

From this table we find that no tornadoes are likely to occur in Kansas in January or December, that in only one year out of 30 is a tornado likely to occur in February, that the monthly frequency increases to three in each May, and that but one tornado occurs in each 10 years in November. The average annual frequency of tornadoes for the State is 8.8. However, since the area of destruction of a single tornado rarely exceeds 25

square miles,¹ and many cover a much smaller area, while the total area of Kansas is more than 80,000 square miles, it follows that, on the average, no given place in the State will experience a tornado oftener than once in about 600 years.

¹ Abbe, Cleveland: Tornado frequency per unit area. MONTHLY WEATHER REVIEW June, 1897, p. 250.

KASSNER ON LEGAL METEOROLOGY.

By C. LeROY MEISINGER.

[Weather Bureau, Washington, D. C., June 21, 1922.]

The lawyer, perhaps more than other professionals, is often forced far afield in the prosecution of his profession. He is not infrequently obliged to interest himself, sometimes intensively, sometimes superficially, in subjects quite antipodal to the ordinary technique of the legalist. The sciences have often had their day in court. Astronomy, chemistry, medicine, engineering, meteorology, and others—all have contributed their expert witnesses. But one difficulty which confronts the lawyer upon examining the expert witness is his own lack of intimate familiarity with the science or data. Not knowing how the data were collected and by whom, not appreciating the full significance of the evidence he is bringing out, the attorney may fail to ask the proper questions or fail to ask them in the proper way. It is for the lawyer, the judge, the administrator, the business man, the layman, and, indeed, for all who may be confronted with the use of meteorological data in legal proceedings and in daily life that Doctor C. Kassner, of the Prussian Meteorological Institute, has written his *Gerichtliche und Verwaltungs-Meteorologie*.¹

In spite of the frequent use of meteorological data in this way, Doctor Kassner's thorough and interesting book, based upon his 30 years of experience, is the first of its kind in the world's meteorological literature. The work is divided into three major divisions—the first dealing with the weather and its observation, the second with questioning concerning the weather, and the third with the giving of information concerning the weather.

The first section is a general compendium of information concerning instruments, units, stations of various orders and their equipment, principal weather services of the world and their addresses. This section enables one unfamiliar with meteorological organizations to get a fair idea in a short time of the character and scope of the work they perform and the data they collect.

The second major section is devoted largely to that phase of the use of meteorological evidence mentioned in the opening paragraph of this review, namely, the intelligent questioning of the expert. Questioners are divided by Doctor Kassner into five groups: (1) Technicians; (2) military officials; (3) attorneys; (4) magistrates; and (5) private individuals.

The author believes that in many instances the German proverb *Wie man in den Wald ruft, schallt's wieder heraus*, is quite applicable to the questions that often are asked and the replies that must be given, for "as one asks, so shall he be answered." He points out the unnecessary circumlocutions often employed in the statement of the question and urges brief and pointed statements. He deprecates the lack of proper use of ordi-

nary terms, incorrect spelling (for example, metrological, meteological, metriological, etc.), and loose ideas concerning the application of the data. He says, finally, that a properly-put question should contain (1) the date, accurately stated to as small time units as possible; (2) the place, as specifically as possible; (3) the weather element involved, clearly stated, as, for example, rain, snow, or hail rather than precipitation; (4) the circumstance involving the data, such as spoiled meat, heat stroke, or accident due to glaze; and (5) the willingness to pay for the information.

The third section of the book is of greatest popular interest and perhaps of greatest value, for it contains running comment, queries, and replies for 438 examples, selected from actual experience, dealing with the various meteorological elements. Some of these possess a touch of humor, some illustrate how a trivial meteorological circumstance may be the turning point of an important case, and all show the manifold ramifications of weather influences in the daily life of man. Some examples follow:

1. An automobile collided with a milk wagon which carried no lights at 9.45 p. m. The driver of the wagon maintained that it was still so light that no lights were necessary.

Reply: Twilight ended at 9 o'clock; the moon was not shining; there were a few clouds. A burning lantern was, therefore, quite necessary.

2. A woman was arrested by the police in a market for having sold spoiled goose meat. She maintained that excessive heat was responsible.

Reply: Highest temperature was only 20° C. (68° F.).

3. In a railroad shipment of filled flasks a part of the flasks were found cracked and empty. The railroad company maintained that it was the result of severe frost.

Reply: No; for on only one day was light frost (-2° C.) (28° F.).

4. A man in running from a large dog fell and broke his leg. The owner of the dog maintained that rain had made the sidewalk so smooth that the man had slipped and thus injured himself.

Reply: No rain, but clear sky instead.

5. Lightning struck a tavern and it burned. In opposition to the guests, whose effects were destroyed, the landlord maintained the misfortune was an "act of God."

Reply: There was a thunderstorm.²

These cases have been selected at random and can presume to do no more than suggest the field covered by the 438 examples. Nor can any idea of the running discussion offered by the author be given, for he constantly points out the best statements and the outcome of the trials. He shows throughout how the reply is limited by the query and how the meteorologist must confine himself strictly to the meteorological aspects of the question, even when there are ramifications closely allied to the meteorological phase, as in the last example given above. A large section is devoted to cases, always frequent where meteorological forces are concerned, involving the "act of God" (*Höhere Gewalt*).

¹ *Gerichtliche und Verwaltungs-Meteorologie, Das Wetter in der Rechtsprechung für Gerichte und Rechtsanwältinnen, Verwaltungen, Magistrate und Hausbesitzer, Berufsgenossenschaften und Versicherungsgesellschaften, für Gewerbe, Handel und Technik. Mit 158 Beispielen aus der Praxis.* Berlin and Leipzig, Vereinig. wiss. Verleger, 1921. 8°; 208 pages.

² It was maintained in the trial, however, that such defense was not valid since the inn was not protected by lightning rods. Had the inn been so protected, it was held, the owner could properly have defended himself upon the grounds of an "act of God."

Doctor Kassner's book suggests the need for a similar work in English, based upon the wealth of experience that is surely to be found among meteorological workers in English-speaking countries. It is a valuable contribu-

tion to the literature of meteorology in a field untouched by others. It should be read by professionals and laymen whose interests carry them into legal and administrative activities likely to employ meteorological data.

DRY SEASON, 1921-22, IN THE CANAL ZONE.

By R. Z. FITZPATRICK, Chief Hydrographer.

The 1921-22 dry season began about January 7 and ended about May 4, 1922. It was of shorter duration than those of 1919-20 and 1911-12, which were, respectively, the driest and next to the driest since the American occupation of the Canal Zone.

Comparative rainfall figures for these three periods are given below.

Rainfall, inches.

Stations.	1921-22, Jan. 7 to May 4, inclusive.	1919-20, Dec. 16 to May 13, inclusive.	1911-12, Dec. 1 to May 7, inclusive.
Porto Bello.....	13.92	10.18	5.74
Colon.....	5.39	5.26	6.37
Gatun.....	7.41	3.37	10.30
Mount Lirio.....	4.75	2.41	9.29
Gamboa.....	3.56	2.52	3.03
Alhajuela.....	1.22	1.78	1.02
Vigia.....	1.22	1.51	1.60
Culebra.....	2.68	2.79	3.85
Empire.....	1.69	3.02	3.20
Pedro Miguel.....	5.64	6.15	6.29
Balboa Heights.....	3.69	4.46	4.76
Total.....	51.17	43.43	55.45

The Chagres River discharge was 48 per cent above the 21-year four-month dry season average, or 1,893 c. f. s. against a mean of 1,279 c. f. s. The minimum discharge of the Chagres for the four months was 555 c. f. s. on April 25; the maximum discharge for the same period was 29,100 c. f. s. in the freshet of January 2, during which, in order to control Gatun Lake, it was necessary to open seven spillway gates with a maximum momentary discharge of 92,778 c. f. s., the highest momentary spill- ing on record.

Gatun Lake fell to elevation 84.47 feet during the four-month period and continued to recede to elevation 84.27 feet on May 7, from which date the recovery of storage was begun. A loss in storage of 11.65 billion cubic feet occurred during the dry season, compared with 22.8 billion cubic feet for last year and 24 billion cubic feet for 1920. There being no necessity for conservation of water, as was necessary in 1920, little if any effort toward this end was made. Evaporation from the lake's surface was 24.59 inches, approximately the entire storage depletion. The water necessary for useful losses was considerably less during the past dry season than that of 1921.

The following data show the net inflow into Gatun Lake for the dry-season months since the formation of the lake:

Net yield in C. F. S.¹

	Dry seasons of record.											Average for month.
	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	
Dec. 2.....	2,690	5,335	4,397	7,010	7,673	4,986	3,218	2,158	4,930	3,698	7,649	5,424
Jan.....	400	2,563	1,739	2,570	1,863	1,111	3,023	1,541	709	1,216	8,641	2,314
Feb.....	271	1,298	744	4,207	1,320	139	431	73	-287	651	1,482	966
Mar.....	-392	678	167	823	698	-182	35	-50	-385	-121	190	133
Apr.....	-363	567	308	5,400	1,076	447	1,119	3,230	-706	214	210	1,050
May.....	2,771	4,992	3,219	6,111	4,033	3,635	7,364	4,352	583	2,109	4,080

¹ Net yield is the total yield minus the evaporation on Gatun Lake.
² Decembers are of previous year; i. e., December, 1911, is in 1912 dry season.

Figure 1, page 256, accompanying this report, gives the hydrology of Gatun Lake for the four-month dry season, January 1 to April 30, 1922.

NOTES, ABSTRACTS, AND REVIEWS.

WEEKLY WEATHER AND CROP REPORTS.

Beginning with the first week of July the system of collecting information respecting the effect of weather on crops hitherto in vogue will be broadened to include the several first and second class Weather Bureau stations in each State. These stations will report direct to the section center. The Section Director will continue to summarize all of the data received and telegraph the results to the Central Office in Washington Tuesday mornings throughout the year. The release of the information to the public has been set for 10 a. m. Wednesday mornings.

PHOTOGRAPHIC SPECTRUM OF THE AURORA OF MAY 13-15, 1921, AND LABORATORY STUDIES IN CONNECTION WITH IT.

By LORD RAYLEIGH.

[Abstracted from *Proceedings of the Royal Society*, A101, 114-124, 1922.]

Exceptionally fine photographs of the auroral spectrum obtained by Rayleigh during the brilliant display of May 13-15, 1921, show quite definitely that the chief auroral line is quite out of coincidence with the krypton line, the

whole spectrum being accounted for by the auroral line, of unknown origin, and the negative bands of nitrogen, the latter predominating. An attempt was made to reproduce the nitrogen bands as they appear in the aurora by a discharge tube in the laboratory, but without complete success. So far as it goes, however, the evidence gathered would favor the idea, which has sometimes been advocated, that rays of atomic nature, not electrons, from the sun, give rise to the aurora.

The photographs clearly confirm all previous evidence that the lines of those elements ordinarily supposed to constitute the high atmosphere are not present. If hydrogen is really present, a formidable difficulty is therefore encountered, for according to all laboratory experience even a trace of hydrogen asserts itself in the spectrum of any kind of electric discharge through air under any conditions of pressure. However, on the suggested hypothesis of atomic rays, it is also difficult, in the light of the evidence afforded by specially devised experiments, to explain the absence of helium and nitrogen lines. It would seem best not to lose sight of the possibility that the mode of excitation may be something entirely different from either electronic or atomic bombardment.—E. W. W.