

D., on the 10th, at Pierre, S. D., on the 14th and 15th, and at Bismarck, N. D., on the 31st, navigation being resumed almost immediately after the channels became clear.

In the Mississippi River the ice gorge at the Wabash Bridge, at Hannibal, Mo., broke on the 2d, and the river was free from ice on the 7th; at Muscatine, Iowa, the ice went out on the 15th; at Davenport, Iowa, from the 16th to the 20th; at LeClaire, Iowa, on the 17th; at Prairie du Chien, Wis., from the 24th to the 26th; at Dubuque, Iowa, south of the bridge on the 17th, and north of the bridge on the 23d; at La Crosse, Wis., in front of the city on the 29th, but not below the railroad bridge until the 31st, and at St. Paul, Minn., below Robert street bridge on the 24th, but not above until the 27th.

Dates of resumption of navigation were as follows: Grafton, Ill., 9th; Hannibal, Mo., 16th; Keokuk, Iowa, 24th; Davenport, Iowa, 25th, and St. Paul, Minn., 27th. Navigation on the Ohio River, above Cincinnati, Ohio, was resumed on the 5th after a suspension since February 12, caused by low water resulting from ice gorges in the river above.

A new special river station of the Weather Bureau was established on March 1, 1901, at New Madrid, Mo., on the Mississippi River, a part of the Memphis, Tenn., district. The new station is 70 miles below Cairo, Ill., 160 miles above Memphis, Tenn., and 1,003 miles from the mouth of the river.

The highest and lowest water, mean stage, and monthly range at 135 river stations are given in table VII. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are: Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.—*H. C. Frankenfield, Forecast Official.*

AREAS OF HIGH AND LOW PRESSURE.

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocities.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
High areas.										
I.....	1, p. m.	50	97	4, a. m.	48	54	Miles.	Days.	Miles.	Miles.
II.....	6, a. m.	29	99	9, a. m.	32	64	2,075	2.5	830	34.6
III.....	11, a. m.	30	88	13, a. m.	32	64	2,050	3.0	683	23.5
IV.....	14, a. m.	51	104	20, a. m.	32	64	1,500	2.0	750	31.2
V.....	20, p. m.	32	95	24, a. m.	32	64	2,725	5.0†	745	31.0
VI.....	22, a. m.	38	123	24, a. m.	47	123	2,050	3.5	588	24.4
VII.....	30, a. m.	41	105	2, p. m.*	44	70	2,725	2.0	362	15.1
Sums.....							1,800	3.5	514	21.4
Mean of 7 paths.....							13,925	31.5	4,470	186.2
Mean of 21.5 days.....							1,989		639	26.6
Low areas.										
I.....	1, a. m.	54	114‡	6, a. m.	46	60	2,950	5.0	590	24.6
II.....	3, p. m.	40	105‡	2, p. m.	35	76	2,900	2.5	1,160	48.2
III.....	1, a. m.	30	90	9, a. m.	39	87	1,275	1.5	850	35.3
IV.....	6, p. m.	48	123	13, a. m.	48	54	1,850	2.5	740	30.8
V.....	8, p. m.	35	102	13, a. m.	48	54	2,900	4.5	644	26.8
VI.....	9, a. m.	49	123	16, a. m.	41	72	2,100	7.0†	443	18.5
VII.....	17, p. m.	44	103	19, a. m.	20	88	1,350	1.5	900	37.5
VIII.....	20, p. m.	37	79	22, a. m.	48	69	2,100	4.5	578	24.1
IX.....	21, a. m.	33	115	30, a. m.	45	64	1,000	1.5	697	37.8
X.....	21, p. m.	50	110	30, a. m.	45	64	2,975	8.5	850	14.6
XI.....	23, p. m.	32	91	28, p. m.	35	75	2,325	9.0	358	14.9
XII.....	25, p. m.	32	100	28, p. m.	35	75	1,750	4.5	339	15.2
XIII.....	28, a. m.	34	112	4, p. m.*	41	71	1,425	2.0	712	29.7
Sums.....							3,500	7.0	500	20.8
Mean of 14 paths.....							82,800	61.5	8,881	369.9
Mean of 61.5 days.....							2,348		634	26.4
									538	22.2

* April. † Stationary for 1 day.

CLIMATE AND CROP SERVICE.

By JAMES BERRY, Chief of Climate and Crop Service Division.

The following extracts relating to the general weather conditions in the several States and Territories are taken from the monthly reports of the respective sections of the Climate and Crop Service. The name of the section director is given after each summary.

Precipitation is expressed in inches and temperature in degrees Fahrenheit.

Alabama.—The mean temperature was 53.2°, or 2.0° below normal; the highest was 84°, at Florence on the 3d, and the lowest, 11°, at Oneonta and Riverton on the 7th. The average precipitation was 6.30, or 0.18 above normal; the greatest monthly amount, 10.14, occurred at Ashville, and the least, 1.39, at Livingston.

Farm work was almost entirely interrupted by excessive rains during the last few days, which caused overflows in nearly all the larger rivers, inundating much prepared land.—*F. P. Chaffee.*

Arizona.—The mean temperature was 54.8°, or 1.2° below normal; the highest was 95°, at Sentinel on the 1st, and the lowest, 5° at Flagstaff on the 31st. The average precipitation was 0.52, or 0.43 below normal; the greatest monthly amount, 1.89, occurred at Camp Creek, while none fell at a number of stations.—*W. G. Burns.*

Arkansas.—The mean temperature was 51.5°, or 0.5° above normal; the highest was 86°, at Conway and Spielerville on the 2d, and the lowest, 4°, at Pond on the 6th. The average precipitation was 4.67, or 0.25 below normal; the greatest monthly amount, 7.32, occurred at Ozark, and the least, 2.45, at Arkansas City.

Good progress has been made in all kinds of farm work during the month; early potatoes and some oats and corn have been planted; land is being prepared for cotton; wheat and oats continue to do well generally; the damage to fruit by frost has been slight.—*E. B. Richards.*

California.—The mean temperature was 53.0°, or 2.1° above normal; the highest was 95.0°, at Volcano on the 1st and at Salton on the 6th, and the lowest, 14° below zero, at Bodie on the 13th. The average precipitation was 1.01, or 2.32 below normal; the greatest monthly amount, 7.02, occurred at Crescent City, while none fell at 10 stations.

Conditions were unusually favorable for all crops during March. The temperature was slightly above normal, and no injurious frosts occurred. Light rain fell throughout the State, benefiting grain and grass, and softening the surface soil, which in some sections had become crusted. Wheat was in excellent condition at close of month, and deciduous fruits were developing rapidly.—*Alexander G. McAdie.*

Colorado.—The mean temperature was 34.7°, or about normal; the highest was 86°, at Lamar on the 2d, and the lowest, 12° below zero, at Wagon Wheel Gap on the 30th. The average precipitation was 1.35, or about normal; the greatest monthly amount, 5.41, occurred at Ruby, and the least, 0.04, at Durango.

The consensus of opinion seems to be that the season is from 10 to 20 days late. The soil is generally in good condition, and some plowing and seeding have been done. Winter wheat is in good condition in the districts where water was available for irrigation last fall. Fruit trees wintered well in nearly all sections and the outlook for a good crop is favorable.—*F. H. Brandenburg.*

Florida.—The mean temperature was 62.1°, or 3.3° below normal; the highest was 91°, at Nocatee on the 25th and De Land on the 31st, and the lowest, 21°, at Quincy on the 7th. The average precipitation was 5.65, or 2.57 above normal; the greatest monthly amount, 11.23, occurred at Carrabelle, and the least, 1.65, at New Smyrna.

Heavy rains during the second and third decades retarded farm work, and low temperatures during the first and second decades damaged vegetables as far south as central counties. Freezing conditions obtained throughout the north half of the State. A great deal of corn has been worked the first time, and considerable cotton has been planted on uplands. Citrus trees and pineapples are vigorous. Farm work is about two weeks late.—*A. J. Mitchell.*

Georgia.—The mean temperature was 53.6°, or 2.0° below normal; the highest was 86°, at Waycross on the 25th and at Fitzgerald on the 30th, and the lowest, 6°, at Dahlonega on the 6th and 7th; the average precipitation was 6.18, or 1.10 above normal; the greatest monthly amount, 9.17, occurred at Rome, and the least, 2.34, at Savannah.

Violent electrical disturbances and local windstorms occurred on the 25th and 26th, causing considerable property damage and some loss of

life. During the first and second decades the weather was particularly favorable for preparation of soil, but the excessive rains of the third decade damaged land by inundation, rotted seed in the ground, and put a stop to all farm operations.—*J. B. Marbury.*

Idaho.—The mean temperature was 36.2°, or 0.7° above normal; the highest was 72°, at Hagerman and Garnet on the 21st, and the lowest, 16° below zero, at Lake on the 28th. The average precipitation was 1.31, or 0.19 below normal; the greatest monthly amount, 3.91, occurred at Murray, and the least, 0.15, at Oakley.

A heavy rain on the 1st of March over the west slope of the Cœur D'Alene Mountains caused the St. Joseph River to rise suddenly and damaged loggers to the extent of about \$1,000.—*S. M. Blandford.*

Illinois.—The mean temperature was 39.4°, or 1.3° above normal; the highest was 76°, at Raum on the 24th, and the lowest, 1° below zero, at Kishwaukee on the 5th. The average precipitation was 3.43, or 0.23 above normal; the greatest monthly amount, 7.30, occurred at Havana, and the least, 2.00, at Monmouth.

Mild weather during the month, and good but not excessive rains. Crops generally in a promising condition. Wheat looks well, but hessian fly is present in some localities. Excellent fruit prospect.—*M. E. Blystone.*

Indiana.—The mean temperature was 40.4°, or 1.2° above normal; the highest was 83°, at Crawfordsville on the 21st, and the lowest, 1° below zero, at Angola on the 6th. The average precipitation was 3.40, or 0.50 below normal; the greatest monthly amount, 5.42, occurred at Bloomington, and the least, 1.10, at Topeka.

Stormy, cloudy weather prevailed during March, with moderate temperature and frequent, but not very heavy, rains. Near the end of the month the snow had disappeared from northern fields. Wheat was improved much by the rains and looks green and vigorous, although thin in some fields; some of the early sown shows effect of injury done by the hessian fly. Rye is in fine condition everywhere. Clover wintered well; the young clover looks especially well; most of the new clover and timothy were sown this month. Meadows and pastures began to grow and look green. Some garden truck was sown and planted in a few localities. Many tobacco beds have been made in Switzerland County. Some early potatoes were planted in a few fields. Farm work was delayed, the ground being too wet for plowing and seeding, but in the southern half of the State some oats were sown and some plowing for corn was done. Fruit is apparently all safe and uninjured by frost; in the southern portion the buds began to swell. Livestock is in very good, healthy condition, with plenty of feed.—*C. F. R. Wappenhans.*

Iowa.—The mean temperature was 34.2°, or 1.0° above normal; the highest was 76°, at Atlantic on the 17th, and the lowest, 8° below zero, at Denison on the 4th. The average precipitation was 2.64, or 0.89 above normal; the greatest monthly amount, 5.25, occurred at Red Oak, the least, 0.70, at Whitten.

Frequent storms of snow, sleet, and rain hindered farm operations in nearly all parts of the State. In the northwest district, and on sandy soil in the east-central district a beginning was made in seeding during the month. Conditions were generally favorable for grasses and winter grain, which were practically uninjured during the winter.—*John R. Sage.*

Kansas.—The mean temperature was 42.5°, or 0.9° above normal; the highest was 89°, at Colby on the 7th, and the lowest, zero, at Colby on the 31st. The average precipitation was 1.71, or 0.32 above normal; the greatest monthly amount, 5.04, occurred at Oswego, and the least, 0.16, at Rome.

A changeable temperature, frequently dropping low enough to stop germination. Wheat continued in good condition over the larger part of the State, and in the extreme northwest the wheat in the ground sprouted. Some oats sown in nearly all parts; nearly completed in south. But little plowing this month. Corn planting just beginning south. Fruit buds unhurt. Apricots blossoming in south. Peaches nearly ready to blossom.—*T. B. Jennings.*

Kentucky.—The mean temperature was 46.4°, or 0.4° above normal; the highest was 87°, at Williamsburg on the 22d, and the lowest, 3°, at Catlettsburg, Loretto, and Shelby. The average precipitation was 3.50, or 1.79 below normal; the greatest monthly amount, 5.98, occurred at Hopkinsville, and the least, 1.95, at Catlettsburg.

Wheat suffered severely from lack of snow protection during the winter, and although it improved considerably during the last ten days in March, the outlook is very unsatisfactory. Tobacco beds all sown. Grass backward and clover badly winter killed. Oat sowing about completed and plowing for corn well advanced. No damaging frosts so far, and outlook for fruit very promising. Farm work generally well advanced.—*H. B. Hersey.*

Louisiana.—The mean temperature was 58.4°, or 2.0° below normal; the highest was 87°, at Rayne on the 31st, and the lowest, 19°, at Plain Dealing on the 6th. The average precipitation was 3.51, or 1.11 below normal; the greatest monthly amount, 6.22, occurred at Lake Providence, and the least, 2.02, at Grand Coteau.

Frost occurred more frequently and later than is usual for the month of March. Peaches were injured slightly; the ripening of early strawberries and maturing of early vegetables was retarded; otherwise, weather conditions were favorable for agricultural interests. Sugar

cane, both plant and stubble, was in a satisfactory condition, off-barring, shaving, and scraping completed on most plantations. The planting of corn and early potatoes was about finished in the southern portion of the State, was well under way in the central portion, and had begun in the northern portion. The preparation of ground for rice and cotton was well advanced and planting was in progress. Fall planted oats were reported as looking well. Daily shipments of strawberries were being made from Tangipahoa Parish, but were not so large as usual at this season.—*W. T. Blythe.*

Maryland and Delaware.—The mean temperature was 42.7°, or 1.9° above normal; the highest was 88°, at Receiving Reservoir, D. C., on the 20th, and the lowest, 9° below zero, at Sunnyside, Md., on the 6th. The average precipitation was 3.47, or 0.23 below normal; the greatest monthly amount, 6.99, occurred at Bachman's Valley, Md., and the least, 1.13, at Johns Hopkins Hospital, Md.

The early part of March was cold, but later in the month warmer weather favored growth, and copious rains were very beneficial, greatly improving the condition of winter grain and grasses. Very little farm work of any kind was accomplished during the month in the more western counties, and less than the usual progress had been made in the northern-central counties. Farther south about average advance had been made, with oats, peas, and potatoes, in the ground in places, and fruit buds swelling generally. Outlook more favorable than a month ago.—*Oliver L. Fassig.*

Michigan.—The mean temperature was 28.0°, or 0.8° above normal; the highest was 72°, at Adrian on the 25th, and the lowest, 20° below zero, at Lake City on the 3d and at Humboldt on the 6th. The average precipitation was 2.65, or 0.31 above normal; the greatest monthly amount, 5.32, occurred at Charlevoix, and the least, 0.68, at Eagle Harbor.—*C. F. Schneider.*

Minnesota.—The mean temperature was 27.3°, or 3.5° above normal; the highest was 65°, at Luverne on the 17th and at St. Cloud on the 30th, and the lowest, 28° below at New Folden and Pokegama on the 5th. The average precipitation was 1.68, or 0.25 above normal; the greatest monthly amount, 4.17, occurred at Grand Meadow, and the least, 0.20, at Crookston.

No work in the soil was possible except a little harrowing and wheat seeding on the high and light lands of Chippewa, Rock, Nobles, Redwood, and Blue Earth counties from the 16th to the 23d, after the surface soil was thawed a little. Frost was in the ground to a considerable depth, with freezing temperatures almost nightly, but toward the end of the month the surface soil was thawing during the afternoons. There is abundant soil moisture. Much plowing is to be done this spring in portions of the Red River Valley, because of the excessive rainfall last autumn.—*T. S. Outram.*

Mississippi.—The mean temperature was 55.2°, or 1.4° below normal; the highest was 84°, at Poplarville on the 28th and at Brookhaven on the 29th, and the lowest, 16°, at Ripley on the 6th. The average precipitation was 3.62, or 2.20 below normal; the greatest monthly amount, 5.60, occurred at Woodville, and the least, 1.55, at Okolona.

The average rainfall, although next to the lightest during past fourteen years, was well distributed over the State and throughout the month. Farm work was in splendid condition in the northern portion of the State, but truck gardening was somewhat delayed in the southern counties on account of continued cool weather. Fruit prospect excellent.—*W. S. Belden.*

Missouri.—The mean temperature was 42.5°, or 1.0° above normal; the highest was 85°, at Wylie on the 2d, and the lowest, 1° below zero, at Potosi on the 6th. The average precipitation was 3.73, or 0.46 above normal; the greatest monthly amount, 6.28, occurred at Boonville, and the least, 1.96, at Hazlehurst.

The weather was very changeable; high winds prevailed a considerable part of the time, and the month was, on the whole, the most disagreeable of the winter. In a number of the southeastern and a few of the east-central and southwestern counties the ground was in good condition to work, and the greater part of the oat crop was sown, early potatoes were planted, and considerable ground prepared for corn, but throughout the remainder of the State the soil was wet and cold and little or no farm work was done. Wheat and clover suffered but little injury from freezing and thawing and were generally in excellent condition at the close of the month.—*A. E. Hackett.*

Montana.—The mean temperature was 34.5°, or 6.7° above normal; the highest was 72°, at Miles City on the 17th, and the lowest, 20° below zero, at Chester on the 4th. The average precipitation was 0.71, or 0.26 below normal; the greatest monthly amount, 2.69, occurred at Columbia Falls, and the least, trace, at Glasgow, Poplar, and Ridgeway.—*E. J. Glass.*

Nebraska.—The mean temperature was 35.7°, or 1.7° above normal; the highest was 87°, at Beaver City on the 2d, and the lowest, 8° below zero, at Lynch on the 5th. The average precipitation was 1.90, or 0.74 above normal; the greatest monthly amount, 4.46, occurred at Stratton, and the least, 0.40, at Whitman.

The warm, wet weather has been very favorable for all fall-sown grain, but has delayed farm work. Wheat and rye are in unusually fine condition.—*G. A. Loveland.*

Nevada.—The mean temperature was 38.9°, or 1.7° above normal; the highest was 90°, at Lovelock on the 15th, and the lowest, zero, at

Potts on the 24th. The average precipitation was 0.59, or 0.63 below normal; the greatest monthly amount, 2.52, occurred at Lee, while none fell at Humboldt.

The first half of the month was warm and springlike; last half was cold, typical March weather. Some plowing and seeding in various parts of the State. Fruit trees blooming early in month.—*J. H. Smith.*

New England.—The mean temperature was 31.5°, or 0.5° above normal; the highest was 64°, at Bennington, Vt., on the 26th, and the lowest, 24° below zero, at Enosburg Falls, Vt., on the 2d. The average precipitation was 5.43, or 1.91 above normal; the greatest monthly amount, 10.30, occurred at Bar Harbor, Me., and the least, 1.17, at Cornwall, Vt.

Excessive precipitation, generally in the form of rain; no destructive or severe storms. Maple sugar a short crop. Some plowing and gardening has been done in Rhode Island and Connecticut at close of month. According to general estimate the season is ten days behind.—*J. W. Smith.*

New Jersey.—The mean temperature was 39.2°, or about normal; the highest was 75°, at Bridgeton and Salem on the 19th, and the lowest, 8° below zero, at Layton on the 7th. The average precipitation was 4.64, or 0.75 above normal; the greatest monthly amount, 8.07, occurred at Charlotteburg, and the least, 2.40, at Mount Pleasant.

The weather was favorable for farming operations in the southern portion, where much plowing has been done and the seeding of oats begun; some hardy truck has been planted. Winter grain in all sections injuriously affected by absence of snow protection. All fruit trees wintered well; buds abundant but still dormant in northern portion.—*E. W. McGann.*

New Mexico.—The mean temperature was 42.8° or 1.8° below normal; the highest was 90°, at San Marcial on the 2d and 6th, and the lowest, 7°, at Winsors on the 14th and 20th. The average precipitation was 0.49, or 0.03 above normal; the greatest monthly amount, 1.83, occurred at Folsom, while none fell at Roswell and San Marcial, and only trace at Olio.

High, cold winds; backward month. In the north vegetation delayed; early blooming fruits, such as peaches, apricots, plums, and cherries, greatly injured by the cold in the southern half of Territory.—*R. M. Hardinge.*

New York.—The mean temperature was 30.6°, or 1.4° above normal; the highest was 64°, at Mohonk Lake on the 4th, Oneonta on the 25th, and Lockport on the 26th, and the lowest, 28° below zero, at Axton on the 3d. The average precipitation was 3.51, or 0.33 above normal; the greatest monthly amount, 7.89, occurred at Carmel, and the least, 0.85, at Hemlock Lake.

Low temperatures characterized the first week of March, the 6th being one of the coldest days of the winter. From this time until the 27th the temperature was generally above normal, and the third week was unusually warm. The precipitation exceeded the usual amount, and was well distributed through the month. At the opening of March the ground was heavily covered with snow, but little remained after the 20th, excepting in the northern section. Vegetation and farm work made little advance, owing to frost and moisture in the ground.—*E. T. Turner.*

North Carolina.—The mean temperature was 50.5°, or 2.0° above normal; the highest was 81°, at Kinston on the 25th, and the lowest, zero, at Linville on the 6th. The average precipitation was 4.71, or 0.07 above normal; the greatest monthly amount, 10.14, occurred at Horse Cove, and the least, 2.05, at Currituck Inlet.

The severe freeze early in March killed some winter wheat, and the outlook for that crop was not promising until the heavy rains of the 25th, which compacted the soil about the roots and started rapid growth. Oats, rye, and clover, were also benefited. During the first half of March farmers made excellent progress in preliminary farm work. Truck crops and strawberries in the east were from one to two weeks later than usual; some shipments of radishes and lettuce were made near the close of the month.—*C. F. von Herrmann.*

North Dakota.—The mean temperature was 25.3°, or 7.7° above normal; the highest was 85°, at Fort Yates on the 18th, and the lowest, 32° below zero, at Woodbridge on the 4th. The average precipitation was 0.86, or 0.08 below normal; the greatest monthly amount, 1.99, occurred at Wahpeton, and the least, 0.06, at Church Ferry.—*B. H. Bronson.*

Ohio.—The mean temperature was 39.5°, or 1.0° above normal; the highest was 84°, at Portsmouth on the 25th, and the lowest, 8° below zero, at Colebrook on the 6th. The average precipitation was 2.66, or 0.71 below normal; the greatest monthly amount, 5.20, occurred at Rittman, and the least, 0.80, at Frankfort.

The temperature ranges have been great and the changes frequent, but at the close of the month fruit is practically uninjured; grass fields and meadows, though backward, show very little winter damage. The condition of wheat is reported to be from fair to very good over the northwestern three-fourths of the State, but in the southeast it is very poor. Farm work was backward at the close of March.—*J. Warren Smith.*

Oklahoma and Indian Territories.—The mean temperature was 49.7°, or 0.2° above normal; the highest was 90°, at Pawhuska on the 2d, and the lowest, 7°, at Jefferson on the 6th. The average precipitation was

1.53, or 0.50 below normal; the greatest monthly amount, 5.10, occurred at Bengal, and the least, trace, at Colbert.

During the month conditions were generally favorable for growing crops. Wheat generally is in fair condition; oats were all sown during the month and coming up with a fair stand. Recent rains are causing small grain to make good growth, and have placed ground in good working condition. Corn is being planted, and cotton land broken; grass is starting up; fruit trees are blooming, with a fine prospect. A severe local storm occurred over Washita County on the 29th, doing considerable damage to property and causing loss of life.—*Charles M. Strong.*

Oregon.—The mean temperature was 44.6°, or 1.1° above normal; the highest was 81°, at Hare on the 5th, and the lowest, 10° at Silverlake on the 23d. The average precipitation was 3.92, or 0.23 below normal; the greatest monthly amount, 11.50, occurred at Glenora, and the least, 0.14, at Riverside.

Vegetation at the close of March, 1901, was not as far advanced as it was at the same time last year; the backwardness of the season being due to an unusually prolonged cool spell which began on the 21st, and continued until the close of the month. The crop outlook, however, is promising, and the fall sown wheat has come through the winter uninjured, well rooted and stooled, and it has a thrifty appearance and good color. Fruit trees wintered well, and at the close of the month peaches, apricots, and some of the earliest varieties of cherries and prunes were in full bloom, and although light frosts frequently occurred during this time no damage from them has so far been reported.—*Edward A. Beals.*

Pennsylvania.—The mean temperature was 37.4°, or 2.0° above normal; the highest was 80°, at Franklin on the 19th, and the lowest, 11° below zero, at Saegerstown on the 1st. The average precipitation was 4.14, or 0.61 above normal; the greatest monthly amount, 7.21, occurred at Somerset, and the least, 1.52, at Alleppo.

Soaking rains, seasonable temperature, and much sunshine gave vegetation an early start. Grain, wheat, and rye look to be in good condition in all sections of State. Plowing in southern counties was commenced in latter part of month.—*L. M. Dey.*

Porto Rico.—The mean temperature was 75.7°, or 0.4° above normal; the highest was 97°, at Bayamon on the 3d, and the lowest, 52°, at Corozal on the 13th. The average precipitation was 6.53, or 3.60 above normal; the greatest monthly amount, 12.58, occurred at Manati, and the least, 0.88, at Ponce.

Dry weather at the opening of March retarded farming operations, but much farm work was done during the month. The heavy rains during the middle of March, which were torrential in some localities on the 17th and 18th, damaged small crops and caused some of the rivers to overflow and inundate much low land. The wet weather was favorable for young canes, but retarded grinding. Cane is maturing fairly well and the saving of the crop is being hastened. The density of the juice has slightly improved, but continues below the normal. The quality and quantity of the crop is not as good as was anticipated. Tobacco cutting continues, but is nearing completion in places. Coffee trees are full of blossoms, now blooming the third time, and an excellent yield is promised. Small crops, such as beans, tomatoes, lettuce, cabbage, carrots, sweet potatoes, oranges, bananas, pineapples, pepper, turnips, tamarindos, squashes, malangos, coconuts, etc., are being marketed. The yield of some of these products is good. Some new crops are being planted.—*Joseph L. Olina.*

South Carolina.—The mean temperature was 53.4°, or 1.3° below normal; the highest was 86°, at Gillisonville on the 25th, and the lowest, 10°, at Liberty on the 7th. The average precipitation was 4.36, or 0.80 above normal; the greatest monthly amount, 8.68, occurred at Greenville and Liberty, and the least, 2.27, at Pinopolis and Yemassee.

There was more than the usual amount of land prepared for planting, and less than the usual amount of planting accomplished, owing to heavy rains during the last ten days. Killing frosts were general on the 6th, 7th, 17th, and 22d, but vegetation was so backward that no injury resulted.—*J. W. Bauer.*

South Dakota.—The mean temperature was 32.4°, or 6.0° above normal; the highest was 79°, at Fort Randall and Yankton on the 17th, and at Oelrichs on the 21st, and the lowest, 16° below zero, at La Delle on the 5th. The average precipitation was 0.89, or 0.61 below normal; the greatest monthly amount, 2.60, occurred at Rosebud, and the least, 0.05, at Ipswich.

A heavy snowstorm over the extreme western portion of the State on the 24th and 25th interrupted railway traffic, rendered wagon roads impassable for several days in some parts, and caused some loss of live stock in localities. At the close of the month spring wheat seeding was progressing fairly well in the southern, and had begun in the middle counties, having previously been frequently interrupted and delayed by freezing weather and rain or snow. The soil is amply moist generally. Winter rye is reported in good condition.—*S. W. Glenn.*

Tennessee.—The mean temperature was 49.2°, or 0.3° above normal; the highest was 82°, at Nunnely on the 3d, Johnsonville on the 4th, and at Liberty on the 5th, and the lowest, zero, at Rugby on the 6th. The average precipitation was 4.10, or 1.53 below normal; the greatest monthly amount, 8.46, occurred at Chattanooga, and the least, 1.30, at Springfield.

Wheat was small and backward at the close of the month, but had made rapid improvement in condition, especially in the middle and western divisions. The work of sowing oats and breaking and preparing land for corn and cotton was about finished and a considerable acreage in corn was planted. Irish potatoes were planted and gardening was well advanced.—*H. C. Bate.*

Texas.—The mean temperature was 58.6°, or 0.3° below normal; the highest was 103°, at Fort Ringgold on the 9th, and the lowest, 12°, at Anna on the 6th and Haskell on the 10th. The average precipitation was 1.43, or 0.58 below normal; the greatest monthly amount, 5.44, occurred at Arthur City, while none fell at Eagle Pass, Fort Brown, and Sanderson.

Except in the eastern portion of the State, where the rainfall was sufficient for agricultural purposes, the weather conditions were generally unfavorable for farming interests. At the close of the month rain was badly needed over the western portion of the State for all interests. Wheat and oats suffered for the want of rain, and insects damaged these crops seriously in many localities. The bulk of the corn crop was planted, but good stands were not secured in all sections. Good progress was made in the preparation of land for cotton, but the majority of farmers are waiting for good rains before planting. Trucking interests suffered generally on account of the dry weather. The strawberry crop was cut short. A good acreage has been planted to sugar cane. Preparations are being made for a large rice crop.—*I. M. Oline.*

Utah.—The mean temperature was 36.8°, or 1.1° below normal; the highest was 78°, at Moab on the 2d and at St. George on the 6th, and the lowest, 2° below zero, at Soldier Summit on the 30th. The average precipitation was 0.84, or 0.48 below normal; the greatest monthly amount, 3.15, occurred at Park City, while none fell at Kanab.—*L. H. Murdoch.*

Virginia.—The mean temperature was 46.6°, or 3.0° above normal; the highest was 83°, at Ashland on the 26th, and the lowest, 3° below zero, at Burkes Garden on the 6th. The average precipitation was 3.49, or 0.43 below normal; the greatest monthly amount, 5.73, occurred at Callville, and the least, 1.29, at Manassas.

Favorable conditions of temperature and moisture prevailed, and winter grains, which had been suffering from drought and were backward, made excellent growth and at the close of the month were nearly normal in condition.—*Edward A. Evans.*

Washington.—The mean temperature was 42.5°, or 2.1° above normal; the highest was 84°, at Dayton on the 21st, and the lowest, 16° at Republic on the 5th. The average precipitation was 2.59, or 0.34 below normal; the greatest monthly amount, 10.40, occurred at Monte Cristo, and the least, 0.06, at Ritzville.

The first three weeks were very mild and favorable but the cool and wet character of the last week of the month was unfavorable for spring work and the growth of crops, making the spring late and crops backward.—*G. N. Salisbury.*

West Virginia.—The mean temperature was 42.9°, or 0.5° above normal; the highest was 83°, at Point Pleasant on the 24th, and the lowest, 11° below zero, at Terra Alta on the 6th. The average precipitation was 3.23, or 0.56 below normal; the greatest monthly amount, 5.27, occurred at Harpers Ferry, and the least, 0.90, at Parsons.

Practically no snow protection and almost constant freezing and thawing, but wheat generally reported in fair condition; considerable late sown winter-killed and some plowed up; farm work well advanced; some oats being sown and gardens made; some potatoes, onions, and peas already planted; just cold enough to retard budding, and fruit prospects excellent; cattle and sheep wintered fairly well, but feed getting scarce.—*E. C. Voss.*

Wisconsin.—The mean temperature was 28.1°, or about normal; the highest was 64°, at Grantsburg on the 16th, and the lowest, 38° below zero, at Butternut on the 6th. The average precipitation was 2.85, or 1.00 above normal; the greatest monthly amount, 5.15, occurred at Port Washington, and the least, 1.55, at West Bend.

A very damaging sleetstorm occurred on the 10th. The telephone and telegraph wires became so burdened by the accumulation of ice that hundreds of miles of wire in the southern portion of the State were borne to the ground, and Milwaukee was practically cut off from the outside world for nearly forty-eight hours. No progress has been made in farm work, the ground being still frozen in many portions of the State.—*W. M. Wilson.*

Wyoming.—The mean temperature was 30.3°, or 1.2° above normal; the highest was 70°, at Buffalo on the 1st, and the lowest, 10° below zero, at Daniel on the 30th and 31st. The average precipitation was 0.87, or 0.49 below normal; the greatest monthly amount, 2.45, occurred at Saratoga, and the least, trace, at Hyattville and Basin.

The mild weather of March allowed some plowing and seeding to be done over some parts of northern Wyoming.—*W. S. Palmer.*

Cuba.—The mean temperature was 73.7°; the highest was 98°, at Holguin on the 23d, and the lowest, 42°, at Batabano on the 18th. The average precipitation was 1.42; the greatest monthly amount, 2.94, occurred at Soledad (Guantanamo), and the least, 0.15, at Holguin.

The precipitation was light but fairly well distributed; it caused very few interruptions in cane harvest, and grinding continued throughout the month. Preparations of soil for spring cane planting was generally and actively carried on; planting is under way at scattered points. New canes and stubble did not receive sufficient rain but they very satisfactorily withstood the effects of the dry weather. The tobacco harvest was finished in Pinar del Rio and western Havana during the first fifteen days of the month; the yield was short but the quality is considered very good; the weather was too dry to admit of handling the crop and but little selecting was under way at the end of the month. Tobacco in Santa Clara improved greatly and yield and quality will prove better than anticipated. Rainfall was entirely too light for small crops, especially in Pinar del Rio. Quite seasonable temperature prevailed.—*Wm. B. Stockman.*

SPECIAL CONTRIBUTIONS.

FOG STUDIES ON MOUNT TAMALPAIS: NUMBER 4.¹

By ALEXANDER G. McADIE, Forecast Official, dated January 25, 1901.

REFRACTION OF SOUND WAVES BY FOG SURFACES.

In a previous paper the aberration of the zones of audibility of fog signals was briefly referred to in connection with the fog billows formed at the common surface of air streams of different temperatures and densities. Some photographs of these Helmholtzian air billows, or rather of the vapor masses which serve as exponents of the air waves, were given, and the question of the reflection and interference of sound waves in the vicinity of Mount Tamalpais briefly alluded to. In the present paper some additional photographs showing rather remarkable curved surfaces of the condensed water vapor are given.

The velocity of sound, it is generally stated, is within wide limits practically independent of both intensity and pitch. In dry air at 0° C., according to Rowland, the velocity of sound propagation is 331.78 meters (1,090 feet) per second. In water vapor at 10° C., according to Masson, the velocity is about 402 meters (1,318 feet), and at 96° C. 410 meters (1,345

feet) per second. In water at 10° C. the velocity is about 1,435 meters (4,708 feet); in copper about 3,560 meters and in glass from 5,000 to 6,000 meters.

The velocity is proportional to the square root of the absolute temperature, as given by the formula,

$$a = a_0 \sqrt{1 + \frac{t}{273}}$$

where a = velocity of sound

a_0 = velocity of sound at 0° C.

The velocity of sound propagation in dry air is therefore about 37 times more rapid than that of the average summer afternoon winds (20 miles per hour), which blow through the Golden Gate with such regularity and which are the prime disturbing factors in the circulation of the air in this vicinity. The question of refraction of sound in free air has been independently studied by Stokes², Taylor³, Henry⁴, Tyndall⁵, and Reynolds⁶, and many of the puzzling phenomena connected with the aberration of sound can be demonstrated to be caused by the bending of the sound beams in traversing air strata of varying temperatures and motions. The most efficient cause of loss of audibility is

¹The Editor regrets that the publication of this article, written before the loss of the steamship *Rio de Janeiro*, has been delayed by waiting for the half-tone plates.

²Report British Association, 1857. ³Smithsonian Report, 1875. ⁴Smithsonian Report, 1877. ⁵Philosophical Transactions, 1874. ⁶Philosophical Transactions, 1876.