pastoral, or, where the amount falls considerably lower, unin­habitable or even deserts. For regions where the precipitation is between 20 and 25 inches cultivation of the soil may be on the whole possible, but will be liable to serious drawbacks, since the smaller the rainfall the greater the liability to a series of years when it will fall below the mean, with partial or total failure of the crops and consequent suffering. Of course, in regions favour­ably situated for artificial irrigation much may be accomplished in the way of making up for deficient precipitation. If in the light of these preliminary remarks we consult Mr Schott’s rainfall charts of the United States we find that the whole of the Eastern division of the country is well supplied with moisture. The isohyetal of 26 inches, which may be taken as approximately the dividing line between a sufficiently and an insufficiently watered area, crosses the northern boundary to the north-west of Lake Superior, runs south-westerly to the 97th meridian, which it strikes in about the latitude of St Paul (45o), and runs thence very nearly south, with a slight westerly inclination, so that when it reaches the northern border of Texas it has advanced westward as far as the 99th merid­ian, near which it remains through four degrees of latitude, to the parallel of 31o, when it again advances about four degrees to the westward, and then runs south-easterly to the Gulf of Mexico, near the mouth of the Rio Grande. As thus indicated, the isohyetal line of 26 inches leaves to the east, or in the moister region, a large part of Minnesota, the eastern edge of Nebraska, rather less than half of Kansas, most of the Indian Territory, and about half of Texas. The line of 20 inches crosses the northern boundary of the country at about the 97th meridian, and runs south with moderate undulations, gaining a little in westing, so that in the centre of Texas, on the 31st parallel, it is in about longitude 102o. Thence its course is south-easterly to the Gulf, in a course nearly parallel to the isohyetal of 26 inches, and at a very short dis­tance from it. The isohyetal curve of 32 inches, or that marking the western limit of abundant precipitation, is in general pretty nearly parallel to that of 26 inches, and not far distant from it, so that in general it may be said that we pass from a region where precipitation is abundant to one where it is decidedly insufficient in traversing a belt of country having an average width in longi­tude of about three degrees. The only important exception is that towards the north the distance between the isohyetal lines widens rapidly, that of 32 inches having an almost easterly course along the southern shore of Lake Superior and the northern of Huron. Moreover, there is in the lines of 26 and 32 inches a marked loop running to the south-east, so that almost the whole of Minnesota is brought within the area over which the precipitation ranges between 20 and 32 inches, considerably the larger portion having over 26 inches. ' The position of the curve of 32 inches is such that a small part of eastern Wisconsin, a portion of eastern Michigan, and a small irregularly shaped belt in New York south of Lake Ontario lie in a region of less than that amount of rainfall.

The regions of largest precipitation are those bordering on the Gulf of Mexico and the Atlantic. Along the Gulf the rainfall between the meridians of 85° and 92o exceeds 56 inches in amount, and the curve of 56 inches extends northward so as to embrace a portion of Arkansas, Tennessee, Georgia, and South Carolina. There is no part of the Atlantic coast, except the extreme end of Florida, where the precipitation is as large as 56 inches. At various points the average is above 50, as in eastern North Carolina, the line of 44 inches running nearly parallel to the coast, and not far from it, as far south as lat. 37°, when it bends westwardly. The greater part of the Eastern division of the United States thus enjoys a sufficient but not over-abundant amount of precipitation, namely, that coming within the limits of 32 and 44 inches. Small areas in several of the States, however, have somewhat over 44 inches of rainfall. In the region of sufficient and in places abundant rainfall thus designated there is, on the whole, no such thing as a clearly-defined rainy season. Along the Atlantic sea-coast from Portland to Washington, through the Hudson river valley, Ver­mont, northern and western New York, in the Ohio valley from western Pennsylvania to Missouri, south to Arkansas and down the Mississippi to its mouth, the rainfall is pretty uniformly dis­tributed throughout the year. There are, however, local peculiarities in the distribution. Thus, in the Atlantic sea-coast region, as far south as Washington, there are three nearly equal maxima, about the middle of May, August, and December. In the region adjacent to the Hudson river valley through to western New York two maxima are indicated, one early in July and one about the middle of October, while there is one principal minimum, early in February. In the Ohio river valley, west to Missouri, there is one principal maximum and one principal minimum, the former early in June, the latter early in February. In the lower Mississippi valley and in that of the Red River there is one principal maximum and one principal minimum, the former early in December, the latter about the middle of October; there is also a secondary maximum in July, and a secondary minimum in June. In the Mississippi delta and along the Gulf coast eastward in Alabama and Mississippi there are two maxima, the principal one about the end of July, the secondary one early in December, while there are a principal minimum early in October and a secondary one towards the end of April. Along the upper Mississippi, in central Minnesota and part of Wisconsin, there is a decided tendency to a condition of summer precipitation and winter drought ; there are two maxima, a principal one about the end of June and a secondary one about the middle of September, and a principal minimum about the begin­ning of February. This is a similar condition of precipitation to that prevailing in the Hudson river valley and westward, except that in the upper Mississippi region the range is much larger. Again, on the Atlantic coast from Virginia south to Florida there is also a strongly-marked prevalence of summer rains, there being one maximum of very large range late in July or early in August, with two small adjacent minima about the middle of April and late in October. There are also subordinate maxima in March and December.

On the Pacific coast the increase in the amount of precipitation as we go northward is a very marked feature of the climate. Thus, at San Diego the mean of the series from 1850 to 1874 is given at 9∙31 inches; that of San Francisco, for nearly the same years, at 21 49; that of Astoria at 77∙61. Along the coast of California, as well as in the interior of that State in the valley and on the western slope of the Sierra Nevada, there is an almost entire absence of rain during the summer months, and a strongly marked maximum in December. Farther north, with the great increase in the total annual amount of precipitation already noted, there is also an increase in the rainfall of the summer, which amounts in the extreme north-western corner of Washington Territory to 10 or 12 inches during the three summer months. A large portion of the precipitation in the higher region of the Sierra Nevada is in the form of snow, of which the amount in different years appears to be very variable. Indeed the same thing may be said of pre­cipitation in general on the coast of California. The largest amount of rainfall at San Francisco during the years 1851 to 1874 is given by Mr Schott as 36∙02 inches, the smallest 11∙78. All through the Cordilleras, from the summit of the Sierra Nevada east to the Rocky Mountains, the statistics of the precipitation are meagre, and have been very irregularly taken. The amount in general is quite small. No doubt the precipitation on the higher portions of the Cordilleran mountain ranges is considerably higher than it is in the valleys, as is indicated by the records kept by the Signal Service at the station on the summit of Pike’s Peak (14,134 feet), the average for 1874-80 being 31∙65 inches. In the Cor­dilleran region generally the fact that the precipitation is larger on the mountain ranges than it is in the valleys, and that it is chiefly in the form of snow, is a matter of great importance. When the ranges are lofty and wide enough to collect and store away a large supply of snow, this by its melting furnishes water enough to irrigate the slopes and valleys, so that they can be cultivated ; when, on the other hand, the ridges are low, they, as well as the valleys at their bases, are absolutely sterile.

Those abnormal disturbances of the atmosphere which are accom­panied by rain and wind may be classed under two heads,—ordinary storms, and those of destructive violence, or tornadoes. The former extend over wide areas, and are ordinarily attended by no evil results ; the latter are limited to comparatively narrow belts, and are often very destructive. The ordinary storms of the United States begin with the formation of areas of low barometer, which are first heard of in the far west or south-west, and move towards the east or north-east with a velocity averaging for the entire year, as shown by Loomis’s investigation of the Signal Service Records for the years 1872-84, 28∙4 miles per hour, the velocity being greatest in February and least in August, the former velocity 50 per cent, greater than the latter, and the velocity varying also very greatly for the same month in different years, the average velocity for the entire year being about two-thirds greater than it is in Europe. The direction in which these storm centres advance in the remote­western stations—as, for instance, Bismarck, long. 100o 38' ; Fort Sully, long. 100° 36' ; Breckenridge, long. 96° 17'—is towards a point considerably south of east, but at the more eastern stations it is a little north of east. In general, probably about half the storms of the country advance from the extreme north-west in great curved lines beginning with a south-easterly direction, and passing out of the country in a direction a little north of east, or, in general, following a track nearly parallel in position to the Great Lakes and the St Lawrence. The remainder of the storms of the Atlantic coast region begin in the south-west and travel north-east, or begin in the south and follow the coast-line pretty closely. In general the area of rainfall attendant on the advance of the centre of low barometer is in advance of the progress of that centre nearly in the direction of its average progress. The diameter of the rain area is variable, often much over 1000 miles. In the case of the great rain storms happening between the years 1873 and 1877, as investigated by Loomis, there were found to be, in many cases, quite a large number of independent rain centres prevailing simultaneously within the general rain area. In one case there were as many as eight of these, and there were only nine cases in which there was