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TEXAS AGRICULTURAL EXPERIMENT STATION

A. B. CONNER, DIRECTOR

COLLEGE STATION, BRAZOS COUNTY, TEXAS

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Rate of Water Evaporation in Texas



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*Dean, School of Veterinary Medicine.

**In cooperation with U. S. Department of Agriculture.

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Losses of water through evaporation from reservoirs is an important consideration in the planning for an adequate supply for domestic, municipal, or irrigation purposes and the rate of such losses from the soil has a marked influence upon crop adaptation and farming practices in a particular region. Measurements of the evaporation from a free water surface have, for a number of years, been collected by the Texas Agricultural Experiment Station at Substations in the various regions of the State and these, together with similar records from U. S. Field Stations located in Texas, and from U. S. Weather Bureau records at Austin and Dilley, are reported in this Bulletin. In all, the monthly and annual evaporation, in inches, is given for 21 points within the State, fairly well distributed from the Upper Panhandle to the Rio Grande Valley and from the more humid regions of the Gulf Coast to the drier Trans-Pecos Region in the west.

Evaporation generally increases gradually from the eastern to the western part of the State. Total annual evaporation from a free water surface ranges from 45 to 55 inches in the eastern part of the State, from 55 to 65 inches in the central part, and from 65 to 75 inches in the western part, or a range of four to six feet per annum. Rainfall, on the other hand, varies in exactly the opposite direction, ranging from 52.81 inches at Beaumont, in the Gulf Coast Region, to 13.75 inches at Balmorhea, in the Trans-Pecos Region. The temperature, atmospheric humidity, wind movement, and rainfall all have a close relationship to evaporation, and, together with the altitude and geographical location, largely determine the extent of losses through evaporation which may be expected in any given region of the State.

When conditions are highly favorable to rapid evaporation, a loss of from one-half to three-fourths of an inch of water may occur in a 24-hour period. In the eastern and southeastern parts of the State the annual rainfall is equal to or slightly more than the annual evaporation but in the drier regions the total annual evaporation from a free water surface may amount to as much as four or five times the total rainfall for the year.

Total annual loss of water through evaporation, when all available measurements are considered, averages 61.65 inches in Texas, approximately two-thirds of which occurs during the six warm months, April to September, inclusive.

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RATE OF WATER EVAPORATION IN TEXAS

R. E. KARPER

Evaporation records at points representative of the various regions of the State are of value not only in connection with agricultural development of these regions but are also useful to municipalities, engineers, and industrial development. The loss of water through evaporation from storage reservoirs is an important factor in reducing the quantity available for domestic supply or irrigation. A knowledge of evaporation losses is important in the adequate planning of reservoirs for domestic, municipal, or irrigation purposes, flood control, and other reclamation projects.

The tremendous influence of evaporation upon crop production in climatic regions such as prevail in Texas, is quite evident and is practically as important as precipitation. Evaporation is an integration of many components of the weather, such as temperature, wind movement, precipitation, and relative humidity, all of which, to a greater or lesser degree, determine the total evaporation losses from the soil. Such losses are intimately associated with agricultural production and with farming practices, such as choosing the right crop to grow, time and method of seed-bed preparation, planting, and cultivation, as well as rotation, fertilizer, and irrigation practices. Soil moisture available for germination of seed and crop production is affected by evaporation to a large degree and this influence must be considered in determining the depth to cover the seed, spacing between plants, and rate of seeding. Loss of water from the soil through evaporation varies for different soils and soil types, but accurate and rapid determinations of such losses are not possible; however, records of evaporation from a free water surface or an evaporation tank in general should resemble evaporation losses from the soil in the different regions of the State.

The Texas Agricultural Experiment Station has, for a number of years, kept daily records of the evaporation, as well as other meteorological observations, at the Substations located in the different agricultural regions of the State. Numerous requests for information on this subject have prompted us to make the record of these observations available in this Bulletin.

LOCATION OF OBSERVATIONS

Evaporation records from the Texas Substations, for the most part, constitute the data reported in this Bulletin, and, in addition, similar records from the several other points at which they are available have been included. Through the courtesy of the Division of Genetics and Biophysics, Dry-Land Agriculture, and Western Irrigation Agriculture, of the United States Department of Agriculture, it has been possible to include evaporation records from the Dry-Land Field Stations at Big Spring and Dalhart, from the Western Irrigation Agriculture Field Station at San Antonio, and from the Amarillo Field Station from 1907 to 1919. While the records for Dalhart, Amarillo, and Big Spring cover only the six months' growing season, April to September, inclusive, this is the usual period of

maximum evaporation losses and the mean annual can be closely approximated by calculation from other records for the entire year in the same general region of the State. The records for Austin and Dilley are taken from the United States Weather Bureau records.

The location of the points of observation cover, for the most part, the important agricultural and geographical regions of Texas, extending from the Upper Panhandle to the Rio Grande Valley and from the more

Table 1. Location of stations recording observations on evaporation

Location	County	Region	North Latitude	West Longitude	Elevation, feet
Nacogdoches	Nacogdoches	East Texas Timber	31°35'	91°40'	271
Angleton	Brazoria	Central Coast Prairie	29°9'	94°24'	23
Beaumont	Jefferson	Eastern Coast Prairie	30°	94°	28
Troup	Smith	East Texas Timber	32°20'	95°17'	484
College Station	Brazos	East Texas Timber	31°39'	96°16'	308
Denton	Denton	Grand Prairie	33°10'	97°10'	600
Winter Haven	Dimmit	Western Rio Grande Plain	29°40'	99°50'	650
Beeville	Bee	Rio Grande Plain	28°32'	97°38'	240
Temple	Bell	Blackland Prairie	31°15'	97°37'	740
Weslaco	Hidalgo	Lower Rio Grande Valley	26°9'	97°57'	80
Lubbock	Lubbock	Central High Plains	33°37'	101°45'	3106
Iowa Park	Wichita	Rolling Plains	33°55'	98°39'	978
Austin	Travis	Edwards Plateau	30°17'	97°44'	502
San Antonio	Bexar	Rio Grande Plain	29°9'	98°21'	539
Spur	Dickens	Rolling Plains	33°30'	100°47'	2274
Chillicothe	Hardeman	Rolling Plains	34°	99°	1406
Balmerhea	Reeves	Mountains and Basins	31°	103°	3200
Dalhart	Dallam	Northern High Plains	36°4'	102°31'	3978
Amarillo	Potter	High Plains	35°13'	101°50''	3676
Dilley	Frio	Western Rio Grande Plain	28°42'	99°10'	569
Big Spring	Howard	Southern High Plains	32°15'	101°23'	2500

humid regions of the Gulf Coast to the drier Trans-Pecos Region in the west. Table 1 shows the location, region, latitude, longitude, and elevation of the points of observation covered in these records.

TYPE OF EQUIPMENT USED

Equipment for evaporation observations, which is standard for all the Substations, consists of an evaporation tank six feet in diameter and two feet deep, with still-well attached, a micrometer evaporation gage, and a water supply piped to the tank (Fig. 1.) Within the same fenced weather enclosure is housed other standard U. S. Weather Bureau equipment consisting of rain gage, maximum and minimum thermometers, whirling psychrometer, and anemometer. The weather yards are located as uniformly as possible, at the various Stations, away from trees, buildings, and other obstructions, and instruments installed in regulation shelters. The anemometer is mounted on a stand about five feet from the ground. Evaporation tanks are given full exposure to the sun. The earlier records at Substations and Field Stations were practically all obtained from eight-foot tanks. In a few cases tanks of this size are still in use but at most of the Stations they have been replaced, and as they are renewed, tanks six feet in diameter are installed.

Evaporation tanks are round and constructed of 20-gage galvanized iron. The upper edge of the tank is reinforced by a piece of angle iron,

the top of which comes about one-fourth of an inch below the top edge of the tank, thus providing reinforcement on the outside of the tank. The top edge of the tank is kept in line and not dented. About one inch above the bottom of the tank is installed a flange coupling on both the inside and outside, riveted and soldered, giving a water-tight thread connection for a one-half inch galvanized iron pipe extending from the outside of the tank to approximately its middle and open at each end to admit the placing of a still-well on the outside of the tank and giving connection with the water in the tank through this small pipe. A brass still-well, with cover, is connected parallel with the side wall of the tank. Tanks are sunk in the ground so that four inches of the rim projects above the surface, and are set level. Installation in the ground provides a more even temperature of the water and the 4-inch rim above the ground level protects the tank somewhat from splashing rain, drifting snow, and blowing dust and trash.

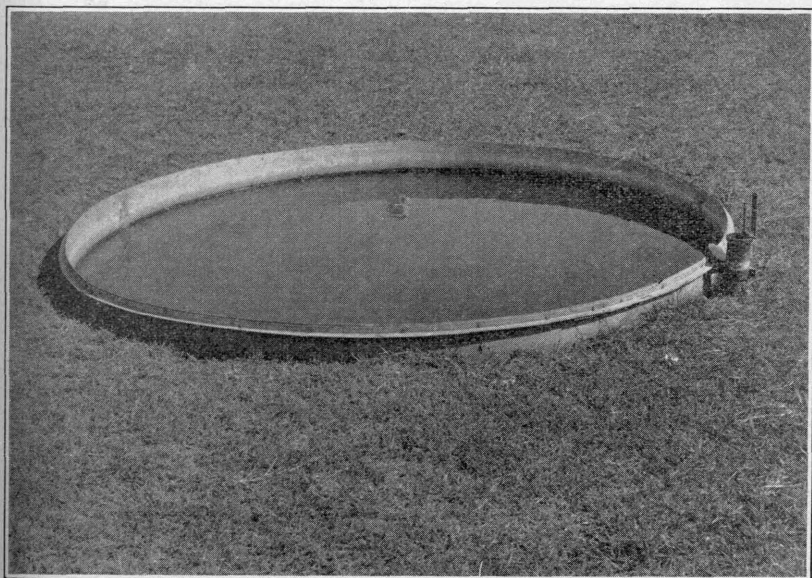


Fig. 1. Sunken exaporation tank, still-well, and micrometer gauge, the equipment used in recording evaporation from a free water surface.

Evaporation records at Hill's Ranch, near Austin, and at Dilley have been obtained by the U. S. Weather Bureau from their standard type of pan installed above ground. Water in this type of installation is more readily affected by the temperature of the air and the rate of evaporation is somewhat higher than where sunken tanks are employed.

Table 2. Mean monthly and annual meteorological data for stations in Texas from which evaporation records are available

	Length of record, years	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Nacogdoches														
Evaporation, inches	18	1.517	2.052	3.130	3.904	4.609	5.425	5.863	5.797	4.665	3.634	2.245	1.668	44.508
Precipitation, inches	20	4.58	3.76	4.33	4.92	5.27	3.79	3.54	3.10	3.02	3.17	4.23	5.02	48.73
Mean max. temp.	19	59.5	64.1	69.0	77.0	82.5	90.3	93.3	93.7	89.8	80.6	68.8	60.1	77.4
Mean min. temp.	19	39.0	42.5	46.4	54.5	61.6	69.1	71.2	70.7	66.0	55.5	45.8	40.2	55.2
Mean mean temp.	19	49.3	53.3	57.7	65.8	72.0	79.7	82.3	82.2	77.9	68.1	57.3	50.2	66.3
Av. rel. humidity	19	84.4	83.9	79.4	79.0	81.7	79.2	78.7	80.5	81.2	81.1	81.1	86.0	81.7
Wind run, miles	19	3298	3367	3949	3383	2785	2133	1847	1730	1719	2012	2489	3097	2651
Angleton:														
Evaporation, inches	18	1.768	2.086	3.234	3.900	5.136	5.320	5.504	5.172	4.372	3.759	2.489	1.957	44.698
Precipitation, inches	19	3.29	2.70	3.23	3.12	3.86	4.41	4.18	4.54	3.91	4.17	3.39	4.56	45.37
Mean max. temp.	19	65.0	68.9	71.8	78.2	83.6	89.4	91.7	92.3	88.5	82.4	73.5	66.3	79.3
Mean min. temp.	19	43.4	47.2	50.2	57.7	64.5	70.1	71.8	71.4	68.1	59.0	49.6	45.0	59.2
Mean mean temp.	19	54.2	58.0	61.0	67.9	74.0	79.8	81.7	81.9	78.3	70.7	61.6	55.7	68.7
Av. rel. humidity	18	81.8	80.4	78.4	79.3	79.2	78.9	79.5	79.2	81.3	79.5	79.3	82.2	79.9
Wind run, miles	19	4716	4415	5237	4692	4021	3057	2529	2409	2660	3122	3698	4437	3749
Beaumont:														
Evaporation, inches	16	2.013	2.334	3.530	4.318	5.227	5.425	5.587	5.564	4.428	3.727	2.575	2.117	46.795
Precipitation, inches	19	4.63	3.72	3.72	4.24	5.20	4.69	4.30	4.59	3.63	3.98	4.24	5.86	52.81
Mean max. temp.	19	63.1	67.5	70.7	77.5	83.6	89.5	91.6	91.6	88.4	80.9	70.6	64.2	78.3
Mean min. temp.	19	43.3	47.0	50.5	57.8	64.1	70.7	72.8	72.4	68.1	58.6	48.9	44.1	58.2
Mean mean temp.	19	53.2	57.3	60.6	67.7	73.9	80.1	82.2	82.0	78.2	69.7	59.8	54.2	68.2
Av. rel. humidity	16	84.8	84.2	81.6	82.2	81.4	82.1	83.0	83.0	84.4	83.1	83.7	85.6	83.3
Wind run, miles	16	4026	3873	4909	4577	3853	2936	2396	2143	2289	2683	3136	3765	3382
Troup:														
Evaporation, inches	18	1.595	2.211	3.491	4.468	5.618	6.781	7.210	7.150	5.450	4.099	2.559	1.820	52.452
Precipitation, inches	28	3.26	3.27	3.89	4.81	4.82	2.96	3.40	2.44	2.40	3.14	3.79	4.63	42.80
Mean max. temp.	28	58.0	61.3	68.4	75.8	82.0	90.2	93.0	93.5	89.0	78.8	68.2	58.2	76.4
Mean min. temp.	28	38.4	41.1	47.6	54.8	61.9	69.5	72.1	71.7	66.7	55.7	46.3	39.4	55.4
Mean mean temp.	28	48.2	51.2	58.0	65.3	72.0	79.9	82.5	82.6	77.9	67.2	57.3	48.8	65.9
Av. rel. humidity	19	77.3	74.7	72.3	72.7	76.3	74.8	73.3	72.9	74.9	74.1	75.1	76.9	74.6
Wind run, miles	19	4532	4460	5581	5077	4392	3677	3110	3068	2919	3376	3868	4435	4041
College Station:														
Evaporation, inches	17	2.210	2.454	4.124	4.771	5.909	7.031	7.773	7.430	5.600	4.462	2.987	2.224	56.974
Precipitation, inches	44	3.25	2.84	2.66	4.06	4.77	3.20	2.44	2.39	2.69	3.11	3.23	3.84	38.49
Mean max. temp.	32	60.7	65.1	71.0	79.1	85.0	91.9	95.8	95.5	90.6	81.8	71.2	63.1	79.2
Mean min. temp.	32	40.2	43.8	48.8	56.7	63.3	69.8	72.3	71.7	67.4	57.5	48.0	42.5	56.8
Mean mean temp.	32	50.4	54.4	59.9	67.9	74.2	80.9	84.0	83.6	79.0	69.6	59.6	52.8	68.0
Av. rel. humidity	28	80.0	79.3	75.6	76.6	78.1	77.0	75.3	74.9	76.4	76.6	77.7	79.0	77.2
Wind run, miles	18	4018	3727	4720	3983	3582	3053	2753	2723	2662	2827	3267	3733	3421

Table 2. Mean monthly and annual meteorological data for stations in Texas from which evaporation records are available—Continued

	Length of record, years	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Denton:														
Evaporation, inches	16	1.883	2.430	4.168	5.071	5.598	7.291	8.045	8.023	6.094	4.494	2.863	2.069	58.030
Precipitation, inches	20	2.34	1.87	1.89	3.89	4.28	3.00	2.12	2.98	2.18	3.69	2.11	2.63	32.96
Mean max. temp.	19	55.0	61.0	67.8	75.8	81.5	91.3	95.4	95.6	89.0	78.9	66.5	55.7	76.1
Mean min. temp.	19	32.5	36.9	42.6	51.8	59.7	68.8	71.9	71.3	65.1	53.7	42.3	34.6	52.6
Mean mean temp.	19	43.7	49.0	55.2	63.8	70.6	80.1	83.7	83.5	77.0	66.3	54.4	45.1	64.4
Av. rel. humidity	19	73.9	70.4	65.4	67.1	72.3	65.7	61.8	63.7	67.7	69.0	70.2	74.5	68.5
Wind run, miles	19	5417	5646	7348	7030	5832	5391	4363	4102	4213	4648	4757	5052	5317
Beeville														
Evaporation, inches	18	2.364	2.899	4.431	5.158	6.029	7.187	7.550	7.559	5.727	4.614	3.147	2.389	59.052
Precipitation, inches	29	1.70	1.69	2.24	2.52	3.98	3.31	2.19	2.15	3.75	2.81	2.18	2.46	30.98
Mean max. temp.	27	67.5	71.4	76.2	81.9	87.0	92.7	95.4	96.7	92.1	85.0	75.5	66.9	82.4
Mean min. temp.	27	45.6	48.1	53.4	60.4	66.4	71.7	73.2	73.3	69.8	61.2	53.1	46.3	60.2
Mean mean temp.	27	56.6	59.7	64.8	71.2	76.7	82.2	84.3	85.0	80.9	73.1	64.3	56.6	71.3
Av. rel. humidity	19	80.4	79.2	77.6	77.1	79.0	78.2	76.2	74.6	77.0	76.3	77.4	77.8	77.6
Wind run, miles	19	5193	4910	6087	5599	5067	4398	4114	3975	3545	3641	4033	4525	4591
Temple:														
Evaporation, inches	18	2.160	2.739	4.237	4.979	5.829	7.223	8.284	7.965	5.900	4.712	2.981	2.137	59.147
Precipitation, inches	20	2.57	2.33	2.31	4.49	4.55	2.40	1.47	2.36	3.78	3.40	2.88	2.95	35.48
Mean max. temp.	20	59.7	64.9	70.9	79.1	84.7	92.4	96.2	96.2	90.0	81.3	70.5	61.1	78.9
Mean min. temp.	20	35.5	40.0	45.1	54.0	61.7	69.5	71.6	71.3	65.9	55.1	45.0	37.6	54.4
Mean mean temp.	20	47.6	52.5	58.0	66.5	73.2	80.9	83.9	83.8	78.0	68.2	57.8	49.3	66.7
Av. rel. humidity	18	75.6	75.4	69.4	72.0	73.4	70.5	67.2	67.0	72.0	72.6	75.8	77.7	72.4
Wind run, miles	19	4399	4425	5544	4834	4041	3653	3183	3032	2794	3070	3509	4064	3879
Lubbock:														
Evaporation, inches	16	1.503	2.700	4.949	6.840	7.191	8.283	8.854	7.798	5.888	4.048	2.488	1.617	62.158
Precipitation, inches	22	.38	.82	.89	1.64	2.12	2.65	2.17	2.07	2.62	2.62	.60	.82	19.45
Mean max. temp.	19	53.3	60.3	66.1	74.4	80.6	89.2	92.4	91.0	84.6	74.3	63.1	53.3	73.5
Mean min. temp.	19	24.9	29.4	34.1	43.5	53.0	61.9	65.1	63.8	57.6	46.6	34.2	25.8	45.0
Mean mean temp.	19	39.1	44.8	50.1	59.0	66.8	75.5	78.7	77.4	71.1	60.5	48.7	39.5	59.3
Av. rel. humidity	17	66.7	57.7	50.1	49.0	55.5	54.6	52.0	56.5	63.0	66.0	65.3	66.8	58.6
Wind run, miles	19	5323	5319	6853	6847	6442	5969	4798	4183	4426	4685	4659	4876	5365
Iowa Park:														
Evaporation, inches	7	1.601	2.253	4.569	5.881	6.747	8.378	9.087	8.203	6.538	4.567	2.871	1.772	62.467
Precipitation, inches	7	1.48	1.98	1.95	2.28	3.38	3.65	4.53	2.26	2.26	4.42	1.27	2.69	32.13
Mean max. temp.	7	52.9	62.1	67.8	78.3	84.1	92.6	95.9	97.0	89.9	79.8	65.0	55.1	76.7
Mean min. temp.	7	29.1	36.8	39.9	51.1	59.1	68.7	71.7	70.9	65.2	54.2	40.4	31.5	51.6
Mean mean temp.	7	41.0	49.5	53.9	64.7	71.6	80.7	83.8	84.0	77.5	67.0	52.7	43.3	64.1
Av. rel. humidity	7	73.0	71.4	61.4	60.4	62.9	60.0	58.8	56.8	61.7	65.2	66.0	70.3	64.0
Wind run, miles	7	4534	4679	6546	5850	5066	4934	3701	3206	3416	3459	4081	4185	4471

RATE OF WATER EVAPORATION IN TEXAS

Table 2. Mean monthly and annual meteorological data for stations in Texas from which evaporation records are available—Continued

	Length of record, years	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Hill's Ranch, Austin:														
Evaporation, inches	17	2.394	3.234	5.126	5.932	6.791	7.836	8.774	8.663	6.455	5.062	3.146	2.326	65.740
Precipitation, inches	75	1.97	2.36	2.40	3.65	4.42	2.53	2.26	2.20	3.69	3.20	2.51	2.59	33.78
Mean max. temp.	33	61.0	64.0	71.7	78.2	84.4	91.9	94.4	94.8	89.3	79.9	69.9	60.8	78.4
Mean min. temp.	33	39.7	42.5	49.9	56.7	64.2	71.2	73.2	73.2	68.7	58.4	49.0	40.7	53.7
Mean mean temp.	75	49.3	53.4	60.6	65.7	74.5	81.1	84.0	83.9	78.4	68.4	58.4	51.0	67.4
Av. rel. humidity	4	76.0	78.0	68.0	68.0	75.0	72.0	70.0	62.0	69.0	72.0	74.0	72.0	71.3
Wind run, miles	4	5580	5309	6398	6480	6026	5616	4762	4687	4320	4687	5472	5506	5404
San Antonio:														
Evaporation, inches	24	2.46	3.03	4.46	5.53	6.51	7.95	9.10	9.19	6.81	5.10	3.16	2.45	65.74
Precipitation, inches	50	1.46	1.65	1.84	3.19	3.20	2.46	2.17	2.42	3.05	2.23	1.90	1.61	27.18
Mean max. temp.	46	62.7	66.2	73.3	79.7	85.1	91.2	94.0	94.7	89.3	81.3	71.0	63.4	79.3
Mean min. temp.	46	42.5	45.2	51.9	58.9	65.3	71.1	73.1	73.2	69.2	59.9	51.1	44.2	58.8
Mean mean temp.	46	52.6	55.7	62.6	69.3	75.2	81.2	83.5	83.9	79.2	70.6	61.0	53.8	69.1
Av. rel. humidity	43	68.0	66.0	64.0	68.0	70.0	69.0	67.0	66.0	70.0	67.0	68.0	68.0	68.0
Wind run, miles	45	5729	5914	6622	6264	6026	5472	5357	4910	4896	5059	5256	5431	5578
Spur:														
Evaporation, inches	17	2.435	3.136	5.113	6.053	7.143	8.390	9.024	8.065	5.964	4.927	3.408	2.677	66.335
Precipitation, inches	22	.42	.79	.92	2.17	2.74	2.38	1.99	2.76	2.72	2.78	.81	.99	21.48
Mean max. temp.	22	56.3	61.0	67.4	76.1	83.1	92.4	95.5	94.7	87.0	77.3	66.4	55.9	76.1
Mean min. temp.	22	26.3	31.0	35.5	46.0	54.7	63.6	67.3	65.8	59.0	47.8	35.9	27.3	46.7
Mean mean temp.	22	41.3	46.0	51.5	61.1	68.9	78.0	81.4	80.3	73.0	62.6	51.2	41.6	61.4
Av. rel. humidity	17	69.8	65.4	61.6	63.4	66.2	63.9	61.7	63.7	69.2	72.0	71.1	69.1	66.4
Wind run, miles	16	4480	4727	5593	5604	5548	4855	4343	3726	3802	4008	4282	4564	4628
Chillicothe:														
Evaporation, inches	21	1.933	2.828	4.944	6.602	7.899	8.698	9.350	8.797	6.433	4.425	2.780	1.944	66.633
Precipitation, inches	27	.58	.79	1.40	2.50	3.15	3.39	2.51	2.41	2.50	3.40	1.36	1.22	25.23
Mean max. temp.	19	52.0	59.1	66.6	75.2	82.4	92.3	96.0	94.8	87.4	75.7	63.9	53.1	74.9
Mean min. temp.	19	27.3	31.9	37.9	49.0	58.3	67.6	71.1	69.7	62.8	50.7	38.8	28.8	49.5
Mean mean temp.	19	39.6	45.5	52.2	62.1	70.3	80.0	83.5	82.3	75.1	63.2	51.3	41.0	62.2
Av. rel. humidity	16	69.6	62.7	57.7	55.1	59.6	57.3	54.2	56.0	62.0	66.0	66.0	69.2	61.3
Wind run, miles	20	4703	5092	6616	6317	5886	5169	4037	3593	3734	3966	4157	4579	4821
Balmorhea:														
Evaporation, inches	14	2.569	3.870	5.949	7.310	8.515	8.919	8.952	8.103	6.106	4.761	3.177	2.362	70.593
Precipitation, inches	19	.37	.63	.50	.94	1.12	1.25	1.68	2.20	2.37	1.36	.69	.65	13.75
Mean max. temp.	19	60.9	67.0	72.8	80.6	88.0	95.2	95.4	93.5	88.5	79.6	68.7	60.0	79.2
Mean min. temp.	19	30.0	35.0	38.6	47.3	56.5	64.9	67.1	66.0	61.1	50.2	38.2	30.9	48.8
Mean mean temp.	19	45.5	51.0	55.7	63.9	72.2	80.0	81.3	79.8	74.8	64.9	53.5	45.4	64.0
Av. rel. humidity	18	61.6	53.4	47.9	46.6	50.2	53.6	56.5	62.3	66.5	65.1	60.1	61.7	57.1
Wind run, miles	19	3805	4038	4999	4763	4752	4295	3903	3304	3030	3108	3014	3365	3865

Table 2. Mean monthly and annual meteorological data for stations in Texas from which evaporation records are available—Continued

	Length of record, years	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Dalhart:														
Evaporation, inches	25				6.912	8.559	9.375	9.827	8.902	7.107				
Precipitation, inches	25	.22	.38	.73	1.89	2.84	3.14	2.56	2.83	1.52	1.75	.58	.51	18.95
Mean max. temp.	25	48	52	59	69	77	86	91	89	83	71	58	47	69
Mean min. temp.	25	17	20	27	38	48	57	62	61	52	39	27	17	39
Mean mean temp.	25	32	36	43	53	62	72	76	75	67	55	42	32	54
Wind run, miles	23	4836	4838	6250	6336	6101	4968	4613	4092	4320	4687	4608	4613	5022
Amarillo:														
Evaporation, inches	13				6.846	8.677	9.934	10.337	9.156	7.163				
Precipitation, inches	39	.49	.79	.84	1.73	2.82	2.84	2.95	3.20	2.39	1.72	1.05	.79	21.57
Mean max. temp.	39	49.0	51.2	60.9	69.2	76.6	85.4	88.4	87.8	82.1	70.2	59.1	48.7	68.9
Mean min. temp.	39	24.3	25.5	33.1	42.4	51.5	60.7	64.8	64.0	55.0	45.4	34.0	25.4	43.9
Mean mean temp.	39	36.6	38.5	46.8	55.7	63.5	72.9	76.5	75.9	69.4	57.9	46.5	36.9	56.5
Av. rel. humidity	39	65.0	64.5	55.5	55.5	50.0	60.5	60.5	62.5	64.5	65.0	64.5	67.5	61.5
Wind run, miles	39	8956	8714	10672	10376	10269	9412	8360	7980	8580	9052	8462	8418	9104
Big Spring:														
Evaporation, inches	17				7.419	8.813	10.202	11.011	10.178	7.538				
Precipitation, inches	15	.49	.59	1.15	2.25	2.68	2.35	1.25	2.01	2.10	2.27	.78	.51	18.43
Mean max. temp.	15	55	63	69	77	84	93	95	94	86	76	65	57	77
Mean min. temp.	15	27	32	40	48	58	67	70	69	62	51	38	28	49
Mean mean temp.	15	40	47	55	63	71	83	82	82	74	64	51	43	63
Wind run, miles	15	3348	3629	4018	4464	3720	3744	3348	2976	2952	2753	2952	3422	3444
Weslaco:														
Evaporation, inches	1	2.960	3.346	5.520	5.592	5.272	6.950	6.480	7.880	4.235	5.514	3.978	2.530	60.257
Precipitation, inches	18	1.53	.94	1.11	1.17	2.95	2.38	1.92	1.70	4.04	2.30	1.65	1.39	23.07
Mean max. temp.	18	71.5	76.8	80.1	85.9	89.4	92.4	94.2	95.6	92.0	86.9	78.8	72.4	84.7
Mean min. temp.	18	48.8	52.8	57.2	63.7	69.1	72.4	73.0	73.1	70.7	63.8	55.7	50.6	62.6
Mean mean temp.	18	60.1	64.8	68.7	74.8	79.3	82.4	83.6	84.4	81.4	75.4	67.3	61.5	73.6
Av. rel. humidity	7	82.0	80.4	75.6	76.9	78.7	80.1	77.8	75.6	81.0	80.0	80.7	82.7	79.3
Wind run, miles	7	4724	4343	5558	6082	5369	4517	3707	3656	3055	3340	3753	3989	4341
Winter Haven:														
Evaporation, inches	2	1.824	2.252	4.996	4.809	5.531	7.565	7.945	7.617	5.852	5.039	3.429	1.638	58.495
Precipitation, inches	11	1.16	.82	1.15	1.86	2.72	2.18	1.79	2.54	2.73	2.19	1.12	.94	21.21
Mean max. temp.	11	66.5	73.5	78.0	85.5	90.6	96.2	98.8	98.9	93.2	85.7	74.5	65.3	83.9
Mean min. temp.	11	41.2	46.3	49.6	57.4	65.2	71.8	73.5	74.0	69.4	60.4	49.4	43.1	58.5
Mean mean temp.	11	53.9	60.0	63.8	71.5	78.0	84.0	86.2	86.5	81.3	73.1	62.0	54.3	71.2
Av. rel. humidity	2	76.3	75.1	59.0	65.0	70.6	65.7	66.2	67.2	73.7	68.7	69.5	79.4	69.7
Wind run, miles	2	2653	2604	3729	3537	3831	4617	3315	3801	2797	2940	2941	2422	3316

RATE OF WATER EVAPORATION IN TEXAS

Table 3. Monthly and annual evaporation, in inches, at Nacogdoches, 1915-1932.

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1915	1.468*	2.041*	2.629	2.632	4.324	5.770	6.564	4.382	4.093	3.807	2.207	1.291	41.208
1916	1.123	2.263	4.437	4.149	4.724	4.961	4.403	3.904	4.450	3.730	2.057	1.675	41.876
1917	1.319	2.313	3.366	4.350	4.614	6.880	5.838	7.173	4.464	4.496	2.608	1.713	49.134
1918	1.568	1.762	4.011	3.895	5.451	6.387	7.398	5.802	5.028	2.738	2.524	1.779	48.343
1919	1.389	2.203	3.147	4.796	3.889	3.363	4.943	5.628	4.488	2.267	2.315	1.854	40.282
1920	1.355	2.104	3.534	4.821	4.086	5.310	4.999	3.729	4.263	3.104	2.098	1.574	40.977
1921	1.623	2.077	3.181	3.343	5.207	4.152	4.978	5.969	4.018	3.731	2.210	1.709	42.198
1922	1.524	1.744	2.541	2.937	4.295	4.506	5.093	4.625	4.435	3.855	1.864	1.557	38.976
1923	1.689	1.766	2.728	2.961	4.629	4.850	5.226	6.035	3.014	3.488	1.690	1.187	39.263
1924	1.633	1.758	2.528	3.406	4.237	5.132	7.156	6.377	5.047	4.116	2.727	1.686	46.403
1925	1.449	2.422	3.215	5.179	5.336	7.174	6.236	6.776	5.223	3.404	2.029	1.978	50.421
1926	1.251	2.563	2.374	3.384	5.058	5.261	5.082	6.043	5.216	3.856	2.449	1.470	44.007
1927	1.597	2.295	2.745	4.124	5.097	4.439	5.886	6.867	5.130	3.692	2.710	2.109	46.691
1928	1.725	2.325	3.159	3.809	5.525	5.307	5.685	6.204	4.966	3.975	2.204	1.869	46.753
1929	1.636	1.780	3.185	3.909	3.595	5.277	5.754	6.369	4.877	3.860	2.013	1.180	43.435
1930	1.236	1.759	3.043	4.994	3.875	6.352	7.377	6.448	4.746	3.218	2.119	1.831	46.998
1931	1.691	1.984	2.991	3.346	4.319	6.464	6.478	5.752	5.945	4.253	2.221	2.009	47.453
1932	2.029	1.770	3.532	4.235	4.707	6.064	6.438	5.662	4.561	3.820	2.356	1.547	46.721
Mean	1.517	2.052	3.130	3.904	4.609	5.425	5.863	5.797	4.665	3.634	2.245	1.668	44.508

*10-year average, 1916-1925, inclusive.

Table 4. Monthly and annual evaporation, in inches, at Angleton, 1915-1932

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1915	1.826*	2.224*	3.416*	3.312	6.395	6.842	6.911	4.560	4.710	3.847	2.869	1.391	48.303
1916	1.735	2.441	4.566	4.605	6.013	5.955	4.301	4.108	4.502	3.909	2.685	2.520	47.340
1917	1.797	2.246	3.226	3.886	4.681	5.552	6.277	5.343	4.745	4.239	2.721	1.965	46.678
1918	2.073	1.742	4.212	4.351	5.436	6.574	6.804	5.616	5.502	3.350	2.516	2.076	50.252
1919	1.572	2.222	3.169	4.310	4.682	4.323	4.566	5.060	4.706	3.224	2.658	2.018	42.510
1920	1.927	2.576	3.152	4.392	4.935	4.898	5.219	3.717	4.800	3.532	2.844	2.014	44.006
1921	2.120	2.342	3.052	4.200	5.185	4.805	5.069	5.475	3.916	4.486	2.567	2.466	46.083
1922	1.673	2.095	3.236	3.364	4.822	4.223	5.071	5.099	3.967	3.548	2.428	2.123	41.649
1923	1.941	1.850	2.931	3.111	5.619	5.347	4.755	5.296	3.435	3.721	2.006	1.639	41.701
1924	1.963	2.205	2.893	3.122	4.674	5.141	5.901	5.893	4.981	3.950	2.724	2.046	45.493
1925	1.474	2.523	3.726	5.410	6.071	4.810	5.733	5.449	3.554	3.444	2.301	1.984	46.619
1926	1.476	2.470	2.393	3.568	4.493	5.138	4.994	5.208	4.789	3.786	2.413	2.092	42.820
1927	1.715	1.910	2.641	3.955	5.533	5.041	5.150	6.378	4.010	3.573	2.278	2.157	44.341
1928	1.942	1.832	2.927	3.355	5.501	4.725	5.571	5.064	3.367	3.668	2.229	1.633	41.814
1929	1.884	1.708	2.613	3.860	4.314	5.068	4.599	4.973	4.468	4.286	2.459	2.315	42.547
1930	1.470	1.640	2.800	4.051	4.019	5.696	5.378	5.642	4.211	3.847	2.192	1.790	42.736
1931	1.526	1.895	3.426	3.245	4.757	5.942	5.709	5.035	5.202	3.877	2.283	1.553	44.450
1932	1.712	1.634	3.826	4.101	5.323	5.684	6.517	5.182	3.833	3.383	2.627	1.399	45.221
Mean	1.768	2.086	3.234	3.900	5.136	5.320	5.504	5.172	4.372	3.759	2.489	1.957	44.698

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1917	2.177	2.183	3.492	4.288	5.282	7.060	6.708	6.071	4.306	3.779	2.588	2.079	50.013
1918	2.091	3.834	4.050	4.204	5.061	5.592	5.889	5.161	4.928	3.047	2.054	1.609	47.520
1919	1.432	2.109	3.431	4.440	4.390	3.870	4.159	4.541	4.023	2.244	2.538	2.857	40.034
1920	1.793	2.411	3.934	4.469	4.817	4.605	4.813	4.464	4.294	3.185	2.474	2.108	43.367
1921	1.986	2.285	3.363	3.950	5.145	4.584	5.104	5.877	3.583	3.882	2.358	1.866	43.983
1922	1.991	1.955	3.481	3.873	5.203	4.480	4.984	4.981	4.013	3.866	2.672	2.001	43.500
1923	2.135	1.994	3.274	3.367	5.290	5.572	4.872	4.690	3.679	3.673	2.169	1.882	42.597
1924	2.191	2.870	3.134	3.493	4.946	5.546	6.838	6.431	5.488	4.164	3.311	2.383	50.795
1925	1.956	2.545	4.253	5.583	6.347	5.651	6.137	6.530	4.017	3.430	2.485	2.615	51.549
1926	1.930	2.688	3.314	3.982	4.917	5.807	4.606	5.102	4.849	4.324	2.818	2.202	46.539
1927	2.004	2.128	3.114	4.382	5.776	4.480	5.438	6.338	4.521	4.275	3.298	2.490	48.244
1928	2.052	2.349	3.293	4.182	6.382	5.004	5.461	5.045	4.010	3.628	2.231	1.894	45.531
1929	2.233	1.874	3.457	4.817	4.979	5.012	4.983	6.135	4.952	4.209	2.623	2.137	47.411
1930	1.853	2.005	2.993	4.970	4.144	7.161	6.167	5.907	4.323	3.952	2.390	1.947	47.812
1931	1.852	2.160	3.845	4.141	5.455	6.228	5.869	5.824	5.038	3.969	2.597	2.056	49.034
1932	2.524	1.953	4.055	4.943	5.495	6.153	6.570	5.919	4.820	4.008	2.601	1.744	50.785
Mean	2.013	2.334	3.530	4.318	5.227	5.425	5.537	5.564	4.428	3.727	2.575	2.117	46.795

Table 6. Monthly and annual evaporation, in inches, at Troup, 1915-1932

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1915	1.569*	2.236*	2.710	3.698	5.449	6.639	7.546	6.178	5.135	4.024	2.985	1.749	49.918
1916	1.717	2.421	4.903	4.328	5.638	6.379	6.420	6.890	5.880	4.544	3.014	2.156	54.290
1917	1.533	2.588	3.532	4.634	5.305	8.047	7.320	6.864	5.275	5.164	2.637	1.592	54.491
1918	1.219	2.451	4.137	4.014	6.448	7.068	8.580	7.167	5.217	3.282	2.505	1.827	53.915
1919	1.163	2.327	2.976	4.881	4.651	4.746	5.935	5.643	4.682	2.327	2.229	1.357	42.917
1920	1.453	2.036	3.835	5.059	5.334	6.775	6.102	4.816	4.900	3.678	2.110	1.809	47.907
1921	1.932	2.408	3.307	3.808	6.669	5.664	6.497	7.780	5.301	5.441	3.139	2.183	54.129
1922	1.781	2.148	3.432	3.970	5.401	6.477	7.204	6.688	6.031	4.417	2.287	1.854	51.690
1923	1.886	1.424	3.246	3.998	5.840	6.855	7.448	7.859	4.632	3.833	2.091	1.267	50.379
1924	1.600	1.828	3.013	3.846	4.707	7.000	8.725	8.773	5.962	4.727	2.767	1.961	54.909
1925	1.408	2.728	4.200	5.767	6.497	8.494	8.343	7.807	5.831	3.370	2.100	1.965	58.510
1926	1.497	2.951	2.677	3.781	5.606	6.400	5.741	7.123	5.646	4.102	2.667	1.584	49.775
1927	1.677	2.154	2.892	4.419	6.451	6.144	7.105	8.184	5.588	3.877	2.959	2.195	53.645
1928	1.829	2.308	3.589	4.276	6.775	6.017	6.904	7.573	6.009	4.219	2.241	2.142	53.882
1929	1.954	1.278	3.640	4.997	4.828	6.907	7.159	8.500	5.530	4.491	2.181	1.600	53.065
1930	1.118	2.314	3.640	4.905	4.367	8.586	8.865	7.200	5.978	3.561	2.347	1.632	54.513
1931	1.442	1.777	3.048	4.428	5.054	6.359	6.362	6.260	5.970	4.366	2.495	1.590	49.151
1932	1.924	2.415	4.059	5.607	6.111	7.496	7.528	7.403	4.541	4.367	3.302	2.305	57.058
Mean	1.595	2.211	3.491	4.468	5.618	6.781	7.210	7.150	5.450	4.099	2.559	1.820	52.452

*10-year mean, 1916-1925, inclusive.

Table 7. Monthly and annual evaporation, in inches, at College Station, 1916-1932

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1916	2.666*	2.833	6.688	6.306	5.930	7.001	6.562	6.929	6.790	5.107	3.080	1.692	61.584
1917	1.969	1.952	4.024	4.714	5.406	4.922	9.275	9.086	5.985	5.923	3.406	2.618	63.850
1918	2.573	1.986	5.049	4.803	6.720	8.350	9.637	7.590	5.549	3.495	2.441	1.990	60.183
1919	1.523	1.939	2.929	4.716	4.876	4.639	6.320	6.080	4.526	3.003	2.582	2.146	45.279
1920	2.498	2.188	4.217	5.785	5.784	5.840	6.963	5.042	5.931	3.956	3.075	1.884	53.163
1921	2.563	2.652	3.523	4.751	6.089	8.730	9.447	7.889	5.918	5.459	3.435	3.217	63.673
1922	2.401	2.080	4.918	3.555	5.288	5.878	7.959	7.549	5.694	5.237	3.012	2.472	56.043
1923	2.480	2.379	3.780	3.601	7.561	6.930	7.327	7.985	4.477	4.064	2.428	2.104	55.116
1924	2.411	2.688	3.222	4.075	5.438	6.264	8.324	8.965	6.622	4.841	3.832	2.791	59.473
1925	1.722	3.558	5.026	6.848	8.111	9.254	8.850	8.144	5.455	3.793	2.834	2.071	66.666
1926	2.180	3.172	3.328	4.029	5.830	6.367	6.562	7.093	5.672	4.159	2.744	1.944	53.080
1927	2.184	2.238	3.278	5.397	6.658	5.875	6.657	7.967*	5.397	3.901	3.013	2.936	55.501
1928	2.249	2.213	3.927	4.414	5.730	8.337	9.435	6.707	4.922	4.301	2.670	2.592	57.357
1929	3.105	2.244	4.154	4.727	5.427	7.008	6.097	7.316	5.922	4.888	3.483	1.736	56.107
1930	1.274	2.336	3.645	4.816	4.130	7.237	7.926	8.084	5.545	4.371	2.773	2.030	54.167
1931	1.674	2.711	4.402	3.843	6.187	6.730	6.178	7.097	6.628	5.234	2.764	1.770	55.218
1932	2.106	2.546	3.995	4.735	5.283	5.587	7.615	6.789	4.301	4.125	3.202	1.813	52.097
Mean	2.210	2.454	4.124	4.771	5.909	7.031	7.773	7.430	5.600	4.462	2.987	2.224	56.974

*Calculated.

Table 8. Monthly and annual evaporation, in inches, at Denton, 1917-1932

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1917	2.325	2.901	4.898	6.186	5.779	8.426	8.035	7.220	5.287	6.144	3.378	2.110	62.869
1918	.893	3.668	5.365	5.850	6.710	7.772	9.836	11.148	6.547	4.139	2.574	2.127	66.629
1919	1.313	2.050	3.364	4.954	4.421	5.566	7.067	6.823	4.764	2.846	2.418	1.510	47.096
1920	1.016	2.444	4.541	6.401	4.288	6.673	6.975	4.811	5.396	3.946	2.429	1.885	50.805
1921	1.893	2.523	3.378	4.550	5.999	5.999	8.035	8.790	7.220	6.280	3.397	2.381	60.645
1922	1.756	2.346	4.496	4.329	4.927	5.938	8.833	8.407	7.223	4.924	2.651	2.295	58.125
1923	2.416	1.581	3.801	3.913	6.045	7.564	8.414	9.295	5.485	3.749	1.942	1.312	55.517
1924	1.276	2.440	3.077	5.496	6.628	9.304	9.046	9.673	6.220	4.955	3.717	1.568	63.400
1925	1.851	3.725	5.897	6.806	6.339	9.643	10.712	7.772	6.833	4.447	2.639	2.661	69.325
1926	1.136	3.364	2.859	3.594	5.329	7.111	5.953	7.200	5.692	4.376	3.689	2.878	53.181
1927	5.354	2.478	3.353	4.063	6.737	6.666	6.810	7.199	5.624	3.545	3.155	2.527	57.511
1928	1.691	2.603	4.606	5.024	5.787	6.066	6.792	7.630	6.544	4.962	2.635	1.964	56.304
1929	2.345	.795	3.850	4.973	4.821	8.465	8.097	8.914	5.465	4.366	2.530	1.952	56.573
1930	.933	2.351	4.602	5.317	4.708	7.591	9.650	7.729	6.522	3.761	2.713	1.901	57.778
1931	1.551	1.974	3.767	4.019	5.235	7.397	7.391	8.121	7.764	4.677	2.469	1.647	56.012
1932	2.384	1.636	4.834	5.659	5.608	6.479	7.079	7.640	4.917	4.794	3.471	2.385	56.886
Mean	1.883	2.430	4.168	5.071	5.598	7.291	8.045	8.023	6.094	4.494	2.863	2.069	58.030

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1915	2.542*	3.235†	4.849	3.349	5.984	7.821†	9.026	6.507†	4.802	4.747	3.311	2.481	58.654
1916	2.083	3.260	6.393	6.478	6.792	10.034	5.631	5.720	5.776	4.741	3.487	2.657	63.052
1917	2.508	3.720	4.917	6.568	6.582	9.438	9.940	9.663	6.610	5.662	3.805	3.060	72.473
1918	3.627	2.536	5.126	4.827	6.105	7.270	9.032	8.638	6.672	3.934	2.599	1.864	62.230
1919	1.614	2.491	3.773	4.965	4.680	5.618	4.951	6.635	5.082	3.334	2.810	2.148	48.101
1920	1.796	2.670	4.465	5.783	5.982	5.512	6.814	6.662	7.866	5.147	3.049	3.067	58.813
1921	2.736	2.862	3.784	5.775	6.189	6.389	7.682	7.806	4.704	5.134	3.480	3.281	59.822
1922	2.452	3.072	4.545	4.487	5.521	6.250	6.873	8.690	5.371	4.935	2.760	3.027	57.983
1923	3.529	2.256	4.608	3.967	7.716	8.403	7.539	8.173	4.776	3.921	2.102	1.406	58.396
1924	2.194	3.169	3.867	5.639	5.603	6.733	8.268	9.223	7.932	5.405	4.277	2.228	64.538
1925	2.877	4.122	4.832	6.567	6.755	8.819	11.215	8.564	5.127	3.952	2.636	2.075	67.541
1926	2.041	3.558	3.403	3.926	5.454	6.707	5.489	6.065	6.238	5.393	3.270	2.091	53.635
1927	2.053	2.736	3.488	4.982	7.707	7.021	7.398	7.990	4.879	3.868	3.186	2.464	57.772
1928	2.841	2.516	4.511	5.814	6.448	6.652	8.143	7.418	4.289	4.256	3.037	2.136	58.061
1929	1.856	2.274	3.692	5.240	5.983	6.850	5.702	6.718	5.870	5.523	3.152	2.403	55.263
1930	1.980	3.041	3.883	5.105	3.620	5.996	7.597	8.221	6.466	3.838	2.467	2.160	54.374
1931	1.857	1.953	4.938	4.144	5.107	6.782	6.777	6.325	5.951	5.089	4.019	2.218	55.160
1932	1.961	2.713	4.675	5.224	6.296	7.074	7.820	7.041	4.666	4.175	3.192	2.231	57.068
Mean	2.364	2.899	4.431	5.158	6.029	7.187	7.550	7.559	5.727	4.614	3.147	2.389	59.052

*10-year average, 1916-1925, inclusive.

†Calculated.

Table 10. Monthly and annual evaporation, in inches, at Temple, 1915-1932

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1915	2.134*	2.840*	4.090	3.477	5.826	7.990	9.340	6.901	5.280	4.801	3.677	2.348	58.704
1916	2.323	3.614	5.956	5.236	6.419	8.418	7.640	7.277	7.241	5.052	3.187	2.930	65.293
1917	2.696	3.500	5.065	6.267	6.343	9.173	8.936	8.973	5.468	6.216	3.210	2.513	68.360
1918	2.570	3.019	5.266	5.200	6.924	7.879	10.670	9.891	7.435	4.086	2.728	1.903	67.571
1919	1.777	2.714	3.047	4.683	4.976	5.177	6.191	6.130	4.221	2.912	2.464	1.570	45.862
1920	1.717	2.490	4.492	6.238	5.063	6.462	6.988	4.828	5.526	3.891	2.178	2.316	52.189
1921	2.268	3.017	3.818	3.950	5.752	6.027	7.433	7.974	5.011	5.557	3.288	2.615	56.210
1922	2.015	2.474	3.917	3.499	4.550	6.325	9.420	8.168	5.991	4.850	2.954	2.592	56.755
1923	2.647	2.151	3.744	3.055	5.889	7.276	8.023	8.818	4.454	3.820	2.981†	1.215	54.073
1924	1.882	2.180	3.038	4.710	5.193	7.222	8.451	8.915	5.797	3.804	3.227	2.121	56.540
1925	1.985	3.813	5.441	7.466	7.193	8.945	10.718	7.897	6.044	3.956	2.637	2.512	68.607
1926	1.890	3.083	2.667	2.870	4.731	6.526	5.658	7.341	5.671	4.173	3.096	1.710	49.416
1927	2.509	2.403	3.219	4.726	5.798	5.326	7.315	8.897	6.167	6.230	3.122	2.623	58.335
1928	3.267	2.596	5.350	5.741	7.903	7.939	8.885	8.152	5.684	5.522	2.771	2.552	66.363
1929	2.785	2.217	3.909	5.501	6.007	7.500	7.828	9.196	7.377	5.588	2.496	1.948	62.352
1930	1.014	2.801	4.267	5.935	4.446	7.896	10.171	8.725	6.291	3.838	2.799	1.854	60.037
1931	1.690	2.349	4.696	5.037	6.769	7.383	8.104	8.469	8.033	5.356	3.215	1.586	62.687
1932	1.709	2.043	4.777	6.028	5.136	6.551	7.339	6.825	4.512	5.171	3.627	1.566	55.284
Mean	2.160	2.739	4.237	4.979	5.829	7.223	8.284	7.965	5.900	4.712	2.981	2.137	59.147

*Calculated.

†Mean, 1915-1927, exclusive of 1923.

Table 11. Monthly and annual evaporation, in inches, at Lubbock, 1917-1932

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1917	1.527	3.449	6.453	8.378	9.142	11.191	11.895	8.913	6.042	6.248	3.211	1.200	77.149
1918	.267	2.298	6.321	8.315	9.262	7.328	9.666	9.301	6.637	4.506	2.488	.960	67.349
1919	.594	3.273	2.450	5.611	5.301	5.409	7.842	7.690	4.772	2.653	1.738	1.615	48.948
1920	.730	2.363	5.303	7.344	5.827	6.372	7.240	5.296	5.322	3.895	1.878	2.349	53.919
1921	2.111	2.179	5.184	7.414	7.284	5.786	6.771	8.442	5.667	4.951	3.329	2.446	61.564
1922	1.616	3.193	5.076	6.356	6.760	6.969	8.935	8.459	7.306	4.717	2.237	2.258	63.882
1923	2.678	2.131	4.552	5.761	7.566	7.845	8.248	7.662	5.122	2.482	1.407	1.136	56.590
1924	1.740	2.221	3.823	6.712	6.745	10.355	8.398	8.317	5.586	3.958	2.961	1.799	62.615
1925	1.294	4.042	6.724	7.467	6.659	9.742	9.662	6.101	4.298	3.368	2.616	1.907	63.880
1926	1.459	3.618	3.309	4.133	6.051	7.231	8.164	7.507	4.722	3.080	2.746	1.116	53.136
1927	1.519	2.363	4.837	7.287	10.669	8.476	8.403	8.672	5.713	4.890	3.792	1.620	68.241
1928	2.415	1.981	5.875	7.911	6.645	10.438	8.961	5.857	6.215	4.800	1.876	1.807	64.781
1929	2.137	1.861	5.200	7.344	6.308	9.167	9.183	8.765	6.064	3.905	1.902	2.178	64.014
1930	.980	3.389	4.851	7.478	7.839	8.462	10.785	9.214	8.154	2.923	2.445	1.048	67.568
1931	1.334	1.843	3.748	4.648	6.469	10.289	9.433	7.518	8.314	4.791	2.204	1.348	61.939
1932	1.643	2.993	5.475	7.274	6.526	7.472	8.573	7.049	4.280	3.594	2.978	1.088	58.945
Mean	1.503	2.700	4.949	6.840	7.191	8.283	8.854	7.798	5.888	4.048	2.488	1.617	62.158

Table 12. Monthly and annual evaporation, in inches, at Iowa Park, 1926-1932

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1926	1.332	3.469	3.539	4.115	6.531	8.717	8.301	7.977	5.991	4.282	3.878	1.978	60.110
1927	1.752	2.430	4.100	5.918	8.610	8.391	7.963	8.006	6.300	4.578	3.710	2.157	63.915
1928	2.171	2.528	5.694	6.864	7.283	9.081	8.691	8.072	7.156	5.806	2.304	1.902	67.552
1929	2.067	.936	4.340	6.276	5.585	7.682	8.952	9.406	5.605	4.072	2.098	1.801	58.820
1930	.492	2.739	4.863	7.145	6.374	8.180	10.242	7.800	7.767	3.458	2.736	1.756	63.552
1931	1.627	1.817	3.866	4.283	5.950	9.017	9.019	8.265	8.230	4.825	2.523	1.540	60.962
1932	1.766	1.851	5.579	6.569	6.899	7.575	10.442	7.894	4.716	4.951	2.846	1.268	62.356
Mean	1.601	2.253	4.569	5.881	6.747	8.378	9.087	8.203	6.538	4.567	2.871	1.772	62.467

1916	2.418*	3.290*	5.148*	6.884	8.088	8.580	7.765	7.455	6.836	5.288	3.246	3.424	68.372
1917	2.582	4.333	6.102	7.276	7.443	10.503	9.964	11.022	7.221	7.153	4.053	2.795*	80.447
1918	2.418*	3.417	6.396	6.054	7.026	9.054	12.335	10.255	8.746	5.882	2.878	2.507	76.968
1919	2.418*	2.572*	4.191	5.772	5.523	6.974	5.785*	6.693	4.830	3.537*	3.155*	1.889	53.339
1920	1.901*	2.733*	6.146*	6.779	6.323*	6.392	8.469	6.154	6.881	4.280	2.805	3.031*	61.894
1921	2.565	3.652	4.283	6.671	6.196	6.881	8.080	9.428	5.263	4.477*	3.129	2.692	63.317
1922	2.837*	3.349	5.596*	4.962*	6.626*	6.644	8.880*	8.392*	6.704	6.026	2.734*	2.731	65.481
1923	3.460*	2.120*	5.263*	4.808*	7.334*	7.957	8.737	8.980*	4.978	4.178*	2.176*	1.977*	61.973
1924	1.948*	2.873*	4.219	4.904	4.644	7.501*	8.605*	9.022*	6.082	4.274	4.151	2.865	62.408
1925	2.292	4.888	6.772	8.076	9.847	10.281	11.413	9.766	6.498*	4.478*	2.996*	2.577	79.384
1926	2.219*	4.354	3.954*	4.748	5.771*	7.336	7.405	7.445	6.395	5.277	3.680*	1.838	60.422
1927	2.397	3.546	3.908	6.227	7.773	6.749	8.269	8.855	6.494*	4.835*	3.635	2.448*	65.136
1928	3.132*	2.788*	6.153	5.669*	7.342*	7.555	9.172*	9.357	6.476*	5.259	2.877*	2.150*	67.930
1929	2.549*	2.130	4.708*	4.960*	6.474*	7.552*	7.199	9.005	6.807*	5.947*	2.899*	2.196	62.426
1930	1.301*	3.302*	4.376*	5.977	4.698*	7.299*	9.451	9.325	6.750	3.621	2.368	1.875*	60.343
1931	1.805	2.752	5.038	4.717	6.108	7.647	8.201	8.481	7.746	6.426	3.112	1.651	63.684
1932	2.456	2.882	4.887	6.363	6.911	8.356	9.426	7.630	5.032	5.113	3.595	1.398	64.049
Mean	2.394	3.234	5.126	5.932	6.791	7.836	8.774	8.663	6.455	5.062	3.146	2.326	65.740

*Estimated.

†U. S. Weather Bureau records from an above-ground pan.

Table 14. Monthly and annual evaporation, in inches, at San Antonio,† 1907-1930

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
1907	2.80	3.28	5.92	5.80	4.91	8.36	8.75	9.74	6.87	4.39	2.18	2.01	65.01
1908	2.60	2.46	2.25	5.49	7.26	8.77	8.00	7.32	6.25	5.28	3.32	3.11	62.11
1909	3.11	4.20	5.90	7.18	7.35	9.93	11.09	8.51	6.95	5.66	3.82	2.87	76.57
1910	2.97	3.53	5.94	6.65	7.06	9.00	11.84	10.36	7.62	5.77	3.62	3.11	77.47
1911	2.87	3.20	4.11	4.74	6.30	9.51	9.80	10.77	8.63	5.89	3.30	1.99	70.61
1912	2.35	3.54	3.01	4.08	7.61	7.07	10.59	10.65	8.55	5.51	3.23	1.92	68.11
1913	2.10	2.21	3.92	6.17	7.93	6.61	8.44	7.90	4.90	4.31	2.27	1.92	58.68
1914	2.72	2.35	3.93	4.89	4.37	7.55	9.80	7.72	8.03	4.40	2.65	2.09	60.50
1915	2.26	2.81	3.37	3.36	6.00	8.99	11.33	8.47	5.29	5.46	4.07	2.51	63.92
1916	2.36	3.79	7.21	6.64	7.32	9.92	7.21	7.69	6.26	5.00	3.44	2.82	69.66
1917	2.61	3.99	5.60	7.68	7.56	9.88	9.89	9.81	6.93	6.17	3.63	2.92	76.67
1918	3.41	2.54	5.83	5.76	6.94	8.16	10.36	10.03	7.88	4.57	2.47	1.89	69.84
1919	1.79	2.48	3.04	5.50	5.52	5.81	5.64	7.06	5.16	3.73	2.77	2.06	50.56
1920	1.31	2.56	4.37	7.23	6.25	6.05	7.14	7.03	7.18	5.21	2.80	2.99	60.12
1921	2.46	3.36	3.78	4.58	6.51	7.56	9.29	10.50	6.16	5.37	3.60	3.57	66.74
1922	2.82	3.30	4.59	4.34	5.39	5.95	10.01	9.94	7.56	6.17	2.77	2.99	65.83
1923	3.25	1.62	4.52	3.91	7.52	9.36	8.96	8.90	5.45	4.84	2.24	1.79	62.36
1924	2.07	2.78	3.73	4.96	5.48	7.45	8.80	9.97	7.39	5.21	4.82	2.56	65.22
1925	2.69	4.43	6.12	8.06	8.38	10.16	11.27	9.98	6.07	4.88	2.55	2.31	76.90
1926	1.71	3.80	3.54	3.54	5.59	7.19	7.22	8.82	7.31	6.00	4.19	2.19	61.10
1927	2.04	2.50	3.80	5.97	7.99	6.13	7.82	10.85	7.37	5.21	4.47	2.37	66.52
1928	2.91	2.57	4.93	6.05	6.10	7.49	9.99	9.98	4.76	4.96	2.50	2.08	64.32
1929	2.22	2.71	3.84	4.65	6.01	7.09	6.71	8.78*	6.83	4.43	2.64	2.54	58.45
1930	1.66	2.72	3.69	5.56	4.86	6.76	8.84	9.82	7.96	3.95	2.52	2.19	60.53
Mean	2.46	3.03	4.46	5.53	6.51	7.95	9.10	9.19	6.81	5.10	3.16	2.45	65.74

*Calculated.

†Records from U. S. Field Station, Division of Western Irrigation Agriculture.

Table 15. Monthly and annual evaporation, in inches, at Spur, 1916-1932

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1916	1.478	2.073	6.590	1.956	9.133	10.544	10.757	9.061	6.325	5.920	3.373	3.466	71.276
1917	2.812	3.683	5.413	7.360	8.095	10.508	10.360	9.814	5.984	6.965	3.868	2.776	77.688
1918	1.291	3.356*	7.011	7.660	9.903	9.164	10.542	10.273	6.805	5.556	3.575	1.947	77.083
1919	2.619	2.925	3.789	6.180	5.434	5.913	8.194	7.686	5.700	4.790	4.226	3.862	61.318
1920	3.473	4.241	5.080	5.616	5.602	5.919	7.742	6.588	5.759	5.104	3.788	4.231	63.143
1921	3.308	3.553	4.075	6.134	6.982	5.865	6.144	6.626	4.781	5.782	4.262	4.357	61.869
1922	3.097	4.119	5.970	5.941	6.697	7.915	10.943	9.043	7.340	5.140	2.902	2.694	71.801
1923	3.175	2.581	4.464	4.580	8.426	7.701	9.232	8.531	5.690	3.871	2.805	2.856	63.862
1924	2.641	2.984	3.800	6.375	6.406	10.645	8.554	8.617	4.580	4.662	5.180	2.068	66.512
1925	2.431	4.208	5.506	6.483	6.669	9.704	10.099	6.861	5.348	4.439	2.800	2.555	67.103
1926	2.610	3.832	3.486	3.924	5.139	7.504	6.380	6.348	4.974	3.964	3.434	1.522	53.117
1927	2.090	2.640	5.369	7.699	10.212	7.342	8.722	8.227	5.903	4.869	3.546	2.121	68.740
1928	2.888	2.529	6.223	7.638	6.138	9.741	7.981	5.083	6.046	5.387	2.472	2.305	64.431
1929	2.155	1.662	5.528	7.142	6.327	8.859	8.519	8.967	5.619	4.623	2.590	3.301	65.292
1930	1.246	3.773	4.919	7.170	7.363	8.404	11.327	8.909	7.859	3.359	3.147	1.535	69.011
1931	2.000	2.069	4.024	4.424	6.559	9.200	9.125	8.571	9.057	4.885	2.619	1.700	64.233
1932	2.085	3.126	5.666	6.627	6.342	7.710	8.795	7.307	3.616	4.446	3.343	2.207	61.270
Mean	2.435	3.136	5.113	6.053	7.143	8.390	9.024	8.065	5.964	4.927	3.408	2.677	66.335

*10-year average, 1919-1928, inclusive.

Table 16. Monthly and annual evaporation, in inches, at Chillicothe, 1912-1932

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1912				6.628	9.110	8.791	10.687	9.285	7.019				51.520
1913				7.818	9.758	8.126	11.547	11.606	6.397				55.252
1914				5.863	4.842	8.346	9.309	7.078	5.767				41.205
1915				4.307	7.349	7.307	8.530	6.929	5.247				39.669
1916				5.732	8.729	10.308	10.719	10.674	7.072				53.234
1917				8.542	7.636	10.657	11.758	9.436	6.959	7.622			62.610
1918				6.627*	11.064	9.580	11.822	12.983	7.497	4.063			63.636
1919			3.915	5.695	6.360	6.533	8.383	5.516	6.900	3.356	2.448		53.106
1920			6.104	8.671	10.171	8.254	9.513	5.936	6.642	4.853	3.558		63.702
1921			3.655	7.774	8.205	9.859	9.204	10.141	8.496	7.178	4.690		68.702
1922			4.850	5.887	7.027	8.441	10.162	10.487	8.087	5.535	3.089	3.347	66.912
1923	3.627	2.487	5.799	6.078	10.259	8.787	9.735	10.881	5.801	3.184	2.057	2.044	70.739
1924	2.591	3.269	3.739	6.420	8.019	10.649	8.647	8.398	6.657	4.904	3.405	2.161	68.859
1925	1.379	4.527	7.942	8.132	8.183	10.340	9.374	6.087	4.384	3.176	1.942	2.291	67.757
1926	1.918	4.464	3.935	4.971	7.131	8.247	6.766	6.159	4.558	3.274	2.880	1.870	56.173
1927	1.685	2.561	4.924	6.655	8.883	7.628	7.620	7.002	5.077	3.678	2.837	1.775	60.325
1928	2.542	2.440	5.573	7.208	8.023	8.213	7.542	6.544	5.933	4.457	2.091	1.585	62.151
1929	1.545	1.211	5.066	7.433	5.341	7.965	8.067	8.834	5.283	3.299	1.873	2.393	58.310
1930	.882	3.119	5.522	7.333	7.183	8.656	10.856	10.264	7.707	2.675	2.626	1.279	68.102
1931	1.564	2.077	3.314	4.337	6.332	9.297	8.252	7.399	8.771	4.566	2.252	1.496	59.657
1932	1.594	2.124	4.871	6.531	6.264	7.175	7.857	9.103	4.833	3.173	1.140		59.641

Table 17. Monthly and annual evaporation, in inches, at Balmorhea, 1916-1932†

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1916	2.761	3.769	7.324	6.209	10.008	11.993	9.418	8.113	5.706	5.245	3.133	3.277	76.956
1917	2.909	4.201	6.522	8.535	10.173	11.166	11.575	9.437	6.582	6.146	3.667	2.872	83.785
1918	2.526	4.580	7.094	8.878	10.414	10.586	11.168	9.400	7.284	5.404	3.109	1.420	81.863
1919	1.944	4.390	5.468	7.884	8.598	8.576	9.179	9.706	5.956	3.176	2.866	1.994	69.737
1920	1.478	2.594	5.499	7.898	7.603	7.668	9.297	6.366	6.037	5.143	2.342	3.007	64.922
1921	2.978	3.453	6.171	8.871	9.369	7.597	9.784	10.044	7.279	6.172	4.223	3.710	79.651
1922	2.781	4.428	6.949	8.273	9.222	9.586	10.742	10.951	7.285	5.214*	3.223*	2.713*	81.367
1926	3.525	5.368	4.421	5.871	8.936	9.642	8.812	6.762	5.597	3.890	3.929	1.967	68.720
1927	2.685	4.175	5.629	7.808	9.563	7.869	8.371	9.289	5.377	5.057	4.098	2.108	72.029
1928	3.118	3.696	7.088	7.484	7.628	9.811	6.982	5.027	5.210	4.356	2.439	2.054	64.893
1929	2.969	3.637	5.101	6.100	6.972	8.011	7.863	7.691	5.364	4.130	2.874	2.729	63.441
1930	2.070	4.173	5.420	6.013	7.930	6.828	7.953	7.402	6.646	3.278	2.500	1.866	62.079
1931	1.638	2.667	5.299	5.692	6.906	7.728	7.366	7.131	7.377	5.910	2.976	1.737	62.427
1932	2.585	3.063	5.300	6.818	5.884	7.809	6.823	6.121	3.783	3.535	3.092	1.614	56.427
Mean	2.569	3.870	5.949	7.310	8.515	8.919	8.952	8.103	6.106	4.761	3.177	2.362	70.593

†Records for 1916-1922, inclusive, from Pecos.

*Mean, 1916-1921, inclusive.

Table 18. Monthly evaporation, in inches, at Dalhart,* April to September, inclusive, 1908-1932

Year	April	May	June	July	Aug.	Sept.	Total
1908	5.920	10.918	12.072	9.182	9.888	7.950	55.930
1909	8.526	9.901	10.890	11.685	10.565	7.835	59.402
1910	8.540	8.183	12.020	11.626	8.822	8.441	57.632
1911	7.562	9.900	12.373	9.707	10.899	8.769	59.210
1912	8.214	10.237	8.475	11.103	9.131	6.750	53.910
1913	7.687	10.063	8.714	12.697	10.771	6.338	56.270
1914	6.535	7.813	10.256	8.837	9.059	8.227	50.727
1915	5.777	8.075	8.740	9.262	7.919	6.853	46.626
1916	6.597	11.088	10.367	11.022	9.597	7.136	55.807
1917	8.561	9.074	11.697	10.997	9.607	7.460	57.396
1918	6.371	10.640	9.157	11.229	10.854	6.318	54.569
1919	5.583	6.994	7.482	9.865	8.291	6.933	45.148
1920	7.000	8.050	8.737	7.877	7.622	6.954	46.240
1921	6.826	7.425	6.912	7.655	7.351	8.304	44.473
1922	6.397	7.955	9.091	9.582	9.914	6.807	49.746
1923	6.161	7.472	7.430	8.140	8.337	5.817	43.357
1924	7.307	7.465	9.407	9.089	9.077	6.387	48.732
1925	7.389	7.041	9.721	9.043	6.602	5.573	45.369
1926	4.618	6.314	6.960	8.503	9.269	6.953	42.617
1927	7.266	10.727	9.529	9.081	6.636	5.174	48.413
1928	6.610	7.236	7.546	7.545	7.213	7.430	43.580
1929	7.301	6.427	8.285	9.836	8.180	6.291	46.320
1930	7.524	9.273	9.967	11.162	9.358	8.067	55.351
1931	5.193	7.355	10.620	10.528	7.731	8.153	49.580
1932	7.320	8.340	7.925	10.414	9.855	6.747	50.601
Mean	6.911	8.559	9.375	9.827	8.902	7.107	50.680

Table 19. Monthly evaporation, in inches, at Amarillo*, April to September, inclusive, 1907-1919

Year	April	May	June	July	Aug.	Sept.	Total
1907	6.355	8.050	9.575	10.669	9.390	7.911	51.950
1908	7.318	9.284	10.378	8.075	8.575	6.776	50.406
1909	8.130	10.020	10.337	9.964	9.658	8.421	56.530
1910	8.494	8.032	12.011	12.167	8.806	9.092	58.602
1911	7.360	10.100	11.482	7.472	8.895	7.268	52.577
1912	7.050	9.895	8.986	10.947	9.490	6.493	52.861
1913	7.736	9.812	7.065	12.734	10.453	5.994	53.794
1914	6.695	6.739	10.124	8.747	8.927	8.041	49.273
1915	4.584	6.920	8.833	9.310	7.299	5.984	42.930
1916	5.955	10.286	10.661	11.656	10.206	7.665	56.429
1917	7.681	7.623	12.475	12.430	8.571	5.961	54.741
1918	6.991	11.014	10.128	10.736	10.339	7.376	56.584
1919	4.652	5.026	7.086	9.470	8.419	6.137	40.790
Mean	6.846	8.677	9.934	10.337	9.156	7.163	52.113

Table 20. Monthly evaporation, in inches, at Big Spring*, April to September, inclusive, 1916-1932

Year	April	May	June	July	Aug.	Sept.	Total
1916	6.610	10.838	13.291	10.435	9.243	7.714	58.131
1917	10.008	10.871	13.376	13.159	12.251	8.126	67.791
1918	9.667	11.325	10.622	13.239	12.642	8.429	65.924
1919	6.988	8.345	8.032	10.272	10.579	6.672	50.888
1920	8.745	8.825	9.348	12.479	6.985	7.059	53.441
1921	9.213	9.110	9.129	11.507	12.839	8.315	60.613
1922	8.481	8.460	8.794	12.930	11.671	9.692	60.028
1923	5.950	8.852	9.790	10.374	10.326	6.927	52.219
1924	7.178	8.183	11.562	10.870	11.089	7.427	56.309
1925	4.438	8.167	11.237	11.872	8.100	6.420	50.234
1926	5.398	8.292	10.148	9.981	10.107	7.665	51.591
1927	8.584	11.712	10.369	10.1E3	12.115	7.058	59.991
1928	8.365	7.437	10.962	9.708	7.170	6.944	50.586
1929	7.334	7.220	10.693	9.277	10.098	6.861	51.483
1930	6.061	8.119	8.712	11.651	10.225	9.181	53.949
1931	5.609	7.554	9.470	9.549	9.551	9.210	50.943
1932	7.496	6.511	7.896	9.734	8.034	3.946	43.617
Mean	7.419	8.813	10.202	11.011	10.178	7.538	55.161

*Records from U. S. Field Station.

Year	San. Angelo	Temple	Weslaco	Winters	Weslaco	Weslaco	Weslaco	Weslaco	Weslaco	Weslaco	Weslaco	Weslaco	Weslaco
Dilley:													
1929	3.459	3.844	7.092	8.172	9.710*	10.378	10.646*	11.903	9.422*	7.180*	3.091	2.962*	87.859
1930	1.880	4.656	5.488	7.503	5.932	7.567	10.542	10.473*	7.692*	4.824	2.488	2.555	71.600
1931	2.584	2.737	6.159	5.491	6.667	8.320	8.640	8.387	8.247	6.682	4.195	2.217	70.326
1932	2.890	3.338	5.831	6.865	8.440	9.841	10.244	9.890	5.449	4.574	3.517	2.029	72.908
Mean	2.703	3.644	6.143	7.008	7.687	9.027	10.018	10.163	7.703	5.815	3.323	2.441	75.673
Winter Haven:													
1931	1.549	2.165	4.774	3.639	4.852	6.268	6.943	7.090	7.285	5.890	3.767	1.652	55.874
1932	2.098	2.338	5.218	5.979	6.210	8.862	8.947	8.144	4.418	4.188	3.090	1.623	61.115
Mean	1.824	2.252	4.996	4.809	5.531	7.565	7.945	7.617	5.852	5.039	3.429	1.638	58.495
Weslaco:													
1932	2.960	3.346	5.520	5.592	5.272	6.950†	6.480†	7.880	4.235	5.514	3.978	2.530	60.257

*Estimated.

†1931 records.

**U. S. Weather Bureau records from an above-ground pan.

Table 22. Summary of evaporation and other meteorological observations at 21 points in Texas

Location	No. of years†	Elevation, feet	Mean temperature	Average relative humidity, per cent	Wind run, miles, per month	Precipitation, inches	Evaporation, inches	Ratio of precipitation to evaporation	Extreme daily maximum evaporation	
									Inches	Date
Nacogdoches	18	271	66.3	81.7	2651	48.73	44.508	1.09:1	.494	April 4, 1920
Angleton	18	23	68.7	79.8	3958	45.37	44.698	1.02:1	.449	May 2, 1929
Beaumont	16	28	68.2	83.3	3382	52.81	46.795	1.13:1	.440	Feb. 13, 1918
Troup (Lindale)	18	484	65.9	74.6	4041	42.80	52.452	.82:1	.514	May 2, 1929
College Station	17	308	68.0	77.2	3421	38.49	56.974	.68:1	.790	June 1, 1917
Denton	16	600	64.4	68.5	5317	32.96	58.030	.57:1	.616	Aug. 3, 1924
Winter Haven	2	600	71.2	69.7	3316	21.21	58.495	.36:1	.462	July 21, 1932
Beeville	18	240	71.3	77.6	4591	30.98	59.052	.52:1	.583	May 2, 1929
Temple	18	740	66.7	72.4	3879	35.48	59.147	.60:1	.588	July 1, 1926
Weslaco	1	80	73.6	79.3	4341	23.07	60.257	.38:1	.539	Oct. 26, 1932
Lubbock	16	3106	59.3	58.6	5365	19.45	62.158	.31:1	.602	May 25, 1917
Iowa Park	7	978	64.1	64.0	4471	32.13	62.467	.51:1	.845	July 31, 1932
Hill's Ranch	17	502	67.4	71.3	5404	33.78	65.740	.51:1		
San Antonio	24	539	69.1	68.0	5578	27.18	65.740	.41:1		
Spur	17	2274	61.4	66.4	4628	21.48	66.335	.32:1	.668	May 13, 1918
Chillicothe	21	1406	62.2	61.3	4821	25.23	66.633	.38:1	.624	July 25, 1918
Balmorhea	14	3200	64.0	57.1	3865	13.75	70.593	.19:1	.598	May 9, 1918
Dalhart	25	3978	54.0	50.2	5022	18.95	70.234*	.27:1	.694	May 7, 1924
Amarillo	13	3676	56.5	61.5	9104	21.57	72.219*	.30:1		
Dilley	4	569	70.8			20.52	75.673	.27:1	.582	Aug. 16, 1929
Big Spring	17	2500	63.0		3444	18.43	76.443*	.24:1	.642	July 22, 1922

†Evaporation.

*Calculated from evaporation for 6 months' period.

RECORDING THE OBSERVATIONS

Readings of the evaporation are usually taken at 7 a.m. and 6 p.m. daily, and when only one daily observation is made it is in the evening reading. The micrometer-point gage is graduated to read to one-thousandth of an inch and all readings are recorded to three decimals and the actual gage readings entered in the record. The evaporation for the past 24-hour period is the difference between the last previous gage reading and the current one. If rain intervenes, the amount of rainfall is added to the current reading and from the total the previous gage reading is subtracted. In attempting to secure evaporation records for the twelve months' period it may often happen, at some of the stations, that the tank remains frozen over for a considerable period. In such cases the word "frozen" is entered in the record for those days and when the tank thaws out the total accumulated evaporation for the period since the last reading is recorded. Daily observations are recorded in the daily meteorological record book and at the end of the month are transferred to monthly blanks provided for this purpose.

Tanks are refilled, at a regular observation time, frequently enough to keep the fluctuations within a narrow range and provide a comparatively uniform depth of water in the tank. Water in the tank is kept clean and occasionally the water is all removed and the tank thoroughly cleaned.

EVAPORATION RECORDS

On account of their close association with and influence upon evaporation, other meteorological observations, such as maximum, minimum, and mean temperatures, precipitation, wind run, and relative humidity, are included in Table 2. Observations on these latter phenomena are shown as the mean monthly and annual for the whole period for which records are available, which is, in most cases, longer than that covered by the records on evaporation. With few exceptions, however, all these meteorological data cover a sufficiently long period of time to furnish a reliable mean which records, accumulating over additional years, will, of course, change slightly but not materially.

Tables 3 to 21 are a complete record of the evaporation, by months and years, since the beginning of evaporation readings at the various Stations. These tables are numbered and arranged in ascending order of the mean annual evaporation, Nacogdoches, which has the lowest mean annual evaporation, in inches, appearing in Table 3. Evaporation records at many of the Stations were begun in 1915 to 1917, while at San Antonio, Dalhart, and Amarillo, the records were begun in 1907 and 1908 and are presented in these tables, including the year 1932. At Iowa Park records have been kept only since 1926. At Chillicothe records for the six months' growing period, April to September, inclusive, are complete from 1912 to 1932, but for the other months of the year are only partially complete, except since 1923. Readings shown for Balmorhea (Table 17) were recorded at

Pecos from 1916 to 1922. The Substation was moved to Balmorhea and records were not resumed until 1926, causing a break of four years in this record.

At Dalhart, Amarillo, and Big Spring, readings are available only for the six months' growing season, April to September, inclusive. An approximation of the mean annual evaporation, in inches, can be calculated for these points by assuming a similar percentage relationship between the evaporation for the six months and the whole year for these points as that existing at Lubbock, where 72.16 per cent of the yearly total evaporation occurs from April to September, inclusive. Keeping of evaporation records at Amarillo ceased in 1919.

Records of evaporation are available for only four years, 1929-32, at Dilley; for only two years, 1931-32, at Winter Haven, and for only one year, 1932, at Weslaco, in the Lower Rio Grande Valley. These short-time records are inadequate to furnish a reliable reading of the average evaporation that may be expected but the data for the three points are combined and presented in Table 21.

The detailed data covering the inches of evaporation from a free water surface, and shown in Tables 3 to 21, by months and years, need little discussion. Total inches of evaporation for each year, together with the average inches monthly and annually, are also given in these tables, so far as the available records will permit.

A summarization of certain climatic factors as they prevail at each of the points where evaporation readings have been recorded is given in Table 22. This includes the elevation, mean temperature, average relative humidity, miles of wind run, and rainfall, all of which undoubtedly have a bearing upon the water lost from the soil or from a free water surface through evaporation. Stations are arranged in this table in order of total inches of evaporation per annum, Nacogdoches, which has the least evaporation, appearing first. With certain exceptions, it will be seen that the order of the Stations listed moves from the eastern to the western part of the State, the evaporation increasing markedly in the higher and drier regions. Total annual evaporation ranges from 45 to 55 inches in the eastern part of the State, from 55 to 65 inches in the central part, and from 65 to 75 inches in the western part (Fig. 2.) From a glance at this table it appears that the Stations located in the lower elevations generally have the lowest annual evaporation. This is probably not due so much to the elevation as to the fact that at the higher elevations the humidity is lower, the wind run greater, and the precipitation less, all of which are favorable to a more rapid loss of water through evaporation. The average relative humidity per cent figure, in the third column of the summary table, is a measure of the degree of saturation of the atmosphere. When the relative humidity and evaporation for these 21 points in Texas are compared, a close relationship is found between a dry atmosphere and a high evaporation. The actual correlation coefficient, as calculated between humidity and evaporation at these points, is $-.82 \pm .05$, showing that

at a point where the humidity is low the rate of evaporation can be expected to be high.

Precipitation at the Stations included in these records ranges from 52.81 inches at Beaumont, in the Gulf Coast Region, to 13.75 inches at

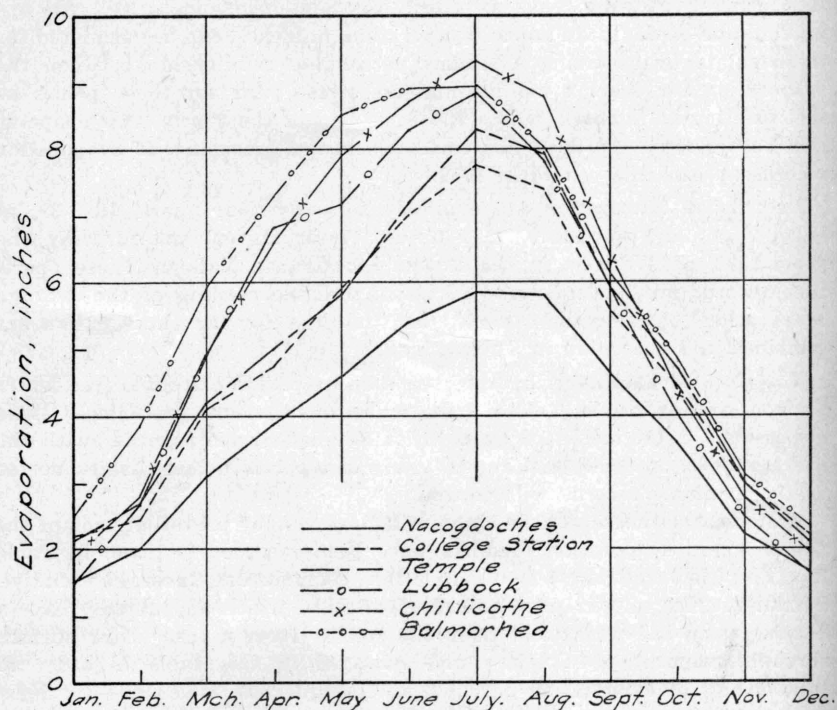


Fig. 2. Mean monthly evaporation curves for six stations in Texas showing the high summer rate. Total annual evaporation ranges from 44.5 inches at Nacogdoches to 70.6 inches at Balmorhea.

Balmorhea, in the Trans-Pecos Region. In general, the change in rate of evaporation in moving across the State from east to west is almost directly inverse to the change in precipitation. A high negative correlation, $-.87 \pm .04$, is found, then, between rainfall and evaporation, but many other factors, aside from precipitation, are operating to cause an increase in evaporation in moving toward the western part of the State. Other regional characteristics, such as dryness of the atmosphere and greater wind movement, are also favorable to high evaporation. Monthly wind run, in miles, increases in this same westerly direction across the State and a positive correlation of $.49 \pm .11$ is found between total monthly wind run and total annual evaporation when these readings at the 21 Stations are considered.

Temperature is an important factor affecting the rate of evaporation from a free water surface or from the soil. From the mean temperature and

evaporation figures for the various Stations given in Table 22 there seems to be no very marked or consistent relationship between them. The highest mean annual temperatures occur at the Stations in the eastern and southern parts of the State, whereas, the greatest evaporation occurs in the western part, where the mean temperature is lower. Other factors less favorable to high evaporation, such as higher humidity and lower wind movement, are operating in opposition to the higher mean temperature in the eastern part of the State. The general climatic features as found at Lubbock compared with those found at Spur and Chillicothe, are not greatly different except that a higher altitude and a somewhat lower mean temperature are found at Lubbock than at the other two points. Slightly lower humidity and greater wind movement at Lubbock should favor a higher annual evaporation but the higher temperature prevailing below the Caprock Escarpment and at the lower elevations of Spur and Chillicothe are probably responsible, in the main, for the higher rate of evaporation found at these two points. An example of the marked influence of high temperature upon the rate of evaporation can be seen in a comparison of the monthly and annual evaporation record from Dilly and Winter Haven for the years 1931 and 1932. These two Stations are in the same general region of the State and located only about 40 miles apart. At Winter Haven the usual sunken tank, like that at all the other Substations reported in this Bulletin, is used, while at Dilly records are obtained from the above-ground type of pan in use by the U. S. Weather Bureau. As the water in the latter type of pan is more completely exposed to the air, its temperature fluctuates more rapidly and follows the air temperature more closely than does that of the water in the sunken tanks. The mean annual air temperatures at Dilly and at Winter Haven are not significantly different, yet the evaporation for these two years was 10 to 15 inches greater at Dilly than at Winter Haven, probably due very largely to the difference in the type of pan used and the influence of temperature of the water upon the rate of evaporation. From this comparison it appears that evaporation records from the sunken tank will more nearly approach the evaporation from reservoirs or natural bodies of water, which fluctuate even less rapidly in relation to air temperatures.

The extreme daily maximum evaporation, in inches, occurring at each of the points of observation throughout the period covered by the records is shown in Table 22. The maximum total water loss from evaporation for any one day varied from .440 inch at Beaumont to .845 inch at Iowa Park. Ordinarily, when conditions are highly favorable for a large water loss through evaporation, a loss of from one-half to three-fourths of an inch in a 24-hour period may be expected in Texas. From an examination of other weather data for the days when such extreme maximum evaporation occurs it is found that the temperature and wind movement are usually high and the atmosphere dry, as shown by a low relative humidity. Abnormally high evaporation occurs during the spring or summer months and during dry years or periods.

Extreme total evaporation, in inches, including all the points in the State from which we have a record for the whole twelve months' period, has varied from 38.97 inches at Nacogdoches in 1922 to 83.78 inches at Pecos in 1917. The average annual evaporation in Texas ranges from 44.5 inches at Nacogdoches to above 70 inches at some of the western Stations, or a water loss of from slightly less than four feet to over six feet per annum. The ratio of precipitation to evaporation, which is a direct comparison of the total annual precipitation with the total annual evaporation for the various Stations and regions of the State, is also shown in Table 22. At some of the Stations in the eastern and southeastern parts of the State the annual rainfall is equal to, or slightly more, than the annual evaporation, while in the drier regions of the State the total annual evaporation greatly overbalances the precipitation and may be four or five times as much as the total annual rainfall. When all of the evaporation records available are considered from all parts of the State it is found that the average annual evaporation for Texas is 61.65 inches and that approximately two-thirds (68.7%) of this occurs during the summer months, April to September, and one-third (31.3%) during the remaining months of the year (Fig. 2).

ACKNOWLEDGEMENTS

Because of the close association between the results of field experiments and the weather, meteorological records have been maintained for many years at State Substations and Federal Field Stations. To the continued, painstaking recording of these observations by the superintendents of the Stations, who have, in most cases, been the observers, we are indebted for these long-time records. Such records embody, in the aggregate, many thousands of observations and calculations made in addition to more pressing duties and with no hope of reward except for the facts recorded. Mention of all the individuals responsible for these evaporation data is precluded but their records have made this compilation possible. Grateful acknowledgment is also made to Mr. Chester Higgs, Executive Assistant, for carefully and painstakingly computing and checking these records for accuracy.

SUMMARY

Losses of water through evaporation have an important bearing upon crop production and farming practices as well as upon the economic and adequate planning of reservoirs and similar engineering projects. The evaporation from a free water surface, by months and years, is shown from 21 observation points scattered throughout the State.

The total evaporation in Texas amounts to about four to six feet per year and ranges from 45 to 55 inches in the eastern part, from 55 to 65 inches in the central part, and from 65 to 75 inches in the western part.

Extreme maximum evaporation in any 24-hour period ranged from .440 inch (at Beaumont) to .845 inch (at Iowa Park). A water loss of one-half to three-fourths of an inch per day may occur when the temperature and wind movement are unusually high and the relative humidity low.

The extreme total minimum evaporation for any one year was 38.97 inches, recorded at Nacogdoches in 1922, and the maximum extreme was 83.78 inches, recorded at Pecos in 1917. Inches of annual rainfall and evaporation are practically equal in the eastern and southeastern parts of the State but in the western part evaporation greatly overbalances precipitation and may be three to five times as much per year.

The total average annual loss of water through evaporation from a free water surface in Texas is 61.65 inches, of which approximately two-thirds occurs during the six warm months of the year, April to September, inclusive.