpipe, carried high into the air, and dropped about a hundred feet in front of the mill, killing several persons who had thus far escaped danger. With the exception of the loss of the cupola, the great standpipe was uninjured. A brick chimney 125 feet high and directly in the path of the storm was uninjured.

The next building in the path of the storm was the Gainesville Iron Works, which was badly damaged; the roof was blown off and the walls thrown out of plumb, but no lives were lost, as no one was in the building at the time.

The storm then jumped across the tracks of the Southern Railway Company, destroying the switch signals and targets and all telegraph and telephone poles along its track. Freight cars standing on the side tracks were taken up bodily and thrown against a near embankment. In some instances cars were lifted from the trucks and carried some distance away; others were carried away trucks and all. Huge pieces of timber and logs were carried along with frightful velocity.

When the storm first crossed the railroad tracks it seemed heading directly toward the center of the city, half a mile distant, but it swerved to the east, cutting a path from 200 to 300 yards wide, until it struck the mill village of New Holland, 2 miles northeast of the Gainesville depot. At New Holland, where is located the Pacolet Mills, one of the largest cotton manufacturing plants in the South, the course of the storm turned and the mill was but little damaged, but the village of cottages, where lived the 1300 employees, was almost entirely destroyed. Out of 120 cottages about 70 were totally wrecked. Hundreds were at work in the mill and were saved, but a large number, especially the aged women and small children, were in the cottages and many were killed. It is estimated that at least $100,000 damage was done goods and machinery at this mill.

After leaving New Holland the fury of the storm lessened so rapidly that, beyond a few fences and small trees being blown down, no damage was done. The entire track of the tornado was about 4 miles. In all, 98 persons were killed, nearly double that number injured, while the money value of the property loss amounted to about $1,000,000.

CLIMATOLOGY OF COSTA RICA.

Communicated by Mr. H. PITTIER, Director, Physical Geographic Institute.

[For tables see the last page of this REVIEW preceding the charts.]

Notes on the weather.—On the Pacific slope the weather showed no marked abnormalities. Rain was moderate although slightly above the normal. At San José pressure, temperature, and relative humidity were very near to the means of the foregoing years of observation. Sunshine, 165 hours against the normal of 133 hours. On the Atlantic slope the rain was in excess, with intermediate weeks of drought at the coastal stations, while in the mountains the rainfall, also generally heavier than usual, was more continuous.

Notes on earthquakes.—June 24, 7^h 14^m a. m., slight shock NW-SE, intensity II, duration 3 seconds.

WEATHER REPORTS FROM VESSELS AT SEA.

By Prof. A. G. McADIE, dated June 19, 1903.

In reply to an inquiry concerning the meteorological reports which were received daily from the cable ship *Silvertown* by the district forecaster at San Francisco during the time when the vessel was engaged in laying the American transpacific cable, the following brief article is submitted:

From December 14 until December 24, 1902, through the courtesy of Captain Morton of the steamer and Mr. H. Benest, Chief of the Cable Expedition, the weather conditions prevail-