PROXIMITY TO MOUNTAIN RANGES.

The influence of mountain ranges is more pronounced on the western side of the mountain than upon the eastern side, and the closer we are to the mountains the greater the precipitation. For example: Ogden Station No. 1, at the base of the Wasatch Mountains, has an average annual precipitation of approximately 25 per cent more than Ogden Station No. 2. The latter station is at the Union Depot and about 2 miles west of the base of the mountains. A second and more pronounced example is that of Fillmore and Deseret, in Millard County. Fillmore, at the base of the mountains, has an average annual precipitation twice as great as Deseret. Geographically, there is very little difference in the location of these stations, but Deseret is in the valley and a few miles from the base of the mountains. It is also a fact verified from the records that the closer we are to the mountains the more frequent the precipitation, and especially is this true of local thunderstorms.

EASTERN OR WESTERN SLOPE OF THE MOUNTAINS.

The greater number of moisture-laden air currents of Utah come from the west, and, as a result, the western side of the mountain is the wet side. A summary of the precipitation records up to and including the year 1908 shows that the western half of the State has an average annual precipitation of 12.8 inches, while the annual average precipitation for the eastern half of the State is 6.4 inches. It is also observed from the same records that there is a material variation in the monthly distribution of this precipitation in those localities. On the western side the moisture is precipitated quite evenly during the months of November to May, inclusive, with a maximum precipitation during the month of March, or at the beginning of the growing season. On the eastern side, the precipitation is evenly distributed during August to November, inclusive, with a maximum precipitation during August and September, or at the close of the growing season. The records indicate that only about 11 per cent of the annual precipitation for the eastern slope occurs during December and January, or at a time when the precipitation would probably be in the form of snow. On the western slope about 17 per cent of the annual precipitation, or, expressed in inches, about three times as much moisture, falls during these months as falls on the eastern slope. This last fact is of importance when considering the amount of precipitation as a factor in stream flow. It is a well-known fact that the streams in the eastern part of Utah are subject to numerous floods during the summer and fall, with a high and rapid spring flow. The streams of the western part of the State are not subject to summer and fall floods, and maintain a more uniform flow in the spring and summer. This condition bears out the popular belief that the snow which falls before the middle of January becomes well packed and melts slowly, while the snow which falls in February and March remains more loose and melts very rapidly. The records of the Weather Bureau would indicate that the western slope of the mountains is best situated for an abundant supply of water in the streams during the late summer than is the eastern slope.

PRECIPITATION ON DIFFERENT SIDES OF THE SAME VALLEY.

This condition is usually the result of eastern and western slopes. To illustrate, we may take the stations of Manti and Richfield. The former is on the eastern side of the valley and the latter on the western side. The average annual precipitation at Manti is 10.5 inches, while at Richfield it is about 6.7 inches. These two stations are both at the foot of the mountains, but the former with a western exposure and the latter with an eastern exposure. In some few instances this relation may be reversed, due to the following fact:

LOCAL AIR CURRENTS INFLUENCE THE AMOUNT OF PRECIPITATION.

In several sections of Utah there are well-known mountain passes through which local air currents pass, and the effect of this condition in influencing precipitation is more pronounced with local storms and summer showers than with general storms. In some instances it is possible to have more precipitation over a small area on the western side of the valley than on the eastern side of the same valley.

ELEVATION AS A FACTOR IN AMOUNT OF ANNUAL PRECIPITATION.

From an agricultural standpoint the influence of this factor upon the amount of annual precipitation is of little importance except when considering the form of precipitation and its relation to water supply for irrigation. It is a commonly accepted idea, and probably a proven fact, that the precipitation increases with elevation, but in this State this condition is so overshadowed by other features that elevation in relation to quantity of precipitation may be disregarded. This may be illustrated by the following: At Levan, with an elevation of 5,010 feet, the annual average precipitation is 15.1 inches, while at Loa, with an elevation of 7,000 feet, there is an annual average precipitation of 6.5 inches. Soldier Summit, at an elevation of 7,054 feet, has only about two-thirds the annual average precipitation of Salt Lake City, which is at an elevation of 4,224 feet. The greater annual average precipitation at Levan and Salt Lake is accounted for from the fact that both are on the western slope and near the base of the mountains.

As stated previously in this article, it was not my intention to point out all the factors which influence the distribution of precipitation in Utah, but rather to emphasize the fact that there are physical features which exert a controlling influence when attempting to adapt the precipitation records of one place to a second place, and that these features must be taken into account.

It is a fact that the distribution of the annual and monthly precipitation is influenced greatly by these physical conditions. That these physical features are also a factor in anticipating the form of precipitation—that is, whether snow or rain—is also shown from a perusal of the records

It is finally suggested that any one desiring an accurate estimate of the precipitation at any point in the State would do well to consult the section director of the Weather Bureau at Salt Lake City, Utah, who will willingly answer inquiries asked either in person or by letter.

SEASONAL PRECIPITATION MEASUREMENTS.

By J. CECIL ALTER, Observer, Salt Lake City, Utah.

The first general attempt to obtain seasonal precipitation records in isolated regions has just been concluded, with a measure of success that seems to warrant the giving of much more attention to this matter. The feasiblity of securing such records has been fairly well demonstrated by this season's trial, which was conducted along lines suggested by the writer, but under the supervision of Mr. A. H. Thiessen, section director in charge of the Salt Lake City office of the Weather Bureau.

No new tests were made of the comparative accuracy of the oil-film one-measurement gage as compared with the regular pattern of Weather Bureau gage, from which measurements are made after each rain, as it was thought that the slight discrepancy shown at the first trial, as reported in the Monthly Weather Review for November, 1907, is

much less than errors due to faulty exposure, and is therefore negligible at present. In the original experiment 0.20 inch of pure olive oil was placed on 0.20 inch of water in the regulation Weather Bureau 8-inch gage—with the funnel receiver, but without the inner tube. This gage was exposed alongside the tipping bucket, or self-recording gage, on April 16, 1907. On November 3, 1907, 6½ months later, 7.77 inches of precipitation, net, were measured from the seasonal gage; the total of the measurements from the regular gage for the same period was 8.03 inches, a discrepancy of about 3 per cent.

During this test it was observed that many of the smaller water drops remained suspended on the oil for some time before sinking, from which some evaporation must have taken place, accounting for a certain amount of the 3 per cent deficiency. However, it is only fair to assume that the errors due to splashing, measuring-stick displacements, creeping up the stick due to capillarity, personal element in measurements, and other sources of variation must have a share in the discrepancy. It is quite probable that a long test with an open gage, without the obstructing funnel to break the fall of the raindrops, would show a slightly greater, more nearly correct, amount, as even the smaller drops, having a greater momentum, would pierce the oil film at once. With these matters in view, it was decided to give this season's attention only to securing records, such as they might be, from places not already represented in the regular climatological reports for the State.

Early in the spring of 1910 a circular letter was addressed by Mr. Thiessen to a number of farmers and ranchmen in various parts of Utah, calling attention to the need for precipitation records in the remote regions, and inviting their cooperation in the comparatively simple task of acquiring this information. The prospective observers were directed to expose a small can with vertical sides in an unobstructed place in such a manner that it would not be molested by persons or animals. To prevent the loss of precipitation by evaporation, they were asked to obtain a few ounces of pure olive oil, sufficient to make a layer nearly a quarter of an inch thick over the bottom of the can. When rain falls in the can it will settle to the bottom, the oil forming an unbroken film on top and preventing evaporation.

The cans used by the observers varied from a 5-inch tomato can to a 5-gallon oil can, but it appears that the observers whose records are published in the accompanying table followed instructions with some care in regard to exposure, protection, and measurement.

A cursory examination of the table may create an unfavorable impression of these records, because of their lack of conformity with the accompanying records of regular cooperative stations; but anyone familiar with the striking differences in amounts of precipitation within very short distances in a mountainous country, particularly in the summer time, when all the rain comes in thundershowers of more or less limited area, will readily see the futility of expecting a reconciliation of these records. However, the lack of uniform receptacles is probably the cause of a small amount of these discrepancies, though it would not seem reasonable to assume the error from this cause to be any greater than the discrepancy errors between the various cooperative stations due to differing surroundings and exposures.

The actual topographical surroundings of most of the exposures were not accurately learned except in a general way, so that a satisfactory discussion of the table is impracticable. However, it is noted that while most of the seasonal records are less than the adjacent regular records, some are also greater; and as nearly as can be determined all the deficient seasonal records came from regions more or less distant from the foothills, where less precipitation would naturally be expected; also, the excesses at Ephraim (near) and Tremonton (near) are derived nearer the foothills than the comparative records at Manti and Garland, respectively. It is understood that nearly all, if not all, of these records were made on farms at some distance from the town or place mentioned in the table.

The Ogden record was made at Hot Springs, about 10 miles northwest of that city, and the much smaller amount there is in conformity with the rapid decrease in amount from Ogden 1 (east side) to Ogden 2 (Union Station) as shown in the regular reports of the Utah section. Kanosh with 5.47 inches, and Fillmore with 6.04 inches, measured by cooperative observers, are 16 miles apart; Meadow, with 5.90 inches from a seasonal gage, lies just halfway between, thus showing consistency. Sterling and Manti are similarly situated topographically, and similar amounts of precipitation were measured.

It must not be understood that, even if it were practicable to have a reliable seasonal summer gage in every township, the data obtained would meet any important demand in itself. The entire year's precipitation must be known to enable the western farmer to draw intelligent conclusions. In fact, many of the most careful arid farmers are inclined to belittle the spring and early summer rains, even to the extent of saying these rains are worse than none at all as a general rule; they "break the mulch" so that a reworking of the mulch soil layer is necessary, and are usually too light to go through the mulch layer to increase the supply held in the lower soil from the previous fall and winter precipitation.

The need appears to be for a great many light, portable gages, with snow hoods for winter and oil films for summer, for exposure in the remoter regions; and for more elaborate, more accurate, gages for use in regions of heavy precipitation, which can be more readily reached. The results of the present seasonal snow-gage experiments and trials by Prof. C. F. Marvin, in charge of the Instrument Division of the Weather Bureau, are being anxiously awaited by the western farmer and engineer, who are insistently demanding, and in some cases getting for themselves, more numerous precipitation records over the sparsely settled and uninhabitable regions of the West. Some of these experiments are to be conducted under the supervision of the Salt Lake office.

Seasonal precipitation data obtained from receptacles containing oil, Utah, 1910.

Place.	County.	Period of exposure.	Amount.	Same period at adjacent regular cooperative stations.		Observer.
				Amount.	Station.	
Alton	Kane	June 1 to Nov. 1	10.00	12.35	Ranch 4 miles sw	Jonathan Heater.
Ephraim	Sanpete	May 1 to Oct. 1	4.75	3.98	Manti 10 miles s	Wm. W. Armstrong.
Fairview	do	Apr. 1 to Oct. 1	4.00	5.94	Moroni 12 miles sw	Walter Cox.
Glendale	Kane	May 1 to Oct. 1	4.62	6.87	Orderville 4 miles s	N. J. Levanger.
Helper	Carbon	Apr. 1 to Oct. 1	10.75		None comparable	J. Tom Fitch.
Meadow	Millard	do	5.90	5.47	Kanosh 8 miles s	Edwin Stott.
Oak City	do	Apr. 15 to Oct. 15	4.00	5.50	Oak City (estimated)	Simeon Walker.
Ogden	Weber	Mar. 3 to Oct. 3	1.25	4.24	Ogden 1, 10 miles se	J. A. Dial.
Scipio	Millard	Apr. 20 to Oct. 15	4.00	5.31	Scipio	Orson Wasden.
Sterling	Sanpete	June 10 to Oct. 1	3.25	3.31	Manti 8 miles n	Ephraim Denison.
Tremonton	Boxelder	May 15 to Oct. 1	2.00	1.66	Garland 2 miles n	Abraham Hunsaker.